-MODULES-

PRODUCTION FUNCTION
THE LAW OF VARIABLE PROPORTIONS
THE LAW OF RETURNS TO SCALE

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Production Function

- A production function expresses the technological or engineering relationship between the output of a commodity and its inputs. The output of an industry is a positive function of the quantities of land, labour and capital, the quality of management, and the level of technology that is employed in its production

Symbolically - Production Function

$X = f(Ld, L, K, M, T)$

$f_1, f_2, f_3, f_4, f_5 > 0$

Where x = output of commodity X

Ld = land employed in the production of X

L = labour employed in the production of X

K = capital employed in the production of X

M = management employed in the production

T = technology employed in the production of X

f = unspecified function

f_1 = partial derivative of f with respect to the ith independent variable.

THE LAW OF VARIABLE PROPORTIONS

- Under this law, it is assumed that only one factor of production is variable while other factors are fixed. As we increase the quantity of variable factor, while keeping other factors constant the output of variable factor may increase proportionately in the initial stages of production but finally, it will not increase proportionately.
- "As the proportion of one factor in a combination of factors is increased after a point, the average and marginal production of that factor will diminish." – F Benham
- "As equal increments of one input are added, the inputs of other productive services being held constant, beyond a certain point the resulting increments of product will decrease i.e. the marginal products will diminish". George Stigler.

The conditions underlying the law are as follows:

- Only one factor is varied and all other factors should remain constant.
- The scale of output is unchanged, and the production plant or the size efficiency of the firm remains constant.
- The technique of production does not change.
- All units of the factor input varied are homogeneous, i.e., all the units have identical characteristics and equal efficiencies.
- In the short run, as the amount of variable factors increases, other things remaining equal, output (or the returns to the factors varied) will increase more than proportionately to the amount of variable inputs in the beginning, that it may increase in the same proportion and ultimately it will increase less proportionately.

Statement: Using the concept of marginal product, the law may be stated as follows:

- During the short period, under the given state of technology and other conditions remaining unchanged, with the given fixed factors, when the units of a variable factor are increased in the production function in order to increase the total product, the total production initially may rise at an increasing rate and, after a point, it tends to increases at a decreasing rate because the marginal product of the variable factor in the beginning may tend to rise but eventually tends to diminish.

Production Schedule…….

THE LAW OF RETURNS TO SCALE

THE LAW OF RETURNS TO SCALE

Adjustment among different factors can be brought about in the long period. Thus, all factors become variable in the long run. That means, in the long run, the size of a firm can be expanded as the scale of production is enhanced. Economists use the phrase "returns to scale" to describe the output behavior in the long run in relation to the variations in factor inputs.

Statement –

"As a firm in the long run increases the quantities of all factors employed, other things being equal, the output may rise initially at a more rapid rate than the rate of increases in inputs, then output may increase in the same proportion of input, and ultimately, output increases less proportionately."

Assumptions - The law assumes that:

- Technique of production is unchanged.
- All units of factors are homogeneous.
- Returns are measured in physical terms.

There are three phases of returns in the long run described as:

- The law of increasing returns
- The law of constant returns; and
- The law of decreasing returns.

The Law of Increasing Returns

- There are increasing returns to scale when a given percentage increase in input will lead to greater relative percentage increase in the resultant output.

- Algebraically, $\Delta Q/Q > \Delta F/F$,

where $\Delta Q/Q$ = proportionate change in output and

$\Delta F/F$=proportionate change in inputs (factors).

Thus, Production Function Coefficient (PFC)> 1 under increasing returns to scale.

The Law of Constant Returns

- As the firm continues to expand its scale of operations, it gradually exhausts the economies responsible for the increasing returns. Then, the constant returns may occur. There are constant returns to scale when a given percentage increase in inputs leads to the same percentage increase in output.

- Algebraically, $\Delta Q/Q = \Delta F/F$. It implies that the doubling of factor inputs doubles the output. Thus, PFC = 1 under constant returns to scale.

The Law of Decreasing Returns

- There are decreasing returns to scale when the percentage increase in output is less than the percentage increase in input.

- Algebraically, $\Delta Q/Q < \Delta F/F$. Thus, PFC < 1 under decreasing returns to scale.

- The Law of Returns .....

Discussion