abnormal profits are over and above these normal profits. In other words, an entrepreneur is said to be earning profits (abnormal) only when his revenues are able to cover not only his explicit costs but also implicit costs.

**Outlay costs and opportunity costs :** Outlay costs involve actual expenditure of funds on, say, wages, material, rent, interest, etc. Opportunity cost, on the other hand, is concerned with the cost of foregone opportunity; it involves a comparison between the policy that was chosen and the policy that was rejected. For example, opportunity cost of using capital is the interest that it can earn in the next best use of equal risk.

A distinction between outlay costs and opportunity costs can be drawn on the basis of the nature of the sacrifice. Outlay costs involve financial expenditure at some time and hence are recorded in the books of account. Opportunity costs relate to sacrificed alternatives; they are not recorded in the books of account in general.

The opportunity cost concept is generally very useful, e.g., in a cloth mill which spins its own yarn, the opportunity cost of yarn to the weaving department is the price at which the yarn could be sold, for measuring profitability of the weaving operations.

In long-term cost calculation also it is useful e.g., in calculating the cost of higher education, it is not the tuition fee and books but the earning foregone that should be taken into account.

**Direct or traceable costs and indirect or non-traceable costs;** Direct costs are costs that are readily identified and are traceable to a particular product, operation or plant. Even overhead can be direct as to a department; manufacturing costs can be direct to a product line, sales territory, customer class etc. We must know the purpose of cost calculation before considering whether a cost is direct or indirect.

Indirect costs are not readily identified nor visibly traceable to specific goods, services, operations, etc. but are nevertheless charged to the jobs or products in standard accounting practice. The economic importance of these costs is that these, even though not directly traceable to the product, may bear some functional relationship to production and may vary with output in some definite way. Examples of such costs are electric power, the common costs incurred for general operation of business benefiting all products jointly.

**Fixed and variable costs :** Fixed or constant costs are not a function of output; they do not vary with output upto a certain level of activity. These costs require a fixed expenditure of funds irrespective of the level of output, e.g., rent, property taxes, interest on loans, depreciation when taken as a function of time and not of output. However, these costs also vary with the size of the plant and are a function of capacity. Therefore, fixed costs do not vary with the volume of output within a capacity level.

Fixed costs cannot be avoided. These costs are fixed so long as operations are going on. They can be avoided only when operations are completely closed down. We can call them as inescapable or uncontrollable costs. But there are some costs which will continue even after operations are suspended, as for example, the storing of old machines which cannot be sold in the market. Some of the fixed costs such as advertising, etc. are programmed fixed costs or discretionary expenses, because they depend upon the discretion of management whether to spend on these services or not.

Variable costs are costs that are a function of output in the production period. For example, wages and cost of raw materials are variable costs. Variable costs vary directly and sometimes proportionately with output. Over certain ranges of production they may vary less or more than proportionately depending on the utilization of fixed facilities and resources during production process.

## 2.2 COST FUNCTION

The cost function refers to the mathematical relation between cost of a product and the various determinants of costs. In cost function, the dependent variable is unit cost or total cost and the independent variables are the price of a factor, the size of the output or any other relevant phenomenon which has a bearing on cost such as technology, level of capacity utilization, efficiency and time period under consideration.

## 2.3 SHORT RUN TOTAL COSTS

**Total, fixed and variable costs :** There are some factors which can be easily adjusted with changes in the level of output. Thus a firm can readily employ more workers if it has to increase output. Similarly, it can purchase more raw material if it has to expand production. Such factors which can be easily varied with a change in the level of output are called variable factors. On the other hand, there are factors such as building, capital equipment, or top management team which cannot be so easily varied. It requires comparatively longer time to make changes in them. It takes time to install a new machinery. Similarly, it takes time to build a new factory. Such factors which cannot be readily varied and require a longer period to adjust are called fixed factors. Corresponding to the distinction between variable and fixed factors we distinguish between short run and long run periods of time. Short run is a period of time in which output can be increased or decreased by changing only the amount of variable factors, such as labour, raw material, etc. In the short run, quantities of fixed factors cannot be varied in accordance with changes in output. If the firm wants to increase output in the short run, it can do so only with the help of variable factors, i.e., by using more labour and/or by buying more raw material. Thus, short run is a period of time in which only variable factors can be varied, while the quantities of fixed factors remain unaltered. On the other hand, long run is a period of time in which the quantities of all factors may be varied. Thus all factors become variable in the long run.

Thus we find that fixed costs are those costs which are independent of output, i.e., they do not change with changes in output. These costs are a "fixed amount" which are incurred by a firm in the short run, whether the output is small or large. Even if the firm closes down for some time in the short run but remains in business, these costs have to be borne by it. Fixed costs include such charges as contractual rent, insurance fee, maintenance cost, property taxes, interest on capital employed, manager's salary, watchman's wages etc. Variable costs on the other hand are those costs which change with changes in output. These costs include payments such as wages of labour employed, prices of raw material, fuel and power used, transportation cost etc. If a firm shuts down for a short period, then it may not use variable factors of production and will not therefore incur any variable cost.

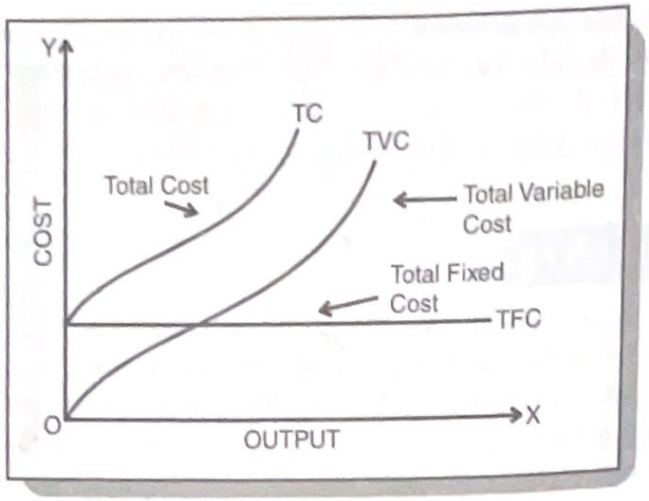


**Fig. 2 : Short-run Total Cost Curves**

Total cost of a business is thus the sum of total variable cost and total fixed cost or symbolically TC = TFC + TVC. We may also represent total cost, total variable cost and fixed cost diagramatically.

In the diagram, total fixed cost curve (TFC) is parallel to X-axis. This curve starts from the point on the Y-axis meaning thereby that fixed cost will be incurred even if the output is zero. On the other hand total variable cost curve rises upward showing thereby that as output increases, total variable cost also increases. This curve starts from the origin which shows that when the output is zero, variable costs are also nil. The total cost curve has been obtained by adding vertically total fixed cost curve and total variable cost curve.

**Short run average cost**

**Average fixed cost (AFC) :** AFC is the total fixed cost divided by the number of units of output produced. i.e. $AFC = \frac{TFC}{Q}$ where Q is the number of units produced. Thus average fixed cost is the fixed cost per unit of output. For example, a firm is producing with total fixed cost at Rs. 2,000/-. When output is 100 units, average fixed cost will be Rs. 20. And now if the output increases to 200 units, average fixed cost will be Rs. 10. Since total fixed cost is a constant amount, average fixed cost will steadily fall as output increases. Therefore, if we draw average fixed cost curve, it will slope downwards throughout its length but not touch the X-axis as AFC can not be zero. (Fig. 3)

**Average variable cost (AVC) :** Average variable cost is the total variable cost divided by the number of units of output produced, i.e. $AVC = \frac{TVC}{Q}$ where Q is the number of units produced. Thus average variable cost is variable cost per unit of output. Average variable cost normally falls as output increases from zero to normal capacity output due to occurrence of increasing returns. But beyond the normal capacity output, average variable cost will rise steeply because of the operation of diminishing returns (the concepts of increasing returns and diminishing returns have already been discussed earlier). If we draw average variable cost curve it will first fall, then reach a minimum and then rise again. (Fig. 3)

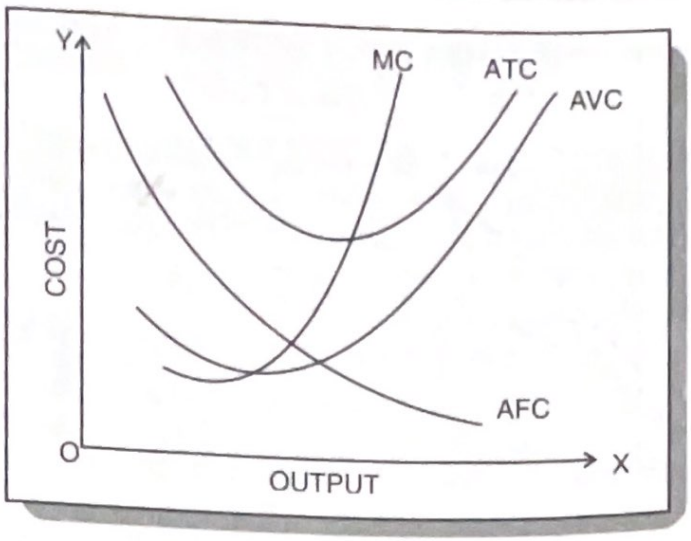


**Fig. 3 : Short-run Average and Marginal Cost Curves**

**Average total cost (ATC) :** Average total cost is a sum of average variable cost and average fixed cost. i.e., ATC = AFC + AVC. It is the total cost divided by the number of units produced. The behaviour of average total cost curve depends upon the behaviour of average variable cost curve and average fixed cost curve. In the beginning both AVC and AFC curves fall, therefore, the ATC curve will also fall sharply in the beginning. When AVC curve begins to rise, but AFC curve still falls steeply, ATC curve continues to fall. This is because during this stage the fall in AFC curve is greater than the rise in the AVC curve but as output increases further, there is a sharp rise in AVC which more than offsets the fall in AFC. Therefore, ATC curve first falls, reaches its minimum and then rises. Thus, the average total cost curve is "U" shape curve. (Fig. 3)

**Marginal Cost :** Marginal cost is the addition made to the total cost by production of an additional unit of output. In other words, it is the total cost of producing t units instead of t-1 units, where t is any given number. For example, if we are producing 5 units at a cost of Rs. 200 and now suppose 6th unit is produced and the total cost is Rs. 250, marginal cost is Rs. 250 - 200 i.e., Rs. 50. It is to be noted that marginal cost is independent of fixed cost. This is because fixed costs do not change with output. It is only the variable costs which change with a change in the level of output in the short run. Therefore, marginal cost is in fact due to the changes in variable costs.

Marginal cost curve falls as output increases in the beginning. It starts rising after a certain level of output. This happens because of the influence of the law of variable proportions. The fact that marginal product rises first, reaches a maximum and then declines ensures that the marginal cost curve of a firm declines first, reaches its minimum and then rises. In other words marginal cost curve of a firm is "U" shaped (see Figure 3).

The behaviour of these costs has also been shown in Table 2.

**Table 2 : Various Costs**

| *Units of output* | *Total fixed cost* | *Total variable cost* | *Total cost* | *Average fixed cost* | *Average variable cost* | *Average total cost* | *Marginal cost per unit* |
|---|---|---|---|---|---|---|---|
| 0 | 150 | 0 | 150 | – | – | – | – |
| 6 | 150 | 50 | 200 | 25.0 | 8.33 | 33.33 | $\frac{50}{6}=8.33$ |
| 16 | 150 | 100 | 250 | 9.38 | 6.25 | 15.63 | $\frac{50}{10}=5.00$ |
| 29 | 150 | 150 | 300 | 5.17 | 5.17 | 10.34 | $\frac{50}{13}=3.85$ |
| 44 | 150 | 200 | 350 | 3.41 | 4.55 | 7.95 | $\frac{50}{15}=3.33$ |
| 55 | 150 | 250 | 400 | 2.73 | 4.55 | 7.27 | $\frac{50}{11}=4.55$ |
| 60 | 150 | 300 | 450 | 2.50 | 5.00 | 7.50 | $\frac{50}{5}=10.00$ |

The above table shows that :

(i) Fixed cost does not change with increase in output upto a given range. Average fixed cost, therefore, comes down with every increase in output.

(ii) Variable cost increases but not necessarily in the same proportion as the increase in output. In the above case, average variable cost comes down gradually till 55 units are produced.

(iii) Marginal cost is the additional cost divided by addition units produced. This also comes gradually till 44 units are produced.

**Relationship between Average Cost and Marginal Cost :** The relationship between marginal cost and average cost is the same as that between any other marginal average quantities. The following are the points of relationship between the two phenomena.

(1) When average cost falls as a result of an increase in output, marginal cost is less than average cost.

(2) When average cost rises as a result of an increase in output, marginal cost is more than average cost.

(3) When average cost is minimum, marginal cost is equal to the average cost. In other words, marginal cost curve cuts average cost curve at its minimum point (i.e. optimum point).

Figure 3 and Table 2 confirm the above points of relationship.

## 2.4 LONG RUN AVERAGE COST CURVE

As stated above long run is a period of time during which the firm can vary all of its inputs - unlike short run in which some inputs are fixed and others are variable. In other words, whereas in the short run the firm is tied with a given plant, in the long run the firm moves from one plant to another; it can acquire a big plant if it wants to increase its output and a small plant if it wants to reduce its output. Long run cost of production is the least possible cost of producing any given level of output when all individual factors are variable. A long run cost curve depicts the functional relationship between output and the long run cost of production.

In order to understand how long run average cost curve is derived we consider three short run average cost curves as shown in Figure 4. These short run cost curves (SACs) are also called plant curves. In the short run the firm can be operating on any short run average cost curve given the size of the plant. Suppose that these are the only three plants which are technically possible. Given the size of the plant, the firm will be increasing or decreasing its output by changing the amount of the variable inputs. But in the long run, the firm chooses among the three possible sizes of plants as depicted by short run average curve ($SAC_1$, $SAC_2$, $SAC_3$). In the long run, the firm will examine with which size of plants or on which short average cost curve it should operate to produce a given level of output so that total cost is minimum. It will be seen from the diagram that upto OB amount of output the firm will operate on the $SAC_1$, though it could also produce with $SAC_2$, because upto OB amount of output, the production on $SAC_1$ results in lower cost than on $SAC_2$. For example, if the level of output OA is produced with $SAC_1$, it will cost AL per unit and if it is produced with $SAC_2$ it will cost AH and we can see that AH is more than AL. Similarly, if the firm plans to produce an output which is larger than OB but less than OD then it will not be economical to produce on $SAC_1$. For this, the firm will have to use $SAC_2$. Similarly, the firm will use $SAC_3$ for output larger than OD. It is thus clear that in the long run the firm has a choice in the employment of plant and it will employ that plant which yields minimum possible unit cost for producing a given output.

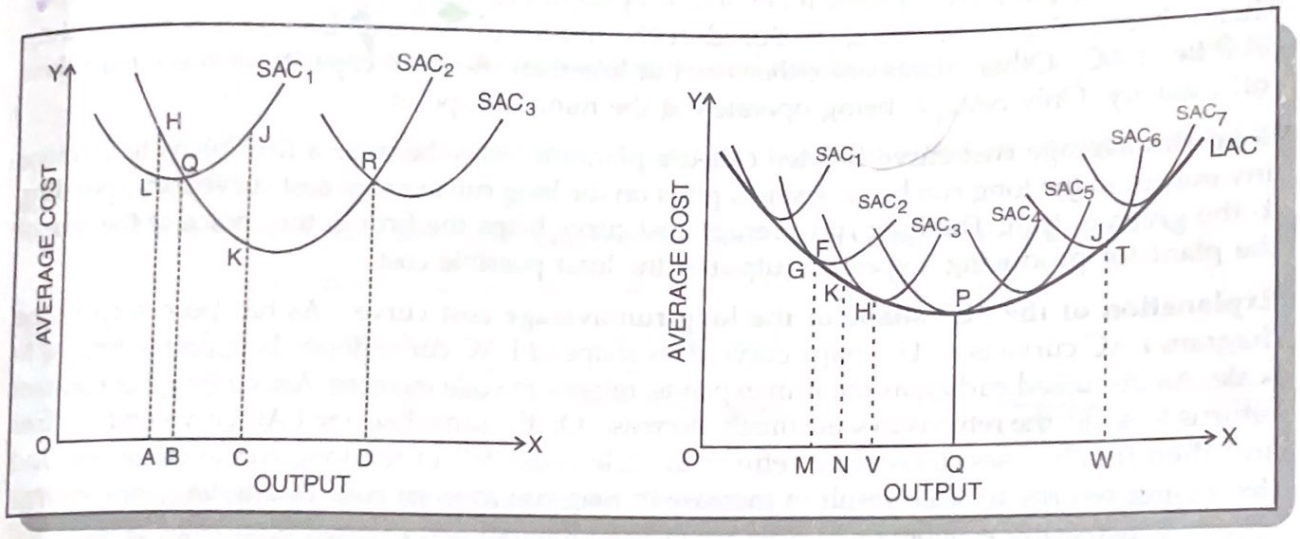


Fig. 4 : Short-run Average Cost Curves




Fig. 5 : Long-run Average Cost Curve

Suppose now, the firm has a choice so that a plant can be varied by infinitely small gradations so that there are infinite number of plants corresponding to which there numerous average cost curves. In such a case the long run average cost curve will be a smooth curve enveloping all these short run average cost curves.

As shown in Figure 5 the long run average cost curve is so drawn as to be tangent to each of the short run average cost curves. Every point on the long run average cost curve will be a tangency point with some short run AC curve. If a firm desires to produce any particular output it then builds a corresponding plant and operate on the corresponding short run average cost curve. As shown in the figure, for producing OM the corresponding point on the LAC curve is G and the short run average cost curve $SAC_2$ is tangent to the long run AC at this point. Thus if a firm desires to produce output OM, the firm will construct a plant corresponding to $SAC_2$ and will operate on this curve at point G. Similarly, the firm will produce other levels of output choosing the plant which suits its requirements of lowest possible cost of production. It is clear from the figure that the large output can be produced at the lowest cost with the larger plant whereas smaller output can be produced at the lowest cost with smaller plants. For example, to produce OM, the firm will be using $SAC_2$ only; if it uses $SAC_3$ for this, it will result in higher unit cost than $SAC_2$. But larger output OV can be produced most economically with a larger plant represented by the $SAC_3$. If we produce OV with the smaller plant it will result in higher unit similarly if we produce larger output with a smaller plant it will involve higher cost because of its limited capacity.

It is to be noted that LAC curve is not a tangent to the minimum points of the SAC curves. When the LAC curve is declining it is tangent to the falling portions of the short run cost curves and when the LAC curve is rising it is tangent to the rising portions of the short run cost curves. Thus for producing output less than "OQ" at the lowest possible unit cost the firm will construct the relevant plant and operate it at less than its full capacity, i.e., at less than its minimum average cost of production. On the other hand for output larger than OQ the firm will construct a plant and operate it beyond its optimum capacity. "OQ" is the optimum output. This is because "OQ" is being produced at the minimum point of LAC and corresponding SAC i.e., $SAC_4$. Other plants are either used at less than their full capacity or more than their full capacity. Only $SAC_4$ is being operated at the minimum point.

Long run average cost curve is often called a planning curve because a firm plans to produce any output in the long run by choosing a plant on the long run average cost curve corresponding to the given output. The long run average cost curve helps the firm in the choice of the size of the plant for producing a specific output at the least possible cost.

**Explanation of the "U" shape of the long run average cost curve :** As has been seen in the diagram LAC curve is a "U" shape curve. This shape of LAC curve depends upon the returns to scale. As discussed earlier, as the firm expands, returns to scale increase. After a range of constant returns to scale, the returns to scale finally decrease. On the same line, the LAC curve first declines and then finally rises. Increasing returns to scale cause fall in the long run average cost and decreasing returns to scale result in increase in long run average cost. Falling long run average cost and increasing economies to scale result from internal and external economies of scale and rising long run average cost and diminishing returns to scale from internal and external diseconomies of scale (economies of scale have been discussed earlier at the relevant place).