Unit-II

THEORY OF PRODUCTION, COST ANALYSIS AND BREAK-EVEN ANALYSIS

THEORY OF PRODUCTION

Production-Meaning:

In common parlance, the term production is used for any activity of making something material like growing of wheat, rice or any other agriculture crop by farmers and manufacturing of cloth, TV sets, computers, wool, machinery or any other industrial product.

In economics, the word production is referred to as the transformation of physical inputs into physical outputs at any given period of time. The inputs are what the firm buys, namely productive resources, and outputs are what the firm sells. Production is also defined as creation of goods and services which satisfy the people wants.

According to J.R Hicks, "Production as any activity weather physical or mental which is directed to the satisfaction of people's wants through exchange".

The Production Function:

Production function is purely technical concept. It represents functional relationship between quantity of inputs and outputs. It shows how and to what extent output changes with changes in production factors (inputs) such as land, labour, capital and organisation etc. during a specified period of time.

According to Stigler, "The production function is the name given to the relationship between rates of input of productive services and the rate of output of product.

It can be mathematically expressed as follows:

$$\mathbf{P_X = f\ (N, L, K, M, T)}$$

Where,

P_X = Production or Output
f = Functional relationship.
N = Land or Natural Resources
L = Labour,
K = capital
M = Management (or organisation),
T = Technology

Here, P_X is the dependent variable and is determined by the inputs (N, L, K, M, T) used as independent variables.

The formula attempts to calculate the maximum quantity of output you can get from a certain number of inputs.

Types of Production Functions – Explained!

Each firm has its own production function depending on the technical knowledge and managerial ability. An improvement of technical knowledge or managerial ability will bring about a new production function of K (knowledge) degree.

The production function as determined by technical conditions of production is of two types: It may be rigid ox flexible. The former relates to the short run and the latter to the long run.

The Short-Run Production Function:

In the short run, the technical conditions of production are rigid so that the various inputs used to produce a given output are in fixed proportions. However, in the short run, it is possible to increase the quantities of one input while keeping the quantities of other inputs constant in order to have more output. This aspect of the production function is known as the ***Law of Variable Proportions***. The short-run, production function in the case of two inputs, labour and capital, with capital as fixed and labour as the variable input can be expressed as

Q=f (L, K) Where, K refers to the fixed input

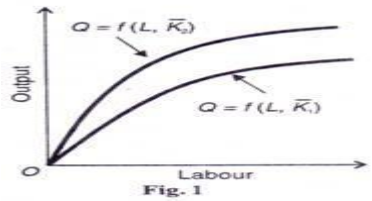


Fig. 1

This production function is depicted in Figure 1 where the slope of the curve shows the marginal product of labour. A movement along the production function shows the increase in output as labour increases, given the amount of capital employed K;. If the amount of capital increases to K, at a point of time, the production function Q = f (L, K1) shifts upwards to Q = f (L, K2), as shown in the figure.

On the other hand, if labour is taken as a fixed input and capital as the variable input, the production function takes the form Q =f (KL) …(4)

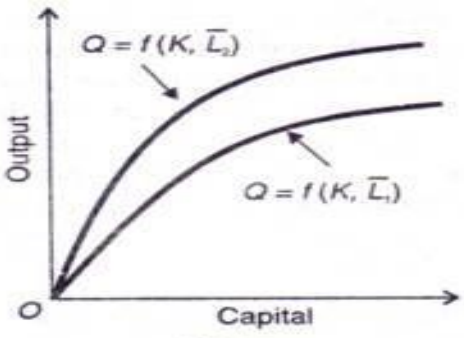


Fig. 2

This production function is depicted in Figure 2 where the slope of the curve represents the marginal product of capital. A movement along the production function shows

the increase in output as capital increases, given the quantity of labour employed, L2 If the quantity of labour increases to L2 at a point of time, the production function Q = f (K,L1) shifts upwards to Q=f(K, L2).

The Long-Run Production Function:

In the long run, it is possible for a firm to change all inputs up or down in accordance with its scale. This is known as ***returns to scale.*** The returns to scale are constant when output increases in the same proportion as the increase in the quantities of inputs. The returns to scale are increasing when the increase in output is more than proportional to the increase in inputs. They are decreasing if the increase in output is less than proportional to the increase in inputs.

Let us illustrate the case of constant returns to scale with the help of our production function.

Q = (L, M, N, K, T)

Given T, if the quantities of all inputs L, M, N, K are increased n-fold, the output Q also increases и-fold. Then the production function becomes nQ –f (nL, nM, nN, nK).

This is known as linear and homogeneous production function, or a homogeneous function of the first degree. If the homogeneous function is of the K^{th} degree, the production function is n^k. Q = f (nL, nM, nN, nK) If k is equal to 1, it is a case of constant returns to scale; if it is greater than 1, it is a case of increasing returns of scale; and if it is less than 1, it is a case of decreasing returns to scale.

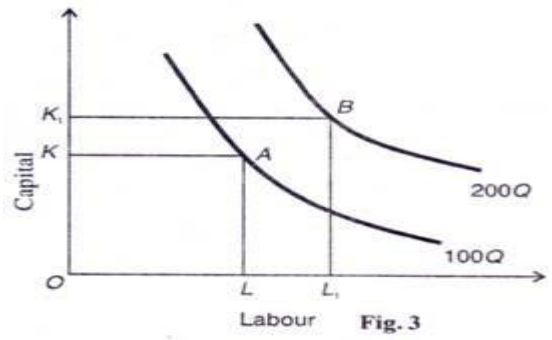


Fig. 3

The long-run production function is depicted in Figure 3 where the combination of OK of capital and OL of labour produces 100 Q. With the increase in inputs of capital and labour to OK1 and OL1, the output increases to 200 Q. The long-run production function is shown in terms of an isoquant such as 100 Q.

Thus a production function is of two types:

(1) Linear and Homogenous Production Function: If the quantities of all inputs are increased in some portion, output will also in that proportion. ***For example:*** if all inputs are increased by 10 percent, output will increase by 10 percent. This type of production function represents ***constant returns to scale***.

(2) Non-Homogeneous Production Function: if quantities of inputs are increased by n times, the outputs may increase n times or greater than n times or less than n times. This type production represents ***law of variable proportion***.

If it is equal to '1' is constant returns.
If it is greater than '1' is increasing returns.
If it is less than '1' is decreasing returns.

There are different types of production functions that can be classified according to the ***degree of substitution*** of one input by the other.

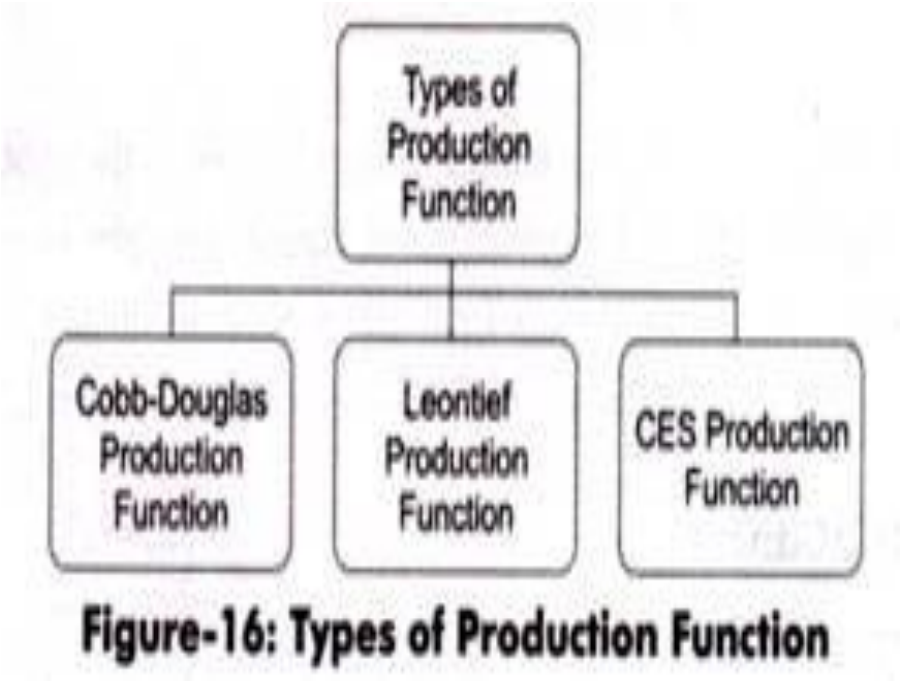


Figure-16: Types of Production Function

The different types of production function (as shown in Figure-16).

(1) Cobb-Douglas Production Function:

The Cobb-Douglas production function is given by American economists, Charles W. Cobb and Paul H. Douglas in 1928, studies the relationship between the input and the output. This function is linear and homogeneous which implies that the labour and capital can be used as a substitute of each other upto a certain extent only. With the proportionate increase in the capital and labour input variables also increases the output in the same proportion. It is also assumed that, if any of the inputs is zero the output is also zero. Thus, there are constant returns to a scale. The expansion path is a straight line passing through the origin. This production can be applied to a sector of the economy such as manufacturing or to the whole economy.

Here's the basic form of the Cobb-Douglas production function can be expressed as follows:

$$Q(L,K) = A * L^{\beta} * K^{\alpha}$$

Where,

Q = Quantity produced from the inputs L and K.

L = Amount of labor expended, which is typically expressed in hours.

K = Physical capital input, such as the number of hours for a particular machine, operation, or perhaps factory.

A = The Total Factor Productivity (TFP) that measures the change in output that isn't the result of the inputs. Typically, this change in TFP is the result of an improvement in efficiency or technology.

Alpha (α) and beta (β) = The change in the output due to change in either labor or physical capital.

For example, if the output elasticity for physical capital (K) is 0.60 and K is increased by 20 percent, then output increases by 3 percent (0.6/0.2). The same is true for the output elasticity of labor: an increase of 10 percent in L with an output elasticity of 0.40 increases the output by 4 percent (0.4/0.1).

Importance of Cobb-Douglas Production Function:

(a) This function states that about 75 percent of increase in manufacturing output in the U.S is due to labour input and the remaining 25 percent is due to capital input.

(b) It helps us to understand the nature of the costs.

(c) It helps us to understand Isoquants.

(d) It is necessary to understand theories of production.

(e) It helps us to understand the effect of changes in factors of production.

(f) It shows elasticity co-efficient which are used in inter sectoral comparisons.

(g) This function is linear and homogeneous.

If (a + b) = 1, there are constant returns to scale.

If (a + b) > 1, there are increasing returns to scale.

If (a + b) < 1, there are decreasing returns to scale.

(2) Leontief Production Function:

Leontief production function evolved by W. Wassily Leontif, uses fixed proportion of inputs having no substitutability between them. It implies that if the input-output ratio is independent of the scale of production, there is existence of Leontief production function. It assumes strict complementarity of factors of production. Leontief production function is also

called as fixed proportion production function. It is regarded as the limiting case for constant elasticity of substitution.

The production function can be expressed as follows:

$$Q = \text{Min } (Z1/a, Z2/b)$$

Where, Q = Quantity of output produced
Z1 = Utilized quantity of input 1
Z2 = Utilized quantity of input 2
a and b = constants

For example, tyres and steering wheels are used for producing cars. In such case, the production function can be as follows:

Q = Min (z1/a, Z2/b)
Q = Min (number of tyres used, number of steering used).

3. CES Production Function:

CES stands for Constant Elasticity Substitution. CES production function shows a constant change produced in the output due to change in input of production. It can be represented as follows:

$$Q = A\,[aK^{\beta} + (1-a)\,L^{-\beta}]^{-1/\beta} \text{ Or, } Q = A\,[aL^{-\beta} + (1-a)\,K^{-\beta}]^{-1/\beta}$$

CES has the homogeneity degree of 1 that implies that output would be increased with the increase in inputs. Labor and capital has increased by constant factor m.

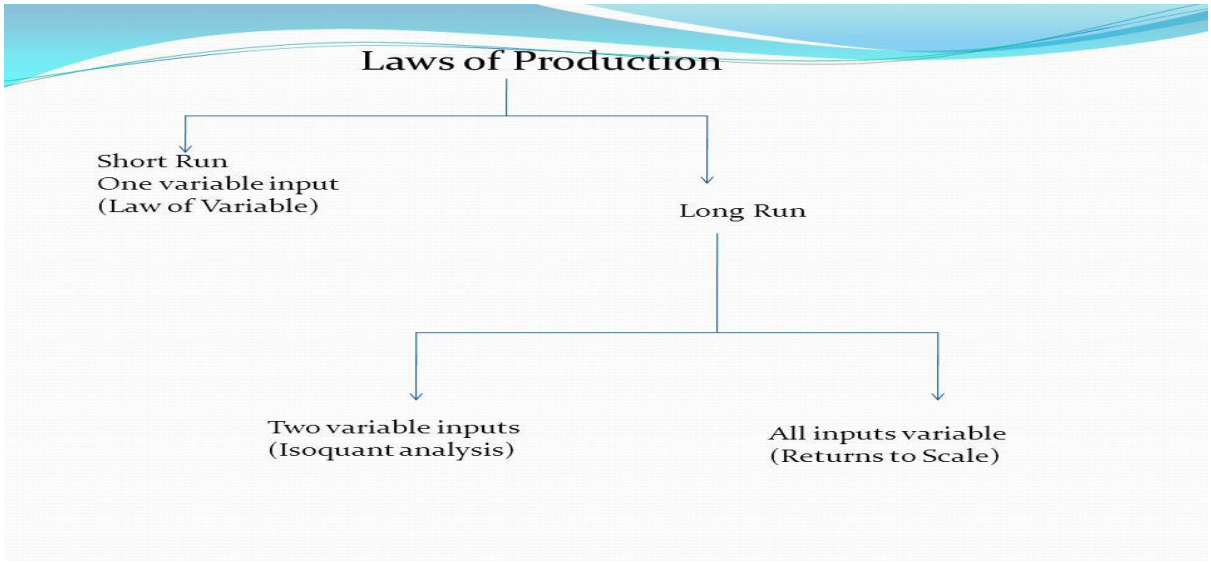
In such a case, production function can be represented as follows:

$Q' = A\,[a\,(mK)^{-\beta} + (1-a)\,(mL)^{-\beta}]^{-1/\beta}$
$Q' = A\,[m^{-\beta}\,\{aK^{-\beta} + (1-a)\,L^{-\beta}\}]^{-1/\beta}$
$Q' = (m^{-\beta})^{-1/\beta}\,.A\,[aK^{-\beta} + (1-a)\,L^{-\beta})^{-1/\beta}$
Because, $Q = A\,[aK^{-\beta} + (1-a)\,L^{-\beta}]^{-1/\beta}$

Therefore, Q' = mQ. This implies that CES production function is homogeneous with degree one.

& & & & &

TYPES OF LAW OF PRODUCTION



THE LAW OF VARIABLE PROPORTIONS:

The law of variable proportions exhibits in the short-run, if one input (production factor) is variable and all other inputs are fixed the firm's production function. Suppose, land, plant and equipment are the fixed factors, and labour the variable factor.

The law of variable proportion has been developed by the 19th century economists David Ricardo and Alfred Marshall. The law states that as keeping the other inputs constant, the quantity of a variable input is increased by equal doses, the total output first increases at an increasing rate, then at a diminishing rate and eventually decreases. Hence, this law is also known as the "law of diminishing returns".

According to Alfred Marshall, "An increase in capital and labour applied in the cultivation of land causes in general less than proportionate increase in the amount of produce raised, unless it happens to coincide with an improvement in the arts of agriculture".

Assumptions of the Law:

The law of diminishing returns is based on the following assumptions:

(1) The law applicable to short period only.
(2) Only one factor is variable while others are held constant.
(3) All units of the variable factor (labour) are homogeneous.
(4) There is no change in technology.
(5) It is possible to vary the proportions in which different inputs are combined.
(6) The product is measured in physical units, i.e., in quintals, tonnes, etc.

Before discussing the law, we understand the three concepts in the law:

(A) Total Product (TP): The total output (product) is obtained by utilizing all of the variable input (labour).

(B) Average Product (AP): The average product is obtained by dividing the total product (TP) with the total number of workers. It refers to the total product per unit of the variable factor.

Formula: Average Product (AP) = $\frac{\text{Total Product (TP)}}{\text{Total nuber of workers employed}}$

(C) Marginal Product (MP): The marginal product is the addition to total product by employing an extra worker. In other words, change in total output due to a unit change in number of workers employed. It is gives as:

Marginal Product (MP_n) = $TP_n - TP_{n-1}$

Explanation:

Given these assumptions, let us illustrate the law with the help of Table 1. Suppose a farmer has 10 acres of land to cultivate for wheat crop. It has some fixed investment i.e. capital on it; a tube well, a form house and farm equipment. The amount of land and capital are called fixed factors of production. Now the farmer can vary the number of labourors for cultivation and the resultant output is obtained.

A production function with one variable input showing three stages of law of variable proportions is considered.

Table. 1: Output of Wheat in Physical Units (Quintals)

(1) *No. of Workers*	(2) *Total Product*	(3) *Average Product*	(4) *Marginal Product*	
1	8	8	8	Stage I
2	20	10	12	
3	36	12	16	
4	48	12	12	Stage II
5	55	11	7	
6	60	10	5	
7	60	8.6	0	Stage III
8	56	7	– 4	

An analysis of the Table-1 shows that the total, average and marginal products increase at first, reach a maximum and then start declining. The total product reaches its maximum when 7 units of labour are used and then it declines. The average product continues to rise till the 4th unit while the marginal product reaches its maximum at the 3rd unit of labour, then they also fall. It should be noted that the point of falling output is not the same for total, average and marginal product.

The marginal product starts declining first, the average product following it and the total product is the last to fall. This observation points out that the tendency to diminishing returns is ultimately found in the three productivity concepts.

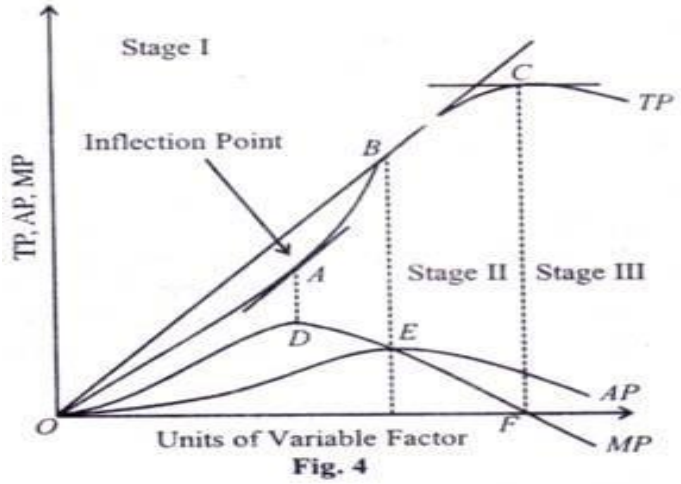


Fig. 4

The law of variable proportions is presented diagrammatically in Figure 4. The TP curve first rises at an increasing rate up to point A where its slope is the highest. From point A upwards, the total product increases at a diminishing rate till it reaches its highest point C and then it starts falling.

Point A where the tangent touches the TP curve is called the inflection point up to which the total product increases at an increasing rate and from where it starts increasing at a diminishing rate. The marginal product curve (MP) and the average product curve (AP) also rise with TP. The MP curve reaches its maximum point D when the slope of the TP curve is the maximum at point A.

The maximum point on the AP curves is E where it coincides with the MP curve. This point also coincides with point B on TP curve from where the total product starts a gradual rise. When the TP curve reaches its maximum point C the MP curve becomes zero at point F. When TP starts declining, the MP curve becomes negative. It is only when the total product is zero that the average product also becomes zero. The rising, the falling and the negative phases of the total, marginal and average products are in fact the different stages of the law of variable proportions which are discussed below.

Three Stages of Production:

When a variable factor is combined with a fixed factor the relationship between the input and the output is generally divided into three stages. These are:

Stage-I: Increasing Returns:

In this stage, the total output increases at an increasing rate and then at diminishing as the variable input is increased. The average product reaches the maximum and equals the marginal product when 4 workers are employed, as shown in the Table 1. This stage is

portrayed in the figure from the origin to point E where the MP curve reaches its maximum and the AP curve is still rising. In this stage, the TP curve also increases rapidly.

Thus this stage relates to increasing returns. Here land is too much in relation to the workers employed. It is, therefore, profitable for a producer to increase more workers to produce more and more output. It becomes cheaper to produce the additional output. Consequently, it would be foolish to stop producing more in this stage. Thus the producer will always expand through this stage I.

Stage-II: Diminishing Returns:

During this stage, Here land is scarce and is used intensively. More and more workers are employed (workers increased from 4 to 7) in order to have larger output. Thus, the total product increases at a diminishing rate and reaches maximum. At this, the average product continuously decreases and marginal product becomes zero. This is the only stage in which production is feasible and profitable because in this stage the marginal productivity of labour, though positive, is diminishing but is non-negative.

But the law of diminishing returns is not applicable to agriculture alone; rather it is of universal applicability. **For example:** if plant is expanded by installing more machines, it may become unwieldy. Entrepreneurial control and supervision become lax, and diminishing returns set in. or, there may arise scarcity of trained labour or raw material that leads to diminution in output.

Stage-III: Negative Marginal Returns:

Production cannot take place in stage III either. In this stage, total product starts declining and the marginal product becomes negative. The employment of the 8th worker actually causes a decrease in total output from 60 to 56 units and makes the marginal product minus 4. Here the workers are too many in relation to the available land, making it absolutely impossible to cultivate it.

The Best Stage:

In stage I, when production takes place to the left of point E, the fixed factor is excess in relation to the variable factors which cannot be used optimally. To the right of point F, the variable input is used excessively in Stage III. Therefore, no producer will produce in this stage because the marginal production is negative.

Thus the first and third stages are of economic absurdity or eco-nomic nonsense. So production will always take place in the second stage in which total output of the firm increases at a diminishing rate and MP and AP are the maximum, then they start decreasing and production is optimum. This is the optimum and best stage of production.

& & & & &

THE LAW OF RETURNS TO SCALE:

It is a long run concept. No fixed factors exist in the long run and all factors become variable. Thus, it described as the relationship between outputs (production) and scale of inputs, when all the inputs are increased in the same proportion and the production will be three stages (scales) viz. increasing, constant and decreasing.

According to Prof. Roger Miller, "Returns to scale refer to the relationship between changes in output and proportionate changes in all factors of production. In a long-run, the firm increases its scale of production by using more space (land), more machines and labourers in the factory'.

Assumptions: This law assumes that:

(1) All factors (inputs) are variable but enterprise is fixed.
(2) A worker works with given tools and implements.
(3) Technological changes are absent.
(4) There is perfect competition.
(5) The product is measured in quantities.

Explanation:

Given these assumptions, when all inputs are increased in unchanged proportions and the scale of production is expanded, the effect on output shows three stages: increasing returns to scale, constant returns to scale and diminishing returns to scale. They are explained with the help of Table 2 and Fig. 5.

Table 2 : Returns to Scale in Physical Units

Unit	*Scale of Production*	*Total Returns*	*Marginal Returns*	
1.	1 Workers + 2 Acres Land	8	8	Increasing Returns
2.	2 Workers + 4 Acres Land	17	9	
3.	3 Workers + 6 Acres Land	27	10	
4.	4 Workers + 8 Acres Land	38	11	Constant Returns
5.	5 Workers + 10 Acres Land	49	11	
6.	6 Workers + 12 Acres Land	59	10	Diminishing Returns
7.	7 Workers + 14 Acres Land	68	9	
8.	8 Workers + 16 Acres Land	76	8	

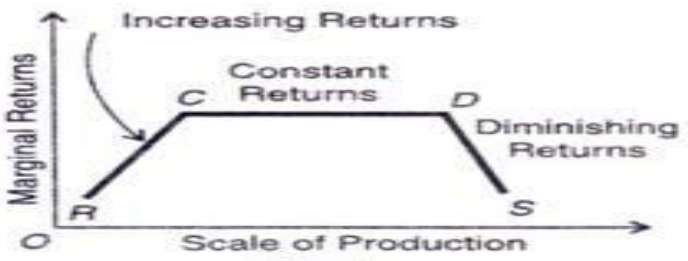


Fig. 5

1. Increasing Returns to Scale: Returns to scale increase because the increase in total output is more than proportional to the increase in all inputs.

The table reveals that in the beginning with the scale of production of (1 worker + 2 acres of land), total output is 8. To increase output when the scale of production is doubled (2 workers + 4 acres of land), total returns are more than doubled. They become 17. Now if the scale is trebled (3 workers + 6 acres of land), returns become more than three-fold, i.e., 27. It shows increasing returns to scale. In the figure RS is the returns to scale curve where R to C portion indicates increasing returns.

2. Constant Returns to Scale: Returns to scale become constant as the increase in total output is in exact proportion to the increase in inputs. If the scale of production in increased further, total returns will increase in such a way that the marginal returns become constant. In the table, for the 4th and 5th units of the scale of production, marginal returns are 11, i.e., returns to scale are constant. In the figure, the portion from C to D of the RS curve is horizontal which depicts constant returns to scale. It means that increments of each input are constant at all levels of output.

3. Diminishing Returns to Scale: Returns to scale diminish because the increase in output is less than proportional to the increase in inputs. The table shows that when output is increased from the 6th, 7th and 8th units, the total returns increase at a lower rate than before so that the marginal returns start diminishing successively to 10, 9 and 8. In the figure, the portion from D to S of the RS curve shows diminishing returns.

Conclusion:

For the management increasing, decreasing or constant returns to scale reflect changes in pro-duction efficiency that result from scaling up productive inputs. But returns to scale is strictly a production and cost concept. Management's decision on what quantity is to produce and how much to produce must be based upon the demand for the product. Therefore, demand and other factors must also be considered in decision making.

& & & & &

PRODUCTION OPTIMISATION

Technically, a producer generally reaches profit through production optimization. Isoquants and iso-cost lines specify the production optimisation point.

Isoquants

Iso means equal and quant means quantity. Hence, isoquant is a graphical representation of all the various combinations of inputs which are equal in the eyes of the producer as they produce the same level of output.

Isoquants are called equal-product or iso-product curves. Again, as all the combinations yield the same level of output the producer tends to be indifferent among them. Hence, isoquants

are also known as producer indifference curves. Further, isoquants share resemblances with the indifference curves.

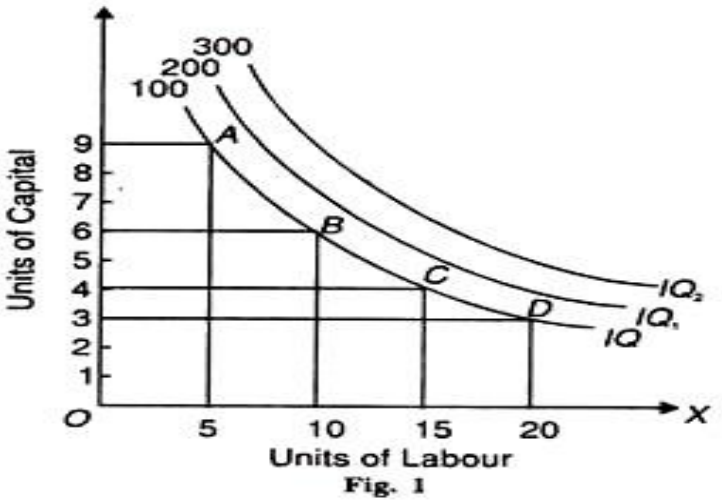


Fig. 1

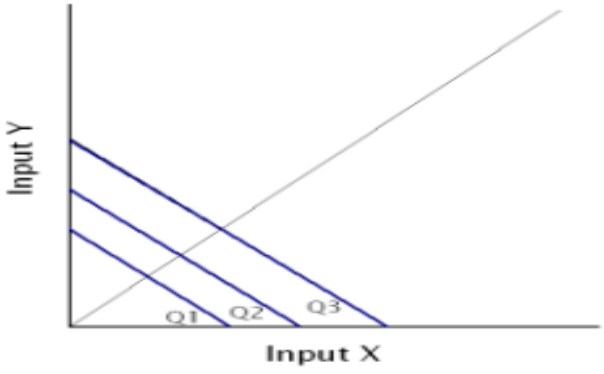
But note that there is one major difference between an indifference curve and an isoquant. It is not possible to quantify the level of a consumer in an indifference curve however we can easily quantify a producer's level of production using an isoquant. An isoquant on the right represents a higher level of production whereas an isoquant on the left represents a lower level of production.

Iso-Cost lines

Iso-cost lines represent the prices of factors. An iso-cost line graphically represents all the combinations of the inputs which the firm can achieve with a given budget for production or given outlay.

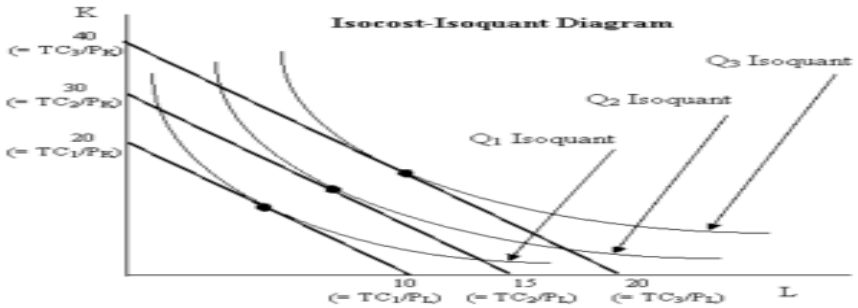
Suppose the firm has Rs. 100 which it can spend on combinations of factor X and factor Y, the former priced at Rs. 10 per unit and the latter priced at Rs. 20. The firm can spend the entire amount on factor X or factor Y.

Further, there will be various combinations of both factors which amount to the outlay. The iso-cost line represents all these combinations. Q1, Q2 and Q3 are three different iso-costs. The iso-cost on the right represents a higher outlay.



Production Optimization

Iso-costs and Isoquants can together help us to determine the optimum production for a firm. We can achieve production optimisation in two ways. Either we can maximize the production for a given outlay or we can minimize the cost of producing a given level of output. This least cost combination is found out by super imposing the iso-quant on the iso-cost line.

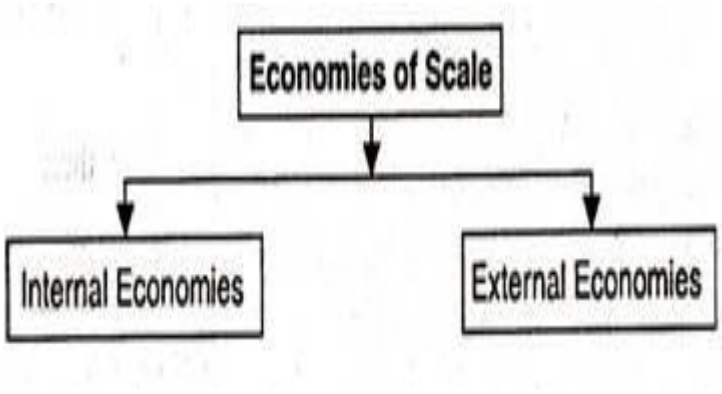


We define the least-cost combinations for three different iso-quants show above at a point where the iso-costs are tangential to the isoquants. Evidently, the least cost combination for a given isoquant is at the point of tangency of the isoquant with the iso-cost line.

& & & & &

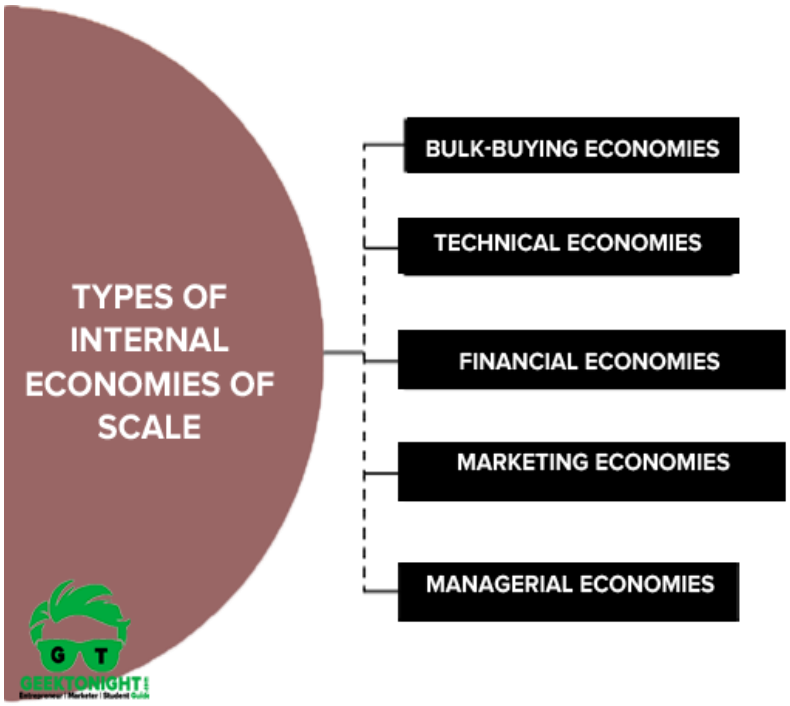
ECONOMIES OF SCALE

Economies of scale are defined as the cost advantages that an organization can achieve by expanding its production in the long run. A firm expands its production capacity and the efficiency of production with lower average total costs. This condition is termed as economies of scale.



Internal Economies of Scale

Internal Economies of Scale refers to the economies that a firm achieves the growth itself. When an organisation reduces costs and increases the production result in achieved cost advantage referred as internal economies of scale. These arise due to several factors like entrepreneurial efficiency, talents of the management team, type of machinery, etc. These economies arise within the firm and help the firm only.



Let us discuss the different types of internal economies of scale in detail:

(A) Bulk-Buying Economies: As a firm grows in size, it requires larger quantities of production inputs, such as raw materials. With increase in the order size, the firm attains bargaining power over the suppliers. It is able to purchase inputs at a discount, which results in lower average cost of production.

(B) Technical Economies: Large-scale production is linked with technical economies. When a firm increases its scale of production, it needs to use advanced machinery or better techniques for production purposes. Such machinery helps to produce larger outputs at a lower unit cost. **For example,** the firm may use mass-production techniques, which provide a more efficient form of production. Similarly, a bigger firm may invest in research and development to increase the efficiency of production.

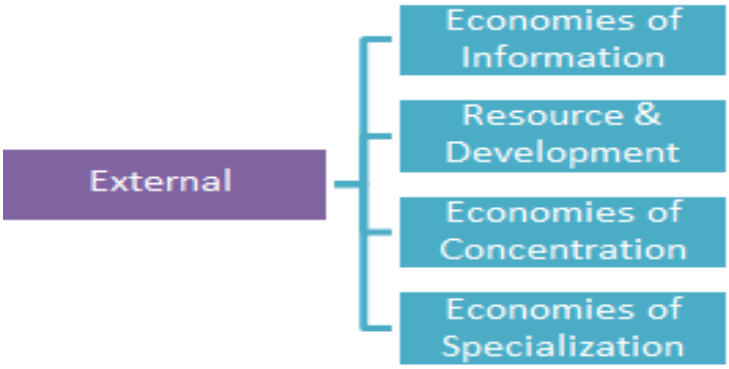
(C) Financial Economies: Financial economies make it cheaper to raise money. When larger firms can easily borrows money at lower interest rates. These organizations have good credibility in the market. Generally, banks prefer to grant loans to those organizations that have strong foothold in the market and have good repaying capacity. While the smaller firms find it hard to obtain finance at reasonable interest rates. This capital is further used to expand the production scale resulting in low average total costs.

(D) Marketing Economies: The marketing economies of scale are achieved in case of bulk buying, branding, and advertising etc. The success of a firm also depends on its promotion. A company can make a financial advantage by effective use of Ads or promotion. For instance, large firms enjoy benefits on advertising costs as they cover larger audience. On the other hand, a smaller firm cannot afford to advertise.

(E) Managerial economies: Managerial economies of scale depends on the scope of employing well skilled, qualified, trained, and better employees in the organisation. This will help the organization to have a greater financial advantage. They help the firm by taking quicker and better decisions. Also, they use new techniques and methods to improve management and to reduce the cost of operations.

External Economies:

External economies of scale refer to the expansion of output of the entire industry and not limited to an individual firm. When an industry expands, organizations may benefit from better transportation network, infrastructure, and other facilities. This helps in decreasing the cost of an organization.



(A) Economies of Information: When the number of firms in an industry expands they become mutually dependent on each other. In other words, they do not feel the need of independent research on individual basis. Many scientific and trade journals are published. These journals provide information to all the firms which relates to new markets, sources of raw materials, latest techniques of production etc.

(B) Research and Development: Usually, when an entire industry expands, new technical knowledge is discovered leading to new and improved machinery for the said industry. This changes the technological coefficient of production and enhances the productivity of the firms in the industry. Hence, the cost of production reduces.

(C) Economies of Concentration: As the number of firms in an area increases each firm enjoys some benefits like, transport and communication, availability of raw materials, research and invention etc. Further, financial assistance from banks and non-bank institutions easily accrue to firm.

(D) Economies of Specialization (Disintegration): As an industry develops, all the firms engaged in it decide to divide and sub-divide the process of production among them. Each firm specializes in its own process. **For instance,** in case of moped industry, some firms specialize in rims, hubs and still others in chains, pedals, tires etc. It is of two types- horizontal disintegration and vertical disintegration.

& & & & &

CONCEPT OF COST:

The main aim of every organization is to earn maximum profit, which depends on costs incurred by an organisation for different activities.

In general terms, cost refers to an amount to be paid up for acquiring any resource or service.

Cost is a key concept in economics, is the monetary expense incurred by organizations for various purposes, such as acquiring resources such as raw materials, hiring workers, land and buildings, plant and machines, technology, and advertising and so on. Thus, all costs are involve a sacrifice some kind and acquiring some benefit. ***Example:*** I want to eat food; I should prepare to sacrifice money.

According to Institute of Cost and Work Accountants (ICWA), cost implies "measurement in monetary terms of the amount of resources used for the purpose of production of goods or rendering services."

There are different types of costs that are relevant to business operations and decisions including determination of price and level of current production. The level of profitability of an organization can also be determined by analyzing its costs and revenue.

Classification of Cost:

The costs are broadly grouped into ***two*** categories, namely, accounting cost and analytical cost, which are important for business operations and decisions.

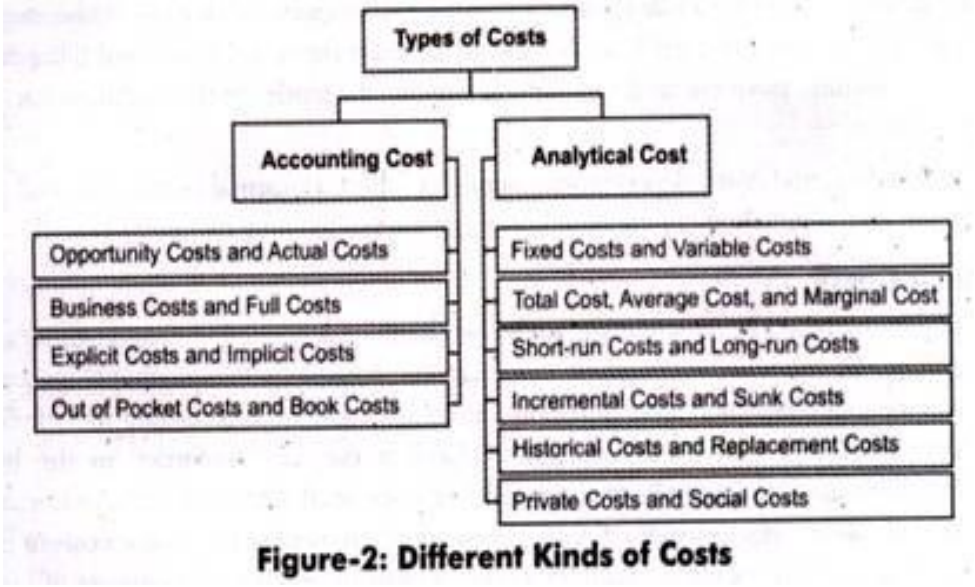


Figure-2: Different Kinds of Costs

(I) Accounting Cost: These are also called as money costs or entrepreneur's costs. These are the expenses of an organization incurred during action and are entered in the books of accounts of the organization. In the words of ***Nicholson,*** "Accounting cost refers to the out of packet expenses, historical costs, depreciation, and other book keeping entries." Out of pocket expenses are the costs that include immediate or instant payment to outsiders. Accounting costs are also known as actual cost or acquisition cost or absolute cost.

These costs include the following:
i. Wages to labor
ii. Interest on borrowed capital
iii. Rent paid to owners of the land
iv. Cost of raw materials
v. Depreciation of capital goods

A producer should ensure that the price of the product should cover all these costs, so that production is continued. Accounting cost comprises a number of costs.

(A) Opportunity Costs and Actual Costs:

This concept is based on resources are scare and wants are unlimited. ***Opportunity cost*** is the cost of next best alternative sacrificed in order to get a particular product. It is a loss of income due to opportunity foregone. **For example:** If we want to produce more of sugarcane, we have to produce less of paddy. You want to eat mutton curry; you should prepare to sacrifice chicken curry. Opportunity cost is also known as alternative cost or displacement cost or transfer cost.

On the other hand, ***actual costs*** are those costs which are incurred by the organization on actual goods to carry out the production activities. These costs are incurred on purchasing raw materials, plant, machinery, and other physical assets. Actual costs are the payments that are made in monetary terms and are recorded in the books of accounts.

(B) Business Costs and Full Costs:

Business costs involve those costs that are incurred while carrying out business. These are also called ***real costs or actual costs***. These costs are used for calculating business profits and losses and filing returns of income tax and other legal purposes. These costs include payment and contractual obligations made by the organization together with the cost of depreciation on plant and equipment.

On the other hand, ***full costs*** include actual costs, depreciation, implicit costs, and normal profits. Normal profits refer to minimum earrings in addition to the opportunity cost which an organization must receive to carry on production.

(C) Explicit Costs and Implicit Costs:

Explicit costs refer to the cash payments incurred by an organization in exchange of acquiring various resources, such as labor, material, plant, machinery, and technology. In other words, explicit costs can be defined as the payments incurred by organizations for outsiders who supply labor services, transport services, electricity, and raw materials.

On the other hand, ***implicit costs*** refer to the payment of factor units that are owned by employer/owner himself. It does not involve cash payments and hence, does not appear in the books of accounts. It is also called notional cost e.g. interest on capital although no interest is

paid. This is particularly useful while decisions are taken regarding alternative capital investment projects.

(D) Out of Pocket Costs and Book Costs:

Out of pocket costs are those cash payments or cash transfers that are made for outsiders. These costs involve either recurring or non-recurring expenses. All the explicit costs, such as wages, rent, interest, transport expenditure, and salaries, are out of pocket costs.

On the other hand, ***book costs*** refer to those costs that do not involve cash outlays, but are added in the accounting system. These costs are included in profit and loss accounts and are useful for getting tax benefits. ***For example,*** depreciation of machinery and unpaid interests are the book costs of an organization.

Both, out of pocket and book costs are important for calculating the total profit and loss of an organization. Generally, small-scale organization ignores book costs, which may lead to overestimation of profit.

(II) Analytical Cost:

Analytical costs are those costs that are taken into account for ***analyzing the production activities*** of an organization. These costs are the deciding criteria for carrying out business activities. For instance, if an organization is planning to expand, it needs to consider various costs, such as incremental costs, replacement costs, and fixed costs.

In case the costs exceed the total budget of the organization, it may drop the idea of expansion. Apart from this, analytical costs are also helpful for making organizational decisions in different time periods.

(A) Fixed Costs and Variable Costs:

Fixed Costs are those which cannot vary with the level of production up to a certain limit e.g., Salaries, Rent, Administration expenses etc.

(B) Variable Cost: Variable Costs are those (e.g. price of raw material, labour etc.,).

Fixed costs refer to those that remain constant for a certain level of output. It is interesting to note that if more units are produced, fixed cost per unit will be reduced, and, if less units are produced, obviously, fixed cost per unit will be increased. The fixed costs include costs incurred on managerial and administrative staff, depreciation of machinery, and maintenance of lands and buildings. These costs are incurred in the short- run.

On the other hand, ***variable costs*** are those costs which can vary with the level of production. But the variable cost per unit will remain fixed irrespective of the quantity produced. That is, there is no direct effect on the cost per unit if there is a change in the volume of output. These costs include costs incurred on raw materials, transportation, and labor.

(B) Total Cost, Average Cost, and Marginal Cost:

Total cost refers to the total sum of the cost incurred on production of goods or services. It involves all implicit and explicit costs as well as fixed and variable costs incurred on acquiring resources for the production of goods or services. On the other hand, ***average cost*** is the total cost of production per unit of output. It is not considered as actual costs and is statistical in nature. ***Marginal cost*** is the addition to the total cost for producing an additional unit of the product.

Total, average, marginal costs play an important role in analyzing the production activities of an organization.

(C) Short-run and Long-run Costs:

Short run refers to a period in which organization can change its output by changing only variable factors, such as labor and capital. In this period, the fixed factors, such as land and machinery, remain the same. The expansion is done by hiring more labor and purchasing more raw materials. Short-run costs involve costs incurred on raw materials and payment of wages. Short-run costs change with the change in the level of output.

On the other hand, ***long run*** refers to a period in which all the factors are variable. The existing size of the plant or building can be increased in case of the long run. Long run costs vary with variation in the size of manufacturing plant or organization. Long-run costs include costs incurred on plant, building, and machinery.

(D) Incremental Costs and Sunk Costs:

Incremental costs are those costs that are incurred during the expansion of an organization. These are the added costs that are involved in changing the level of production or the nature of business activity. Expansion can be in the form of men, materials, and machinery. Incremental costs are incurred by an organization for various purposes, such as purchasing new machines, changing distribution channel, and launching a new product.

On the other hand, ***sunk costs*** are those costs that are incurred whether there is an expansion or not. These are the costs which are made once and cannot be altered, increased, or decreased. These types of costs are based on the prior commitment; thus, cannot be revised or recovered. For instance, if an organization hires a machine; it has to bear the rent and other operational charges, which are the sunk costs of the organization.

(E) Historical and Replacement Costs:

Historical costs are those costs that are incurred in the past by an organization for acquiring assets, such as land, building, and machinery. These costs help in assessing the net worth of the organization. Historical costs reduce on an annual basis due to depreciated value of assets, such as machinery and equipment. On the contrary, historical cost increases in case of land, buildings, and metals, such as gold and silver.

On the other hand, ***replacement cost*** is incurred when an asset depreciates and is replaced with the new asset. Let us understand the concept of replacement costs with the help of an example. ***For instance,*** the historical cost of a machine is Rs. 85, 000, which was purchased by an organization two years ago. Now, the organization is willing to replace the existing machine with the new one. The current price of the machine in the market is Rs. 90, 000, which is a replacement cost.

(F) Private and Social Costs:

Private costs are those costs that are incurred for carrying out different business operations. In other words, these costs are added in the total cost of production of an organization. In the words of miller, "private costs are those costs that are incurred by the firm or the individual producer as a result of their own decisions." All explicit and implicit costs fall into the category of private costs.

On the contrary, ***social costs*** are those costs that are borne by the society and are not explicitly paid by the organization. Such costs include pollution (air, water, and noise) and global warming, which take place due to production activities of an organization.

& & & & &

THE COST FUNCTION:

The cost function expresses a functional relationship between total cost and factors that determine it.

Usually, the cost function can be expressed as:

$$C=f(Q, T, Pf, F)$$

Where, C = the total cost of production of a firm
T = the level of technology,
Pf = the prices of factors and
F = the fixed factors.

Such a comprehensive cost function requires multi-dimensional diagrams which are difficult to draw. In order to simplify the cost analysis, certain assumptions are made. It is assumed that a firm produces a single homogeneous good (q) with the help of certain factors of production.

Thus, the total cost function is expressed as:

$$C=f(Q)$$

Which means that the total cost (C) is a function (f) of output (Q), assuming all other factors as constant. The cost function is shown diagrammatically by taking output on the horizontal (X) axis and total cost on the vertical (Y) axis.

Cost-Output Relation: Cost Curves (Explained With Diagram)

The Cost-output relation is discussed under the short-run and long-run cost analyses which are explained as under:

The behaviour of cost curves in the short run and the long run and arrives at the conclusion that both the short run and the long run curves are U-shaped but the long-run cost curves are flatter than the short-run cost curves.

(A) Firm's Short-Run Cost Curves:

The short run is a period in which the firm cannot change its plant, equipment and the scale of organization. To meet the increased demand, it can raise output by hiring more labour and raw materials or asking the existing labour force to work overtime.

(i) Short-Run Total Costs: The scale of organization being fixed, the short-run total costs are divided into total fixed costs and total variable costs:

$$TC = TFC + TVC$$

Total Costs (TC): Total costs are the total expenses incurred by a firm in producing a given quantity of a commodity. They include payments for rent, interest, wages, taxes and expenses on raw materials, electricity, water, advertising, etc.

Total Fixed Costs (TFC): Are those costs of production that do not change with output. They are independent of the level of output. In fact, they have to be incurred even when the firm stops production temporarily. They include payments for renting land and buildings, interest or borrowed money, insurance charges, property tax, depreciation, maintenance expenditures, wages and salaries of the permanent staff, etc. They are also called ***overhead costs***.

Total Variable Costs (TVC): Are those costs of production that change directly with output. They arise when output increases, and fall when output declines. They include expenses on raw mate-rials, power, water, taxes, hiring of labour, advertising etc. They are also known as ***direct costs***.

TABLE 1 : COST FUNCTION IN THE SHORT-RUN

TO (1)	*TFC* (2)	*TVC* (3)	*TC* (4) (2+3)	*AFC* (5) (2÷1)	*AVC* (6) (3÷1)	*ATC* (7) (5+6) or(4÷1)	*MC* (8) (from 4)
	Rs	Rs	Rs	Rs	Rs	Rs	Rs
0	300	0	300	300	0	300	—
1	300	300	600	300	300	600	300
2	300	400	700	150	200	350	100
3	300	450	750	100	150	250	50
4	300	500	800	75	125	200	50
5	300	600	900	60	120	180	100
6	300	720	1020	50	120	170	120
7	300	890	1190	42.9	127.1	170	170
8	300	1100	1400	37.5	137.5	175	210
9	300	1350	1650	33.3	150	183.3	470
10	300	2000	2300	30	200	230	650

The relation between total costs, variable costs and fixed costs is presented in Table 1, where column (1) indicates different levels of output from 0 to 10 units. Column (2) indicates that total fixed costs remain at Rs. 300 at all levels of output. Column (3) shows total variable costs which are zero when output is nothing and they continue to increase with the rise in output.

In the beginning they rise quickly, and then they slow down as the firm enjoys economies of large scale production with further increases in output and later on due to diseconomies of production, the variable costs start rising rapidly. Column (4) relates to total costs which are the sum of columns (2), and (3) i.e., TC – TFC + TVC. Total costs vary with total variable costs when the firm starts production.

The curves relating to these three total costs are shown diagrammatically in Figure 2.

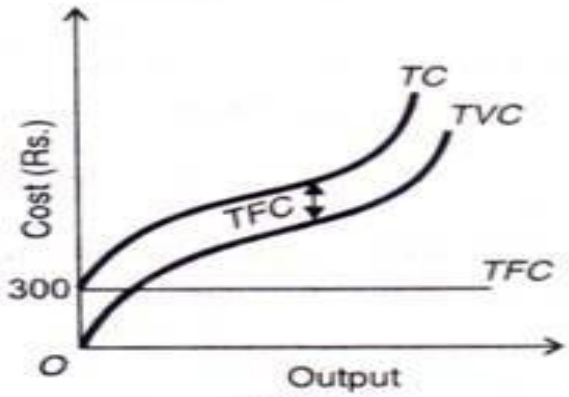


Fig. 2

The TC curve is a continuous curve which shows that with increasing output total costs also increase. This curve cuts the vertical axis at a point above the origin and rises continuously from left to right. This is because even when no output is produced, the firm has to incur fixed costs.

The TFC curve is shown as parallel to the output axis because total fixed costs are the same (Rs. 300) whatever the level of output. The TVC curve has an inverted-S shape and starts from the origin O because when output is zero, the TVCs are also zero. They increase as output increases.

So long as the firm is using less variable factors in proportion to the fixed factors, the total variable costs rise at a diminishing rate. But after a point, with the use of more variable factors in proportion to the fixed factors, they rise steeply because of the application of the law of variable proportions. Since the TFC curve is a horizontal straight line, the TC curve follows the TVC curve at an equal vertical distance.

(ii) Short-Run Average Costs:

In the short run analysis of the firm, average costs are more important than total costs. The units of output that a firm produces do not cost the same amount to the firm. But they must be

sold at the same price. Therefore, the firm must know 'per unit cost' or the average cost. The short-run average costs of a firm are the average total costs, the average fixed costs, the average variable costs, and also short-run marginal cost,

Short-Run Average Total Costs (SATC or SAC) are the average costs of producing any given output. They are arrived at by dividing the total costs at each level of output by the number of units produced:

SAC or SATC = TC/Q = TFC/Q + TVC/Q = AFC+ AVC

Average total costs reflect the influence of both the average fixed costs and average variable costs. At first average total costs are high at low levels of output because both average fixed costs and average variable costs are large. But as output increases, the average total costs fall sharply because of the steady decline of both average fixed costs and average variable costs till they reach the minimum point.

This results from the internal economies, from better utilization of existing plant, labour, etc. The minimum point B in the figure represents optimal capacity. As production is increased after this point, the average total costs rise quickly because the fall in average fixed costs is negligible in relation to the rising average variable costs.

The rising portion of the SAC curve results from producing above capac-ity and the appearance of internal diseconomies of management, labour, etc. Thus the SAC curve is U-shaped, as shown in Figure 3.

Average Fixed Costs (AFC) is total fixed costs at each level of output divided by the number of units produced:

AFC = TFC /Q

The average fixed costs diminish continuously as output increases. This is natural because when constant total fixed costs are divided by a continuously increasing unit of output, the result is continuously diminishing average fixed costs. Thus the AFC curve is a downward sloping curve which approaches the quantity axis without touching it, as shown in Figure 23.4. It is a rectangular hyperbola.

Short-Run Average Variable Costs (SAVC) is total variable costs at each level of output divided by the number of units produced:

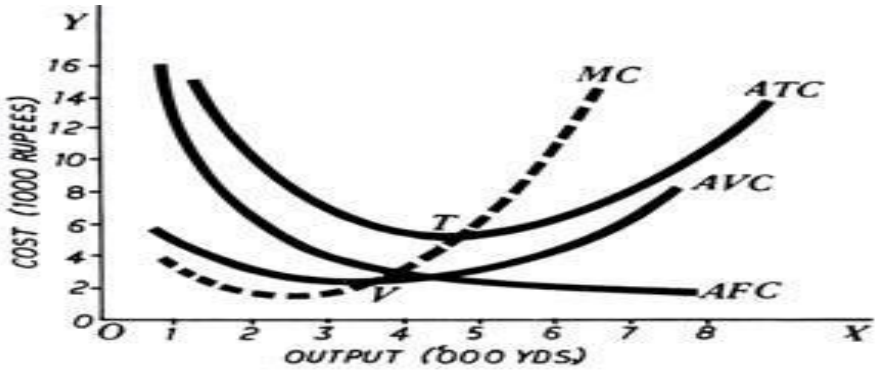
SAVC = TVC/Q

The average variable costs first decline with the rise in output as larger quantities of variable factors is applied to fixed plant and equipment. But eventually they begin to rise due to the law of diminishing returns. Thus the SAVC curve is U-shaped, as shown in Figure 23.4.

Short Run Marginal Cost: A fundamental concept for the determination of the exact level of output of a firm is the marginal cost. Marginal cost is the addition to total cost by producing an additional unit of output:

$$SMC = \Delta TC/\Delta Q$$

Algebraically, it is the total cost of n + 1 units minus the total cost of n units of output MCn = (TCn+1) – (TCn). Since total fixed costs do not change with output, therefore, marginal fixed cost is zero. So, marginal cost can be calculated either from total variable costs or total costs. The result would be the same in both the cases. As total variable costs or total costs first fall and then rise, marginal cost also behaves in the same way. The SMC curve is also U-shaped, as shown in Figure 23.4.



Average, Variable and Fixed Costs
Fig. 23.4

Why a SAC is U-shaped?

The U-shape of the SAC curve can also be explained in terms of the law of variable proportions. This law tells that when the quantity of one variable factor is changed while keeping the quantities of other factors fixed, the total output increases but after some time it starts declining.

Machines, equipment and scale of production are the fixed factors of a firm that do not change in the short run. 'On the other hand, factors like labour and raw materials are variable. When increasing quantities of variable factors are applied on the fixed factors, the law of variable proportions operates.

When, say the quantities of a variable factor like labour are increased in equal quantities, production rises till fixed factors like machines, equipment, etc. are used to their maximum capacity. In this stage, the average costs of the firm continue to fall as output increases because it operates under increasing returns.

Due to the operation of the law of increasing returns when the variable factors are increased further, the firm is able to work the machines to their optimum capacity. It produces the optimum output and its average costs of production will be the minimum which is revealed by the minimum point of the SAC curve, point B in Figure 23.4.

It the firm tries to raise output after this point by increasing the quantities of the variable factors, the fixed factors like machines would be worked beyond their capacity. This would lead to diminishing returns. The average costs will start rising rapidly. Hence, due to the working of the law of variable proportions the short-run AC curve is U-shaped.

Conclusion:

Thus the short-run cost curves of a firm are the SAVC curve, the AFC curve, the SAC curve and the SMC curve. Out of these four curves, the AFC curve is insignificant for the determination of the firm s exact output and is, therefore, generally neglected.

(B) Firm's Long-Run Cost Curves:

In the long run, there are no fixed factors of production and hence no fixed costs. The firm can change its size or scale of plant and employ more or less inputs. Thus in the long run all factors are variable and hence all costs are variable.

The long run average total cost (LAC) curve of the firm shows the minimum average cost of producing various levels of output from all-possible short-run average cost curves (SAC). Thus the LAC curve is derived from the SAC curves. The LAC curve can be viewed as a series of alternative short-run situations into any one of which the firm can move.

The long-run average cost curve (LAC) is usually shown as a smooth curve fitted to the SAC curves represents a plant of a particular size which is suitable for a particular range of output. The firm will make use of the various plants up to that level where the short-run average costs fall with increase in output so that it is tangent to each of them at some point, as shown in Figure 5, where SAC1, SAC2, SAC3, SAC4 and SAC5 are the short-run cost curves. It is tangent to all the SAC curves but only to one at its minimum point.

The LAC is tangent to the lowest point E of the curve SAC3 in Figure 5 at OQ optimum output. The plant SAC3 which produces this OQ optimum output at the minimum cost QE is the optimum plant, and the firm produc-ing this optimum output at the minimum cost with this opti-mum plant is the optimum firm.

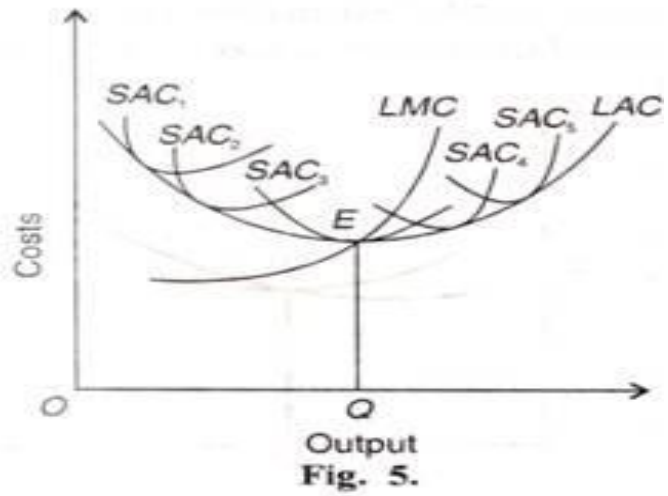


Fig. 5.

If the firm produces less than the optimum output OQ, it is not working its plant to full capacity and if it produces beyond it is overworking its plants. In both the cases, the plants SAC2 and SAC4 have higher average costs of production than the plant SAC3.

The LAC curve is known as the "envelope" curve because it envelopes all the SAC curves. According to Prof. Chamberlin, "It is composed of plant curves; it is the plant curve. But it is better to call it a "planning" curve because the firm plans to expand its scale of production over the long run."

The long-run marginal cost (LMC) curve of the firm intersects SAC1 and LAC curves at the minimum point E.

LAC Curve Flatter than SAC Curve:

Though the long-run average cost (LAC) curve is U-shaped, yet it is flatter than the short-run average cost (SAC) curve. It means that the LAC curve first falls slowly and then rises gradually after a minimum point is reached.

1. Initially, the LAC gradually slopes downwards due to the availability of certain economies of scale like the economical use of indivisible factors, increased specialization and the use of technologically more efficient machines or factors. The return to scales increase because of the indivisibility of factors of production.

When a business unit expands, the return to scale increase due to the indivisible factors are employed to their maximum capacity. Further, as the firm expands, it enjoys internal economies of production. It may be able to install better machines, sell its products more easily, borrow money cheaply, procure the services of more efficient manager and workers, etc. All these economies help in increasing the returns to scale more than proportionately.

2. After the minimum point of the long-run average cost is reached, the LAC curve may flatten out over a certain range of output with the expansion of the scale of production. In such a situation, the economies and diseconomies balance each other and the LAC curve has a disc base.

3. With further expansion of scale, the diseconomies like the difficulties of coordination, manage-ment, labour and transport arise which more than counterbalance the economies so that the LAC curve begins to rise. This happens when the indivisible factors become inefficient and less productive due to the over expansion of the scale of production. Moreover, when supervision and coordination become difficult, average cost increases. To these internal diseconomies are added external diseconomies of scale.

These arise from higher factor prices or from diminishing productivities of factors. As the indus-try continues to expand, the demand for skilled labour, land, capital, etc. rises. Transport and marketing difficulties also emerge. Prices of raw materials go up. All these factors lead to diminishing returns to scale and tend to raise costs.

Conclusion:

The LAC curves first falls and then rises more slowly than the SAC curve because in the long run all costs become variable and few are fixed. The plant and equipment can be altered and adjusted to the output. The existing factors can be worked fully and more efficiently so that

both the average fixed costs and average variable costs are lower in the long run than in the short run. That is why, the LAC curve is flatter than the SAC curve.

Similarly, the LMC curve is flatter than the SMC curve because all costs are variable and there are few fixed costs. In the short-run, the marginal cost is related to both the fixed and variable costs. As a result, the SMC curve falls and rises more swiftly than the LMC curve. The LMC curve bears the usual relation to the LAC curve. It first falls and is below the LAC curve. Then rises and cuts the LAC curve at its lowest point E and is above the latter throughout its length, as shown in Figure 6.

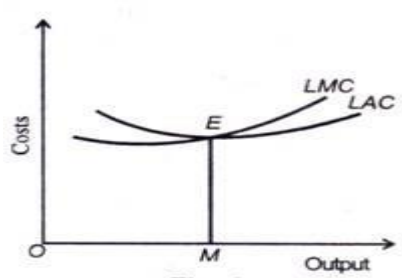


Fig. 6

& & & & &

THE BREAK-EVEN ANALYSIS

The objective of a business is to make profits. Profits are the difference between total revenue and total cost. Profits are influenced by several factors like selling price, sales volume and cost of product.

Thus, Break-even analysis is defined as analysis of costs and their possible impact on revenues and volume of the production of the firm. Hence it is also known as "cost-volume-profit (CVP) analysis". It helps to know the operating condition that exists when a company is said to Break-even, when its total revenue is equal to the total cost. It is a point of no profit, no loss. It enables the financial manager to study the general effect of the level of output upon income and expenses and, therefore, upon profits.

C.V.P analysis, break-even analysis and profit-graphs are interchangeable words. A profit-graph has been defined as a "diagram showing the expected relationship between the costs of revenue at various volumes". Similarly, c-v-p- analysis furnishes complete picture of the profit structure which enables management to distinguish between the effect of sales volume fluctuations and the" results of price or cost changes upon profits.

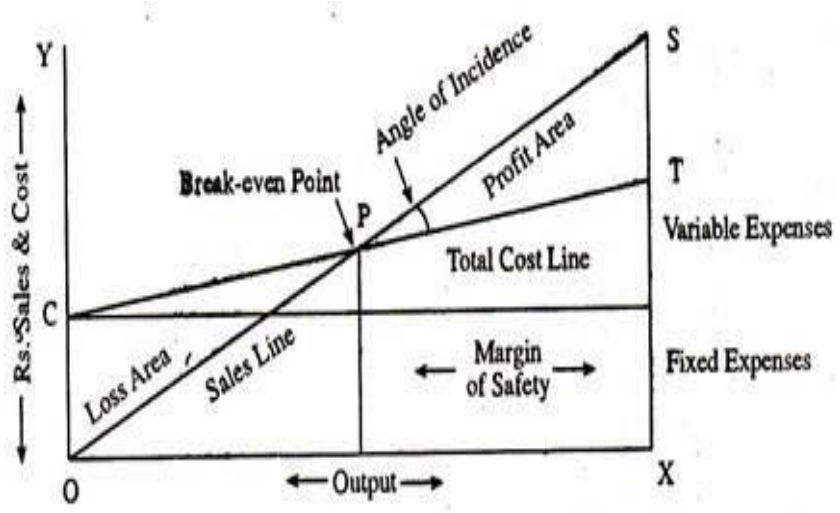
Assumptions Underlying Break-Even Analysis:

The break-even analysis is based on certain assumptions. They are:
(i) All costs can be separated into fixed and variable components.
(ii) Fixed costs will remain constant at all volumes of output.
(iii) Variable costs will fluctuate in direct proportion to volume of output.
(iv) Selling price will remain constant.

(v) Product-mix will remain unchanged.
(vi) There is no opening or closing stock.
(vii) Productivity per worker will remain unchanged.
(viii) There will be no change in operating efficiency.

Break-Even Chart:

Break-Even charts are being used in recent years by the managerial economists, company executives and government agencies in order to find out the break-even point. In the break-even charts, the concepts like total fixed cost, total variable cost, and the total cost and total revenue are shown separately. The break even chart shows the extent of profit or loss to the firm at different levels of activity. The following Fig. 1 illustrates the typical break-even chart.



In this diagram output is shown on the X-axis and costs and revenue on Y-axis. P is the break-even point in the break-even chart where OS and CT being the sales line and total cost line intersects. Loss results in the left side of P, i.e., before the break-even point are reached, and, beyond P, profit starts to generate. Break-even point has a wide use in the field of marginal costing and helps to decide the product mix, fixation of selling price, steps to be taken in long-term planning etc.

& & & & &

Determination of Break-even Point:

(a) Fixed cost
(b) Variable cost
(c) Contribution
(d) Margin of safety
(e) Angle of incidence
(f) Profit volume ratio
(g) Break-Even-Point

(a) ***Fixed cost:*** Expenses that do not vary with the volume of production are known as fixed expenses. Example: Manager's salary, rent and taxes, insurance etc. It should be noted that fixed changes are fixed only within a certain range of plant capacity. The concept of fixed overhead is most useful in formulating a price fixing policy. Fixed cost per unit is not fixed.

(b) ***Variable Cost****:* Expenses that vary almost in direct proportion to the volume of production of sales are called variable expenses. Example: Electric power and fuel, packing materials consumable stores. It should be noted that variable cost per unit is fixed.

(c) ***Contribution:*** Contribution is the difference between sales and variable costs and it contributed towards fixed costs and profit. It helps in sales and pricing policies and measuring the profitability of different proposals. Contribution is a sure test to decide whether a product is worthwhile to be continued among different products.

Contribution = Sales – Variable cost
Contribution = Fixed Cost + Profit.

(d) ***Margin of safety:*** Margin of safety is the excess of sales over the break even sales. It can be expressed in absolute sales amount or in percentage. It indicates the extent to which the sales can be reduced without resulting in loss. A large margin of safety indicates the soundness of the business. The formula for the margin of safety is:

Margin of Safety = Present sales – Break even sales **or** $\frac{\text{Profit}}{\text{P. V. ratio}}$

Margin of safety can be improved by taking the following steps.

1. Increasing production
2. Increasing selling price
3. Reducing the fixed or the variable costs or both
4. Substituting unprofitable product with profitable one.

(e) ***Angle of incidence:*** This is the angle between sales line and total cost line at the Break-even point. It indicates the profit earning capacity of the concern. Large angle of incidence indicates a high rate of profit; a small angle indicates a low rate of earnings. To improve this angle, contribution should be increased either by raising the selling price and/or by reducing variable cost. It also indicates as to what extent the output and sales price can be changed to attain a desired amount of profit.

(f) ***Profit Volume Ratio:*** It is usually called P. V. ratio. It is one of the most useful ratios for studying the profitability of business. The ratio of contribution to sales is the P/V ratio. It may be expressed in percentage. Therefore, every organization tries to improve the P. V. ratio of each product by reducing the variable cost per unit or by increasing the selling price per unit. The concept of P. V. ratio helps in determining break-even-point, a desired amount of profit etc.

$$\text{P.V ratio} = \frac{\text{Contributi on}}{\textit{Sales}} \text{ X } 100$$

(g) ***Break – Even- Point:*** Break Even Point refers to the point where total cost is equal to total revenue. It is a point of no profit, no loss. This is also a minimum point of no profit, no loss. This is

also a minimum point of production where total costs are recovered. If sales go up beyond the Break Even Point, organization makes a profit. If they come down, a loss is incurred.

$$\text{Break-even point (Units)} = \frac{\text{Fixed Expenses}}{\text{Contributi on per unit}}$$

$$\text{Break Even point (In Rupees)} = \frac{\text{Fixed expenses}}{\text{Contributi on}} \text{ X sales}$$

Uses of Break-Even Analysis:

(i) It helps in the determination of selling price which will give the desired profits.

(ii) It helps in the fixation of sales volume to cover a given return on capital employed.

(iii) It helps in forecasting costs and profit as a result of change in volume.

(iv) It gives suggestions for shift in sales mix.

(v) It helps in making inter-firm comparison of profitability.

(vi) It helps in determination of costs and revenue at various levels of output.

(vii) It is an aid in management decision-making (e.g., make or buy, introducing a product etc.), forecasting, long-term planning and maintaining profitability.

(viii) It reveals business strength and profit earning capacity of a concern without much difficulty and effort.

& & & & &