SUBJECT : ECONOMICS

CHAPTER NUMBER: 3(3.2)

CHAPTER NAME :PRODUCTION AND COST (COST)

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COST

Meaning of Cost:

Cost is the total expenditure incurred in producing a commodity. In Economics, Cost is the sum total of:

1. Explicit Cost:

It is the actual money expenditure on inputs or payment made to outsiders for hiring their factor services. For example, wages paid to the employees, rent paid for hired premises, payment for raw materials, etc.

2. Implicit Cost:

It is the estimated value of the inputs supplied by the owners including normal profit. For example, interest on own capital, rent of own land, salary for the services of entrepreneur, etc. Such costs are the costs of self supplied factors.

So, Cost in economics includes actual expenditure on inputs (i.e. explicit cost) and the imputed value of the inputs supplied by the owners (i.e. implicit cost).

Economic cost of production includes not only the accounting cost (i.e. the explicit costs) but also the implicit cost. The sum of Explicit cost and Implicit cost is the total cost of production of a commodity.

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Cost Function:

Opportunity Cost:

Opportunity cost is cost of the next best alternative foregone.

The concept of opportunity cost is very important as it forms the basis of the concept of cost. When a firm decides to produce a particular commodity, then it always considers the value of the alternative commodity, which is not produced. The value of the alternative commodity is the opportunity cost of the good that the firm is now producing.

For example, suppose, a farmer can produce either 50 quintals of rice or 40 quintals of wheat on his land with the given resources. If he chooses to produce rice, then he will have to forego the opportunity of producing 40 quintals of wheat.

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Cost Function:

Costs can be of different types:

(i) Money Cost;
(ii) Real Cost;
(iii) Private Cost; and
(iv) Social Cost.

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Short Run Costs:

We know, in the short run, there are some factors which are fixed, while others are variable. Similarly, short run costs are also divided into two kinds of costs:

(i) Fixed Costs

(ii) Variable Costs

The sum total of fixed cost and variable cost is equal to total cost. Let us discuss the short run costs in detail.

Total Fixed Cost (TFC) or Fixed Cost (FC):

Fixed Costs refer to those costs which do not vary directly with the level of output. For example, rent of premises, interest on loan, salary of permanent staff, insurance premium, etc.

Fixed Cost is also known as:

(i) Supplementary Cost; or

(ii) Overhead Cost; or

(iii) Indirect Cost; or

(iv) General Cost; or

(v) Unavoidable Cost.

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Short Run Costs:

Total Fixed Cost (TFC) or Fixed Cost (FC):

Fixed cost is incurred on fixed factors like machinery, land, building, etc., which cannot be changed in the short run. The payment to these factors remains fixed irrespective of the level of output, i.e. fixed cost remains the same, whether output is large, small or even zero.

The concept of fixed cost can be better explained through following schedule and diagram:

Table 6.1: Total Fixed Cost Schedule:

Output (in units)	TFC (Rs.)
0	12
1	12
2	12
3	12
4	12
5	12

COST

Short Run Costs:

Total Fixed Cost (TFC) or Fixed Cost (FC):

TFC curve is a horizontal straight line parallel to X-axis showing that total fixed costs remain same (Rs. 12) at all levels of output.

Fixed costs are diagrammatically shown in Fig. 6.1. Units of output are measured along the X-axis and fixed costs along the Y-axis. TFC is the fixed cost curve obtained by plotting the points shown in Table 6.1. The curve makes an intercept on the Y-axis, which is equal to the fixed cost of Rs. 12. TFC curve is a horizontal straight line parallel to the X-axis because TFC remains same at all levels of output, even if the output is zero.

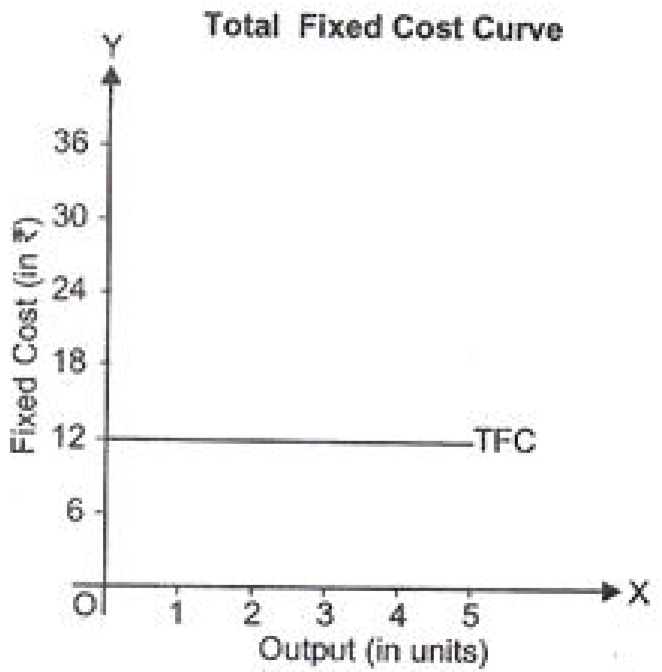

Fig. 6.1

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Short Run Costs:

Total Variable Cost (TVC) or Variable Cost (VC):

Variable costs refer to those costs which vary directly with the level of output. For example, payment for raw material, power, fuel, wages of casual labour, etc. Variable costs are incurred on variable factors like raw material, direct labour, power, etc., which changes with change in level of output. It means, variable costs rise with increase in the output and fall with decrease in the output. Such costs are incurred till there is production and become zero at zero level of output.

Variable cost is also known as 'Prime Cost', 'Direct Cost' or 'Avoidable Cost'.

Let us discuss the concept of variable cost with the help of the following schedule and diagram:

Table 6.2: Total Variable Cost Schedule:

Output (units)	TVC (Rs.)
0	0
1	6
2	10
3	15
4	24
5	35

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Short Run Costs:

Total Variable Cost (TVC) or Variable Cost (VC):

In Fig. 6.2, units of output are measured along the X-axis and variable cost along the Y-axis. TVC is the variable cost curve obtained by plotting the points shown in Table 6.2. As seen in the diagram, TVC curve starts from the origin indicating that when output is zero, variable cost is also zero. TVC is an inversely S-shaped curve due to the Law of Variable Proportions.

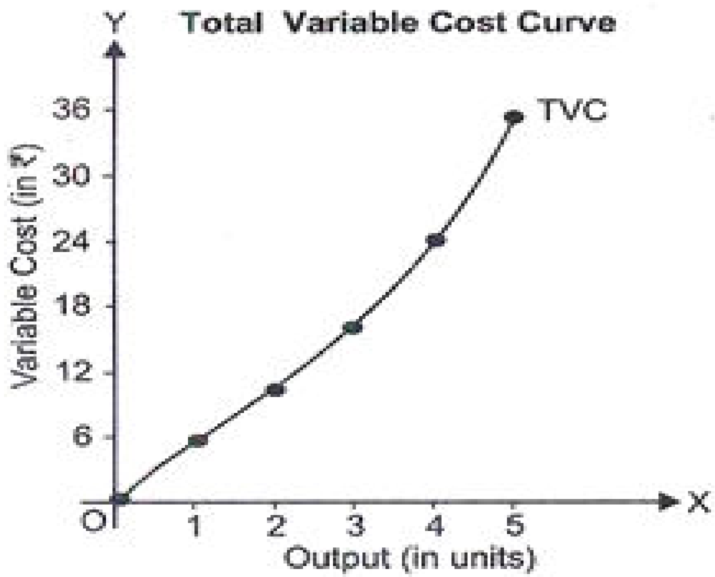

Fig. 6.2

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Total Cost (TC):

Total Cost (TC) is the total expenditure incurred by a firm on the factors of production required for the production of a commodity.

TC is the sum of total fixed cost (TFC) and total variable cost (TVC) at various levels of output.

TC = TFC + TVC

Since TFC remains same at all levels of output, the change in TC is entirely due to TVC. The concept of total cost can be better understood through Table 6.3 and Fig. 6.3.

Table 6.3: Total Cost Schedule:

Output (units)	Total Fixed Cost or TFC (Rs.)	Total Variable Cost or TVC (Rs.)	Total Cost or TC (Rs.) ADVERTISEMENTS: TFC + TVC = TC
0	12	0	12 + 0 = 12
1	12	6	12 + 6 = 18
2	12	10	12 + 10 = 22
3	12	15	12+15 = 27
4	12	24	12 + 24 = 36
5	12	35	12 + 35 = 47

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Total Cost (TC):

i. TC curve is also inversely S-shaped as TC derive its shape from TVC.

ii. TC is equal to TFC (Rs. 12) at zero output.

iii. TC and TVC curves are parallel to each other as vertical distance between them is TFC, which remains constant at all output levels.

In Table 6.3, TC = TFC = Rs. 12 at zero level of output because TVC is zero. At 1 unit of output, TFC remains same at Rs. 12, but TVC increases to t 6. As a result, TC becomes 12 + 6 = Rs. 18. Similarly, other values of TC have been calculated.

In Fig. 6.3, TC curve is obtained by summation of TVC and TFC curve.

The change in TC curve is entirely due to TVC as TFC remains constant. By adding TFC to TVC curve, we get the TC curve. The vertical distance between TC and TVC always remains the same due to constant TFC. Like TVC curve, TC curve is also inversely S-shaped, due to the Law of Variable Proportions.

The change in TC is entirely due to TVC as TFC is constant at all levels of output, TC = TFC at zero output as variable cost is zero. With increase in output, TC also increases by the extent of increase in TVC.

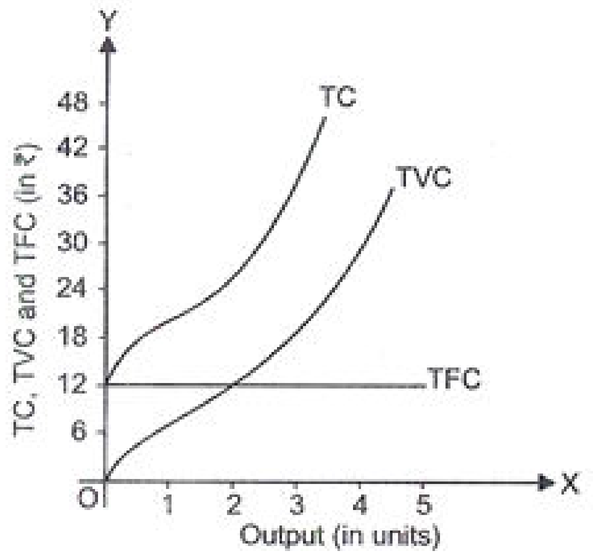

Fig. 6.3

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AVERAGE COSTS :

The per unit costs explain the relationship between cost and output in a more realistic manner. From total fixed cost (TFC), total variable cost (TVC) and total cost (TC), we can obtain per unit costs. The 3 kinds of 'per unit costs' are:

1. Average Fixed Cost (AFC)
2. Average Variable Cost (AVC)
3. Average Total Cost (ATC) or Average Cost (AC)

Average Fixed Cost (AFC):

Average fixed cost refers to the per unit fixed cost of production. It is calculated by dividing TFC by total output.

AFC = TFC ÷ Q

{Where: AFC = Average fixed cost; TFC = Total fixed cost; Q = Quantity of output}

AFC falls with increase in output as TFC remain same at all levels of output.

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Average Fixed Cost (AFC):

Table 6.4: Average Fixed Cost:

Output (in units)	Total Fixed Cost or TFC (Rs.)	Average Fixed Cost or AFC(Rs.) TFC / Output = AFC
0	12	12 / 0= ∞
1	12	12/1 =12
2	12	12 / 2= 6
3	12	12 / 3= 4
4	12	12 / 4= 3
5	12	12 / 5= 2.40

As seen in Table 6.4, AFC falls with rise in output because constant TFC is divided by increasing output. AFC curve in Fig. 6.4 is obtained by plotting the points shown in Table 6.4. AFC curve is a rectangular hyperbola, i.e. area under AFC curve remains same at different points.

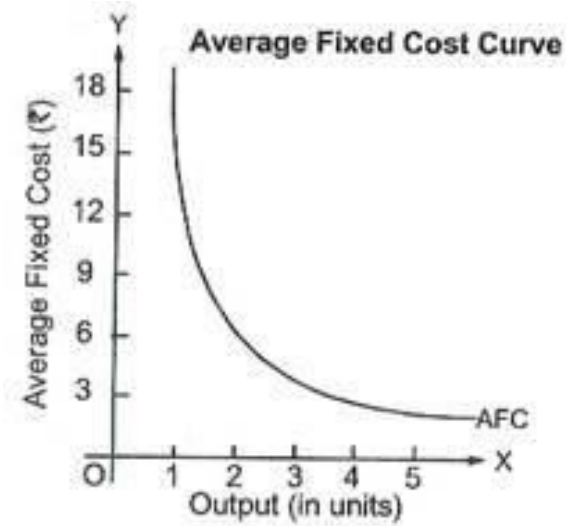

Fig. 6.4

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Average Fixed Cost (AFC):

AFC does not touch any of the axes:

As AFC is a rectangular hyperbola, it approaches both the axes. It gets nearer and nearer to the axes, but never touches them.

i. AFC can never touch the X-axis as TFC can never be zero.

ii. AFC curve can never touch the Y-axis because at zero level of output, TFC is a positive value and any positive value divided by zero will be an infinite value.

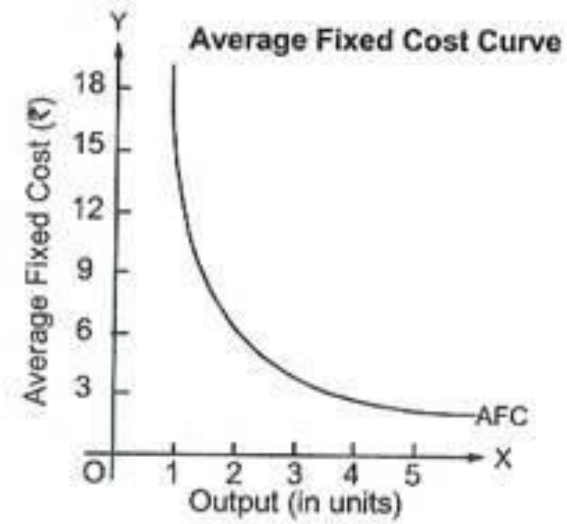

Fig. 6.4

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Average Variable Cost (AVC):

Average variable cost refers to the per unit variable cost of production. It is calculated by dividing TVC by total output.

AVC initially falls with increase in output. Once the output rises till optimum level, AVC starts rising. It can be better understood with the help of Table 6.5 and Fig. 6.5.

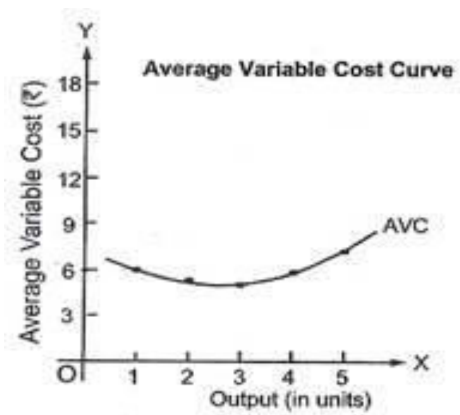

Fig. 6.5

Table 6.5: Average Variable Cost:

Output (in units)	Total Variable Cost or TVC (Rs.)	AVC (Rs.) TVC / Output = AVC
0	0	–
1	6	6 / 1 = 6
2	10	10 / 2= 5
3	15	15 / 3= 5
4	24	24 / 4= 6
5	35	35 / 5= 7

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Average Variable Cost (AVC):

As seen in Table 6.5, AVC initially falls with increase in output and after reaching its minimum level of Rs. 5, it starts rising.

AVC curve in Fig. 6.5 is obtained by plotting the points shown in Table 6.5. AVC is a U-shaped curve as it initially falls and then remains constant for a while and finally, it starts increasing.

The 3 phases of AVC curve i.e. decreasing, constant and increasing phases correspond to the three phases of Law of Variable Proportions.

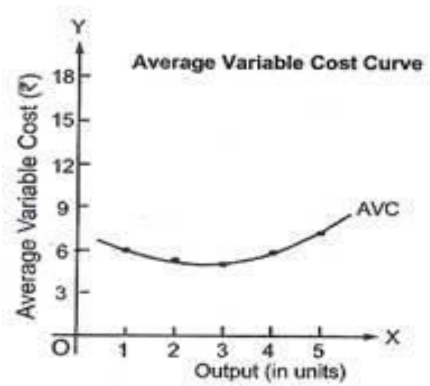

Fig. 6.5

Table 6.5: Average Variable Cost:

Output (in units)	Total Variable Cost or TVC (Rs.)	AVC (Rs.) TVC / Output = AVC
0	0	–
1	6	6 / 1 = 6
2	10	10 / 2= 5
3	15	15 / 3= 5
4	24	24 / 4= 6
5	35	35 / 5= 7

Average Total Cost (ATC) or Average Cost (AC):

Average cost refers to the per unit total cost of production. It is calculated by dividing TC by total output.

AC = TC ÷ Q

{Where: AC = Average cost; TC = Total cost; Q = Quantity of output}

Average cost is also defined as the sum of average fixed cost (AFC) and average variable cost (AVC), i.e. AC = AFC + AVC

Like AVC, average cost also initially falls with increase in output. Once the output rises till optimum level, AC starts rising. It can be better understood with the help of Table 6.6 and Fig. 6.6.

Table 6.6: Average Cost::

Output (in Units)	AFC (Rs)	AVC (Rs.)	AC (Rs.) AFC + AVC = AC
0	∞	–	–
1	12	6	12 + 6 = 18
2	6	5	6 + 5= 11
3	4	5	4 + 5= 9
4	3	6	3 + 6= 9
5	2.40	7	2.40 + 7 = 9.40

Average Total Cost (ATC) or Average Cost (AC):

As seen in Table 6.6, AC is calculated by adding AFC and AVC. As seen in Fig. 6.6, AC curve is a U-shaped curve. It means AC initially falls (1st phase), and after reaching its minimum point (2nd phase), it starts rising (3rd phase).

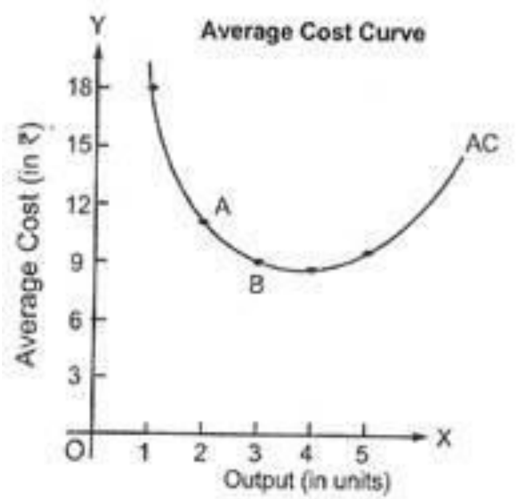

Fig. 6.6

Let us understand the three phases of AC:

1st Phase:

When both AFC and AVC fall till the level of 2 units of output, AC also falls i.e. till point A.

2nd Phase:

From 2 units to 3 units, AFC continues to fall, but AVC remains constant. So, AC falls (due to falling AFC) till it reaches its minimum point 'B'. From 3 units to 4 units, fall in AFC (by Rs. 1) is equal to rise in AVC (by Rs. 1). So, AC remains constant.

3rd Phase:

After 4 units of output, rise in AVC (by Rs. 1) is more than fall in AFC (by Rs. 0.60) and, therefore, AC starts rising.

Important Observations: AC, AVC and AFC:

1. AC curve will always lie above the AVC curve (See Fig. 6.7) because AC, at all levels of output includes both AVC and AFC.

2. AVC reaches its minimum point (point 'B') at a level of output lower than that of AC (point 'A') because when AVC is at its minimum point, AC is still falling because of falling AFC.

3. As the output increases, the gap between AC and AVC curves decreases, but, they never intersect each other. It happens because the vertical distance between them is AFC, which can never be zero.

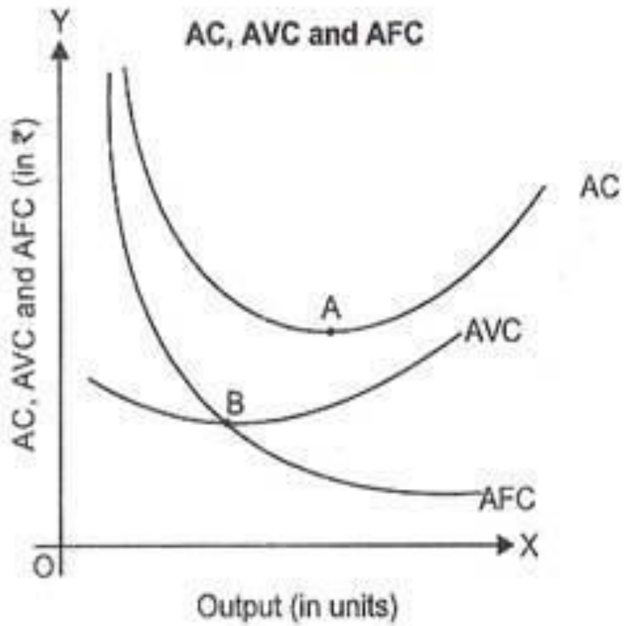

Fig. 6.7

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Marginal Cost:

Marginal cost refers to addition to total cost when one more unit of output is produced.

For example, If TC of producing 2 units is Rs. 200 and TC of producing 3 units is Rs. 240, then MC = 240 – 200 = Rs. 40.

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

Where:

n = Number of units produced

MC_n = Marginal cost of the nth unit

TC_n = Total cost of n units

TC_{n-1} = Total cost of (n – 1) units.

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Marginal Cost:

One More way to Calculate MC:

We know, MC is the change in TC when one more unit of output is produced. However, when change in units produced is more than one, then MC can also be calculated as:

MC = Change in Total Cost / Change in units of output = ΔTC/ΔQ

If TC of producing 2 units is Rs. 200 and TC of producing 5 units is Rs. 350, then MC will be:

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MC = TC of 5 units-TC of 2 units/5 units – 2 units = 350-200/5-2 = Rs. 5-2

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Marginal Cost:

MC is not affected by Fixed Costs:

We know, MC is addition to TC when one more unit of output is produced. We also know, TC = TFC + TVC. As TFC does not change with change in output, MC is independent of TFC and is affected only by change in TVC.

This can be explained with the help of a simple mathematical derivation:

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We know:

$MC_n = TC_n - TC_{n-1}$ … (1)

TC = TFC + TVC … (2)

Putting the value of (2) in (1), we get

$MC_n = (TFC_n + TVC_n) – (TFC_{n-1} + TVC_{n-1})$

$= TFC_n + TVC_n – TFC_{n-1} – TVC_{n-1}$

$= TFC_n – TFC_{n-1} + TVC_n – TVC_{n-1}$

Now, TFC is same at all levels of output, so $TFC_n = TFC_{n-1}$

It means, $TFC_n – TFC_{n-1} = 0$

So, $MC_n = TVC – TVC_{n-1}$

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Marginal Cost:

Let us now understand the concept of MC with the help of a schedule and diagram:

Table 6.7: Marginal Cost:

Output (units)	TVC (Rs.)	TFC (Rs.)	TC(Rs.)	MC (in T) $TC_n - TC_{n-1} = MC_n$	MC (in T) $TVC_n - TVC_{n-1} = MC_n$
0	0	12	12	—	—
1	6	12	18	18-12= 6	6-0= 6
2	10	12	22	22-18= 4	10-6= 4
3	15	12	27	27 – 22 = 5	15-10= 5
4	24	12	36	36 – 27 = 9	24-15= 9
5	35	12	47	47 – 36 = 11	35 – 24 = 11

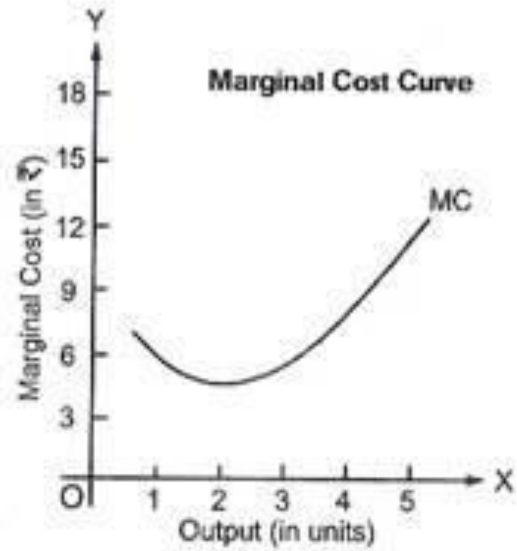

Fig. 6.8

As seen in Table 6.7, MC can be calculated from both TC and TVC. MC curve in Fig. 6.8 is obtained by plotting the points shown in Table 6.7. MC is a U-shaped curve, i.e. MC initially falls till it reaches its minimum point and, thereafter, it starts rising. The reason behind its U-shape is the Law of Variable Proportions.

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Relationship Between Short Run Cost Curve:

Let us now understand the concept of MC with the help of a schedule and diagram:

1. Average Cost (AC) and Marginal Cost (MC)
2. Average Variable Cost (AVC) and Marginal Cost (MC)
3. Average Cost (AC) and Average Variable Cost (AVC) and Marginal Cost (MC)
4. Average Cost (AC) and Average Variable Cost (AVC)
5. Total Cost (TC) and Marginal Cost (MC)
6. Total Variable Cost (TVC) and Marginal Cost (MC)

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Relationship between AC and MC:

There exists a close relationship between AC and MC.

i. Both AC and MC are derived from total cost (TC). AC refers to TC per unit of output and MC refers to addition to TC when one more unit of output is produced.

ii. ii. Both AC and MC curves are U-shaped due to the Law of Variable Proportions. The relationship between the two can be better illustrated through following schedule and diagram.

Table 6.8: Relationship between AC and MC:

Output (units)	TC (Rs.)	AC (Rs.)	MC (Rs.)	Phase
01	1218	-18	-6	I (MC < AC)
2	22	11	4	
3	27	9	5	
4	36	9	9	II (MC = AC)
5	47	9.40	11	III (MC > AC)

Relationship between AC and MC:

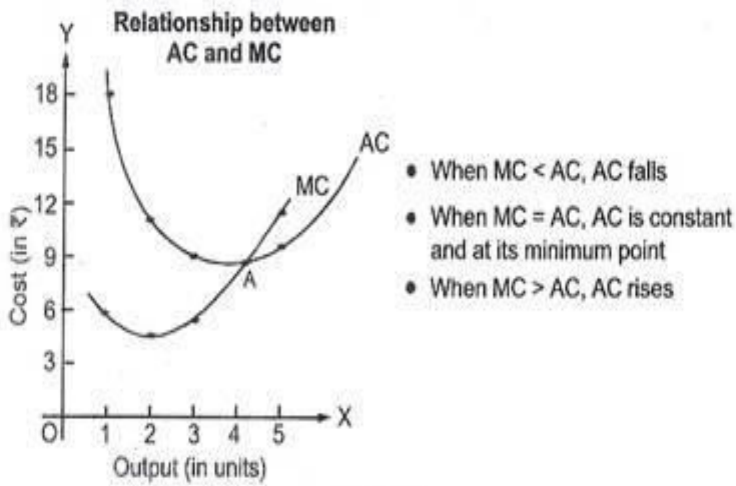

Fig. 6.9

Table 6.8: Relationship between AC and MC:

Output (units)	TC (Rs.)	AC (Rs.)	MC (Rs.)	Phase
01	1218	-18	-6	I (MC < AC)
2	22	11	4	
3	27	9	5	
4	36	9	9	II (MC = AC)
5	47	9.40	11	III (MC > AC)

With the help of Table 6.8 and Fig. 6.9, the relationship can be summarized as under:

1. When MC is less than AC, AC falls with increase in the output, i.e. till 3 units of output.
2. When MC is equal to AC, i.e. when MC and AC curves intersect each other at point A, AC is constant and at its minimum point.

Relationship between AC and MC:

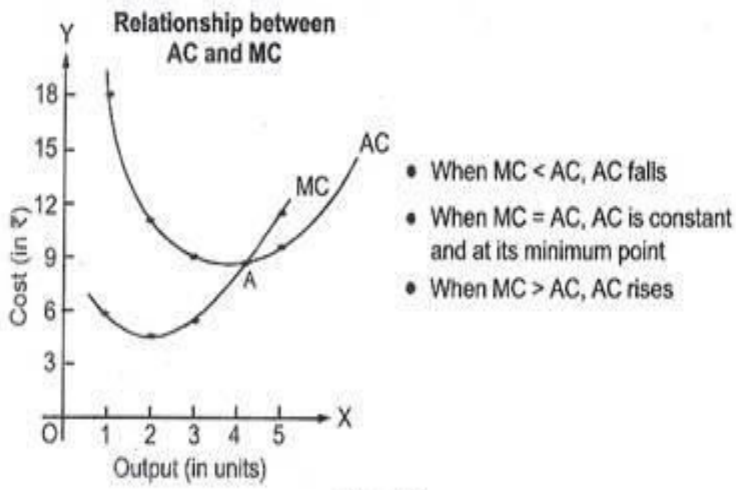

Fig. 6.9

3. When MC is more than AC, AC rises with increase in output, i.e. from 5 units of output.

4. Thereafter, both AC and MC rise, but MC increases at a faster rate as compared to AC. As a result, MC curve is steeper as compared to AC curve.

AC depends on the nature of MC:

i. When MC curve lies below the AC curve, it pulls the latter downwards;

ii. When MC curve lies above AC curve, it pulls the latter upwards;

iii. Consequently, MC and AC are equal where MC intersects AC curve.

Relationship between AC and MC:

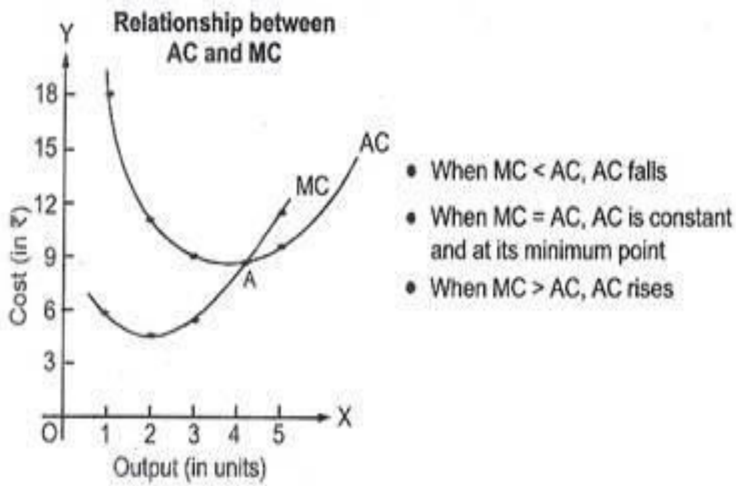

Fig. 6.9

Can AC fall, when MC is rising?

Yes, AC can fall, when MC is rising. However, it is possible only when MC is less than AC. It means that as long as MC curve is below the AC curve, AC will fall even if MC is rising. As per Table 6.8, when we move from 2 units to 3 units, MC rises and AC falls. It happens because during this range, MC is less than AC.

Can AC rise, when MC is falling?

No, AC cannot rise, when MC is falling because when MC falls, AC will also fall.

Relationship between AC and MC:

Conceptual Clarity — Relationship between AC and MC:

The relationship between AC and MC can be better understood through example of a ‘Cricketer’s Batting Average’ given by Stonier and Hague in their book ‘A Text Book of Economic Theory’.

Assume that a cricketer (say, Sachin Tendulkar) has scored 180 runs in 3 matches. It means, his present average score is: 180 / 3 = 60 runs. Now, consider the following 3 cases:

Case 1:

Sachin scores 50 runs in his 4th match. Now, his average score will fall as his marginal score is less than the average score. This is shown in the following table:

Matches Played	Total Runs	Average Runs	Marginal Runs
3	180	60	–
4	230	57.50	50

When the marginal score is less than the average score, average score will decrease.

Similarly, when MC < AC, AC will fall.

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Relationship between AC and MC:

Case 2:

If Sachin scores 60 runs in the 4th match, then his average and marginal score will be equal as his marginal score is equal to average score.

Matches Played	Total Runs	Average Runs	Marginal Runs
3	180	60	–
4	240	60	60

When the marginal score is equal to average score, average score will remain constant. Similarly, when MC = AC, AC is constant.

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Relationship between AC and MC:

Case 3:

If Sachin scores 80 runs in the 4th match, then his average will rise as his marginal score is more than the average score.

Matches Played	Total Runs	Average Runs	Marginal Runs
3	180	60	–
4	260	65	80

When the marginal score is more than the average score, average score will increase. Similarly, when MC > AC, AC will rise.

Relationship between AVC and MC:

The relationship between AVC and MC curves is similar to that of AC and MC.

i. Both AVC and MC are derived from total variable cost (TVC). AVC refers to TVC per unit of output and MC is the addition to TVC, when one more unit of output is produced.

ii. Both AVC and MC curves are U-shaped due to the Law of Variable Proportions.

The relationship between AVC and MC can be better illustrated with the help of following schedule and diagram.

Table 6.9: Relationship between AVC and MC

Output (units)	TVC (Rs.)	AVC(Rs.)	MC(in Rs.)	Phase
0 1	0 6	6	6	I (MC < AVC)
2	10	5	4	
3	15	5	5	II (MC = AVC)
	24 35	6 7	9 11	III (MC > AVC)

Relationship between AVC and MC:

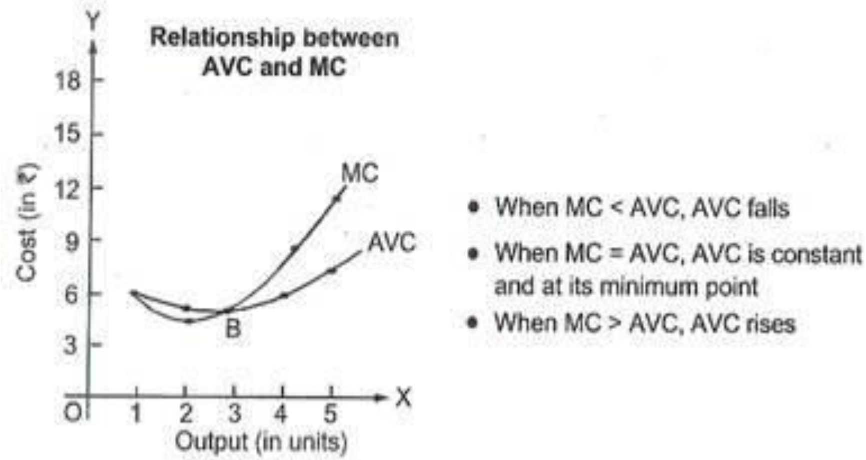

Fig. 6.10

Table 6.9: Relationship between AVC and MC

Output (units)	TVC (Rs.)	AVC(Rs.)	MC(in Rs.)	Phase
0 1	0 6	6	6	I (MC < AVC)
2	10	5	4	
3	15	5	5	II (MC = AVC)
	24 35	6 7	9 11	III (MC > AVC)

1. When MC is less than AVC, AVC falls with increase in the output, i.e. till 2 units of output.

2 When MC is equal to AVC, i.e. when MC and AVC curves intersect each other at point B), AVC is constant and at its minimum point (at 3rd unit of output).

3. When MG is more than AVC, AVC rises with increase in output, i.e. from 4 units of output.

4. Thereafter, both AVC and MC rise, but MC increases at a faster rate as compared to AVC. As a result, MC curve is steeper as compared to AVC curve.

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Relationship between AC, AVC and MC:

The relationship between AC, AVC and MC can be better illustrated with the help of following schedule and

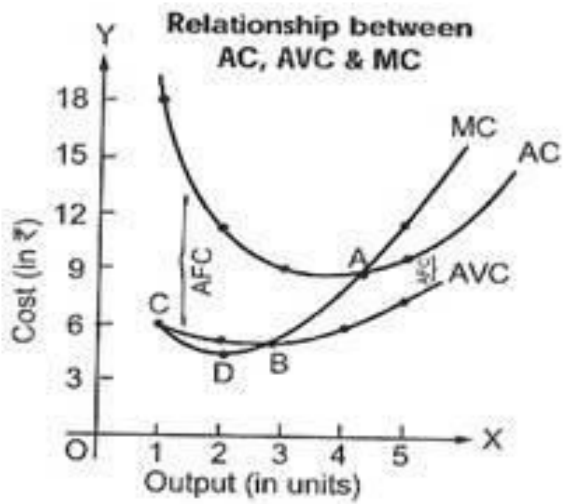

Fig. 6.11

Table 6.10: Relationship between AC, AVC and MC:

Output (units)	TVC (Rs.)	AC (Rs.)	AVC (in Rs.)	MC (in Rs.)
0	0	—	—	—
1	6	18	6	6
2	10	11	5	4
3	15	9	5	5
4	24	9	6	9
5	35	9.40	7	11

1. When MC is less than AC and AVC, both of them fall with increase in the output.

2. When MC becomes equal to AC and AVC, they become constant. MC curve cuts AC curve (at 'A') and AVC curve (at 'B') at their minimum points.

3. When MC is more than AC and AVC, both rises with increase in output.

COST

Relationship between AC and AVC:

The relationship between AC and AVC can be discussed with the help of Fig. 6.11.

1. AC is greater than AVC by the amount of AFC.

2. The vertical distance between AC and AVC curves continues to fall with increase in output because the gap between them is AFC, which continues to decline with rise in output.

3. AC and AVC curves never intersect each other as AFC can never be zero.

4. Both AC and AVC curves are U-shaped due to the Law of Variable Proportions.

5. MC curve cuts AVC and AC curves at their minimum points.

6. The minimum point of AC curve (point A) lie always to the right of the minimum point of AVC curve (point B).

COST

Important Observations: AC, AVC and MC (Refer Fig. 6.11):

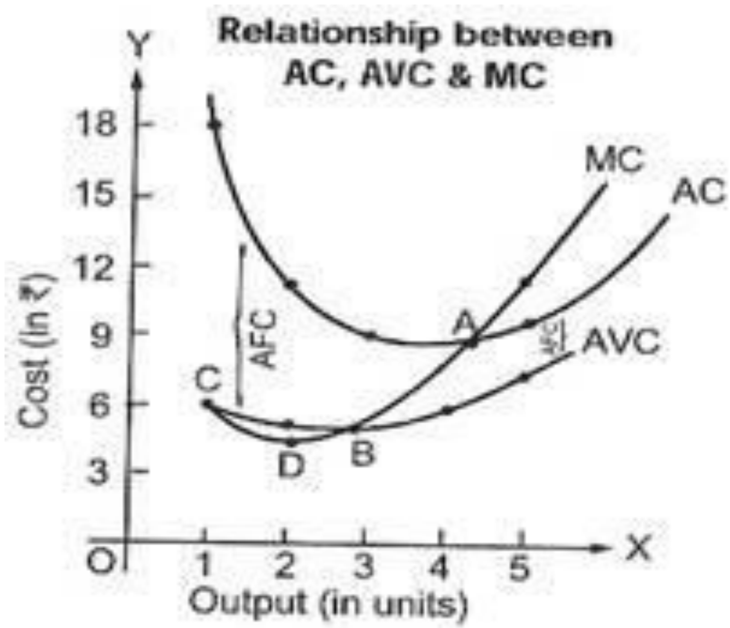

Fig. 6.11

1. MC = AVC at first unit of output (Point C):

MC is addition to TVC by producing one more unit of output.

As TVC of one unit of output is same as AVC, both MC and AVC are equal at the first unit of output.

2. AC, AVC and MC are U-shaped curves:

All these curves are U-shaped due to Law of Variable proportions.

3. Minimum point of MC curve comes before the minimum points of AC and AVC curves:

MC curve reaches its minimum point (point 'D') before the AC curve (point 'A') and AVC curve (point 'B') reaches their minimum points.

Important Observations: AC, AVC and MC (Refer Fig. 6.11):

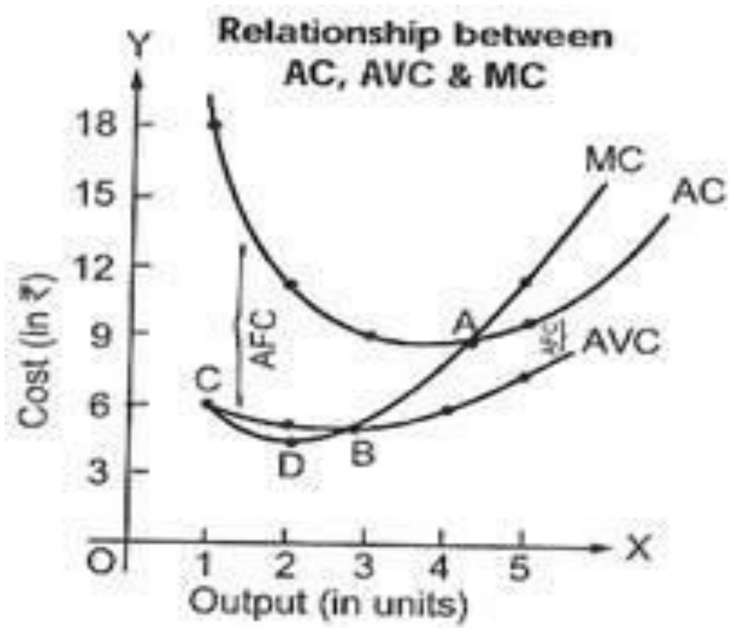

Fig. 6.11

4. MC curve is common to both AVC and AC curve:

MC reflects change in either total cost or total variable cost. So, MC curve is common to both AVC and AC curve.

5. MC curve cuts AC and AVC curves at their minimum points:

When MC is less than AC and AVC, MC pulls both of them downwards. Similarly, when MC is more than AC and AVC, MC pulls both of them upwards. As a result, MC curve cuts AC curve (at 'A') and AVC curve (at 'B') at their minimum points.

Relationship between TC and MC:

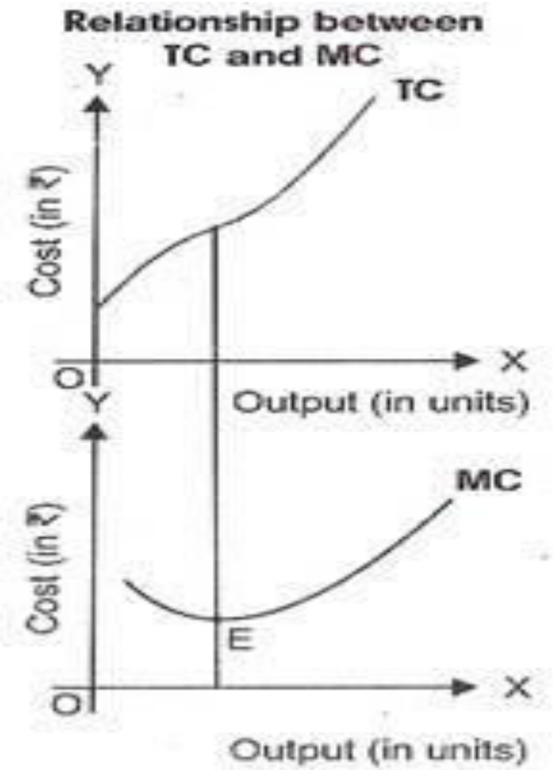

Fig. 6.12

The main points of relationship between TC and MC are:

1. Marginal cost is the addition to total cost, when one more unit of output is produced. MC is calculated as: $MC_n = TC_n - TC_{n-1}$

2. When TC rises at a diminishing rate, MC declines.

3. When the rate of increase in TC stops diminishing, MC is at its minimum point, i.e. point E in Fig. 6.12.

4. When the rate of increase in total cost starts rising, the marginal cost is increasing.

Relationship between TVC and MC:

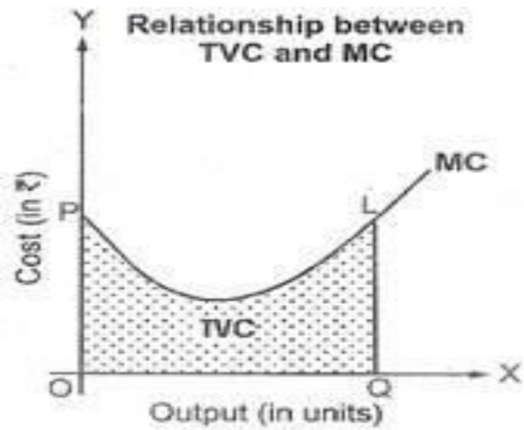

Fig. 6.13

We know, MC is addition to TVC when one more unit of output is produced. So, TVC can be obtained as summation of MC's of all the units produced. If output is assumed to be perfectly divisible, then total area under the MC curve will be equal to TVC.

As seen in the diagram, at OQ level of output, TVC is equal to the shaded area OPLQ in the diagram.

THANKING YOU

ODM EDUCATIONAL GROUP