

Level I of the CFA® Exam

Study Notes - Economics

Offered by AnalystPrep

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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.

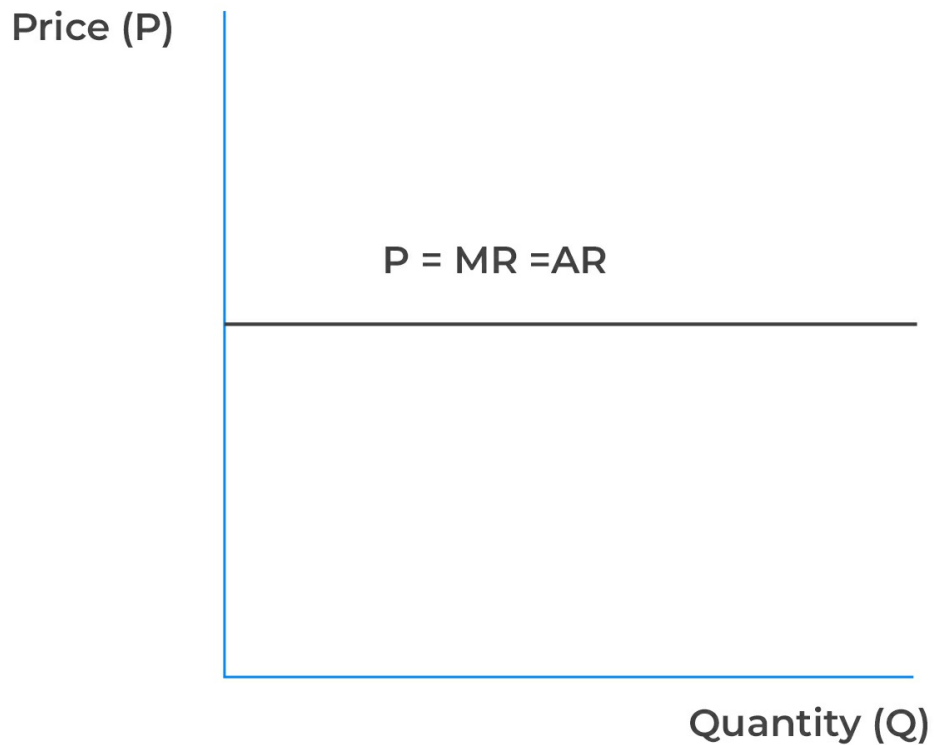
Perfectly Competitive Environment

In a perfectly competitive environment, firms are the price takers. That is, the firm must accept the market price for its output, resulting in a perfectly elastic and horizontal demand curve.

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,
 $P = MR = AR$



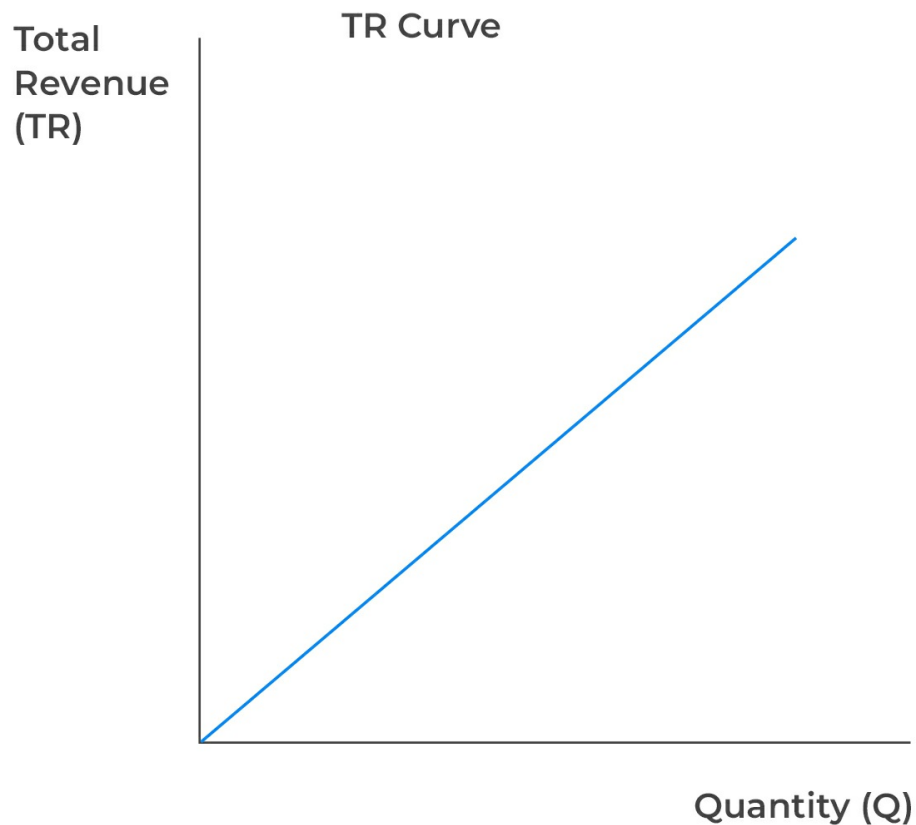
Demand Curve under Perfect Competition



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:

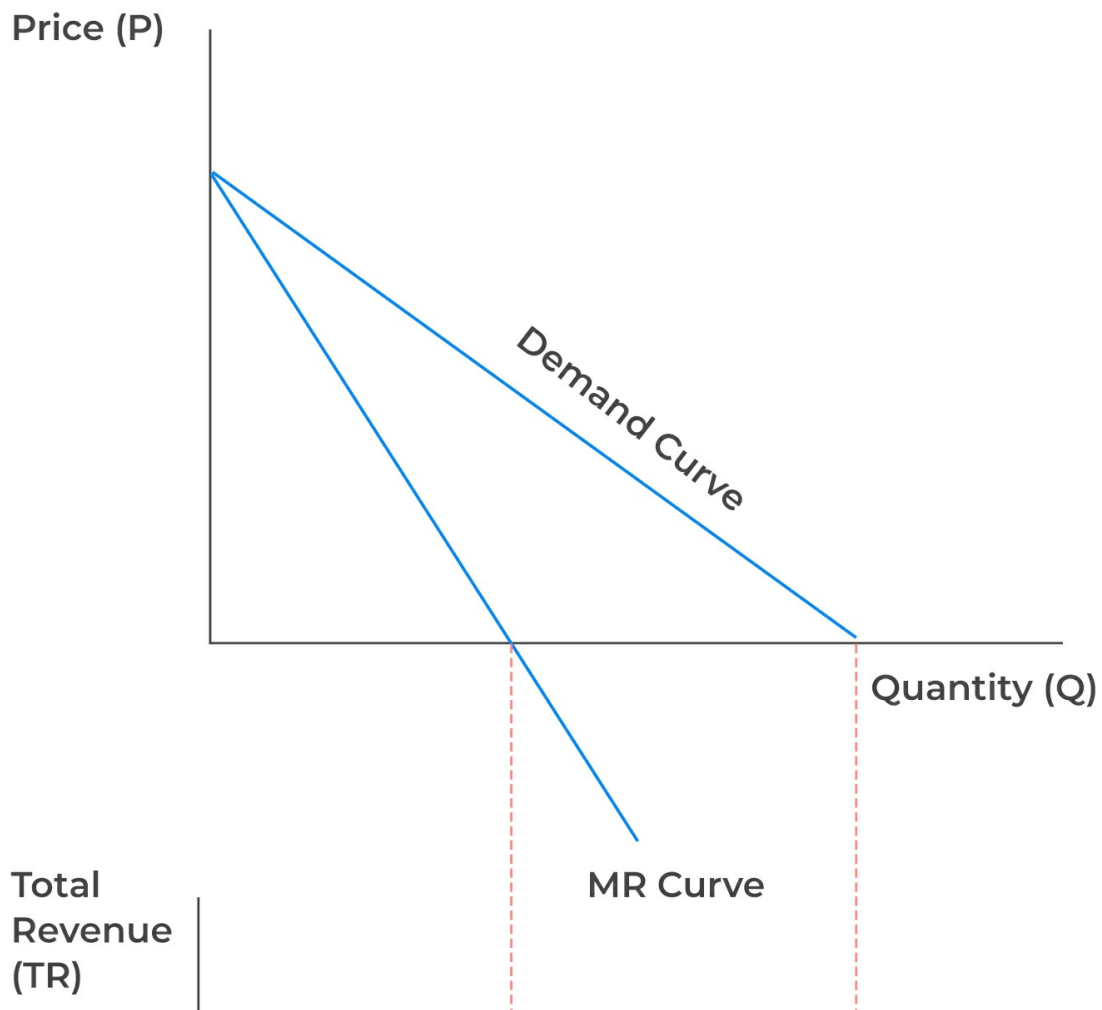
$$TR = f(Q) \times Q$$

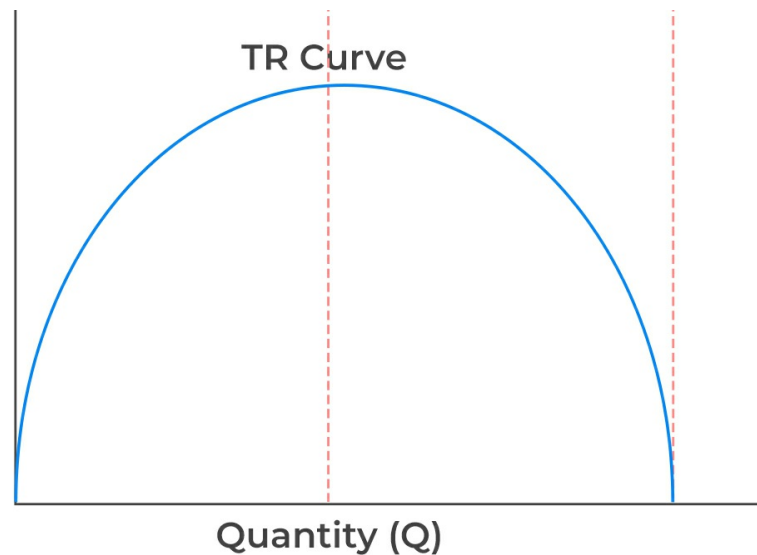
Assuming that the demand curve is linear and negatively sloped, TR is equal to the total expenditure of all the buyers in the market.

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:



Demand, TR and MR Curves under Monopolistic Competition





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, Breakeven, 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 distinction between the short run and the long run depends on whether the firm can adjust all of its inputs.

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.

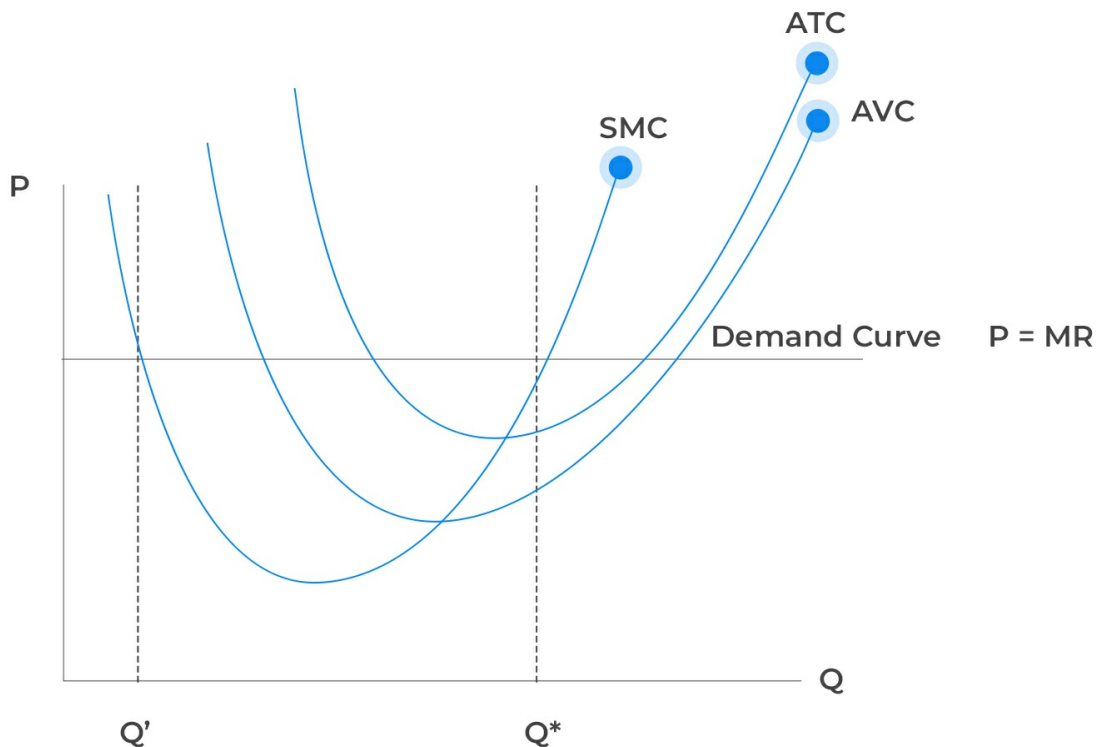
Profit-Maximization Point

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



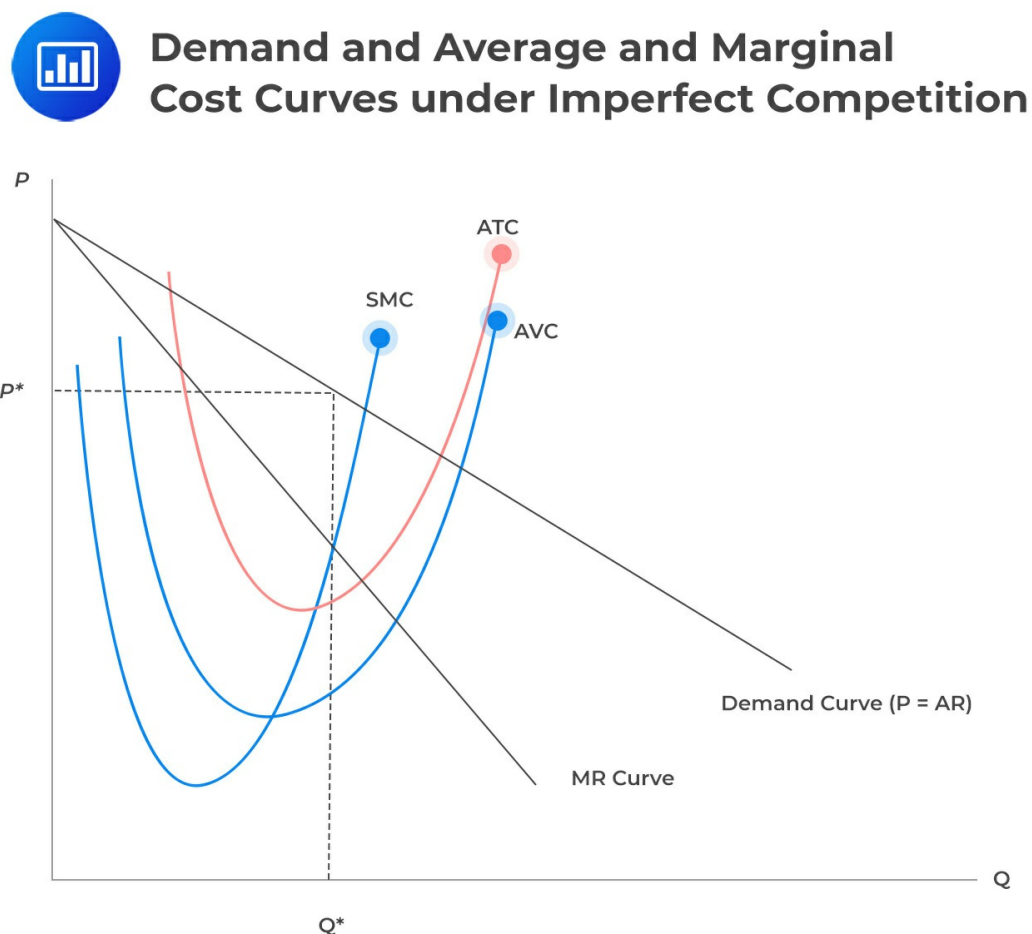
The firm maximizes profit at Q^* , where price equals short-run marginal cost (SMC) and SMC is rising. However, at a different output, denoted as Q' , even though the price is equivalent to the SMC, the SMC has not yet started to increase but is still decreasing. Hence, this cannot be a point where profit 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.



The marginal revenue (MR) and demand curves for a monopolist are not the same. The profit-maximizing rule is to produce the quantity at which marginal revenue equals short-run marginal cost, provided marginal cost is rising.

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.

Breakeven Analysis

A firm reaches its breakeven point when its total revenue (TR) matches its total cost (TC). Similarly, a firm is at the breakeven 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.

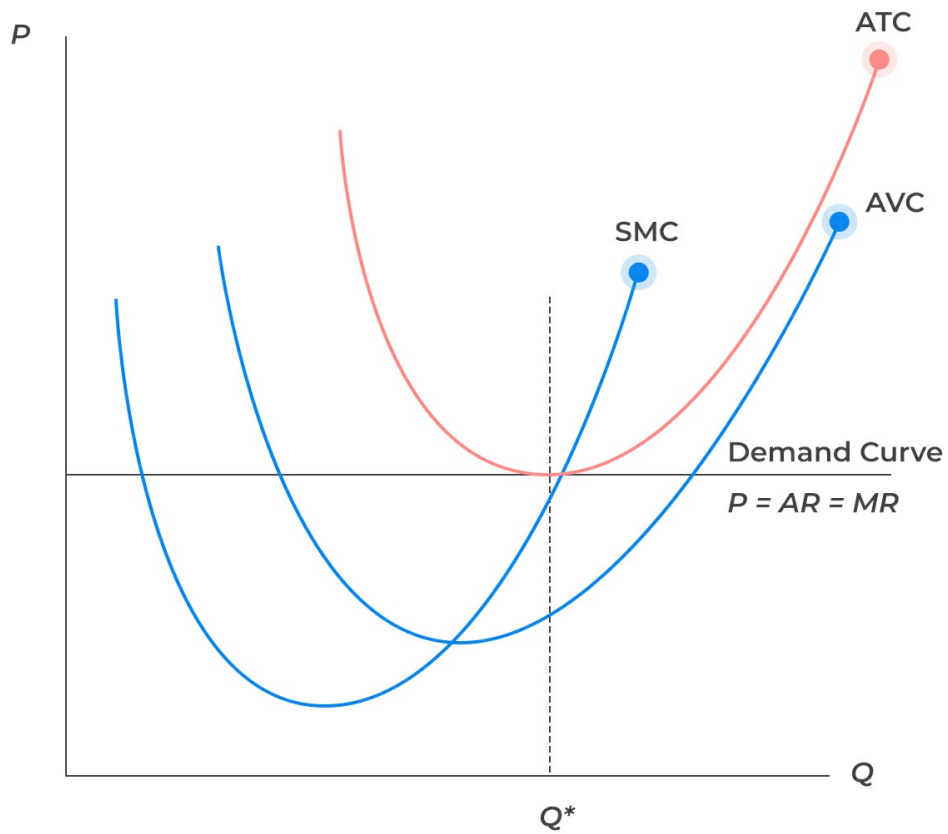
When the firm's revenue is equal to its economic costs, it implies that the company can cover the opportunity cost of all factors of production. In this case, the firm is said to be earning normal profit but not positive economic profit.

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

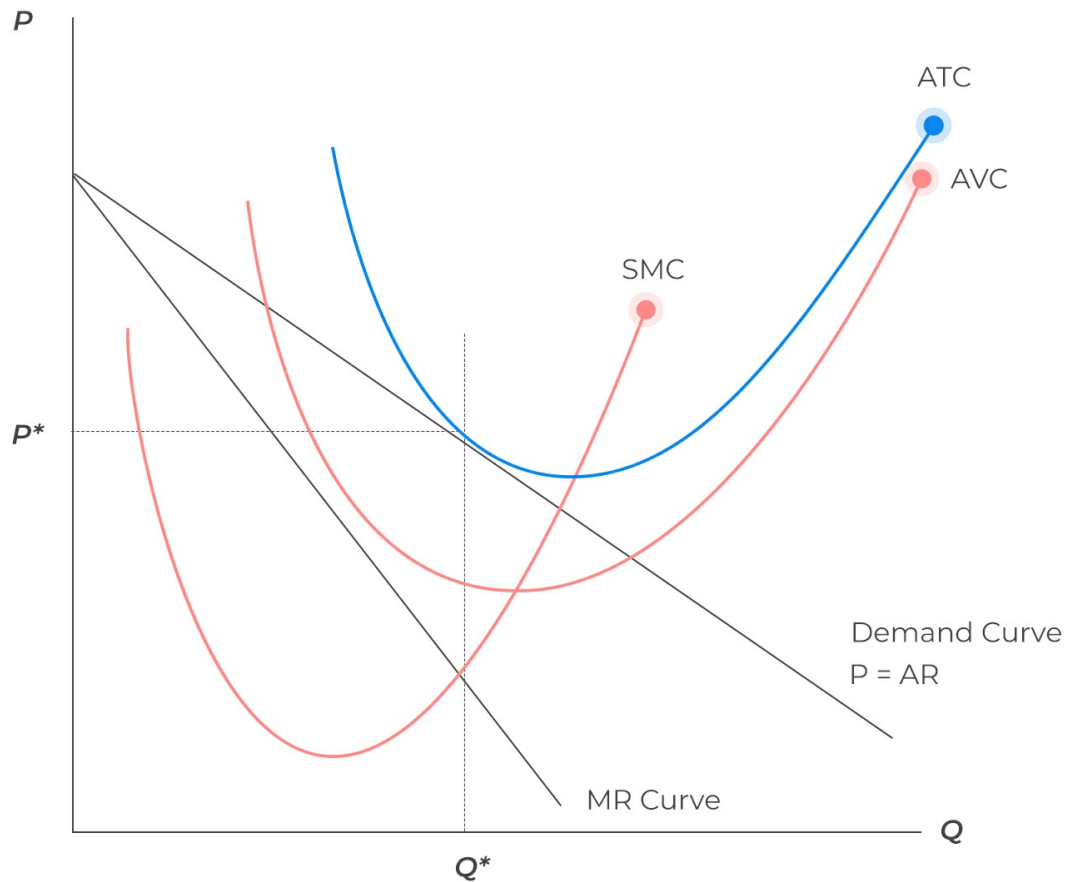


Recall that the best a firm can do is to break even. Note that in the graph above, the level of output where $SMC = MR$ is where $P = ATC$. This implies that economic profit is zero, and the firm is at a breakeven point.

The equivalent graph of a monopolist firm is shown below:



Breakeven Point under Monopolistic Market



Shutdown Analysis

In the long run, a firm exits the industry if it cannot earn at least zero economic profit. In the short run, however, it may continue operating even with an economic loss if revenue covers variable cost and contributes to fixed cost.

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).

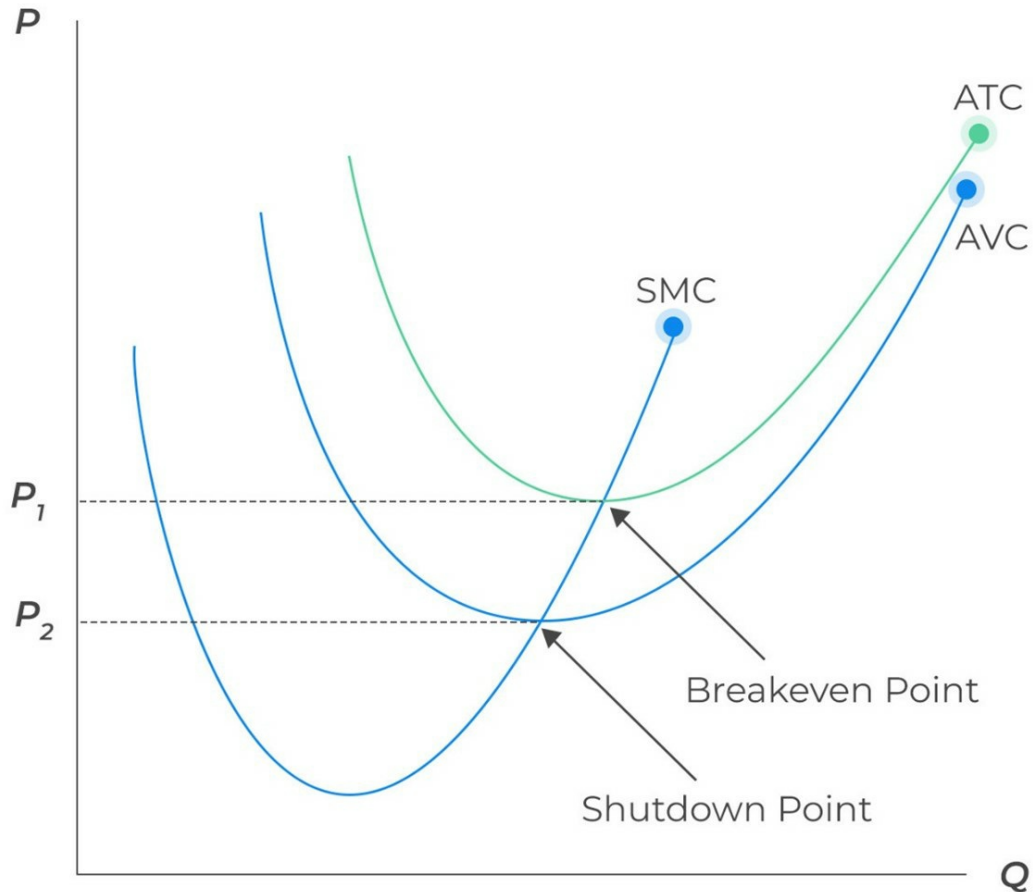
However, in the long run, the firm should exit the industry if market prices do not increase, as it becomes unsustainable to stay in the market without the potential for higher returns.

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



If price is at or above the breakeven price, the firm can cover average total cost. If price is between the breakeven price and the shutdown price, the firm should continue operating in the short run because it covers variable cost and part of fixed cost. If price falls below shutdown point, which represents the lowest average variable cost (AVC), the firm should shut down.

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 the firm produces 1,000 units and sells each unit for \$5. Total revenue is $\$5 \times 1,000 = \$5,000$, fixed cost (FC) is \$4000, and a variable cost (VC) is \$3,000 for all units. Total cost is \$7,000, consisting of fixed cost of \$4,000 and variable cost of \$3,000. Therefore, Average Total Cost (ATC) = \$7 per unit, and Average Variable Cost = \$3 per unit.

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.

The firm should continue operating in the short run because price per unit of \$5 exceeds average variable costs (AVC) of \$3. In the long run, it should exit unless price rises enough to cover average total cost (ATC) of \$7.

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.

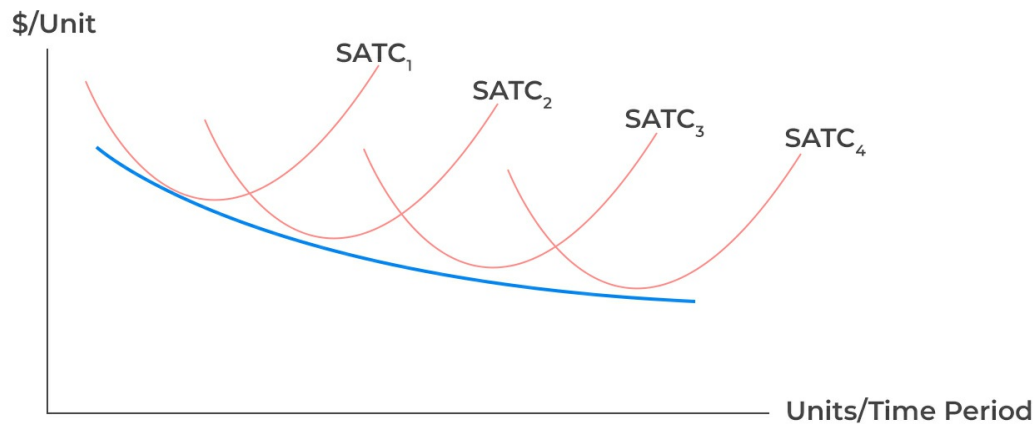
Economies and Diseconomies of Scale

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



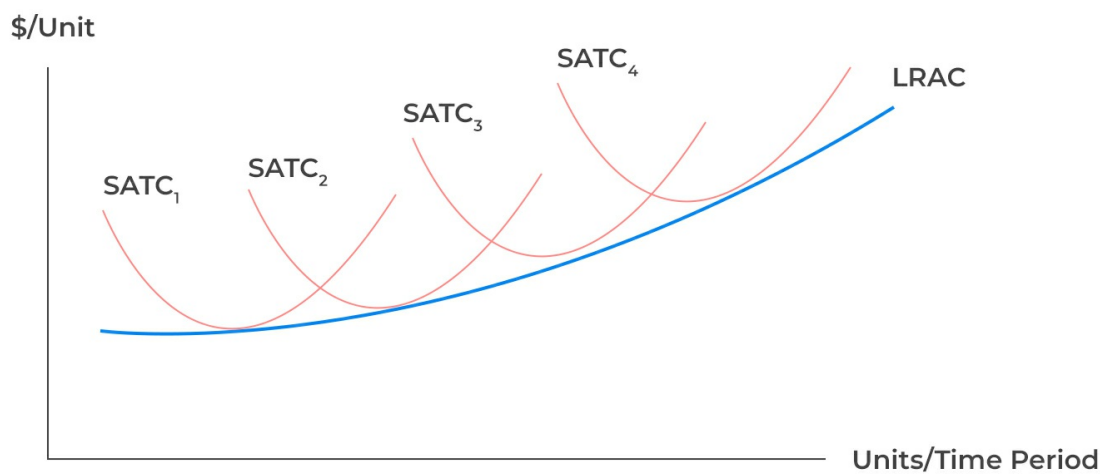
The following factors can lead to economies of scale:

- 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 economies of scale nor diseconomies of scale. It is constant returns to 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

Factors that Influence Market Structure.

- i. The number and relative magnitude of firms supplying a product.
- ii. The extent of product differentiation.
- iii. The seller's power over pricing decisions.
- iv. The strength of the barriers to entry and exit.
- v. The extent of non-price competition observed in the market.

There are four types of economic market structures.

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 a form of imperfect competition, with strong elements from both perfect competition and the monopoly market structure. A monopolistically competitive market includes many firms selling differentiated products. 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.

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. Firms seek to maximize profits.
3. Firms have some pricing power, but their decisions are interdependent because competitors' actions affect them.
4. Barriers to entry are typically high.
5. Firms may earn abnormal (economic) profits in the long run because of barriers to entry.
6. Products may be homogeneous or differentiated.
7. Firms are strategically interdependent, meaning each firm considers competitors' likely reactions when making decisions.

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 may charge different prices to different customers based on their willingness to pay.
4. There are very high barriers to entry for other firms.
5. There is a single seller that controls the whole market.

6. Monopolies, particularly natural monopolies, may be subject to government regulation to protect consumers and promote efficiency.

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 and strategic
Monopoly	One	Unique Product	Very High	Considerable	Usually low, are few or no substitutes.

Question

An industry has many firms selling nearly identical products that are close substitutes for one another, and there are no meaningful 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).

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

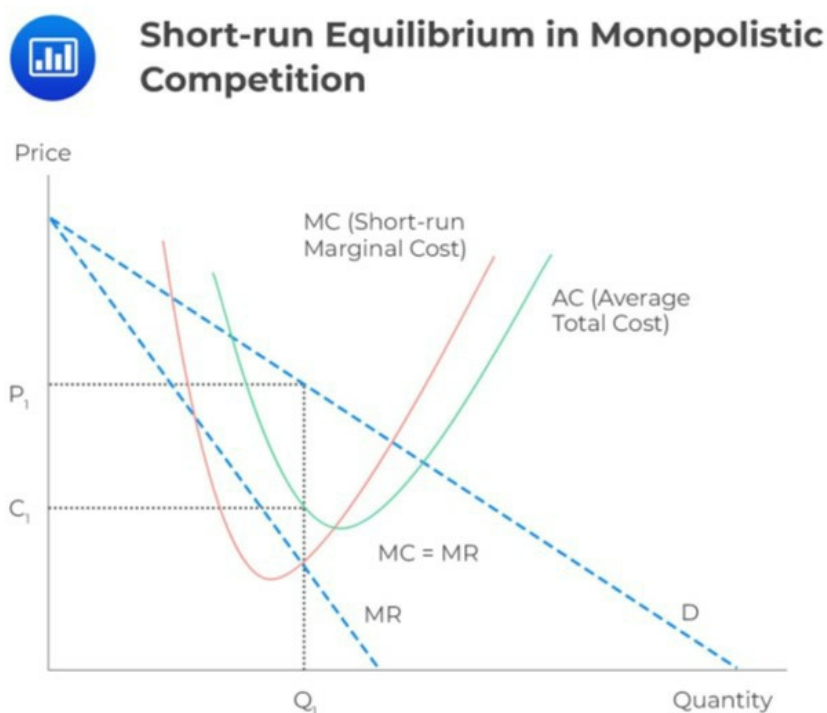
B is incorrect. Monopolistic competition involves differentiated products and some pricing power. The stem describes products that are essentially homogeneous/undifferentiated.

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 not well-defined. The appropriate output level is determined by the point where the Marginal Cost and Marginal Revenue curves intersect ($MC=MR$).

A monopolistically competitive firm does not have a well-defined supply curve because the profit-maximizing quantity depends on demand, marginal revenue, and marginal cost rather than on marginal cost alone.

Optimal Price and Output under Monopolistic Competition

In this market structure, the short-run profit-maximizing point is the point where marginal revenue equals marginal cost ($MR=MC$). Total revenue (TR) is the product of P_1 and Q_1 as shown in the graph above.

The average cost incurred in producing Q units of a product is C_1 (As shown in the graph above), and the total cost (TC) is the area of the rectangle,

$$C_1 \times Q_1$$

The economic profit is the difference between TR and TC denoted by:

$$\pi = TR - TC$$

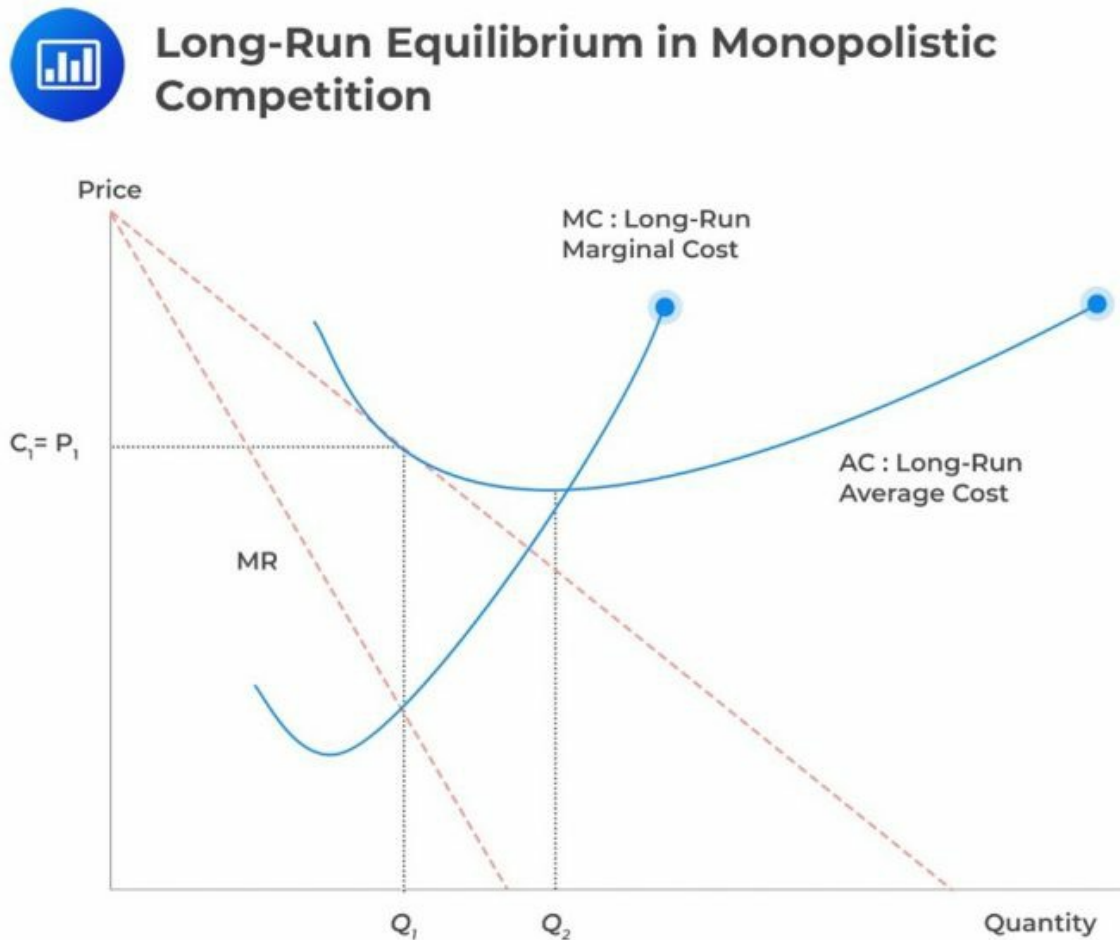
Long-Run Equilibrium under Monopolistic Competition

As firms under monopolistic competition start reporting higher profits, and because the barriers to entry are low in this market structure, more firms will enter the market, and consequently drive demand down since the new entrants will attract some customers.

As a result, the economic profits realized by firms in monopolistic competition will fall (to zero in the long run). 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 the level where marginal revenue (MR) equals marginal cost (MC), represented by Q_1 . The demand curve determines the price consumers are willing to pay for any amount of the product, 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 position in a monopolistic competition market is situated at

a higher level of 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 profit is zero since total revenue equals total cost. Mathematically,

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

In long-run monopolistic competition, economic profit is driven to zero, but the firm does not produce at the minimum point of average total cost. Product differentiation and advertising can increase costs and contribute to excess capacity relative to perfect competition.

Question

A firm operating under monopolistic competition maximizes profit 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.