Economics 101A
(Lecture 19)

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November 9, 2004
Outline

1. Monopoly

2. Price Discrimination

3. Oligopoly?

4. Game Theory
1 Profit Maximization: Monopoly

- **Monopoly.** Firm maximizes profits, that is, revenue minus costs:

\[
\max_y p(y) y - c(y)
\]

- Notice \( p(y) = D^{-1}(y) \)

- First order condition:

\[
p'(y) y + p(y) - c'_y(y) = 0
\]

or

\[
\frac{p(y) - c'_y(y)}{p} = -p'(y) \frac{y}{p} = -\frac{1}{\varepsilon_{y,p}}
\]

- Compare with f.o.c. in perfect competition

- Check s.o.c.
• Elasticity of demand determines markup:
  – very elastic demand → low mark-up
  – relatively inelastic demand → higher mark-up

• Graphically, $y^*$ is where marginal revenue $(p'(y)y + p(y))$ equals marginal cost $(c'_y(y))$

• Find $p$ on demand function
• Example.

• Linear inverse demand function \( p = a - by \)

• Linear costs: \( C(y) = cy \), with \( c > 0 \)

• Maximization:

\[
\max_y (a - by) y - cy
\]

• Solution:

\[
y^* (a, b, c) = \frac{a - c}{2b}
\]

and

\[
p^* (a, b, c) = a - b \frac{a - c}{2b} = \frac{a + c}{2}
\]
• s.o.c.

• Figure

• Comparative statics:
  
  – Change in marginal cost \( c \)

  – Shift in demand curve \( a \)
• Monopoly profits

• Case 1. High profits

• Case 2. No profits
• Welfare consequences of monopoly
  – Too little production
  – Too high prices

• Graphical analysis
2 Price Discrimination

- Nicholson, Ch. 13, pp. 397–404 [OLD: Ch. 18, pp. 508–515].

- Restriction of contract space:
  
  - So far, one price for all consumers. But:

  - Can sell at different prices to differing consumers (*first degree* or perfect price discrimination).

  - Self-selection: Prices as function of quantity purchased, equal across people (*second degree* price discrimination).

  - Segmented markets: equal per-unit prices across units (*third degree* price discrimination).
2.1 Perfect price discrimination

- Monopolist decides price and quantity consumer-by-consumer

- What does it charge? Graphically,

- Welfare:
  - gain in efficiency;
  - all the surplus goes to firm
2.2 Self-selection

• Perfect price discrimination not legal

• Cannot charge different prices for same quantity to A and B

• Partial Solution:
  – offer different quantities of goods at different prices;
  – allow consumers to choose quantity desired
• Examples (very important!):

  – bundling of goods (xeroxing machines and toner);

  – quantity discounts

  – two-part tariffs (cell phones)
• Example:

• Consumer A has value $1 for up to 100 photocopies per month

• Consumer B has value $.50 for up to 1,000 photocopies per month

• Firm maximizes profits by selling (for $\varepsilon$ small):
  
  – 100-photocopies for $100-\varepsilon$

  – 1,000 photocopies for $500-\varepsilon$

• Problem if resale!
2.3 Segmented markets

- Firm now separates markets

- Within market, charges constant per-unit price

- Example:
  - cost function $TC(y) = cy$.
  - Market A: inverse demand function $p_A(y)$ or
  - Market B: inverse function $p_B(y)$
• Profit maximization problem:

\[
\max_{y_A, y_B} p_A(y_A) y_A + p_B(y_B) y_B - c(y_A + y_B)
\]

• First order conditions:

• Elasticity interpretation

• Firm charges more to markets with lower elasticity
• Examples:

  – student discounts

  – prices of goods across countries:
    * airlines (US and Europe)
    * books (US and UK)
    * cars (Europe)

• As markets integrate (Internet), less possible to do the latter.
3 Oligopoly?

• Extremes:
  – Perfect competition
  – Monopoly

• Oligopoly if there are \( n \) (two, five...) firms

• Examples:
  – soft drinks: Coke, Pepsi;
  – cellular phones: Sprint, AT&T, Cingular,...
  – car dealers
• Firm $i$ maximizes:

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

where $y_{-i} = \sum_{j \neq i} y_j$.

• First order condition with respect to $y_i$:

$$p_Y^l (y_i + y_{-i}) y_i + p - c'_y(y_i) = 0.$$ 

• Problem: what is the value of $y_{-i}$?
  
  – simultaneous determination?
  
  – can firms $-i$ observe $y_i$?

• Need to study strategic interaction
4 Game Theory

- Nicholson, Ch. 15, pp. 440–449 [OLD: Ch. 10, pp. 246–255].

- Unfortunate name

- Game theory: study of decisions when payoff of player $i$ depends on actions of player $j$.

- Brief history:
  
  - von Neuman and Morgenstern, Theory of Games and Economic Behavior (1944)
  
  - Nash, Non-cooperative Games (1951)
  
  - ...
  
  - Nobel Prize to Nash, Harsanyi (Berkeley), Selten (1994)
• Definitions:

- Players: $1, \ldots, I$

- Strategy $s_i \in S_i$

- Payoffs: $U_i(s_i, s_{-i})$
Example: Prisoner’s Dilemma

- \( I = 2 \)

- \( s_i = \{D, ND\} \)

- Payoffs matrix:

\[
\begin{array}{ccc}
\ 1 \ \mid \ 2 & D & ND \\
D & -4, -4 & -1, -5 \\
ND & -5, -1 & -2, -2 \\
\end{array}
\]
• What prediction?

• Maximize sum of payoffs? No

• Choose dominant strategies!
• Battle of the Sexes game:

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<th>Football</th>
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<tr>
<td>Football</td>
<td>0, 0</td>
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• Choose dominant strategies? Not possible

• Nash Equilibrium.

• Strategies $s^* = (s_i^*, s_{-i}^*)$ are a Nash Equilibrium if

$$U_i(s_i^*, s_{-i}^*) \geq U_i(s_i, s_{-i}^*)$$

for all $s_i \in S_i$ and $i = 1, ..., I$
5 Next lecture

• More game theory

• Back to oligopoly:
  – Cournot
  – Bertrand