



Notes

17

PRODUCTION FUNCTION

When you go to the market to buy commodities such as note-books, fountain pens, shirts, bread, butter, fruits, vegetables etc. do you ever think about how these things came into the market. In previous lessons, you have studied about consumers, who constitute one part of the market and demand goods and services to satisfy their wants. Now, you will study the other part of the market - the producers or firms who produce goods and services for the satisfaction of consumers' wants. A producer or firm combines various factors inputs like land, labours, capital, entrepreneurship and other inputs like raw material, fuel etc. to produce goods and services that are demanded by the consumers. Man can neither produce a physical product nor can he destruct. Man can change only the form of a physical product. He can create utilities only. Thus production means creation or addition of utility. Any activity that makes a product more useful is collect production. In this lesson you will study about how these inputs are combined to produce goods and services.



OBJECTIVES

After completing this lesson, you will be able to:

- explain the meaning of production;
- define production function;
- understand the meaning of production function in the short run known as law of variable proportions;
- understand the different concepts of production and show their relationships;
- differentiate between fixed and variable factors of production or inputs; and
- explain the reasons of operation of the laws of production.



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17.1 MEANING OF PRODUCTION

Production may be defined as a process through which a firm transforms inputs into output. It is the process of creating goods and services with the help of factors of production or inputs for satisfaction of human wants. In other words, 'transformation of inputs into output' whereby value is added, is broadly called production. Whatever is used in the production of a commodity is called input. For example, in the production of wheat, the use of land, seed, fertilizer water, pesticides, tractors, labour etc. are inputs and wheat is output. The relationship between inputs and output of a commodity depends upon the state of technology because with the help of advanced technology more can be produced with the help of same inputs or same output can be produced with the help of less inputs.

Before defining production function we should understand the following concepts related to production function:

(a) Short run and long run

Short run refers to a time period in which a firm does not have sufficient time to increase the scale of output. It can increase only the level of output by increasing the quantity of a variable factor and making intensive use of the existing fixed factors. On the other hand long run refers to the time period in which the firms can increase the scale of output by increasing the quantity of all the factor inputs simultaneously and in the same proportion.

The distinction between fixed and variable factors is relevant only in the short run but this distinction disappears in the long run.

(b) Fixed factors and variable factors

Fixed factors are those factors of production whose quantity can not be hanged with change in the level of output. For example, the quantity of land, machinery etc. can not be hanged during short run.

On the other hand, variable factors are those factors of production whose quantity can easily be hanged with change in the level of output. For example, we can easily change the quantity of labour to increase or decrease the production.

(c) Level of production and scale of production

When any firm increases production by increasing the quantity of one factor input where as the quantity of other factor inputs keeping constant; it increases the level of production. But on the other hand, when the firms increases production by increasing the quantity of all the factors of production simultaneously and in the same proportion, it increases the scale of production.

17.2 DEFINITION OF PRODUCTION FUNCTION

In economics, production function refers to the physical relationship between inputs and output under given technology. In other words production function is a mathematical functional/technical/engineering relationship between inputs and output such that with a given combination of factor inputs and technology at a given period of time, the maximum possible output can be produced. Such as land, labour capital and entrepreneurship.

If there are two factor inputs: labour (L) and capital (K), then production function can be written as:

$Q_x = f(L, K)$ where Q_x is the quantity of output of commodity x, f is the function and L and k are the units of labour and capital respectively. It says that quantity of output depends on units of labour on capital used in production.

Here two points are worth considering. Firstly, production function must be considered with reference to particular period of time i.e. short period and long period. Secondly, production function is determined by state of technology.

(i) Short run production function

A production function that shows the changes in output when only one factor is changed while other factor remains constant is termed as a short run production function. In the above example of production function, Labour (L) is considered as the variable factor which can be changed to influence the level of output. The other factor capital (K) is a fixed factor which can not be changed. The underlying theory to the short run production function is the “Law of variable proportion or Returns to a factor”. This law will be discussed later in this chapter.

(ii) Long run production function

A long run production function studies the impact on output when all the factors of production can be changed simultaneously and in the same proportion. So in the long run size of operation of the firm can be expanded or contracted depending on the fact that the factors of production are increased or decreased. The underlying theory to the long run production function is the returns to scale which will be discussed later in this lesson:



INTEXT QUESTIONS 17.1

- (i) What is meant by production?
- (ii) Define a production function.



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- (iii) Distinguish between short-run production function and long-run production function.

Before studying the law of variable proportions we have to understand the three measures of production and their relationships because without understanding these measure of production, the concepts of laws of production can not be clearly understood.

There are mainly the following three measures of production:

- (a) Total product or total physical product denoted by TPP.
- (b) Average Product (AP) or Average physical product denoted by APP.
- (c) Marginal Product (MP) or marginal physical product denoted by MPP.

(a) Total Physical Product (TPP)

TPP is the total amount of a commodity that is produced with a given level of factor inputs and technology during a given period of time. For example, 2 units of labour combined with 2 units of capital can produce 26 fans per day. Here 26 fans is the total physical product which is produced with the given level of inputs (labour and capital)

(b) Average Physical Product (APP)

APP is the output produced per unit of input employed. It can be obtained by dividing TPP by the number of units of variable input. So $APP = TPP/L$ where L is the units of labour. For example, if 10 workers make 30 chairs per day, the APP of a worker per day will be $30 \div 10 = 3$ chairs. If the productivity of a factor increases, it implies that the output per unit of input has increased.

(c) Marginal Physical Product (MPP)

MPP of an input is the additional output that can be produced by employing one more unit of that input while keeping other inputs constant. For example, if ten tailors can make 50 shirts per day and 11 tailors can make 54 shirts per day, the marginal product of 11 workers will be $54 - 50 = 4$ shirts per day.

We can further clarify the above three concepts of production with the help of the following table 17.1.

Table showing TPP, APP and HPP of fans per day in short run.

Table 17.1

Fixed factor (Capital units)	Variable factor (Labour units)	TPP (units)	APP (units)	MPP (units)
(1)	(2)	(3)	(4)	(5)
2	1	10	10	10
2	2	26	13	16
2	3	48	16	22
2	4	68	17	20
2	5	85	17	17
2	6	96	16	11
2	7	98	14	2
2	8	98	12.25	0
2	9	90	10	-8

The above table shows values of TPP, APP and MPP for different units of variable factor. For example, if we know the TPP of all the units of variable factor we can calculate APP by dividing TPP by the number of units of a variable factor. So $APP = TPP / \text{units of variable factor}$. For example in table 17.1 the TPP of 2 units of labour is 26, the APP will be $26 \div 2 = 13$. In the same way we can calculate APP of all the units of a variable factor. We calculate MPP of 2 units labour by deducing TPP of 1 unit. From the TPP of 2 units labour i.e. $26 - 10 = 16$ units. So $MPP_n = TPP_n - TPP_{n-1}$. If we know APP of all the units of a variable input we can calculate TPP by multiplying APP by the units of variable factor. In the above table APP of 4 units of labour is 17. TPP will be $17 \times 4 = 68$ units. In the same way we can calculate TPP of all other units of variable factor. So $TPP = APP \times L$ where L is the units of labour. If we know MPP of all the units of a variable we can calculate TPP by summing up the MPP of all the units of variable factor. For example, in table 17.1 the MPP of 1, 2, 3 and 4 units of labour are 10, 16, 22 and 20 respectively, the TPP of 4 units of labour can be derived by summing up the MPP of these 4 units of labour i.e. $10 + 16 + 22 + 20 = 68$ units. TPP of all other units can be calculated in the same manner. Remember that for the 1 unit of labour TPP, APP and MPP are equal. So we can give the following formulas to calculate TPP, APP and MPP.

$TPP = \sum MPP$ (Sum of MPP of all the units of a variable factor)

or $TPP = MPP_1 + MPP_2 + MPP_3 + \dots + MPP_n$

or $TPP = APP \times L$ where L indicates units of labour

$APP = \frac{TPP}{L}$ where L indicates units of labour



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$MPP = \frac{\Delta TPP}{\Delta L}$ where ΔTPP is change in TPP and ΔL is change in units of labour

or $MPP_n = TPP_n - TPP_{n-1}$ for example, MPP of 2 units = TPP of 2 units – TPP of 1 units of labour

17.4 RELATIONSHIP BETWEEN TPP AND MPP

The relationship between TPP and MPP can be explained as given below:

- (i) As long as MPP increases, TPP increases at an increasing rate.
- (ii) When MPP falls but remains positive, TPP increases but at a diminishing rate.
- (iii) When MPP becomes zero, TPP is maximum.
- (iv) If MPP becomes negative, TPP starts decreasing.

17.5 RELATIONSHIP BETWEEN APP AND MPP

- (i) As long as MPP is greater than APP, APP increases.
- (ii) When MPP is equal to APP, APP is maximum and constant.
- (iii) When MPP is less than APP, APP decreases.
- (iv) MPP can be zero and negative but APP is never zero or negative.

The relationship among TPP, APP and MPP can also be explained with the help of the following table. 17.2

Table 17.2: Hypothetical schedule of TPP, APP and MPP

Land (Fixed factor)	Units of variable Factor (labour)	TPP (Units)	APP (Units) (TPP/L)	MPP (Units) ($\Delta TPP/\Delta L$)
1 Acre	0	0	–	–
1 Acre	1	2	2	2
1 Acre	2	6	3	4
1 Acre	3	12	4	6
1 Acre	4	20	5	8
1 Acre	5	25	5	5
1 Acre	6	29	4.8	4
1 Acre	7	31	4.4	2
1 Acre	8	31	3.9	0
1 Acre	9	29	3.2	–2



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In the above table 17.2 MPP is increasing upto 4 units of labour and TPP is increasing at an increasing rate. MPP is decreasing but remains positive from 5th to 8th unit of labour so TPP is increasing at a diminishing rate. For 8th unit of labour MPP is zero where TPP is maximum. But for 9th unit of labour MPP becomes negative so TPP also starts decreasing.

In the same way upto 4 units of labour MPP is greater than APP, so APP is increasing. At 5th units of labour $MP = APP$ so APP is maximum and constant. At 6th units of labour MPP is less than APP, So APP is decreasing.

Relationship among TPP, APP and MPP (through diagram)

To understand the relationship among TPP, APP and MPP, let us consider the following diagram.

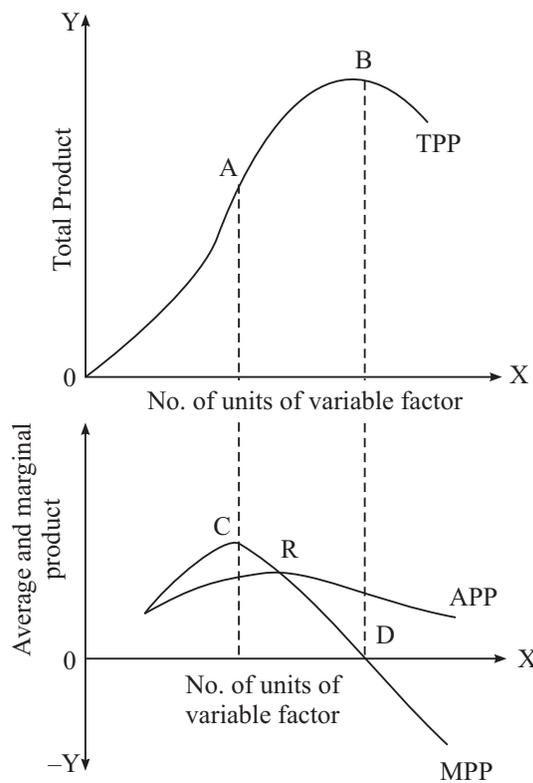


Fig. 17.1

In the above figure 17.1 TPP increases from point O to point B. There are two phases of this increase in TPP. First, from O to A in which TPP increases at an increasing rate. In this phase in the lower portion of the diagram MPP increases upto point



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C. So we can conclude that when MPP increases TPP increases at an increasing rate. Second phase of increase in TPP is from A to B in which TPP increases at a diminishing rate. In the lower portion of the diagram, MPP decreases from point C to point D but it remain positive. So we can conclude that when MPP falls but remains positive, TPP increases at a diminishing rate. At point B on TPP curve, TPP is maximum. In the lower portion of the diagram MPP is zero at point D. So we conclude that where MPP is zero, TPP is maximum. After point B, TPP falls. After point D MPP becomes negative and TPP falls.

In the lower portion of the above figure 17.1, APP and MPP curves have been drawn. Before point R on APP curve, MPP is greater than APP, so APP increases. At point R MPP is equal to APP. At this point. APP is constant and maximum. After point R on APP curve, MPP curve is below APP curve, so we can say that when MPP is less than APP, APP falls.



INTEXT QUESTIONS 17.2

1. What are primary inputs? Give example.
2. What are secondary inputs? Give example.
3. Define variable factors of production.
4. What are fixed factors of productions? Explain with example.
5. Distinguish between fixed and variable factors of production.
6. Can total product ever decline? If yes, when?
7. What happens to TPP when MPP is zero?
8. What happens to TPP when MPP increases?
9. Explain the relationship between TPP and MPP.
10. What is the relationship between APP and MPP?

17.6 LAW OF VARIABLE PROPORTIONS

The law of variable proportions is a short period production law. It is also called returns to a factor. Let us first understand the meaning of variable proportions. In a production process when only one factor is varied and all other factors remain constant, as more and more units of variable factor are employed, the proportion between fixed and variable factors goes on changing. So it is termed as the law of variable proportions. This law states that if you go on using more and more units of variable factor (labour) with fixed factor (capital), the total output initially

increases at an increasing rate but beyond a certain point, it increases at a diminishing rate and finally it falls. This law was initially called the law of diminishing returns Marshall who applied the law only in agriculture sector but modern economist called it the law of variable proportion and proposed its applicability to all the sectors of the economy.

Assumption of the law

The law operates under the following assumptions:

- (i) The firm operates in the short run.
- (ii) There is no change in technology of production.
- (iii) The production process allows the different factor ratios to produce different levels of output.
- (iv) All the units of variable factor are equally efficient.
- (v) Full substitutability of factors of production is not possible.

According to the law when we employ more and more units of a variable factor with the fixed quantity of other factors and technology, the marginal product of the variable factor first increases and then decreases. In other words, with employment of more and more units of a variable factor with fixed quantity of other factors, the total product first increases and then starts decreasing. It means that in short run labour is the only variable factor, Return to labour or marginal product of labour initially increases but as more units of labour are employed its MPP declines and may also become negative. There are three phases of returns to a variable factor which are discussed below.

(a) Phase I: Increasing Returns to a factor

In this phase TPP increases at an increasing rate and marginal product of variable factor, labour increases. In the end of this phase MPP is maximum. So, this is the phase of increasing returns to a factor.

(b) Phase II: Diminishing Returns to a factor

In this phase TPP increases but at a diminishing rate MPP declines but remains positive. At the end of this phase MPP is zero. At this point TPP is maximum. So, this is the phase of diminishing returns to a factor.

(c) Phase III: Negative Returns to a factor

In this phase, MPP declines and it becomes negative. Here the TPP also starts falling. It operates from the level of output where MPP of labour is zero but subsequently becomes negative. The table 17.2 given below illustrates the three phases of the law of variable proportions.

**Notes**

Table 17.2: Law of variable proportions

Units of land (Fixed input)	Units of labour (variable input)	TPP (units)	MPP (units)	Phases
1	1	3	3	TPP increase at an increasing rate MPP is increasing (Phase I)
1	2	7	4	
1	3	12	5	
1	4	16	4	TPP increases at a diminishing rate and MPP falls but remains positive (Phase II)
1	5	19	3	
1	6	21	2	
1	7	22	1	TPP falls and MPP becomes negative (Phase III)
1	8	22	0	
1	9	21	-1	
1	10	20	-2	



Notes

This law can also be explained with the help of figure given below.

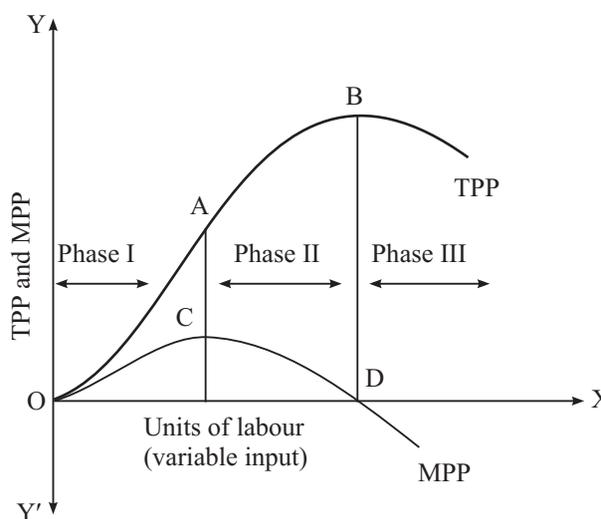


Fig. 17.2

The figure 17.2 given above shows that TPP increases from 0 to B but there are two parts of this increase. First is from 0 to A in which TPP increases at an increasing rate. This is in the I phase of the law. In this phase MPP increases from 0 to C.

In the second part from A to B TPP increases at a diminishing rate. This is in the II phase of the law. In this phase MPP decreases from point C to point D. At point D MPP is zero. TPP is maximum at point B.

After point B TPP starts falling. This is in III phase of the law. In this phase MPP becomes negative after point D.

17.7 REASONS BEHIND DIFFERENT PHASES OF THE LAW OF VARIABLE PROPORTIONS

In phase I, we get increasing returns to a variable input because greater use of variable inputs makes it possible to utilize fixed indivisible factor more efficiently and also to introduce a greater division of labour and specialization. It leads to optimum combination of fixed and variable inputs.

In phase II, we get diminishing returns to a variable input because in this stage the proportion between variable and fixed inputs has crossed the optimum proportion between them and a variable input such as labour has less and less fixed input to work with.

In phase III, the variable input becomes too much relative to fixed inputs which obstructs the production process and therefore results in fall of TPP. because MPP becomes negative. So, phase III is called the stage of negative returns to variable factor. So phase III is called the stage of negative returns to variable factor.

17.8 LAW OF DIMINISHING MARGINAL PRODUCT

The law of variable proportions is an extension of the law of diminishing returns to a factor. The law of diminishing returns to a factor states that as more and more units of a variable factor are employed with fixed factors and technology, its marginal product eventually declines. The difference between this law and the law of variable proportions is that the former does not take into account increasing returns to a factor. According to the law of diminishing returns to a factor, the firm can operate only in phase II and III of the law of variable proportions. Hence the law of diminishing returns to a factor is a part of more general law of variable proportions. In figure 17.2, the law of diminishing returns to a factor operates after point A on TPP curve and point C on MPP curve.

Early economists believed that the diminishing returns to a factor sets in only in agriculture as land was fixed. It did not apply in industry as this sector continuously underwent technical upgradation. However, industry can postpone setting in of diminishing returns with technical advances. If technical advancements do not take place there is no increase in the efficiency of the factor inputs, then diminishing returns shall be applicable even in industry. According to modern economists, diminishing returns under the law of variable proportions are universally applicable to both the agriculture and industrial sectors.

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WHAT YOU HAVE LEARNT

- Production is the process of converting inputs into output.
- A production function shows the technical relationship between inputs and output.
- Fixed factors are those whose quantity does not change with change in output.
- Variable factors are those whose quantity changes with change in output.
- TPP is defined as the total output that is produced in a given time with given inputs and technology.
- APP is the output per unit of input.
- MPP is the addition to TPP by the employment of on additional unit of input.
- Relationship between TPP and MPP
 - (i) When MPP increases, TPP increases at an increasing rate.
 - (ii) When MPP decreases but remains positive, TPP increases at a diminishing rate.
 - (iii) When MPP is zero, TPP is maximum.
 - (iv) When MPP become negative, TPP starts decreasing.
- Relationship between TPP and MPP:
 - (i) As long as MPP is greater than TPP, APP increases.
 - (ii) When MPP is equal to APP, APP is constant and maximum.
 - (iii) When MPP is less than APP. APP decreases.
- The law of variable proportion states that as the additional units of a variable factor are combined with a given level of fixed factors and technology, the MPP of the variable factor first increases and then declines.
- There are three phases of the law of variable proportions:
 - (i) In phase I, increasing returns to a factor occur return MPP is increasing and TPP increases at an increasing rate:
 - (ii) In phase II, diminishing returns to a factor occur, taken MPP is declining but remain positive and TPP increase at a diminishing rate.

In phase III, negative returns to a factor occur when MPP is negative and TPP starts following.



TERMINAL EXERCISE

1. Define production
2. Define production function
3. Distinguishes between short period and long period production functions.

4. What is meant by IPP?
5. Define APP.
6. Define MPP.
7. Explain the relationship between TPP and MPP.
8. Explain the relationship between APP and MPP.
9. Explain the law of variable proportions with the help of a schedule and a diagram.
10. What are the reasons of the operation of law of variable proportions?
11. What are general shapes of APP and MPP?
12. Distinguish, between fixed factors and variable factors.



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ANSWERS IS INTEXT QUESTIONS

17.1

- (i) Reads section 17.1
- (ii) Reads section 17.2
- (iii) Read sections 17.2 (i) and (ii) Basic concepts

17.2

- (i) Read section 17.3 (i) (Primary inputs)
- (ii) Read section 17.3 (ii) (Secondary inputs)
- (iii) Read section 17.3 (i) Variable inputs)
- (iv) Read section 17.3 (ii) Fixed inputs)
- (v) Read section 17.3
- (vi) Read section 17.4
- (vii) Read section 17.4
- (viii) Read section 17.4
- (ix) Read section 17.4
- (x) Read section 17.5



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COST OF PRODUCTION

Cost analysis is the life line of modern business. It cannot be ignored at any cost for the success of any business organisation. On analysis of cost is required. A producer can supply/produce the product by organising the factors of production. That means the producer has to hire or purchase land, labour, capital, etc. by paying price. So, to produce the product the firm or producer must incur some expenditure and the expenditure so involved is called cost of production. This lesson is aimed at discussing this aspect of production called cost of production.



OBJECTIVES

After completing this lesson, you will be able to:

- define cost of production;
- distinguish between the meaning of cost as used in business and as used in economics;
- explain the meaning and importance of various concepts of cost such as, explicit cost, implicit cost and normal profit, fixed costs and variable costs; and
- find out total fixed cost, total variable cost, average fixed cost, average variable cost, average total cost and marginal cost.

18.1 DEFINITION OF COST AND COST FUNCTION

Cost is defined as the expenditure incurred by a firm or producer to purchase or hire factors of production in order to produce a product. As you know, factors of production are land, labour, capital and entrepreneurship. In the production process, the entrepreneur organises land, labour, capital and raw materials to produce output. As a producer he/she has to pay rent for land, wages to labour and interest to procure capital. The producer must also be compensated for his/her

services which is called normal profit. Wages, rent, interest, profit are called factor costs of production. Besides these, the producer also incurs expenditure on raw materials, electricity, water, depreciation of capital goods such as machines and indirect taxes etc. The producer also uses the services of certain factors supplied by his/her own self. The imputed value of such inputs also form the part of cost.

Cost Function

Since the producer who produces output incurs cost, we can say that cost is a function of output. It means that cost of production will increase or decrease, depends on whether level output is increasing or decreasing.

In the lesson on production, you have studied that output depends on factors of production such as labour, capital. Hence cost is related to expenditure on these factors. If the producer hires more amount of factors, cost will automatically increase and vice versa.

18.2 TYPES OF COST

(a) Explicit Costs (Money Costs)

A firm purchases the services of assets like building, machine etc. It pays hiring charges for building, normally termed as rent. It employs workers, accountant manager etc. and pays wages and salaries to them. It borrows money and pays interest on it. It purchases raw material, pays electricity bills and makes such other payments. All such actual payments, on purchasing and hiring different goods and services used in production are called '**explicit costs**'.

Normally, in business, the accountant takes into account only the actual money expenditure as cost. So in business the cost is normally the '**explicit cost**' only.

(b) Implicit costs (Imputed costs) :

Many a times, we find that all inputs are not always bought or hired by the producer from the market. Some of the inputs are provided by the entrepreneur or producer himself. He may use his own building. He may invest his own money in the business. He may be the manager of his own firm. A farmer may cultivate his own land. If a producer had taken a building from another production unit, he would have paid rent. In the same way, if he had borrowed money he would have paid a certain amount of interest. Similarly, if he had engaged a manager he would have paid him a salary. But he is not paying these amounts explicitly i.e. (rent for his building, interest on his money and salary for his services) because he has contributed them for his own business. So market value of these self-owned and self supplied inputs must be calculated. It is, therefore, a cost to the producer. We can make an estimate





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of these costs on the basis of their prevailing market prices. Let us term such costs as '**implicit costs**' (to distinguish them from explicit costs). These are also termed as imputed costs. One example of such cost is the imputed rent of the self owned factory building. It can be taken as equivalent to the actual rent paid for a similar type of building. Similarly, we can find out imputed interest and imputed wages.

In microeconomics, in addition to the paid out cost, imputed cost is also included in the cost of production.

Opportunity cost

Economists define opportunity cost as the value of next best alternative foregone. What does this mean? It is a common practice that a person makes a list of several activities before adopting a particular one to pursue his/her goal. Similarly, in production a producer leaves some alternatives before finally choosing to produce the particular output. So, while finally choosing one, the producer did forego the alternative production. Let us take example of a farmer. He can produce either rice or wheat on a piece of land. If he has decided to produce wheat on this piece of land, he has to forego the production of rice for producing wheat. So, value of rice foregone (next best alternative) is the opportunity cost of producing wheat.

18.3 NORMAL PROFIT AS COST OF PRODUCTION

Another component of cost is '**normal profit**'. Normal profit is an additional amount over the monetary and imputed cost that must be received by an entrepreneur to induce him to produce the given product. Normal profit is entrepreneur's opportunity cost and therefore enters into cost of production. Opportunity cost is the value of the opportunity or alternative that is sacrificed. You may be wondering how is it that profit is an element of cost. We will try to convince you.

For that let us first understand the meaning of the term '**normal profit**'. It is nothing but the minimum assured profit in the next best occupation. Normal profit is the reward which an entrepreneur must receive for the risk and uncertainties he bears in the production of a commodity. It can be understood with an example. Suppose there is a publisher who has the option of publishing commerce books or science books. He chooses to publish commerce books because he gets higher return from these. Now, suppose, that the market for science books is more assured but profit is lower. This would mean that the publisher who is publishing commerce books is sacrificing an assured return on science books and is taking a risk. He would be prepared to face the risk only when he thinks that he would be able to get at least the same profit which he would have in any way got from science books. Loss of assured return on science books is then an element of cost for the

publisher who is publishing commerce books instead of science books. It is termed as **'normal profit'** because it is an estimate of the minimum expectations of a producer from a business. So long as he gets this minimum, he will continue to publish commerce books. If, at any stage, he does not get this amount, he will shift to the publication of science books. So, in order that a producer continues to produce a commodity he must get normal profit in addition to recovering his **'explicit cost'** and **'implicit cost'**. We hope you are now convinced that minimum expectation of a producer from a business is also an element of cost.



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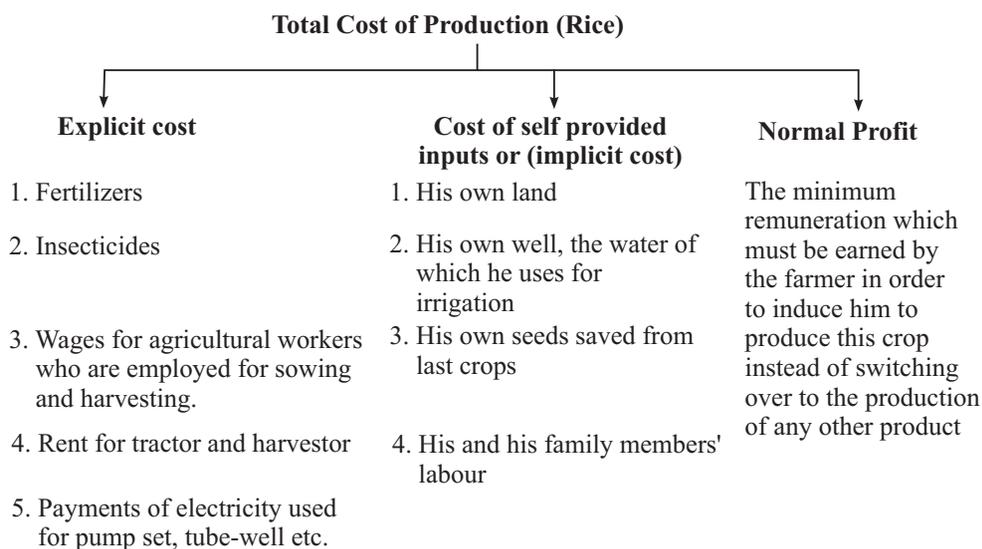
There are three elements of the total cost of production in micro economics

- (a) Explicit costs
- (b) Implicit costs and
- (c) Normal profits.

In business accounts only explicit costs are treated as cost.

Let us consider an example of the total cost elements for a farmer, He requires following inputs to produce say rice; a piece of land; agricultural workers; tools and implements; tractor and harvester; water, seeds, manures, power, and many other things. He will either provide these inputs himself or he will purchase them from the market. Suppose; some of these inputs he provides himself and some of these he purchases from the market (see the following chart).

Chart Showing the Cost Elements for a Farmer





Notes



INTEXT QUESTIONS 18.1

1. Fill in the blanks using appropriate word from the choice given in brackets:
 - (i) Paid out cost is (explicit cost, implicit cost).
 - (ii) Normal profit a part of cost of production in micro economics (is, is not).

2. Some of the cost elements of a publisher are given below. Allocate them into explicit cost and implicit cost : (i) his own labour (ii) expenditure on papers, ink, electricity etc. (iii) expenditure on printing machine (iv) insurance premium (v) payments of wages and salaries to workers (vi) his own building where he prints the books and (vii) expenditure on transport to bring raw material like papers, ink etc.

18.4 PRIVATE AND SOCIAL COSTS

(a) Private Costs

While producing a commodity a firm has to pay for raw material; it has to pay wages of workers; it has to pay rent of building. These are private costs for the firms. Thus private costs are the expenditure of an individual firm in producing a commodity.

(b) Social Costs

Factories emit large amount of smoke from their chimneys into the atmosphere. This may not figure in the calculation of costs in their records. But the cost to the community may be in the form of additional washing bills for clothes and the money spent by the community on medical bills etc. These costs are social costs.

18.5 MONEY COST VS REAL COST

The explicit cost and the private cost referred above are actually incurred by the producer in money terms. So, they are also called money cost. Wage to labour, rent for building, interest on borrowed funds etc. are paid in monetary units and hence called money cost.

Real cost, on the otherhand, has no definite money value nor it can be measured in monetary terms. A producer makes a lots of sacrifices and toils hard to set up business. The pain, discomfort, stress and strain that he/she undergoes cannot be measured in money. This is called real cost to the producer. The sacrifice, discomfort, disutility, toils and efforts involved in supplying factors of production by their owners make real cost of production.

18.6 NATURE OF COST IN PRODUCTION PROCESS

You have already studied that production process, in the short run, involves fixed and variable factors whereas in the long run all factors are variable. Accordingly, cost of production is calculated depending on whether production is taking place in short run or in the long run.

Cost in the short run: Fixed vs variable cost : In the short run two types of factors are identified. One, fixed factors which cannot be changed and two, variable factors which can be changed to increase output. Fixed costs are those costs which do not change with any changes in the quantity of production or size of output during period. They remain constant during the whole period at any level of output. Whether the production is zero or less or more. Then cost are fixed in nature. Fixed costs are also known as supplementary cost. Let the rent of a factory building paid by the producer is ₹ 1000 per month. Whether the producer produces the output or not, he/she has to pay the rent after hiring the building.

On the other hand variable cost are those cost which vary with the change in the quantity of output or production. They do not remain constant and are variable in nature. Their cost increase with increase in output and decrease with a decrease in output. These costs are related to variable factor of production. They are also known as direct cost or prime cost. For example, labour is called variable factor in the short run. So, wage paid to labour is a variable cost. In order to increase output, producer can hire more units of labour. So, the expenditure on wages will increase. If output level is to be reduced, then producer can reduce the amount of labour and accordingly less amount of wage will be paid. So variable cost varies with change in level of output.

18.7 CALCULATION OF FIXED AND VARIABLE COST

TFC Total expenditure on fixed factors is called total fixed cost (TFC)

TVC Total expenditure on variable factors is called total variable cost (TVC)

TC Sum of TFC and TVC is the total cost (TC)

$$TC = TFC + TVC$$

(c) Illustration

The concepts of fixed costs and variable costs can be understood better with the help of a schedule and an illustration. Suppose, a firm producing pens incurs the following costs at different levels of output (as given in Table 18.1): You will see that its fixed cost remains constant whereas variable cost changes with every change in level of output. In this schedule, the fixed cost is ₹ 60 and remains the



Notes



Notes

same at all levels of output. The variable cost is ₹ 60 when the producer is producing 100 pens. It rises to ₹ 100 when he produces 200 pens and to ₹ 150 when he produces 300 pens and so on.

Table 18.1 : Cost Schedule of a Firm

No. of pens in units (1 unit = 100 pens)	Total fixed cost (₹)	Total variable cost (₹)
0	60	0
1	60	60
2	60	100
3	60	150
4	60	260
5	60	390



INTEXT QUESTIONS 18.2

State whether the following statements are true or false:

- (i) With increase in the quantity of output fixed costs increase.
- (ii) There are no variable costs at zero output
- (iii) Expenses incurred on watchmen and property tax are fixed cost.
- (iv) Variable costs change with every change in output.
- (v) Cost incurred on all the labour is variable.

18.8 CALCULATION OF COST

Total cost of a given volume of output is the sum of the explicit and implicit costs and normal profit. In the previous section we have learnt that production costs are classified into fixed cost and variable cost.

These two costs together make total cost

i.e., $TC = TFC + TVC$

where TC stands for total cost, TFC for total fixed cost and TVC for total variable cost.

When a production unit is established but there is no production, total cost is the same as the total fixed cost. As production takes place, variable cost is also incurred and so total cost changes. Total cost increases as the quantity of output

risers, The change in total cost equals the change in total variable cost. This is because total fixed cost remains constant at all quantities of output. Change in total cost is due to changes in variable cost only. The calculation of total cost can be explained through the following example :

Table 18.2 : Cost Schedule of a Pen Producer

No. of pens in units (one unit = 100 pens)	TFC (₹)	TVC (₹)	TC (TFC+TVC) (₹)
0	60	0	60
1	60	60	120
2	60	100	160
3	60	150	210
4	60	260	320
5	60	390	450



Notes

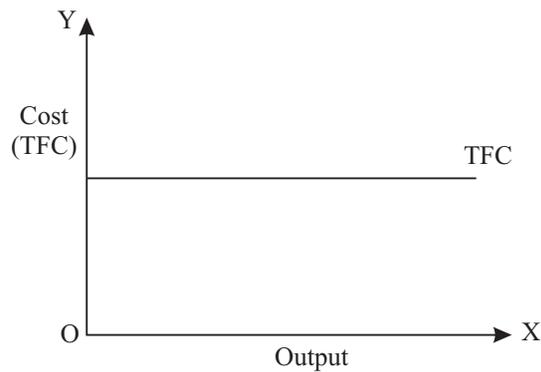


Fig. 18.1

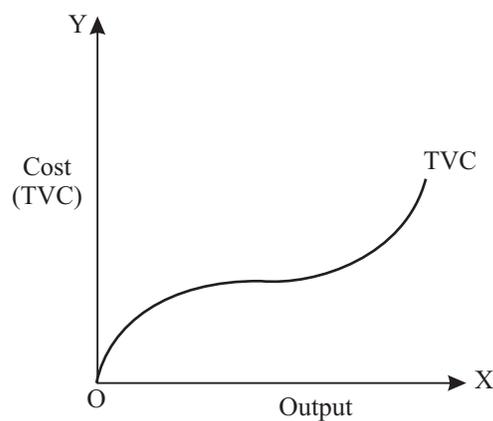


Fig. 18.2



Notes

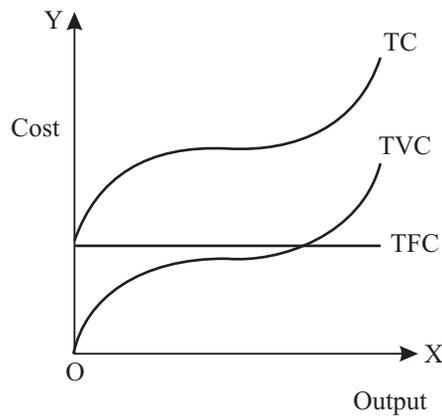


Fig. 18.3

The Table 18.2 shows that total fixed cost is ₹ 60 and remains the same at all quantities of output. The variable cost equals ₹ 60 when one unit is produced, increases to ₹ 100 at 2 units and to ₹ 150 at 3 units and so on. As the total cost is the sum of total fixed cost and total variable cost, it can be obtained by adding them at various quantities of output. For example, when one unit is produced total cost is ₹ 120 (₹ 60 + ₹ 60) and when two units are produced, it works out to be ₹ 160 (₹ 60 + ₹ 100). Thus, we find that total cost varies directly with the level of output.



INTEXT QUESTIONS 18.3

Fill ill the blanks with appropriate words given in the brackets:

- (i) Changes in total cost when output varies are due to changes in
(fixed cost, variable cost).
- (ii) To find total cost we have to total fixed cost and total variable
cost (add, multiply)
- (iii) Total cost zero at zero output (is, is not).
- (iv) When output is zero total cost equals(fixed cost, variable cost).

18.9 AVERAGE COST

In this section, we will discuss the concepts of average fixed cost (AFC), average variable cost (AVC) and average total cost (ATC). We make the following schedule showing calculations of these costs:

Table 18.3 : Cost Schedule of a Pen Producer

Output of pens(1 unit = 100 pens)	TFC (₹)	TVC (₹)	TC (TFC+TVC) (₹)	AFC ₹	AVC ₹	ATC (AFC+AVC) (₹)
0	60	0	60	-	-	-
1	60	60	120	60	60	120
2	60	100	160	30	50	80
3	60	150	210	20	50	70
4	60	260	320	15	65	80
5	60	390	450	12	78	90



Notes

(a) Average Fixed Cost (AFC) :

Average fixed cost is obtained by dividing total fixed cost by the number of units of output produced.

$$AFC = \frac{TFC}{\text{Units of output}}$$

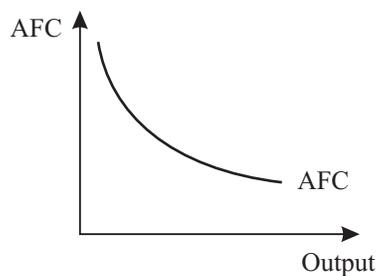


Fig. 18.4

Thus, Average Fixed Cost is per unit fixed cost in producing a commodity or fixed cost per unit of output.

Fixed cost by definition remains fixed whatever is the level of output. Therefore, as production expands the total fixed cost is distributed over a larger numbers of units. As a result average fixed cost falls with every increase in output. For example, the total fixed cost of our producer is ₹ 60 when he produces one unit. Average fixed cost is ₹ 60 (₹ 60 ÷ 1) But if the production is increased to 2 units, average fixed cost is ₹ 30 (₹ 60 ÷ 2). When he produces 3 units it is ₹ 20 (₹ 60 ÷ 3). Therefore, the larger the output the lower will be the average fixed cost.



Notes

(b) Average Variable Cost (AVC)

Average variable cost is obtained by dividing the total variable cost by the units of output produced.

$$AVC = \frac{TVC}{\text{Units of output}}$$

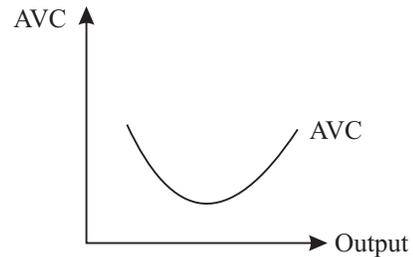


Fig. 18.5

Thus, average variable cost is per unit variable cost in producing a commodity or variable cost per unit of output.

When output of pens is one unit TVC is ₹ 60, so AVC will be ₹ 60 (₹ 60 ÷ 1). TVC at 2 units of pens is ₹ 100. So AVC at 2 units of output of pens is ₹ 50 (₹ 100 ÷ 2) and so on.

(c) Average Total Cost (ATC) :

ATC is obtained by dividing the Total Cost (TC) by the total units of output:

$$ATC = \frac{TC}{\text{Units of output}}$$

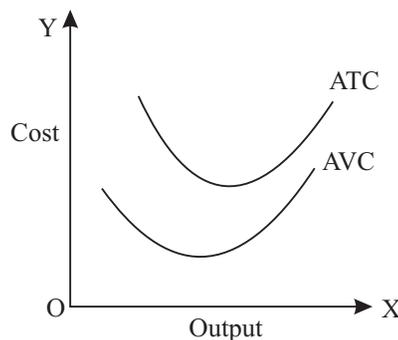


Fig. 18.6

Thus, total cost is the per unit total cost in producing a commodity or cost per unit of output.

The total cost of producing one unit of pen is ₹ 120. Therefore, ATC is ₹ 120 (₹ 120 ÷ 1).

Total cost of 2 units of output is ₹ 160. So ATC is ₹ 80 (₹ 160 ÷ 2). As total cost is the sum of TFC and TVC, average total cost is the sum of AFC and AVC. So we can also find out ATC by adding AFC and AVC :

$$ATC = AFC + AVC$$

$$\frac{TC}{\text{Units of output}} = \frac{TFC}{\text{Units of output}} + \frac{TVC}{\text{Units of output}}$$

Check up from the schedule that ATC can also be calculated in this manner.



Notes



INTEXT QUESTIONS 18.4

Fill in the blanks with appropriate words given in the brackets:

- (i) Average cost is (cost per unit, cost incurred on additional unit).
- (ii) To find total cost we have to average cost by quantity of output (multiply, divide).
- (iii) Average fixed cost with the increase in output (falls, rises).
- (iv) Average total cost is the sum of and (average fixed cost, average variable cost, variable cost, fixed cost).

18.10 MARGINAL COST

The concept of marginal cost is a very important concept in micro economics. The importance of this concept will be more clear to you when you read lesson No. 20 on 'Maximisation of Profits'. The word marginal should be taken to mean additional. For example, Marginal cost of producing a level of output is the addition to the total cost or total variable cost caused by producing an extra unit of output.

$$MC_N = TC_N - TC_{N-1}$$

or
$$MC_N = TVC_N - TVC_{N-1}$$

To explain how it is calculated, look at the following Table.

Table 18.4

Output of pens (1 unit = 100 pens)	Total cost (₹)	Marginal cost (₹)
0	60	—
1	120	60
2	160	40
3	210	50
4	320	110
5	450	130



Notes

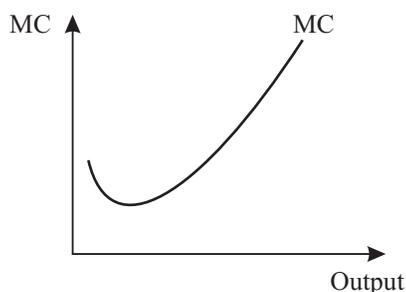


Fig. 18.7

When output level is zero, total cost is ₹ 60. As one unit of pen is produced by the producer the total cost rises to ₹ 120. So the marginal cost of producing one unit of output is ₹ 60 (₹ 120-₹ 60). When it produces 2 units his total cost increases to ₹ 160; the marginal cost at 2 units of output is ₹ 40 (₹ 160-₹ 120). This has been calculated by deducting total cost of 1 unit from total cost of 2 units. Marginal cost at one unit of output is ₹ 60. This we got by deducting total cost of zero unit from total cost of one unit.

It should be kept in mind that marginal cost is dependent on the variable cost only. It is not affected by fixed cost because fixed cost remains constant. As output expands, changes in total cost are due to changes in variable cost only. So, marginal cost can also be calculated if only total variable costs are known to us. For example, take the following Table 18.5 showing TFC, TVC and TC. When we calculate MC from either TC or TVC we get the same result. Calculate yourself and the check the result.

Table 18.5

Output of pens (1 unit = 100 pens)	Total cost (₹)	TFC (₹)	TVC (₹)	MC (₹)
0	60	60	0	–
1	120	60	60	60
2	160	60	100	40
3	210	60	150	50
4	320	60	260	110
5	450	60	390	130



INTEXT QUESTIONS 18.5

Fill in the blanks:

- (i) Marginal cost is the cost incurred on additional unit of output.

- (ii) Marginal cost equals the change in total cost or the change in per unit change in output.
- (iii) Output increases from 3 units to 4 units. As a result TC rises from ₹ 19.60 to ₹ 24.50. MC is

18.11 RELATIONSHIP BETWEEN AC, AVC AND MC

The relationship between AC, AVC and MC can be illustrated with the help of the table 18.6 and diagram 18.8.

Output (Units)	TVC (₹)	AVC (₹)	MC (₹)
0	0	—	—
1	6	6	6
2	10	5	4
3	15	5	5
4	24	6	9
5	35	7	11

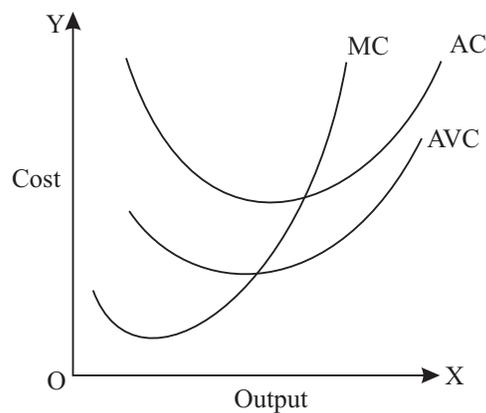


Fig. 18.8

(a) Relationship between AC and MC

- (i) When MC is less than AC, AC falls with increase in the output
- (ii) When MC becomes equal to AC, AC becomes minimum and constant.
- (iii) When MC is more than AC, AC rises with increase in the output.



Notes



Notes

(b) Relationship between AVC and MC

- (i) When MC is less than AVC, AVC falls with increase in the output
- (ii) When MC becomes equal to AVC, AVC becomes minimum and constant.
- (iii) When MC is more than AVC, AVC rises with increases in the output

**WHAT YOU HAVE LEARNT**

- In Micro Economics, cost is the sum of (a) explicit cost (b) implicit cost and (c) normal profit. It is different from cost used in business which includes only explicit cost.
- Explicit cost is the cost of inputs hired and purchased from the market. It is also called money cost.
- Implicit cost is the cost of the inputs which are owned and supplied by the entrepreneur himself in the production of a commodity. It is equal to the opportunity cost of these inputs.
- Normal profit is the minimum supply price of the entrepreneur which he must get in order to remain in the present business.
- Private cost is the cost which a firm has to incur in the production of a commodity.
- Social cost is the cost to the society as a whole for producing a commodity in the form of air-pollution, water-pollution and noise pollution etc.
- Fixed costs are the costs which do not change with change in the level of output.
- Variable costs are the costs that directly vary with changes in the level of output.
- Total cost is the sum of Total Fixed Cost (TFC) and Total Variable Cost (TVC).
- Average Fixed Cost is the per unit fixed cost of the output produced. It goes on decreasing with increase in output.
- Average Variable Cost (AVC) is the per unit variable cost of output produced.
- Average Total Cost (ATC) is the sum of the AFC as AVC.
- Marginal Cost (MC) is the addition to TC/TVC by the production of an additional unit of the product.



TERMINAL EXERCISE

1. What is implicit cost? How is it different from explicit cost?
2. What is explicit cost? Distinguish it from implicit cost.
3. Explain the concept of 'normal profit'. Justify that it is an element of cost in micro economics.
4. Explain the various elements of cost in micro economics.
5. Differentiate between the concepts of cost as used in business and in micro economics.
6. Distinguish between fixed cost and variable cost with suitable examples.
7. Explain the relationship between output and average fixed cost.
8. Distinguish between AFC and AVC and describe how these are calculated.
9. Explain the term 'marginal cost'. Show with the help of an example how is it calculated.
10. Which cost, fixed or variable, determines marginal cost? Give reasons.
11. Classify the following expenditure into explicit cost and implicit cost:
 - (a) A farmer growing seeds and using them for cultivation
 - (b) Use of chemical fertilizers by a farmer.
 - (c) Use of the services of a tractor owned by the farmer
 - (d) Farming by the farmer who owns the land
 - (e) Unpaid family labour used on farms
 - (f) Transport charges
 - (g) Interest on borrowings
 - (h) Wages paid
 - (i) Use of own building for production
 - (j) Excise duty.
12. Classify the following expenditure into fixed cost and variable cost :
 - (a) Rent of the factory building
 - (b) Wages to watchman
 - (c) Annual licensing fee of factory premises
 - (d) Raw material
 - (e) Rent of the agricultural land



Notes



Notes

- (f) Seeds
- (g) Fertilizers
- (h) Interest on borrowings
- (i) Excise duty
- (j) Transport charges.

13. Calculate total cost, average total cost, average fixed cost, average variable cost and marginal cost on the basis of the following information:

Output (units)	TFC	TVC
0	60	0
1	60	50
2	60	90
3	60	180
4	60	300

14. Calculate (i) TFC and TVC (ii) AFC and AVC and (iii) MC from the following data :

Output (units)	TC
0	180
1	300
2	400
3	510
4	720
5	1000

15. Suppose that TFC is ₹ 120, find out

TC, TVC and MC from the following data :

Output (units)	ATC (₹)
1	240
2	160
3	~140
4	160
5	180

16. Fill in the blanks :

Output (units)	TC	TFC	TVC	MC
0	12	-	-	-
1	20	-	-	-
2	24	-	-	-
3	30	-	-	-
4	44	-	-	-



Notes

17. Complete the following table :

Output (units)	Total fixed cost	Total cost	ATC	Marginal cost	AFC
0	8			-	8
1				12	
2				10	
3				8	
4				6	
5				5	



ANSWERS TO INTEXT QUESTIONS

18.1

- (i) explicit cost
(ii) is
- Explicit cost: (ii) (iii) (iv) (v) and (vii)
Implicit cost: (i) and (vi)

18.2

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

18.3

- (i) variable cost (ii) add (iii) is not (iv) fixed cost



Notes

18.4

(i) cost per unit (ii) multiply (iii) falls (iv) average fixed cost, average variable cost

18.5

(i) additional (ii) Total variable cost (iii) ₹ 4.90

Terminal Exercise

1. Read section 18.3 (b)
2. Read section 18.3 (a)
3. Read section 18.3 (c)
4. Read section 18.3
5. Read section 18.3
6. Read section 18.5
7. Read section 18.7 (a)
8. Read section 18.7 (a, b)
9. Read section 18.8
10. Read section 18.8
11. Explicit costs : b, f, g, h, j
Implicit costs : a, c, d, e, i
12. Fixed cost: a, b, c, e, h
Variable cost: d, f, g, i, j
- 13.

Total Cost (₹) TFC+TVC	AFC	AVC	ATC	MC
60	-	-	-	-
110	60	50	110	50
150	30	45	75	40
240	20	60	80	90
360	15	75	90	120



Notes

14.

Output (units)	TC ₹	TFC ₹	TVC ₹	AFC ₹	AVC ₹	MC ₹
0	180	180	0	-	-	-
1	300	180	120	180	120	120
2	400	180	220	90	110	100
3	510	180	330	60	110	110
4	720	180	540	45	135	210
5	1000	180	820	36	164	280

15.

Output (units)	ATC	TC	TFC	TVC	MC
1	240	240	120	120	120
2	160	320	120	200	80
3	140	420	120	300	100
4	160	640	120	520	220
5	180	900	120	780	260

16.

Output (units)	TC ₹	TFC ₹	TVC ₹	MC ₹
0	12	12	0	-
1	20	12	8	8
2	24	12	12	4
3	30	12	18	6
4	44	12	32	14

17.

Output (units)	Total fixed cost	Total cost	Marginal cost	ATC	AFC
0	8	8	-	-	-
1	8	20	12	20	8
2	8	30	10	15	4
3	8	38	8	12.66	2.66
4	8	44	6	11.00	2.00
5	8	49	5	9.80	1.60

MODULE - 7

Producer's Behaviour



Notes

19

SUPPLY

We have already studied about the meaning of demand, factors determining demand and the law of demand etc. the demand for the commodities comes from the buyers of the commodities. But the buyers can purchase a commodity only when it is available in the market. The firms produce goods and services which are demanded by the households for the satisfaction of their wants. Firms have to incur some expenditure on the purchase of inputs required for producing the goods and services. They get revenue by selling these goods and services. In this process, the firms have an objective of earning maximum profit. The focus of this chapter is to understand why a firm or a seller is willing to sell its product in the market. We assume that there are no intermediaries in the market, so the firm is also the seller of the commodity.



OBJECTIVES

After completing this lesson, you will be able to:

- define supply;
- discuss the factors that affect the supply;
- know the meaning of supply function;
- prepare a supply schedules from supply function;
- state and explain the law of supply;
- differentiate between individual and market supply;
- prepare and individual and market supply schedule;
- draw an individual and market supply curves;
- distinguish between change in supply and change in quantity supplied; and
- differentiate between movement along a supply curve and shift of supply curve.

19.1 MEANING OF SUPPLY

supply a commodity by a firm or seller **may be defined as the quantity of a commodity that a firm or seller offers for sale at a given price during a given time period.** But the actual sale of the commodity may be different from its supply. For example a farmer (producer of wheat) is willing to sell 50 quintals of wheat at a price of ₹ 15 per kg but he is able to sell only 30 quintals at this price. So in this case the supply of wheat is 50 quintals but the actual sale is 30 quintals. So these two concepts should not be confused with each other. Like demand supply also has three elements. The definition of supply includes (i) the quantity of the commodity that a firm is willing to supply (ii) the price at which it is willing to supply that quantity and (iii) the time period during which it is willing to supply that quantity.



Notes

19.2 FACTORS DETERMINING SUPPLY OR DETERMINANTS OF SUPPLY OF A GOOD

The main determinant of supply is the price of the commodity. But the cost of production of a commodity is an important factor in determining profit maximized on output of a firm. The cost of production depends on the prices of various inputs, like raw material, wages of workers, interest of capital, rent of building etc. The supply of a commodity also depends on the technology used in the production of the commodity and many other factors. The main factors determining supply of a commodity are

- (i) Price of the commodity
 - (ii) Price of other related good
 - (iii) Price of inputs/factors
 - (iv) Taxation policy of government
 - (v) Objective of the firm
- (i) **Price of the commodity:** Other factors determining supply remaining constant, there is a direct relationship between price and quantity supplied of a commodity. It means the quantity supplied of a commodity increases with rise in price and decreases with fall in price of the commodity. More quantity of a commodity is supplied at a higher price and less quantity is supplied at a lower price. For example a seller of tomatoes is willing to sell 100 kgs of tomatoes at a price of ₹ 40 per kg and only 50 kgs at a price of ₹ 20 per kg. Due to this direct relationship between price and quantity supplied of a commodity the supply curve has a positive slope. Supply curve is upward sloping to the right.
- (ii) **Price of other related goods:** Supply of a commodity is also influenced by the change in the price of other related goods. With the help of given resources



Notes

we can produce several goods by using the same technology. This helps the firm to diversify and tide over fluctuations in demand. For example, a farmer can produce either pulses or food grains by using the resources. If the price of pulses increases it becomes more profitable for him to make more production of pulses. So he will divert some resources from the production of food grains to the production of pulses. The production of pulses will increase and that of food grains will decrease. So the supply of pulses will increase if the price of pulses increases and the supply of food grain will decrease at the same price reverse will happen if the price of food grains increases.

- (iii) **Price of inputs/factors:** Change in the price of inputs like raw material, wage, rent or interest also influences the supply of a commodity. For example, in the production of cloth, cotton is the main raw material. If the price of cotton increases, the cost of production of cloth will increase. At the same price, the margin of profit will decrease. So the producer will decrease the supply of cloth at the same price. On the other hand if the price of cotton falls, the cost of production per unit of cloth will decrease and hence the supply of cloth will increase. The price of other inputs will also influence the supply of a good in the same manner.
- (iv) **Technology of production:** an improvement in the technology of production of a commodity decreases the per unit cost of the commodity. The margin of profit will increase at the same price. So the supply of a commodity will increase, with improvement in technology of production, at the same price. On the other hand if a firm uses absolute technology of production, the cost of production per unit of the commodity will increase. The margin of profit will decrease, so the firm will decrease its supply at the same price. This is the main reason that the firms are trying to use better technology of production because it not only reduces the cost of production per unit but also improves the quality of the product.
- (v) **Taxation policy of government:** If the government reduces the excise duty or the production of a commodity, the cost of production per unit of the commodity will decrease, the margin of profit will increase at the same price so the producer of the commodity will increase its supply. It happens when the government wants to increase the production of the commodity. On the other hand to discourage the production of some harmful goods, like cigarettes, liquor etc, the government increases the rate of excise duty on the production of such goods. So the cost of production per unit of the commodity increases and the supply of such commodities decreases.
- (vi) **Objective of the firm:** The objective of the producer also influences the supply of a commodity. Generally, the objective of a producer is get maximize his profits. Profits are maximized at a higher price. So he increases the supply

of a commodity at a higher price and decreases its supply at a lower price. But sometimes, the producer may be in maximizing his sales and not in maximizing his profits as he wants to capture the market. In that case, he goes on increasing the supply so long his target is not achieved can profit is not adversely affected. He may increase the supply at the same price to any extent.



INTEXT QUESTIONS 19.1

1. Define supply.
2. What is the meaning supply?
3. State any three determinants of supply.
4. How does technological progress influence the supply of a commodity?
5. What is the effect of change in price of inputs on the supply of a commodity?
6. How does change in the price of other related goods affect the supply of a commodity?

19.3 SUPPLY FUNCTION

When the relationship between quantity supplied and the determinants of supplied is expressed mathematically in an equation, it is called a supply function. So a supply function can be expressed as:

$$S_n = f(P_n, P_r, P_f, T, T_r, G)$$

where S_n = Supply of commodity n

P_n = Price of the commodity n

P_r = Price of other related goods

P_f = Price of inputs/factors

T = Technology of production

T_r = Government policy or tax rate

G = Goal or objective of the producer

Typically supply function shows the relationship between price and quantity supplied, keeping all other determinants of supply as constant. It shows the amount of a good that a seller supplies at different levels of price.

For example, a supply function can be

$$q_s = -15 + 3P$$





Notes

In the above equation quantity supplied q_s is a function of price P . The sign before p is always positive which indicates that the price and quantity supplied are directly related and the supply curve is upward sloping to the right. Here $+3$ means that the every unit increase in price there is an increase of 3 units in supply. -15 in the supply function represents the point at which the supply curve cuts x-axis.

We can derive a supply schedule with the help of supply function.

Table 19.1: Supply schedule of commodity x

Price of unit (₹)	Quantity supplied per unit of time (units)
5	0
6	3
7	6
8	9
9	12

The above table shows that for the price levels more than ₹ 5, there is a positive quantity supplied. But for ₹ 5, or less than ₹ 5, the supply of commodity x is zero because supply can not be negative.

19.4 LAW OF SUPPLY

The law of supply depicts the relationship between price and quantity supplied of a commodity when all other determinants of supply remain constant. This law states that there is a direct relationship between price and quantity supplied of a commodity, other factors determining supply remaining constant. It means quantity supplied of a commodity increases with increase in price and decreases with decrease in price.

19.4.1 Assumptions of the law of supply

The phrase other determinants of supply remaining constant in the law of supply shows the assumptions of the law of supply. The main factors which influence the supply of a commodity are, price of the commodity, price of other related goods, price of inputs, technology of production, taxation policy of the government and objective of the firm etc. The law of supply is based on the assumptions that all these factors determining supply except price of the commodity should remain constant. The following are the main assumptions of the law of supply.

- (i) Price of other related goods should remain the same
- (ii) There should be no change in the price of inputs (factors)

- (iii) Technology of production should not change.
- (iv) There is no change in the taxation policy of the government.
- (v) Objective of the firm should not change

The law of supply is based on the assumptions that the supply of commodity changes only due to change in price when all other determinant of supply remain constant.



Notes

19.4.2 Individual and Market Supply

Individual Supply

Individual supply refers to the quantity of a commodity which an individual firm is willing to sell at a given price during a given period of time. It is related with the supply of an individual firm.

Market Supply

Market supply is the collective supply of all the firms in the market of a commodity at a given price during a given period of time. Market supply tells us the total availability of a commodity which can be used to meet the total demand of the commodity. **Market supply can be derived by summing up the supply of all the individual firms in the market.**

19.4.3 Supply Schedule

Supply schedule is a table showing different quantities of a commodity that a firm is willing to sell at different prices during a given period of time. Supply schedule can be of two types.

- (i) *Individual supply schedule:* When we represent a single firm, willingness to sell different quantities of a commodity at different prices during a given time period, we get individual supply schedule.
- (ii) *Market supply schedule:* **Market supply schedule is constructed by summing up the supplies of all the individual firm at different prices during a given period of time.** A market supply schedule is a table showing the total supply of a good by all the firms at different price during a given time period. Market supply schedule can be explained with the help of the following table.



Notes

Market supply schedule for sugar

Price per kg (₹)	Quantity supplied of sugar by firm A (kgs)	Quantity supplied by firm B (kgs)	Quantity supplied by firm C (kgs)	Market supply A + B + C (kg)
25	100	200	0	300
30	200	300	100	600
35	300	400	200	900
40	400	500	300	1200
45	500	600	400	1500

In the above table we see that at a price of ₹ 25 per kg the firms A, B and C willing to sell 100, 200 and 0 kgs of sugar respectively. So the market supply as ₹ 25 is $100 + 200 + 0 = 300$ kgs of sugar. In the same way the market supply has been calculated at other prices also. The market supply is influenced by the number of firms in the market.

19.4.4 Supply Curve

Supply curve is the graphical presentation of a supply schedule. It shows the quantity that all the firms in the market are willing to supply at a given price during a given time period when all other factors influencing supply remain constant. Supply curve is also of two types.

- (i) **Individual supply curve:** Graphical presentation of individual supply schedule is called individual supply curve. It shows the different quantities of a commodity, an individual firm is willing to sell at different prices during a given time period.
- (ii) **Market supply curve: Market supply can be derived by horizontal summation of all individual supply curve:** It show the different quantities of a commodity that all the firms are willing to sell at different prices during a given time period.

Let us assume that these are only 3 firms supplying sugar in the market. The supply curves of these firms are represented by SA, SB and SC respectively. If a t ₹ 30 per kg each firm is willing to sell 200, 300 and 100 kgs of sugar respectively. The market supply at ₹ 30 per kg is the sum of a the supply of the three firms $200 + 300 + 100 = 600$ kgs of sugar. This gives us one point A on the market supply curve as shown in the figure given below.

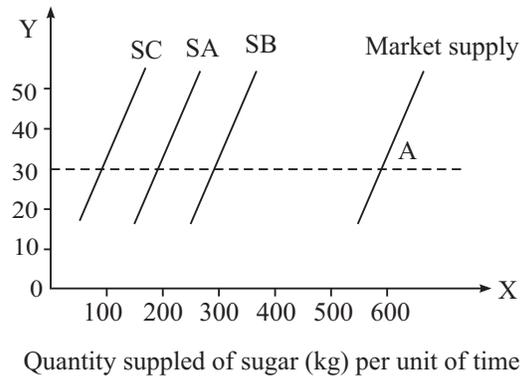


Fig. 19.1



INTEXT QUESTIONS 19.3

- (i) State the law of supply.
- (ii) Define market supply.
- (iii) What is supply schedule?
- (iv) How is market supply schedule deviated from individual supply schedule?
- (v) What is supply curve?
- (vi) How is market supply curve derived from individual supply curves?
- (vii) Explain the law of supply with the help of a schedule and a diagram.

19.5 FACTORS DETERMINING SUPPLY

All the factors determining supply of a commodity can be classified into two parts.

- (i) Price of the commodity
- (ii) Other factors determining supply

This classification is based on the fact that the law of supply or the supply curve shows the relationship between price and quantity supplied of a commodity when all other determinants of supply remain constant.

- (i) **Price of the commodity:** In the law of supply we have studied that the quantity supplied of a commodity increases with increase in price and decrease with decrease in price all other determinants of supply remaining constant. These increase and decrease in supply are also termed as expansion and contraction of supply respectively. Expansion of supply is shown through



Notes



Notes

an upward movement along the same supply curve on the other hand contraction of supply is shown through downward movement on the same supply curve.

Movement along the supply curve or expansion and contraction of supply can be explained with the help of the following diagram.

In the above figure initial price and quantity supplied are OP and OQ respectively. When the price increased from OP to OP1, the quantity supplied increases from OQ to OQ1. This is shown by upward movement from point A to point B on the same supply curve. This upward movement of the same supply curve shows the expansion of supply.

On the other hand when the price falls from OP to OP2, the quantity supplied decreases from OQ to OQ2. This is shown by downward movement from point A to point C on the same supply curve. This downward movement on the same supply curve shows the contraction of supply.

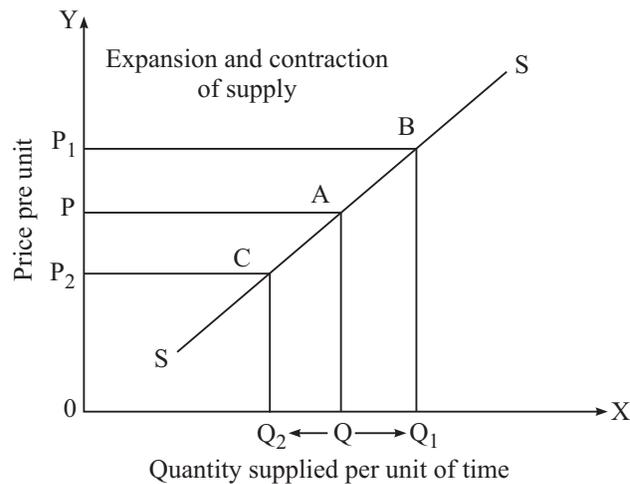


Fig. 19.2

We can say that change in price of the commodity leads to change in quantity supplied of the commodity. It is shown by movement on the same supply curve. Increase in quantity supplied reflects expansion of supply and decrease in quantity supplied reflects contraction of supply.

- (ii) **Other factors determining supply:** But if there is change in factors other than the price of the commodity, then either more is supplied at the same price or less supplied at the same price. In such cases, the price of the commodity remains constant but there is a change in other factors like change in the price

of inputs, change in technology of production, change in price of other related goods, change in taxation policy of the government etc.

For example, there is an improvement in the technology of production of the commodity in question. It leads to decrease in per unit of cost production of the commodity. The firm is willing to sell more quantity of the commodity at the same price. So the supply of the commodity increases at the same price. This increase in supply is shown by rightward shift of supply curve.

On the other hand if the firm uses inferior technology of production, the cost of production per unit of the commodity increases. The firm is willing to sell less quantity at the same price. So the supply of the commodity decreases at the same price. This decrease in supply is shown by leftward shift of the supply curve.

The above cases of increase and decrease in supply can be shown with the help of the following figures.

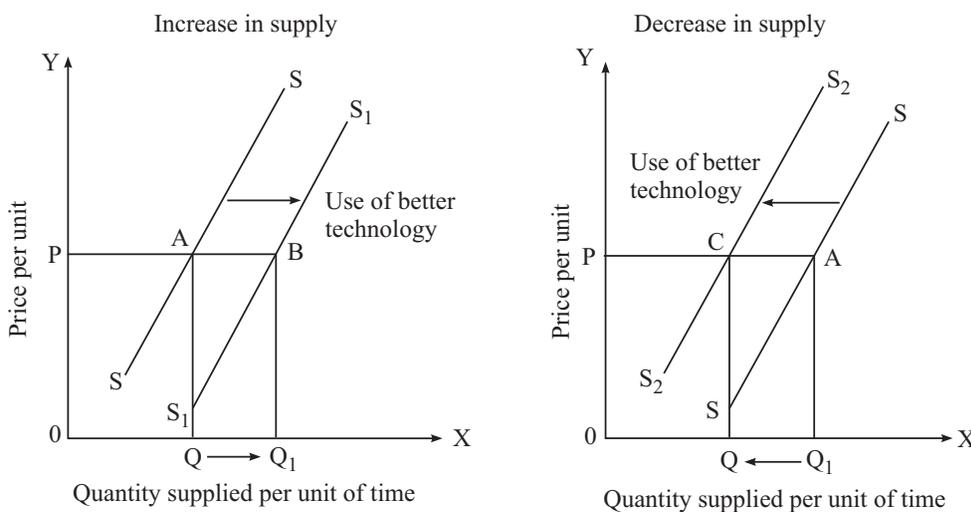


Fig. 19.3

19.5.1 Main factors causing increase in supply or rightward shift of supply Curve

- (i) Fall in the price of other related goods
- (ii) Fall in the price of inputs/factors
- (iii) use of better technology in production
- (iv) Decrease in the rate of excise duty by government
- (v) If the objective of producer changes from profit maximization to sales maximization



Notes



Notes

19.5.2 Main factors causing decrease in supply or leftward shift of supply curve

- (i) Increase in the price of other related goods
- (ii) Rise in the price of inputs/factors
- (iii) use of inferior technology in production
- (iv) Increase in the rate of excise duty by the government
- (v) If the objective of the producer changes from sales maximization to profit maximization.



INTEXT QUESTIONS 19.4

- (i) If the quantity supplied of a commodity falls only due to rise in its price, what is that fall in supply called?
- (ii) If the supply of a commodity rises due to improvement in technology, what is that rise in supply called?
- (iii) State any three factors causing increase in supply of a commodity.
- (iv) State any three factors causing decrease in supply of a commodity.
- (v) State any three factors causing rightward shift of supply curve.
- (vi) State any three factors causing leftward shift of supply curve.
- (vii) Distinguish between expansion in supply and increase in supply.
- (viii) Distinguish between decrease in supply and contraction in supply.
- (ix) Distinguish between movement along the same supply curve and shift of supply curve.
- (x) Distinguish between change in quantity supplied and change in supply.



WHAT YOU HAVE LEARNT

- Supply of a commodity refers to the quantity of a commodity that a seller is willing to sell at a given price during a specific period of time.
- Supply of a commodity is influenced by the factors (i) price of the commodity (ii) price of other related good (iii) Price of inputs/factor (iv) Technology of production (v) Taxation policy of the government (vi) Objective of the firm
- When the relationship between quantity supplied and determinants of supply is represented in a mathematical equation, it is called a supply function.

Supply

- The law of supply states that other factors determining supply remaining constant, there is a direct relationship between price and quantity supplied of a commodity.
- Supply schedule is a table which shows the different quantities of a commodity supplied at different prices.
- Supply curve is graphical presentation of supply schedule.
- Market supply schedule can be obtained by summing up all individual supply schedules.
- Market supply curve can be obtained by horizontal summation of all individual supply curves.
- Change in quantity supplied takes place only due to change in the price of the commodity.
- Change in supply takes place due to change in factors other than the price of the commodity.
- Increase in supply leads to rightward shift of supply curve and decrease in supply leads to leftward shift supply curve.
- Expansion of supply leads to upward movement and contraction of supply leads to downward movement on the same supply curve.



TERMINAL EXERCISE

1. Give the meaning of the term supply.
2. Explain in brief the various determinants of supply.
3. Define supply function.
4. Explain the law of supply and point out the main assumptions behind this law.
5. Distinguish between a supply schedule and a supply curve.
6. How is market supply curve derived from individual supply curves?
7. State the curves of increase in supply
8. How is it possible that a seller is ready to sell less quantity of commodity even at the same price.
9. Distinguish between movement along the supply curve and shift of supply curve.
10. Distinguish between decrease in supply and contraction of supply.

MODULE - 7

Producer's Behaviour



Notes

**Notes****ANSWERS TO INTEXT QUESTIONS****19.1**

1. Read section 19.1
2. Read section 19.1
3. Read section 19.2
4. Read section 19.2 (iv)
5. Read section 19.2 (iii)
6. Read section 19.2 (ii)

19.2

- (i) Price = 3
- (ii) Price = 8
- (iii) Quantity = 28

19.3

- (i) Read section 19.4
- (ii) Read section 19.4.2
- (iii) Read section 19.4.3
- (iv) Read section 19.4.3 (ii)
- (v) Read section 19.4.4
- (vi) Read section 19.4.4 (ii)
- (vii) Read section 19.4

19.4

- (i) Read section 19.5 (i)
- (ii) Read section 19.5 (ii)
- (iii) Read section 19.5.1
- (iv) Read section 19.5.2
- (v) Read section 19.5.1
- (vi) Read section 19.5.2
- (vii) Read section 19.5 (i) and 19.5 (ii)
- (viii) Read section 19.5 (i) and 19.5 (ii)
- (ix) Read section 19.5 (i) and 19.5 (ii)
- (x) Read section 19.5 (i) and 19.5 (ii)