

LAW OF VARIABLE PROPORTION AND LAW OF RETURNS TO SCALE

[Academic Script]

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Introduction

Hello friends today we will talk about two major types of production function. In the last lecture the concept of production and production function has been explained. There are two types of production function – short run production function and long run production function. In short run firm cannot increase its fixed factor of production if it want to increase its output it can do so with the help of variable factors of production.

Law of Variable Proportion

The manner in which total output can be increased is explained through law of variable proportion. Now let us see what is law of variable proportion.

Law of variable proportion states that as the proportion of factors is changed, the total production at first increase more then proportionately, then proportionately and finally less than proportionately.

According to Leftwitch " The law of variable proportion states that the input of one resource increased by equal increased per unit time, while the inputs of other resources are held constant, total output will increase, but beyond some point the resulting output increase will become smaller and smaller". Hence law of variable proportion occupies a very important place in economic theory. It describes the production function with one variable factor while the quantites of other factor are fixed, so when the quantity of one factor is increased and the quantities of other factor are constant, naturally the proportion between variable factor and fixed factor is altered it is because in this law we study the effect on the output of of the variation in factor proportion. This law is called law of variable proportion. Now this law is based on certain assumption. Let us see the assumption.

ASSUMPTIONS :

- **1.** Production is of variable proportion type.
- Units of variable factor are homogeneous or equally efficient.
- **3.** Some of the factors are fixed, only variable factor is increasing.
- **4.** State of technology does not change.

let us see the law of variable proportion in detail.

EXPLANATION

The law can be explained with the help of following table.

Units	Units	Total	Marginal	Average
of land	of labor	production	production	production
1	1	2	2	2
1	2	5	3	2.5
1	3	9	4	3
1	4	12	3	3
1	5	14	2	2.8
1	6	15	1	2.5
1	7	15	0	2.1
1	8	14	-1	1.7

In the following table units of land is kept fixed as it is fixed factor of production and unit of labour is increasing continuously as it is variable factor of production. In the following table we can see that we have five tables unit of land, unit of labor, total production, marginal production and average production. The table is divided into three stages. The first stage is stage of increasing returns to variable proportion.

The table shows that as more and more units of labour are combined with fixed amount of land total production is initially increasing at increasing rate. This stage is called increasing returns to variable proportion.

Hence we can see that as unit of land are constant and unit of labor increased from 1 to 4 total production increased 2 to 5, then 9 and 12. Marginal production initially increased and then starts diminishing in first stage itself from 4 to 3. Average production also increases initially and then becomes constant at the end of first stage. Now let us see second stage of diminishing returns to variable proportion. Additional application of the variable factor increases the total output only at decreasing rate in this stage and marginal output tends to diminish. that is why it is called stage of diminishing returns. We can see that at the end of second stage marginal output becomes zero and throughout the second stage average output is diminishing. Hence the increase in total output is at diminishing rate. The third stage is called stage of negative returns.

The diminishing marginal output may ultimately become zero and even negative. Total output is maximum when marginal output is zero and it starts declining when marginal output becomes negative. That is why this stage is also called stage of negative returns. Let us see law of variable proportion digramatically.

In the figure production is shown on OY axis and number of labourers are shown on OX axis. TP is total product curve. This curve indicates that upto point "E". Total product is increasing at increasing rate. From point "E" to "F" it increases at diminishing rate. At point G it is maximum. Then it starts diminishing. In the figure MP is marginal product curve. Upto point "H" it is increasing and it is maximum at point "H". Then after it begin to diminish. At point I marginal and average product are equal and at point C It is zero. Which is the end point of second stage. In third stage marginal product starts declining. AP is average production curve, upto point "I" It is increasing and after that it begins to diminish throughout the second and third stage. We can see law of variable proportion also with the help of one table in which we have four column first column is showing stages total product, marginal product and average product consecutively.

STAGES	TOTAL	MARGINAL	AVERAGE
	PRODUCT	PRODUCT	PRODUCT
1 ST	Initially	Initially	Increases
STAGE	from O to	increases	and
O to F	E it	and reaches	reaches
	increases	the	its
	at	maximum	maximum
	increasing	point . Then	point. At
	rate and	starts	maximum
	later at	decreasing	point it is
	diminishing		equal to
	rate.		MP.
2 nd STAGE	Increasing	Decreasing	After
F to G	at	and	reaching
	diminishing	becomes	its
	rate and	zero.	maximum

	reaches to		point,
	maximum		begins to
			decrease.
3 rd	Begins to	Becomes	Continue
STAGE	fall	Negative	to
			diminish.

Now let us see the causes of three stages why it so happen that total product initially increases at increasing rate, then at decreasing rate and finally negative. There are certain reason

CAUSES OF ALL THREE STAGES

1 CAUSES OF INCREASING RETURNS TO A FACTOR—there are two reasons for that indivisibilities of factor and second is specialisation

INDIVISIBILITIES :

Absence of divisibility of factor into small units, whatever amount of output is to be produced there Is minimum amount or size of fixed factor is must to be employed. Hence with sufficient amount of fixed factor output increase at higher rate.

SPECIALISATION:

The efficiency and productivity of a variable factor increases more and more units of it are employed to fixed factors.

2. CAUSES OF DIMINISHING RETURNS TO FACTOR :

The successive increase in the units of a variable factor lead increasing returns till the indivisible fixed factors reaches its maximum capacity. Further increase in variable factor leads to over utilisation of former.

3. CAUSES OF NEGATIVE RETURNS

It is due to too much variable factor relative to fixed factor. Hence because of shortage of fixed factor and excessive amount of variable factor, the operation efficiencies of the firm decreases and the output start declining.

After looking to law of variable proportion which is short run production function

Law of Returns to Scale

Let us now see long run production function which is also called law of returns to scale.

In long run all factor of production can be varied land, labour, capital and entrepreneur can be increased or decreased in the same proportion and hence firms scale of operation changes it moves from lower scale to higher scale of operation or vice - versa. But the factor proportion remains same. When the firm move to higher scale the output will change but the manner in which it will change is explained in law of raw of returns to scale.

In the words of Watson "Returns to scale relates to the behaviour of total outputs as all inputs varied in same proportion and is a long run concept".

Output can be increased in following three manner in case of law of returns to scale.

1) INCREASING RETURNS TO SCALE:

Increasing returns to scale occur when a given percentage increase in all factor input that is land, labor capital and entrepreneur causes proportionately greater increase in output. This happens in intial stage of production in the firm. For example if 10% increase in all factor input causes say 15% increase in output it is case of increasing returns to scale. In the figure on x axis we have shown onput and on -y axis input. Figure aside shows that a 10% increase in all factor input has increased output by 15%.

The second stage of returns to scale is constant returns to scale. CONSTANT RETURNS TO SCALE: Constant returns to scale occurs when a given percentage increase in all factor inputs again land labour, capital and entrepreneur causes equal percentage increase in output. If 20% increase in all factor input causes 20% increase in output. That is the similar increase in output the stage will be called constant returns to scale.

Figure aside shows that 10% increase in input shown on y axis increases output by same proportion which is shown on x axis. DIMINISHING RETURNS TO SCALE: Diminishing returns to scale occurs when a given percentage increase in all factor input causes proportionately lesser increase in output. For example when 20% increase in input leads to only 10% increase in output it is said to be diminishing returns to scale. Figure aside shows that 20% increase in input has increased output only by 10%.

Now let us understand the reasons of occurring all these three stages.

In the table you can see that there are reasons shown for the stages. There are three stages in returns to scale increasing returns to scale, Constant returns to scale and diminishing returns to scale.



REASONS FOR THREE STAGES

In case of increasing returns to scale output is more because the firm is enjoying internal as well as external economies of scale. After certain point of time the returns becomes constant, because now with economies of scale firm is also suffering from certain diseconomies of scale. So in the chart it is written that economies plus diseconomies of scaleresults in constant returns to scale. The third stage which is called diminishing returns to scale the firm is suffering from certain internal diseconomies of scale and external diseconomies of scale.

Now let us see economies and diseconomies of scale in detail. Let us first see internal economies of scale and external economies of scale.

INTERNAL ECONOMIES OF SCALE

- Technical economies of scale
- Managerial economies of scale
- Commercial economies of scale
- Financial economies of scale
- Risk bearing economies

EXTERNAL ECONOMIES OF SCALE

- External Technical diseconomies
- Cheaper raw material and input
- Development of skilled labour
- Development of ancillary industry
- Economies of information
- Development of marketing and transportation

INTERNAL DISECONOMIES OF SCALE

- Technical diseconomies
- Managerial diseconomies
- Commercial diseconomies
- Financial diseconomies

These are all the disadvantages the firm is suffering from because of its large size.

EXTERNAL DISECONOMIES OF SCALE

- Increase in price of raw material and other inputs
- Lack of flexibility
- Governments policies

ECONOMIES OF SCALE

Let us understand economies of scale.

Economies of scale are the advantages the firm enjoys because of large scale production. Firms get various advantages in production, financial settlement, marketing, research, salesman ship etc. Now let us see each economies of scale one by one.

 Technical economies of scale : A large scale production requires huge and expensive machineries and its own repairing unit. There is specialized machinery and plant for each process which results in highly economical production.

In addition to this large units have quality labour and ample scope of division of labour. Large scale producers can appoint specialized and trained labours for each production process and hence enjoys technical economies of scale.

- Managerial Economies : Managerial capabilities ar under utilized in small firms. In large scale units production is large so managers time, skill and ability are efficiently utilized and there is proper delegation of authority which is most fruitful and increase specialization.
- Commercial economies : Large firms enjoy advantage on both sides, in buying goods and in selling goods. While purchasing goods and necessary raw material giant firms can negotiate well and fix favourable terms on account of bulk purchase. While selling goods they can offer attractive package, and variety of goods. A low rate of profit will result in huge sales and high net profit.

- Financial economies : As the credit of large firms are high in money market and the bank and corporate are willing to give advances and loans to large firms and that too at low cost, that is at very low rate of interest these firm can occupy a very huge amount of loan. Easy and low cost of credit reduces the production cost for the firm and hence they are getting all the financial benefits from the money market which small firm is not getting.
- Risk-bearing economies : A large business can accept and resist the adversities of market. They can bear the losses and survive in depression for a long period of time. Moreover they can take the risk of introducing new product and new methods of production They can dilute risk through product diversification that means they can produce at a time number of products. There is also diversification of markets, sources of supply and processes of manufacturing. Hence they are reaping all the benefits at commercial scale.
- Research and development : A large firm can spend huge amount of money and resources on research and development. Successful and regular research can lead to new and cheaper product. This also increase their sales and profit that means the firm can take advantage of innovation.

EXTERNAL ECONOMIES OF SCALE

 Economies of information and market intelligence: Huge firms can be well informed about foreign technology and can introduce it to their units and can call foreign technicians for training and development programs. They can publish trade and technical publication every year. Statistical,technical and market information become readily available to them which is not available to small scale units.

- Cheap Raw Material A large scale unit can take advantage of cheap raw material available in market. Large firms generally have sufficient warehousing facility and hence it can buy in bulk and store so in the adverse market situation. So in the adverse market situation also they have stored material which they can use for production.
- Development of skilled labour: Labour are the core input for any firm. skilled, trained and Dexter labour can do wonders for the firm. Large firm can follow labour policies effectively and recruit efficient labour from the market.the labourer also get number of benefits like certain allowance and holidays that is why they they are attracted by large firm.
- Development of ancillary units: A big business can always utilises by- products and can have ancillary units.
 Forexample a firm producing edible oil uses its left out for making washing soda or washing cake.
- Economies of information: All large firms in one industry can use published data, publication and research journal for necessary information. Individual firm need not spend on research. It can take benefits from common pool.

 Economies of disintegration: When firm become too huge it spreads some of its process to other firm. They have one unit for one process.

DISECONOMIES OF SCALE

These diseconomies of scale are actually responsible for constant and diminishing returns to scale.

FINANCIAL DISECONOMIES OF SCALE : For expanding the business firm needs huge and fresh capital. It is not easy to arrange for for capital. Though it is easy to arrange for capital for a new businessman it sometimes become costly and troublesome with high interest and that is why a very established firm also faces financial problem in later stage.

MANAGERIAL DISECONOMIES OF SCALE : An entrepreneur cannot tackle firms problem of firms beyond a certain limit. Large business become unmanageable after a point and supervision become ineffective . Delegation of authorities become ineffective and vertical and horizontal division becomes more complicated.Cost often increase because wastage of raw material and dishonesty of employees.

COMMERCIAL DISECONOMIES OF SCALE : As business is expanded prices of factors of production rises and a lot of rent, wages, interest, have to be paid. On the other hand because of more output in the market, prices drop down which bring losses to firm. Reduction in price will reduce marginal revenue and gradually marginal cost will become equal to marginal revenue. At this point firm will reach to equilibrium and will be maximizing its profit.

EXTERNAL DISECONOMIES OF SCALE :

INCREASE IN THE PRICE OF RAW MATERIAL : In long run price of most of raw material increase sharply which makes the firm unprofitable. Being a large scale firm it is involved in bulk production resulting increase in supply of production but after that point firm increases and it suffer losses.

Lack of flexibility : In the time of depression small firm can shift to other business whereas large firm find it difficult to move to flourishing business. In this way large firm make huge losses because they retain in the same declining trade.

GOVERNMENT POLICIES : As the firm grows bigger its credit in the market will increase and so the profitability. Due to its name in the market government will also be strict towards imposition of labour laws, environment policies, taxation policies etc. Hence the strict government policy also results in decreasing returns to scale.