

Lecture 5

Strategic Competition



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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

Estimated duration: 130min



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Assumptions > Oligopoly

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 comes from the small number of firms, NOT from product differentiation
3. **Barriers to entry:**
 - ▶ Oligopolistic firms are large enough to **create barriers** to entry to protect their profits
 - ▶ Barriers allow firms to **maintain their S-R profits** in the L-R
 - ▶ Threatening **price wars**, building **excess capacity**, proliferation, advertisement

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Strategic game > Oligopoly

- ★ The **distinguished** 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 **advertisement**
 - ▶ 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 **research**
 - ▶ 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 cooperate and act as if they were a monopoly
- * **Kinked demand model**: Firms are reluctant to reduce prices

BREAK

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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 decide **how much** to produce:
 1. Separately
 2. Simultaneously
 3. Irrevocably

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How firm 1 views the market demand

> Oligopoly > Cournot markets

- ★ 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

$$p = (100 - q_2) - q_1$$

- ★ In **firm's 1** demand, the **intercept** is equal to $(100 - q_2)$ and the **slope** is -1

- ★ The **marginal revenue** for firm 1 is

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

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Optimal choice

> Oligopoly > Cournot markets

- ★ 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 Π_1 for every q_2 firm 2 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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Price & profits

> Oligopoly > Cournot markets

- ★ 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**:

$$p = MC \text{ or } 100 - Q = 0 \text{ or } Q = 100 \text{ or } q_1 = q_2 = 50.$$

$$p = \$0; \text{ and } \Pi_1 = \Pi_2 = \$0.$$

- ★ If firms form a **monopoly**:

$$MR = MC \text{ or } 100 - 2Q = 0 \text{ or } Q = 50 \text{ or } q_1 = q_2 = 25.$$

$$\text{Price: } p = 100 - q_1 - q_2 = 100 - 25 - 25 \text{ or } p = \$50.$$

$$\text{Profit per firm: } \Pi_1 = R_1 - C = p \cdot q_1 - 0 = \$50 \cdot 25 \text{ or } \Pi_1 = \Pi_2 = \$1,250.$$

- ★ Cournot is **between** PC and Monopoly

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Incentive for cheating

> Oligopoly > Cournot markets

	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**, collusion is **not sustainable**

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Bertrand competition (1883)

> Oligopoly > Bertrand markets

- * 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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Bertrand equilibrium

> Oligopoly > Bertrand markets

- * 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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The Bertrand paradox

> Oligopoly > Bertrand markets

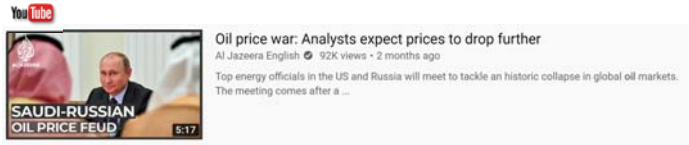
- * This Bertrand equilibrium is **paradoxical**
firms have **market power** but **behave as if they do not have**
- * **The source** of the paradox is the particularly **strong motive** for undercutting
even 1-cent **price-cut** may shift the **market share** from 0% to 100%
- * There are 3 **major 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?



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Thank you!

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

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WARNING!

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