

## Law of Variable Proportions

“The law of variable proportion states that if the inputs of one resource is increased by equal increment per unit of time while the inputs of other resources are held constant, total output will increase, but beyond some point the resulting output increases will become smaller and smaller.”

Leftwitch

### **Assumptions:**

**Law of variable proportions is based on following assumptions:**

#### ***(i) Constant Technology:***

The state of technology is assumed to be given and constant. If there is an improvement in technology the production function will move upward.

#### ***(ii) Factor Proportions are Variable:***

The law assumes that factor proportions are variable. If factors of production are to be combined in a fixed proportion, the law has no validity.

#### ***(iii) Homogeneous Factor Units:***

The units of variable factor are homogeneous. Each unit is identical in quality and amount with every other unit.

#### ***(iv) Short-Run:***

The law operates in the short-run when it is not possible to vary all factor inputs.

### **Explanation of the Law:**

In order to understand the law of variable proportions we take the example of agriculture. Suppose land and labour are the only two factors of production.

**By keeping land as a fixed factor, the production of variable factor i.e., labour can be shown with the help of the following table:**

Table 1.

Units of Land	Units of Labour	Total Production	Average Production	Marginal Production
10 Acres	0	—	—	—
"	1	20	20	20
"	2	50	25	30
"	3	90	30	40
"	4	120	30	30
"	5	140	28	20
"	6	150	25	10
"	7	150	21.3	0
"	8	140	17.5	-10

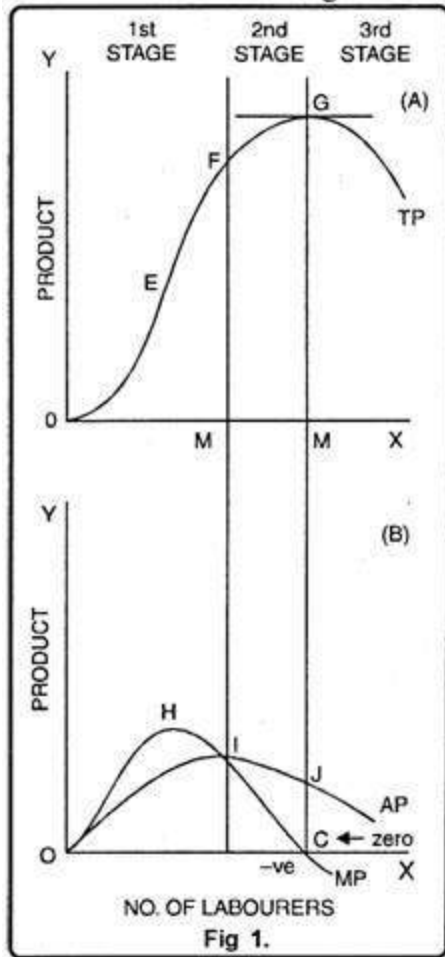
From the table it is clear that there are three stages of the law of variable proportion. In the first stage average production increases as there are more and more doses of labour and capital employed with fixed factors (land). We see that total product, average product, and marginal product increases but average product and marginal product increases up to 40 units. Later on, both start decreasing because proportion of workers to land was sufficient and land is not properly used. This is the end of the first stage.

The second stage starts from where the first stage ends or where AP=MP. In this stage, average product and marginal product start falling. We should note that marginal product falls at a faster rate than the average product. Here, total product increases at a diminishing rate. It is also maximum at 70 units of labour where marginal product becomes zero while average product is never zero or negative.

The third stage begins where second stage ends. This starts from 8th unit. Here, marginal product is negative and total product falls but average product is still positive. At this stage, any additional dose leads to positive nuisance because additional dose leads to negative marginal product.

**Graphic Presentation:**

In fig. 1, on OX axis, we have measured number of labourers while quantity of product is shown on OY axis. TP is total product curve. Up to point 'E', total product is increasing at increasing rate. Between points E and G it is increasing at the decreasing rate. Here marginal product has started falling. At point 'G' i.e., when 7 units of labourers are employed, total product is maximum while, marginal product is zero. Thereafter, it begins to diminish corresponding to negative marginal product. In the lower part of the figure MP is marginal product curve.



Up to point 'H' marginal product increases. At point 'H', i.e., when 3 units of labourers are employed, it is maximum. After that, marginal product begins to decrease. Before point 'I' marginal product becomes zero at point C and it turns negative. AP curve represents average product. Before point 'I', average product is less than marginal product. At point 'I' average product is maximum. Up to point T, average product increases but after that it starts to diminish.

### Three Stages of the Law:

#### 1. First Stage:

First stage starts from point 'O' and ends up to point F. At point F average product is maximum and is equal to marginal product. In this stage, total product increases initially at increasing rate up to point E. between 'E' and 'F' it increases at diminishing rate. Similarly marginal product also increases initially and reaches its maximum at point 'H'. Later on, it begins to diminish and becomes equal to average product at point T. In this stage, marginal product exceeds average product ( $MP > AP$ ).

## 2. Second Stage:

It begins from the point F. In this stage, total product increases at diminishing rate and is at its maximum at point 'G' correspondingly marginal product diminishes rapidly and becomes 'zero' at point 'C'. Average product is maximum at point 'I' and thereafter it begins to decrease. In this stage, marginal product is less than average product ( $MP < AP$ ).

## 3. Third Stage:

This stage begins beyond point 'G'. Here total product starts diminishing. Average product also declines. Marginal product turns negative. Law of diminishing returns firmly manifests itself. In this stage, no firm will produce anything. This happens because marginal product of the labour becomes negative. The employer will suffer losses by employing more units of labourers. However, of the three stages, a firm will like to produce up to any given point in the second stage only.

### ADVERTISEMENTS:

Total Product	Marginal Product	Average Product
<b>Stage I</b> First increases at increasing rate then at diminishing rate.	Increases in the beginning then reaches a maximum and begins to decrease.	First increases, continues to increase and becomes maximum.
<b>Stage II</b> Continues to increase at diminishing rate and becomes maximum.	Continues to diminish and becomes equal to zero.	Becomes equal to MP and then begins to diminish.
<b>Stage III</b> Diminishes	Becomes negative.	Continues to diminish but will always be greater than zero.

### In Which Stage Rational Decision is Possible:

To make the things simple, let us suppose that, a is variable factor and b is the fixed factor. And  $a_1, a_2, a_3, \dots$  are units of a and  $b_1, b_2, b_3, \dots$  are unit of b.

Stage I is characterized by increasing AP, so that the total product must also be increasing. This means that the efficiency of the variable factor of production is increasing i.e., output per unit of a is increasing. The efficiency of b, the fixed factor, is also increasing, since the total product with  $b_1$  is increasing.

The stage II is characterized by decreasing AP and a decreasing MP, but with MP not negative. Thus, the efficiency of the variable factor is falling, while the efficiency of b, the fixed factor, is increasing, since the TP with  $b_1$  continues to increase.

Finally, stage III is characterized by falling AP and MP, and further by negative MP. Thus, the efficiency of both the fixed and variable factor is decreasing.

***Rational Decision:***

Stage II becomes the relevant and important stage of production. Production will not take place in either of the other two stages. It means production will not take place in stage III and stage I. Thus, a rational producer will operate in stage II.

Suppose b were a free resource; i.e., it commanded no price. An entrepreneur would want to achieve the greatest efficiency possible from the factor for which he is paying, i.e., from factor a. Thus, he would want to produce where AP is maximum or at the boundary between stage I and II.

If on the other hand, a were the free resource, then he would want to employ b to its most efficient point; this is the boundary between stage II and III.

Obviously, if both resources commanded a price, he would produce somewhere in stage II. At what place in this stage production takes place would depend upon the relative prices of a and b.