

Module 2

Production

Part 1

Production is the process by which inputs are transformed into output. In other words it is the creation of utility.

Factors of Production

There are four major factors of production.

Land

Labour

Capital

Entrepreneurship

These are the primary factors.

Production function

In simple words, production function refers to the functional relationship between inputs and output.

Short run production function or variable proportion

Long run production function or fixed proportion

Law of variable proportion or returns to a factor or production function with one variable input

Law of variable proportion describes the changes in output when more and more units of one variable factor is employed while keeping the quantities of other factors constant.

Total Product of a factor(TP)- *It is the total physical output produced by employing a certain quantity of that factor.*

$$TP_L = f(\bar{K}, L)$$

Marginal product of a factor(MP) – *It is the addition to total product by employing one more unit of that factor.* That is

$$MP_L = \frac{\Delta TP}{\Delta L} \text{ or } \frac{dTP}{dL}$$

Average product of a factor(AP)–*It is the output per unit of that factor employed.* It is obtained by dividing the TP by the number of units of that factor employed. For example AP of labour can be written as

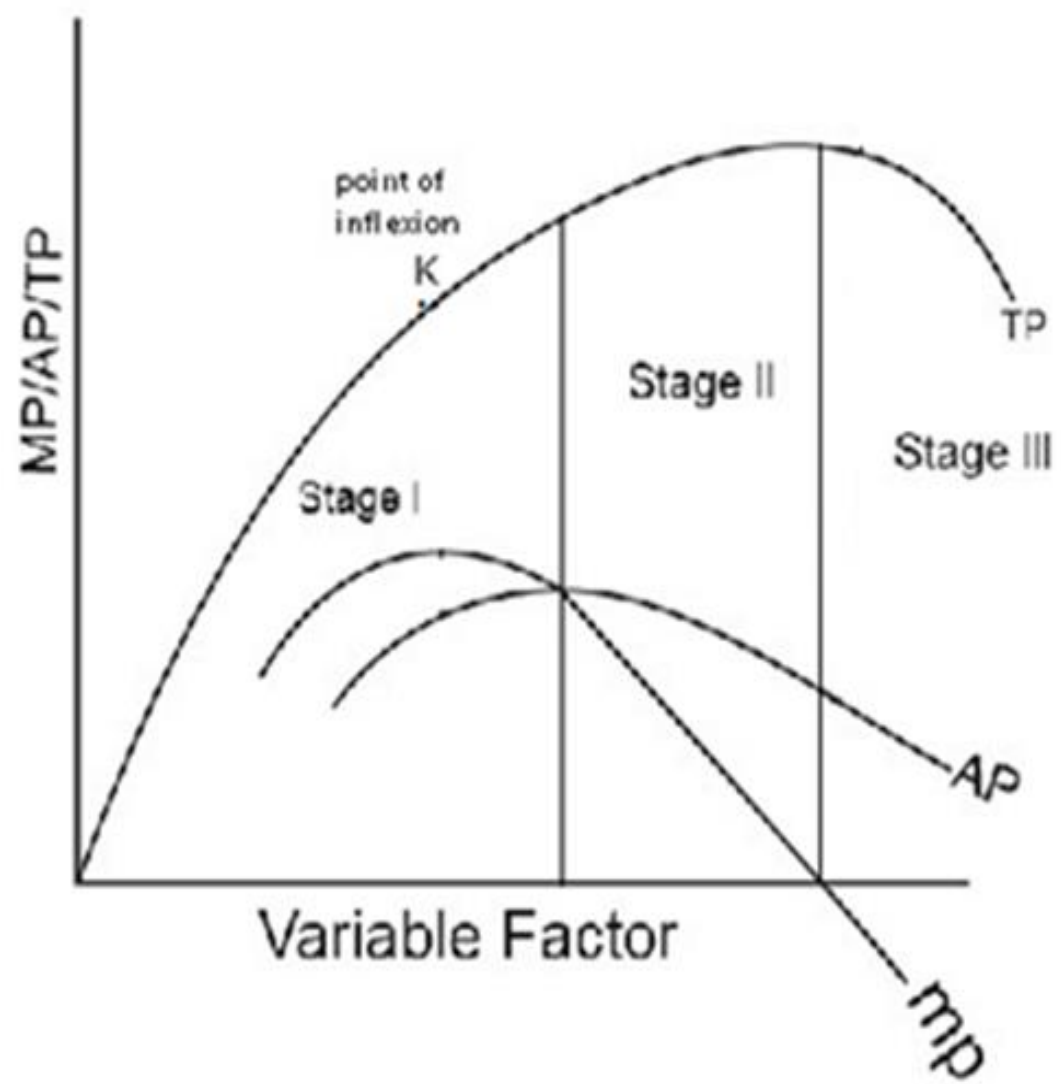
$$AP_L = \frac{TP}{L}$$

Assumptions of the

1. All units of the variable factor employed are equally efficient.
2. Technology remains constant
3. The proportion of inputs can be varied

The law states that when more and more units of one variable factor is employed with fixed quantities of other factors, initially MP increases, then it decreases and finally it becomes negative. In other words initially the total product increases at an increasing rate, then TP increases at a decreasing rate and finally it starts declining. It is similar to the law of diminishing returns.

No. of units of Labour	Total Product	Marginal Product	Average Product	
1	8	8	8	
2	18	10	9	
3	30	12	10	<u>Increasing returns</u>
4	40	10	10	
5	45	5	9	
6	48	3	8	
7	49	1	7	
8	49	0	6.1	<u>Diminishing returns</u>
9	45	-4	5	
10	40	-5	4	Negative returns



Stage 1: This is the stage of increasing returns

Stage 2 : This is the stage of diminishing returns.

Stage 3 : This is the stage of negative returns where MP becomes negative and TP starts declining.

Relation between MP and TP

- 1 When MP increases TP increases at an increasing rate
2. When MP decreases but remains positive TP increases at a decreasing rate
3. When MP becomes negative TP declines

Relation between MP and AP

1. When $MP > AP$, AP increases
2. When $MP = AP$, AP is maximum
3. When $MP < AP$, AP decreases

Reasons for different returns

Module 2

Production

Part 2

Returns to scale or Fixed proportion or Long-run production function

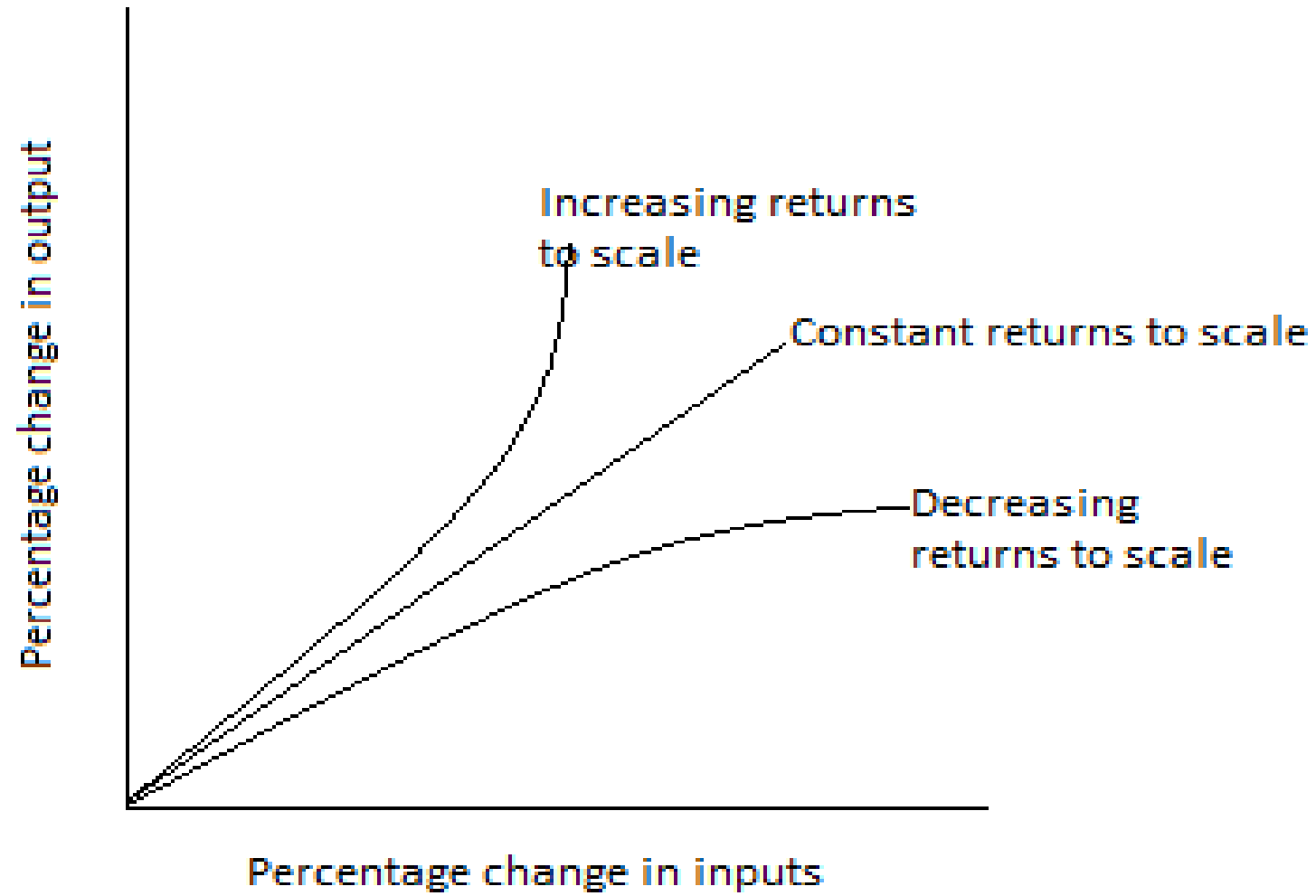
In the long run all the factors are variable. Therefore output can be increased by increasing the quantities of all the factors in the same proportion.

The long run production function is also called fixed proportion.

The long run production function is also called returns to scale.

The long run production function describes the changes in output when all the inputs are varied at the same proportion.

When all the inputs are varied at the same proportion, initially the producer gets increasing returns to scale, then constant returns to scale and finally decreasing returns to scale.



Economies of Scale

Economies of scale mean advantages of largescale production which help in reducing the average cost of production.

The economies of scale can be broadly classified as i) Internal economies ii) External economies

Internal Economies

Internal economies depend on the size of the firm. These advantages emerge within the firm itself as its scale of production increases. Internal economies are entirely enjoyable by the firm itself.

- 1. Labour economies:**
- 2. Technical economies:**
- 3. Managerial economies:**
- 4. Marketing economies:**
- 5. Financial economies:**
- 6. Risk minimising economies:.**

External Economies

External economies mean gains available to all the firms in an industry from the growth of that industry. That is advantages accruing to a firm due to localisation of the industry.

- 1. Economies of localisation:**
- 2. Economies of Information:**
- 3. Economies of Vertical Disintegration**
- 4. Economies of by-product:**

Diseconomies of Scale

Diseconomies of scale means disadvantages of large production. Beyond a certain limit, diseconomies surpass internal and external economies. These diseconomies increase the average cost of production and limit the further expansion of the firm.

- 1. Difficulties of management:**
- 2. Difficulties of coordination:**
- 3. Difficulties in decision making:**
- 4. Communication Problems:**
- 5. Labour Diseconomies:**
- 6. Scarcity of Inputs:**
- 7. Marketing Diseconomies:**

Module II

Production

Part III

Isoquants

An isoquant is a curve which shows various combinations of two inputs which give the same level of output.

Combinations of Labour and Capital	Units of Labour (L)	Units of Capital (K)	Output of Cloth (meters)
A	5	9	100
B	10	6	100
C	15	4	100
D	20	3	100



Properties of an Isoquant

The following are the important features or properties of isoquants.

1. Isoquants are negatively sloped.

2. Isoquants are convex to the origin. This is because along the isoquant $MRTS_{LK}$ (Marginal rate of technical substitution of labour for capital) goes on decreasing

That is, $MRTS_{LK} = \Delta K / \Delta L$

From the diagram, it can be understood that ΔK , the amount capital replaced by one additional unit of labour is going on decreasing,

Since output remains constant along the isoquant, the loss in output due to the replacement of capital should be compensated by the additional output produced with the help of the extra amount of labour employed.

That is

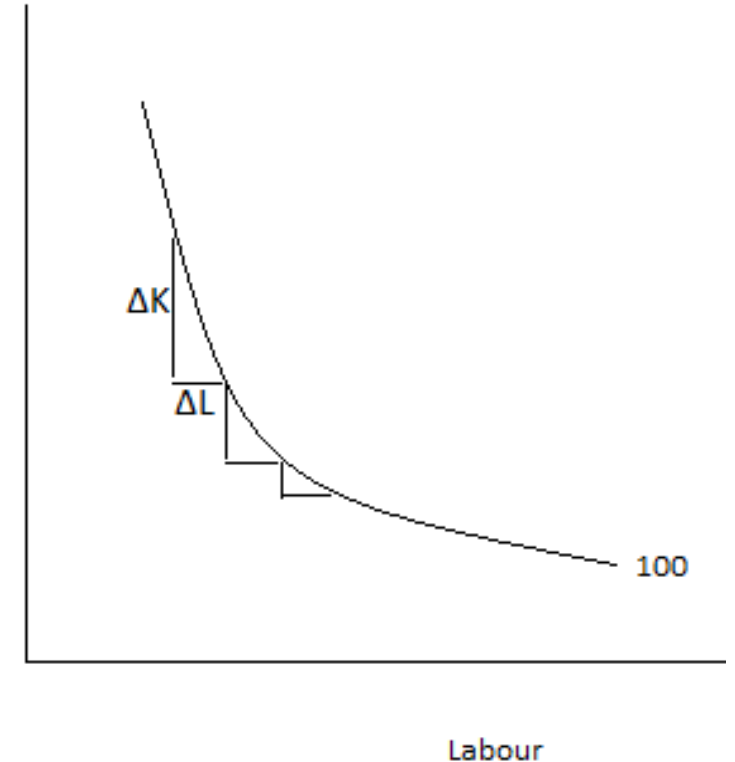
$$-\Delta K * MPK + \Delta L * MPL = 0$$

(Where MPK and MPL are the marginal productivity of labour and capital)

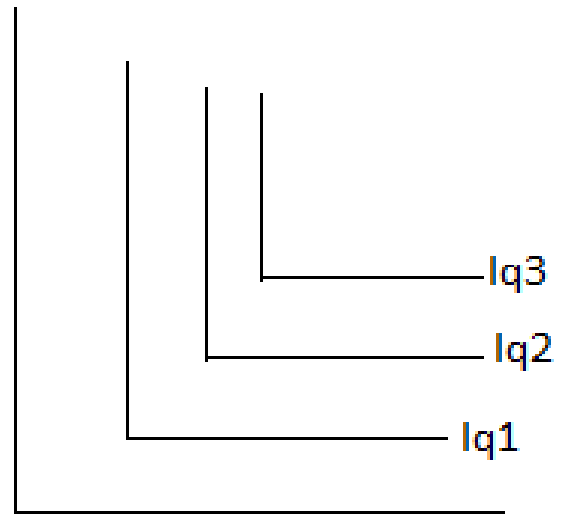
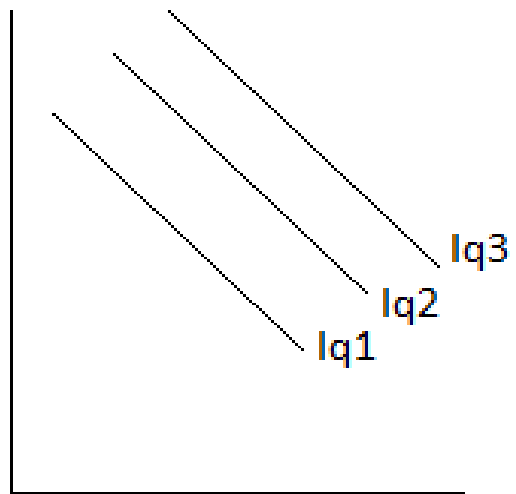
Therefore $-\Delta K / \Delta L = MPL / MPK$

3. Two isoquants never intersect

4. Higher isoquants represents higher levels of output

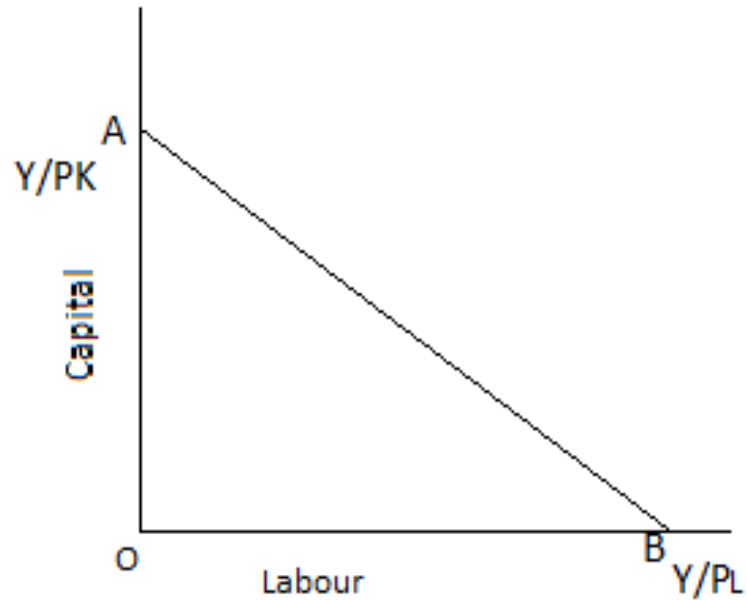


Special type of isoquants



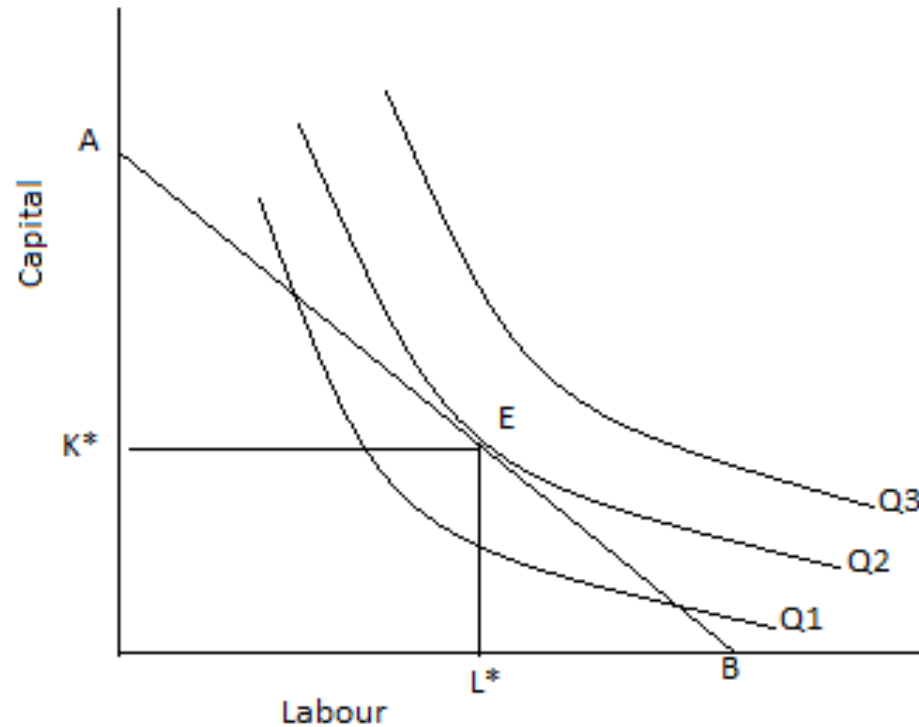
Isocost line

An isocost line shows various combinations of labour and capital (two inputs) that can be purchased for a given expenditure of the firm. In other words, it shows various combinations of labour and capital that is available to the firm at the same cost and at given prices of the inputs



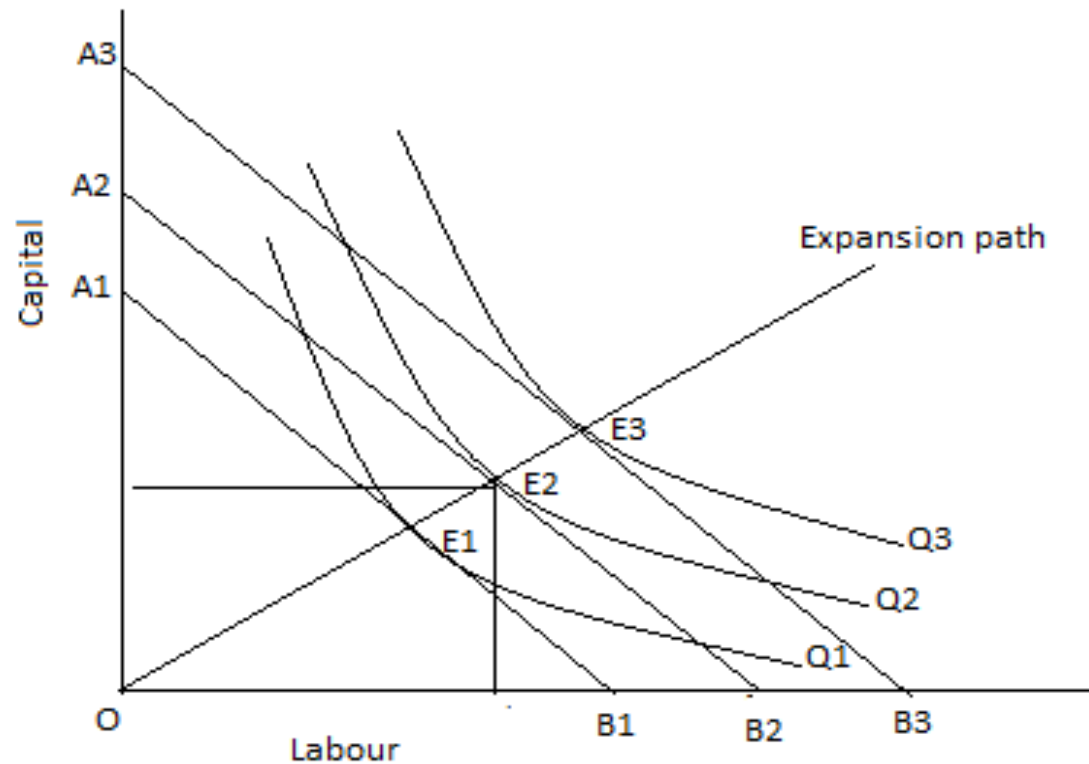
Least Cost Combination – Producer's Equilibrium

Least cost combination of inputs is that combination which cost least to the firm in producing a certain quantity of output.



Expansion Path

Expansion path is a line connecting optimal input combinations as the scale of production expands. In other words, it gives the least cost inputs combinations at every level of output.



Module 2

Production

Part IV

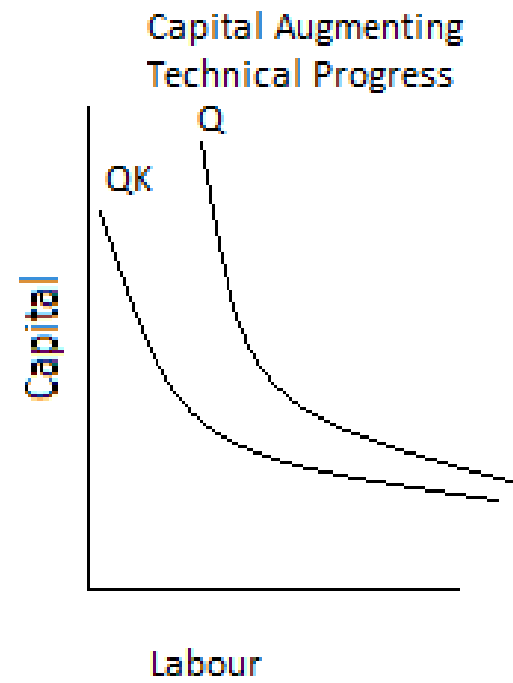
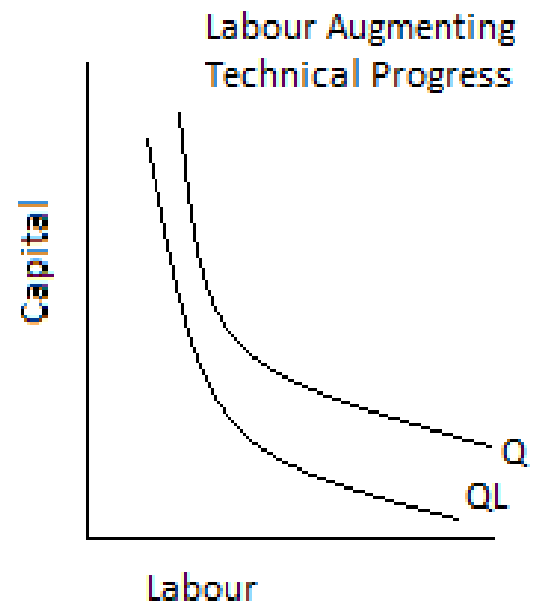
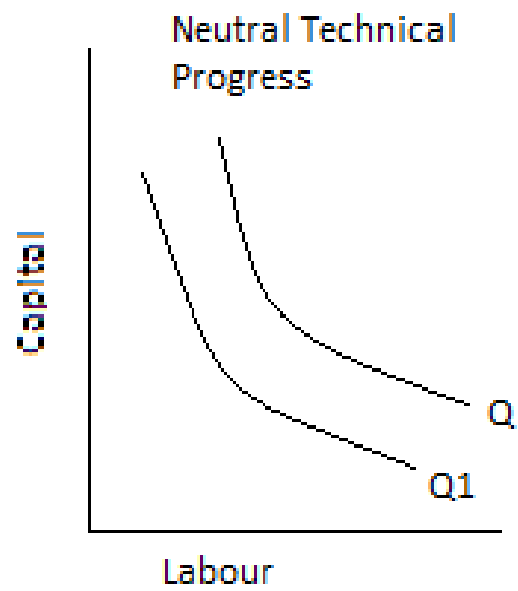
Technical Progress and its Implications

When there is a change in technology, the production function will change. There will be an upward shift in the production function which means that more output is produced with the same level of inputs. In other words, there will be a downward shift of the isoquant which implies that same output is produced with lesser quantities of inputs.

Technical progress may be embodied and disembodied

There are three types of technological progress

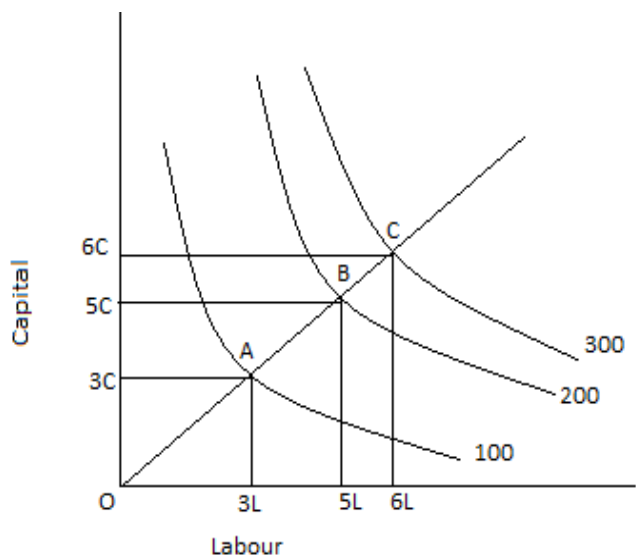
1. **Neutral technical progress:** It is neutral when change in the marginal product of labour and capital are same due to the technical progress.
2. **Labour Augmenting Technical Progress:** It means the marginal product of labour increases faster than the marginal product of capital.
3. **Capital Augmenting Technical Progress:** It means the marginal product of capital increases faster than the marginal product of labour.



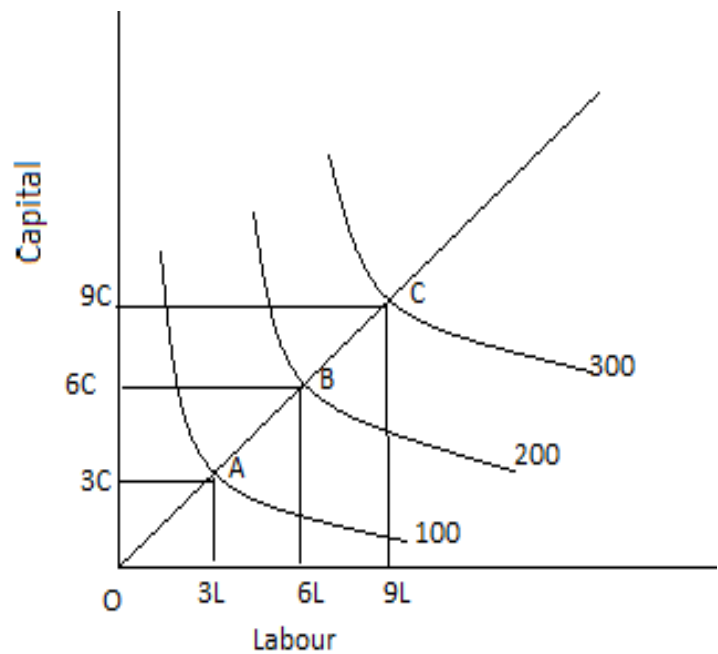
Isoquants and different returns to scales

The laws of returns to scale can also be explained in terms of the isoquants.

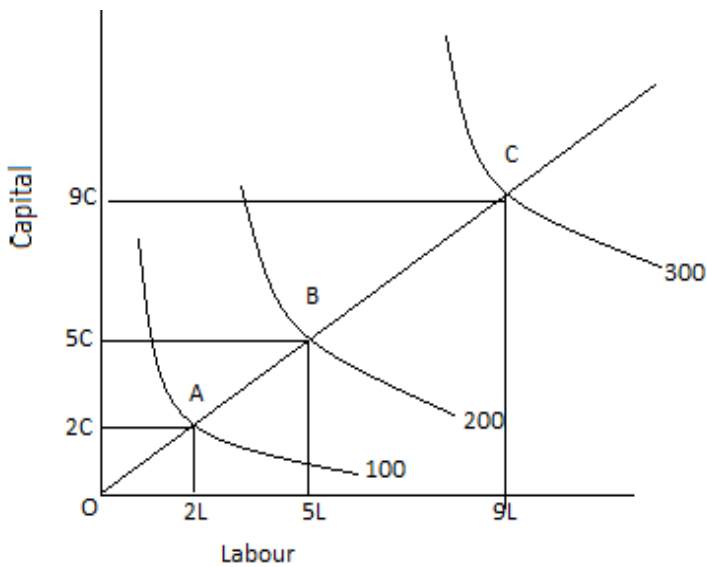
Increasing returns to scale



Constant Returns to Scale



Decreasing returns to scale



Cobb-Douglas production function

In its most standard form for production of a single good with two factors, the function is written as

$$Q = AL^{\alpha}K^{\beta}$$

Cobb-Douglas production function is a homogeneous production function.

Cobb-Douglas production function is linearly homogeneous as $\alpha + \beta = 1$.

Production function is given as $Q = AL^{\alpha}K^{\beta}$. Derive marginal product of labour and capital.

Industrial Economics and Foreign Trade

Module 2 – Part 5 Cost and Revenue

By

Dr. Johnson T T

Assistant Professor in Economics

CET

Mob. 9447450408

Cost is the expenditure incurred by a firm in the production of a commodity

Cost Concepts

1. Explicit and implicit cost

Explicit cost is the expenses actually met by the producer while producing a commodity.

Implicit cost is the opportunity cost of the factor services supplied by the organisation itself.

2. Real cost

This is the actual pain and suffering involved in the production of a commodity.

3. Accounting cost

Accounting cost is the money cost that can be recorded in the books of account.

5. Social cost

Social cost is the sum of private cost and external cost. Private cost is the cost incurred by the producer in the production of a commodity.

When a commodity is produced it may cause damages to the environment in the form of air pollution, water pollution etc. These are the external cost and it is met by the society.

6. Replacement cost

Replacement cost is the cost incurred when an asset depreciates and it is replaced with the new asset.

7. Sunk cost

Sunk cost is the cost which has already been incurred and cannot be recovered.

Short run costs

Fixed Cost(TFC) – *It is the cost which does not vary with the level of output.*

Total variable cost(TVC) – *Variable cost is the cost that vary with the level of output.*

Total Cost(TC) – *Total cost is the sum of total fixed cost and total variable cost.* $TC = TFC + TVC$

Average fixed cost(AFC) – *It is the fixed cost per unit of output.* $AFC = \frac{TFC}{Q}$

Average variable cost(AVC) – *It is the variable cost per unit of output.* $AVC = \frac{TVC}{Q}$

Average cost(AC) – *AC is the cost per unit of output produced.* $AC = \frac{TC}{Q} = \frac{TFC}{Q} + \frac{TVC}{Q} = AFC + AVC$

Marginal cost(MC) – *MC is the addition to total cost when one more unit of output(Q) is produced.* $MC = \frac{\Delta TC}{\Delta Q}$ or $\frac{dTC}{dQ}$

or $MC_n = TC_n - TC_{n-1}$

The relation between MC and AVC or MC and AC

1. When $MC < AVC$, AVC decreases.
2. When $MC = AVC$, AVC is the minimum.
3. When $MC > AVC$, AVC increases

Revenue

Revenue is the income from the sale of output.

Total Revenue(TR)- *It is the total receipts from the sale of a given quantity of output.*

Average Revenue(AR)- *It is the revenue per unit of output sold.*

Marginal Revenue(MR)- *It is the addition to total revenue by selling one more unit of output.* $MR = \frac{dTR}{dQ}$

TR, MR and AR under imperfect competition

Relation between MR and TR

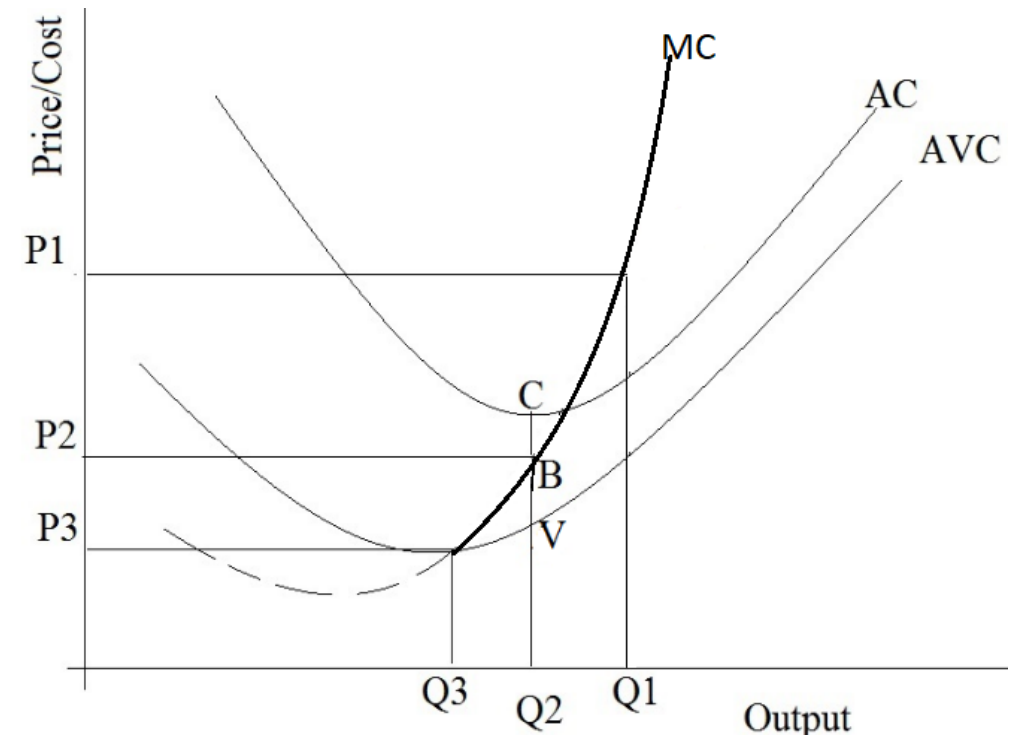
The following relations can be observed between MR and TR

1. When MR is positive TR increases.
2. When MR is zero TR is maximum
3. When MR is negative TR decreases

TR, MR and AR under perfect competition

Shut down point in the short run

Price=AVC is the shutdown point of the firm. That is the minimum point of the AVC curve.



Break-even Analysis

Break-even analysis is a method that is used to analyse the relationship between total cost, total revenue and profit of an organisation at different levels of output.

It is the point at which total revenue of a firm equals total cost. In other words it is the point at which there is no profit or loss for the firm.

Graphical method

Algebraic Method

$$Q_b = \frac{TFC}{P - AVC}$$

PV Ratio

P/V Ratio (Profit Volume Ratio) is the ratio of contribution to sales.

$$PV \text{ Ratio} = \frac{\text{Sales} - \text{Variable cost}}{\text{Sales}} = \frac{S - V}{S}$$

$$BEP = \frac{TFC}{PV \text{ Ratio}}$$

Margin of Safety is the sales beyond break -even point. It is calculated as the difference between total sales and the break-even sales.

Uses of Break-even analysis

- (i) It helps in the determination of selling price which will give the desired profits.
- (ii) It helps in the fixation of sales volume to get a desired level of revenue.
- (iii) It helps in making inter-firm comparison of profitability.
- (iv) It helps in determination of costs, revenue and profit at various levels of output.
- (v) It helps in managerial decision-making

Limitations of Break-Even Analysis

1. Break-even analysis is based on the assumption that all costs and expenses can be clearly separated into fixed and variable components. In practice, however, it may not be possible to achieve a clear-cut division of costs into fixed and variable types.
2. It assumes that fixed costs remain constant at all levels of activity. However, fixed costs tend to vary beyond a certain level of activity.
3. It assumes that variable costs vary proportionately with the volume of output. In practice, it may not be varying in direct proportions.
5. It is based on the assumptions that whatever is produced is sold. This may not happen.
6. It assumes that the business conditions may not change which is not true