Economics 101A
(Lecture 20)

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Outline

1. Price Discrimination II
2. Oligopoly?
3. Game Theory

1 Price Discrimination II

1.1 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. 236-252 (*better* than Ch. 15, pp. 440–449, 9th).

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

- 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: Bertrand
- Dynamic games
- Stackelberg duopoly
- Auctions