

Cost Analysis

Cost of Production

Generally, economists include the following expenditures in the cost:

(i) cost of the raw materials, (ii) wages of the labourers, (iii) interest payments on capital loans, (iv) rent of the land and the buildings, (v) repairing costs of machines and depreciation, (vi) tax payments to the government and local bodies, (vii) imputed wage payment to the producer for the work performed by him, (viii) imputed interest payment for the capital invested by the producer himself, (ix) rent of land and buildings owned by the producer himself and (x) normal profits of the firm.



Fixed Costs, Variable Costs, and Total Costs

Fixed costs are those that are spent and cannot be changed in the period of time under consideration.

Workers represent **variable costs** – those that change as output changes.

The sum of the variable and fixed costs are total costs.

$$TC = FC + VC$$

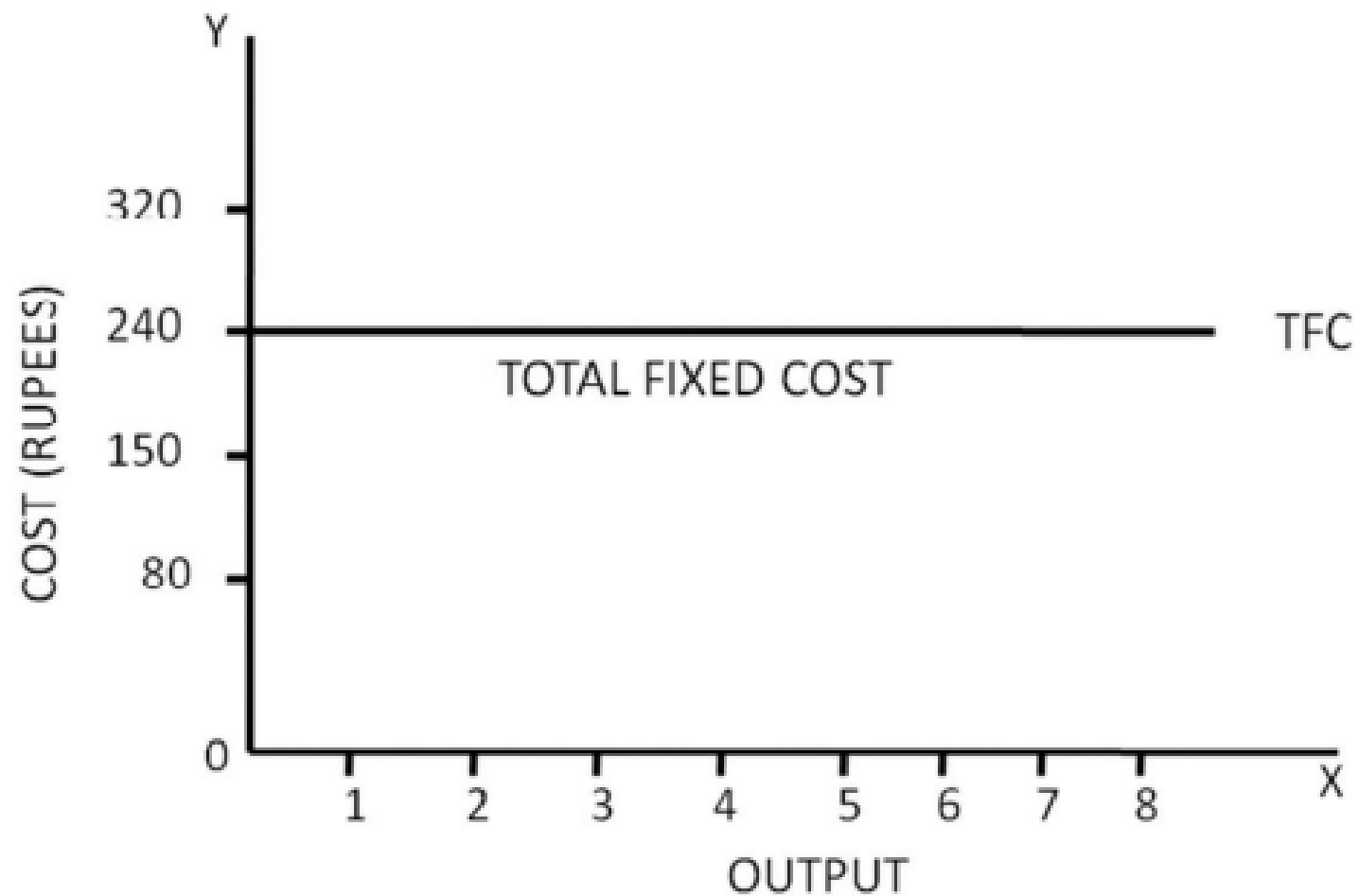


Fig. 10.1 : Total Fixed Cost curve is parallel to X axis as total fixed cost remains the same for all levels of output

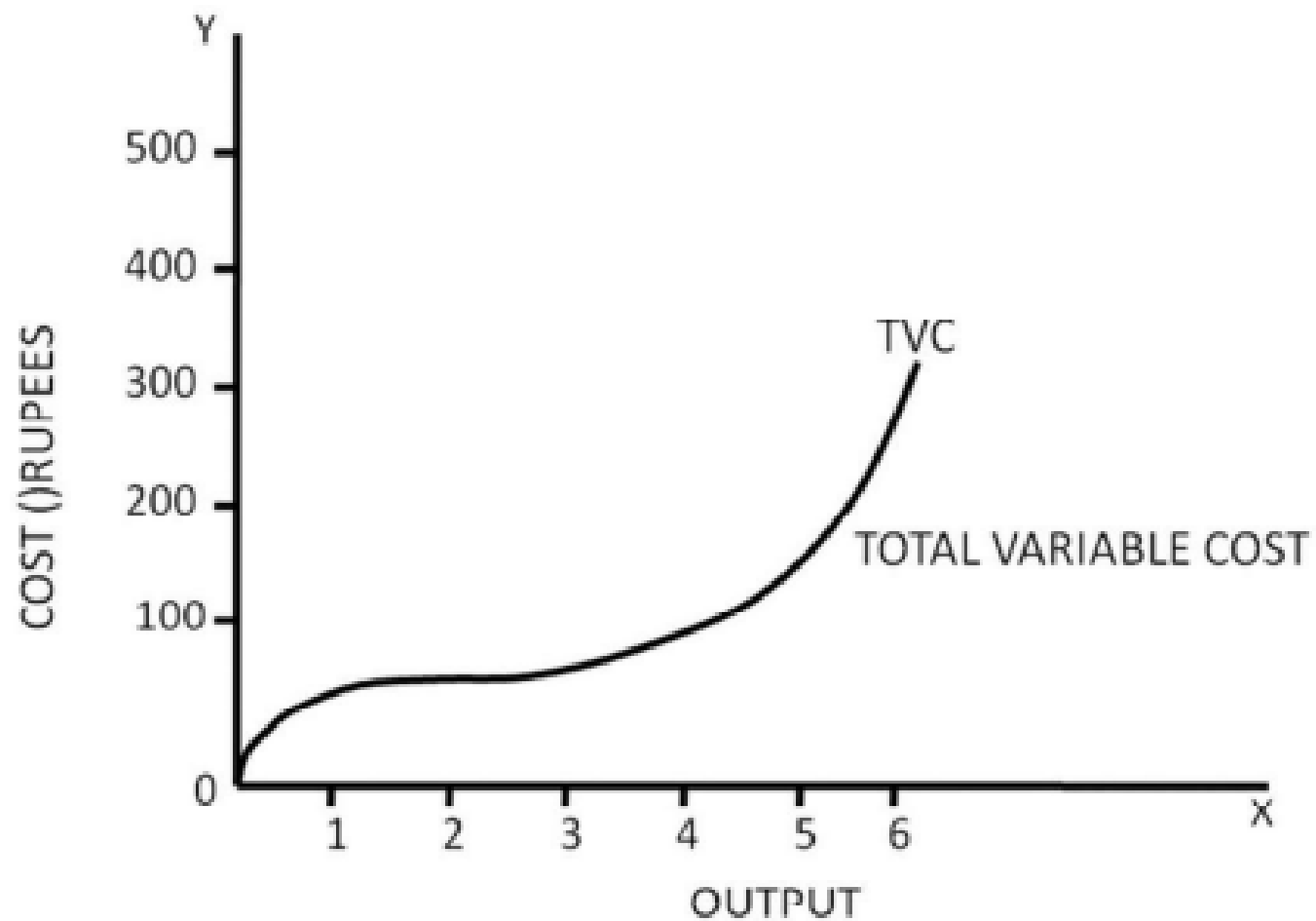
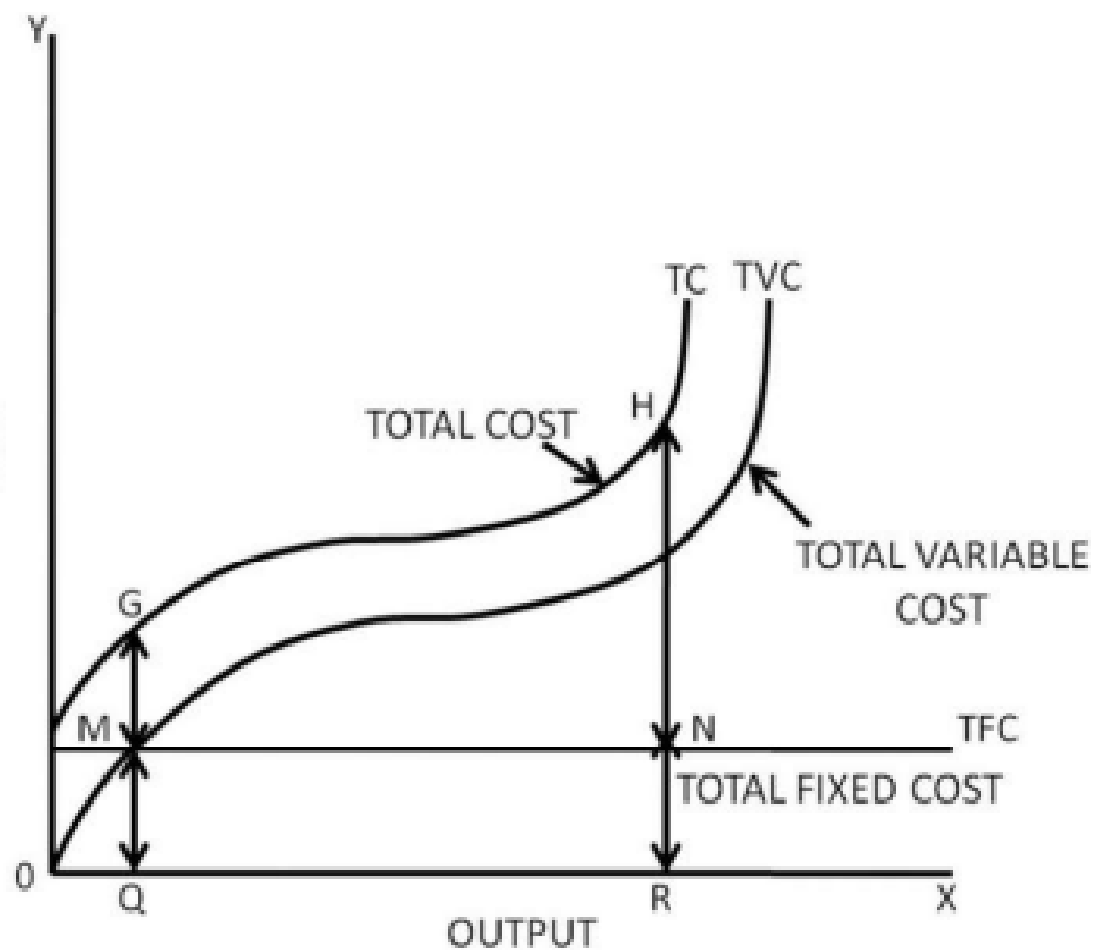


Fig. 10.2 : Total Variable Cost Curve rises from left to right



4 : Total Fixed Cost, Total Variable Cost and Total Co

Average Cost

Average total cost (often called average cost) equals total cost divided by the quantity produced.

$$ATC = TC/Q$$

Average fixed cost equals fixed cost divided by quantity produced.

$$AFC = FC/Q$$

Average variable cost equals variable cost divided by quantity produced.

$$AVC = VC/Q$$

$$ATC = AFC + AVC$$

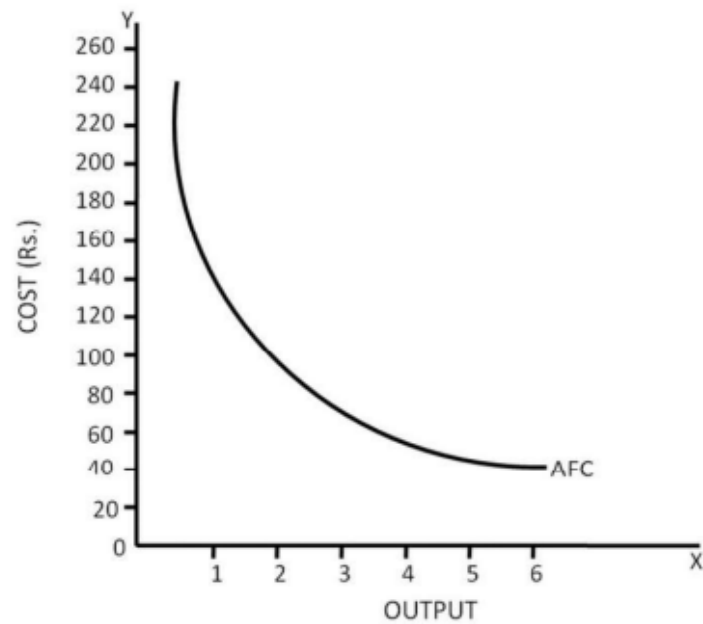
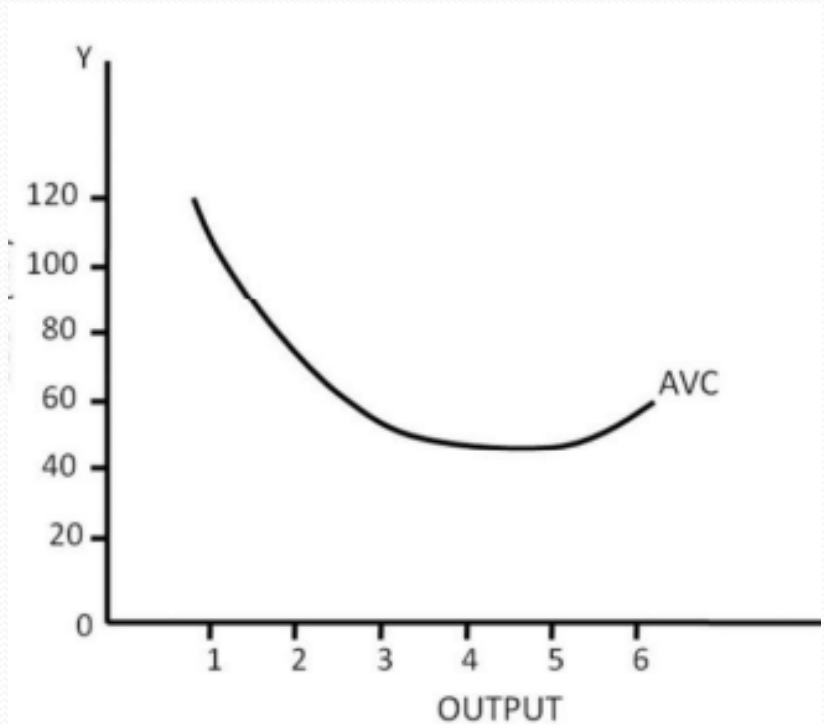


fig. 10.5: Average Fixed Cost curve is a rectangular hyperbo



10.6: Average variable cost curve is a U-shaped c



Marginal cost is the increase (decrease) in total cost of increasing (or decreasing) the level of output by one unit.

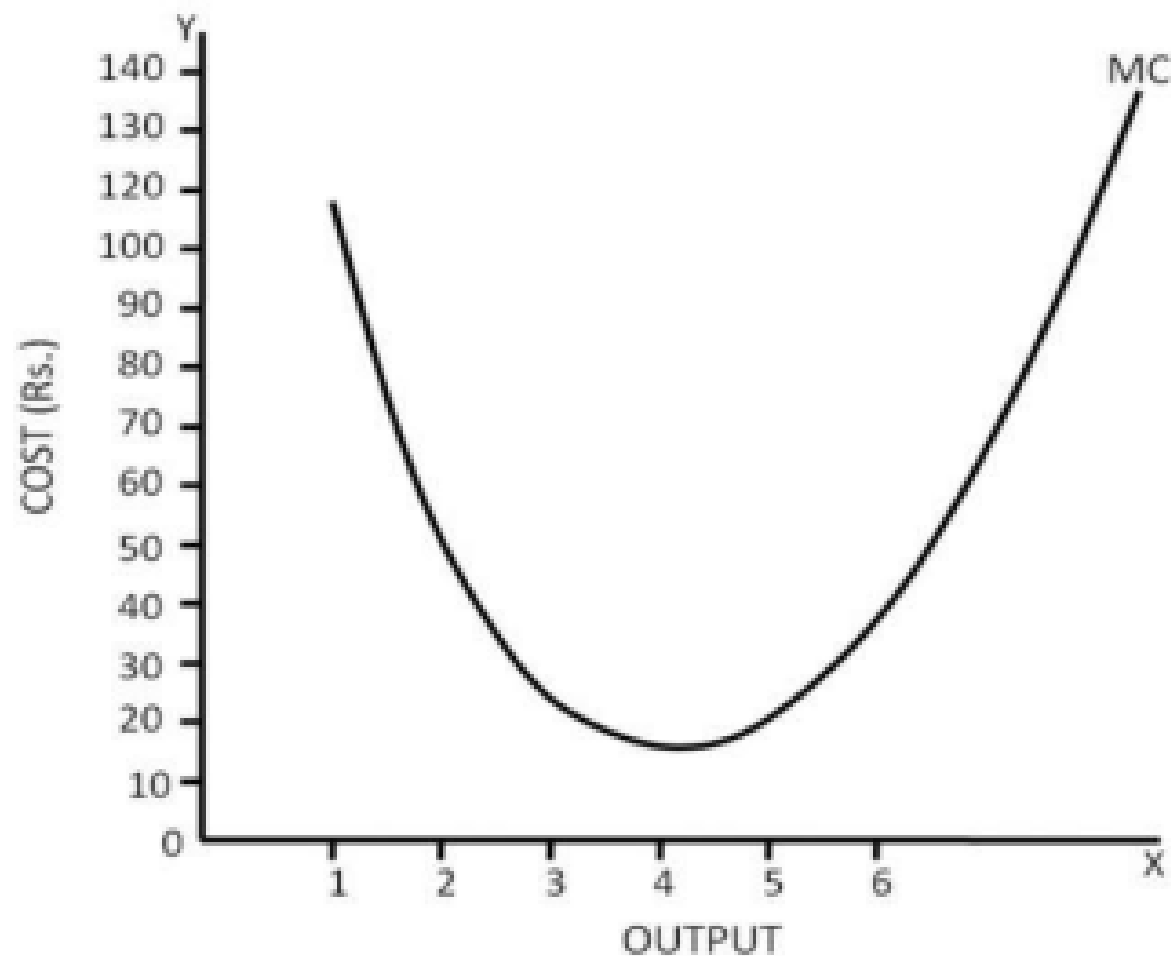


Fig. 10.9 : Marginal Cost Curve is a U-shaped Curve

- Hence, the ATC curve slopes downward. Since at point T on the AVC curve the rate of increase of the average variable cost is the same as the rate at which the average fixed cost falls corresponding to this level of output, average total cost is minimum at this output level.
- As the level of output increases beyond this point, the average variable cost rises far more rapidly than the rate at which average fixed cost falls. Therefore, the ATC curve slopes upward.

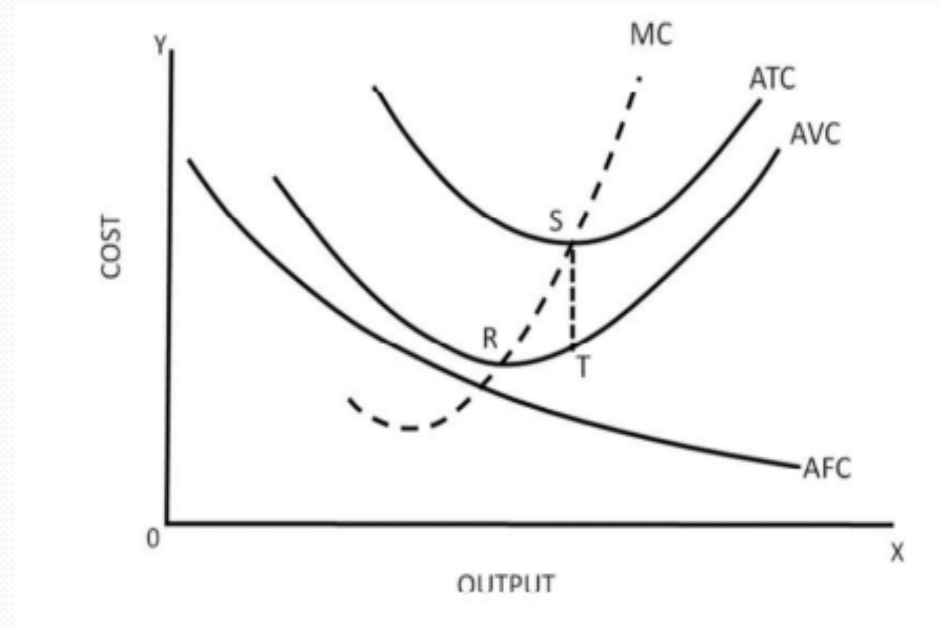


Fig. 10.8: Average total cost is the vertical sum of AFC and AVC

Relationship between Marginal Cost and Average Cost

- There is a close relationship between the marginal cost (MC) curve and the average total cost (ATC) and average variable cost (AVC) curves.
- We shall explain the relationship only between the MC curve and the ATC curve, but the relationship between the MC curve and the AVC curve can be explained along the same lines of reasoning.
- Fig. 10.10 shows the MC curve together with the ATC curve and the AVC curve. The relationship between the ATC curve and the MC curve is as follows:
 - **1) When the MC curve is below the AC curve (which means marginal cost is less than average cost), the AC falls.**
 - **2) When the MC curve is above the AC curve (which means marginal cost is more than average cost), the AC rises.**
 - **3) The MC curve intersects the AC curve at its minimum point.**

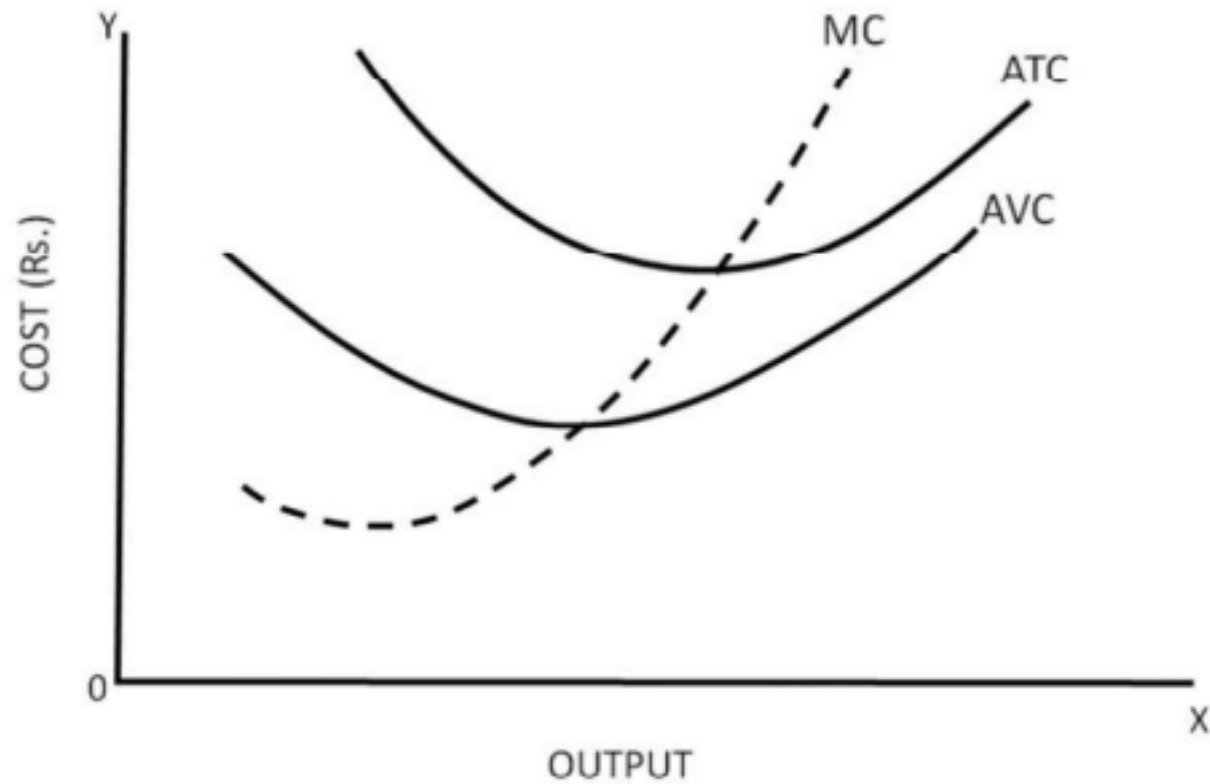


Fig. 10.10: MC curve intersects both AVC curve and ATC curve at their minimum points

If $MC > ATC$, then ATC is rising.

If $MC = ATC$, then ATC is at its low point.

If $MC < ATC$, then ATC is falling.

Cost Equation

If total cost is given by $TC = a + bQ - cQ_2 + dQ_3$,

Total Fixed Cost is 'a'

Total Variable Cost is $bQ - cQ_2 + dQ_3$

From this, AFC, AVC and AC can be computed

Marginal Cost (MC) = $d(TC)/dQ$

Minimum point of AC means, slope is zero. That means,

$d(AC)/dQ = 0$

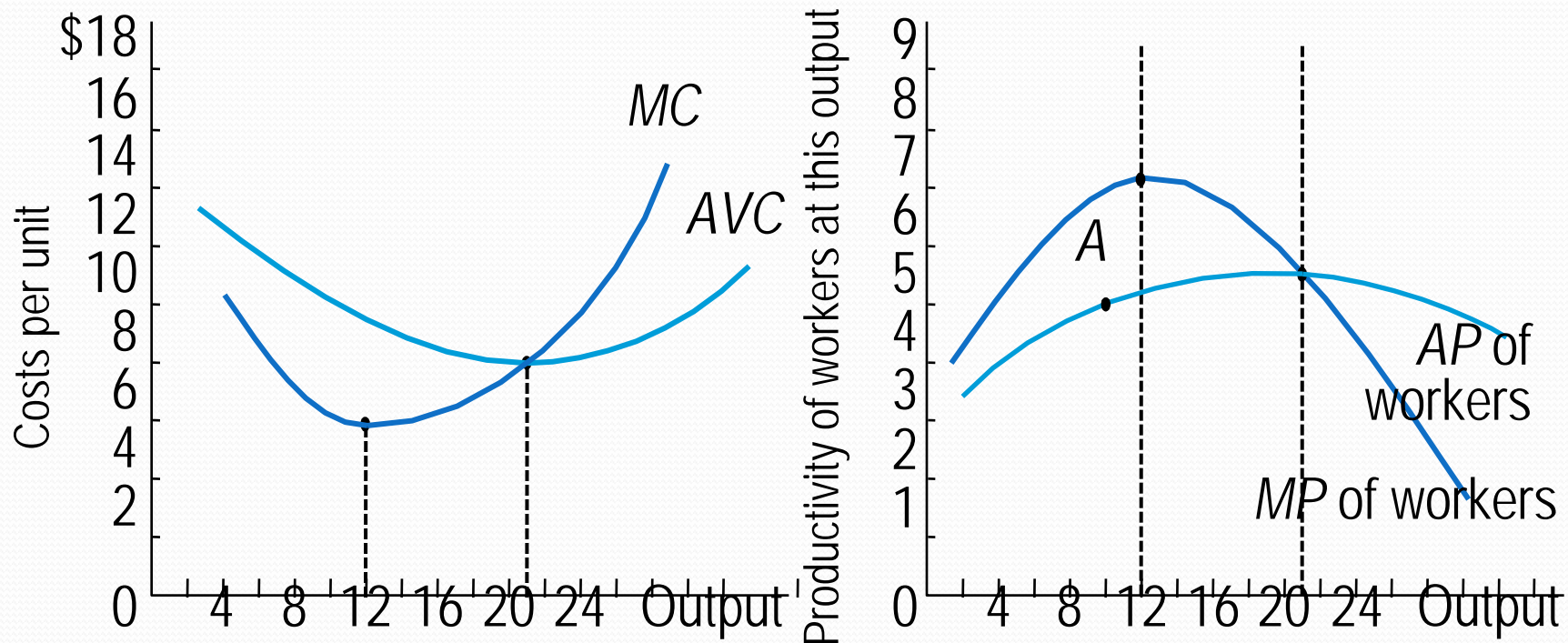
Cost Related Problem

Output	Average Variable Cost (AVC)	Average Cost (AC)	Total Cost (TC)	Average Fixed Cost (AFC)	Marginal Cost (MC)
0			500		-
1			700		200
2					100
3					250
4					400
5					510

The Relationship Between Productivity and Costs

- The shapes of the cost curves are mirror-image reflections of the shapes of the corresponding productivity curves.
- When one is increasing, the other is decreasing.
- When one is at a maximum, the other is at a minimum.

The Relationship Between Productivity and Costs



BREAK-EVEN ANALYSIS

The main objective of break-even analysis is to find the cut-off production volume from where a firm will make profit.

s = selling price per unit

v = variable cost per unit

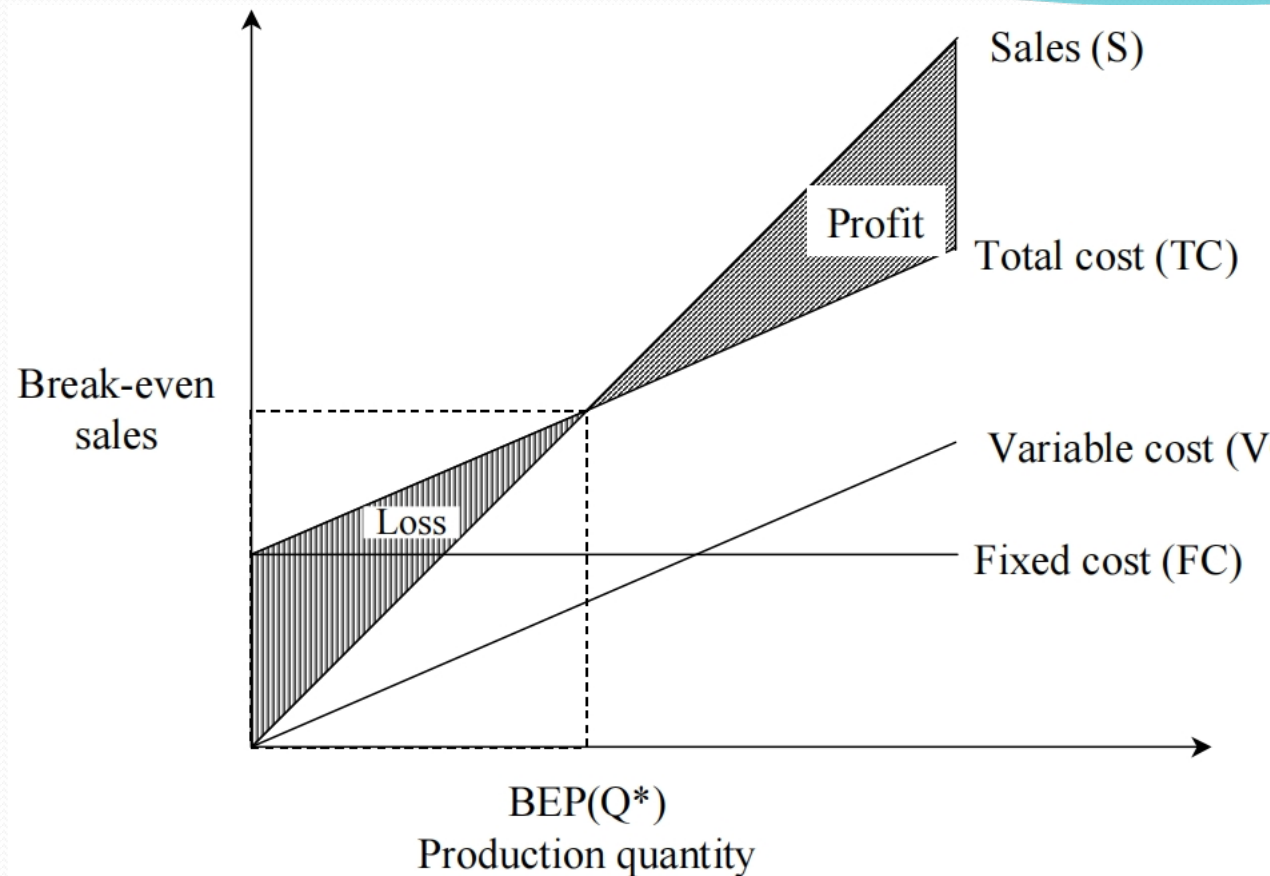
FC = fixed cost per period

Q = volume of production

The total sales revenue (S) (Total Revenue) of the firm is given by the following formula: $S = s * Q$

The total cost of the firm for a given production volume is given as

$TC = \text{Total variable cost} + \text{Fixed cost} = v * Q + FC$



The intersection point of the total sales revenue line and the total cost line is called the break-even point. At the intersection point, the total cost is equal to the total revenue. This point is also called the no-loss or no-gain situation.

- Profit = Sales – (Fixedcost + Variable costs) = $s * Q - (FC + v * Q)$

$$\text{Break-even quantity} = \frac{\text{Fixed cost}}{\text{Selling price/unit} - \text{Variable cost/unit}}$$

$$= \frac{FC}{s - v} \text{ (in units)}$$

$$\text{Contribution} = \text{Sales} - \text{Variable costs}$$

$$\text{Contribution/unit} = \text{Selling price/unit} - \text{Variable cost/unit}$$

$$\text{M.S.} = \text{Actual sales} - \text{Break-even sales}$$

$$= \frac{\text{Profit}}{\text{Contribution}} \times \text{sales}$$

The margin of safety (M.S.) is the sales over and above the break-even sales

EXAMPLE 1.1 Alpha Associates has the following details:

Fixed cost = Rs. 20,00,000

Variable cost per unit = Rs. 100

Selling price per unit = Rs. 200

Find

- (a) The break-even sales quantity,
- (b) The break-even sales
- (c) If the actual production quantity is 60,000, find (i) contribution; and (ii) margin of safety by all methods.

PROFIT/VOLUME RATIO (P/V RATIO)

$$P/V \text{ ratio} = \frac{\text{Contribution}}{\text{Sales}} = \frac{\text{Sales} - \text{Variable costs}}{\text{Sales}}$$

The relationship between BEP (Break Even Point) and P/V ratio is as follows:

$$\text{BEP} = \frac{\text{Fixed cost}}{P/V \text{ ratio}}$$

EXAMPLE 1.2

- Consider the following data of a company
- Sales = Rs. 1,20,000
- Fixed cost = Rs. 25,000
- Variable cost = Rs. 45,000
- Find the following:
- (a) Contribution
- (b) Profit
- (c) BEP
- (d) M.S

$$\begin{aligned} \text{(a) Contribution} &= \text{Sales} - \text{Variable costs} \\ &= \text{Rs. } 1,20,000 - \text{Rs. } 45,000 \\ &= \text{Rs. } 75,000 \end{aligned}$$

$$\begin{aligned} \text{(b) Profit} &= \text{Contribution} - \text{Fixed cost} \\ &= \text{Rs. } 75,000 - \text{Rs. } 25,000 \\ &= \text{Rs. } 50,000 \end{aligned}$$

(c) BEP

$$\begin{aligned} P/V \text{ ratio} &= \frac{\text{Contribution}}{\text{Sales}} \\ &= \frac{75,000}{1,20,000} \times 100 = 62.50\% \end{aligned}$$

$$\text{BEP} = \frac{\text{Fixed cost}}{P/V \text{ ratio}} = \frac{25,000}{62.50} \times 100 = \text{Rs. } 40,000$$

$$\text{M.S.} = \frac{\text{Profit}}{P/V \text{ ratio}} = \frac{50,000}{62.50} \times 100 = \text{Rs. } 80,000$$



Question 1.1

Derive the short-run Average Cost Curve(SAC) with the help of Average Variable Cost (AVC) curve and Average Fixed Cost (AFC) curve. Do you find that SAC is minimum at a higher level of output than the AVC? Why?

Question 1.2

The total fixed cost of a company is \$300000 and produces a product with variable cost of \$42 per unit. The selling price per unit is \$72.

- (i) Find the P/V ratio and break even sales using P/V ratio
- (ii) If the company producing 15000 units find the margin of safety in percentage.
- (iii) Sketch a suitable figure to display the break-even point and margin of safety.

Question 2.1

- The fixed cost of a small firm is Rs.500000. The variable cost per unit is Rs.50 and the selling price per unit is Rs.100.
- (i) What is the contribution Margin per unit and profit-volume ratio?
- (ii) Find the Quantity at which the firm is neither getting profit nor incurring loss. Also find the sales value at this point using profit-volume ratio.
- (iii) If currently the firm is producing 18000 units of output, find the margin of safety in percentage. Show the margin of safety with a proper diagram.

Question 2.2

The Average Variable Cost (AVC) function of a production unit at a certain level of output is

$$AVC = 100 - 15Q + Q^2$$

The Average Fixed Cost (AFC) at this level of output is \$50.

- (i) Find the output at which the MC (Marginal Cost) is minimum.
- (ii) Find the output at which Average Cost (AC) is minimum.
- (iii) On the basis of the MC and AC values show the relation between MC and AC with the help of a correct figure.

Question 3.1

A company has following sales and profit in 2022 and 2023.

Year	Sales(in ₹)	Profit(in ₹)
2022	2,50,000	50,000
2023	2,90,000	70,000

Find out:

- (i) P/V ratio
- (ii) Fixed cost
- (iii) Variable cost in 2010
- (iv) BES(Break Even Saes)
- (v) Margin of safety in 2011
- (vi) Sales required to have a target profit of ₹ 30,000

Question 4.1

The Total Cost function faced by a firm is

$$TC = 8000 + 10Q + 20Q^2 - Q^3$$

- (i) What is the output beyond which Marginal Cost (MC) will rise?
- (ii) Find the price below which the firm should shut down production.

Question 4.2

Given the Total Cost (TC) function of a firm as

$$TC = 100 + 60Q - 12Q^2 + Q^3$$

(i) Find the output level at which Average Variable Cost (AVC) is minimum.

(ii) Find the output level at which Marginal Cost (MC) is minimum.

Graphically show the relationship between AVC and MC on the basis of the results you get.

Question 5.1

Sanchit manufacturing unit faces the following Total Variable Cost (TVC) condition

$$TVC = 300Q - 30Q^2 + Q^3$$

(i) Determine the output (Q) where Marginal Cost (MC) curve cuts the Average Variable Cost (AVC) curve.

(ii) Find the output after which MC rises.



Question 1.2: Answer

$$FC = 300000$$

$$AVC = 42$$

$$SP = 72$$

$$(i) \quad P/V \text{ ratio} = 5/12$$

$$\text{Break-even sales} = 300000 \frac{300000}{30} = 100000$$

12

X

Question 2.1: Answer

$$(i) \quad CM = 100 - 50 = 50$$

$$\frac{500000}{50} = 10000 \text{ units}$$

DAZ

4

Question 2.2: Answer

$$\begin{aligned}\text{(i) } AVC &= 100 - 15Q + Q^2 \\ TVC &= 100Q - 15Q^2 + Q^3 \\ \frac{dMC}{dQ} &= -30 + 6Q = 0 \\ \Rightarrow Q &= 5\end{aligned}$$

ME

Question 3.1: Answer

- (i) P/V ratio = **50%** (% change in profit/ % change in sales)
- (ii) Fixed cost = **75,000** (sales* P/V ratio)-Profit
- (iii) V₂₀₁₀ = **1,25,000** (1-p/v) Sales
- (iv) BES = **1,50,000** (Fixed cost / p/v ratio)
- (v) MS₂₀₁₁ = **1,40,000** (Sales-Break even sales)
- (vi) **2,10,000**

Question 4.1: Answer

$$C = 8000 + 10Q + 20Q^2 - Q^3$$

$$(i) \quad MC = 10 + 40Q - 3Q^2$$

$$\Rightarrow \frac{dMC}{dQ}$$

Question 4.2: Answer

$$TC = 100 + 60Q - 12Q^2 + Q^3$$

$$(i) \quad AVC = 60 - 12Q + Q^2$$

$$\Rightarrow \frac{dAVC}{dQ}$$

$$\frac{\quad}{10} =$$

Question 5.1: Answer

$$TVC = 300Q - 30Q^2 + Q^3$$

$$(i) \quad MC = 300 - 60Q + 3Q^2$$

$$AVC = 300 - 30Q + Q^2$$

AVC min

$$\frac{dAVC}{dQ} = 0 \quad \Rightarrow -30 + 2Q = 0$$

$$\Rightarrow Q = 15$$

Students might have equated MC and AVC for getting the result

$$(ii) \quad MC \text{ min}$$

$$\frac{dMC}{dQ} = 0 \quad \Rightarrow -60 + 6Q = 0$$

$$\Rightarrow Q = 10$$