SPRING 2025 | PRACTICAL SESSIONS

Industrial Organization

Bertrand with differentiated products

Midterm revision

Week 8

The	Bertrand Model			EXAMPLES : telecommunication automobile industry, tech ind	
		Perfect competition	Monopolistic competition	Oligopoly	Monopoly
	Characteristics	Homogeneous product Many firms Many consumers Free entry and exit	Many firms Many consumers Differentiated product Free entry and exit $(\pi^{LR} = 0)$	<pre>Some producers but not many Depending on the characteristics of the oligopoly we will use different models. Examples: A Cournot; Stackelberg; Bertrand; </pre>	Only one firm Unique product Entry barriers
	Behaviour	Takes market determined price as given and chooses quantity to maximize profits (" <u>Price-takers</u> ")	Sets price and quantity to maximize profits (" <u>Price-maker</u> ")		Sets price and quantity to maximize profits (" <u>Price-maker</u> ")
	Optimal decision	P = MC	MR = MC		MR = MC





The Bertrand Model

Main assumptions:

- Oligopolistic model (more than one firm)
- Firms choose **simultaneously**
- ... the price they will charge
- In for a homogenous product

Bertrand Equilibrium

Symmetric firms: Each firm has incentives to undercut each other until they reach the marginal cost.

$$MC_1 = MC_2 = c \rightarrow P_1 = P_2 = c$$



Additional assumptions:

No capacity constraints.

• If
$$p_1 = \dots = p_n \rightarrow q_1 = \dots = q_n = \frac{Q}{n}$$

/Not mandatory! Just for simplicity!



The Bertrand Model

Main assumptions:

- Oligopolistic model (more than one firm)
- Firms choose **simultaneously**
- ... the price they will charge
- In for a homogenous product

Bertrand Equilibrium

Asymmetric firms: The most efficient firm will undercut its competitor and be the sole producer.

 $\underline{If MC_1} < \underline{MC_2} \rightarrow \underline{P_1} = \underline{MC_2} - \varepsilon$



Additional assumptions:

No capacity constraints.

• If
$$p_1 = \dots = p_n \rightarrow q_1 = \dots = q_n = \frac{Q}{n}$$

/Not mandatory! Just for simplicity!



Bertrand with differentiated products

General case $\rightarrow q_1 = a - bp_1 + dp_2 \wedge q_2 = a - bp_2 + dp_1 \wedge MC_1 = MC_2 = c$

Goal of all firms \rightarrow Maximize profits

$$\max_{p_i} \pi_i = (P_i - c)q_i$$

$$\frac{d\pi}{dp_i} = \mathbf{0} \leftrightarrow (\dots) \leftrightarrow p_i = \frac{a+cb}{2b} + \frac{d}{2b}p_j$$





Bertrand with differentiated products

EXERCISE

compete in prices, which they set simultaneously and independently.

(a) What price will each firm set? How much will each sell? What profit will each attain? Quantify.

Firm 1 has embarked on an R&D project that has lowered its constant marginal and average cost to 2.

(b) What price will each firm set? How much will each sell? What profit will each attain? Quantify.



9. Two firms sell imperfectly differentiated products, denoted 1 and 2, whose demand functions are $q_1 = 10 - p_1 + p_2$ and $q_2 =$ $10 - p_2 + p_1$, respectively. Each produces its product at a constant marginal and average cost of 6, i.e., $c_1 = 6 = c_2$. They



Bertrand with differentiated products

EXERCISE

compete in prices, which they set simultaneously and independently.

Suppose that firm 2 is unaware of firm 1's R&D project. This gives rise to the **direct effect**. Suppose now that firm 2 becomes aware of the R&D project. This would give rise to additional price changes, which constitute the **strategic effect**. The two together yield the **total effect**. of the R&D project.

(c) What is the direct effect of the R&D project on firm 1's decision variable, i.e., its price? And the strategic effect? Quantify and explain.



9. Two firms sell imperfectly differentiated products, denoted 1 and 2, whose demand functions are $q_1 = 10 - p_1 + p_2$ and $q_2 =$ $10 - p_2 + p_1$, respectively. Each produces its product at a constant marginal and average cost of 6, i.e., $c_1 = 6 = c_2$. They





Information about the midterm

Midterm topics:

- The Extremes: Perfect Competition and Monopoly
- Market Structure:
 - Measures of Concentration
 - Measures of Volatility
- Game Theory
- Oligopoly models:
 - Dominant Firm and Monopolistic Competition
 - Cournot
 - Stackelberg
 - Bertrand

NOVA SCHOOL OF BUSINESS & ECONOMICS

Midterm structure:

- 2 True or False questions (8 points)
- 2 Exercises (12 points)

Office Hours: TBA @ Moodle







be making no profit whatsoever and yet the Herfindahl-Hirschman index may be approximately 1."



"In a duopoly, price may be equal to both firm's constant average and marginal cost, i.e., both firms may

Competition in Quantities EXERCISE

3)

How much will each **produce**? What **price** will prevail? How much will each **profit**? (i) Firm 2's factory has partially burned down. As a result, **firm 2 can produce at most 2 units of output**.

(ii) How does this affect firm 2's **best-reply function**? Draw a figure. And firm 1's? Complete the figure.

(iii) What is firm 2's **output**? And firm 1's? What is firm 2's **profit**? And firm 1's?



- Two firms, 1 and 2, supply a market for an homogeneous product whose demand equals q = 10 p. They do so at a constant marginal and average cost of 2 while competing in quantities which they decide simultaneously.

Competition in Quantities EXERCISE



Two firms, 1 and 2, supply a market for an homogeneous product whose demand equals q = 10 - p. They do so at a constant marginal and average cost of 2 while competing in quantities.

Suppose that firm 1's manager is unaware of the fire.

(iv) What is firm 1's **output**? And firm 2's? What is firm 2's **profit**? And firm 1's?

(v) Is it preferable for consumers that firm 1's manager remain unaware of the fire? Compute and explain.



EXERCISE

Competition in Prices



and average cost of 2.

What **price** will firm 1 set? What will its profit be? Quantify. (i)

and independently.

(ii) What is the **value of firm 2's** new medicine to its shareholders?

society as a whole? Compute and explain.



- One firm, denoted 1, supplies a medicine whose demand is equal to q = 10 p, producing it at a constant marginal
- Another **firm, denoted 2**, comes up with another medicine that is a **perfect substitute** for the medicine produced by firm 1. Firm 2 also produces at a marginal and average cost of 2. **Both firms quote prices**, which they choose simultaneously
- (iii) Who benefits from firm 2's invention? Who is hurt by firm 2's invention? What is the value of firm 2's new medicine for