UNIT II
PRODUCTION ANALYSIS

- ❖ CONCEPT OF PRODUCTION
- ❖ FACTORS
- ❖ LAW OF PRODUCTION
- ❖ ECONOMIES OF SCALE
- ❖ ECONOMIES OF SCOPE
- ❖ PRODUCTION FUNCTIONS

CONCEPT OF PRODUCTION

- The term production is taken to mean the creation or making of any product.

- In economics, thoughts about production were related to utility. A change in anything which adds or creates utility was called production activity

- By production we mean the process of creating the various good and services which are consumed by the people of the country .

- Production is a process in which some material are transformed from one form to other.

- Whatever is used in the production process is called an input or factor the production and whatever is obtained from the process is an output.

CONCEPT OF PRODUCTION

- **A particular production process may use various types of inputs or factors and may yield two or more outputs.**
- **Production also means creation of utility.**
- **The process of production can be shown as follows:**

INPUT ➡ TRANSFORMATION ➡ OUTPUT

PRODUCTION PROCESS

CONCEPT OF PRODUCTION

- Since production is transformation it can be done through the following changes:

- **Change of shape**

- **Change of form or appearance**

- **Change of place**

- **Change of time**

- **Other methods**

FACTORS OF PRODUCTION

❑ Process of production require many input or elements without which production is not possible.

❑ In economics all these inputs are elements called factors of production and they have been classified as:

➢ **LAND**

➢ **LABOUR**

➢ **CAPITAL**

➢ **ENTREPRENEURSHIP**

CHARACTERSTICS OF FACTORS OF PRODUCTION

❖ **COMPLEMENTARY:** Production is possible only when all factors of production are present.

❖ **SUBSTITUTABILITY:** One factor of production can substitute another to some extent. Example: capital for labour, plastic for metal.

❖ **SPECIFICITY:** It can be used for specific products only and not for others. Some land is suitable for production of paddy crops and not for wheat or others.

❖ **MOBILITY:** Ability of factor of production to move from one place to another.

LAWS OF PRODUCTION

❑ As we have seen that production is possible only through the factors of production and therefore quantum of production is dependent on quantity of factors.

❑ The relationship between factors of production and the resultant output is studied under laws of production.

❑ The output can change under two conditions:

❑ Only one factor of production is changed while other are kept constant this condition is called law of variable proportions.

❑ All factors of change in a given proportion this is called returns to scale.

LAW OF VARIABLE PROPORTION

- It is also known as **law of Diminishing Returns** or **Returns to a Factors.**
- This law becomes applicable when we increase one factor of production while keeping other factors as constant.

- When we increase this variable factor the output will go on increasing this increase in output will be called **marginal physical product(MPP).**

- This marginal product does not remain constant but will sometime increase or decrease , the study of this phenomenon is known as **LAW OF VARIABLE PROPORTIONS**

LAW OF VARIABLE PROPORTION

According to this law:

If we keep other factors as constant and increase only one factor of production, then Total Physical Product(TPP) will increase at an increasing rate ,then at a constant rate and finally at a diminishing rate.

Assumptions:
- **Constant Technology**
- **Short-Run**
- **Factor Proportions are Variable**
- **Homogeneous Factor Units**

EXPLANATION TO LAW

- This law can be explained by the following example of Agricultural production. Suppose we have 10 acre land and capital investment of 20000 which is fixed. Then we can increase the number of labour one by one and see the increase in physical product.

Fixed Factor : Land (Acres)	Variable Factor: Land (Units)	TPP (Total Physical Product) (Quantity)	MPP (Marginal Physical Product) (Quantity)	
1	0	0	-	
1	1	2	2	Stage I
1	2	6	4	
1	3	12	6	
1	4	16	4	Stage II
1	5	18	2	
1	6	18	0	
1	7	14	-4	Stage III
1	8	8	-6	

EXPLANATION TO LAW

- In this example, the land is the fixed factor and labour is the variable factor. The table shows the different amounts of output when you apply different units of labour to one acre of land which needs fixing.

- The following diagram explains the law of variable proportions. In order to make a simple presentation, we draw a Total Physical Product (TPP) curve and a Marginal Physical Product (MPP) curve as smooth curves against the variable input (labour).
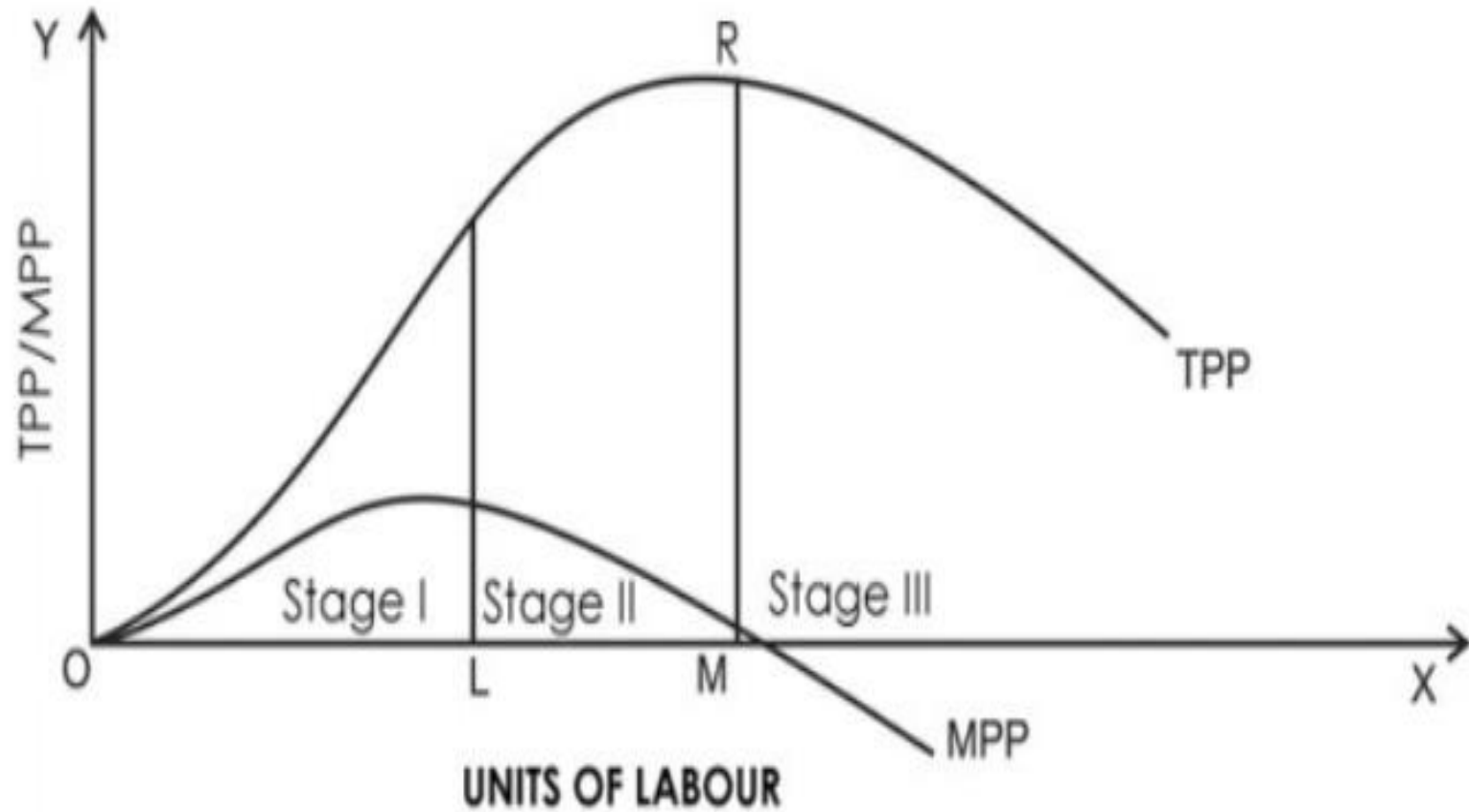
Production Functions

TP & MP RELATION

THREE STAGES OF THE LAW

- **Three Stages of the Law**

The law has three stages as explained below:

- **Stage I** – The TPP increases at an increasing rate and the MPP increases too. The MPP increases with an increase in the units of the variable factor. Therefore, it is also called the stage of increasing returns. In this example, the Stage I of the law runs up to three units of labour (between the points O and L).

- **Stage II** – The TPP continues to increase but at a diminishing rate. However, the increase is positive. Further, the MPP decreases with an increase in the number of units of the variable factor. Hence, it is called the stage of diminishing returns. In this example, Stage II runs between four to six units of labour (between the points L and M). This stage reaches a point where TPP is maximum (18 in the above example) and MPP becomes zero (point R).

- **Stage III** – Now, the TPP starts declining, MPP decreases and becomes negative. Therefore, it is called the stage of negative returns. In this example, Stage III runs between seven to eight units of labour (from the point M onwards)

| Stage	Total Product	Marginal Product	Average Product
Stage I	Initially increases at an increasing rate and subsequently at a diminishing rate.	Increases first, reaches the maximum and then starts decreasing.	Increases throughout the stage and reaches the maximum.
Stage II	Continues to increase at a diminishing rate, and eventually reaches the maximum.	Continues to decrease and eventually becomes zero.	From the maximum begins to decrease.
Stage III	Diminishes.	Is negative.	Continues to decrease, but is always positive.
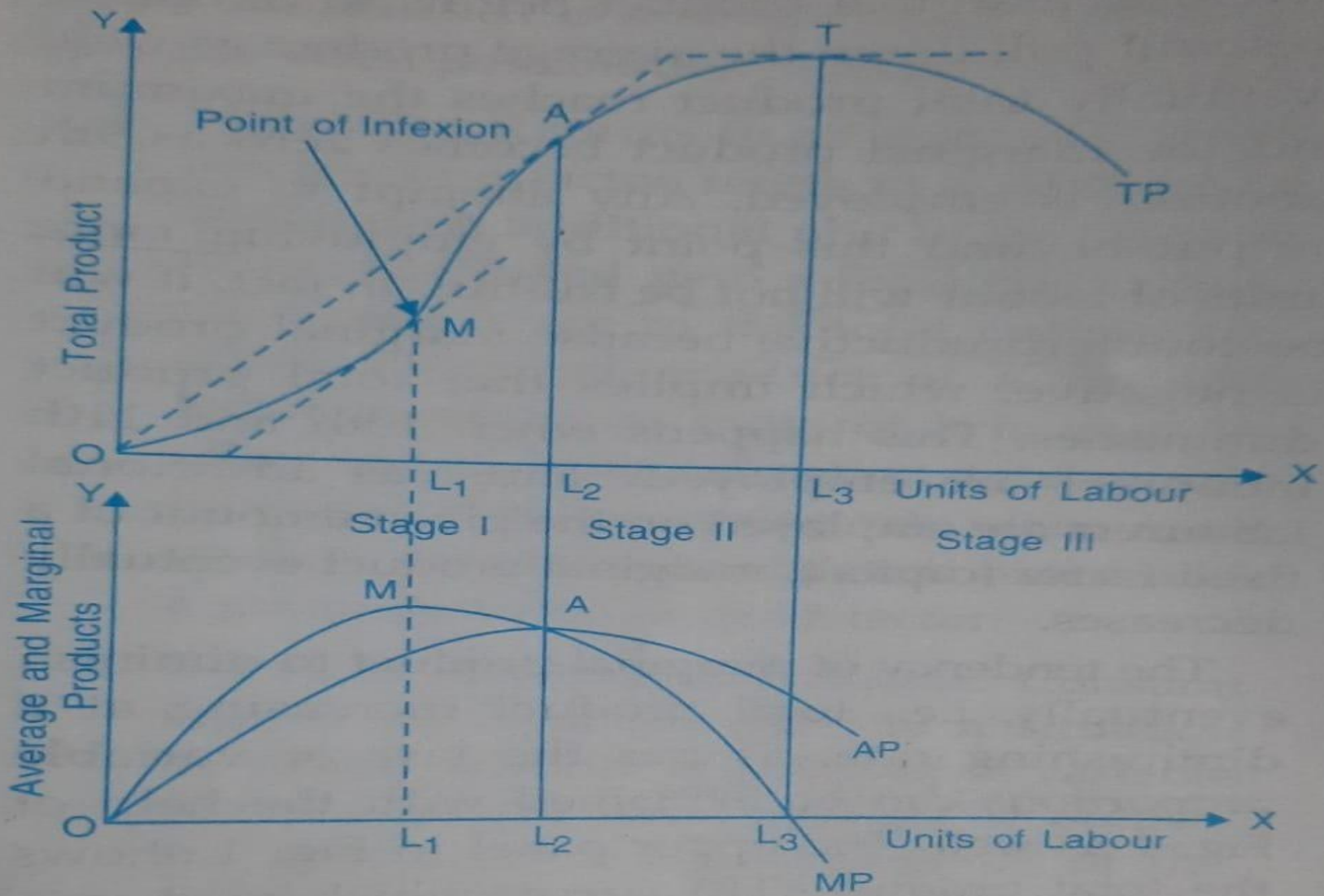
Fig. 1 Behaviour of TP, AP and MP Curves as per the Law of Variable Proportions

SIGNIFICANCE OF THE THREE STAGES

Stage I

- A producer does not operate in Stage I. In this stage, the marginal product increases with an increase in the variable factor.

- Therefore, the producer can employ more units of the variable to efficiently utilize the fixed factors. Hence, the producer would prefer to not stop in Stage I but will try to expand further.

Stage III

- Producers do not like to operate in Stage III either. In this stage, there is a decline in total product and the marginal product becomes negative.

- In order to increase the output, producers reduce the amount of variable factor. However, in Stage III, he incurs higher costs and also gets lesser revenue thereby getting reduced profits.

Stage II

- Any rational producer avoids the first as well as third stages of production. Therefore, producers prefer Stage II – the stage of diminishing returns. This stage is the most relevant stage of operation for a producer according to the law of variable proportions.
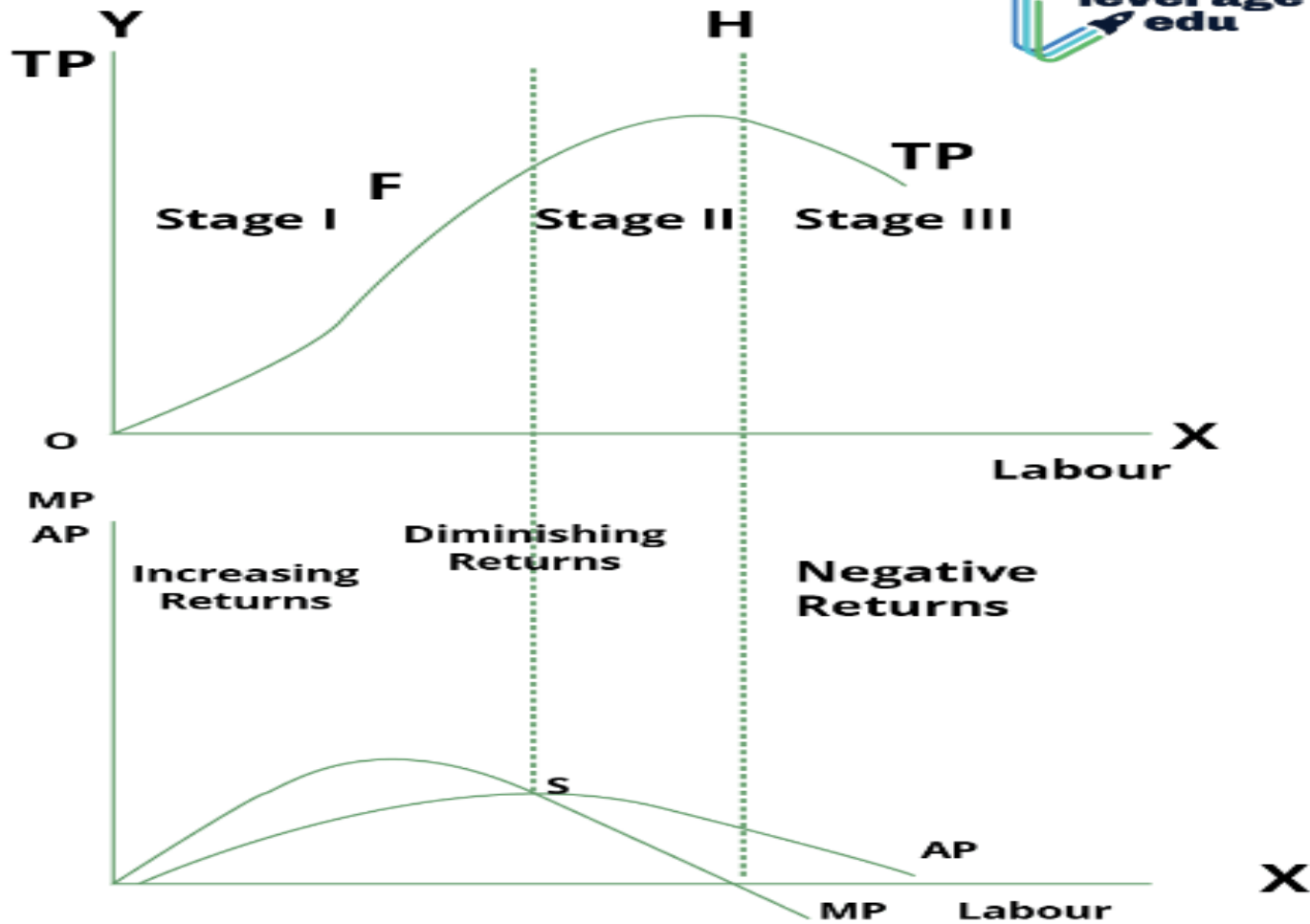
3 Stages of Law of Variable Proportion

In the above table and graph of the Law of Variable Proportions, you would notice that:

EXPLANATION OF THE LAW OF VARIABLE PROPORTION

CAUSES OF INCREASING RETURNS TO SCALE:

1. Fuller utilisation of fixed resources

2. Increase in efficiency

CAUSES OF DIMINISHING RETURNS

1. Disturbing the optimum proportion

2. Imperfect substitutability of factors of production

CAUSES OF NEGATIVE RETURN

1. Overcrowding

2. Management problem

RETURNS TO SCALE

When all inputs are changed simultaneously in the same proportion we call this as change in the scale of production . The way total output changes due to change in the scale of production is known as the law of returns to scale.

In long run output can be increased by changing all the factors of proportion in the same proportion .

When all the inputs are increased in same proportion, total product may increase at an increasing rate, at a constant rate or at diminishing rate.

The increasing returns to scale arises largely due to internal economies and decreasing returns to scale arises largely due to internal diseconomies.

INCREASING RETURNS TO SCALE

- Increasing returns to scale means that the increase in output is more than proportional to increase in inputs.

- For example, if inputs are increased by 100 per cent and the output increase by more than 100 per cent (say by 150 %) , the increasing returns to scale will operate.

INPUTS (units)	OUTPUT (units)
1 CAPITAL + 1 LABOUR	100
2 CAPITAL + 2 LABOUR	250

CONSTANT RETURNS TO SCALE

- If increase in output is in the same proportion as increase in quantity of all inputs, returns to scale are said to be constant.

- Thus if all inputs are increased by 100 per cent and as a consequence output also increases by 100 per cent , returns to scale are constant.

INPUTS (units)	OUTPUT (units)
1 CAPITAL + 1 LABOUR	100
2 CAPITAL + 2 LABOUR	200

DECREASING RETURNS TO SCALE

- If output increases in a smaller proportion than the increase in inputs there are decreasing returns to scale thus if inputs are increased by 100 per cent and output increases by less than 100% (say by 50%) decreasing returns to scale.

INPUTS (units)	OUTPUT (units)
1 CAPITAL + 1 LABOUR	100
2 CAPITAL + 2 LABOUR	150

ECONOMIES TO SCALE

INTERNAL ECONOMIES

Internal economies are those economics which arises from the expansion of plant size or increase in scale of production of firm.

Technical economies
managerial economies
marketing economies
financial economies
economies in transport and storage
research and development
risk and survival of economy

ECONOMIES TO SCALE

Internal diseconomies: internal diseconomies are those which are experienced by a particular firm when it expands its scale of production beyond a particular point.

Main types of internal diseconomies are managerial diseconomies, labour inefficiency, technical diseconomies.

External economies which are shared by all the firms in the industry they arise as a result of expansion of the industry as a whole. Important external economies are cheaper inputs, technological economies , supply of skilled labour , growth of ancillary industry, constant flow of information , Economics of concentration.

ECONOMIES TO SCALE

- External diseconomies are those which are experienced by all the firms of an industry when the scale of production of the industry as a whole expand beyond a manageable limits. Increase in in input prices, higher wages and costlier transport.

Economies of scope

Economies of scale we find that economic benefits in terms of reduced when we produce a product at a larger scale than at a smaller scale . Economic benefits in terms of reduced costs can be opened not merely from output or volume but from where variety. Many firms produce variety of products and that helps them achieve benefits which results in lower costs. These set of benefits accruing to a producer are known as economies of scope.

The real test of accrual of economy of scope is that a firm producing more than one product is able to produce them at a lower cost then what it will take it same products are produced separately by different firms.

ECONOMIES OF SCOPE

Suppose a firm producer 1000 units of product A and 2000 units of product B at a cost of rupees 100000. However ,if two products are produced separately and the cost for same level of output of A and B are rupees 50000 and rupees 80000 respectively .Then, the firm producing the two outputs is said to be reaping economy of scope. This is because the cost of joint production is rupees 100000 while the summation of separate cost is rupees 130000.

The degree of economies of scope is calculated using the following equation:

$$DSC = \frac{TC(q_1) + TC(q_2) - TC(q_1,q_2)}{TC(q_1,q_2)}$$

ECONOMIES OF SCOPE

The main reason for existence of Economics of scope is that there is better utilisation of existing resources and production facilities. For example the production of CARS and TRUCKS can use the same sheets and molding machine. Another reason for Economics of scope is "by products" of one and be used as input for another product which otherwise might have gone waste or would have fetched a low price. For example if a sugar mill manufacturers both sugar and alcohol it can make better use of its resources and inputs.

PRODUCTION FUNCTION

- The act of making goods and services and their by acting utility to the object is production in economics.

- A study of relationship between inputs and outputs is known as theory of production.

- Functional relationship between input and output is usually referred to as production function.

- A production function shows the amount of quantity for commodity that can be produced per unit of time with given amount of inputs, when the best production techniques available is used.

- For example, production function for a shoe making factory may indicate that a certain quantity of shoes can be produced per day with given quantities of leather, glue, workers, machinery etc.

PRODUCTION FUNCTION

- Production function can be expressed as:

$$Q_x = f(f_1, f_2,.......,f_n)$$

- Q_x is the quantity of output (dependent variable)
- $F_1, f_2 ,......,f_n$ are physical quantities of different inputs used to produce commodity X (independent variable)

If we assume there are only two inputs : labour(L) and capital (K)

$Q_X = f(L,K)$

The quantity of commodity X produced is the function i.e., depends upon the quantity of L and K.

IMPORTANT POINTS:

- Production function with reference to a particular period of time
- It expresses physical relation because both inputs and outputs are expressed in physical terms.
- Production function describe purely technological relation because what can be produced with the given amount of resources depends upon the state of Technology

Short Run and long run

The nature of production i.e. How output varies with change in quantity of inputs depends upon the time period allowed for adjustment of inputs.

SHORT RUN: Short run refers to the period of time during which the amount of one or more inputs called the fixed factor cannot be changed. For example the amount of plant and equipment fixed in short firm.This implies that an increase in a firm in short run can be brought about by increasing those inputs that can be varied known as variable inputs.

Long run is defined as the time period during which all the factors of production can be carried and there are no fixed asset in long and a plant can install new machinery or set up new factory building.

Short run production

Short run production function short run production function refers to a situation when only one input is variable and all other inputs are assumed to be constant.

The behaviour of output when only one input is changed is called returns to factor the short run production function is the subject matter or law of variable proportions .

LONG RUN PRODUCTION

A long run production function refers to the situation when all the inputs are variable. Long of production function studies changes in output when all inputs used in the production of a commodity are changed simultaneously and in the same proportion.

The response of output to changes in scale of all factors in same proportion is termed as returns to scale.

Basic concepts

TOTAL PRODUCT: TP refers to the total amount of a commodity produced during some specific period of time by combining a particular quantity of a variable factor with a given quantity of fixed factor.

AVERAGE PRODUCT: refers to output per unit of variable factor. AP=TP/L

MARGINAL PRODUCT: change in total product resulting from use of one additional unit of variable factor. MP= △ TP / △ L