20

PROFIT MAXIMISATION

20.1 INTRODUCTION

A producer generally wants to earn maximum profits. We have to find out the position of maximum profit for a producer. It was in this context that the concepts of costs were explained in lesson No. 18 and the concepts of revenue were explained in lesson No. 19. With the help of the knowledge about costs and revenue, we will try to find out the position of maximum profit for a producer.

20.2 OBJECTIVES

After going through this lesson you will be able to :

- explain the concept of profit as used in business;
- explain the concept of normal profit as an element of cost;
- explain the concept of above-normal or super-normal profit;
- find out the amount of profit at different levels of output, given the data on total cost and total revenue;
- locate the position of maximum profit, given the data on total cost and total revenue at different levels of output;
- find out the position of maximum profit, given the data on marginal revenue and marginal cost;
- explain what the producer would do to maximise his profits when he finds :
  (a) MR > MC; MR < MC and MR = MC;
- explain that equality of MR and MC alone does not determine the level of output that will fetch maximum profits to the producer;
- explain that maximum profits are earned when equality of MR and MC is at such a level of output from which no profitable movement (change in output) is possible;
- state that the position of maximum profits determined by using TR and TC data will be the same as determined by using MR and MC data.

20.3 VARIOUS CONCEPTS OF PROFIT

(a) Concept of Profit

The word 'profit' is used in many different ways. To understand the different concepts of profit used let us take an example. Suppose a carpenter decides to manufacture wooden tables with his own labour, own capital and in his own house, and manufactures 10 such tables in a week. He must have spent some money on the purchase of wood and other material. This expenditure incurred by the carpenter is his money cost of making these tables. Let such cost be Rs. 600 and these tables are sold for Rs. 1,300. The carpenter will think that he has earned a profit of Rs. 700 (Total revenue - Money cost). This is how the concept of profit is used in business or accounting sense. But the carpenter has not calculated the total cost of making tables, he has taken into account only the money cost. He has used his own labour, his own capital and his own house. And each one of these inputs has a cost which is called imputed cost. You have already learnt in lesson No. 18 the meaning of imputed cost.

So for calculating his cost of making the table, he must add these imputed costs to money cost. Furthermore, the carpenter has also provided another input - entrepreneurship. While acting as an entrepreneur he is bearing some risks and uncertainties. For this he must get a price which must be some minimum reward (in money) to induce him to make these tables. The minimum reward is actually the opportunity cost of manufacturing the tables. If he does not get this, he will manufacture some other thing and not these tables. And this minimum reward is called normal profit which is the price of entrepreneurship as an input. This must also be included in the cost of manufacturing the tables. Suppose the imputed cost of his own labour, own capital and use of the house is Rs. 400 and his minimum expected profit i.e. normal profit is Rs. 100. The total cost would be Rs. 600 + Rs. 400 + Rs. 100 (Money Cost + Imputed Cost + Normal Profit) = Rs. 1,100. So he gets a surplus of Rs. 200 over and above his total cost. This surplus is called profit. This profit is an addition to the normal profit which is already included in total cost. This is what profit means in micro economics. Let us now distinguish among various levels of profits.

(b) Levels of Profit

(i) Normal (or zero) Profit :
Profit is defined as the excess of TR over TC. Thus if TR=TC, level of profit is zero. Zero level of profit is also the same as 'normal profit'. It is because 'normal profit' is a part of TC. In a situation when TR=TC, the producer has realised his minimum expectations in full because he has received back the entire cost incurred by him in full. So, in micro economics, zero profit is the same as normal profit.

(ii) Above Normal (or more than zero) Profit :
Thus if TR is greater than TC (i.e. TR>TC), the level of profit is greater than zero. Since zero profit is the same as normal profit, the 'greater than zero profit is termed as above normal profit. So a positive (i.e. greater than zero) profit is the same as above normal profit.

(c) Loss Position

We normally use the words 'normal' and 'above normal' profits in micro economics. There is another term called 'below normal profit'. But 'below normal profit' position is actually a 'loss' position. This situation arises when TR is less than TC (or TR < TC). It means that producer is not in a position to recover all his costs including normal profit. May be his 'normal profit' is partly realised or may be not realised at all. In both situations he is incurring a loss. If such a situation persists and he has no hope of making up his losses he will wind up the production of the commodity at the earliest possible opportunity. In any case a producer will never plan the production of a commodity if his calculations show that he is likely to incur a loss. He will better like to produce a commodity where he at least gets normal profit.

When we say that a producer wants to earn maximum profit, we always mean that he wants to get as much of above normal profits as possible. He will, however, continue to produce so long as he is getting at least the normal profit. Sometimes a situation may arise when he has to be content with just normal profit which is the same as zero profit. In this case, the zero-profit level is the maximum attainable profit level. Therefore, the maximum profit level of a producer may range from zero to any higher level.

POINTS TO REMEMBER

- Excess of total revenue over total cost (money cost+imputed cost+normal profit) is called profit in economics.
- When total revenue is equal to total cost, the profit is zero and termed as 'normal profit'.
- When total revenue is greater than total cost, the profit is positive and termed as 'above normal profit'.
- When total revenue is less than total cost, the producer faces a loss.

INTEXT QUESTIONS 20.1

State whether the following statements are true or false :

(i) Profit is the difference between TR and Money Cost.

(ii) Profit is the difference between TR and TC.

(iii) Normal profit is the minimum reward (in money) which a producer must get to induce him to produce a given commodity.

(iv) A producer gets just normal profit when TR is greater than TC.

(v) Normal profit is the same thing as profit in business sense.

(vi) Normal profit is a part of cost.

(vii) When TR = TC, the producer gets only normal profits.

20.4 MAXIMISATION OF PROFIT WITH DATA ON TOTAL REVENUE AND TOTAL COST

Locating Maximum Profit Position

Once a producer has selected a commodity he would like to produce and sell, we have to find out how much quantity of this commodity he should produce and sell so that he gets maximum profit. For this we must get the information about the total cost and total revenue at different levels of output. In table 20.1 imaginary figures are given on level of output, TC and TR at each level of output.

In lesson No. 19 on "revenue" we have pointed out two situations. In one situation a producer is in a position to sell any quantity at a given price. In another situation a producer is able to sell more only at a lower price. Here we are taking the second situation. However, it would make no difference in finding out the maximum profit position if we take the first situation.

Table 20.1
TR, TC and Profit Schedules of a Product

Output (units)	Price (Rs.)	TR (Rs.)	TC Rs.)	Profit (Rs.) (TR-TC)
(1)	(2)	(3)	(4)	(5)
1	50	50	40	10
2	45	90	70	20
3	40	120	90	30
4	35	140	120	20
5	30	150	160	-10

Let us first understand how the figures in table 20.1 are worked out. We take the figures of revenue first. In lesson No.19 we pointed out two market situations. In one situation a producer is in a position to sell any quantity of output at a given price. In the second situation a producer is able to sell higher quantity only at a lower price. In our example above we have taken the second situation.

Here it is necessary to point out that even if we had taken the first situation it would have made no difference. The process of locating the maximum profit position remains the same. In this situation as output rises TR increases but every successive addition is less than the previous addition because of fall in the price. This tendency is evident from column (3) of the table 20.1.

The figures on total cost have been worked out on the assumption that as more and more output is produced, the average cost of production (TC/output) initially falls and after a certain level of output, starts rising. You must remember that AC first falls and then rises, as more and more output is produced. The pattern adopted of change in cost, as output expands, is the general pattern adopted in micro economic theory. However, it is not the only pattern.

In the last column (5) of the table 20.1 we have taken the excess of total revenue over total cost, which we call profit. The producer wants to get as much of profit as possible. So he wants to produce only that level of output which gives him maximum profit. In column (4) we find that the profit is maximum (Rs. 30) when the level of output is 3 units. So the producer earns maximum profit of Rs. 30 when he produces only 3 units and not any other level of output. Thus, we take the excess of TR over TC at each level of output and select that level of output at which this profit is maximum.

This method of finding the position of maximum profit can be understood more easily with the help of bar-charts.
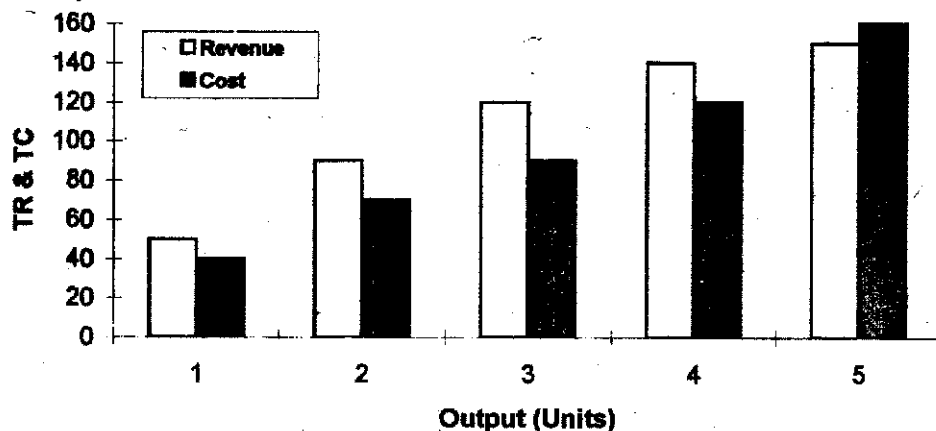

Fig. 20.1 : Total Revenue and Total Cost

The unshaded rectangles show the TR at different levels of output and the shaded rectangles show the TC at different levels of output. We observe that upto 4 units for each level of output, the area of unshaded rectangle is more than the area of shaded rectangle. In case of 5th unit shaded rectangle (TC) is higher than unshaded rectangle (TR). In figure 20.1 we have simply represented TR and TC. Excess of TR over TC is represented separately below in figure 20.2. We show below the difference between the areas of unshaded and shaded rectangles for each level of output.
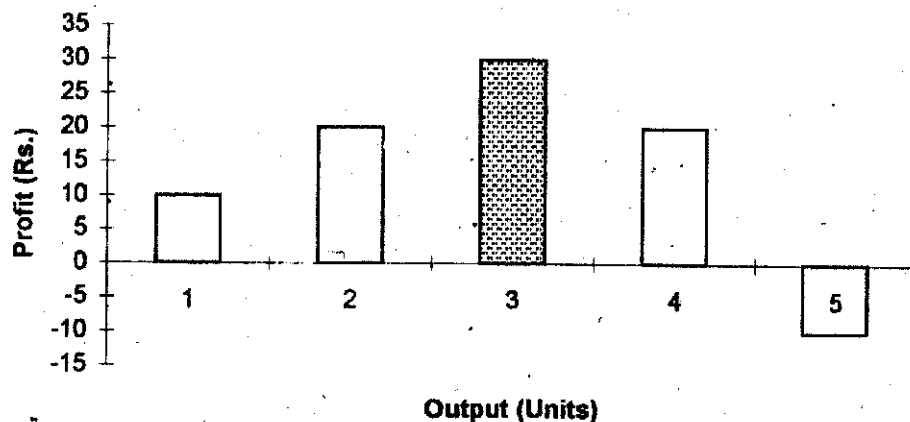

Fig. 20.2 : Profit

Area of each of these rectangles show above-normal profit. The rectangle for 5th unit of output is below the X-axis and show 'position of loss'. Since the producer wants to earn maximum profit, he will select that rectangle whose area is maximum and is above the X axis. Such a rectangle in the figure 20.2 is the one with dotted shade. This shows that if the producer produces 3 units, he will get maximum profit equal to Rs. 30. If he produces more or less than 3 units, his profit would be less than Rs. 30.

To sum up, we can say that a producer will compare the total revenue and total cost at each level of output and will decide to produce that level of output at which the excess of TR over TC is maximum, as this will give him maximum profit.

> Profit is maximum when excess of total revenue over the total cost is maximum.

INTEXT QUESTIONS 20.2

1. State whether the following statements are true or false :

   (i)   When TR>TC, there are above-normal profits.
   (ii) When TR=TC, there are normal profits.
   (iii) When TR<TC, there are profits.
   (iv) When the excess of TR over TC is maximum, the producer gets maximum profit.

2. Calculate profits at each level of output :

Output (units)	TR (Rs.)	TC (Rs.)	Profit (Rs.)
1	75	60	-
2	147	117	-
3	216	180	-
4	282	258	-
5	345	345	-

20.5 MAXIMISATION OF PROFIT WITH DATA ON MARGINAL REVENUE AND MARGINAL COST

The position of maximum profit can also be located with the help of data on marginal revenue and marginal cost. As you know, marginal revenue is the addition made to total revenue by producing and selling an additional unit of output, and marginal cost is the addition to total cost when an additional unit is produced.

(a)   To produce an extra unit or not

To decide whether to produce and sell an additional unit of output, the producer finds out

whether the production of this unit will fetch him profit. To find it he compares the marginal revenue and marginal cost of producing this additional unit. In this process he may be confronted with three alternative situations.

(i)   When MR>MC :

If he finds that the MR is greater than the MC, he will be earning profit on this unit and this will induce him to produce more and he will continue to increase his production so long as MR>MC. But as he increases his level of production, MR will continue to fall if more can be sold only at a lower price. We are once again taking a situation when these sales are possible only at a lower price. Thus the addition to total revenue by each successive unit will go on falling. In other words, total revenue will increase at a diminishing rate with increase in the level of output. By diminishing rate we mean that each new addition to TR is less than the previous addition. On the other hand, as the level of output is increased, marginal cost starts rising after a certain level of output.

(ii)   When MR=MC

Thus, we find that when MR>MC, the producer is induced to produce more as additional production is fetching him above normal profit. But as he produces more, MR starts falling and MC starts rising, so the initial difference between MR and MC will be wiped out at some level of output. This means that the tendency of MR to fall and of MC to rise will ultimately result in a situation where MR would be equal to MC. The figure 20.3 depicts these changes :
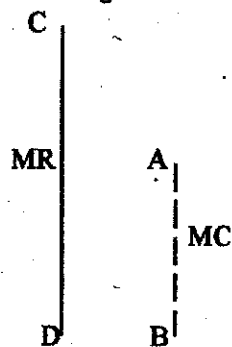

Fig. 20.3

The height of the dotted line AB shows the MC and the height of the other line CD shows the MR. Obviously the height of CD is greater than of AB. So MR>MC.

This induces the producer to produce more. As he produces more MR starts falling and MC starts rising as shown in fig. 20.3 :
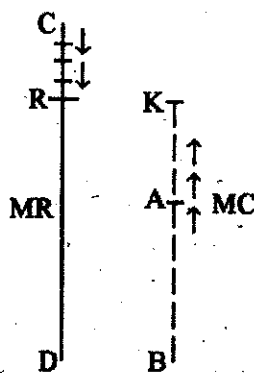

Fig. 20.4

As MR starts falling and MC starts rising, the height of the line CD showing MR starts falling and the height of dotted line AB showing MC starts rising.

When MR falls to RD and MC rises to BK we find that the two (MR and MC) are equal as shown in fig. 20.4.

(iii) **When MR<MC :**

If he produces even after this point where MC=MR, the MC will be greater than MR and so the production of additional unit will result in a loss because now the addition to total cost is more than addition to total revenue. He would not like to have losses, so he will not produce any more units beyond the point where MR=MC.

(b) Locating Maximum Profit Position

Now we take a numerical example to explain how by this method we can locate the position of maximum profit.

Table 20.2

Level of Output (in units)	Marginal Revenue (in Rs.)	Marginal Cost (in Rs.)	Above normal profit	Comparison of MR and MC	Reaction of the Producer
1	50	45	5	MR>MC	Incentive
2	49	40	9	MR>MC	to produce
3	47	42	5	MR>MC	more
4	45	45	0	MR=MC	Stops at this level
5	40	50	-10	MR<MC	Deincentive to reduce output

(i) **MC = MR, A Necessary Condition :**

Each additional unit of commodity produced makes lesser addition to total revenue. This trend can be observed in the column of MR. When 2 units are produced, addition to total revenue by producing 2nd unit falls from Rs. 50 to Rs. 49. When 3rd unit is produced, the addition to total revenue falls to Rs. 47 and so on. On the other hand, as more is produced MC first falls and then rises.

If the producer produces only 1 unit, the finds that MR is Rs. 50 and MC is Rs. 45. So MR>MC and the production of this unit fetches him a profit equal to Rs. 5. This induces him to produce more. When he produces 2nd unit, he finds that its MR>MC and this fetches him Rs. 9 as above normal profit. So he produces more. For the 3rd unit also MR>MC, so he produces still more. When he produces 4th unit he finds MR = MC. For any output less than 4 units MR>MC so he increases production and will stop at the 4th unit. If he increases production beyond 4th unit, say, he goes upto 5th unit, he finds that MC>MR, so the production of this unit results in loss to him. So he will not produce beyond 4th unit. Any level of output

less than 4 units leaves scope for earning more profits and any level of output beyond 4 units results in lowering of profits. In this way, if he produces less than 4 units, he is not maximising his profits and if he produces more than 4 units, again he is not maximising his profits. However, if he produces only 4 units, he is getting maximum profits. At this level of output MR = MC. Thus, the producer will earn maximum profits if he produces that level of output at which MR = MC.

(ii) MC>MR Beyond MC=MR Position : An Additional Condition

However, the equality of MR and MC alone does not ensure maximum profit to a producer. The equality must be at such a level of output from which no profitable movement in terms of changing the level of output is possible. It may be possible that the MR and MC may be equal at two different levels of output. In such a situation that level of output would be chosen from which any change will reduce the total profit. In other words, profits would be maximised when MR is equal to MC at such a level of output beyond which MR<MC and prior to that MR>MC.

Let us take an example to further clarify this point ;

Table 20.3

Level of output (in units)	MR (Rs.)	MC (Rs.)	Comparison of MC and MR	Reaction of the producer
1	35	35	MR = MC	Incentive to produce more
2	34	28	MR > MC	as more production results
3	33	29	MR > MC	in MR being greater than MC
4	31	31	MR = MC	Stops at this level
5	29	34	MR < MC	Reduces production as production of this unit results in lowering of profits

In this example we find that MR and MC are equal at two different levels of output. They are equal when only 1 unit is produced and they are also equal when 4 units are produced. So which level of output should the producer produce. If he decides to produce only 1 unit, we find that he will not be earning the profit which the production of 2nd and 3rd unit can fetch him because for these units MR>MC. So by producing only one unit, he will not be maximising his profits, although at this level of output MR=MC. Hence, he will not stop at unit one. He will produce the 2nd unit, 3rd unit and will go upto 4th unit. At 4th unit MR and MC are again equal. But here besides the equality of MR and MC, we find that further production will result in losses as MR<MC for the 5th unit and lowering of the total profits. Similarly lesser production will mean foregoing profits as for all the units less than 4 units MR>MC. Thus any change from the level of output of 4 units will reduce his profit. Hence he will get maximum profit if he produces only 4 units.

To sum up, we can say that level of output will give maximum profit to the producer at which the following two conditions are fulfilled :

(i)   MR must be equal to MC.

(ii)   At any level of output greater than the one at which MR=MC, MR should be less than MC and at any level of output less than the one at which MC=MR, MR should be greater than MC.

(c)   Do Above Normal Profit Persists

Thus, we now know how a producer selects the level of output giving him the maximum profit. A producer is interested in getting as much of above normal profits as possible. But when a producer is earning above normal profit by producing a commodity, other producers who were not producing this commodity would now be tempted to produce this commodity. As soon as these other producers start producing this commodity the total market supply of this commodity will increase. This would reduce the price. As soon as the price falls, the above normal profits would be reduced. This process will continue i.e., more and more producers will continue to enter into the production of this commodity so long as above normal profit is earned by the already existing producers. Ultimately a situation will be reached when the above normal profit would be wiped out and each producer would earn only normal profit. In such a situation MC would be equal to MR, TC would be equal to TR and hence AC would be equal to AR.

But a producer may continue to earn above normal profits if new producers are not allowed to produce this commodity.

You must remember that the two alternative approaches of finding the situation of maximum profit, one with the help of TR and TC and the other with the help of MR and MC, will yield the same result. In other words, the level of output determined with the help of TR and TC, which fetches maximum profit will be the same as determined with the help of MR and MC data. Thus, we can say that when MR=MC the difference between TR and TC will also be maximum, both showing the situation of maximum profit.

POINTS TO REMEMBER

> * Profit is also maximum when marginal cost is equal to marginal revenue and no further profitable movement of production is possible.
> * Above normal profit can persist if there are barriers to the entry of new firms in an industry.

INTEXT QUESTIONS 20.3

State whether the following statements are true or false :

(i)   A producer will produce more to maximise profit so long as MR > MC.

(ii) When MC = MR the producer gets maximum profit.

(iii) When MC = MR and this equality is at that level of output from which no profitable movement is possible, the producer gets maximum profit.

(iv) When TC = TR the producer gets above normal profit

GLOSSARY

Profit in business sense : Excess of TR over money costs.

Normal Profit : The minimum reward that an entrepreneur must get in order to induce him to produce the given commodity. It is the price of entrepreneurship. It arises when TR = TC.

Above normal profit : Excess of TR over TC.

TERMINAL EXERCISE

1. Explain the meaning of the term 'profit'. Distinguish between 'above normal profit' and 'normal profits'.

2. Explain the term 'maximum profit' as used in micro economics.

3. Explain with the help of total revenue and total cost data how a producer chooses the maximum profit position.

4. Explain with the help of marginal revenue and marginal cost data how a producer chooses the maximum profit position.

5. Is 'maximum total revenue' position the 'maximum profit position ? Give reasons for your answer.

6. Is 'minimum total cost' position the 'maximum profit position ? Give reasons for your answer.

7. Is it enough to say that profit is maximised when MC = MR ? Give reasons for you answer.

8. On the basis of the following information locate the maximum profit position of a producer. Give reasons for you choice.

Output (in units)	Total Revenue (Rs.)	Total Cost (Rs.)
3	30	20
4	40	26
5	50	33
6	60	44
7	70	56

9. On the basis of the following locate the maximum profit position of a producer. Give reasons for the choice. Also find out the total profit at the maximum profit position.

Output (in units)	MR (Rs.)	MC (Rs.)
1	10	5
2	10	6
3	10	7
4	10	8
5	10	9
6	10	10
7	10	11
8	10	12

10. Find out the maximum profit position from the following data.

Output (in units)	TR (Rs.)	TC (Rs.)
1	10	12
2	18	20
3	24	24
4	21	36
5	18	50

Is the maximum profit level super normal, or just normal. Give reason for your answer.

11. Find out the maximum profit position from the following data.

Output (in units)	MR (Rs.)	MC (Rs.)
1	10	4
2	9	5
3	8	6
4	7	7
5	6	8

Also calculate the maximum profit. Comment on the level of profit.

12. Find out the maximum profit position by comparing TC and TR on the basis of following data.

Output (in units)	AR (Rs.)	AC (Rs.)
1	12	7
2	11	9
3	10	10
4	9	11
5	8	12

13. At a particular level of output a producer finds that MR = MC. Is the producer getting maximum profit in this situation ? If not why ?

14. Explain what will a producer do to maximise profit when he finds that at a particular level of output MC < MR ?

ANSWERS

Intext Questions 20.1

(i) False (ii) True (iii) True (iv) False (v) False (vi) True (vii) True

Intext Questions 20.2

1. (i) True (ii) True (iii) False (iv) True
2. Profit 15   30   36   24   0

Intext Questions 20.3

(i) True (ii) False (iii) True (iv) False

Hints to Terminal Exercise

1. Read section 20.3 (a) and (b)
2. (a) The term 'maximum profit' refers to that level of output at which 'above normal profits' are maximum.
   (b) Give in brief the meaning of 'normal' and 'above normal' profit.
   (c) Give a simple imaginary schedule about TR and TC and indicate the maximum - profit portion.
3. Read section 20.4
4. Read section 20.5
5. TR alone cannot determine profit. Knowledge about TC is essential.
6. In order to determine profit, knowledge about TR is essential. TC alone cannot determine profit.
7. Read section 20.5 (b)
8. 5 units of output, for reasons read section 20.4
9. 6 units of output, total profit Rs. 15 for reasons read section 20.5 (b)
10. 3 units of output, for reasons read section 20.3 (b)
11. 4 units of output, profit Rs. 12
12. 1 unit of output
13. Read section 20.5 (b)
14. Read section 20.5 (b).