Economics 101A
(Lecture 20)

Stefano DellaVigna

April 4, 2017

Outline

1. Price Discrimination

2. Oligopoly?

3. Game Theory

1 Price Discrimination

- Nicholson, Ch. 14, pp. 513-519

- 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).

1.1 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

1.2 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!

1.3 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)
    * drugs (US vs. Canada vs. Africa)
- As markets integrate (Internet), less possible to do the latter.

2 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

3 Game Theory

- Nicholson, Ch. 8, pp. 251-268

- 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: $U_i\left(s_i, s_{-i}\right)$

- 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 stategies**

- Strategies $s^* = \left(s_i^*, s_{-i}^*\right)$ are an Equilibrium in dominant stategies if

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

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

- 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 $s^* = \left(s_i^*, s_{-i}^*\right)$ 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 $i = 1, ..., I$

- 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 distibution.

- 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

4 Next lecture

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