Economics 101A
(Lecture 21)

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Outline

1. Oligopoly: Cournot

2. Oligopoly: Bertrand

3. Second-price Auction

4. Auctions: eBay Evidence
1 Oligopoly: Cournot

- Nicholson, Ch. 14, pp. 524-530 (better than Ch. 14, pp. 418–419, 421–422, 9th)

- Back to oligopoly maximization problem

- Assume 2 firms, cost $c_i(y_i) = cy_i$, $i = 1, 2$

- Firms choose simultaneously quantity $y_i$

- Firm $i$ maximizes:

$$\max_{y_i} p(y_i + y_{-i})y_i - cy_i.$$ 

- First order condition with respect to $y_i$:

$$p_Y (y_i^* + y_{-i}^*) y_i^* + p - c = 0, \ i = 1, 2.$$
• Nash equilibrium:
  
  - $y_1$ optimal given $y_2$;
  
  - $y_2$ optimal given $y_1$.

• Solve equations:

  \[ p_Y^I (y_1^* + y_2^*) y_1^* + p - c = 0 \]

  \[ p_Y^I (y_2^* + y_1^*) y_2^* + p - c = 0. \]

• Cournot -> Pricing above marginal cost

• Numerical example -> Problem set 5
2 Oligopoly: Bertrand

- Cournot oligopoly: firms choose quantities

- Bertrand oligopoly: firms first choose prices, and then produce quantity demanded by market

- Market demand function $Y(p)$

- 2 firms

- Profits:

$$\pi_i(p_i, p_{-i}) = \begin{cases} (p_i - c)Y(p_i) & \text{if } p_i < p_{-i} \\ (p_i - c)Y(p_i)/2 & \text{if } p_i = p_{-i} \\ 0 & \text{if } p_i > p_{-i} \end{cases}$$
• First show that $p_1 = c = p_2$ is Nash Equilibrium

• Does any firm have a (strict) incentive to deviate?

• Check profits for Firm 1

• Symmetric argument for Firm 2
• Second, show that this equilibrium is unique.

• For each of the next 5 cases at least on firm has a profitable deviation

• Case 1. \( p_1 > p_2 > c \)

• Case 2. \( p_1 = p_2 > c \)

• Case 3. \( p_1 > c \geq p_2 \)
• Case 4. \( c > p_1 \geq p_2 \)

• Case 5. \( p_1 = c > p_2 \)

• Only Case 6 remains: \( p_1 = c = p_2 \), which is Nash Equilibrium

• It is unique!
• Notice:

• To show that something is an equilibrium → Show that there is *no* profitable deviation

• To show that something is *not* an equilibrium → Show that there is *one* profitable deviation
• Surprising result of Bertrand Competition

• Marginal cost pricing

• Two firms are enough to guarantee perfect competition!

• Realistic? Price wars between PC makers
3 Second-price Auction

• Nicholson, Ch. 18, pp. 659–66 [Not in old book]

• Sealed-bid auction

• Highest bidder wins object

• Price paid is second highest price

• Two individuals: $I = 2$

• Strategy $s_i$ is bid $b_i$

• Each individual knows value $v_i$
• Payoff for individual $i$ is

$$u_i(b_i, b_{-i}) = \begin{cases} 
    v_i - b_i & \text{if } b_i > b_{-i} \\
    (v_i - b_{-i})/2 & \text{if } b_i = b_{-i} \\
    0 & \text{if } b_i < b_{-i}
\end{cases}$$

• Show: weakly dominant to set $b_i^* = v_i$

• To show:

$$u_i(v_i, b_{-i}) \geq u_i(b_i, b_{-i})$$

for all $b_i$, for all $b_{-i}$, and for $i = 1, 2$. 
1. Assume $b_{-i} > v_i$
   
   $u_i(v_i, b_{-i}) = 0 = u_i(b_i, b_{-i})$ for any $b_i < b_{-i}$
   
   $u_i(b_{-i}, b_{-i}) = (v_i - b_{-i}) / 2 < 0$
   
   $u_i(b_i, b_{-i}) = (v_i - b_{-i}) < 0$ for any $b_i > b_{-i}$

2. Assume now $b_{-i} = v_i$
3. Assume now $b_{-i} < v_i$. 
4  Auctions: Evidence from eBay

- In second-price auction, optimal strategy is to bid one’s own value

- Is this true?

- eBay has proxy system: If you have highest bid, you pay bid of second-highest bidder

- eBay is essentially a second-price auction

- Two deviations:
  1. People bid multiple times – they should not in this theory
  2. People may overbid
An example: eBay Bidding for a Board Game

- Bidding environment with clear boundary for rational willingness to pay ("buy-it-now price").
- Empirical environment unaffected by common-value arguments (presumably bidding for private use; in addition "buy-it-now" price).
- Still non-negligible amount ($100-$200).

→ Is there evidence of overbidding?
→ If so, can we detect determinants of overbidding?
The Object
The Data

- Cashflow 101: board game with the purpose of finance/accounting education.
- Retail price: $195 plus shipping cost ($10.75) from manufacturer (www.richdad.com).
- Two ways to purchase Cashflow 101 on eBay
  - Auction (quasi-second price proxy bidding)
  - Buy-it-now
Sample

• Listings
  – 206 by individuals (187 auctions only, 19 auctions with buy-it-now option)
  – 493 by two retailers (only buy-it-now)

• Remove non-US$, terminated, unsold items and items without simultaneous professional buy-it-now listing. \( \rightarrow \) 169 auctions

• Buy-it-now offers of the two retailers
  – Continuously present for all but six days. (Often individual buy-it-now offers present as well; they are often lower.)
  – 100% and 99.9% positive feedback scores.
  – Same prices $129.95 until 07/31/2004; $139.95 since 08/01/2004.
  – Shipping cost $9.95; other retailer $10.95.
  – New items (with bonus tapes/video).
<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
<th>Quantity</th>
<th>Delivery Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rich Dad's Cashflow Quadrant, Rich dad ...</td>
<td>$12.50</td>
<td>4</td>
<td>1d 00h 14m</td>
</tr>
<tr>
<td>Rich Dad's Cashflow Quadrant by Robert T. ...</td>
<td>$9.00</td>
<td>9</td>
<td>1d 00h 43m</td>
</tr>
<tr>
<td>Real Estate Investment Cashflow Software $$$!</td>
<td>$10.49</td>
<td>2</td>
<td>1d 04h 36m</td>
</tr>
<tr>
<td>CASHFLOW® 101 202 Robert Kiyosaki Best Pak $</td>
<td>$207.96</td>
<td>1</td>
<td>1d 06h 47m</td>
</tr>
<tr>
<td>TRY IT TODAY, WITH ABSOLUTELY NO RISK,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASHFLOW® 101 Robert Kiyosaki Plus Bonuses!</td>
<td>$129.95</td>
<td>1</td>
<td>1d 08h 02m</td>
</tr>
<tr>
<td>Your satisfaction is GUARANTEED, 100% $ back</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIINT Cashflow 101 *Robert Kiyosaki Game NR!</td>
<td>$140.00</td>
<td>13</td>
<td>1d 08h 04m</td>
</tr>
<tr>
<td>It's easy to be rich. Brand New. Still sealed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cashflow Hard Money Funding 101 real estate</td>
<td>$14.99</td>
<td>1</td>
<td>1d 09h 28m</td>
</tr>
<tr>
<td>BRANDNEW RICHDAD CASHFLOW FOR KIDS E-GAME</td>
<td>$20.00</td>
<td>1</td>
<td>1d 13h 54m</td>
</tr>
<tr>
<td>CASHFLOW® 101 Robert Kiyosaki Plus Bonuses!</td>
<td>$129.95</td>
<td>1</td>
<td>1d 14h 17m</td>
</tr>
<tr>
<td>Your satisfaction is GUARANTEED, 100% $ back</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CASHFLOW® 101 202 Robert Kiyosaki Best Pak $</td>
<td>$207.96</td>
<td>1</td>
<td>1d 15h 47m</td>
</tr>
<tr>
<td>TRY IT TODAY, WITH ABSOLUTELY NO RISK,</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Listing Example – Magnified

Pricing:
[Buy Now]
$129.95

Pricing:
$140.00
Bidding history of an item

<table>
<thead>
<tr>
<th>User ID</th>
<th>Bid Amount</th>
<th>Date of bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>breezeshugs (21)</td>
<td>US $152.50</td>
<td>Aug-11 04:51:21 PDT</td>
</tr>
<tr>
<td>mlady-hal (21)</td>
<td>US $150.00</td>
<td>Aug-11 04:51:33 PDT</td>
</tr>
<tr>
<td>breezeshugs (21)</td>
<td>US $140.00</td>
<td>Aug-08 12:00:05 PDT</td>
</tr>
<tr>
<td>sijobbt (86)</td>
<td>US $130.01</td>
<td>Aug-08 25:49:02 PDT</td>
</tr>
<tr>
<td>successbrok (991)</td>
<td>US $110.00</td>
<td>Aug-08 19:56:26 PDT</td>
</tr>
<tr>
<td>successbrok (991)</td>
<td>US $105.00</td>
<td>Aug-06 17:13:21 PDT</td>
</tr>
<tr>
<td>002la (1)</td>
<td>US $102.50</td>
<td>Aug-06 17:11:31 PDT</td>
</tr>
<tr>
<td>successbrok (991)</td>
<td>US $100.00</td>
<td>Aug-05 15:41:40 PDT</td>
</tr>
<tr>
<td>002la (1)</td>
<td>US $95.00</td>
<td>Aug-06 17:10:21 PDT</td>
</tr>
<tr>
<td>12-gauge (29)</td>
<td>US $88.00</td>
<td>Aug-05 09:13:30 PDT</td>
</tr>
<tr>
<td>imdyke (110)</td>
<td>US $68.00</td>
<td>Aug-05 10:47:33 PDT</td>
</tr>
<tr>
<td>imdyke (110)</td>
<td>US $45.00</td>
<td>Aug-05 10:45:41 PDT</td>
</tr>
<tr>
<td>imdyke (110)</td>
<td>US $40.00</td>
<td>Aug-05 10:45:06 PDT</td>
</tr>
<tr>
<td>beardnbulls22 (3)</td>
<td>US $31.00</td>
<td>Aug-05 06:49:19 PDT</td>
</tr>
<tr>
<td>75ton (1)</td>
<td>US $30.00</td>
<td>Aug-04 19:48:54 PDT</td>
</tr>
<tr>
<td>beardnbulls22 (3)</td>
<td>US $26.00</td>
<td>Aug-05 06:49:26 PDT</td>
</tr>
<tr>
<td>beardnbulls22 (3)</td>
<td>US $25.00</td>
<td>Aug-05 04:48:01 PDT</td>
</tr>
</tbody>
</table>

If you and another bidder placed the same bid amount, the earlier bid takes priority.
Hypotheses

Given the information on the listing website:

• (H1) An auction should never end at a price above the concurrently available purchase price.

• (H2) Mentioning of higher outside prices should not affect bidding behavior.
Figure 1. Starting Price (\textit{startprice})

- 45\% below $20; mean=$46; SD=43.88
- only 6 auctions with first \textit{bid} (not price) above buy-it-now
Figure 2. Final Price (*finalprice*)

41% are above “buy-it-now” (mean $132; SD 16.83)
Figure 4. Total Price (incl. shipping cost) ➔ 51% are above “buy-it-now” plus its shipping cost (mean=$144.20; SD=15.00)
5  Next lecture

- Dynamic Games

- Stackelberg duopoly