

## Long-run production function - Returns to Scale

In the long run, all factors can be changed. Returns to scale studies the changes in output when all factors or inputs are changed. An increase in scale means that all inputs or factors are increased in the same proportion.

### Three phases of returns to scale

The changes in output as a result of changes in the scale can be studied in 3 phases. They are

1. Increasing returns to scale
2. Constant returns to scale
3. Decreasing returns to scale

#### 1. Increasing returns to scale

If the increase in all factors leads to a more than proportionate increase in output, it is called increasing returns to scale. For example, if all the inputs are increased by 5%, the output increases by more than 5% i.e. by 10%. In this case the marginal product will be rising.

#### 2. Constant returns to scale

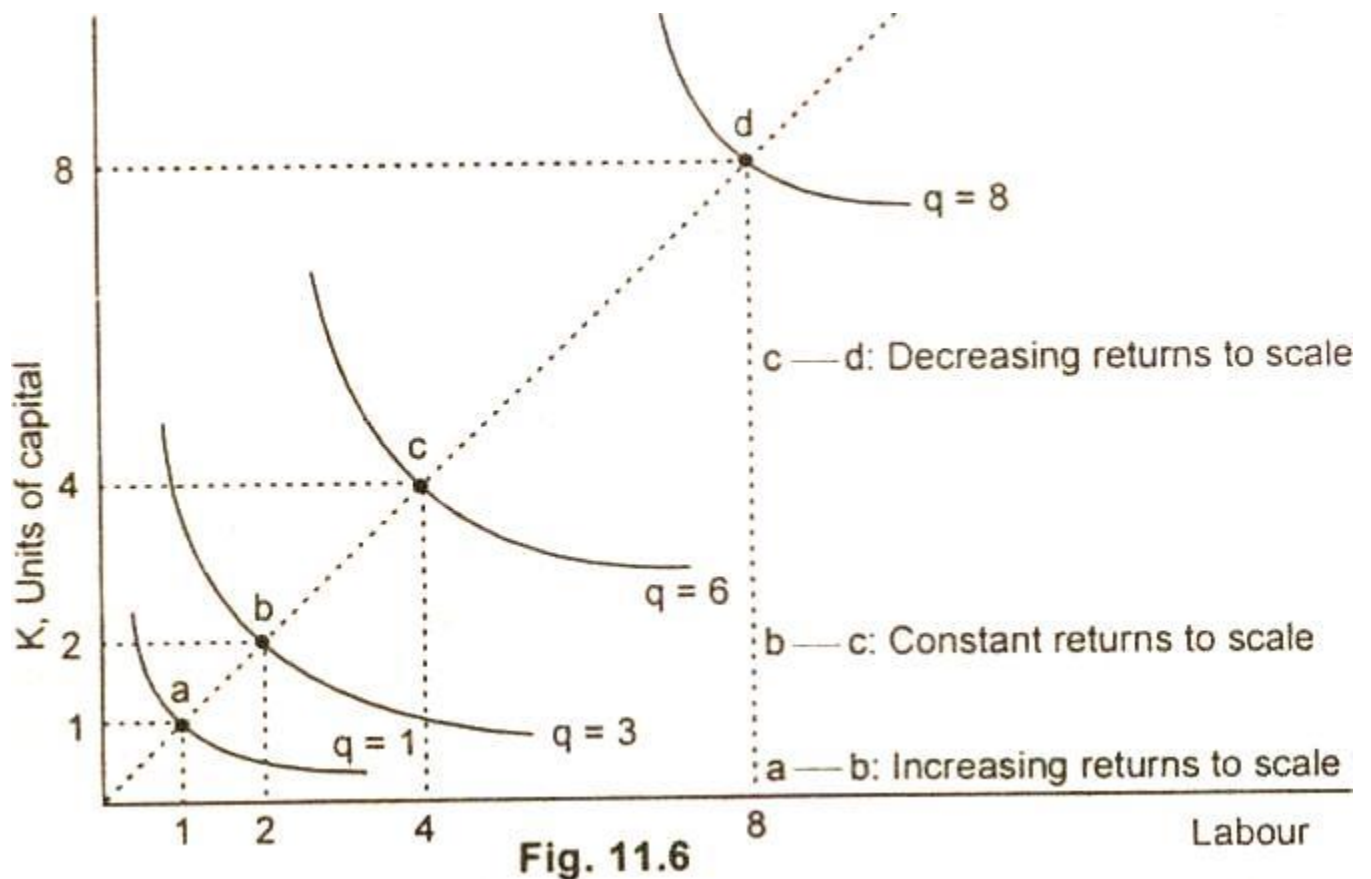
If we increase all the factors (i.e. scale) in a given proportion, the output will increase in the same proportion i.e. a 5% increase in all the factors will result in an equal proportion of 5% increase in the output. Here the marginal product is constant.

### 3. Decreasing returns to scale

If the increase in all factors leads to a less than proportionate increase in output, it is called decreasing returns to scale i.e. if all the factors are increased by 5%, the output will increase by less than 5% i.e. by 3%. In this phase marginal product will be decreasing.

#### Graph/Diagram:

The three laws of returns to scale are now explained with the help of a graph below:



The figure 11.6 shows that when a firm uses one unit of labor and one unit of capital, point a, it produces 1 unit of quantity as is shown on the  $q = 1$  isoquant. When the firm doubles its outputs by using 2 units of labor and 2 units of capital, it produces more than double from  $q = 1$  to  $q = 3$ .

So the production function has increasing returns to scale in this range. Another output from quantity 3 to quantity 6. At the last doubling point c to point d, the production function has

decreasing returns to scale. The doubling of output from 4 units of input, causes output to increase from 6 to 8 units increases of two units only.