Costs are mainly of the following types:

1. Total cost

2. Average cost

3. Marginal cost.

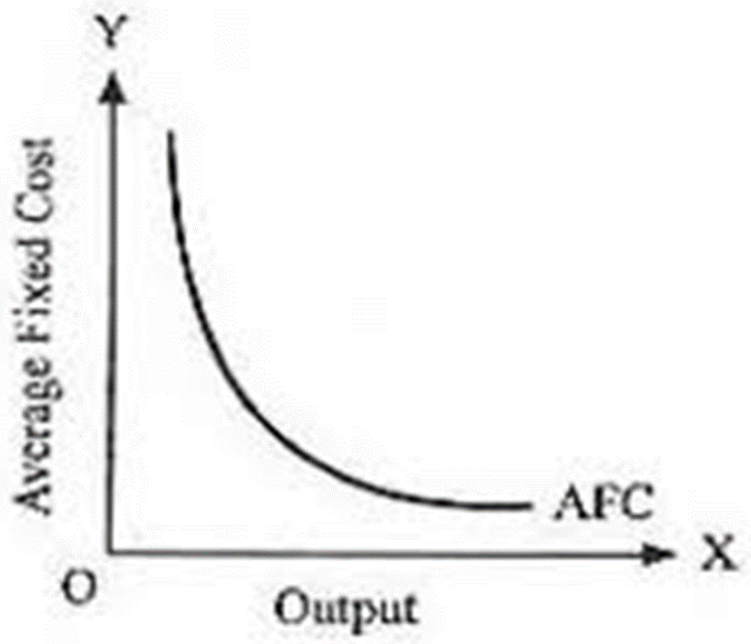
I. Total Cost:According to Dooley, “Total cost of production is the sum of all expenditure incurred in producing a given volume of output.” In other words, the amount of money spent on the production of different levels of a good is called total cost. For instance, if a total sum of Rs. 2500 is spent on the production of 100 bicycles, then the total cost of producing 100 bicycles will be Rs. 2500. Since, there are two types of factors of production in the short run, so there are two types of costs.

Thus $\boxed{TC = FC + VC}$

TC → Total cost

FC → Fixed cost

VC → Variable cost



Fixed Costs or Supplementary Costs:

- The cost that remains fixed at any level of output is known as the fixed cost. These costs must be paid whether there is production or not. These costs include, depreciation allowance, interest on fixed capital, license fee, salaries to permanent staff etc.

- In the words of Anatol Murad, “Fixed costs are costs which do not change with change in the quantity of output.” These costs are also known as the overhead costs or indirect costs because a firm has to incur these costs even if it shuts down temporarily. Thus, fixed costs are unavoidable which occur even at the zero level of output.

Total fixed cost can be explained as under :

$$TFC = \text{Explicit Fixed Cost} + \text{Implicit cost}$$

Or

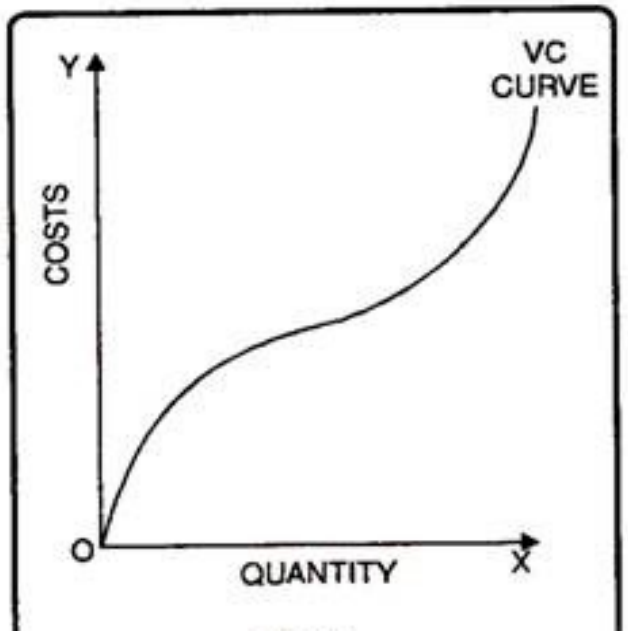
$$TFC = \text{Total Costs} - \text{Total variable costs}$$

Or

$$TFC = TC - TVC$$

Variable costs refer to those costs which change with the change in the volume of output. These costs are unavoidable or contractual costs. Marshall called these costs as “Prime Costs”, “Direct Costs” or “Special Costs”. Variable costs include expenditure on transport, wages of labour, electricity charges, price of raw material etc. Thus, according to Dooley, “Variable costs are one which varies as the level of output varies.”

Variable cost curve starts from zero. It means when output is zero, variable costs are also zero. But as the output increases variable costs also increase.



Relationship between different types of costs

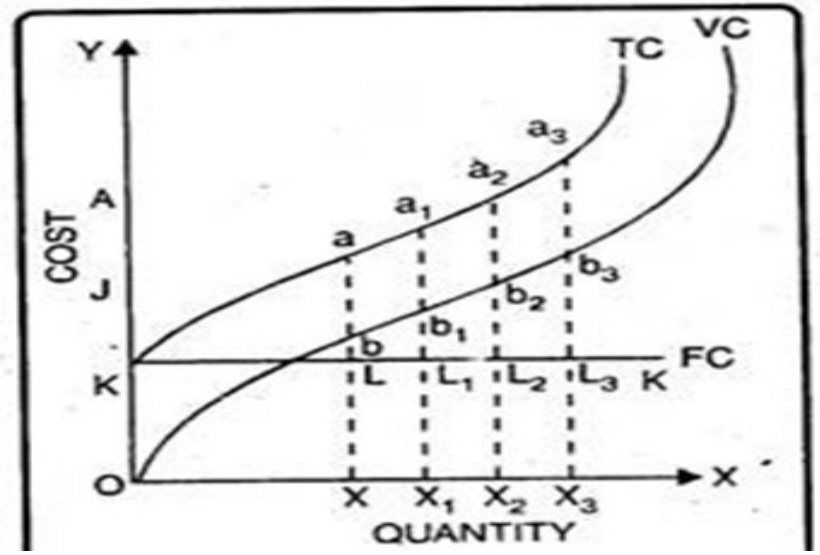
Equations

- $MC = \Delta TC / \Delta Q = \Delta TVC / \Delta Q$
- $TC = TFC + TVC$
- $ATC = TC/Q$ therefore $TC = ATC(Q)$
- $AFC = TFC/Q$ therefore $TFC = AFC(Q)$
- $AVC = TVC/Q$ therefore $TVC = AVC(Q)$
- $ATC = AFC + AVC$

TC = FC + VC

Table 3.

Output 1	Fixed Cost 2	Variable Cost 3	Total Cost (2 + 3)
0	40	0	40
1	40	20	60
2	40	30	70
3	40	32	72
4	40	34	74
5	40	36	76
6	40	38	78
7	40	40	80
8	40	46	86



- when output is zero, variable costs are also zero. But the fixed costs as well as total costs are 40. As the output increases to 8 units, total costs go up to 86. It means as the output increases fixed costs remain the same, but variable costs increase at a diminishing rate then at constant rate and ultimately at an increasing rate. The relationship has been shown in the following diagram.

Marginal cost: an addition to the total cost caused by producing one more unit of output.

where
MC = Marginal cost
TC_n = total cost of 'n' units
TC_{n-1} = Total cost of $n-1$ units
ΔTC = Change in total cost
ΔQ = Change in output.

"Marginal cost is the addition to total cost due to the addition of one unit of output." **–Ferguson**

"Marginal cost at any level of output is the extra cost for producing one extra unit more or less." **–Samuelson**

The derivation of MC can be studied with the help of a table 6.

Table 7.

Units of Output	TC = TFC + TVC	MC = $(TC_n - TC_{n-1})$
1	60	–
2	70	10
3	76	6
4	78	2
5	84	6
6	90	6
7	108	18
8	130	22

From this table, we can draw the following conclusions :

(*i*) TC increases at diminishing rate upto 4 units.

(*ii*) TC increases at constant rate *i.e.* 4th to 5th unit.

(*iii*) TC increases at an increasing rate *i.e.* from 6th unit onwards.

In Figure 8 output has been measured on X-axis and costs on Y-axis. MC is marginal cost curve. It is also of U-shape which signifies the fact that as output is increased initially MC curve falls. The MC curve reaches the minimum point after that it starts rising in upward direction. It is only on account of this reason that MC curve is also of U-shape.

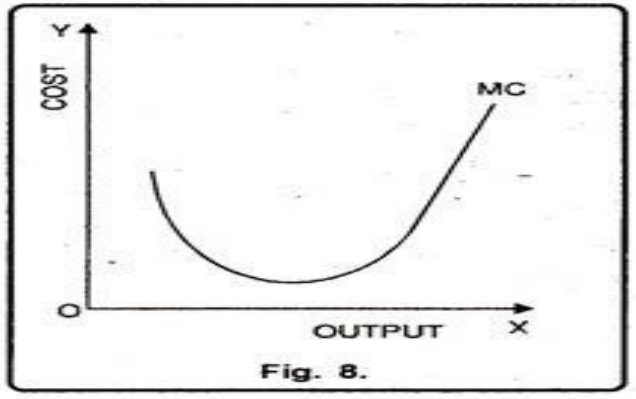


Fig. 8.

$MC_n = TC_n - TC_{n-1}$

$= (TVC_n + TFC) - (TVC_{n-1} + TFC)$

$= TVC_n + TFC - TVC_{n-1} - TFC$

$= TVC_n - TVC_{n-1}$

Hence, marginal cost is the addition to the total variable costs when output is increased from n-1 units to n units of output. Hence, marginal cost is independent of the amount of the fixed costs.

- **Why is the MC Curve of U-shape?**
- Marginal cost means the addition made to total cost on account of producing one more unit of output. In the beginning, when a firm increases its output, total costs as well as variable costs start increasing at a diminishing rate.
- It is only due to the reason that in the initial stage of production law of increasing returns applies. Moreover, in the initial stage of production, the firm enjoys many economies which cause the MC to fall. As the output continues, marginal cost becomes minimum, thus, ultimately starts rising.
- The reason being the operation of the Law of Diminishing Returns. In short, initially marginal cost falls and after having the minimum point it begins to rise. Thus, it is how the MC is also of U-shape.

- **Why the short-run AC is curve U-shaped?**

In the short-run average cost curves are of U-shape. It means, initially it falls and after reaching the minimum point it starts rising upwards. It can be on account of the following reasons.

1. Basis of Average Fixed Cost and Average Variable Cost: It is well known, that average cost is the aggregate of average fixed cost and average variable cost (AC = AFC + AVC). To begin with, as production increases, initially the average fixed cost and average variable cost falls. But after a minimum point, average variable cost stops falling but not the average cost. It is due to this reason that average variable cost reaches the minimum before AC. The point, where AC is minimum is called the optimum point. After this point, AC begins to rise upward. The net result is the increase in AC. Therefore, it is only due to the nature of AFC and AVC that AC first falls, reaches minimum and afterwards starts rising upward and hence assume the U-shape.

2. Basis of the Law of Variable Proportion: The law of variable proportion also results in U-shape of short run average cost curve. If in the short period variable factors are combined with a fixed factor, output increases in accordance with the law of variable proportions. In other words, the law of 'Increasing Returns' applies. Similarly, if we employ more and more variable factors with fixed factors the law of Diminishing Returns is said to apply. Thus, it is due to the law of variable proportions that the average cost curve assumes the shape of U.

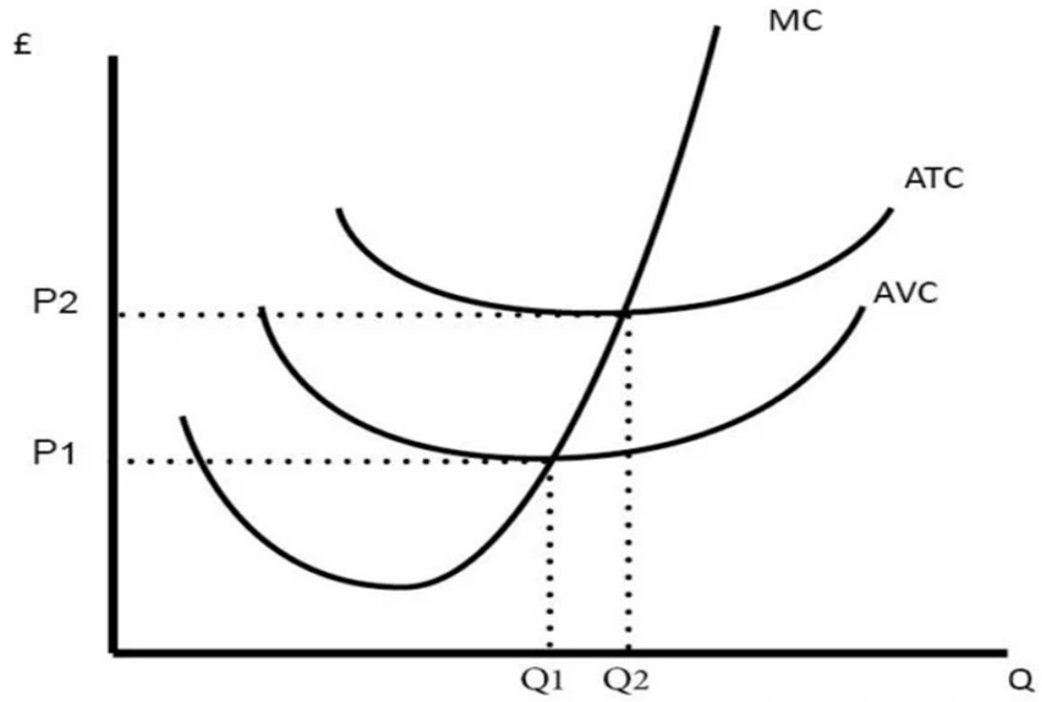
3. Indivisibilities of the Factors:

Another reason due to which the average cost curve forms U-shape is the indivisibilities of factors. When in the short-run a firm increases its production due to indivisibilities of fixed factors, it gets various internal economies. It is these economies which cause the average cost curve to fall in the initial stage. Generally, there are three types of internal economies which help to bring down the cost viz., technical economies, marketing economies and managerial economies.

Relationship between ATC and AVC

- The AVC is a part of the ATC given ATC = AFC+AVC
- Both AVC and ATC are U shaped reflecting the law of variable proportions
- The minimum point of ATC occurs to the right of the minimum point of the AVC. This is due to the fact that ATC includes AFC, and the latter falls continuously with increase in output. After the AVC has reached its lowest point and starts rising, its rise over a certain range offset by the fall in AFC, so that the ATC continues to fall (over that range) despite the increase in AVC. However, the rise in AVC eventually becomes greater than the fall in the AFC so that the ATC starts increasing.

- The minimum AVC is reached at Q1 while the ATC is at its minimum at Q2. Between Q1 and Q2 the fall in AFC more than offsets the rise in AVC so that the ATC continues to fall. Beyond Q2, the increase in AVC is not offset by the fall in AFC, so that ATC rises.



Relation between Average and Marginal Cost:

The relation between average and marginal cost can be explained with the help of following table:

Output	Total cost	Average cost	Marginal cost
1	15	15	15
2	28	14	13
3	34	11.3	6
4	39	9.7	5
5	42	8.4	3
6	48	8.0	6

- Main points of the relation are as under:

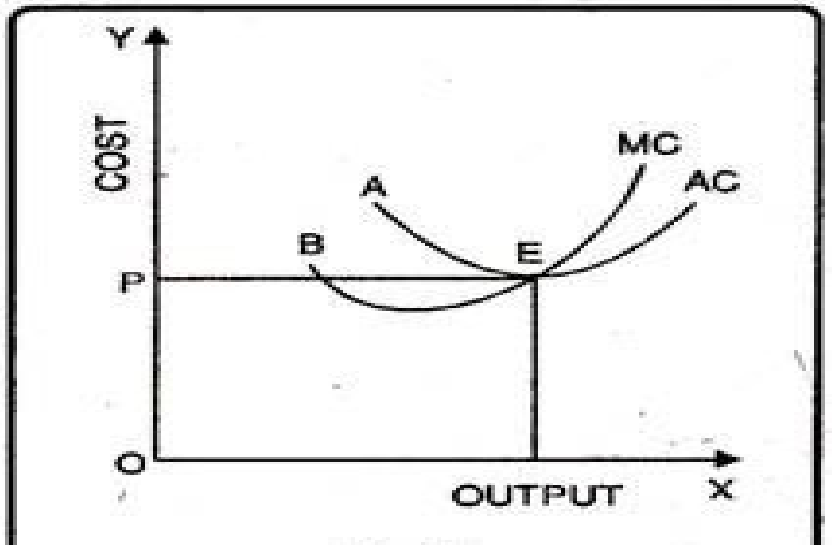
(1) Average Cost and Marginal Cost can be calculated from Total Cost: Average cost and marginal cost can be calculated from total cost. As is known, average cost is the ratio of total cost to total output. In other words, AC is calculated by dividing the total cost by the quantity of output. It means AC = TC / Q

- In the same way, marginal cost can also be calculated from total cost. It refers to an addition made to total output by producing one more unit of output. Thus, MC = TCn – TC n-1; MC = ΔTC / ΔQ

(2) When average cost falls, MC also falls: In this situation, rate of fall in marginal cost is more than fall in average cost. In other words, when AC curve is falling, MC curve will be below it. The reason behind this is that whereas average cost is the aggregate of average fixed cost and average variable cost, marginal cost refers only to change in average variable cost.

(3) When AC rises, MC also rises: When average cost curve rises, marginal cost too rises, but rate of increase in marginal cost is more than that of average cost.

(4) MC cuts AC at its Lowest Point: Marginal cost is equal to average cost when the latter is at its minimum. The minimum point of marginal cost occurs earlier than the average cost.



(5) When AC is constant MC becomes equal to AC: When AC is constant, marginal cost first increases and then becomes equal to it. Figure shows the picture more vividly.

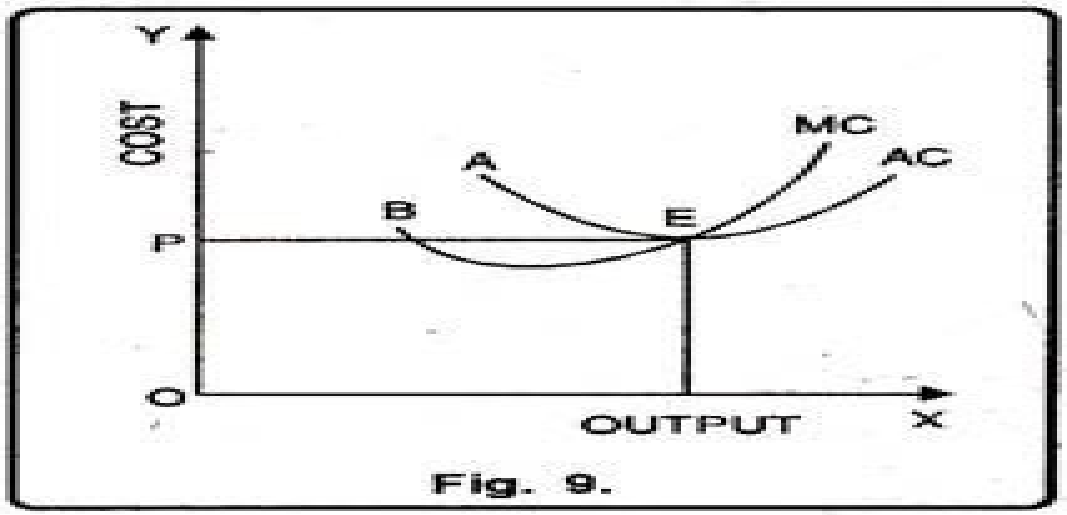


Fig. 9.

(6) Use of MC and AC in Price Determination: The concept of marginal cost is of great significance in finding out equilibrium output and that of average cost in finding out profit and loss. Equilibrium output is one at which marginal cost is equal to marginal revenue.

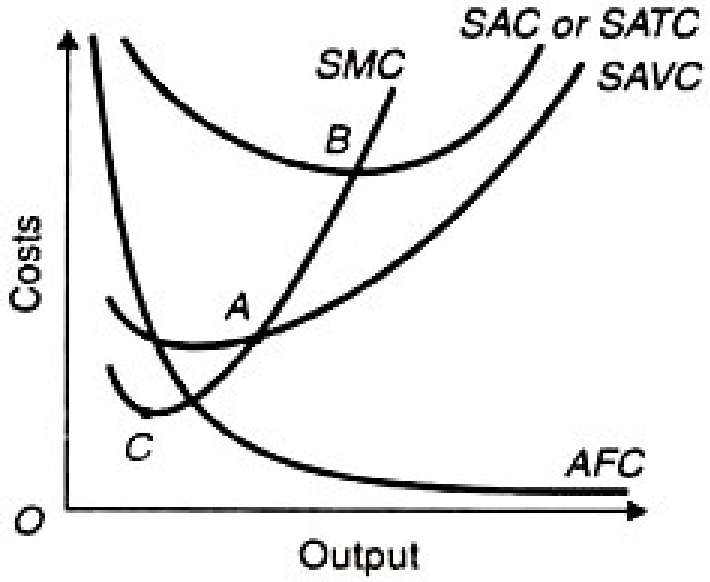
A firm earns normal profit when its average cost is equal to average revenue. It earns supernormal profit when average revenue is more than average cost. Moreover, a firm earns losses when average cost is more than average revenue.

Relationships of Short-Run Cost Curves:

(a) The AFC curve declines continuously and is asymptotic to both axes. It means that the AFC curve approaches both axes but never touches either X-axis or Y-axis. Thus the AFC curve is a rectangular hyperbola.

(b) The SAVC curve first declines, reaches a minimum at point A, and rises thereafter. When the SAVC curve reaches its minimum point A, the SMC curve equals the SAVC curve.

(c) The SAC curve first declines, reaches a minimum at point B, and rises thereafter. When the SAC curve reaches its minimum point B, the SMC curve equals the SAC curve. Since SAC = AFC + AVC, the vertical distance between the SAC and the SAVC curves gives the AFC curve, So there is no need to draw a separate AFC curve. As output expands, the vertical distance between the SAC curve and the SAVC curve declines because of the falling AFC curve.



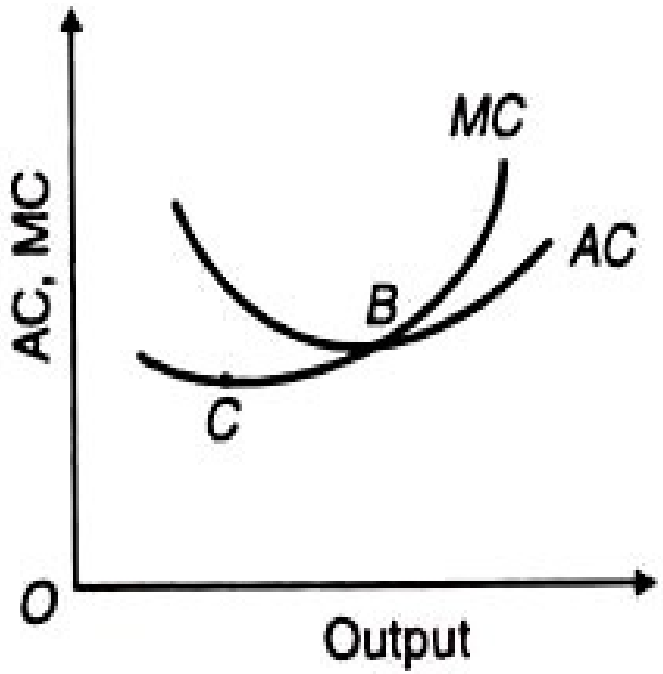
(d) Relation between AC and MC Curves:

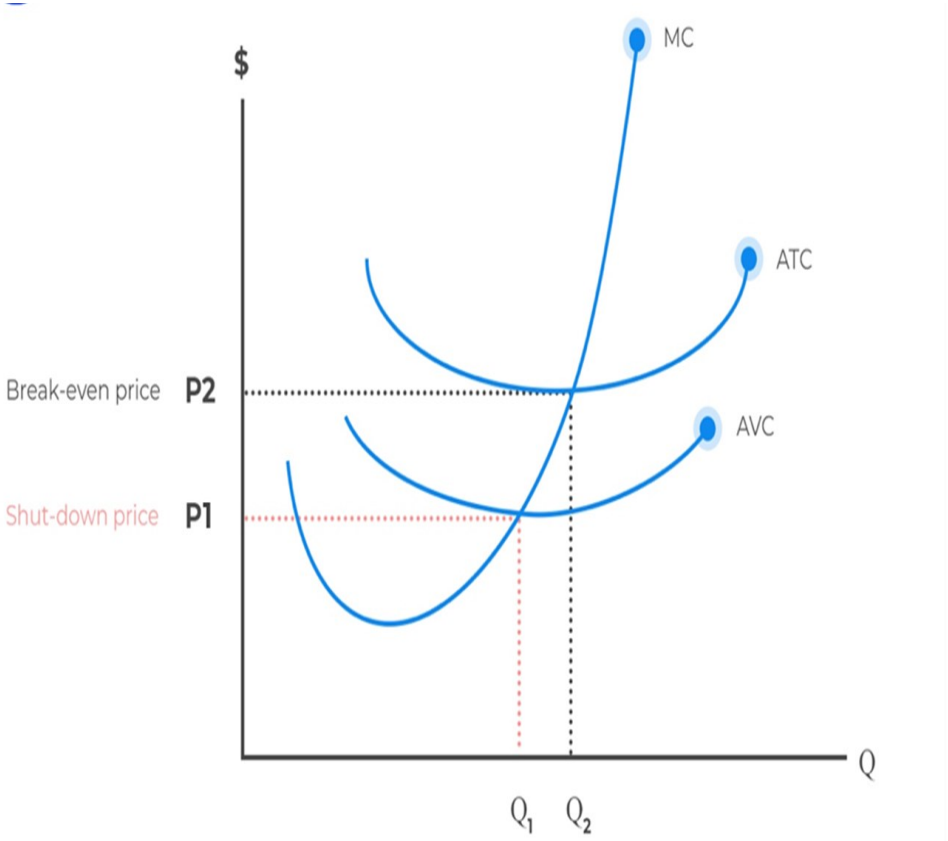
There is a direct relationship between AC and MC curves as shown in the figure. Both the AC curve and the MC curve are U-shaped.

1. When AC falls, MC is less than AC. This is because the fall in MC is related to one unit of output while in the case of AC the same decline is spread over all units of output. That is why the fall in AC is less and that in MC is more. This also explains the fact that MC reaches its minimum point C before the minimum point B of AC is reached. So When MC starts rising, AC is still declining.

2. When AC is minimum, MC equals AC. The MC curve cuts the AC curve from below at its minimum point B in the figure.

3. When AC rises, MC is greater than AC. MC is above AC when AC is rising but the rise in MC is greater than AC. This is because the rise in MC is the result of the increase in one unit of output while in the case of AC the same increase is spread over all units of output.





Shut Down: The producer may not cover the total costs, if the price of the product is less than the short-run average cost. The shut-down point refers to the minimum price where companies prefer shutting down their operation instead of continuing to operate. In other words, it is the minimum price and quantity for keeping operations open.

Assume that a manufacturing company produces 1000 units and selling them at a price of $5 each. Then the Total Revenue (TR) is 5 × 1,000=$5,000. The Average Total Cost (AVC) is $7,000 with a fixed cost (FC) of $4000 and a variable cost (VC) of $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 then obliged to pay it whether it operates or not. That is, if it closes its operations, both the revenue and the variable cost will be zero but still incur $4,000 fixed cost. In the case that it continues its operations, it will earn a revenue of $5000 and pay a variable cost of $3000 and use $2000 to pay the fixed cost, and hence the company will lose less by continuing the operations. However, in the long run, the company will exit the market unless the 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 graphic.

Break Even vs. Shut Down

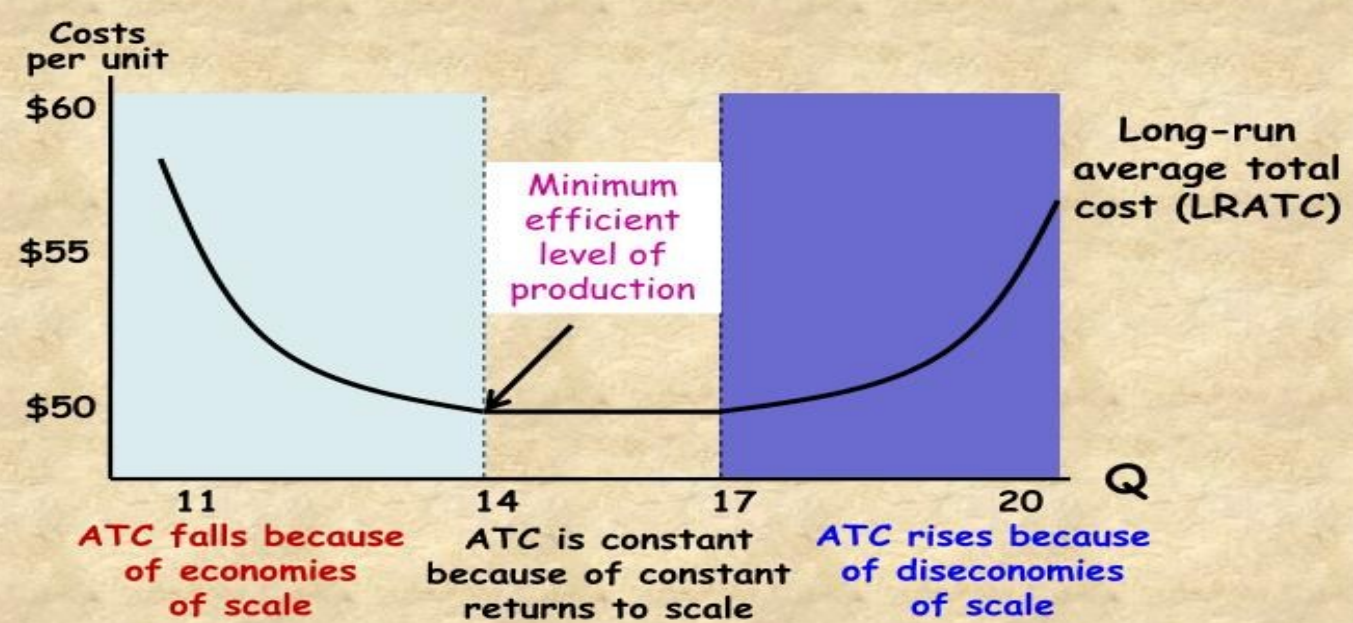
Break-Even

- The break-even point refers to the point at which total cost and total revenue are equal. At the break-even point, a business has neither gained a net profit, nor suffered a net loss. In relation to the output decisions of a competitive firm, the break-even point is a reliable indication of the amount of output needed before a business can begin to make a net profit. If a business cannot meet this demand, then it is unlikely that they will be able to continue functioning since the break-even point is the bare minimum level to which sales revenue must aspire.

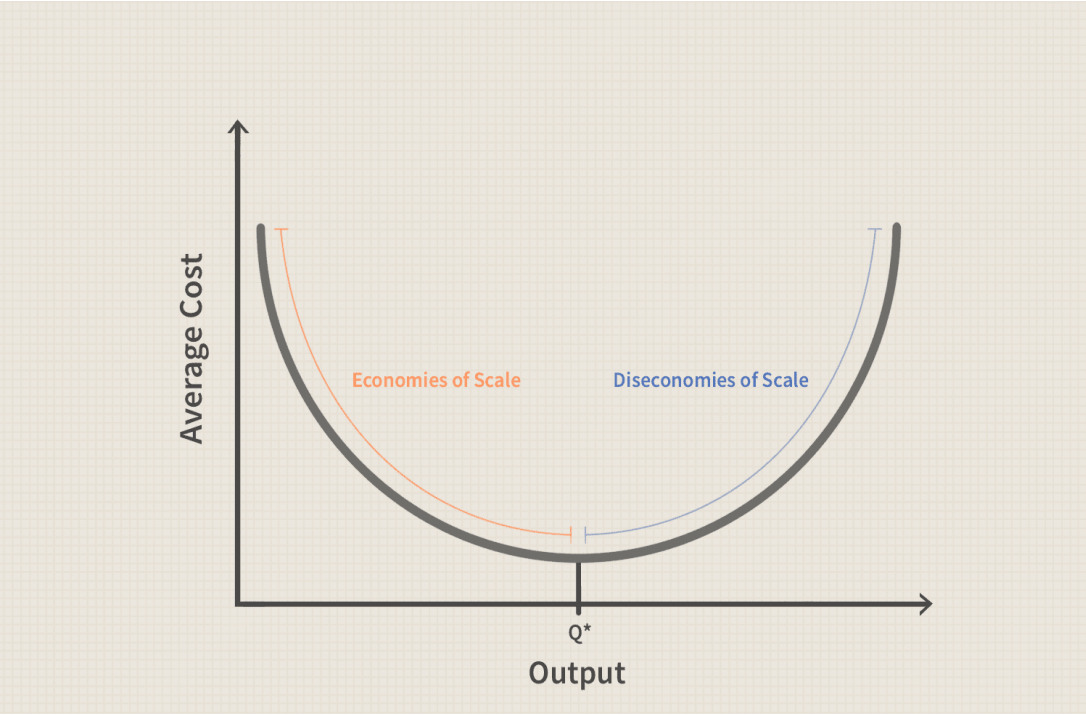
Shut-Down

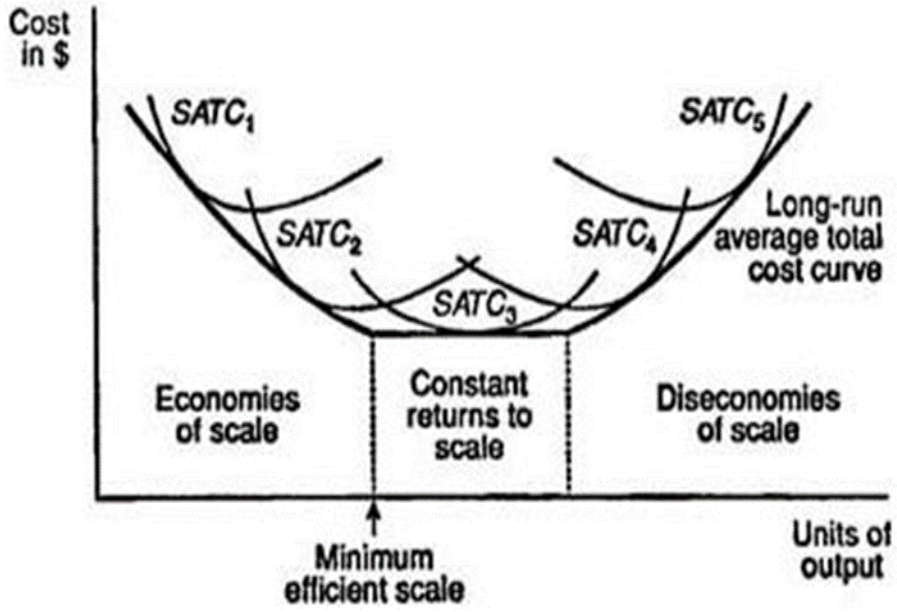
- The shut-down point is the point at which total revenue is equal to variable cost. At this point, there is neither incentive to continue production, nor incentive to limit it. In relation to the output decisions of a competitive firm, the shut-down point is a reliable indication of the point at which a business should consider shutting down production. If a business cannot even meet the demands of its variable costs, then the business is operating with costs that are greater than the benefits generated by those operations, even if costs remain fixed.

A Typical Long-Run Average Total Cost Curve



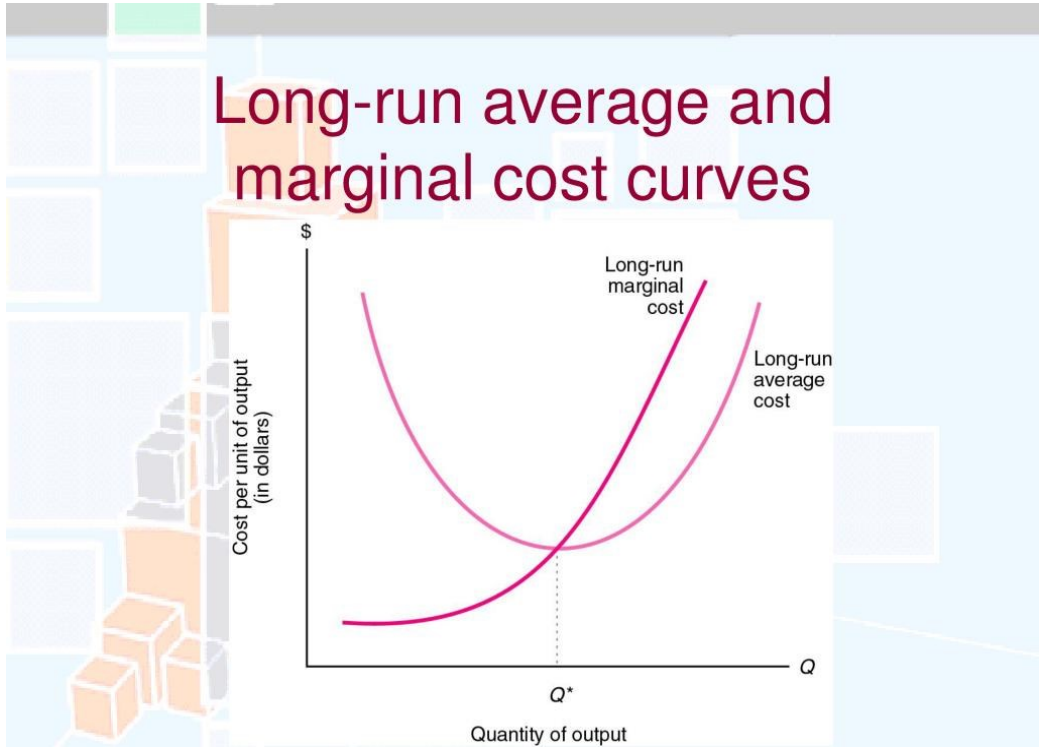
Economies and Diseconomies of Scale





Long-Run Average Cost Curves

- **Long-Run Average Cost Curves (LAC)**
- Long-run- all factors are become variable.
- Long-run cost curve is a ***planning curve*** because it is a guide to the entrepreneur to plan his output.
- Long-run average cost is derived from short-run cost curves.
- LAC curve is the locus of points denoting the least cost of producing the corresponding output.
- It is a planning curve because on the basis of this curve the firm decides what plant to set up in order to produce optimally.



- LRMC is the minimum increase in total cost associated with an increase of one unit of output when all inputs are variable.

1. Accounting and Economic Costs:

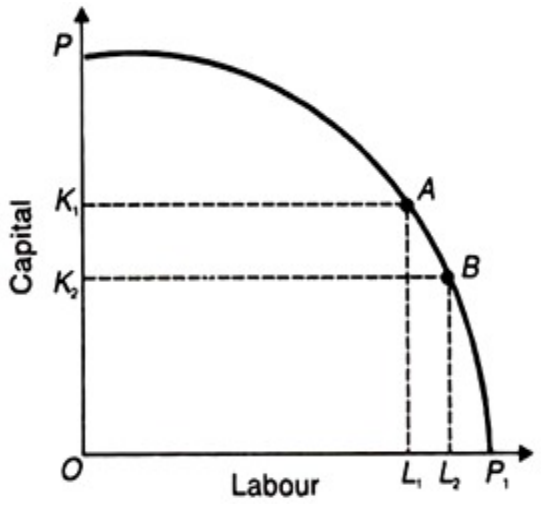
Money (accounting or explicit) costs are the total money expenses incurred by a firm in producing a commodity.

They include wages and salaries of labour; cost of raw materials; expenditures on machines and equipment; depreciation and obsolescence charges on machines; building and other capital goods; rent on buildings; interest on capital borrowed; expenses on power, light, fuel, advertisement and transportation; insurance charges and all types of taxes.
There are the accounting costs which an entrepreneur takes into consideration in making payments to the various factors of production.
These money costs are also known as explicit costs that an accountant records in the firm's books.
"Explicit costs are the payments to outside suppliers of inputs." There are other types of economic costs called implicit costs.
Implicit costs are the imputed value of the entrepreneur's own resources and services.
According to Salvatore, **"Implicit costs are the value of owned inputs used by the firm in its own production process."**
The salary of the owner-manager who is content with having normal profits but does not receive any salary; estimated rent of the building if it belongs to the entrepreneur, and interest on capital invested by the entrepreneur himself at the market rate of interest. Thus economic costs include accounting costs plus implicit costs, that is, both explicit and implicit costs.

Opportunity Cost

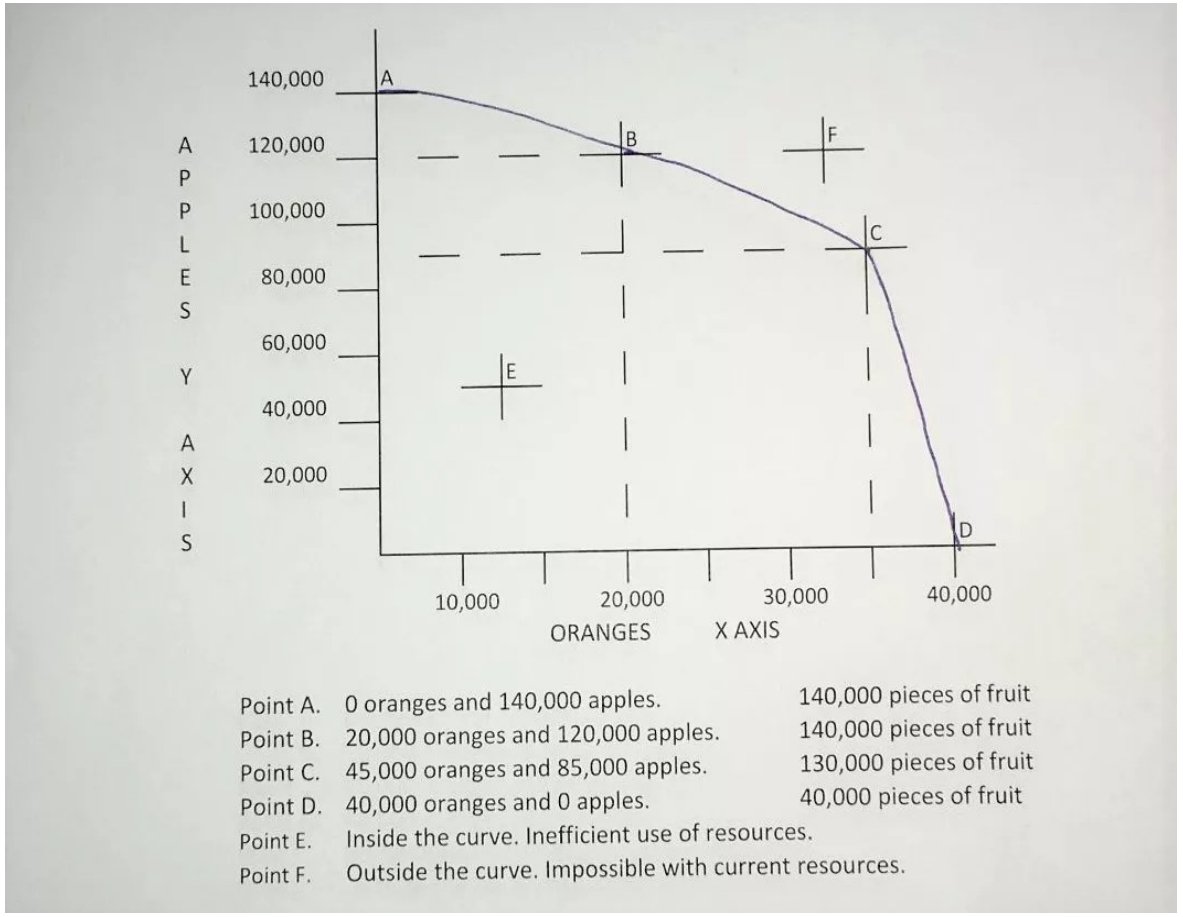
- In the words of Benham, “The opportunity cost of anything is the next best alternative that could be produced instead by the same factors or by an equivalent group of factors, costing the same amount of money.” The cost of using land for wheat growing is the value of alternative crop that could have been grown on it.

- The real cost of labour is what it could get in some alternative employment. The cost of capital to the capitalist is the amount of interest he could earn elsewhere. The normal earnings of management are what an entrepreneur could earn as a manager in some other joint stock company. In this way, opportunity cost is the cost of the opportunity missed or alternative forgone.
- If, for example, you spend time and money going to a movie, you cannot spend that time at home reading a book, and you can't spend the money on something else.



- The concept of opportunity cost is explained diagrammatically in Figure with the help of the production possibility curve PP1. At combination A on this curve, the producer uses OL1 of labour and OK1 of capital. If he wants to use L1L2 more labour, he will have to forgo K1K2 of capital. Thus the opportunity cost of L1L2 labour is K1K2 of capital.

Production Possibility Curve: A production possibility curve measures the maximum output of two goods using a fixed amount of input.



- For example, say an economy can produce 20,000 oranges and 120,000 apples. On the chart, that's point B. If it wants to produce more oranges, it must produce fewer apples. On the chart, Point C shows that if it produces 45,000 oranges, it can only produce 85,000 apples.

- By describing this trade-off, the curve demonstrates the concept of opportunity cost. Making more of one good will cost society the opportunity of making more of the other good.

Applications of opportunity cost

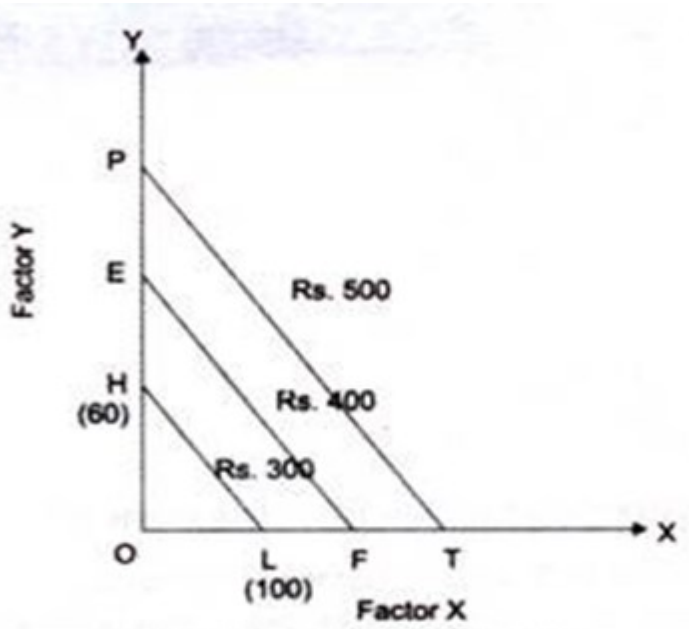
- 1. It is applicable to the determination of factor prices and in international trade.

- 2. It can also be applied to consumption and public expenditure. The cost of seeing a movie is the pen whose purchase is forgone by a student. For the society, the cost of setting up an ammunition factory is the civilian benefits which are sacrificed.

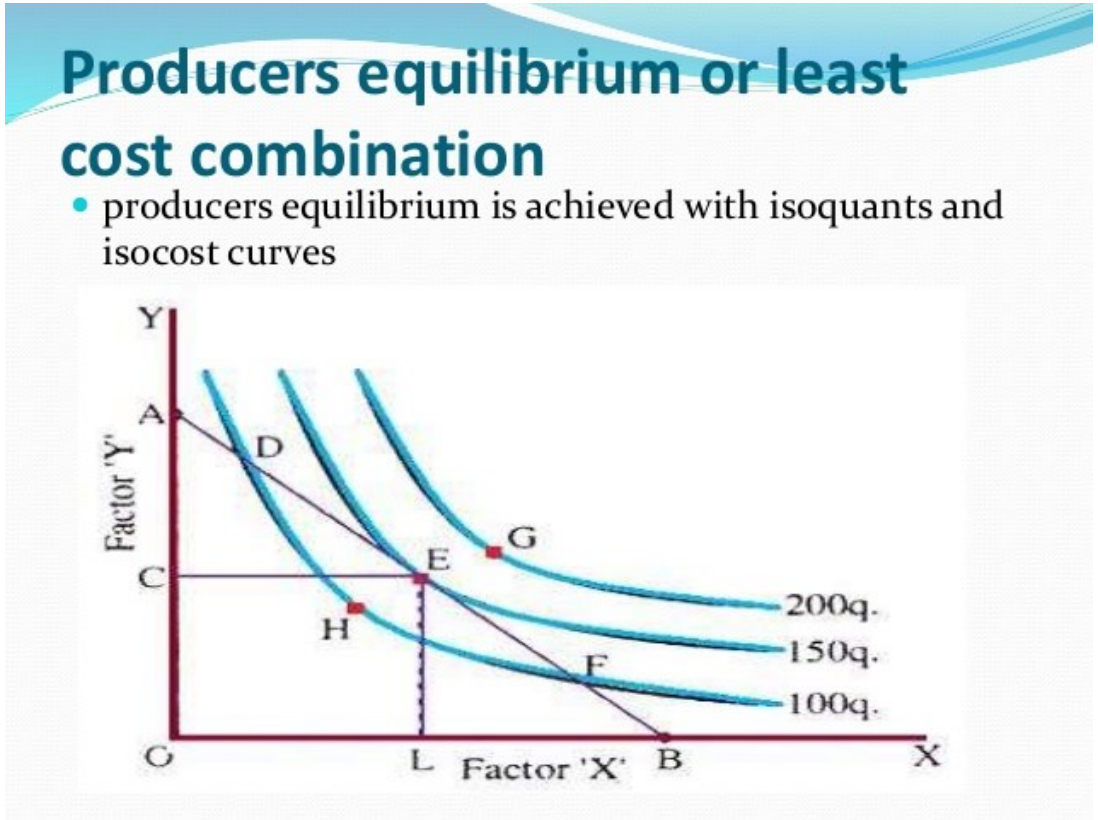
- 3. It is the opportunity cost which explains the phenomenon of price. Since there is scarcity of goods and factor services, they are put to alternative uses and thus command a price. If they were in plenty, there would be no alternatives forgone, no opportunity cost and no price. They are priced because of their opportunity cost.

Isocost: An isocost line is a graphical representation of various combinations of two factors (labor and capital) which the firm can afford or purchase with a given amount of money or total outlay. It is an important tool for determining what combination of factor-inputs the firm will choose for production process.

- If the producer spends the whole amount of money to purchase X, then he/she can purchase 100 units of X, which is represented by OL. On the other hand, if the producer purchases Y with the whole amount, then he/she would be able to get 60 units, which is represented by OH. If points H and L are joined on X and Y axes respectively, a straight line is obtained, which is called iso-cost line. All the combinations of X and Y that lie on this line, would have the same amount of cost that is Rs. 300. Similarly, other iso-cost lines can be plotted by taking cost more than Rs. 300, in case the producer is willing to spend more amount of money on production factors.
- With the help of isoquant and iso-cost lines, a producer can determine the point at which inputs yield maximum profit by incurring minimum cost. Such a point is termed as producer's equilibrium.



PRODUCER'S EQUILIBRIUM



- It is attained at the point where the isocost line is tangent to the isoquant curve.
- It doesn't intersect the isocost line.
- Slope of the isoquant curve and isocost line are the same at this point • MRTS = w/r.