



ΠΑΝΕΠΙΣΤΗΜΙΟ  
ΠΑΤΡΩΝ  
UNIVERSITY OF PATRAS

## An Introduction to Special Topics in Business Economics

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# Overview

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## What is Industrial Organization?

- Industrial organization is concerned with the workings of markets and industries, in particular the way firms compete with each other.
- The main reason for considering industrial organization as a separate subject from microeconomics is its emphasis on the study of a firm's strategies that are characteristic of market interaction: price competition, product positioning, advertising, research and development etc.
- Moreover, whereas microeconomics typically focuses on the extreme cases of monopoly and perfect competition, industrial organization is primarily concerned with the intermediate case of oligopoly, that is, competition between a few firms.

# Productivity

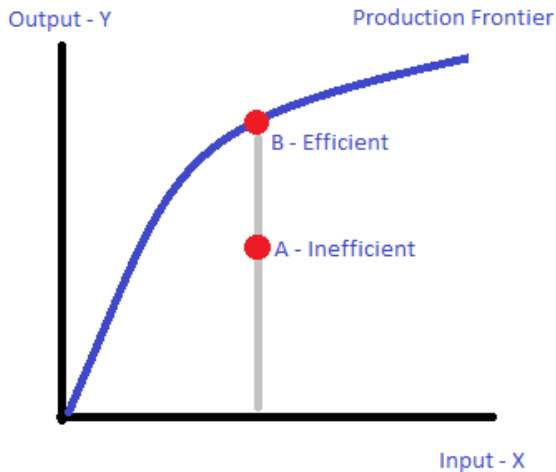
- Productivity is an index that measures output (goods and services) relative to the input (capital, labor, materials, energy, and other resources) used to produce them
- It is usually expressed as the ratio of output to input:

$$Productivity = \frac{Output}{Input}$$

- Operations manager aims to increase firm's productivity. What are the ways to achieve it?
  - Increase output by using the same or a lesser amount of input
  - Reduce input used while keeping output constant or increasing it
  - Use more input as long as output increases at a greater rate
  - Decrease output as long as input decreases at a greater rate

- Efficiency is the ratio of actual output generated to the expected (or standard) output prescribed
- Given a production function curve, if a point A does not reach the production frontier, we call it inefficient
- Efficiency generally relates to some form benchmark or target

# Efficiency



# Production Function

- Production function describes the technical relationship between the inputs and outputs of a production process. Gives the maximum output(-s) attainable from a given vector of inputs
- The production function describes a boundary or frontier representing the limit of output obtainable from each feasible combination of input. *Alternatively*, a production function can be defined as the specification of the minimum input requirements needed to produce designated quantities of output.
- Usually the mathematical formulation is the following:

$$Q = f(x_1, x_2, \dots, x_n)$$

- Maximizing profit is the goal of every firm, industry, organization

# Production Function

- The **Cobb-Douglas** production function is a particular form of the production function. It is the most common and is widely used because it has many attractive characteristics.

The basic form of the Cobb-Douglas production function is as follows:

$$Q(K, L) = AK^\alpha L^{1-\alpha}$$

Where:

- Q denotes the quantity of products
  - K depicts the quantity of capital
  - L depicts the quantity of labor
  - A is a positive constant
  - $\alpha$  is a constant between 0 and 1
- **Translog** and **Leontief** are two productions functions that are less commonly used.



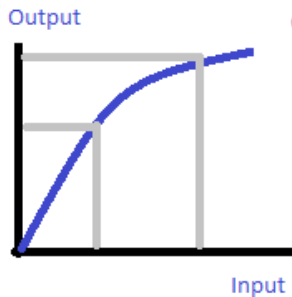
## What is Returns to Scale?

Returns to scale is the variation or change in the output that is the outcome from a proportionate increase of all the input

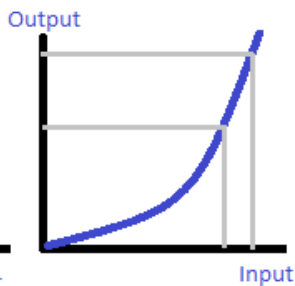
## Types of Returns to Scale

- **Increasing returns to scale** occurs when the output increases by a larger proportion than the increase in inputs during the production process
- **Decreasing returns to scale** occurs when the proportion of output is less than the desired increased input during the production process
- **Constant returns to scale** means that the proportionate increase in input is exactly equal to the increase in output

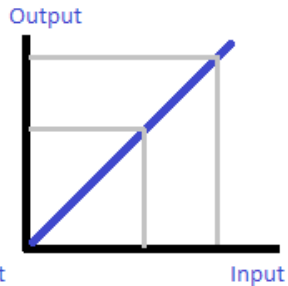
# Scale Economies



Decreasing Returns to Scale



Increasing Returns to Scale



Constant Returns to Scale

Given the following Cobb-Douglas production function,

$$Q = 2\chi_1^{0.7}\chi_2^{0.25}$$

can you calculate the partial production elasticities?

Total production elasticities?

*Increasing, Decreasing or Constant Returns to Scale?*

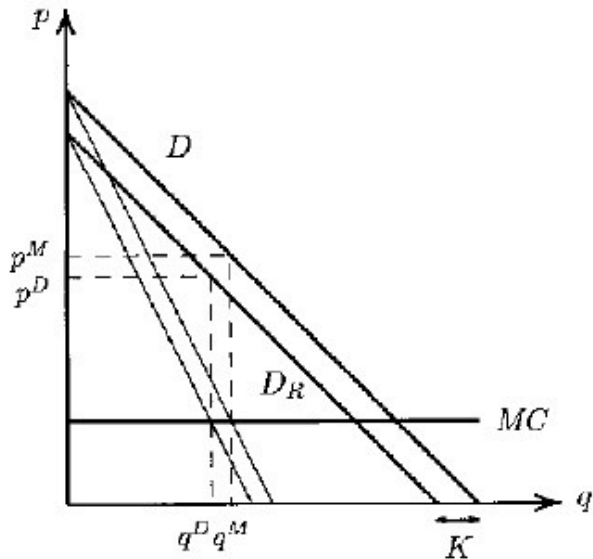
Any changes when

$$Q = 3\chi_1^{0.85}\chi_2^{0.25}$$

## Monopoly - Types of Monopoly

- 1 The model of monopoly is based on the assumption that there is a well-defined market with one single supplier.
- 2 Pure monopoly is the situation in which one firm holds a 100% share of the market.
  - Examples include many electric, telephone, water utilities.
- 3 A dominant firm may be classified as one with 50% to 100% of the market and no close rival.
  - Examples include Kodak film from back in the day.
- 4 The degree of monopoly power is inversely related to the demand elasticity faced by the firm.
  - As monopoly power, we refer to the ability to set a price much higher than the cost.

# Monopoly - Dominant Firm



# Perfect Competition

- 1 There are many suppliers in the market: Each supplier is so small that its actions have no significant impact on other suppliers.
- 2 Product supplied by each firm is the same.
- 3 Consumers and firms know the prices set by all firms.
- 4 All firms have access to all production technologies.
- 5 Any firm may enter or exit the market as it wishes.

## Objective

Profit maximization. In other words: marginal revenue equals marginal cost. But in a perfectly competitive market marginal revenue is equal to price which means:

$$p = MC$$

If one firm sets a price above that of other firms, it sells nothing. If it sets a price below?

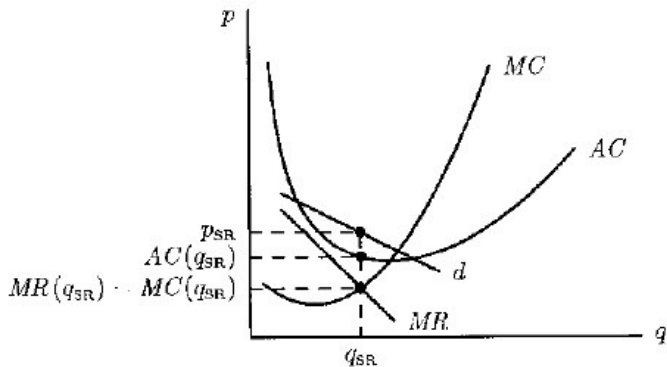
At the price level set by the other firms, demand goes from zero to infinity.

We assume that the demand faced by each firm is horizontal and that each firm is a price taker.

# Monopolistic Competition

- The **Monopolistic Competition** model has the same assumptions as the Perfect Competition model except that of product homogeneity .
- Thus the demand curve faced by each firm is not horizontal. Hence, each firm is a price maker, not a price taker.
- At the short-run output level the price received by each firm ( $p$ ), is greater than average cost (AC).
- As long as price is different from average cost, the short-run equilibrium is not a long-run equilibrium.
- If  $P > AC$  are firms willing to enter the market?
- What will happen if  $P < AC$ ?

# Short-Run Equilibrium in Monopolistic Competition

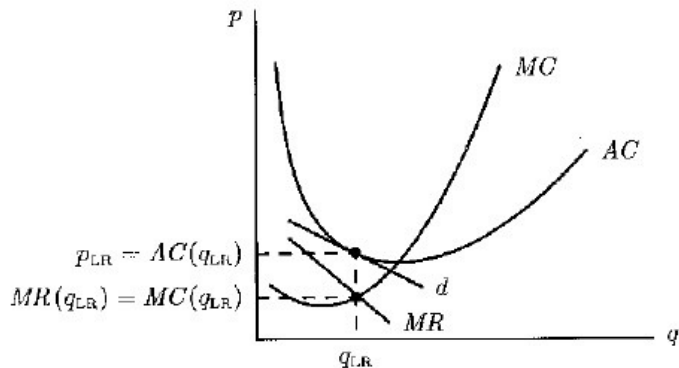




# Long-Run Equilibrium in Monopolistic Competition

- Long-run equilibrium is the situation in which firms maximize profits, so that marginal revenue equals marginal cost and firms make zero profits (that is, price equals average cost), so that no active firm wishes to become inactive or vice versa.
- The zero-profit equilibrium implies that price equals the minimum average cost in the perfect competition model. Price equals marginal cost under perfect competition, whereas price is greater than marginal cost under monopolistic competition.

# Long-Run Equilibrium in Monopolistic Competition



## Oligopoly Competition - Duopoly

- Industries with a few (more than one) firms, but less than the very large number usually assumed by the model of perfect competition.
- In contrast with monopoly and perfect competition, in oligopoly firm has to consider its rivals reactions.
- The situation in which there are 2 competitors is designated by duopoly.
- The process of interdependent strategic decision making under oligopoly: the Bertrand model and the Cournot model.

# Bertrand Model

The model consists of **two firms** in a market for an *homogeneous product* and the assumption that **firms simultaneously set their prices**



The firm that sets the lowest price gets all of the demand



Firm 1's optimal price depends on what it conjectures Firm 2 will choose, and vice versa

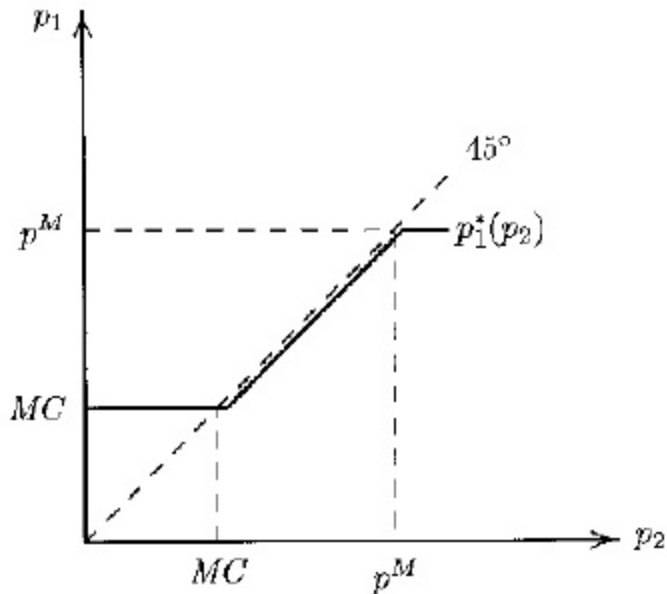


What is each firm's best strategy?

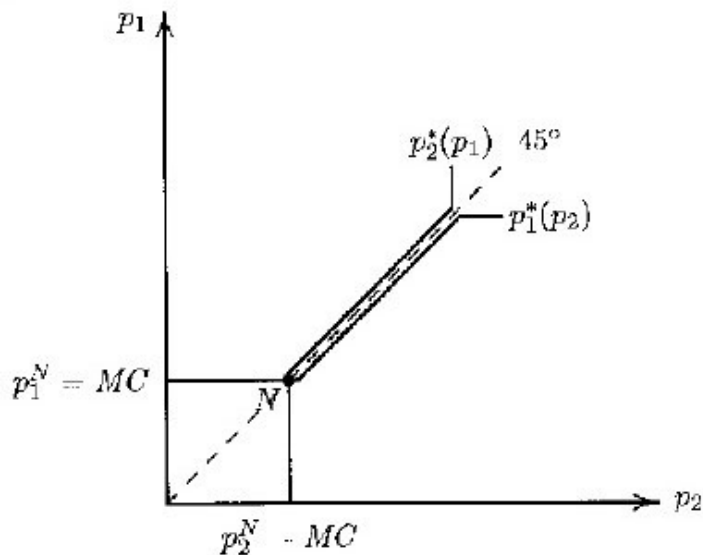
# Bertrand Model

- Suppose that Firm 1 expects Firm 2 to price above monopoly price. Then Firm 1's optimal strategy is to price at the monopoly level. Thus, Firm 1 gets all of the demand and receives monopoly profits.
- Suppose that Firm 1 expects Firm 2 to price below monopoly price but above marginal cost. Then Firm 1's optimal strategy is to set a price just below that of Firm 2. Pricing below gives firm  $i$  all of the market demand, but with lower profits, the lower the price is.
- Suppose Firm 1 expects Firm 2 to price below marginal cost, then Firm 1's optimal choice is to price higher than Firm 2, say, at marginal cost level.

# Bertrand Model



# Bertrand Model-Equilibrium



# Bertrand Model-Equilibrium

- Point N in fact, is the point at which  $p_1 = p_1^*(p_2)$  because the point is on Firm 1's reaction curve and  $p_2 = p_2^*(p_1)$  because the point is on Firm 2's reaction curve.
- Under price competition with homogeneous product and constant, symmetric marginal cost (aka Bertrand competition), firms price at the level of marginal cost.



# Cournot Model

The model consists of **two firms** in a market for an *homogeneous product* and the assumption that **firms simultaneously set their output levels**.



The market price is then set at the level such that demand equals the total quantity produced by both firms.



Firm 1's optimal quantity depends on what it conjectures Firm 2 will choose, and vice versa.

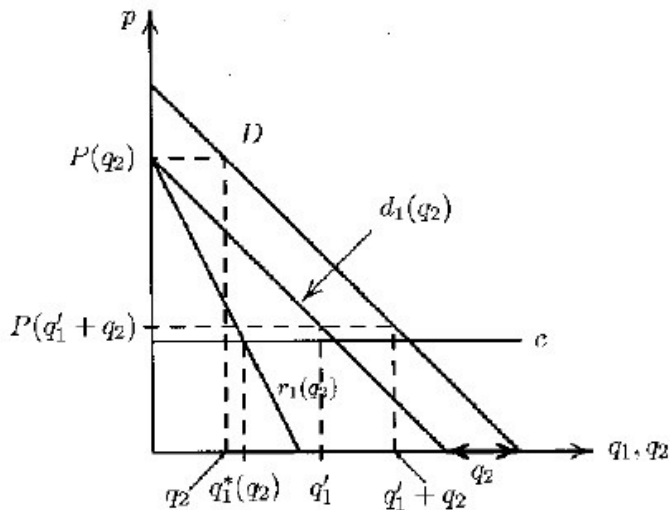


What is each firm's best strategy?

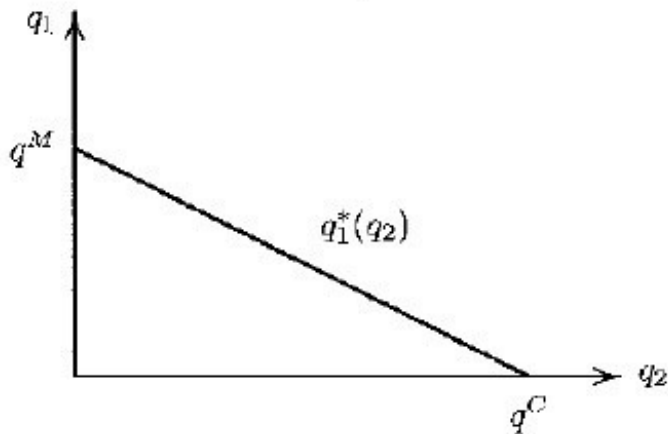
# Cournot Model

- Suppose that Firm 1 expects Firm 2 to produce quantity  $q_2$ . If Firm 1 decides not to produce anything, then price is given by  $P(0 + q_2) = P(q_2)$
- If Firm 1 decides to produce, let's say,  $q'_1$  then price is given by  $P(q'_1 + q_2)$
- For each quantity that Firm 1 might decide to set, price is given by the curve  $d_1(q_2)$ . The curve  $d_1(q_2)$  is called Firm 1's residual demand and gives all possible combinations of Firm 1's quantity and price for a given value of  $q_2$

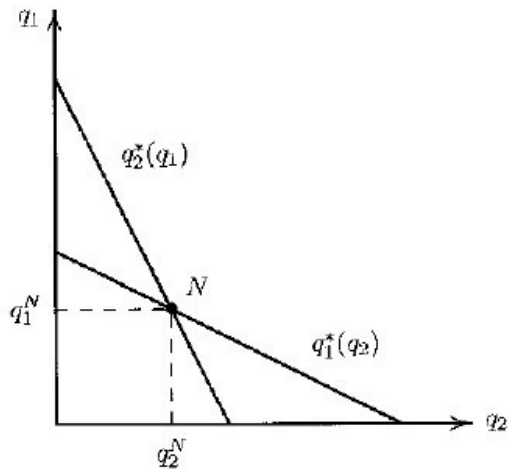
# Cournot Model



# Cournot Model



# Cournot Model - Equilibrium



## What we choose

If capacity and output can be easily adjusted, then the Bertrand model is a better approximation of duopoly competition. If, by contrast, output and capacity are difficult to adjust, then the Cournot model is a good approximation of duopoly competition.

- Suppose that capacity or output is a long-run decision with respect to prices. Hence, the right model is one wherein firms first set capacity/output and then prices.
- Suppose it is easier to adjust output levels than it is to adjust prices. Then, the right model is one whereby firms set prices first and then output levels.

# Market Concentration

- *Market concentration* shows the degree to which production in a particular market or industry is concentrated in the hands of a few large firms.
- *Market power* can be understood as the level of influence that a company has on determining its price on an industry.
- *Market share* represents the percentage of an industry, or a market's total sales, that is earned by a particular company over a specified time period. Market share is calculated by taking the company's sales over the period and dividing it by the total sales of the industry over the same period. This metric is used to give a general idea of the size of a company in relation to its market and its competitors.

# Market Concentration - $C_m$ & Herfindahl Index

- The most commonly used index is the coefficient  $C_m$ , the sum of the market shares of the largest  $m$  firms. The value of  $C_4$  (4 largest firms) varies between zero (minimum concentration) and one (maximum concentration).

$$C_4 \equiv \sum_{i=1}^4 s_i$$

- Herfindahl index is an alternative measure of market concentration. It computes concentration of 1 firm. The value of  $H$  varies between zero (minimum concentration) and one (maximum concentration aka monopoly).  $H$  requires knowledge of the market share of all firms in the industry.

$$H \equiv \sum_{i=1}^n s_i^2$$



## Market Power - Lerner Index

- Market power may be defined as the ability to set prices above cost, specifically above incremental or marginal cost, that is, the cost of producing one extra unit.
- We measure market power by the Lerner index, defined as the weighted average of each firm's margin, with weights given by the firm's market shares and  $s_i$  is firm  $i$ 's market share:

$$L \equiv \sum_{i=1}^n s_i \frac{p - MC_i}{p}$$

# Market Power, Market Concentration, Example

- The last equation in a general Cournot model with  $n$  firms, each with a cost function  $C_i(q_i)$  can also be written as:

$$L = \frac{H}{\epsilon}$$

where  $\epsilon$  depicts elasticity

- The greater concentration is ( $H$ ), the greater the degree of market power ( $L$ )
- *Consider two markets with identical demands. In one market, there are two firms with identical market shares. In the other market, there is one firm with a 70% market share and two small firms with 15% each. Assuming that both markets are in a Cournot equilibrium, where is market power the greatest?*

ALWAYS  
LOOK ON  
THE  
BRIGHT  
SIDE  
OF LIFE