

Kosmas Marinakis, Ph.D. Economics & Society

## Lecture 5




### Strategic Competition



SMU

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### 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 

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### Modeling real markets

- ★ There are **no perfectly competitive** markets out there
- ★ There are **no pure monopolies**, either
- ★ Then, **why** do we consider such models?

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### Strategic Competition



Lecture 5

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OLIGOPOLY

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### Assumptions

Oligopoly

- Small number of firms:**
  - ▶ The number of firms is low enough, so that **interaction** is **possible** and **meaningful**
  - ▶ Every firm needs to **take into account** other firms' actions.
- Homogeneous product:**
  - ▶ Product differentiation is **not required** for oligopolistic firms to have **market power**
  - ▶ **Market power** comes from the relative **lack of alternatives** for the consumers, **not** from the **attributes of the brand**.
- Barriers to entry:**
  - ▶ Oligopolists are usually large enough to **create barriers** to entry to protect their turf
  - ▶ Threatening **price wars**, building **excess capacity**, proliferation, advertisement
  - ▶ Barriers allow firms to **maintain their S-R profits** in the L-R.

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### Strategic game

Oligopoly

- ★ The **most important** 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**, every firm plans its actions considering **how its competitors will react** to those actions  
every firm's **outcome** is **affected** by the **actions of its rivals**
- ★ Therefore, actions in oligopoly are **strategic**  
"strategic" **does not mean** "smart".

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### Examples of oligopolistic markets

Oligopoly

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

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### Competition with respect to what?

Oligopoly

- ★ Firms have to choose in **which field** they will compete:
  - ▶ Apple and Samsung are competing with respect to **technological advancement**
  - ▶ BMW and Benz are competing with respect to **quality**
  - ▶ Coke and Pepsi are competing with respect to **design**
  - ▶ DKNY and Calvin Klein compete with respect to **design**
  - ▶ Firefox and Chrome compete with respect to **market share**
  - ▶ SMU and NUS compete with respect to **quality**
  - ▶ Oil producing nations are competing with respect to **quantities**
  - ▶ Supermarkets compete with respect to **price**.

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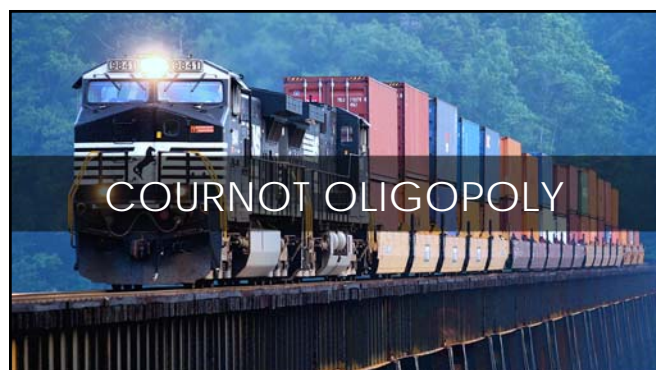
### Oligopoly models

Oligopoly

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

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### The Cournot duopoly (1838)

Oligopoly Cournot markets

- ★ Two **identical** and **symmetric** firms produce a **homogeneous** good  
firm 1 & firm 2
- ★ **Fixed** and **marginal costs** for both sellers are zero  
for **example**, producing water from a **natural** spring
- ★ Assume that the **market demand** is  

$$p = 100 - Q$$
 where  $Q = q_1 + q_2$
- ★ Firms **simultaneously** decide **how much** to produce:
  1. Firm 1 decides about  $q_1$ ; and **separately**, firm 2 decides about  $q_2$
  2. They decide at the **same time**
  3. Their decisions are **irrevocable**.

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Oligopoly Cournot markets

### How firm 1 views the market demand

- ★ The market demand **can be written** as  

$$p = 100 - q_1 - q_2$$
- ★ Firm 1 views its **demand** as:  
 "How much  $q_1$  can I sell, given that firm 2 will also be selling  $q_2$ "
- ★ Thus, demand **as seen by firm 1** is y-intercept  

$$p = (100 - q_2) - q_1$$
- ★ That is, "remove  $q_2$  from the maximum quantity that the market can absorb (100) and I can serve the **residual**"
- ★ The **marginal revenue** for firm 1 is  

$$MR_1 = (100 - q_2) - 2q_1$$

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Oligopoly Cournot markets

### Optimal choice

- ★ Profit maximization for firm 1 implies:  

$$MR_1 = MC \text{ or } (100 - q_2) - 2q_1 = 0 \text{ or } q_1 = \frac{100 - q_2}{2} \quad (1)$$
- ★ **Equation (1)** yields the  $q_1$  that maximizes  $\Pi_1$  for every  $q_2$  the rival may choose  
 we call this: "**best response**" or "**optimal reaction**" function for firm 1
- ★ Firm 2 responds **symmetrically** to firm 1:  

$$q_2 = \frac{100 - q_1}{2} \quad (2)$$
- ★ Since both firms are **symmetrical**, in the end  $q_1 = q_2$ , so we can write (1) as:  

$$q_1 = \frac{100 - q_1}{2} \text{ or } 2q_1 = 100 - q_1 \text{ or } q_1 = q_2 = 33.33$$

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Oligopoly Cournot markets

### Price & profits

- ★ Price in **Cournot**:  $p = 100 - q_1 - q_2 = 100 - 33.33 - 33.33$  or  $p = \$33.33$
- ★ Profit per firm:  $\Pi_1 = R_1 - C = p \cdot q_1 - 0 = \$33.33 \cdot 33.33$  or  $\Pi_1 = \Pi_2 = \$1,111.11$
- ★ If both firms **act as in PC**:  
 $p = MC$  or  $100 - Q = 0$  or  $Q = 100$  or  $q_1 = q_2 = 50$ .  
 $p = \$0$ ; and  $\Pi_1 = \Pi_2 = \$0$ .
- ★ If firms form a **monopoly**:  
 $MR = MC$  or  $100 - 2Q = 0$  or  $Q = 50$  or  $q_1 = q_2 = 25$ .  
 Price:  $p = 100 - q_1 - q_2 = 100 - 25 - 25$  or  $p = \$50$ .  
 Profit per firm:  $\Pi_1 = R_1 - C = p \cdot q_1 - 0 = \$50 \cdot 25$  or  $\Pi_1 = \Pi_2 = \$1,250$ .
- ★ Cournot is **between PC** and Monopoly

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Oligopoly Cournot markets

### Incentive for cheating

	Price	Quantity per firm	Profit per firm
PC	\$0	50	\$0
Cournot	\$33.3	33.33	\$1,111
Collusion	\$50	25	\$1,250

- ★ Assume that firm 1 sets  $q_1 = 25$  and **expects** firm 2 to also produce  $q_2 = 25$ :  
 ► Firm 2 can produce  $q_2 = 25$  and each firm earn **profit** \$1,250  
 ► OR firm 2 can produce  $q_2 = (100 - q_1)/2 = (100 - 25)/2 = 37.5$ .
- ★ If  $q_2 = 37.5$ , **price** will be:  $p = 100 - q_1 - q_2 = 100 - 25 - 37.5 = \$37.5$   
 ► Profit for firm 2:  $\Pi_2 = R_2 - C = p \cdot q_2 - 0 = \$37.5 \cdot 37.5$  or  $\Pi_2 = \$1,406.25$   
 ► Profit for firm 1:  $\Pi_1 = R_1 - C = p \cdot q_1 - 0 = \$37.5 \cdot 25$  or  $\Pi_1 = \$937.5$ .
- ★ Each firm has a strong **incentive to cheat** hurting the other firm
- ★ Without **commitment mechanism**, the collusive outcome is **not sustainable**.

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Oligopoly Bertrand markets

### Bertrand competition (1883)

- ★ Firm 1 and firm 2 produce a **homogeneous** good with **constant unit cost**,  $c$
- ★ **Market demand** is  $p = 100 - Q$
- ★ Firms choose **prices simultaneously**
- ★ Since good is **homogeneous**, consumers buy from **cheapest** seller
- ★ Thus:

Prices	Demand for firm 1	Demand for firm 2
$p_1 < p_2$	$p_1 = 100 - q_1$	0
$p_1 > p_2$	0	$p_2 = 100 - q_2$
$p_1 = p_2$	$p = 100 - q_1 - q_2$	

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Oligopoly Bertrand markets

## Bertrand equilibrium

- ★ If firm 1 charges any  $p_1$  above cost  
firm 2 will want to *undercut* with  $p_2 < p_1$  and grab the *entire market*
- ★ If firm 1 charges any  $p_1$  below cost  
firm 2 will produce 0 and let firm 1 take the *losses*
- ★ If firm 1 charges  $p_1$  equal to cost  
firm 2 will *follow suit* – neither firm will have an *incentive to deviate*
- ★ The Bertrand **equilibrium** is  $p_1^* = p_2^* = c$
- ★ In Bertrand, firms end up producing the **PC output** and earning **zero profit**
- ★ If firms tried to **collude** and both charge the same price above cost  
both firms would have a **strong incentive to cheat** by undercutting.

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Oligopoly Bertrand markets

## The Bertrand paradox


- ★ This Bertrand equilibrium is **paradoxical**  
firms have *market power* but *behave as if they do not have*
- ★ **The source** of the paradox
- ★ 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 one period* – the benefit from collusion is *lower* but for *many periods*
  3. **Differentiation**: when a firm's product is perceived as *better*, its customers *will not abandon* it if it charges a higher price.

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## 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...

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**Thank you!**

You may stay for consultation or discussion

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