

## **Learning Module 1: Firm & Market Structures**

**LOS 1a: determine and interpret breakeven and shutdown points of production, as well as how economies and diseconomies of scale affect costs under perfect and imperfect competition**

Companies can be grouped as operating in perfect or imperfect competitive environments depending on the slope of the demand curve.

### **Perfectly Competitive Environment**

In a perfectly competitive environment, firms are the price takers. That is, it must the market price of its output so that its demand curve is perfectly elastic and horizontal.

In a perfectly competitive environment, marginal revenue (MR) is equal to the price per unit output (P). Moreover, the average revenue (AR) is also equal to the price per unit. Put simply,  
 $P = MR = AR$



## Demand Curve under Perfect Competition

Price (P)

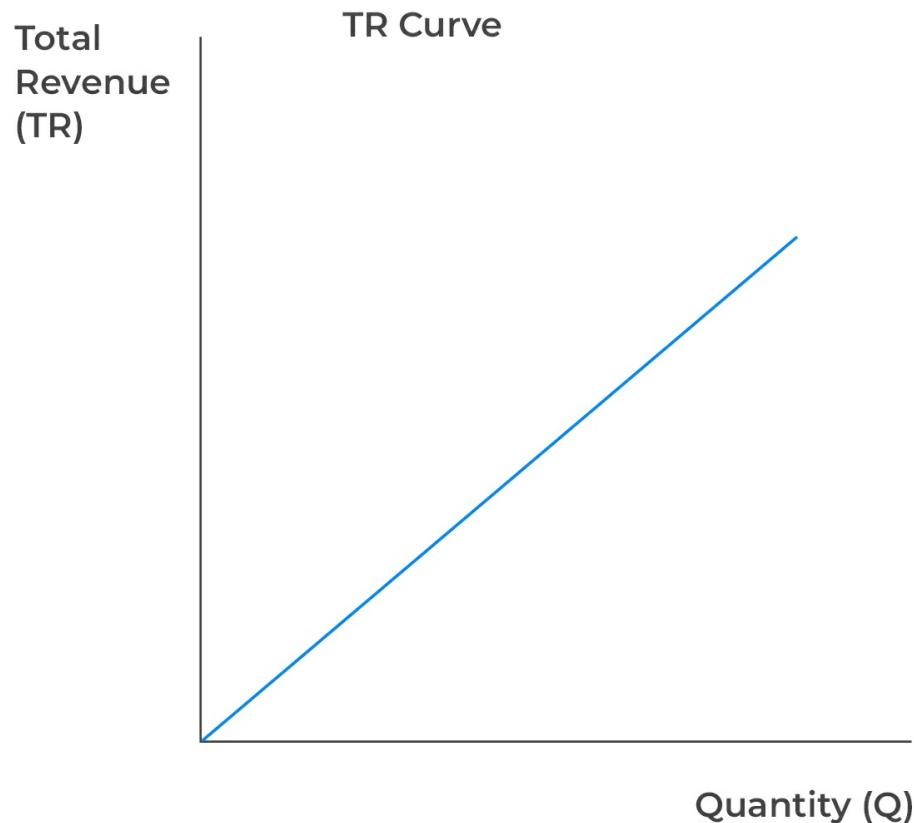
$$P = MR = AR$$

Quantity (Q)

In perfect competition, total revenue (TR) is equal to price times quantity. That is,  $TR = (P)(Q)$ . However, note that in perfect competition, the market determines the price. As such, when a company sells an additional unit, TR rises by an amount equal to the price per unit (P). Consider the following graph:



## TR Curve under Perfect Competition



## Imperfectly Competitive Environment

In the case of imperfect competition, the demand curve has a negative slope.

Assume that a company is monopolistic. In this case, the firm has control over the price. Simply stated, the price is a function of the quantity. Mathematically, this is stated as:

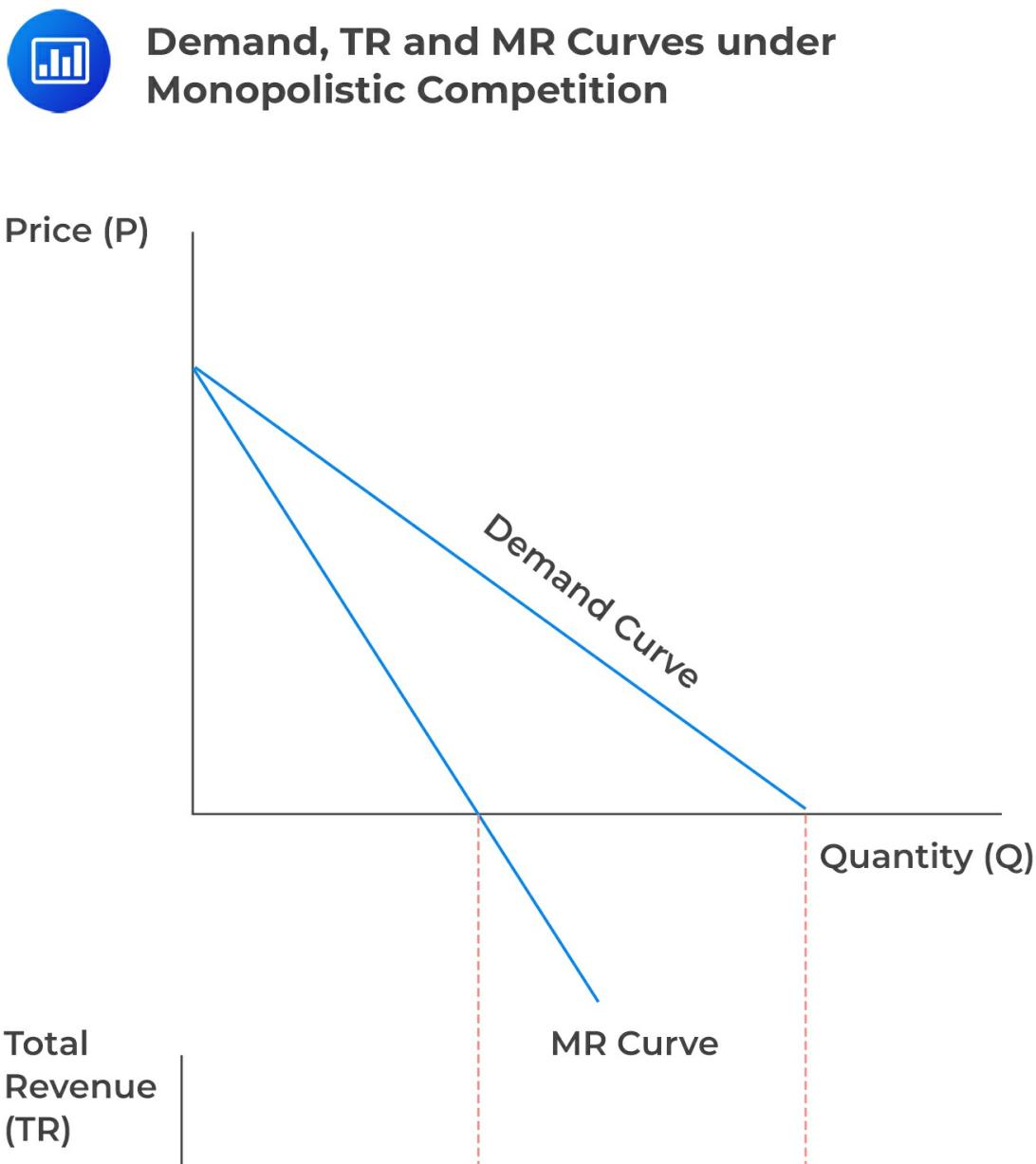
$$P = f(Q)$$

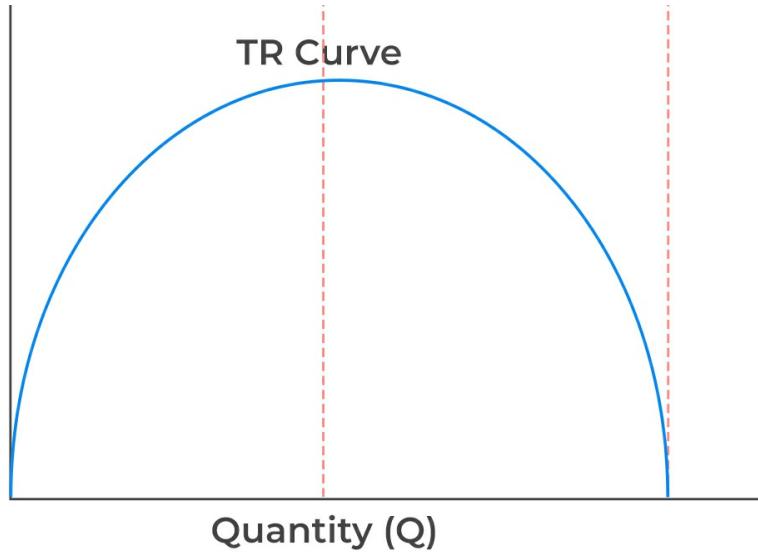
As such, the total revenue (TR) is given by:

$$TR = f(Q) \times Q$$

Assuming that the demand curve is linear and negatively sloped, TR is equal to the total expenditure of all the buyers in the market.

Note that a monopolist sets the price. As such, when the price decreases, the quantity sold increases. This initially increases the total expenditure by the buyers and, hence, the TR of the company because a price decrease is overpowered by the increase in units sold. This happens in the range where MR is positive, and demand is elastic. Consider the following image:





When the price drops, even though more units are sold, the total spending by buyers decreases because the price reduction has a greater impact. This happens when marginal revenue (MR) is negative and demand is inelastic.

## **Profit-Maximization, Break-even, and Shutdown Points of Production**

We use the short-run total cost (STC) curves and its associated TR curves to show the profit maximization point. The short-term run and long run time for a company depends on the ability of the firm to adjust the amounts of the fixed resources it utilizes.

The short run is the amount of time during which at least one of the factors of production, such as technology, physical capital, and plant size, is fixed. On the other hand, the long run is the time period during which all factors of production are variable. Moreover, in the long run, companies can enter or exit the market depending on the profitability analysis.

The long run is also termed the planning horizon because the company can choose the short-run position or optimal operating size that maximizes profit. Specifically, a company always operates in the short run and plans in the long run.

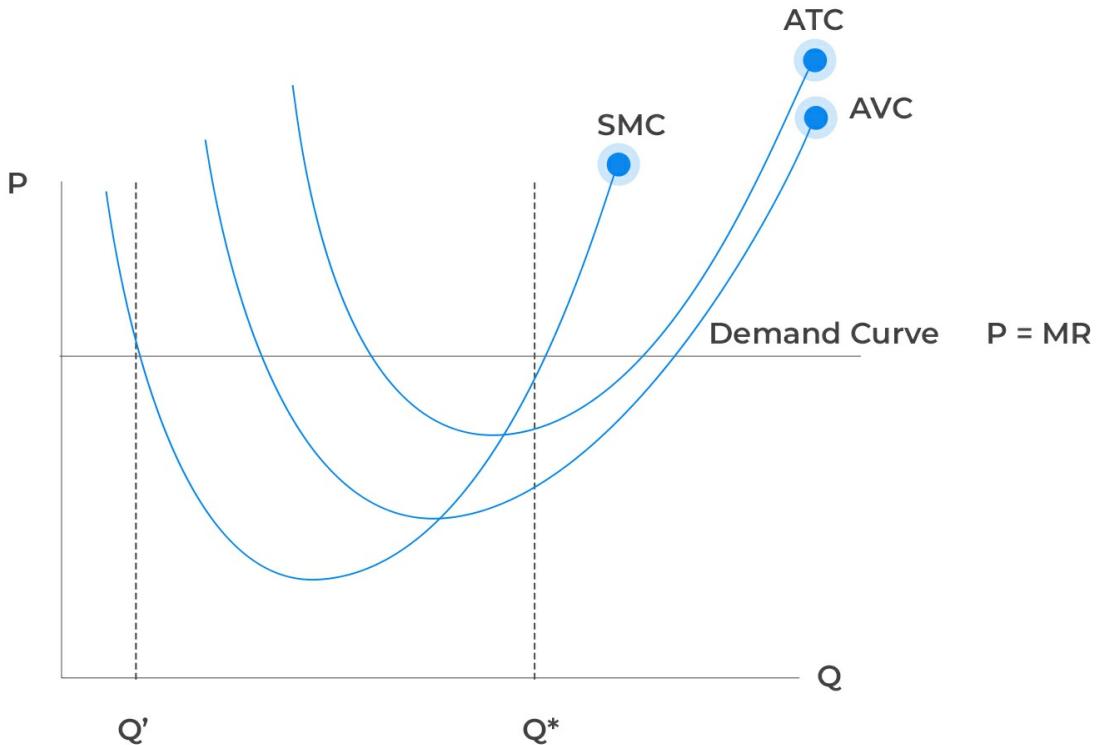
### **Profit-Maximization Point**

## Under Perfect Competition

Consider the following demand and average and marginal cost curves for the firm under conditions of perfect competition:



### Profit Maximization Point under Perfect Competition



The company maximizes its profit by producing at an output level of  $Q^*$ , where the price matches the short-run marginal cost (SMC) and the SMC is increasing. However, at a different output, denoted as  $Q'$ , even though the price is equivalent to the SMC, the SMC has not yet started to increase but is still decreasing. Hence, this cannot be a point where profit is maximized.

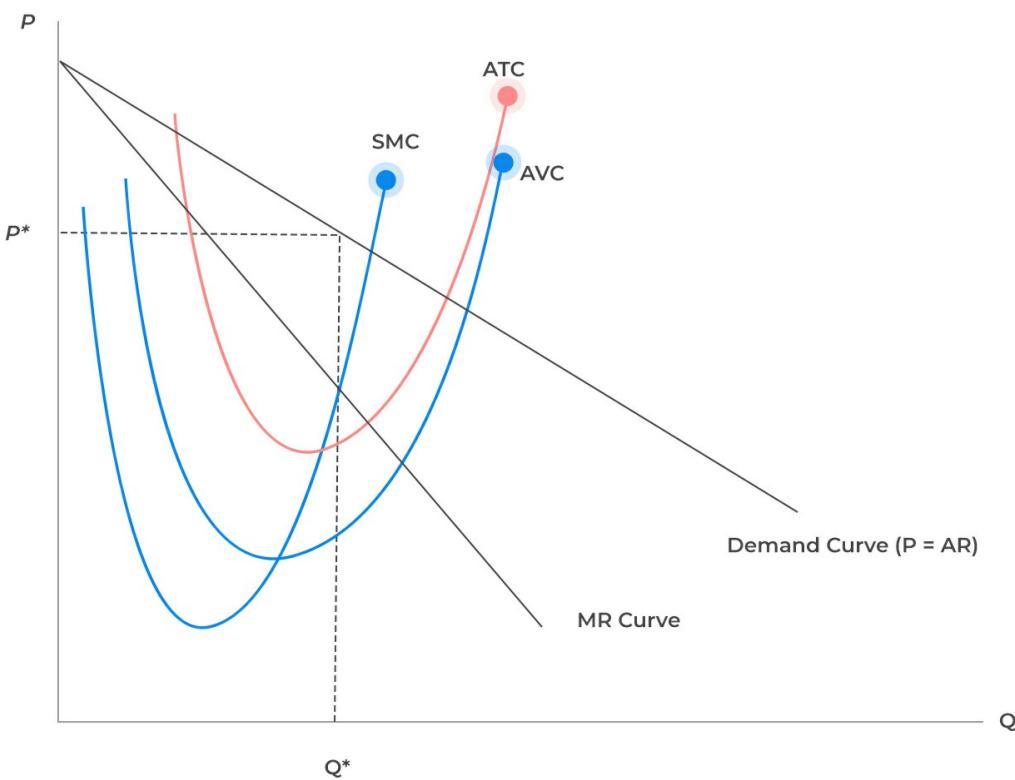
If the market price were to increase, the company's demand and marginal revenue (MR) curve would shift upwards, leading the firm to determine a new optimal production output greater than  $Q^*$ . On the contrary, if the market price decreased, the demand and MR curve would move downward, setting a decreased profit-maximizing output.

As shown in the image, this company is realizing positive economic profits since the market price is greater than the average total cost (ATC) when producing at  $Q^*$ . This kind of profit is achievable in the short run. However, in the long run, rival companies would likely enter the market aiming to obtain some of these profits, subsequently pushing the market price down to match each company's ATC.

## Under Imperfect Competition

Consider the following demand and average and marginal cost curves for the firm under imperfect competition (monopolist) conditions.

### Demand and Average and Marginal Cost Curves under Imperfect Competition



The marginal revenue (MR) and demand curves for a monopolist are not the same. However, the rule for maximizing profits remains consistent: Identify the quantity (Q) where short-term marginal cost (SMC) equals MR, which in this instance is at  $Q^*$ .

After determining the suitable output level, the best price to set is indicated by the firm's demand curve at price  $P^*$ . The monopolistic company enjoys a positive economic profit since its price is higher than its average total cost (ATC).

The entry barriers, which grant the firm its monopolistic dominance, ensure that potential competitors cannot erode the firm's profit margins.

## **Break-even Analysis**

A firm reaches its break-even point when its total revenue (TR) matches its total cost (TC). Similarly, a firm is at the break-even point when its average revenue (AR) is precisely equal to its average total cost (ATC). This holds true in both perfect and imperfect competitive environments.

While management usually aims for maximum profits, some firms can only cover all their economic costs. Economic costs include both accounting and implicit opportunity costs.

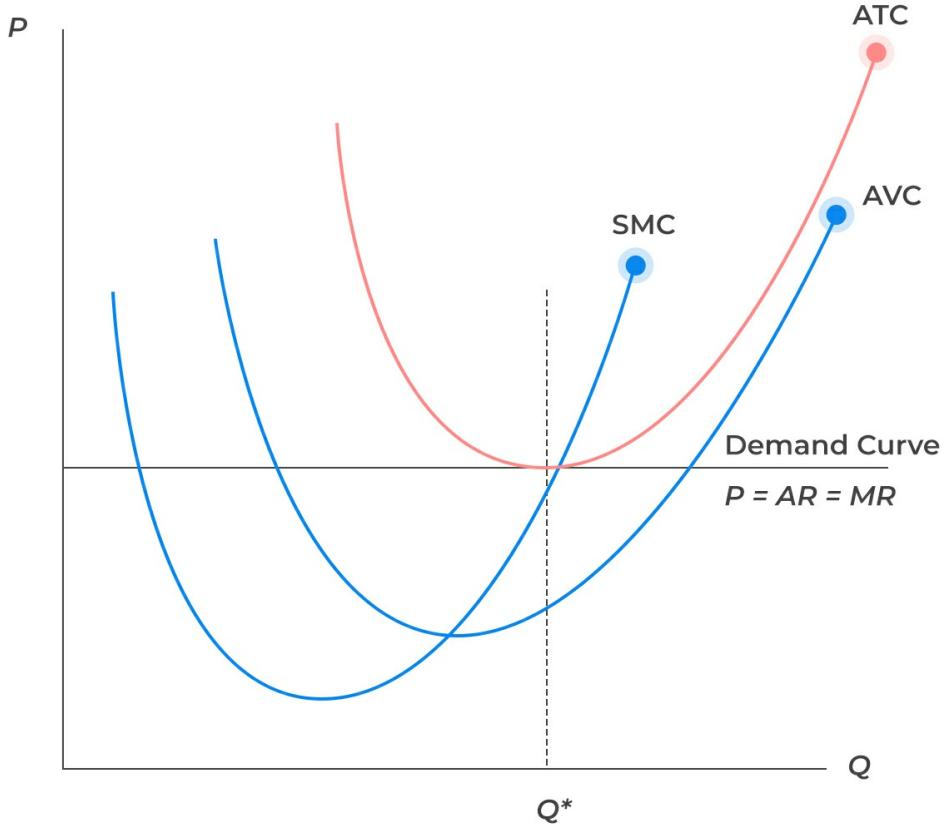
When the firm's revenue is equal to its economic costs, it implies that the company can cover the opportunity cost of all factors of production. In this case, the firm is said to be earning normal profit but not positive economic profit.

Firms operating in a perfectly competitive environment will not be able to earn a positive economic profit in the long run because an excess rate of return will lure new entrants into the market. These newcomers would increase the supply, subsequently pushing the market price down until every firm merely achieves a normal profit. It's crucial to understand that this scenario doesn't mean the firm is making zero accounting profit.

Consider the following graph of a firm under perfect competition:



## Breakeven Point under Perfect Competition

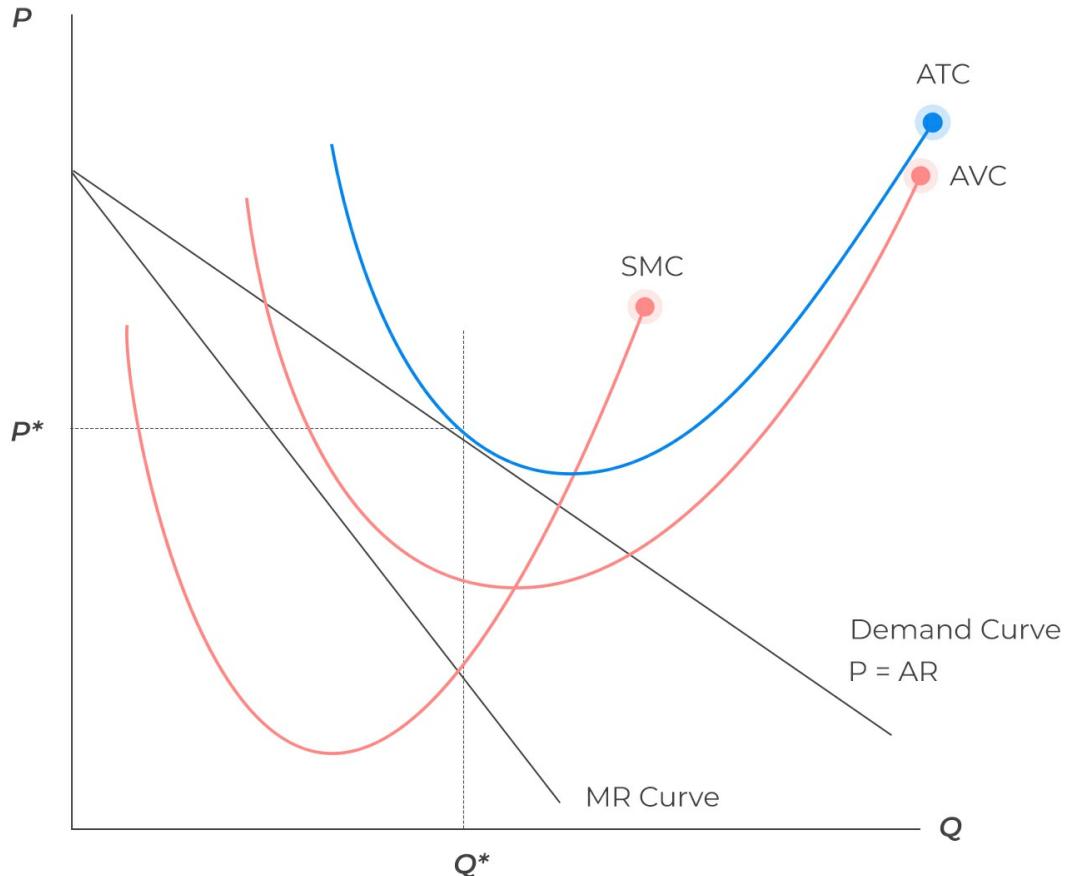


Recall that the best a firm can do is to break even. Note that in the graph above, the level of output where  $SMC = MR$  is where  $P = ATC$ . This implies that economic profit is zero, and the firm is at a breakeven point.

The equivalent graph of a monopolist firm is shown below:



## Breakeven Point under Monopolistic Market



## Shutdown Analysis

In the long run, if a firm can't make zero economic profit, it will shut down as it can't cover all its costs, including labor and capital. But in the short run, a firm might keep operating even if it doesn't make zero economic profit.

Recall that fixed costs are expenses that remain constant regardless of a company's production level, such as rent and fixed interest charges. On the other hand, variable costs are directly tied to the volume of production and include items like raw materials, wages, and other costs that

vary based on production levels.

As long as the firm's revenues cover its variable costs, it can continue operations, covering both variable and a portion of its fixed costs (essentially operating at a loss). This is possible if the price ( $P$ ) per unit is greater than the average variable cost (AVC).

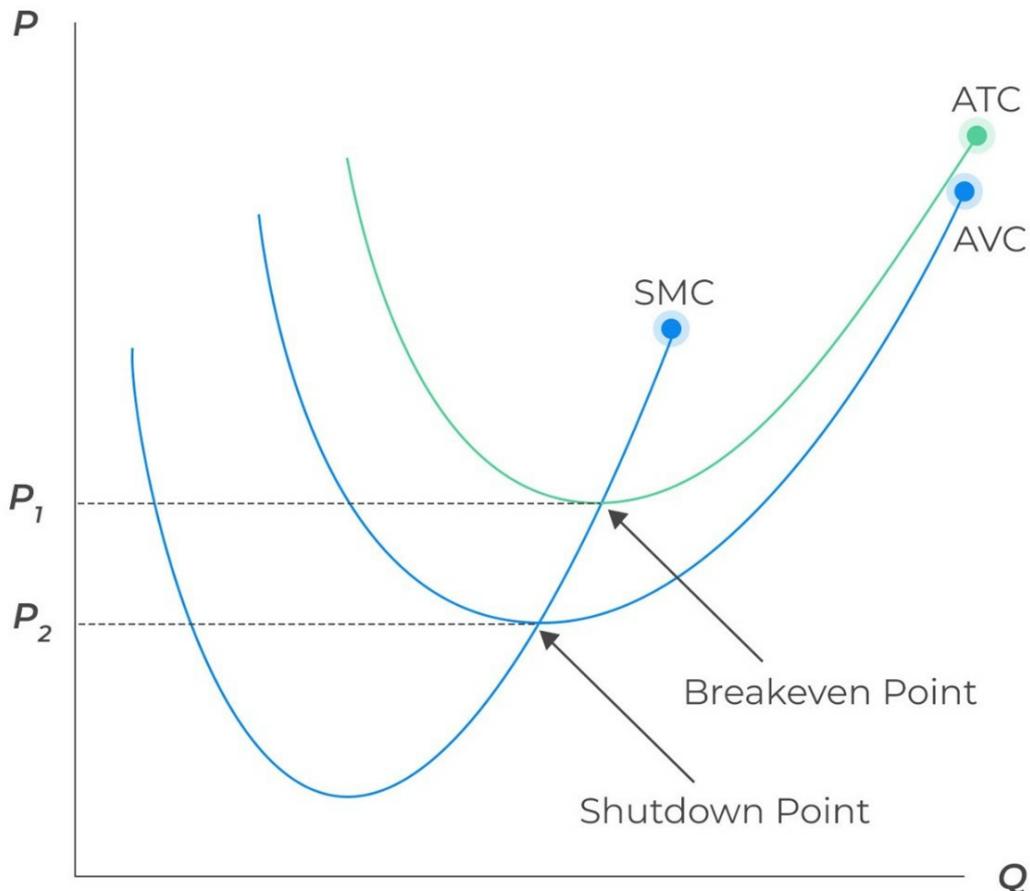
However, in the long run, the firm should exit the industry if market prices do not increase, as it becomes unsustainable to stay in the market without the potential for higher returns.

When deciding whether to continue operating in the short run, it is essential to disregard sunk costs since they have already been incurred and are irrecoverable, regardless of the firm's choice.

This is shown in the graph below:



## Breakeven and Shutdown Points of Production



When the price is higher than  $P_1$ , the firm has the potential to achieve a positive profit, and it definitely should remain in operation. If the price falls below  $P_2$ , which represents the lowest average variable cost (AVC), the firm will fail to cover its variable expenses, and it should cease operations.

For prices ranging between  $P_2$  and  $P_1$ , it's beneficial for the firm to keep operating in the short term because it can meet all variable costs and contribute to covering the fixed costs.

The lowest point on the AVC curve is the shutdown point, and the lowest point on the average total cost (ATC) is the breakeven point.

The following table shows the conditions for a firm to operate, shut down, or exit the market in the short and long run.

Relationship between Revenue and Costs	Short-Term Decision	Long-Run-Decision
Total cost = Total revenue	Remain in the market	Remain in the market
Total revenue < Total costs and > Total variable costs	Remain in the market	Leave the market
Total revenue < Total variable cost	Cease production	Cease operating in the market

### **Example: Shut-down Point of Production**

Assume that a manufacturing company produces 1000 units and sells them at \$5 each (Total Revenue (TR) is  $5 \times 1,000 = \$5,000$ ), Average Total Cost (ATC) is \$7,000, fixed cost (FC) is \$4000, and a variable cost (VC) is \$3,000 for all units.

Evidently, this manufacturing company is operating at a loss of -\$2000 (economic loss). In economics, we assume that the FC cannot be avoided. The company is obliged to pay it up regardless of whether it operates or not. That is, if it closes its operations, the revenue will be zero, but it will still incur a \$4,000 fixed cost.

If it continues its operations, it will earn a revenue of \$5,000, pay a variable cost of \$3,000, and use \$2,000 to pay the fixed cost. In this instance, the company will lose less by continuing its operations. However, the company will exit the market in the long run unless prices increase because, eventually, the average variable costs exceed average revenue (AR). Thus, it will shut down at the point of minimum average variable cost (AVC), as seen on the graph.

## **Economies and Diseconomies of Scale with Short-run and Long-run Cost Analysis**

Recall that the distinction between the short run and long run for any firm depends on its capacity to modify the quantities of fixed resources it employs. In the short run, the firm experiences a time period during which at least one factor of production, such as technology,

physical capital, or plant size, remains fixed. On the other hand, the long run is characterized by a time period in which all factors of production are variable and can be adjusted.

The duration of long-run adjustments varies across industries, with capital-intensive firms generally requiring more time for adaptations compared to labor-intensive firms.

## **Short-Run Cost Curves**

In short-run curves, we assume that the capital input is constant so that the output varies depending on the level of labor, which is the variable input in this case. However, if the capital input were to vary, we would have to generate short-run cost curves for each level of capital input.

The short-run total cost (STC) often increases with output. Initially, it rises at a diminishing rate due to the economies of specialization. However, as output grows, the curve ascends at an accelerating rate due to the law of diminishing marginal returns to labor.

Total fixed cost (TFC) determines the vertical intercept of the STC curve. When there's more fixed input, the total fixed cost (TFC) is higher. However, this also means that the firm's production capacity increases.

For every short-run total cost (STC) curve, there's a related short-run average total cost (SATC) curve. Additionally, there's a corresponding long-run average total cost (LRAC) curve, which serves as the envelope curve encompassing all potential short-run average total cost curves.

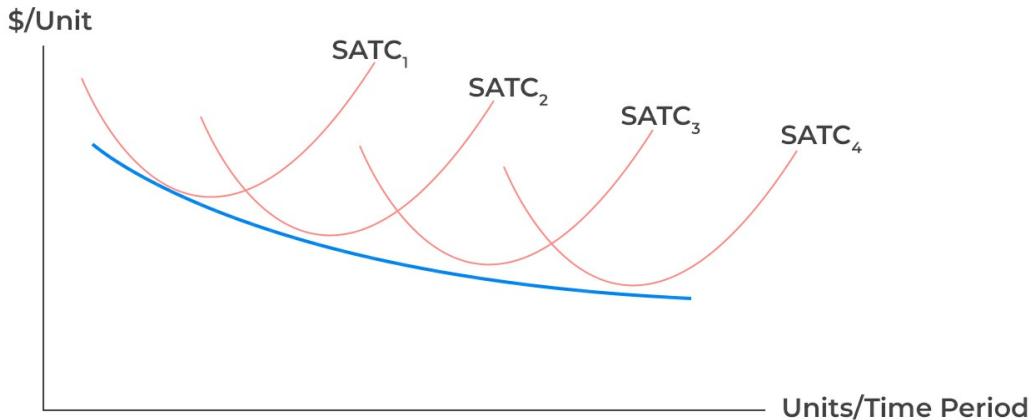
## **Economies and Diseconomies of Scale**

When a firm enhances its output by increasing all of its inputs, it is said to be scaling up production. Economies of scale come into play when the firm experiences a decrease in the cost per unit of production as it expands its output.

In the case of economies of scale, LRAC has a negative slope. Consider the following graph with SATC for each level of capital input (levels 1,2,3 and 4) in the case of economies of scale.



## Economies of Scale



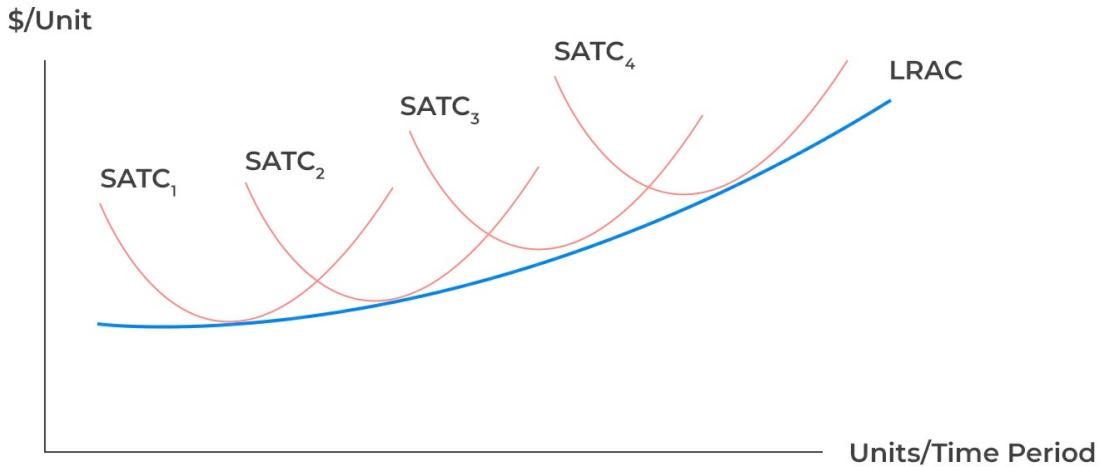
The following factors can lead to economies of scale:

- Achieving economies of scale through increasing returns to scale means the production process yields output increases proportionately larger than the increase in inputs.
- Implementing a division of labor and management to allow workers to specialize in specific tasks, leading to improved job proficiency.
- Enhancing productivity by investing in more expensive and efficient equipment.
- Effectively reducing waste and lowering costs by capitalizing on marketable by-products, reducing energy consumption, and implementing enhanced quality control measures.
- Utilizing market information and knowledge to make more effective managerial decisions.
- Capitalizing on discounted prices when purchasing resources in larger quantities.

Conversely, diseconomies of scale occur when the cost per unit rises as the firm further increases its production. This implies that LRAC has a positive slope. Consider the following graph with SATC for each level of capital input (levels 1,2,3 and 4) in the case of diseconomies of scale:



## Diseconomies of Scale



The following factors can result in diseconomies of scale:

- Experiencing diseconomies of scale due to decreasing returns, where the production process results in output increases that are proportionately smaller than the increase in inputs.
- Struggling with proper management due to excessive size.
- Encountering inefficiencies caused by overlapping and duplicating business functions and product lines.
- Facing higher resource prices due to supply constraints when purchasing inputs in large quantities.

Economies of scale and diseconomies of scale can coexist; their effect on the long-run average total cost (LRAC) depends on which one has a stronger influence.

If the economies of scale are more influential, the LRAC will decline as output increases. Conversely, if diseconomies of scale are more prevalent, the opposite happens. It's possible for the LRAC to first decrease (due to economies of scale) over a certain output range, then stabilize over another range, and subsequently increase in a range where diseconomies of scale take

effect.

Theoretically speaking, perfect competition compels a firm to function at the lowest point of the long-run average total cost (LRAC) curve. This is because, over the long term, the market price will settle at this point. If a firm doesn't operate at this optimal cost-efficiency point, its sustainability in the long run could be at risk.

## **Question #1**

A firm that increases the quantity it produces without any change in per-unit cost is experiencing:

- A. Economies of scale.
- B. Diseconomies of scale.
- C. Constant returns to scale.

### **Solution**

**The correct answer is C.**

An increase in output proportional to an increase in input would be considered a constant return to scale. This is neither an economies nor diseconomies of scale.

## **Question #2**

The short-term shut-down point of production for a firm operating under perfect competition will most likely occur when the price per unit is equal to:

- A. Marginal cost per unit.
- B. Average total cost per unit.
- C. Average variable cost per unit.

### **Solution**

**The correct answer is C.**

Any firm will shut down its production when the marginal cost is less than the average variable cost. We will see later that for a firm in perfect competition to maximize profit, marginal revenue must be equal to marginal cost.

## **LOS 1b: describe characteristics of perfect competition, monopolistic competition, oligopoly, and pure monopoly**

Market structure can be defined as the characteristics of a market, which can either be competitive or organizational. Moreover, market structure outlines the nature of the competition and the pricing procedure in a market. Therefore, it describes the number of entities producing similar goods and services in a market and whose structure is determined by the current competition in the market.

The following key factors influence market structure:

1. The quantity and relative magnitude of firms involved in supplying the product.
2. The level of product differentiation present in the market.
3. The seller's power over pricing decisions.
4. The strength of barriers regulating market entry and exit.
5. The extent of non-price competition observed in the market.

There are four types of economic market structures (organized from the least competitive to the most competitive):

1. Perfect competition.
2. Monopolistic competition.
3. Monopoly market structure.
4. Oligopoly market structure.

## **Perfect Competition**

Perfect competition refers to a market with many buyers and sellers, similar products, and substitutes. A good example is agriculture, where all rice farmers sell homogeneous products to consumers.

### **Characteristics of Perfect Competition**

1. There exist a vast number of buyers.
2. There exists a vast number of sellers willing to supply their products at given market prices.
3. No single seller or producer is large enough to influence the market price.
4. Homogeneous products: the products being sold in this market are perfect substitutes for one another. Their quality and characteristics don't vary from one another.
5. Perfect information: Every consumer and producer is aware of the market prices and the utility derived from using any of the products.
6. There are no entry barriers.

## **Monopolistic Competition**

This is an imperfect competition in which several producers sell products that are different from one another. The difference lies in branding or, in most cases, quality. This means that the goods are not perfect substitutes for one another but are close substitutes. An example of this can be clothing, where marketing and branding are the main marks of distinction among different but similar black shirts. Another example would be the fast-food industry, where a burger made by McDonald's is quite similar to a burger made by Burger King from an economic standpoint. Consumers, nevertheless, usually have a preference between the two chains.

## **Characteristics of Monopolistic Competition**

1. There are many producers and consumers in the market.
2. There is not one firm that has total control over the price of the market.
3. Consumers assume that there are non-price differences among the products of competitors.
4. Few barriers to entry and exit exist.
5. Producers have some control over prices.
6. Producers and consumers have no perfect information.

## **Monopoly**

A monopoly is a market consisting of a single firm that produces goods with no close substitutes. Often, this market has many entry barriers. For instance, water providers, natural gas, telecommunications, and electricity are often granted exclusive rights to service.

### **Characteristics of a Monopoly**

1. A monopoly is a profit maximizer.
2. Monopolies are price makers.
3. Price discrimination: Monopolies can change both the price and quality of their products.
4. There are very high barriers to entry for other firms.
5. There is a single seller that controls the whole market.
6. The government regulates pure monopolies.

## **Oligopoly**

An oligopoly market consists of a small number of relatively large firms that produce similar but slightly different products. Under oligopolies, there also exist some entry barriers with which other enterprises have to contend. Good examples include industries such as oil & gas, airlines, and automakers.

### **Characteristics of an Oligopoly**

1. Only a few firms operate in the market.
2. Profit maximization is a condition in this market.
3. Monopolies set their own prices.
4. Barriers to entry are high.
5. Firms make abnormal profits in the long run.
6. Products may be homogeneous.

7. There is a relatively small number of firms supplying the market.

## Summary of Characteristics of Market Structures

Type of Market Structure	Number of Sellers	Product Differentiation	Barriers to Entry	Pricing Power	Non-Price Competition
Perfect competition	Many	Homogeneous/standardized	Very low	None	None
Monopolistic competition	Many	Differentiated	Low	Some	Advertising Product Differentiation
Oligopoly	Few	Homogeneous/standardized	High	Some or Considerable	Advertising Product Differentiation
Monopoly	One	Unique Product	Very High	Considerable	Advertising

## Question

An industry is made up of twenty firms. These firms produce products that easily complement one another, and there are no barriers to entry. This industry can be best characterized as:

- A. An oligopoly.
- B. A monopolistic competition.
- C. Perfect competition.

## Solution

**The correct answer is C.**

Even though there are only twenty firms in the industry, there are no barriers to entry, and the products can easily complement one another (no branding or quality constraints).

Firms voluntarily choose not to enter the market.

**A is incorrect.** In an oligopoly, barriers to entry are high.

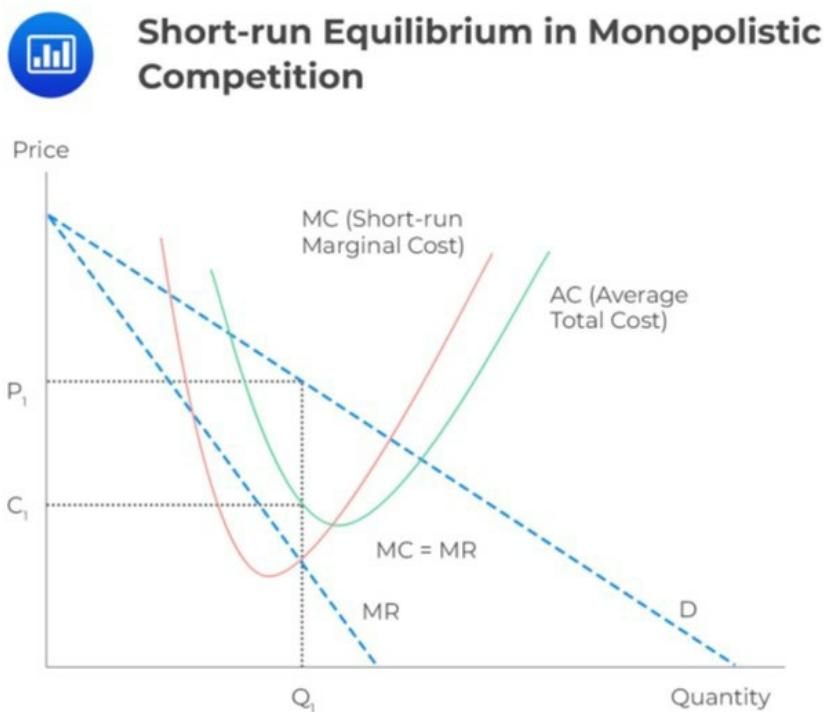
**B is incorrect.** In monopolistic competition, barriers to entry and exit exist.

**LOS 1c: explain supply and demand relationships under monopolistic competition, including the optimal price and output for firms as well as pricing strategy**

## Demand Analysis under Monopolistic Competition

In monopolistic competition, firms have a downward-sloping demand curve, meaning lower prices lead to more demand and vice versa. At some prices, demand is very responsive to changes (elastic), and at lower prices, demand is less responsive (inelastic).

In the short run, a firm maximizes its profit by producing the level of output where marginal revenue (MR) equals marginal cost (MC).



In the graph above, the optimal output level is represented by  $Q_1$ , while  $P_1$  represents the price consumers are prepared to pay for this quantity. The rectangle formed by  $P_1$  multiplied by  $Q_1$  represents the total revenue.

## **Supply Analysis under Monopolistic Competition**

In this market structure, the supply function is also not well-defined. The appropriate output level is determined by the point where the Marginal Cost and Marginal Revenue curves intersect ( $MC=MR$ ).

However, it is important to note that the price will be charged in accordance with the demand schedule of the market. The supply curve of a firm should measure the quantity that the firm is willing and able to supply at different price levels. Unfortunately, the marginal revenue and marginal cost do not include this information.

## **Optimal Price and Output under Monopolistic Competition**

In this market structure, the short-run profit-maximizing choice occurs when marginal revenue equals marginal cost ( $MR=MC$ ). Total revenue (TR) is a product of price and quantity:

$$TR = P \times Q$$

The average cost incurred in producing  $Q$  units of a product is taken as  $C$ . Therefore, the total cost (TC) is calculated as the product of average cost and total quantity. That is,

$$TC = C \times Q$$

The economic profit is the difference between TR and TC. We denote the economic profit by  $\pi$ . Then,

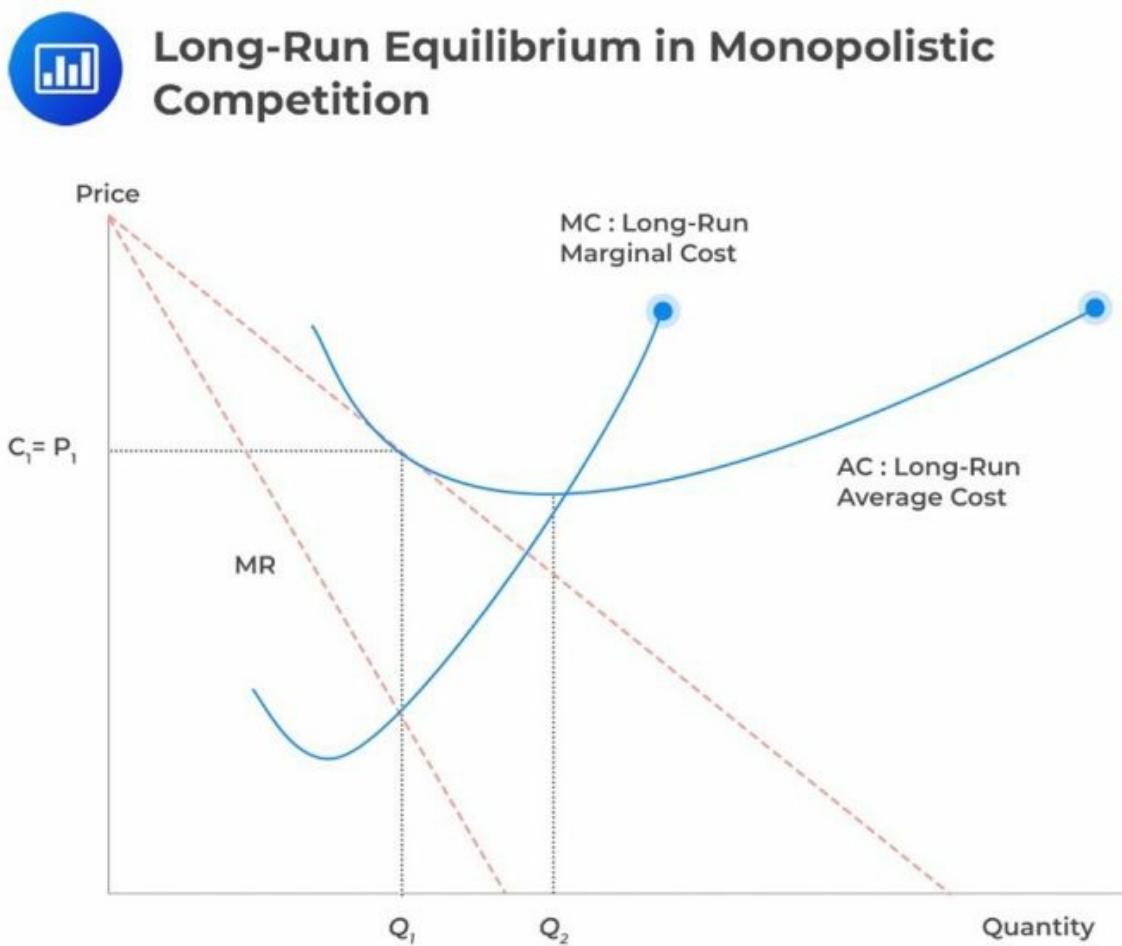
$$\pi = TR - TC$$

## **Long-Run Equilibrium under Monopolistic Competition**

As firms under monopolistic competition start reporting higher profits, more firms will venture into the market. Since entrant prices are low, customers will shift to buying products from these new firms. This will reduce the demand for firms that produce similar goods.

As a result, the economic profits realized by firms in monopolistic competition will fall. Further, firms will incur advertising costs for product differentiation. This can be seen in consumer products, such as clothing, with high advertising costs. For example, large sporting brands pay lucrative contracts to professional sports personalities to differentiate themselves from the competition.

Consider the following diagram:



In long-run equilibrium, the optimal output level is still determined where marginal revenue (MR) equals marginal cost (MC), represented by  $Q_1$ . The price that consumers are prepared to pay for a specific quantity of the product is derived from the demand curve, in this case,  $Q_1$ , for the price  $P_1$ .

The total revenue (TR) is represented by the area of the rectangle formed by multiplying  $P_1$  by  $Q_1$ . It's important to observe that, in contrast to the long-run equilibrium in a perfectly competitive market, the equilibrium in a monopolistic competition market is situated at a higher average cost than the output level that minimizes average cost.

The average cost does not hit its lowest point until the output reaches  $Q_2$ . In this long-run equilibrium scenario, the total cost is represented by the area of the rectangle obtained by multiplying  $C_1$  by  $Q_1$ . The economic profit can be calculated by subtracting the total cost from the total revenue.

Note that in the graph above, the economic is zero economic profit since total revenue equals total cost. Mathematically,

$$P_1 \times Q_1 = C_1 \times Q_1$$

Note that the zero economic profit is the same for both monopolistic competition and perfect competition in the long run. However, the long-run level of output in  $Q_1$  is less than  $Q_2$ , which represents the minimum average cost of production and long-run level of output in a perfectly competitive market.

## Question

A firm that is operating under a monopolistic competition maximizes its profits when:

- A. The average cost is minimized.
- B. Marginal revenue equals average cost.
- C. Marginal revenue equals marginal cost.

## Solution

The correct answer is **C**.

The firm will maximize its profit when the level of output is such that the marginal revenue equals marginal cost. In other words, it will produce a quantity such that  $MR=MC$ .

**A and B are incorrect.** From the graph given below, we can clearly see that it's neither the point where average cost is minimized nor the point where marginal revenue equals average cost.

**LOS 1d: explain supply and demand relationships under oligopoly, including the optimal price and output for firms as well as pricing strategy**

## Demand Analysis under Oligopoly Competition

The demand curves in oligopoly markets are influenced by the level of pricing interdependence among firms. When collusion exists in a market, the aggregate market demand curve is divided among the individual producers. In contrast, each firm faces its own demand curve in non-colluding market scenarios. Additionally, the demand characteristics in non-colluding oligopoly markets are shaped by the pricing strategies employed by the participating firms.

Three primary pricing strategies include **Pricing interdependence**, the **Cournot assumption**, and **the Nash equilibrium**.

### Price Interdependence

In oligopolies, price interdependence means that firms' pricing actions are linked. In these markets, it's often assumed that competitors will lower prices to keep their customers and avoid raising prices to lure customers away from rivals.

The idea is that by matching a competitor's lower price, the company won't see a drop in customer interest. On the other hand, by not raising prices like another company, they can pull in customers from the company that did.

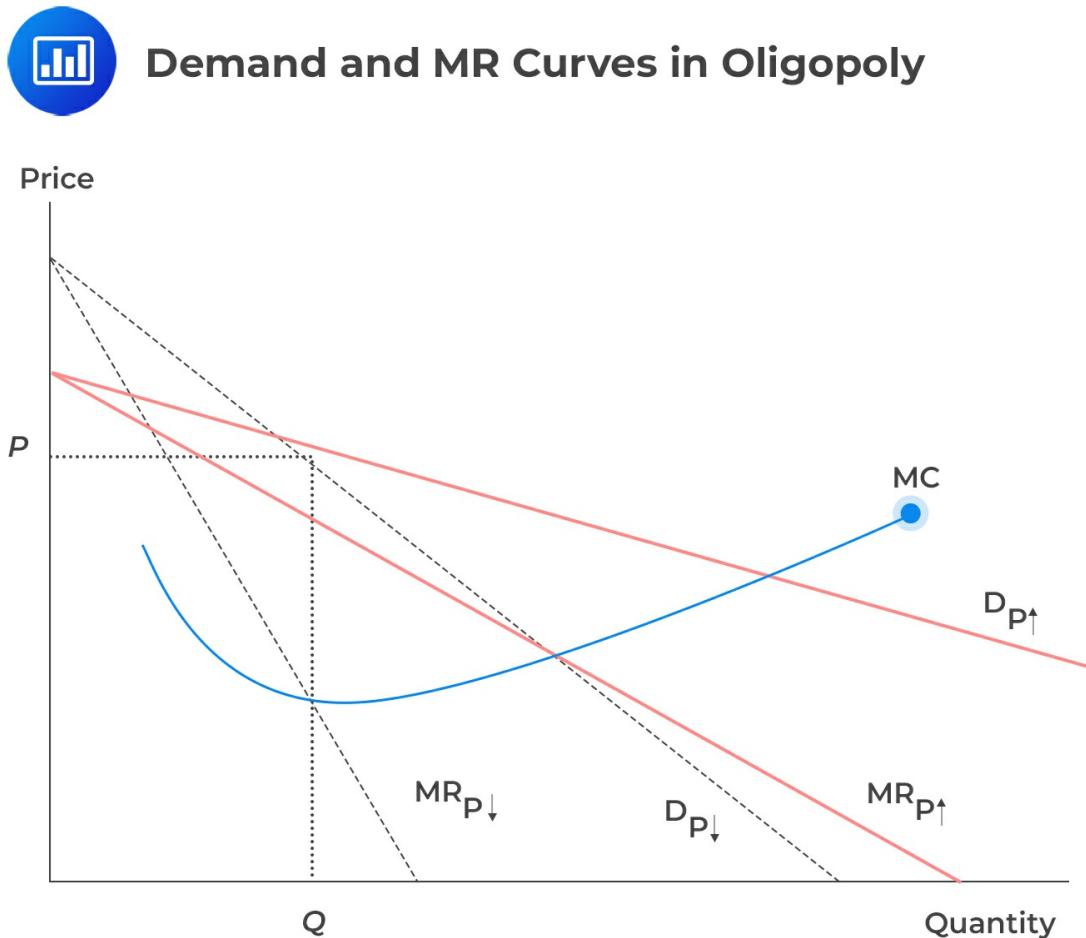
Customers of a firm are highly responsive to price increases when its competitors offer lower prices. On the other hand, customers become less responsive to price decreases because the firm's rivals are likely to match its price changes.

As a result, there are two different demand structures:

- i. One for price increases.
- ii. Another for price reductions.

Note that each demand curve will have its own marginal revenue. Denote the demand and

marginal revenue curve by  $D_{P\uparrow}$  and  $MR_{P\uparrow}$  when the price increases and by  $D_{P\downarrow}$  and  $MR_{P\downarrow}$  when the prices fall. Consider the following diagram:

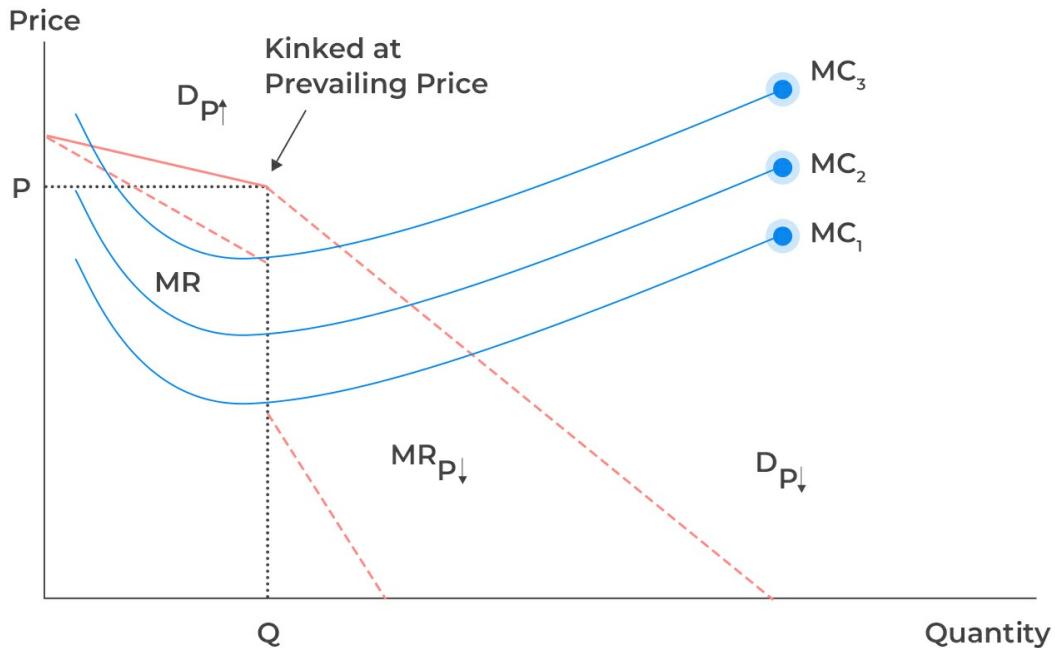


From the above diagram, the overall demand can be seen as  $D = D_{P\uparrow} + D_{P\downarrow}$ . This oligopolistic pricing strategy leads to a kinked demand curve, where the two segments represent distinct competitor reactions to price changes. The kink in the demand curve creates two parts in the marginal revenue structure. One part is connected to price increases, and the other is related to price decreases.

Observe the following kinked demand curve in the Oligopoly market:



## Kinked Demand Curve



If the company has low marginal costs, labeled as  $MC_1$ , the earlier rule of setting marginal revenue (MR) equal to marginal cost (MC) remains true even in an oligopoly. The marginal cost can increase to  $MC_2$  and  $MC_3$  before affecting the firm's profit. If the  $MC_2$  curve intersects the space in the marginal revenue, the best price-output combo stays the same at the current price and initial output level.

### The Cournot Assumption

Under the Cournot assumption, each firm determines its optimal production level, assuming that the output of other firms will remain unaltered. Their goal is to maximize profits while expecting the other firm to maintain a constant output in the future.

Cournot assumption makes pricing strategy easier as there's no need to predict a competitor's response. It offers a practical way to study actions in oligopoly markets. Consider the simplest oligopoly scenario: a duopoly with two firms. When in equilibrium, neither wishes to alter

production based on the other's output. Each company tries to maximize profits, thinking the other will maintain its current production level.

The Cournot strategy approach is believed to persist until both firms reach their long-run equilibrium. In this equilibrium, both output and price stabilize, and no changes in price or output can result in increased profits for either firm.

## **The Nash Equilibrium**

The Nash equilibrium occurs when participants in a non-cooperative market choose strategies and stick to them, even after considering their opponents' strategies.

In oligopoly markets, the Nash equilibrium is characterized by the fact that no firm in the oligopoly can increase its profits by unilaterally altering its pricing strategy. The basic assumption is that each participating firm does the best it can, considering the reactions of its rivals.

In other words, each firm expects the other firms to respond to any change made by competitors by doing their best under the changed circumstances.

In the oligopoly market, firms' actions are interdependent and non-corporative, with each firm making decisions that maximize its own profits. In other words, the firms do not collude. Equilibrium is achieved when all firms are striving to do their best in their interest, considering the actions of their rivals.

## **Example: Illustrating Nash Equilibrium**

Consider a duopoly with companies A and B. Both companies can charge high or low prices for their products. The following table gives the amount of profits each company receives if it charges a high or low price:



## Nash Equilibrium in Duopoly Market

Company A : Low Price = 60	Company A : Low = 90
Company B: Low Price = 80	Company B: High Price = 10
Company A : High Price = 400	Company A : High Price = 600
Company B: Low Price = 450	Company B: High Price = 400

The interpretation of the table is as follows: Consider the top left corner cell. The cell shows that when both companies offer the product at low prices, company A earns a profit of 60, and company B earns 80.

It is easy to see that both companies earn a maximum combined profits of 1,000 if both companies charge high prices.

Recall that according to Nash equilibrium, each firm behaves in its own best interest. In our case above, company B can improve its position by charging low prices when company A charges high prices. Specifically, in the lower left cell, company B earns a profit of 450 when company A charges a high price of 400.

Notice that company A can earn a maximum profit of 600 only if company B agrees to charge a high price. However, this is not in Company B's best interest because it can still earn a profit of 450 by charging lower prices.

## Collusion in Oligopoly Markets

In oligopolistic industries, the conditions promote collusion as there are only a few competitors, and their pricing behavior is interdependent. Collusion is motivated by several factors, such as the potential for increased profits, the desire to reduce uncertainty in cash flow, and the opportunity to create barriers that discourage new entrants.

When firms openly and formally establish collusive agreements, they form a cartel. Six factors significantly influence the chances of successful collusion:

- The number and size distribution of sellers:** Collusion is more likely to succeed in markets with a small number of firms or when one firm dominates the market.
- The similarity of the products:** Collusion has a higher chance of success when the products are homogeneous and indistinguishable.
- Cost structure:** Successful collusion is more probable when the participating firms have similar cost structures.
- Order size and frequency:** Collusion is more likely to be successful when orders are frequent, regular, and of relatively small sizes.
- The strength and severity of retaliation:** The fear of severe retaliation discourages firms from breaking collusive agreements.
- The degree of external competition:** Collusive agreements have higher chances of success when external competitors face higher production costs.

In oligopolistic markets, another notable decision-making strategy is the first-mover advantage in the Stackelberg model. This model assumes sequential decision-making, where the leader firm selects its output first, and then the follower firm chooses after observing the leader's output. The leader firm gains an advantage by being the first mover in this scenario.

## Demand, Supply Analysis under Oligopoly Competition

Just like in monopolistic competition, the oligopoly firm lacks a well-defined supply function. It's impossible to ascertain the oligopolist's best output and price without considering the demand conditions and competitors' moves. Still, the oligopolist possesses a cost function that indicates the optimal supply level. Thus, the previously stated rule remains true: The output level maximizing profit occurs where  $MR = MC$ .

The price charged by the oligopolist is determined by what the consumers are willing to pay. Therefore, the equilibrium price results from the demand curve, while the output levels result from the association between the MR and the MC.

A dominant firm in an oligopoly market is one that has greater capacity, a lower cost structure, is a pioneer in the market, or has secured greater customer loyalty. As such, the dominant firm becomes the price maker with similar powers as monopolists.

The other firms in the market follow the pricing strategies of the dominant firm. The followers cannot undermine the dominant firm because the leader has a lower cost of production. Surprisingly, the price followers would rather charge a higher price than the dominant firms' price.

## **Optimal Price and Output in Oligopoly Markets**

There is no optimum price and output analysis that applies to all oligopoly market scenarios. The interdependence of the few firms in an oligopoly leads to an intricate range of pricing options, which vary based on the specific market conditions.

For instance, in a kinked demand curve, the optimum price is the prevailing price at the kink on the demand function. However, when a dominant market exists, the optimum price is determined at a point where  $MR = MC$ . The profit-maximizing price is based on the output position of the part of the demand function faced by the dominant firm.

## **Factors Affecting Long-Run Equilibrium in Oligopoly Markets**

In the long run, there is a possibility for economic profits in oligopoly markets. However, the market share of a dominant firm will decline in the long run. As is always the case, profits will attract more firms to enter the oligopoly market.

Over time, marginal costs incurred by entrant firms fall due to the adoption of more efficient production methods. Likewise, the profitability of the dominant firm declines. The reactions of entrant firms are included in the optimal pricing strategy.

Some firms may decide to incorporate innovation as a way of maintaining market leadership. For example, Shell's gasoline is said to clean the engine valves and fuel injectors. However, these innovations are usually not very effective at maintaining the market share of the dominant firm.

Generally, an optimal pricing strategy, in the long run, incorporates the reactions of rival firms to changes in prices effected by competitors. However, history shows price wars are not beneficial, as market share gains are often fleeting. For instance, cutting prices to outdo rivals reduces overall earnings for everyone in the oligopoly.

## Question

Which of the following is a factor that influences the chances of a successful collusion?

- A. Similarity in cost structures.
- B. Presence of a dominant firm.
- C. Infrequent, large order sizes.

## Solution

**The correct answer is A.**

Successful collusion is more probable when the participating firms have similar cost structures.

**B is incorrect.** Collusion is more likely to succeed in markets with a small number of firms or when one firm dominates the market.

**C is incorrect.** Collusion is more likely to be successful when orders are frequent, regular, and of relatively small sizes.

## **LOS 1e: identify the type of market structure within which a firm operates and describe the use and limitations of concentration measures**

Monopoly markets and situations where companies hold pricing power can result in inefficiencies. Nevertheless, government agencies and regulators face the difficult task of assessing market power and determining if a firm has a dominant position. This requires regulators to measure whether future events that have not yet occurred might lead to excessive market power.

### **Econometric Approaches**

To gauge market power, one can estimate the elasticity of demand and supply in the market. If demand is elastic, the market exhibits characteristics similar to perfect competition. On the contrary, if it is inelastic, companies may possess market power.

A challenge arises because the observed values of price and quantity may not accurately reflect the true values of supply and demand. To calculate elasticity, a model with two equations is necessary: one for the demanded quantity and another for the supplied quantity. This, in turn, requires a substantial number of observations, leading to the additional problem of potential changes in market structure over the extended data collection period.

Alternatively, a cross-sectional regression analysis can be employed, where sales from various companies in the market are observed within a single period. Nevertheless, implementing this approach demands a significant effort in data collection.

To address these issues, we employ more straightforward metrics such as:

### **Concentration Ratio**

The concentration ratio is the sum of market shares covered by the largest N firms in a market. It is determined by finding the sales value for the largest firms and dividing it by the total market sales.

Therefore, the resulting figure lies between zero (for perfect competition) and 100 (for monopolies).

The main advantage of this concentration measure is the simplicity of its calculation. However, there are some limitations to the usage of this method.

### **Example: Concentration Ratio**

Suppose there are 10 producing companies in a market. The production percentages for the top three companies are 35%, 20%, and 10%. Calculate the concentration ratio for these three companies.

### **Solution**

The concentration ratio is the sum of market shares covered by the largest N firms. So, the concentration ratio for the first 3 companies are:

$$\text{Concentration ratio} = 35\% + 20\% + 10\% = 65$$

### **Limitations of the Concentration Ratio**

This method cannot quantify market power directly. The big question should be whether high concentration levels can be interpreted as an indication of monopoly power. An example is the case of only one sugar company in a country. This company enjoys monopoly power. However, the problem comes when there exist large wholesalers in, say, the food sector. These wholesalers may decide to import sugar alongside their range of products. As a result, this will most likely compel the sugar company to adjust its prices as if it's in perfect competition.

The concentration ratio tends not to be affected by mergers among the top market incumbents. If there exists a merger between the largest and second-largest companies, their combined pricing power is most likely to be larger than that of the two pre-existing companies, which the concentration ratio will not accurately represent.

### **The Herfindahl-Hirschman Index (HHI)**

Economists OC Herfindahl and A.O. Hirschman came up with an index that first squares the market shares of top N companies. These squares are then summed up. The Herfindahl-Hirschman Index (HHI) for a monopoly firm should equal 1.

Consequently, in the case of M firms with equal market shares, the HHI should be equal to  $\frac{1}{M}$ . This is a very useful gauge for interpreting the HHI. This measure was developed to try and overcome some issues associated with the concentration ratio.

This measure was developed to try and overcome some issues associated with the concentration ratio.

### **Example: Herfindahl-Hirschman Index (HHI)**

Using the same example as above, the HHI for the top three companies can be calculated as:

$$\text{HHI} = 0.35^2 + 0.20^2 + 0.10^2 = 0.1725$$

### **Limitations of the HHI**

The HHI does not consider the elasticity of demand; thus, it cannot approximate the potential profitability of a single company or a group of companies.

HHI does not consider barriers to entry.

## Question

Which of the following best describes a market structure with only one buyer?

- A. Monopoly.
- B. Monopsony.
- C. Monopolistic competitive market.

## Solution

**The correct answer is B.**

A monopsony has only one buyer.

**A is incorrect.** A monopoly has one seller but many buyers.

**C is incorrect.** A monopolistic competitive market has many buyers and fairly many sellers.

## Question

If a market has 5 suppliers and each of the top two suppliers holds 20 percent of the market share, which of the following best represents the concentration ratio for the top 2 suppliers and their respective HHI?

- A. Concentration ratio = 4%; HHI = 40.
- B. Concentration ratio = 40%; HHI = 0.08.
- C. Concentration ratio = 40%; HHI = 0.4.

## Solution

**The correct answer is B.**

The concentration ratio is the sum of the two suppliers' market share.

Therefore,  $20\% + 20\% = 40\%$ .

For the HHI, we take  $0.20^2 \times 2 = 0.08$ .