Law of variable proportions

- The law of variable proportions is very important law of economics which is related with the short-run production function. **This law examines production function with one variable factor keeping other factors constant.** It is also known as the law of diminishing returns.
- Propounded by Alfred Marshall, Joan Robinson, P.A. Samuelson etc.
- According to **P.A. Samuelson** *"An increase in some inputs relative to other fixed inputs will, in a given state of technology, cause output to increase; but after a point the extra output resulting from the same additions of extra inputs will become less and less."*
- According to this law, quantity of a variable factor is increased by equal amount keeping quantities of other factors constant, initially TP increases at an increasing rate, but after a point TP increases at a diminishing rate, thereafter becomes maximum and finally declines.
- When quantity of one factor is changed, keeping quantity of other factors constant, the proportion between variable and fixed factor is change. So that it is known as the law of variable proportions.

Assumptions:

- Technology is constant.
- Labour is only a variable factor.
- At least, one factor of production is fixed.
- There must be possibility of varying the proportion of factors of production.
- All units of labour are homogeneous.

On the basis of above assumptions, the law of variable proportions can be explained with the help of table and figure given below:

Table

Land (In Ropanies)	Units of labour	TP	AP = TP/L	MP	State of production
10	0	0	0	0	Stage I [Increasing returns]
10	1	10	10	10	
10	2	30	15	20	
10	3	60	20	30	
10	4	80	20	20	
10	5	90	18	10	Stage II [Decreasing returns]
10	6	90	15	0	
10	7	80	11.4	-10	Stage III [Negative Returns]

In the above table,

- Land is considered as fixed factor and labour is variable factor of production.

- As the labour are increased keeping land fixed, TP first increases tat the increasing rate up to the 3rd unit of labour and increases at a diminishing rate up to the 5th unit of labour. TP is maximum at the 5th unit of labour and becomes stable upto the 6th units of labour and starts to fall.
- MP first increases, becomes maximum at the 3rd unit of labour and thereafter declines.
- MP is zero at 6th units of labour and thereafter negative.
- AP also increases at first, becomes maximum at the 3rd unit of labour and stable upto 4th unit of labour, thereafter declines.
- AP and MP are equal at the 4th unit of labour.
- Though AP declines it never becomes zero.

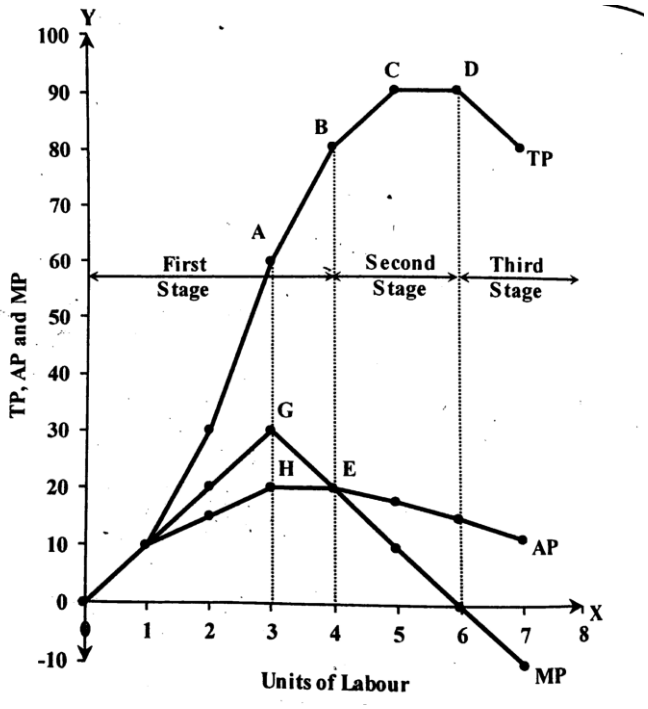

Figure: law of variable proportions

1. First Stage (Stage of increasing returns)

- Total product increases at an increasing rate up to a certain point and then increases but at the decreasing rate.
- In figure, TP is increasing at the increasing rate up to point A, increasing at diminishing rate thereafter. TP is maximum at C and D (constant).
- MP is increasing up to point G and then it is decreasing.
- AP is increasing up to the point H, stable up to point E.
- The first stage ends at the point E where AP and MP are equal (i.e. AP = MP)

Cause of increasing returns in the first stage

- **Increase in efficiency of fixed factor**

- In this stage of production, the quantity of fixed factor is abundant relative to the variable factor. When more variable factors are employed, the fixed factor is more efficiently utilized. As such, increasing returns are achieved.

▪ **Increase in the efficiency of variable factor**

- Due to additional units of variable factors employed, at the beginning the efficiency of productive capacity of variable factor itself increases. It is due to division of labour or specialization which helps to obtain higher productivity.

2. Second Stage (Stage of decreasing returns)

↘ In this stage of production, total product continues to increase at the diminishing rate until it reaches to maximum.

↘ In figure, this stage begins from the point B of TP curve. TP is maximum at point C and remains stable up to point D.

↘ In this stage AP is continuously decreasing.

↘ MP is also continuously decreasing and becomes zero (Point F of figure) where second stage ends.

↘ When TP is maximum and constant, MP is zero.

Causes of decreasing returns

▪ **Scarcity of fixed factors**

- In short-run amount of fixed factor can not be changed. Fixed factor becomes inadequate relative to the quantity of the variable factor. This result decreasing returns.

▪ **Indivisibility of fixed factor**

- Once the optimum proportion between fixed factor and variable factors is disturbed by further increase in the variable factor, indivisible factor is being used in wrong proportion with variable factor. So, the average product of variable factor diminishes which depicts diminishing returns.

▪ **Imperfect substitutability of the factor**

- Fixed factor is inadequate relatively to the variable factor whose quantity cannot be increased in accordance with the varying quantities of the other factors. This results diminishing returns.

3. Third Stage (Stage of negative returns)

↘ This stage begins from the point (point D in figure) in which TP is declining.

↘ AP is also declining but never becomes zero and negative.

↘ When TP declines, MP becomes negative.

Causes of negative returns

- Inefficient utilization of variable factors
- Over utilization of fixed factors
- Complexity of management

Which stage of production does a rational producer choose?

- A rational producer does not choose the first and third stage or production. In first stage, there is no full utilization of fixed factors of production because TP increase at increasing rate and MP of the variable factor also increases. It is possible to increase production by increasing quantity of variable factor.
- In the third stage, TP declines, AP also declines and MP becomes negative.
- Therefore, **a rational producer always chooses second stage of production** because there is full utilization of resources. In this stage, both AP and MP of variable factors are diminishing.
- The particular point of operation depends upon the prices of factors.

Application of law of variable proportions

- This law specially applies to agriculture due to the following reasons:
- He agricultural operations is difficult to supervise efficiently and effectively.
- Scope of Specialization is also very limited.
- Agricultural operations are affected by seasonal, environmental and natural factors like climate change, rain fall etc.