

# LM 2 - The Firm and Market Structures

## KIA Fresh Graduates Program - Economics

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# Learning Outcomes

The candidate should be able to:

- 1 describe characteristics of perfect competition, monopolistic competition, oligopoly, and pure monopoly;
- 2 explain relationships between price, marginal revenue, marginal cost, economic profit, and the elasticity of demand under each market structure;
- 3 describe a firm's supply function under each market structure;
- 4 describe and determine the optimal price and output for firms under each market structure;
- 5 explain factors affecting long-run equilibrium under each market structure;
- 6 describe the use and limitations of concentration measures in identifying market structure;
- 7 identify the type of market structure within which a firm operates.

# Overview

- 1 Introduction to Market Structures
- 2 Analysis of Market Structures
- 3 Practice Questions

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# Introduction to Market Structures

- Market structure is very important in understanding firm's pricing decisions and its potential to increase profitability.
- In the long run, profitability is largely determined by market structure.
- If a market is highly competitive, profits will decrease in the long run.
- In less competitive markets, large profits are possible in the long run.

# Introduction to Market Structures

## Factors That Determine Market Structure

- The number and relative size of firms supplying the product;
- The degree of product differentiation;
- The power of the seller over pricing decisions;
- The relative strength of the barriers to market entry and exit;
- The degree of non-price competition.

# Introduction to Market Structures

	<i>Perfect competition</i>	<i>Monopolistic Competition</i>	<i>Oligopoly</i>	<i>Monopoly</i>
<b>Number of sellers</b>	Many firms	Many firms	Few firms	Single firm
<b>Barriers to entry</b>	Very low	Low	High	Very high
<b>Nature of substitute products</b>	Very good substitutes	Good substitutes but differentiated	Very good substitutes but differentiated	No good substitutes
<b>Nature of competition</b>	Price only	Price, marketing, features	Price, marketing, features	Advertising
<b>Pricing power</b>	None	Some	Some to significant	Significant

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# Perfect Competition

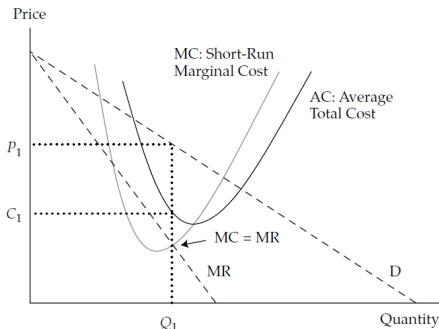
Perfect competition is characterized by five conditions:

- ① There are a large number of potential buyers and sellers;
- ② The products offered by the sellers are virtually identical;
- ③ There are few or easily surmountable barriers to entry and exit;
- ④ Sellers have no market-pricing power;
- ⑤ Non-price competition is absent.

# Monopolistic Competition

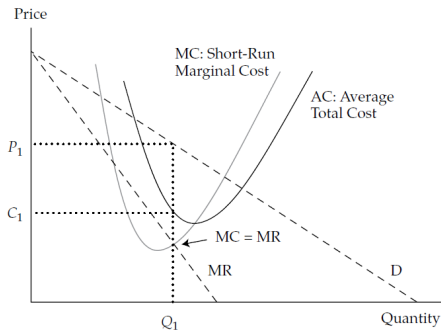
- The most distinctive factor in monopolistic competition is product differentiation.
- The extent to which the producer is successful in product differentiation determines pricing power in the market.
- Because of relatively low entry and exit costs, competition will, in the long run, drive prices and revenues down toward an equilibrium similar to perfect competition.

# Short-Run Equilibrium in Monopolistic Competition



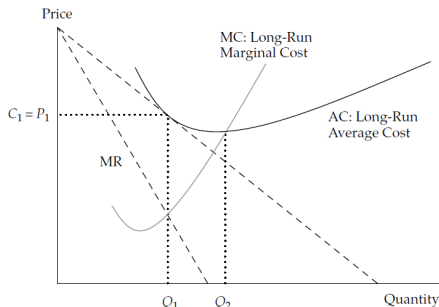
- Because of product differentiation, each firm faces a downward sloping demand curve.
- Profit is maximized at the quantity  $Q_1$  that sets  $MR = MC$ .
- Given optimal quantity, price is determined by the demand curve.

# Short-Run Equilibrium in Monopolistic Competition



- Total revenue  $TR = P_1 \times Q_1$ .
- The average total cost at  $Q_1$  is given by  $C_1$ .
- Total cost  $TC = C_1 \times Q_1$ .
- Economic profit  $\pi = TR - TC$ .

# Long-Run Equilibrium in Monopolistic Competition



- In the long-run, firms' entry pushes down economic profits to zero.
- Profit is maximized at the quantity  $Q_1$  that sets  $MR = MC$ .
- At  $Q_1$ , economic profits are zero since  $TR = TC$  ( $P_1 = C_1$ ).
- The long-run equilibrium output  $Q_1$  is lower than  $Q_2$ , the level that would prevail under perfect competition.

# Oligopoly Market Structure

- An oligopoly is characterized by only a few firms that dominate the market.
- The degree of product differentiation varies but in general products are close substitutes;
- Entry into the market is difficult, with fairly high costs and significant barriers to competition;
- The pricing decisions are interdependent: each firm takes into account other firms reaction when setting its price;
- Price collusion can be observed in many oligopoly markets (e.g. oil market);
- Even without price collusion, a dominant firm may easily become the price maker.

# Oligopoly Pricing Strategies

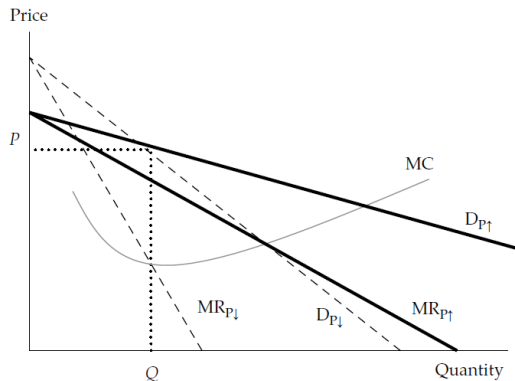
- oligopoly demand curves' depend on the degree of pricing interdependence.
- In the presence of price collusion, the aggregate demand curve is divided across all firms (e.g. OPEC+);
- In the absence of price collusion, each firm faces an individual demand curve;
- The characteristics of the demand curve depends on the pricing strategies adopted by competitors;
- Three main pricing strategies:
  - ▶ Pricing interdependence;
  - ▶ Cournot competition;
  - ▶ Nash equilibrium.

# Pricing Interdependence

- The market is characterized by "price wars".
- The most common pricing strategy assumption is that competitors will match a price reduction and ignore a price increase.
- This implies that price elasticity of demand will be much greater if the price is increased and less if the price is decreased.

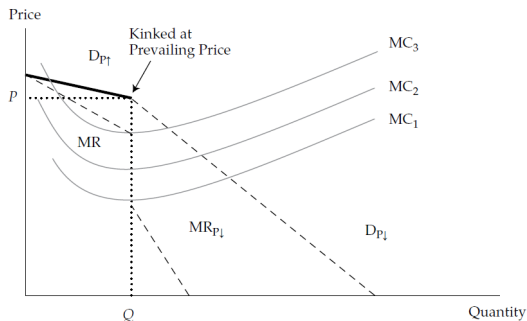


# Pricing Interdependence



- At a given prevailing price, firm faces two different demand structures, one associated with price increases and another relating to price reductions.

# Pricing Interdependence



- Kinked demand curve, with the two segments representing the different competitor reactions to price changes.
- Discontinuity in MR schedule implies multiple MC curves are consistent with the same optimal price and quantity.

# Issues with Pricing Interdependence

- The kinked demand curve analysis helps explain why stable prices have been observed in oligopoly markets.
- However, it is considered an incomplete pricing analysis because it cannot determine the original prevailing price.

# Cournot Competition

- Developed by French economist Augustin Cournot in 1838.
- Each firm determines its profit-maximizing production level by assuming that the other firms' output will not change.
- In equilibrium, neither firm has an incentive to change output, given the other firm's production level.

## Cournot Competition: Example

- Aggregate market demand:  $Q_D = 450 - P$ .
- Supply function for each firm:  $MC = 30$ .
- Quantity supplied  $Q_S = q_1 + q_2$ .
- We solve for the equilibrium such that  $Q_D = Q_S$ .
- This implies:  $P = 450 - q_1 - q_2$ .
- Total revenue for each firm:

$$TR_1 = Pq_1 = 450q_1 - q_1^2 - q_1q_2$$

$$TR_2 = Pq_2 = 450q_2 - q_1q_2 - q_2^2$$

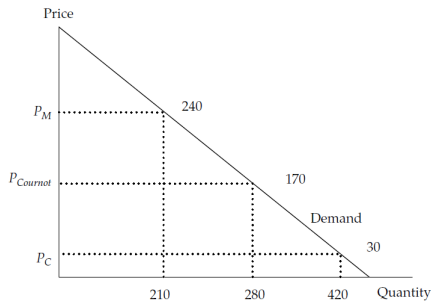
- Profit maximization requires  $MR = MC$  for each firm:

$$450 - 2q_1 - q_2 = 30$$

$$450 - q_1 - 2q_2 = 30$$

- This is a system of two equations in two unknowns that we can solve to get  $q_1 = q_2 = 140$ ,  $Q = 280$ ,  $P = 170$ .

# Cournot Competition: Example



- Cournot solution falls between the competitive equilibrium and the monopoly solution.
- Cournot firms have some market power: They produce less to keep prices higher and maximize profits.
- As the number of firms increases, the Cournot equilibrium solution moves toward the competitive equilibrium solution.

# Nash Equilibrium

- Based on the work of the mathematician John Nash, the 1994 Nobel Prize winner.
- Nash equilibrium is a situation where two or more participants in a non-cooperative game have no incentive to deviate from their respective equilibrium strategies after they have considered and anticipated their opponent's rational choices or strategies (i.e. mathematically, its a fixed point of the best response functions of all players).
- In the context of oligopoly markets, the Nash equilibrium is an equilibrium defined by the characteristic that none of the oligopolists can increase its profits by unilaterally changing its pricing strategy.

# Nash Equilibrium: Example

<p>ArcCo – Low Price</p> <p>50                      70</p> <p>BatCo – Low Price</p>	<p>ArcCo – Low Price</p> <p>80                      0</p> <p>BatCo – High Price</p>
<p>ArcCo – High Price</p> <p>300                      350</p> <p>BatCo – Low Price</p>	<p>ArcCo – High Price</p> <p>500                      300</p> <p>BatCo – High Price</p>

- Two firms in the market, ArcCo and BatCo.
- ArcCo and BatCo can charge high prices or low prices for the product.
- Nash equilibrium is (High Price, Low Price).
- However, this situation presents an incentive for price collusion!

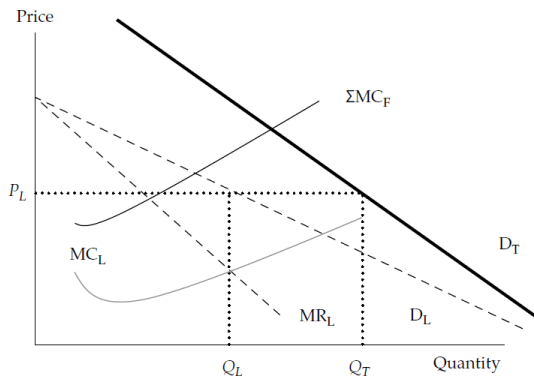


# Price Collusion

Price collusions are more likely to succeed when:

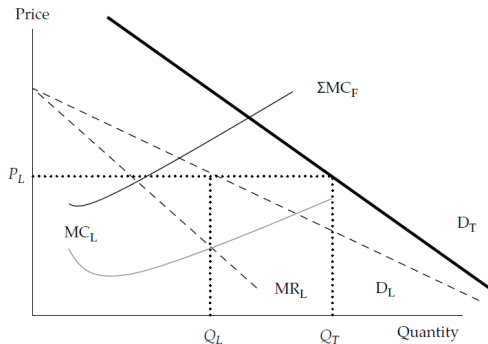
- Number of firms is small or if one firm is dominant.
- Products are homogeneous with little differentiation.
- Firms have similar cost structure.
- Orders are frequent, regular, and of relatively small sizes.
- The fear of severe retaliation discourages firms from breaking collusive agreements.
- Low degree of external competition.

# Oligopoly: Dominant Firm Optimal Output and Price



- Dominant firm has typically  $> 40\%$  market share.
- Dominant firm is the price maker: behaves like a monopolist.
- Other firms usually follow the pricing decisions of the dominant firm.

# Oligopoly: Dominant Firm Optimal Output and Price

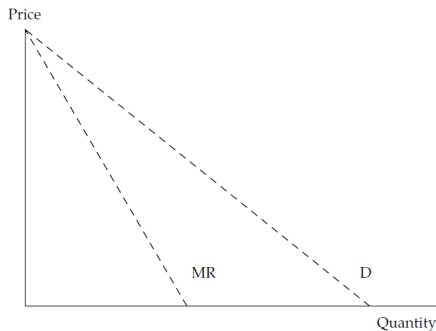


- Dominant firm has a lower  $MC_L$  curve, and its demand segment  $D_L$  is a large share of total demand  $D_T$ .
- Dominant firm choose  $Q_L$  such that  $MC_L = MR_L$ .
- Price charged  $P_L$  is determined by  $D_L$ .  $P_L$  determines  $Q_T$  given  $D_T$ .
- Followers supply the remainder  $Q_F = Q_T - Q_L$ .

# Monopoly Market Structure

- Monopoly market structure is at the opposite end of the spectrum from perfect competition.
- Significant barriers to entry such that a single firm produces a highly specialized product and faces no threat of competition.
- Examples: Patents, copyright, large economies of scale, network effects, control over critical resources, government regulation.
- No good substitutes for the product in the relevant market.

# Demand Analysis in Monopoly Markets



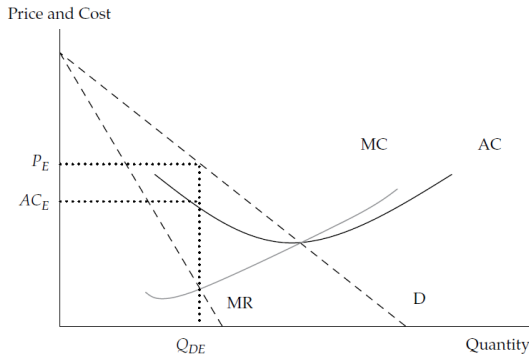
- Market demand function is same as individual firm's demand schedule.
- Linear demand function:  $Q_D = a - bP \Rightarrow P = (a/b) - (1/b)Q_D$ .
- Total revenue:  $TR = P \times Q_D = (a/b)Q_D - (1/b)Q_D^2$
- Marginal revenue:  $MR = (a/b) - (2/b)Q_D$ .

## Example

Suppose a company operating on a remote island is the single seller of natural gas:

- Demand function:  $Q_D = 400 - 0.5P$ .
- Inverse demand function:  $P = 800 - 2Q_D$ .
- Total revenue:  $TR = 800Q_D - 2Q_D^2$ .
- Marginal revenue:  $MR = 800 - 4Q_D$ .
- Average revenue  $AR = 800 - 2Q_D$  is the same as the inverse demand function.

# Supply Analysis in Monopoly Markets



- A monopolist's supply analysis is based on the firm's cost structure.
- There is no well-defined supply function that determines the optimal output level and the price to charge.
- The profit-maximizing level of output occurs where  $MR = MC$ .

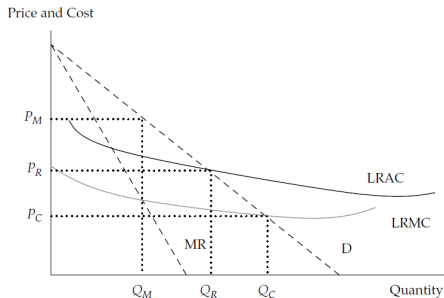
## Example

We continue the example of the natural gas monopolist from above:

- Total cost:  $TC = 20000 + 50Q_S + 3Q_S^2$
- Marginal cost:  $MC = 50 + 6Q_S$
- Combine supply and demand  $Q_S = Q_D$  to determine equilibrium solution.
- Profit maximization requires  $MR = MC$  which implies  $800 - 4Q_D = 50 + 6Q_D$ .
- Solve to get profit-maximizing quantity  $Q^* = 75$ .
- Get price from demand curve:  $P^* = 800 - 2 \times 75 = 650$ .
- $P^* > AC \Rightarrow$  Positive economic profit  $\pi = TR - TC$ .



# Monopoly Markets: Long-Run Equilibrium



- If unregulated, the firm must defend monopoly position to continue to earn economic profits.
- If regulated, regulators may attempt to set price:
  - ▶ = ATC so that output and consumer surplus increase, and economic profit is zero
  - ▶ = MC to maximize surplus, but if  $MC < ATC$ , monopolist will require a subsidy to operate.

# Concentration Measures

- N-Firm Concentration Ratio: Sum of the percentage market shares of the N largest firms in an industry
  - ▶ Advantage: Simple
  - ▶ Limitations: Ignores barriers to entry, largely unaffected by mergers.
- Herfindahl-Hirschman Index (HHI): Sum of squared market shares of N largest firms in a market.
  - ▶ Advantage: More sensitive to mergers than N-firm ratio, widely used by regulators.
  - ▶ Limitations: Ignores barriers to entry, ignores elasticity of demand.

## Concentration Measures: Example

- Suppose there are eight producers of a certain good in a market. The largest producer has 35 percent of the market, the second largest has 25 percent, the third has 20 percent, the fourth has 10 percent, and the remaining four have 2.5 percent each. Suppose the two largest companies merged.
- Concentration ratio of the top three producers:
  - ▶ Before the merger:  $35 + 25 + 20 = 80\%$
  - ▶ After the merger:  $60 + 20 + 10 = 90\%$
- HHI of the top three producers:
  - ▶ Before the merger:  $0.35^2 + 0.25^2 + 0.20^2 = 0.225$
  - ▶ After the merger:  $0.60^2 + 0.20^2 + 0.10^2 = 0.410$

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# Question 1

- Market competitors are least likely to use advertising as a tool of differentiation in an industry structure identified as:
  - ▶ A. monopoly.
  - ▶ B. perfect competition.
  - ▶ C. monopolistic competition.

## Question 2

- The demand schedule in a perfectly competitive market is given by  $P = 93 - 1.5Q$  (for  $Q \leq 62$ ) and the long-run cost structure of each company is:
  - ▶ Total cost:  $256 + 2Q + 4Q^2$
  - ▶ Average cost:  $256/Q + 2 + 4Q$
  - ▶ Marginal cost:  $2 + 8Q$
- New companies will enter the market at any price greater than:
  - ▶ A. 8.
  - ▶ B. 66.
  - ▶ C. 81.

## Question 3

- Upsilon Natural Gas, Inc. is a monopoly enjoying very high barriers to entry. Its marginal cost is 40 and its average cost is 70. A recent market study has determined the price elasticity of demand is 1.5. The company will most likely set its price at:
  - ▶ A. \$40.
  - ▶ B. \$70.
  - ▶ C. \$120.

## Question 4

- Deep River Manufacturing is one of many companies in an industry that make a food product. Deep River units are identical up to the point they are labeled. Deep River produces its labeled brand, which sells for 2.20 per unit, and house brands for seven different grocery chains which sell for 2 per unit. Each grocery chain sells both the Deep River brand and its house brand. The best characterization of Deep River's market is:
  - ▶ A. oligopoly.
  - ▶ B. perfect competition.
  - ▶ C. monopolistic competition.



## Question 5

- In an industry comprised of three companies, which are small-scale manufacturers of an easily replicable product unprotected by brand recognition or patents, the most representative model of company behavior is:
  - ▶ A. oligopoly.
  - ▶ B. perfect competition.
  - ▶ C. monopolistic competition.