

Economics 101A

(Lecture 21)

Stefano DellaVigna

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Outline

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

1 Profit Maximization: Monopoly

- 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

$$p^*(a, b, c) = a - b \frac{a - c}{2b} = \frac{a + c}{2}$$

- Figure

- 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 ε 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 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:

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

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

- First order condition with respect to y_i :

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

- 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: $1, \dots, I$

- 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?
- Choose dominant strategies
- **Equilibrium in dominant strategies**
- Strategies $s^* = (s_i^*, s_{-i}^*)$ are an Equilibrium in dominant strategies if

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

for all $s_i \in S_i$, for all $s_{-i} \in S_{-i}$ and all $i = 1, \dots, I$

- Battle of the Sexes game:

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

- Choose dominant strategies? Do not exist

- **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 $i = 1, \dots, I$

- Is Nash Equilibrium unique?

- Does it always exist?

- Penalty kick in soccer (matching pennies)

Kicker \ Goalie	L	R
L	0, 1	1, 0
R	1, 0	0, 1

- Equilibrium always exists in mixed strategies σ

- Mixed strategy: allow for probability distribution.

- Back to penalty kick:

- Kicker kicks left with probability k
- Goalie kicks left with probability g

- utility for kicker of playing L :

$$\begin{aligned}U_K(L, \sigma) &= gU_K(L, L) + (1 - g)U_K(L, R) \\ &= (1 - g)\end{aligned}$$

- utility for kicker of playing R :

$$\begin{aligned}U_K(R, \sigma) &= gU_K(R, L) + (1 - g)U_K(R, R) \\ &= g\end{aligned}$$

- Optimum?

- $L \succ R$ if $1 - g > g$ or $g < 1/2$

- $R \succ L$ if $1 - g < g$ or $g > 1/2$

- $L \sim R$ if $1 - g = g$ or $g = 1/2$

- Plot best response for kicker

- Plot best response for goalie

- Nash Equilibrium is:
 - fixed point of best response correspondence
 - crossing of best response correspondences

5 Next lecture

- Oligopoly: Cournot
- Oligopoly: Bertrand
- Dynamic games
- Stackelberg duopoly
- Auctions