

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 ▶

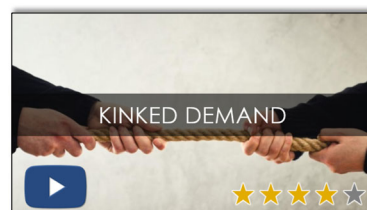
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Modeling real markets

- ★ 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



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Assumptions

> Oligopoly

- 1. Small number** of firms:
 - ▶ Small enough, so that interaction is **possible** and **meaningful**
 - ▶ Every firm must **consider** the actions of its rivals.
- 2. Homogeneous** product:
 - ▶ The product **CAN be heterogeneous** in oligopoly
 - ▶ We will focus on **market power** that results from the number of firms, NOT from differentiation
- 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**

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Strategic game

> Oligopoly

- ★ In all other market structures, every firm was simply **doing its best** no matter what **other firms** do
- ★ In oligopoly, actions will **affect rivals** causing them to **react** firms cannot think of their actions **independently**, anymore
- ★ Therefore, actions in oligopoly are **strategic**

Examples of oligopolistic markets

> Oligopoly

- ★ Upper-middle class **cars**
BMW, Mercedes, Audi, Volvo, Lexus, Land Rover
- ★ Flagship **smartphones**
iPhone, Samsung Galaxy, Huawei, Pixel
- ★ Commercial **aircraft** manufacturing
Boeing, Airbus, COMAC, Embraer
- ★ **Credit card** Networks
Visa, Mastercard, Amex, Discover

Competition with respect to what?

> Oligopoly

★ Firms have to choose in **which field** they will compete:

- ▶ Apple and Samsung compete with respect to
- ▶ BMW and Benz compete with respect to
- ▶ Coke and Pepsi compete with respect to
- ▶ DKNY and Calvin Klein compete with respect to
- ▶ Chrome and Safari compete with respect to
- ▶ MIT and Caltech compete with respect to
- ▶ Russian and Saudi Arabian oil compete with respect to **quantity**
- ▶ FairPrice and RedMart compete with respect to **price** ▲

Oligopoly models

> Oligopoly

★ **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 ▲▲



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The Cournot duopoly (1838)

> Oligopoly > Cournot markets

- ★ 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

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MR for firm 1

> Oligopoly > Cournot markets

- ★ 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

> Oligopoly > Cournot markets

- ★ Profit maximization for **firm 1** implies:

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

- ★ **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**:

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

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

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

Price & profits

> Oligopoly > Cournot markets

★ 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 $\Pi_1 = \Pi_2 = \$1,600$

★ If both firms **acted as PC competitors**:

$p = MC$ 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 $\Pi_1 = \Pi_2 = \$0$

★ 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 $\Pi_1 = \Pi_2 = \$1,800$

Comparing models

> Oligopoly > Cournot markets

	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

★ The **most profitable outcome** for firms is to **collude** by setting $q = 30$

Incentive for cheating !

> Oligopoly > Cournot markets

	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** could produce $q_2 = 30$ and each firm earn **profit** \$1,800

▶ 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 $\Pi_2 = \$$

▶ Profit for **firm 1**: $\Pi_1 = (p - c)q_1 = (\$55 - \$10)30$ or $\Pi_1 = \$$

★ 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

- ★ 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 takes all customers
 - ▶ If $p_1 = p_2$, firms **share** the demand as in Cournot ($p = 130 - q_1 - q_2$).

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Bertrand equilibrium

> Oligopoly > Bertrand markets

- ★ For any price above MC **NOT EQUILIBRIUM**
firms would want to
- ★ For any price below MC **NOT EQUILIBRIUM**
firms would want to
- ★ If firms price at MC: **EQUILIBRIUM**
 - ▶ No reason to exit because firms make **zero profit**
 - ▶ Undercutting yields
 - ▶ Individually increasing price yields
- ★ The Bertrand **equilibrium** is $p_1^* = p_2^* = MC$
firms end up producing the **PC output** and earning **PC profit**.

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The Bertrand paradox

> Oligopoly > Bertrand markets

- ★ 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
- ★ 3 **reasons** why we **rarely** observe the Bertrand paradox in reality:
 1. **Capacity constraints**: if the cheaper firm does not have the **capacity** to serve the entire market, rivals 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 **forever**
 3. **Differentiation**: when a firm's product is perceived as **different**, consumers may keep consuming it even when rival products are cheaper ▲▲

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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?

YouTube



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 are welcomed to stay for consultation or discussion)

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