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Economics
& Society

Lecture 5

Strategic Competition

1

Previously in E&S

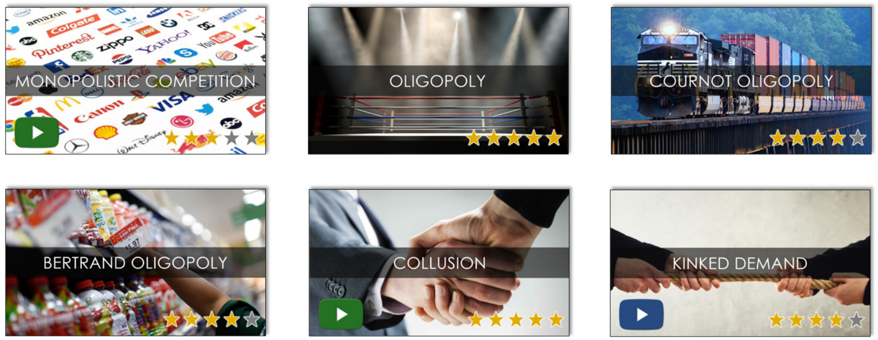
- Monopoly
- Supply curve in monopoly
- Market power
- Market efficiency
  consumer surplus, producer surplus, DWL
- Taxation
  PC & Monopoly
- Case: Market of human kidneys

2

Modeling real markets

3

Strategic Competition



4

Assumptions

1. ***Small number*** of firms:
   - The number of firms is low enough, so that interaction is ***possible*** and ***meaningful***
   - Every firm needs to ***consider*** other firms' actions.
2. ***Homogeneous*** product:
   - ***Market power*** results from the small number of firms, NOT from product differentiation
   - Coca-Cola has ***power*** on consumers because they can ***replace*** it only with Pepsi.
3. ***Barriers*** to entry:
   - Firms are large and can ***create barriers*** to maintain their ***S-R profits*** in the ***L-R***
   - Threatening ***price wars***, excess ***capacity***, excessive ***advertisement***, ***proliferation***

Strategic game

- The ***key***-characteristic of oligopoly is ***interaction***
  we cannot think of firms' actions ***independently***, anymore
- In all other market structures, every firm is simply ***doing its best***
  no matter what ***other firms*** do
- In oligopoly, any action will ***affect the rivals*** causing them to ***answer***
  every firm's ***outcome*** is ***affected*** by its actions but also its ***rivals' actions***
- Therefore, actions in oligopoly are ***strategic***
  "strategic" ***does not mean*** "smart"

Examples of oligopolistic markets

- Middle-high class ***sedans***
  BMW, Mercedes, Audi, Volvo
- High-end ***smartphones***
  iPhone, Galaxy, Huawei
- Web based ***email***
  Hotmail, Gmail, Yahoo

Competition with respect to what?

- Firms have to choose in ***which field*** they will compete:
  - Apple and Samsung are competing with respect to
  - BMW and Benz are competing with respect to
  - Coke and Pepsi are competing with respect to
  - DKNY and Calvin Klein compete with respect to
  - Firefox and Chrome compete with respect to
  - SMU and NUS compete with respect to
  - Oil producing nations are competing with respect to
  - Supermarkets compete with respect to

Oligopoly models

- ***Cournot:*** Competition with respect to quantities
  the choice variable of the firm is the ***quantity***
- ***Bertrand:*** Competition with respect to prices
  the choice variable of the firm is the ***price***
- ***Collusion:*** Firms cooperate and act as if they were a monopoly
- ***Kinked demand model:*** Firms are reluctant to reduce prices

The Cournot duopoly (1838)

- Two ***identical*** and ***symmetric*** firms produce a ***homogeneous*** good
  firm 1 & firm 2
- For both sellers, $FC = 0$ and $MC = \$10$
- The ***market demand*** is

$$p = 130 - Q$$

  where $Q = q_1 + q_2$
- Firms decide ***how much*** to produce:
  1. Separately
  2. Simultaneously
  3. Irrevocably

MR for firm 1

- The market demand *can be written* as

$$p = 130 - q_1 - q_2$$

- In this demand function, firm 1 can *control* q_1

  but sees 130 and q_2 as *constant*

- Thus, demand *as seen by firm 1* is

$$p = \underbrace{(130 - q_2)}_{\text{constant}} - \underbrace{q_1}_{\text{gradient}}$$

- Thus, *marginal revenue* for firm 1 is

$$MR_1 = (130 - q_2) - 2q_1.$$

Optimal choice of output

- Profit maximization for firm 1 implies:

$$MR_1 = MC \quad \text{or} \quad (130 - q_2) - 2q_1 = 10 \quad \text{or} \quad q_1 = \frac{120 - q_2}{2} \qquad (1)$$

- *Equation* (1) is called firm's 1 "*best response*" or "*optimal reaction*" function

  because it yields the profit maximizing q_1 *for every* q_2 that firm 2 may choose

- Firm 2 *responds symmetrically* to firm 1:

$$\boxed{q_2 = \frac{120 - q_1}{2}} \quad (2)$$

- Since both firms are *identical*, in the end $q_1 = q_2$, so we can write (1) as:

$$q_1 = \frac{120 - q_1}{2} \quad \text{or} \quad 2q_1 = 120 - q_1 \quad \text{or} \quad \boxed{q_1 = q_2 = 40.}$$

Price & profits

- Price in **Cournot**: $p = 130 - q_1 - q_2 = 130 - 40 - 40$ or $p = \$50$
- Profit per firm: $\Pi_1 = (p - c)q_1 = (\$50 - \$10)40$ or $\boxed{\Pi_1 = \Pi_2 = \$1{,}600}$
- If both firms *acted as PC competitors*:

  $D = S$ or $130 - Q = 10$ or $Q = 120$ or $q_1 = q_2 = 60$.

  Price: $p = 130 - q_1 - q_2 = 130 - 60 - 60$ or $p = \$10$

  Profit per firm: $\Pi_1 = (p - c)q_1 = (\$10 - \$10)60$ or $\boxed{\Pi_1 = \Pi_2 = \$0.}$

- If firms *collude* and behave as a *monopoly*:

  $MR = MC$ or $130 - 2Q = 10$ or $Q = 60$ or $q_1 = q_2 = 30$.

  Price: $p = 130 - q_1 - q_2 = 130 - 30 - 30$ or $p = \$70$.

  Profit per firm: $\Pi_1 = (p - c)q_1 = (\$70 - \$10)30$ or $\boxed{\Pi_1 = \Pi_2 = \$1{,}800.}$

Comparing models

	Price	*Quantity per firm*	*Profit per firm*
PC	\$10	60	\$0
Cournot	\$50	40	\$1,600
Collusion	\$70	30	\$1,800

- Price, quantity and profit of Cournot are *between* PC and Monopoly
- What if *price* in this market was *\$20*?
- What if *price* was *\$65*?
- What if *price* was *\$5*?
- The *most profitable outcome* for firms is to *collude* by setting $q = 30.$

Incentive for cheating

	Price	*Quantity per firm*	*Profit per firm*
PC	$10	60	$0
Cournot	$50	40	$1,600
Collusion	$70	30	$1,800

- Assume that firm 1 sets $q_1 = 30$ and ***expects*** firm 2 to also produce $q_2 = 30$:
  - Firm 2 can produce $q_2 = 30$ and each firm earn ***profit*** $\$1,600$
  - OR firm 2 can produce $q_2 = (120 - q_1)/2 = (120 - 30)/2 = 45$.
- If $q_2 = 45$, ***price*** will be: $p = 130 - q_1 - q_2 = 130 - 30 - 45 = \$55$:
  - Profit for firm 2: $\Pi_2 = (p - c)q_2 = (\$55 - \$10)45$ or $\boxed{\Pi_2 = \$2,025}$
  - Profit for firm 1: $\Pi_1 = (p - c)q_1 = (\$55 - \$10)30$ or $\boxed{\Pi_1 = \$1,350.}$
- Each firm has a strong ***incentive to cheat*** hurting the other firm

  without ***commitment mechanism***, collusion is ***not sustainable***.

Bertrand competition (1883)

- Two ***identical*** and ***symmetric*** firms produce a ***homogeneous*** good

  firm 1 & firm 2
- For both sellers, $FC = 0$ and $MC = \$10$
- The ***market demand*** is

$$p = 130 - Q$$

  where $Q = q_1 + q_2$
- Firms separately, simultaneously, and irrevocably choose ***prices***
- Since the good is ***homogeneous***, consumers buy from ***cheapest*** seller:
  - The ***cheapest*** seller serves the ***entire*** demand
  - If $p_1 = p_2$, firms ***share*** the demand as in Cournot ($p = 100 - q_1 - q_2$).

Bertrand equilibrium

- If firm 1 charges any $p_1 > \$10$

  firm 2 would want to ***undercut*** with $p_2 < p_1$ and grab the ***entire market***
- If firm 1 charges any $p_1 < \$10$

  firm 2 would produce 0 and let firm 1 take the ***losses***
- If firm 1 charges $p_1 = \$10$

  firm 2 would ***follow suit*** – neither firm would have ***an incentive to deviate***
- The Bertrand ***equilibrium*** is $p_1^* = p_2^* = MC$

  firms end up producing the ***PC output*** and earning ***PC profit***.

The Bertrand paradox

- The Bertrand equilibrium is ***paradoxical***
  firms are supposed to have ***market power*** but ***behave as if they do not have***
- This happens ***because*** even a minuscule price-cut will change the firms' market shares dramatically
- There are 3 ***major ways*** to ***resolve*** this paradox:
  1. ***Capacity constraints***: if the cheaper firm does not have the ***capacity*** to serve the entire market alone, its rival can profit from exploiting the ***residual*** customers
  2. ***Repeated interaction***: the benefit from cheating is ***high*** but ***for only one*** period – the benefit from collusion is ***lower*** but for ***more periods***
  3. ***Differentiation***: when a firm's product is perceived as ***better*** by its customers, they ***will not abandon*** it if a rival undercuts the price

External video

In this Al Jazeera Video, watch how Russia and Saudi Arabia found themselves amid a harsh price war during one of the worst economic downturns of the last century. Try to figure out what kind of game petroleum is: Cournot or Bertrand?

Oil price war: Analysts expect prices to drop further
Al Jazeera English · 92K views · 2 months ago
Top energy officials in the US and Russia will meet to tackle an historic collapse in global oil markets. The meeting comes after a ...

Thank you!

(you are welcomed to stay for *consultation* or *discussion*)

WARNING!

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