Economics 101A
(Lecture 21)

Stefano DellaVigna

November 15, 2005

Outline

1. Profit Maximization: Monopoly
2. Price Discrimination
3. Oligopoly?
4. Game Theory

1 Profit Maximization: Monopoly

- Nicholson, Ch. 13, pp. 385–393 [OLD: Ch. 18, pp. 496–504]

- Nicholson, Ch. 9, pp. 248–255 [OLD: Ch. 13, pp. 335–342]

- **Perfect competition.** Firms small

- **Monopoly.** One, large firm. Firm sets price p to maximize profits.

- What does it mean to set prices?

- Firm chooses p, demand given by $y = D(p)$

- (OR: firm sets quantity y. Price $p(y) = D^{-1}(y)$)

- Write maximization with respect to y

- 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 $\longrightarrow$ low mark-up
  - relatively inelastic demand $\longrightarrow$ 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 discimination

- 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 ε small):

  - 100 photocopies for \$100-ε

  - 1,000 photocopies for \$500-ε

- 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 dunction $p_A(y)$ or

  - Market B: inverse dunction $p_B(y)$

- 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)
    * drugs (US vs. Canada vs. Africa)
- 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:

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

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

- First order condition with respect to y_i:

$$p'_Y\left(y_i + y_{-i}\right) y_i + p - c'_y\left(y_i\right) = 0.$$

- 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: $1, ..., I$

  - 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:

$1 \setminus 2$	D	ND
D	$-4, -4$	$-1, -5$
ND	$-5, -1$	$-2, -2$

- What prediction?

- Maximize sum of payoffs? No

- Choose dominant strategies!

- Battle of the Sexes game:

He \ She	Ballet	Football
Ballet	$2, 1$	$0, 0$
Football	$0, 0$	$1, 2$

- Choose dominant strategies? Not possible

- **Nash Equilibrium**.

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

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

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

5 Next Lecture

- More game theory
- Back to oligopoly:
  - Cournot
  - Bertrand