

Unit-4

Cost and Revenue Curves

a. Concept of Cost: actual Cost and opportunity cost, implicit cost and Explicit cost, accounting cost and economic cost

Concept of Cost

- What is Cost?
- When commodities or services are produced, various expenses have to be incurred, e.g. purchase of **raw materials**, payment to **labour** as a **wage**, payment to **capitalists** for money borrowed as a **interest** , payment to **landlord** as **rent**, expected normal **profit** to entrepreneurs etc.
- Thus, the **sum of total expenses** incurred **plus imputed cost** and **normal profit expected** by the producer are together called cost of the production of the commodity.
- The mathematical expression of the **relationship between cost and its determinants** (output, Factor price, state of technology, Govt. policy) is called cost function.
 - $C = f(Q, P_f, T, G_p, \dots)$
 - $C = f(Q)$ other things remaining the same
 - where, C= Cost, Q= Output, f=function
- The **graphical representation** showing the relationship between output and cost is called cost curve.

Different concept of cost

1. a. Actual Cost:

- Actual cost is defined as the expenditure, which is actually incurred by the firm in payment for labour, raw materials, plant, building, machinery, equipment, travelling and transport, fuel etc. or
- Total monetary expenses recorded in the books of the accounts for all practical purpose is the actual cost.
- Money Costs: Money cost refers to costs incurred on **purchasing or hiring productive factor services**.
- Thus actual cost concept come under accounting cost concept.

Different Concepts of Cost

- 1.b.Opportunity Cost:** The Opportunity Cost of any economic resources is defined as the **value of next best commodity** which could have been produced by the use of the same resources that can be used to produce many things.
- Example: a plot of land can be used to produce wheat, maize, rice. A factor service is used to produce one good. It can not be used to produce another or all. Thus, when we use a plot of land to produce wheat, we have to sacrifice other products like Rice or maize that could be produced. **The next best alternative goods** that could be produced with the same resources.
 - Wheat production: **10mt**, **Rice Production: 9.5mt**, Maize:8mt
 - The opportunity Cost of any goods is the amount of the next best **alternative good that is given up** to produce these good.
 - Opportunity cost is also defined as the loss of income due to opportunity foregone

Different Concepts of Cost

2.a. Explicit Costs: Explicit Costs refer to all types of monetary expenses incurred on those inputs which are owned by outsiders except producers.

2.b. Implicit Costs: Implicit Costs refers to all types of estimated costs incurred on those inputs which are owned by producer himself/herself.

- Implicit cost can be classified into two categories
 1. Imputed Cost: imputed cost refers to the imputed value of the inputs(land labour and capital) owned by the firm and used by it in its production unit
 2. Normal profit: Normal profit is defined as the minimum payment which must accrue to an entrepreneur in order to induce him to undertake the risk of the business

Different Concepts of Cost

Importance of Opportunity cost

1. Determination of relative price of Goods

- If a group of factors can produce a car or 6 Scotties, and management decide the to produce a car... Price of a car will be at least more than the price of 6 time of a scooty.

2. Determination of normal remuneration to a factor

- If a professor earns Rs. 40000 per month as an alternative job in the private institute, then college has to pay at least Rs. 40000 per month to keep him in the college.

3. Decision making and efficiency resources allocation.

- A management has to decide in the automobile sector which one is to produce, either A car or 6 Scooties? Suppose, A car price in the market is \$14000 and a price of scooty is \$2000.
- A Decision of car production is worthwhile (\$2000 more revenue generation by the decision of car production in comparison to scooty production.)
- The resources will always tend to move or will be used in the occupation where it has high opportunity cost.

Different Concepts of Cost

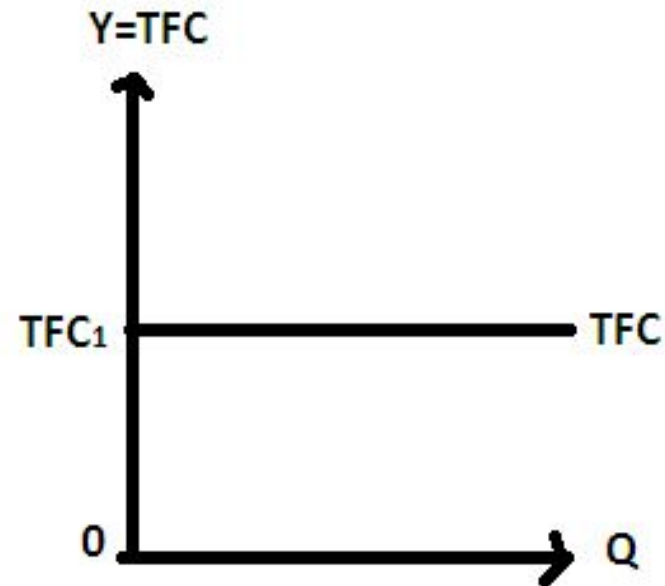
- Accounting Costs: Accounting costs refers to all types of explicit costs recorded in accounting book.
 - Accounting Cost = Explicit Cost (money Cost)
- Economic Costs: Economic Costs are aggregate of explicit costs and implicit costs.
 - Economic Cost = Explicit Costs + Implicit Costs
 - Economic Cost = Accounting Costs + Imputed Costs + Normal Profit (Normal rate of returns to entrepreneur)

Traditional theory of Cost

- Traditional theory of Cost has identified Short run and long run Cost
- Short Run Cost is derived from short run production function; where some factors are fixed and some factors are variable.
- In the short run, there are fixed cost and variable cost
- In the long run, all factors are variable and so all are variable cost only.

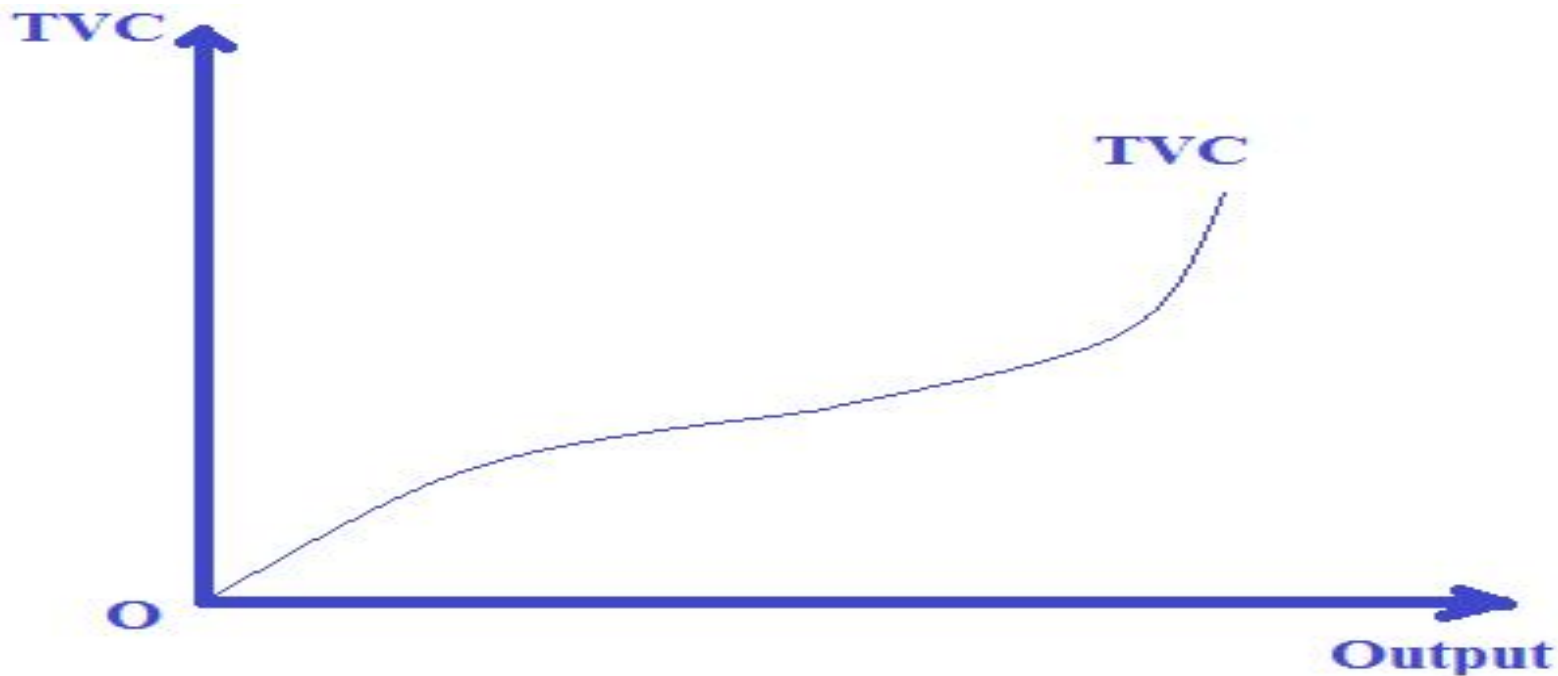
Short Run Total Cost(STC)

- Short Run Total Cost (STC/TC) consists of Total Fixed Cost(TFC) and Total Variable Cost(TVC).
- $STC = TFC + TVC$. ($TC = TFC + TVC$)(Aggregate of TFC & TVC)
- Total Fixed Cost(TFC) is the total payment to the fixed factor of the production. It is fixed irrespective/independent to the level of output.
- All types of Money cost incurred on fixed factors of production employed in the production process are called TFC



Short Run Total Variable Cost(TVC)

- TVC is the total payment made to the variable factors of production which changes according to the level of output.
- Variable cost refers to all types of cost incurred by the firm on the use of the variable factors.
- The Shape of TVC is inverted-S shape starting from the origin due to law of variable proportion.



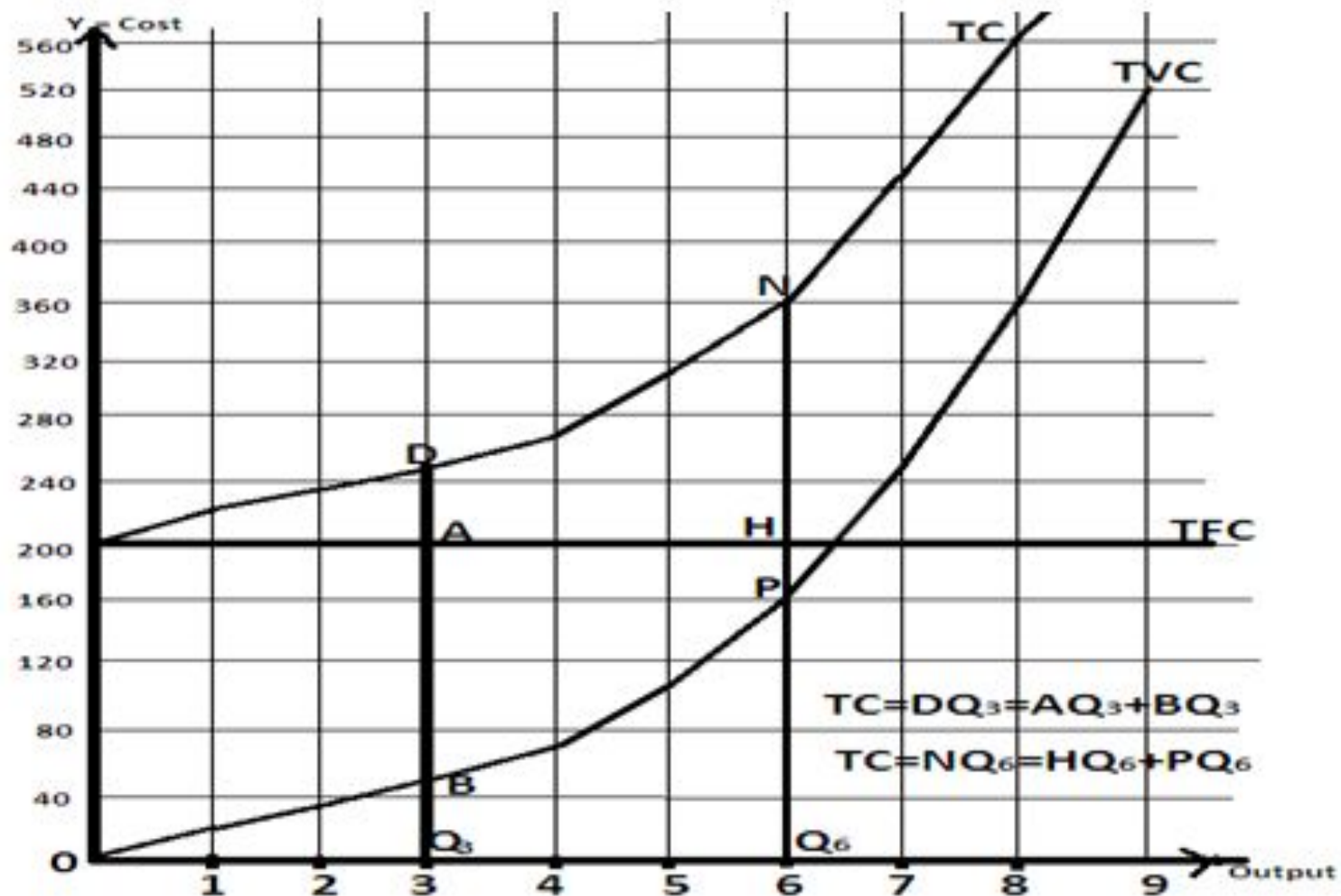
Difference between Fixed Cost and Variable cost

Fixed Cost	Variable Cost
1. All types of costs incurred on fixed inputs	1. All types of costs incurred on variable inputs
2. They do not vary with the change in the level of output.	2. They vary with the change in the level of the output.
3. Fixed cost are always greater than Zero.	3. When output is zero, or production is closed, Variable cost is also zero.
4. A firm gives continuity in production even at the loss of fixed costs.	4. A firm gives continuity in production only if there is no loss of variable costs.
5. Fixed cost are unavoidable.	5. They are avoidable.

Example of TFC TVC and TC

Output(Q)	<u>TFC</u>	<u>TVC</u>	<u>TC</u>
0	200	0	200
1	200	20	220
2	200	36	236
3	200	48	248
4	200	64	264
5	200	100	300
6	200	160	360
7	200	248	448
8	200	360	560
9	200	520	720

TC TVC and TFC Curve



Why does TC or TVC increases at diminishing rate initially and at increasing rate late?

or

Why does TC curve or TVC curve slope upward to the right as inverse 'S' shape?

- Behaviour of TC or TVC curve follows the directly to the law of variable proportion.
- Total Variable cost(TVC) or Total Cost(TC) increases at first at diminishing rate due to application of increasing returns and then at increasing rate due to application of diminishing returns.
- Thus, TC or TVC curve slope upwards to the right as inverse-shape due to the operation of the law of variable proportions.

Short Run Average Costs

1. Average Fixed Cost(AFC)
 2. Average Variable Cost(AVC)
 3. Average Cost (AC)
- AFC is the outcome of total fixed Cost divided by total produced Quantity or total output. It is also called per unit cost of fixed factor . e.g. $AFC = TFC/Q$
 - AVC is the outcome of Total Variable Cost divided by the Total produced quantity or total output. It is also called per unit cost of variable factor. Eg $AVC = TVC/Q$
 - AC is the outcome to Total Cost divided by total produced quantity. It is also defined as the sum of AFC and AVC.
 $AC = TC/Q = (TFC+TVC)/Q = TFC/Q + TVC/Q = AFC + AVC$

Characteristics of Average Cost Curves: AFC, AVC and AC in the short run

- AFC curve falls continuously at diminishing rate(it falls at a high rate initially and at a low rate later) when output increases.
- AVC Curve decreases when TVC increases at a decreasing rate, and AVC curves increases when TVC increases at increases rate.
- AC in the short run is the summation of AFC and AVC, so it falls initially; reaches at its minimum and it rises later as output increases.

Trend of AC

Trend of AC depends upon trend of AFC and AVC.

- a. At the initial phase of production: both AFC and AVC falls then AC also falls.
- b. At the later phase of production: AFC falls and AVC rises. Then the trend of AC depends upon the rate of change in AFC and AVC.
 - (i) if the rate of falls in AFC $>$ rate of rise in AVC, AC falls,
 - (ii) if the rate of falls in AFC $<$ rate of rise in AVC, AC rises
 - (iii) if the rate of falls in AFC $=$ rate of rise in AVC, AC reaches at its minimum and constant

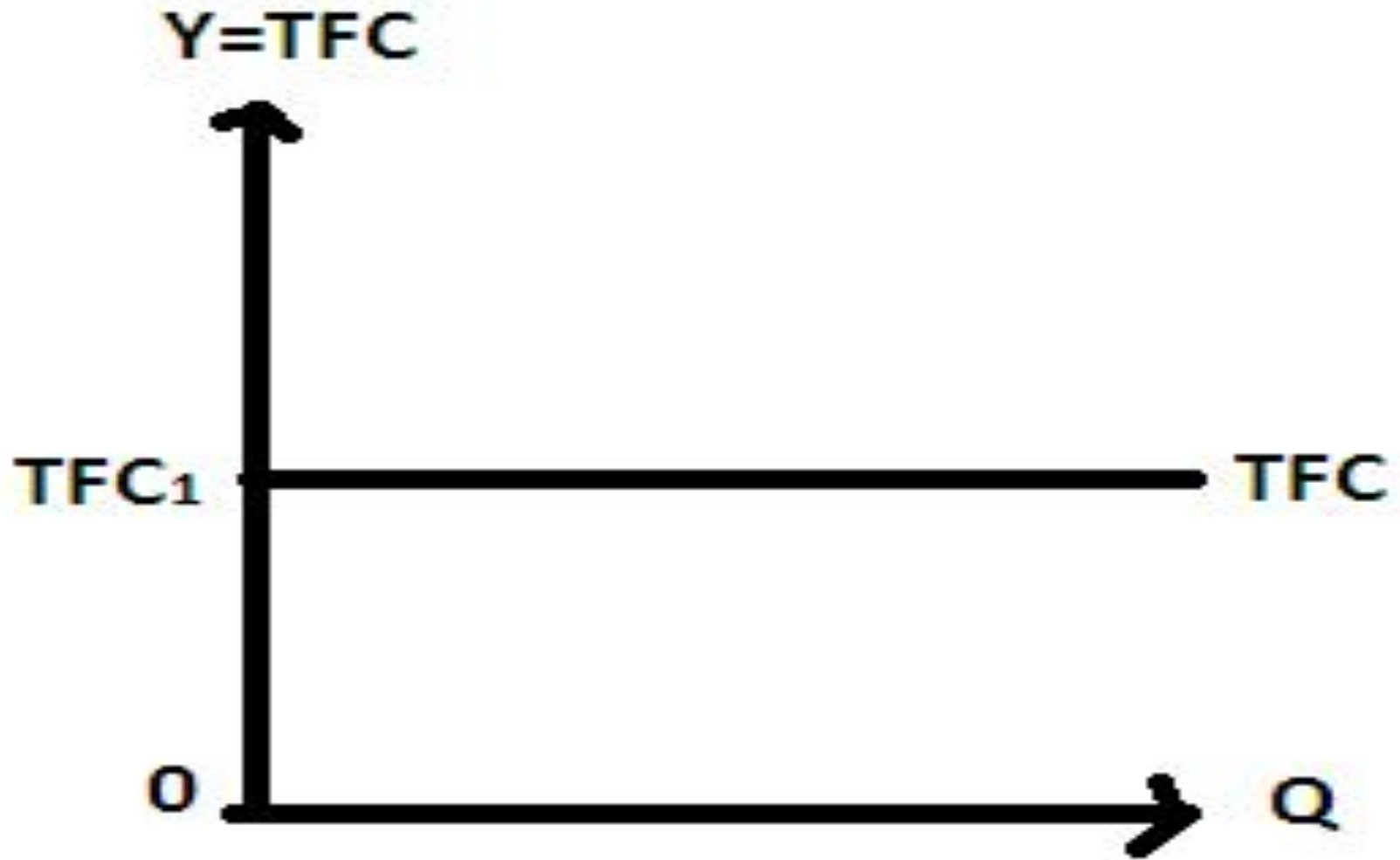
Short Run Marginal Cost (SMC)

- Short Run Marginal Cost is the ratio of the change in the total variable cost with change in total output.
- Marginal Cost is addition made to total cost by producing one more units of output.
- $MC = \Delta TVC / \Delta Q$
 - ΔTVC = Change in total variable cost,
 - ΔQ = change in total output
- 1. When total variable Cost increases at a **decreasing rate**, **Marginal Cost falls**.
- 2. When total variable Cost increases at a **increasing rate**, **Marginal Cost rises**.
- $MC_n = TC_n - TC_{n-1}$
 - $= (TVC_n + TFC) - (TVC_{n-1} + TFC) = (TVC_n + TFC - TVC_{n-1} - TFC)$
- $MC_n = TVC_n - TVC_{n-1}$

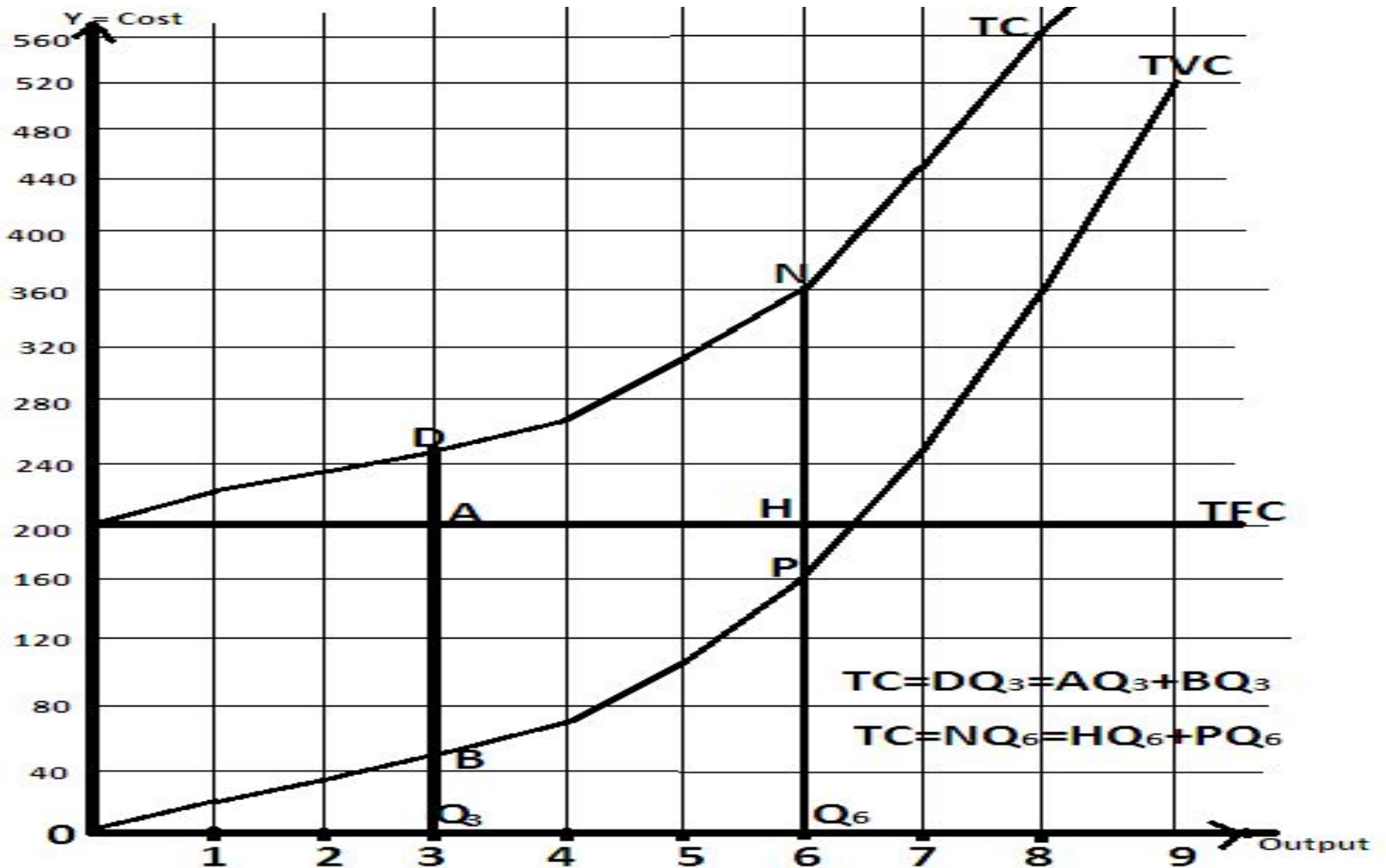
Table

Output (Q)	<u>TFC</u>	AFC <u>=TFC/Q</u>	<u>TV</u> <u>C</u>	<u>AVC</u> <u>=TVC/Q</u>	<u>TC</u>	<u>ATC</u> <u>=TC/Q</u>	MC
0	200	-	0	-	200	-	-
1	200	200	20	20	220	220	20
2	200	100	36	18	236	118	16
3	200	66.67	48	16	248	82.67	12
4	200	50	64	16	264	66	16
5	200	40	100	20	300	60	36
6	200	33.34	160	26.67	360	60	60
7	200	28.57	248	35.43	448	64	88
8	200	25	360	45	560	70	112
9	200	22.22	520	57.78	720	80	160

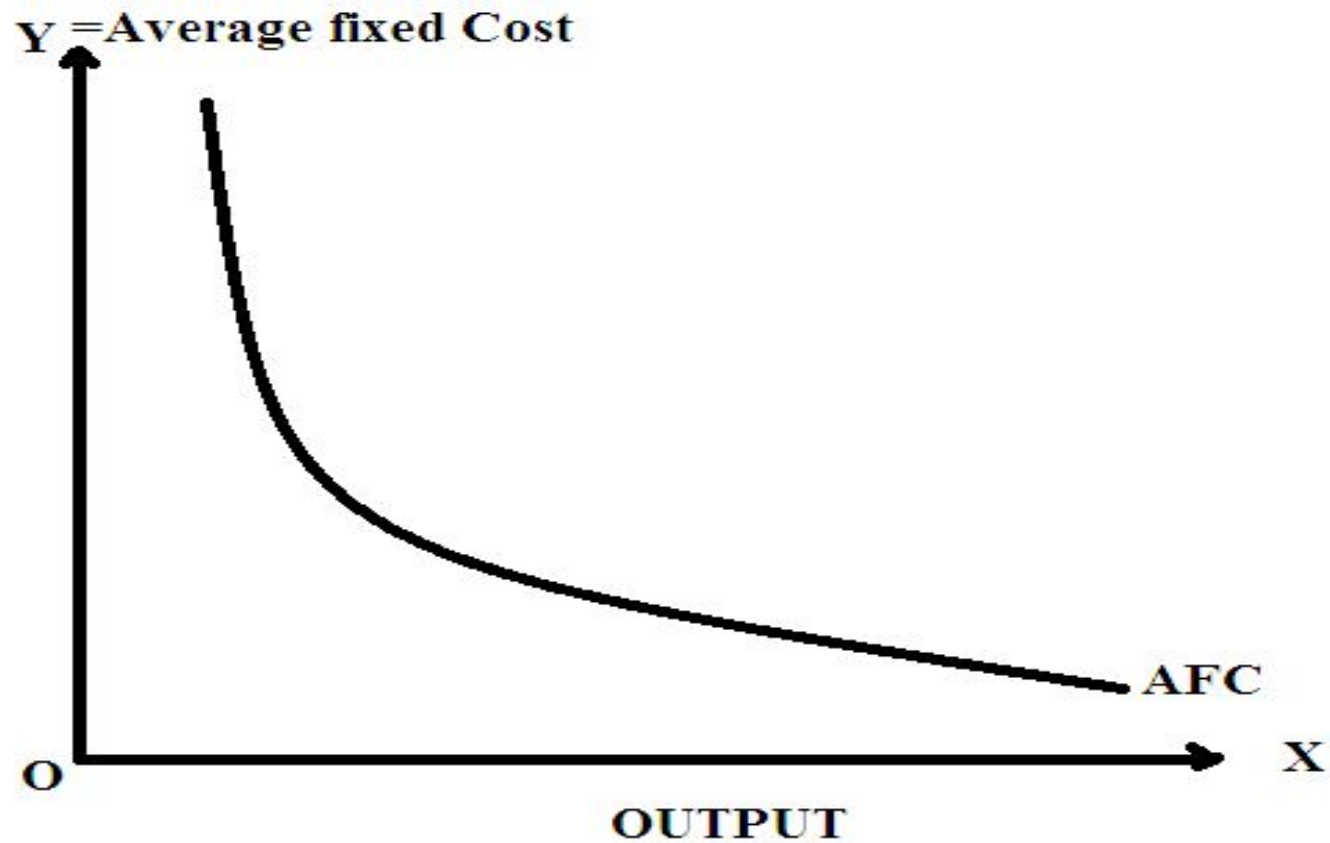
Total Fixed Cost



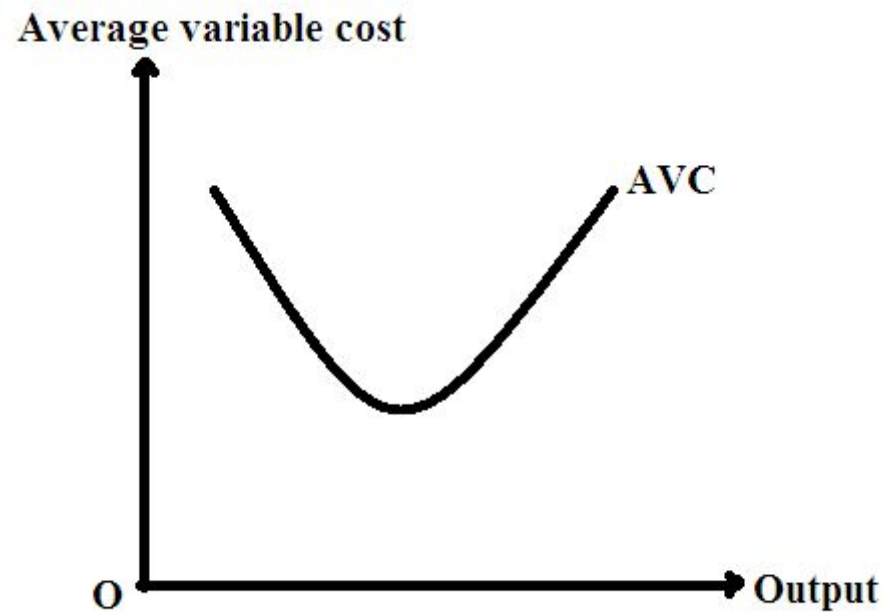
TVC TC TFC
 $TC = TVC + TFC$



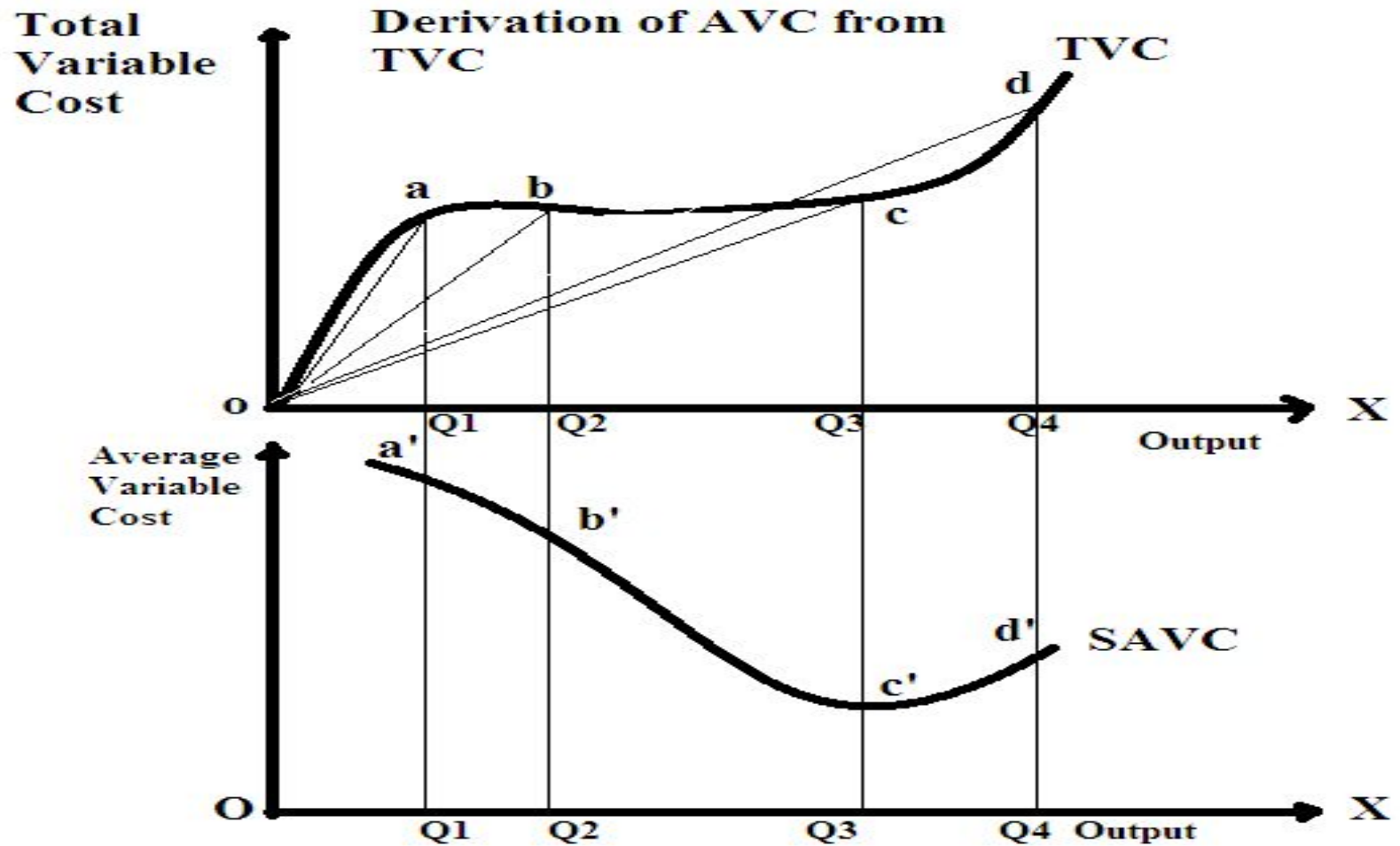
Average Fixed Cost



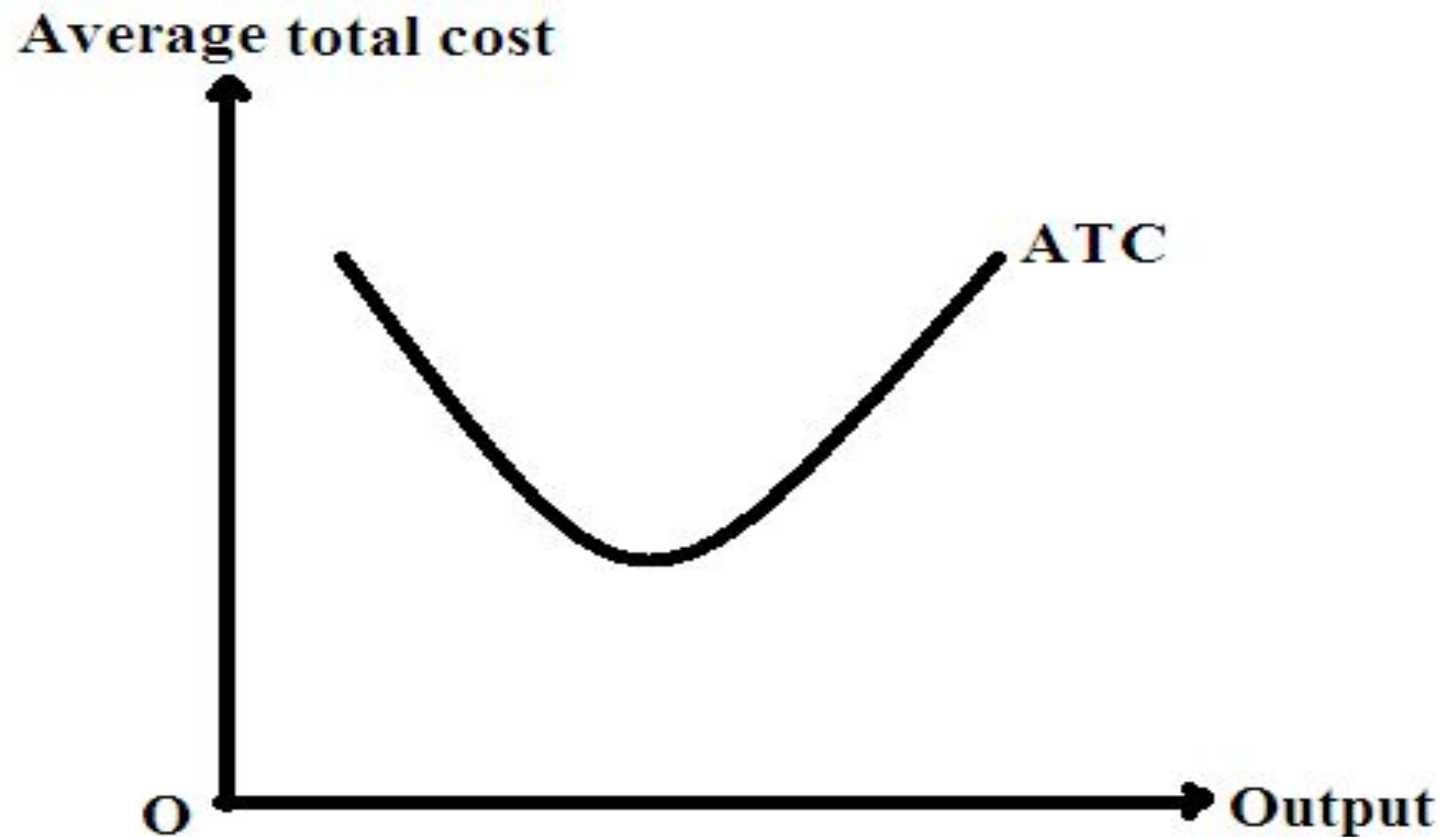
Average variable Cost



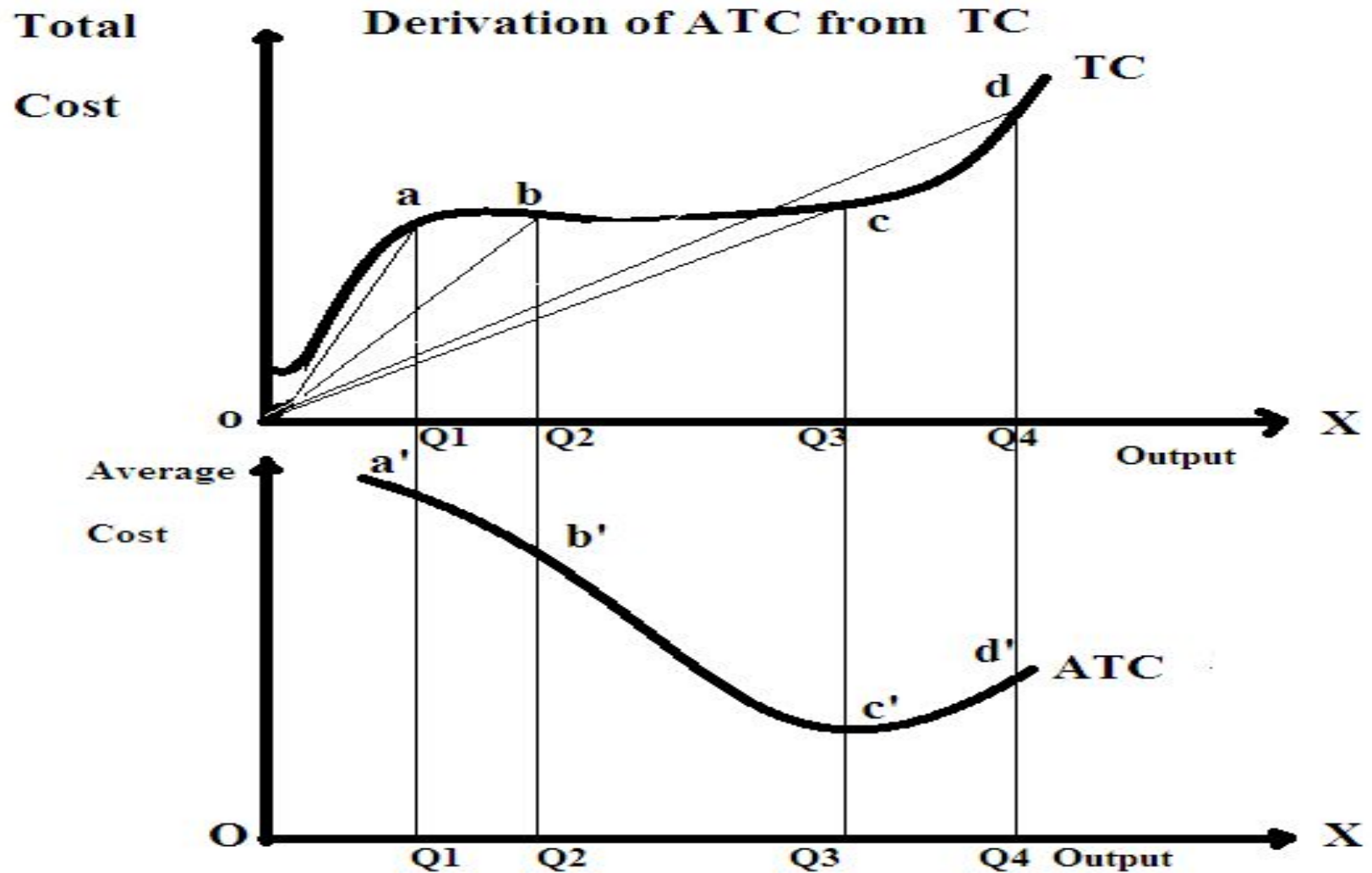
SAVC derivation From TVC



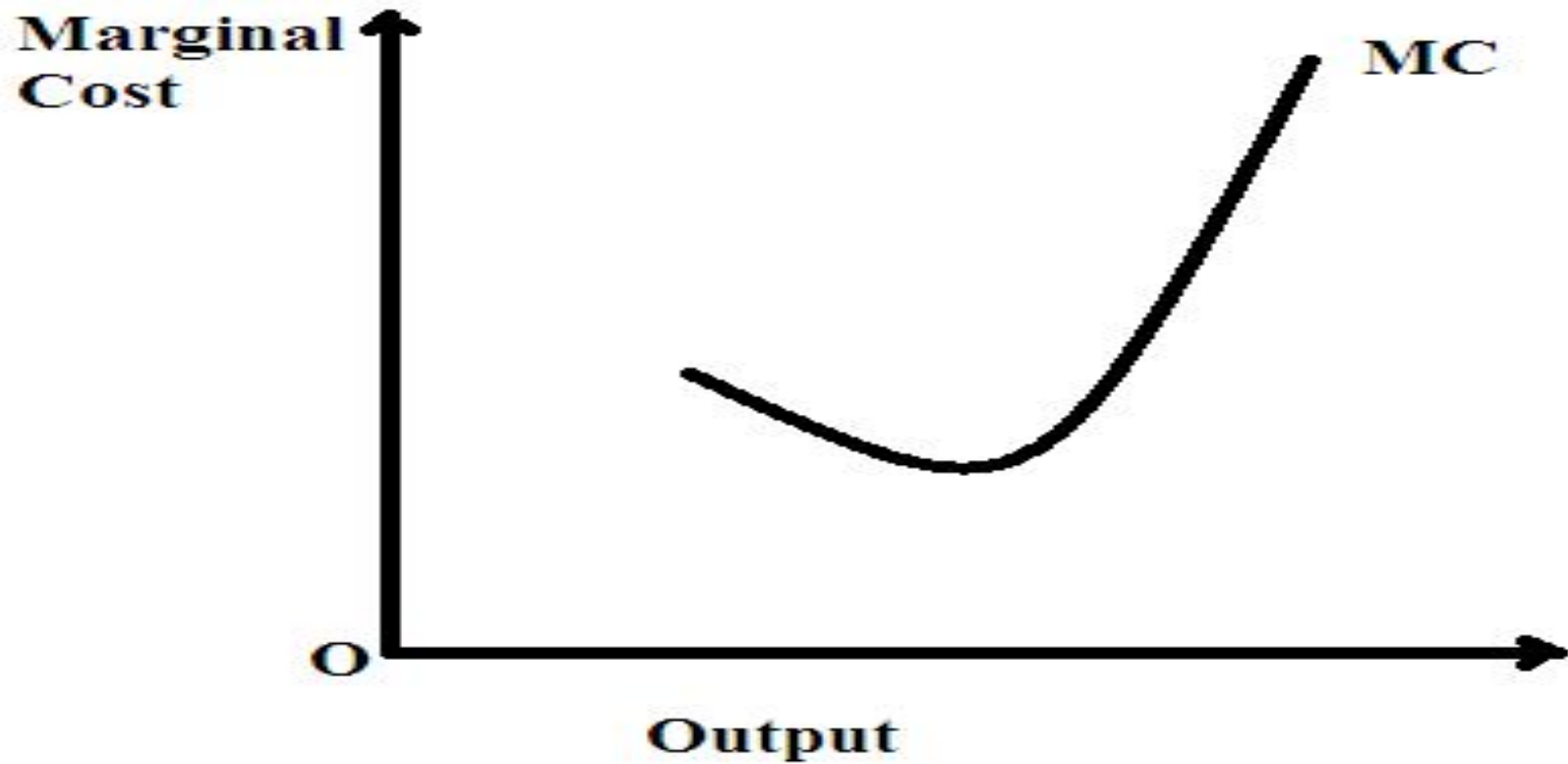
Average Total Cost (ATC/AC)



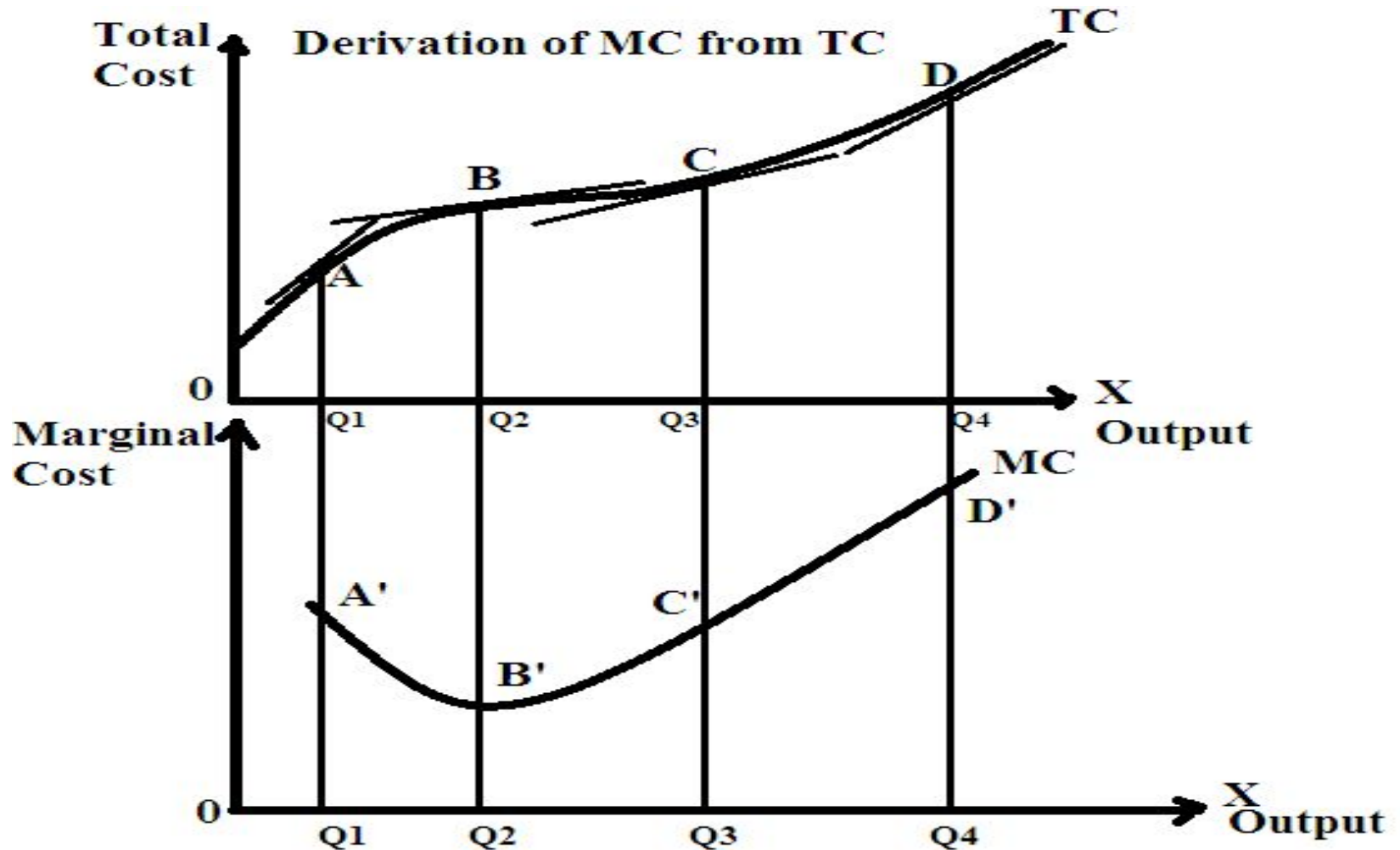
ATC derivation



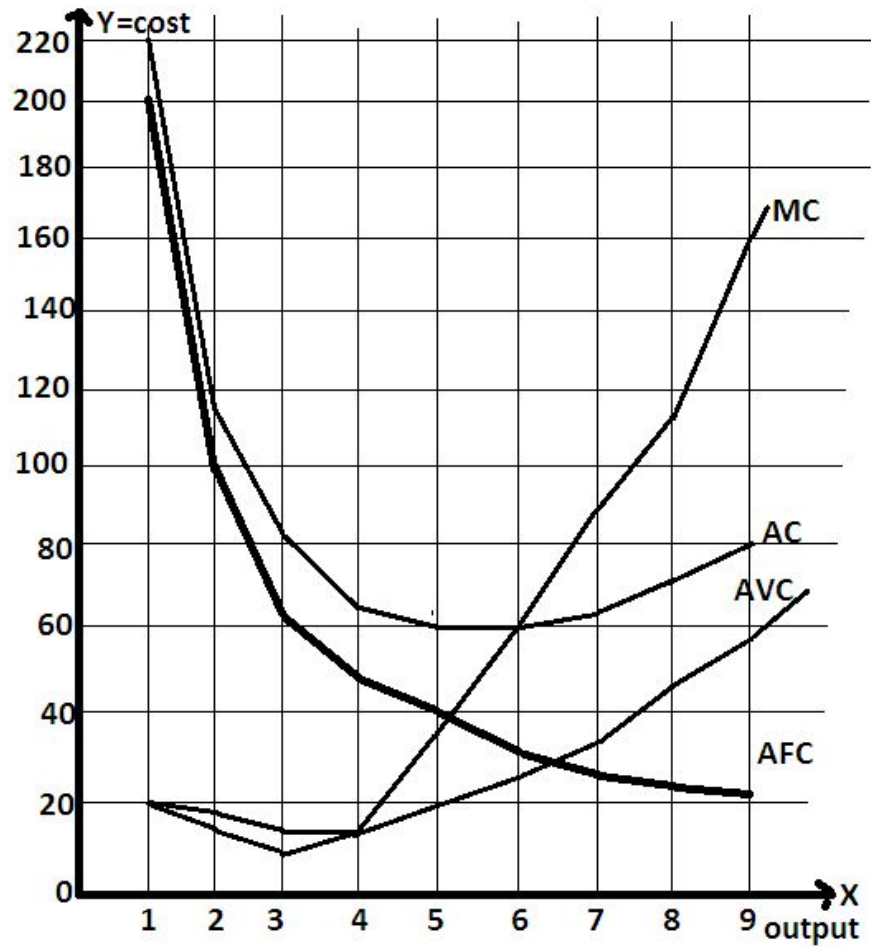
Marginal Cost (MC)



MC derivation From TC



MC, AC, AVC, AFC in figure



Why AC curve slopes U-Shaped?

- At first, Average Cost falls ,reaches minimum point and rises later as output increases.
- It is due to the operation of the law of variable proportion in the short run production function.
- When law of increasing returns operates in the production, Average product increases and become maximum (maximum and constant)
- When law of diminishing returns operates in production, the average product decreases and the average cost rises.
- Therefore, shape of AC curves follows the law of variable proportions.
- The shape of AC is also determined by the trend of AFC and AVC.
- Answer of AC of U-shaped based on three point of view which are:
 1. Basis of the law of Variable Proportion
 2. Basis of AFC and AVC
 3. Indivisibility of the factors

Long Run Cost Curve Derivation:

- Long-Run : Long-run is a period of time during which the quantities of all factors of production are variable.
- Thus in the long run, output can be increased by increasing capital equipment or by increasing the size of existing plant or by building new plant.
- The long run costs are the costs incurred during a period of time, which is sufficiently large to allow the variation in all factors of production including capital equipment, land and managerial staffs to produce a level of output.

Long-Run Cost of the Traditional Theory

- In the long run all factors of production are variable and remained no factors of production are fixed.
- Long run cost curve is a planning cost curve it provides the guideline to the producer for expanding its firm in the long-run, so it is also called planning curve .
- Long run average cost (LAC): long run average cost is per unit cost of production in long run. It is calculated by dividing long run total cost by the total quantity of output.

$$LAC=LTC/Q$$

Where,

LAC= long-run average cost

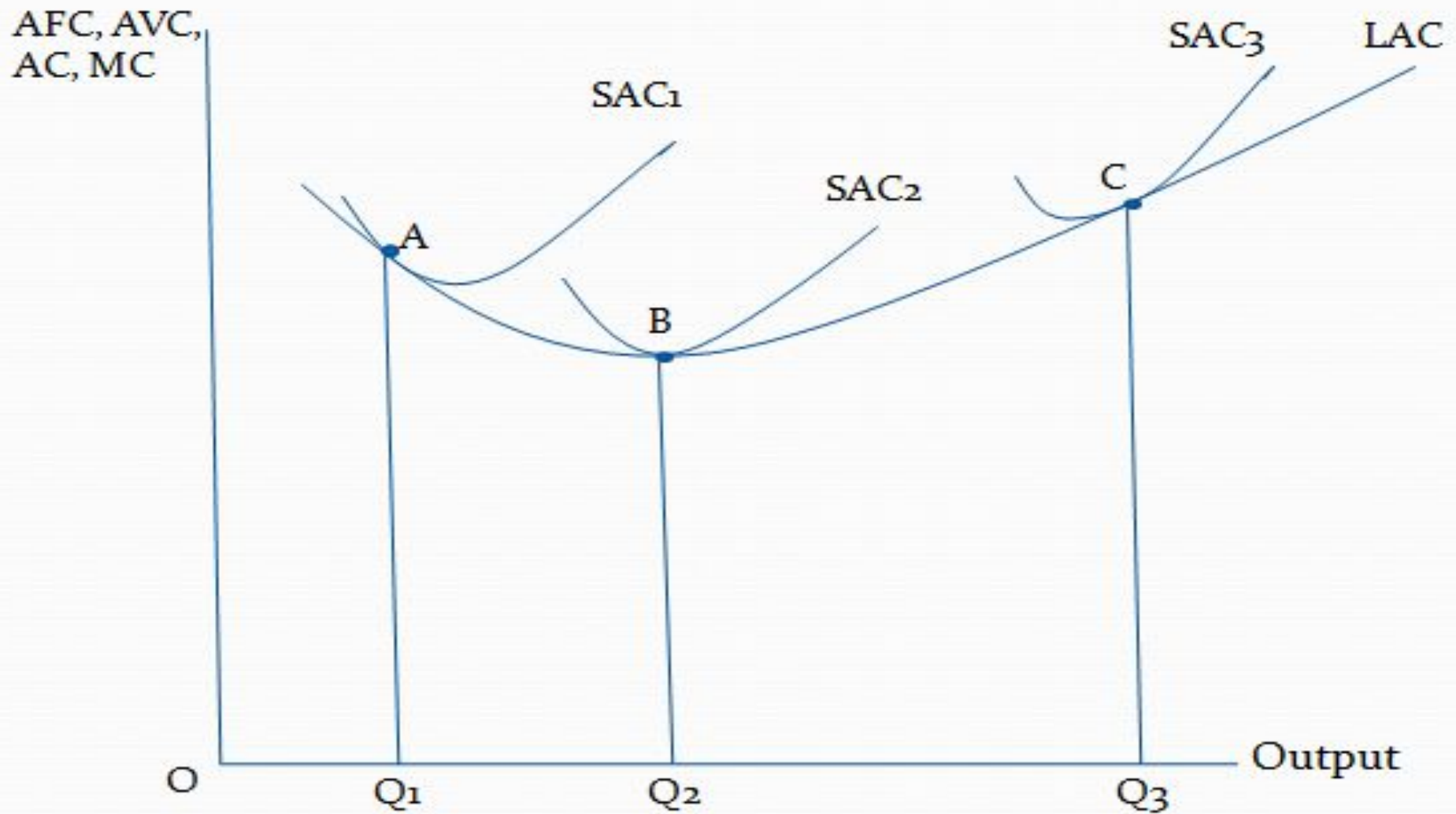
LTC=Long-run Total cost

Q = Quantity of output

Optimum size of the firm

- Optimum size of the firm refers that a firm is operating at the scale at which in existing technology and organizing ability, it has the **lowest average cost of production**, when all those cost which must be covered in the long run are included.
- *Optimum firm* is that firm which fully utilizes its scale of operation and produces optimum output with the minimum cost per unit production.
- In the short-run, a firm would build the scale of plant and operate it at a point where the average cost is at its minimum. This is regarded as the *optimum level of production for the firm* concerned,
- In the long run, all inputs are variable. The firm can build larger plant sizes or revert to smaller plants to deal with the changed demand for the product. If the size of plant increases to cope with the increased demand, the average cost per unit begins to fall due to the economies of scale such as increased specialization of labor, better and greater specialization of management, efficient utilization of productive equipment, etc., etc. So long as the resources are successfully utilized, the average cost of production continues declining.

The **concept of the optimum firm** can be explained with the help of the following figure:



Explanation of Figure

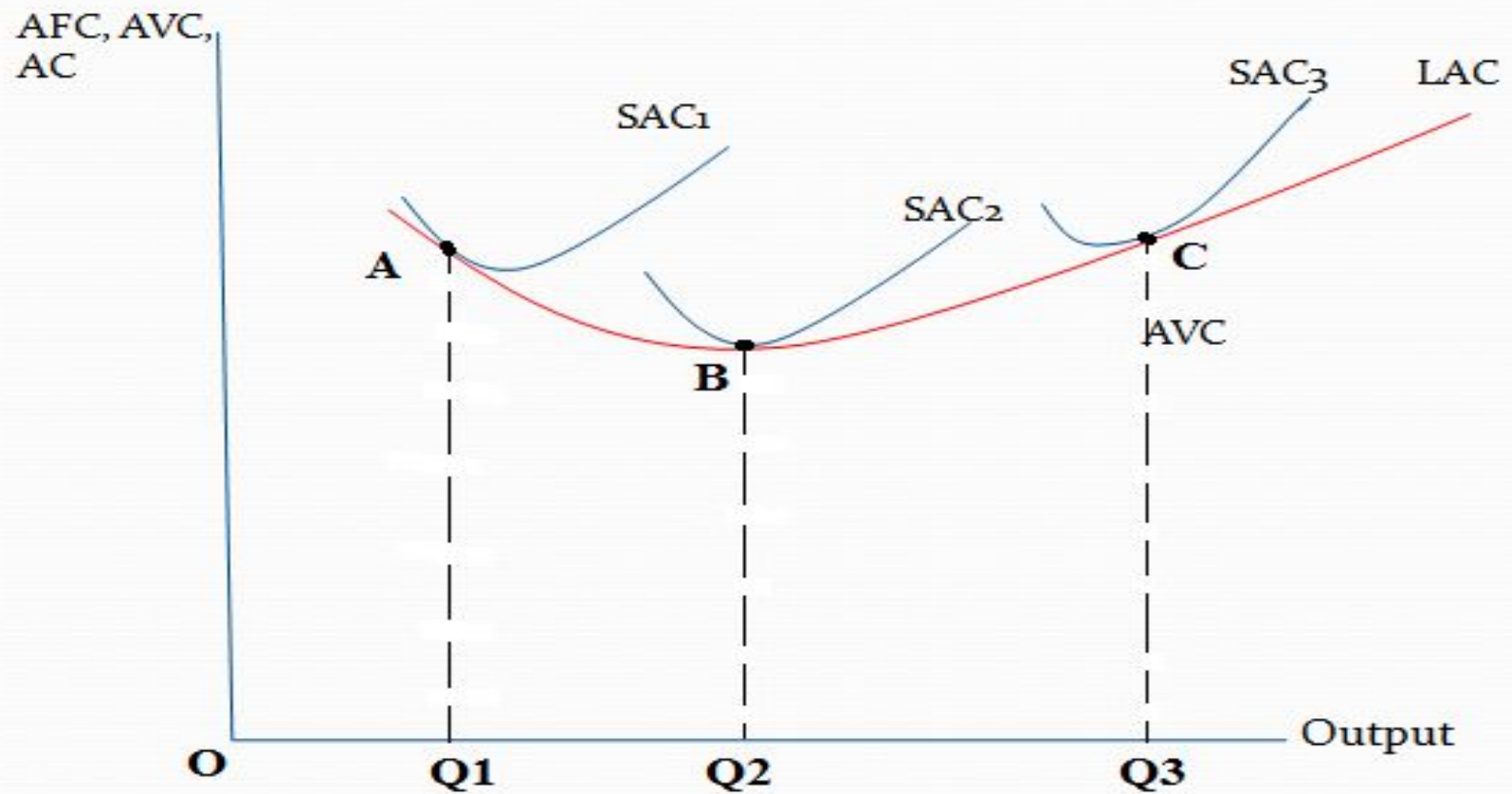
- In figure, output is measured along OX axis and units of cost along OY axis. In this figure, there are 3 alternative scales of plant. SAC^1 , SAC^2 and SAC^3 .
- If the anticipated output rate is OQ1, the firm should choose the smallest plant, SAC^1 . This is due to the fact that the cost per unit for OQ1 output is lowest at point A on plant SAC^1 . If the anticipated output rate is OQ2 plant SAC^2 yields lowest cost per unit at point B. This is the optimum plant of the firm and is of the most efficient size. If a larger plant of the SAC^3 size is constructed, per unit cost of production begins to arise. Thus the scale SAC^2 represent the optimum plant and BQ2 is the least cost output of this plant.

Long run Average Cost (LAC)

Derivation:

- In the long run, A firm can change its plant's size as per requirements, therefore, the number of plants as well as the number of SACs are finite in the long run.
- LAC curve can be obtained from the short-run average cost curves.
- LAC is deriving with the help of SACs as a tangential line.
- **LAC envelops the SACs, so, LAC is also called envelope curve.**
- LAC curve can be derived through enveloping all short run Average cost curves (SACs).
- LAC shows the least cost for producing the respective level of output in the existing technology and factor price.
- LAC is the per unit cost in the long run.

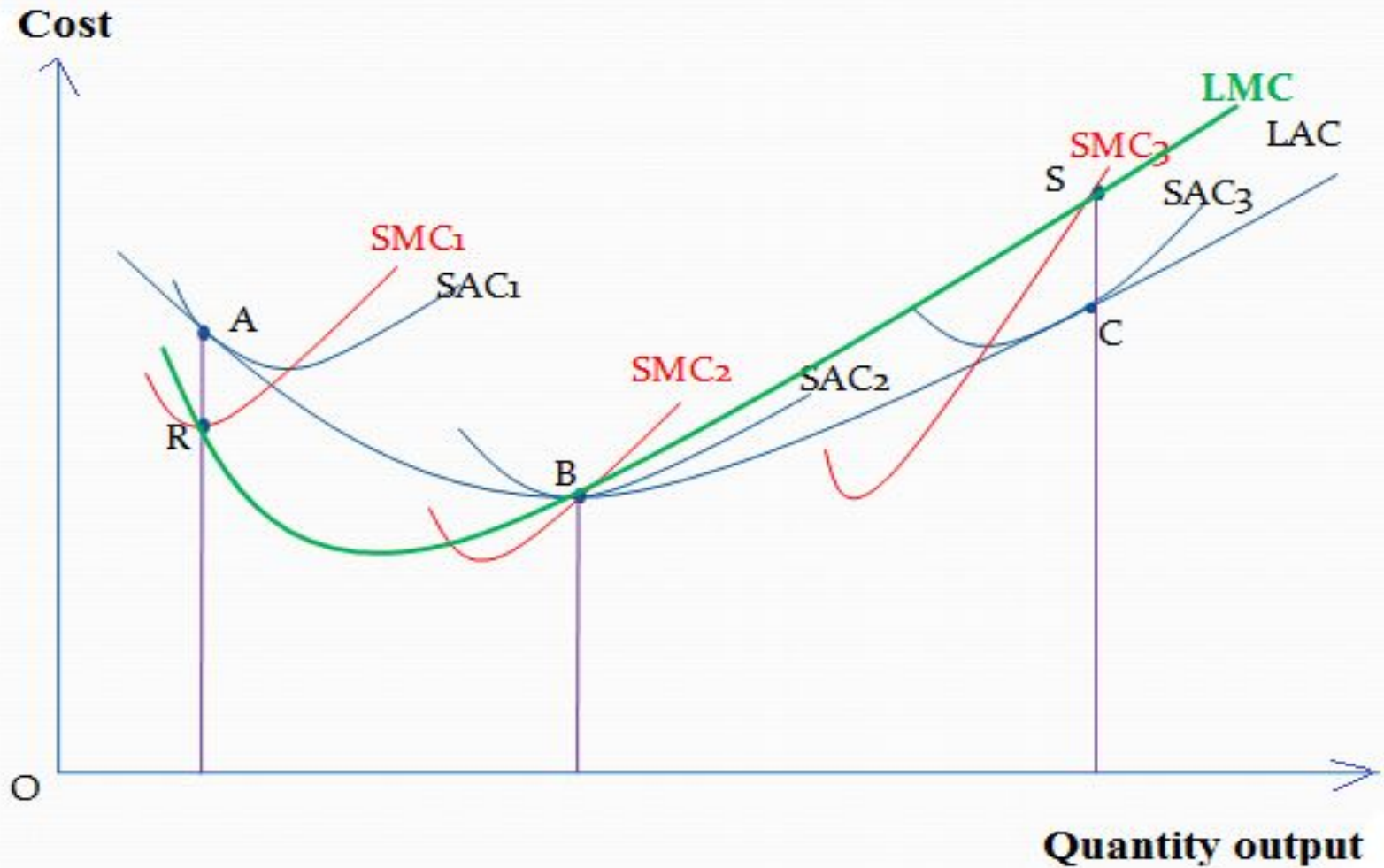
LAC Derivation



LMC derivation:

- LMC Curve can be derived with the help of all short-run Marginal Cost Curves.
- We can derive LMC by joining the points of intersection between the SMC and perpendicular line to the output axis from the tangential point of SAC and LAC.
- Less than output of the minimum point of LAC, LMC curve lies below the LAC and when LAC is raising, LMC lies above the LAC.

LMC derivation

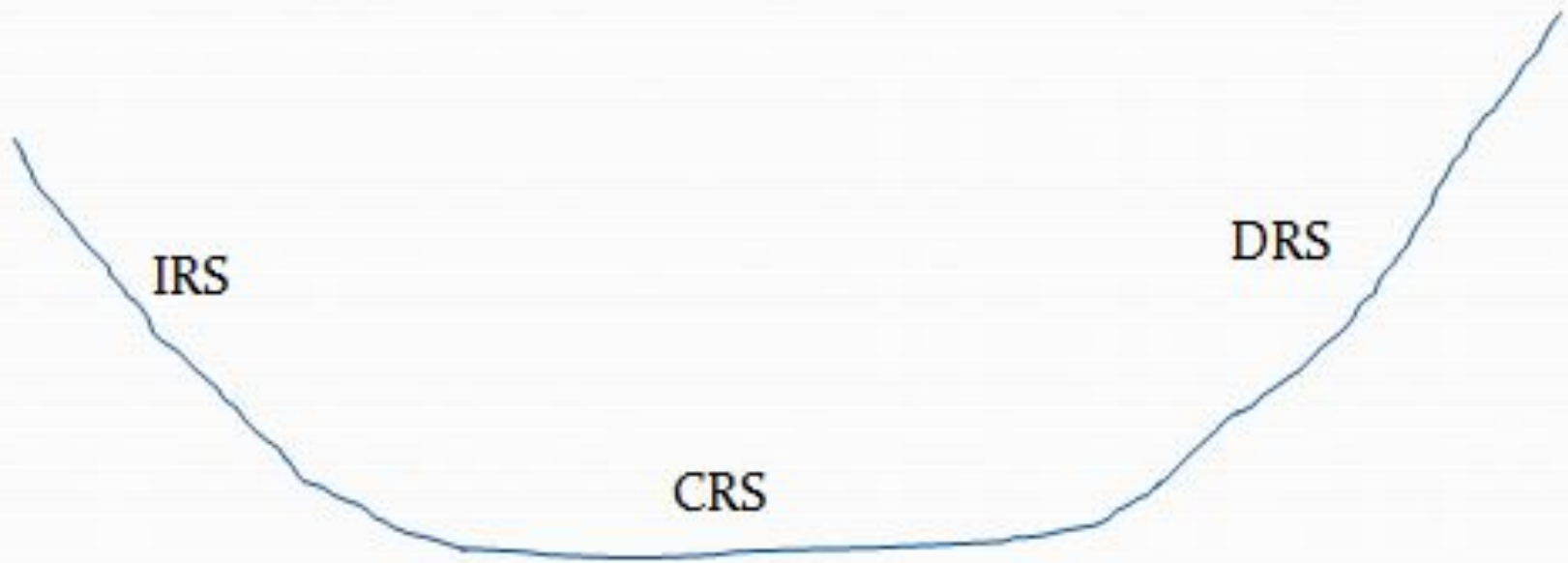


Explanation of LMC derivation

- The figure shows the derivation of LMC-Curve.
- As in figure, SAC1 and LAC are tangent at 'A' point. Perpendicular line from 'A' point is **AQ1**, which has cut SMC1 at 'R' point. This 'R' point represents LMC for OQ1.
- Similarly SAC2 and LAC are tangent at 'B' point, **which is minimum point** for both SAC2 and LAC. So SMC2 and LMC are equal to SAC2 and LAC, (**SMC2=LMC=SAC1=LMC**). This shows that for OQ2 level of output, BQ2 is LMC.
- Again SAC3 and LAC are tangent at 'C' point. Perpendicular line from 'C' point is **CQ3**, which cannot intersect SMC3. So we extend the perpendicular line upward and it is the 'S' point where perpendicular line from C point intersects SMC3. This 'S' point represents LMC for OQ3.
- Now joint the point R, B and S, we get a curve called LMC curve.
- The **LMC curve cuts LAC at its minimum** and its shape is **U-shaped** reflecting the **LAW OF RETURNS TO SCALE**.

Why LAC curve is 'U' shaped?

Due to the operation of law of returns to scale: IRS, CRS and DRS



Why is LAC U-shaped?

- **External Economies at initial phase : increasing returns to scale**
 1. **Cheaper inputs**
 2. **Technological economies**
 3. **Supply of Skilled Labour**
 4. **Growth of Ancillary Industries**
 5. **Constant flow of information**
 6. **Economies of Localization**

Thus, large firm can expand its scale is able to secure many external economies of production. As a result of these external economies, the firm is able to reduce the per unit cost or it can get increasing returns to scale.

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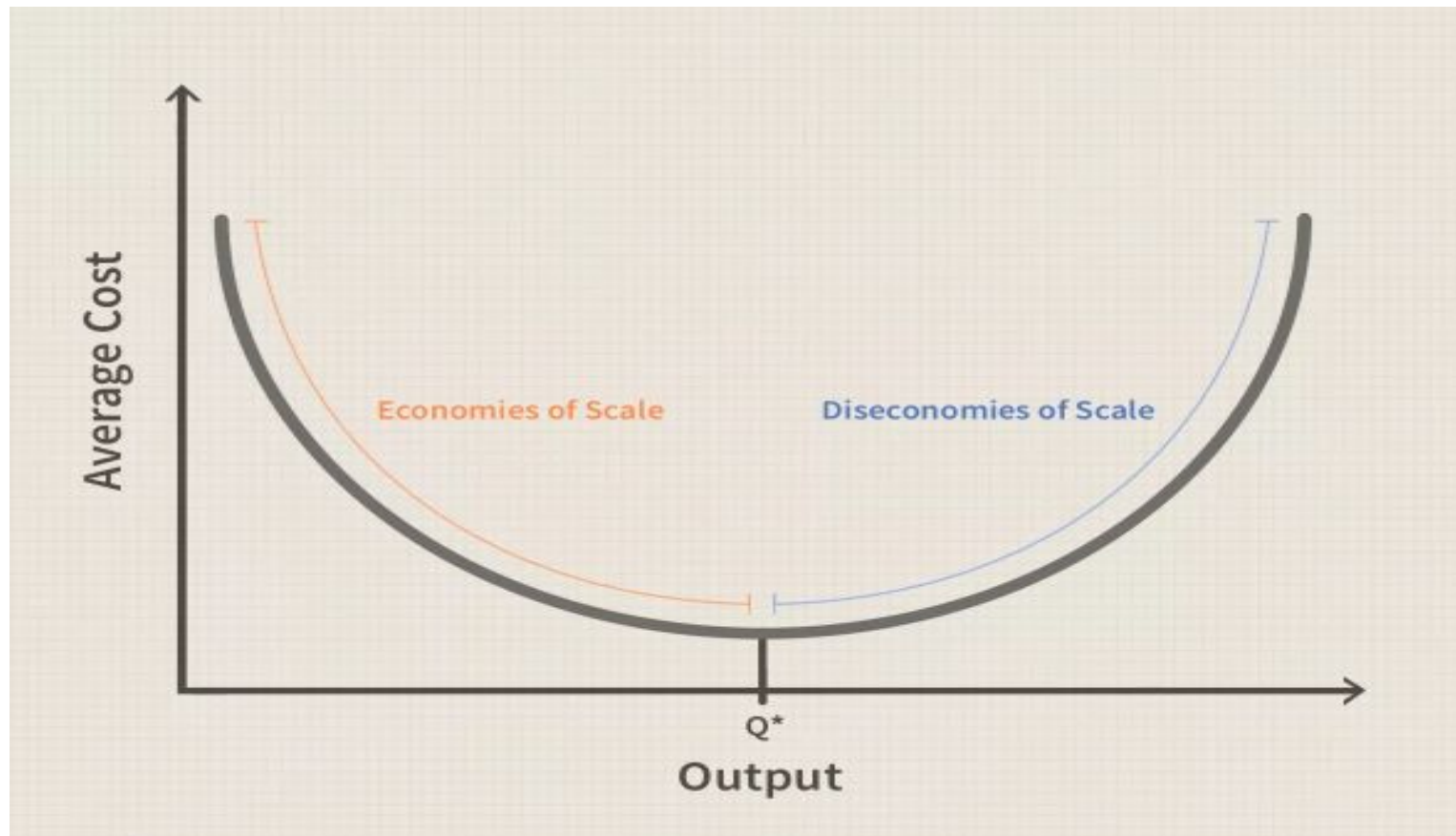
Thus, large firm can expand its scale is able to secure many external economies of production. As a result of these external economies, the firm is able to reduce the per unit cost or it can get increasing returns to scale.

Why is LAC U-shaped?

- Internal Diseconomies at last phase :decreasing returns to scale
 1. Managerial Diseconomies
 2. Labour inefficiency
 3. Technical Diseconomies
- External diseconomies at last phase :decreasing returns to scale
 - Rise in Input price
 - Higher Wages
 - Costlier Transport

Due to this internal and external diseconomies, the firm is not able to reduce the per unit cost or it can get decreasing returns to scale.

Why LAC curve is 'U' shaped?
Economies and Diseconomies of scale



Economies of Scale

- Economies of scale is defined as the **reduction in per unit cost of production (AC) with the expansion of output**. In other words, economies of scale are the cost advantages that arise with increase in output of a product.
- Economies of scale happens because of the inverse relationship between the quantity produced and per-unit fixed costs so that greater the quantity of a good produce, lower will be per unit fixed cost because these costs are shared over a larger number of goods. Economies of scale may also happens due to reduce variable costs per unit because of operational efficiencies and cooperation and collaboration (working together) of all involved in the operation of a firm.

Economies of scale

- The main economies of scale are summarized on following points.

- **(i) Production Economies**

Production economies are appeared due to following factors:

(a) Specialization of labor and indivisibility of capital.

(b) Decrease in set up cost.

(c) Initial fixed cost—such as cost for research & development

Economies of scale

- **(ii) Marketing or Selling Economies**

The marketing or selling economies is mainly related with the distribution of product, which includes following factors:

(d) Advertising economies: When output increases the average advertising cost decreases and regular advertisement also gets discount as a result cost of production declines.

(e) Selling activities economies: Cost of sales man, sample distribution cost, transportation cost etc. are decreases as increase in sales of production.

- **(iii) Managerial Economies**

When production increases then managerial expenses decreases due to following reasons:

(e) Specialization of management

(f) Increase in managerial efficiency due to fast decision making process or power.

Economies of Scale

- **(iv) Financial Economies**

When a firm or an industry operates with large scale then different discounts are given to the organization, so cost starts to decline as output increases. The financial economies appear due to following discount.

(g) Discount given in the price of raw materials,

(b) High-discount for large scale advertisements and discount in storage cost,

(c) Discount on transport cost, transportation rates are often lower, if the amount of commodities transported is large volume.

Diseconomies of Scale

● What are Diseconomies of Scale?

- Diseconomies of scale happen when a company or business grows so large that the costs per unit increase. It takes place when economies of scale no longer function for a firm. With this principle, rather than experiencing continued decreasing costs and increasing output, a firm sees an increase in costs when output is increased.
- Diseconomies of scale occur for several reasons, but all as a result of the difficulties of managing a larger workforce.
- **Poor communication**
- As the business expands communicating between different departments and along the **chain of command** becomes more difficult. There are more layers in the hierarchy that can distort a message and wider **spans of control** for managers. This decreases the average production and increases the average cost.
- **Lack of motivation**
- Workers can often feel more isolated and less appreciated in a larger business and so their loyalty and motivation may diminish which may be the cause of decrease in average production and increases in average cost.

Diseconomies of Scale

- **Loss of direction and coordination**
- It is more difficult for managers to supervise their subordinates and check that everyone is working together effectively, as the spans of control have widened so that the average cost increases.

CONCEPT OF REVENUE

- The amount of income which is received by a firm or any producer or seller by selling certain amount of goods and services in a market within a specific period of time is defined as Revenue. The amount of Revenue depends on quantity of sale and price of goods. The concept of revenue is discussed under Three parts.
- **Total Revenue (TR)**
- The total amount of money received by producers or firms by selling certain amount of goods is said to be total revenue. It is also known as total sales value. The total revenue is obtained by multiplying price per unit of a commodity by the total amount of quantity sold. Hence, it is expressed in equation Form as

$$TR = P \times Q$$

Where, TR = total revenue

P = price per unit of commodity

Q = quantity sold

CONCEPT OF REVENUE

- **Average Revenue (AR)**

- The average revenue is defined as the ratio between total revenue and total quantity sold at a specific period of time. It is obtained by dividing total revenue by the total quantity sold in a market at a particular unit of time. Hence, it is expressed as,

$$AR = \frac{TR}{Q} = P$$

Where, TR = Total Revenue

Q = Total quantity sold

- In economic sense, average revenue is also known as price per unit of a commodity.

CONCEPT OF REVENUE

- **Marginal Revenue (MR)**

- The marginal revenue is defined as the additional revenue while a producer or seller is able to gain after selling one extra more unit of goods in the market. Therefore it is also said as ratio between change in total revenue and total quantity sold. In equation form, it can be written as

- $$MR = \frac{\Delta TR}{\Delta Q}$$

- Where, ΔTR = change in total revenue

- ΔQ = change in quantity sold

$$MR = TR_n - TR_{n-1}$$

RELATION OF REVENUE CURVE IN PERFECT COMPETITION MARKET

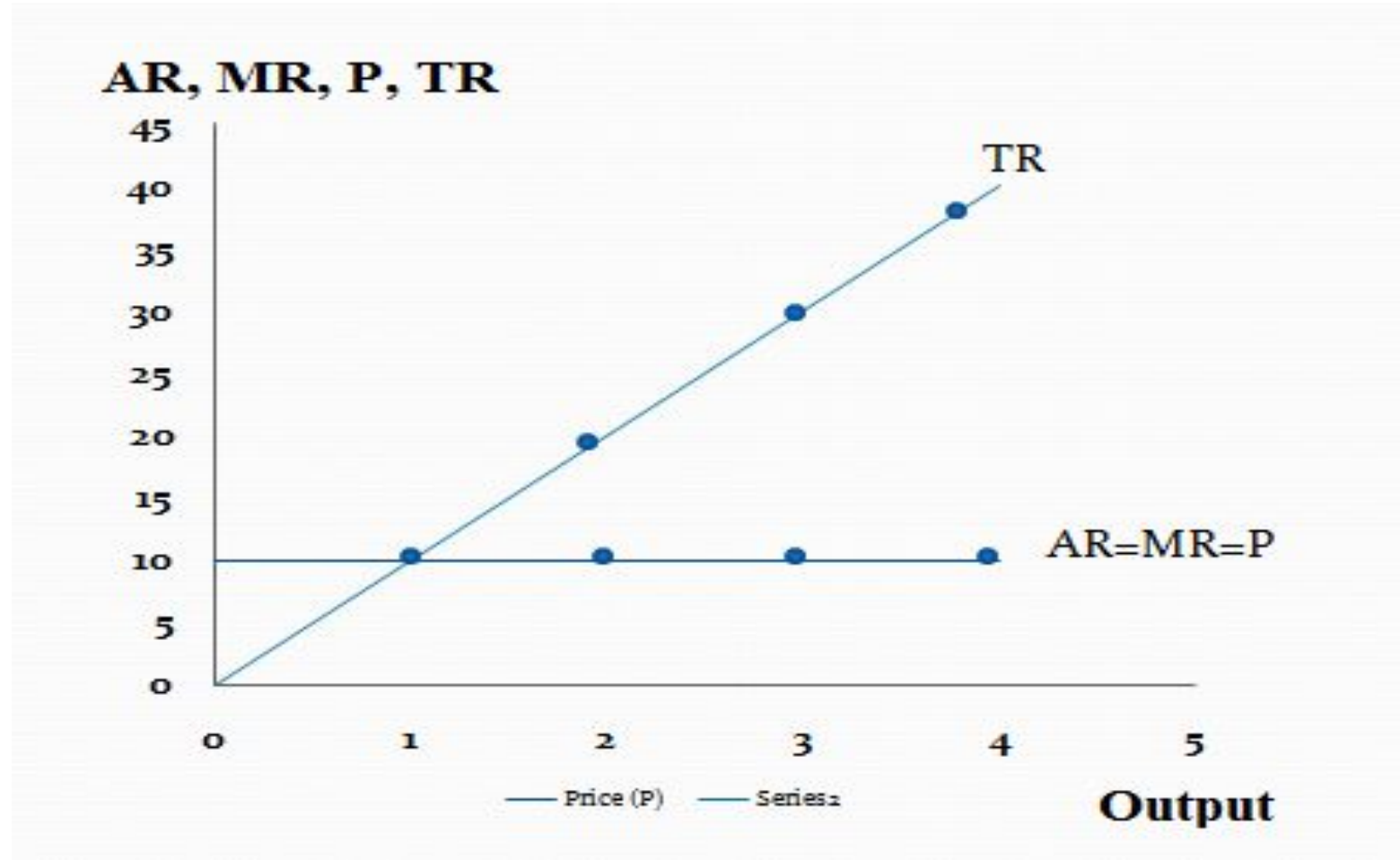
- A market structure is said to be **perfect competition** in which there are large number of sellers and buyers in the market. Each individual firm supplies only a small part of the total quantity offered in the market. The products are homogenous, there is perfect mobility of resources, free entry and exit of firms into and from the industry, the goal of firm is profit maximization, and all sellers and buyers have complete knowledge of the conditions of the market.
- The relation between various revenue curves in perfect competition market can be seen in next slide with a table:

Table :AR, MR TR MR in perfect Competition market

Output (Q)	Price (P)	TR = P×Q	AR = TR/Q	MR = TR _n - TR _{n-1}
0	10	0	-	-
1	10	10	10	10
2	10	20	10	10
3	10	30	10	10
4	10	40	10	10

AR = MR = Price = constant = parallel to X axis

AR, MR TR MR in Curve in perfect competition market



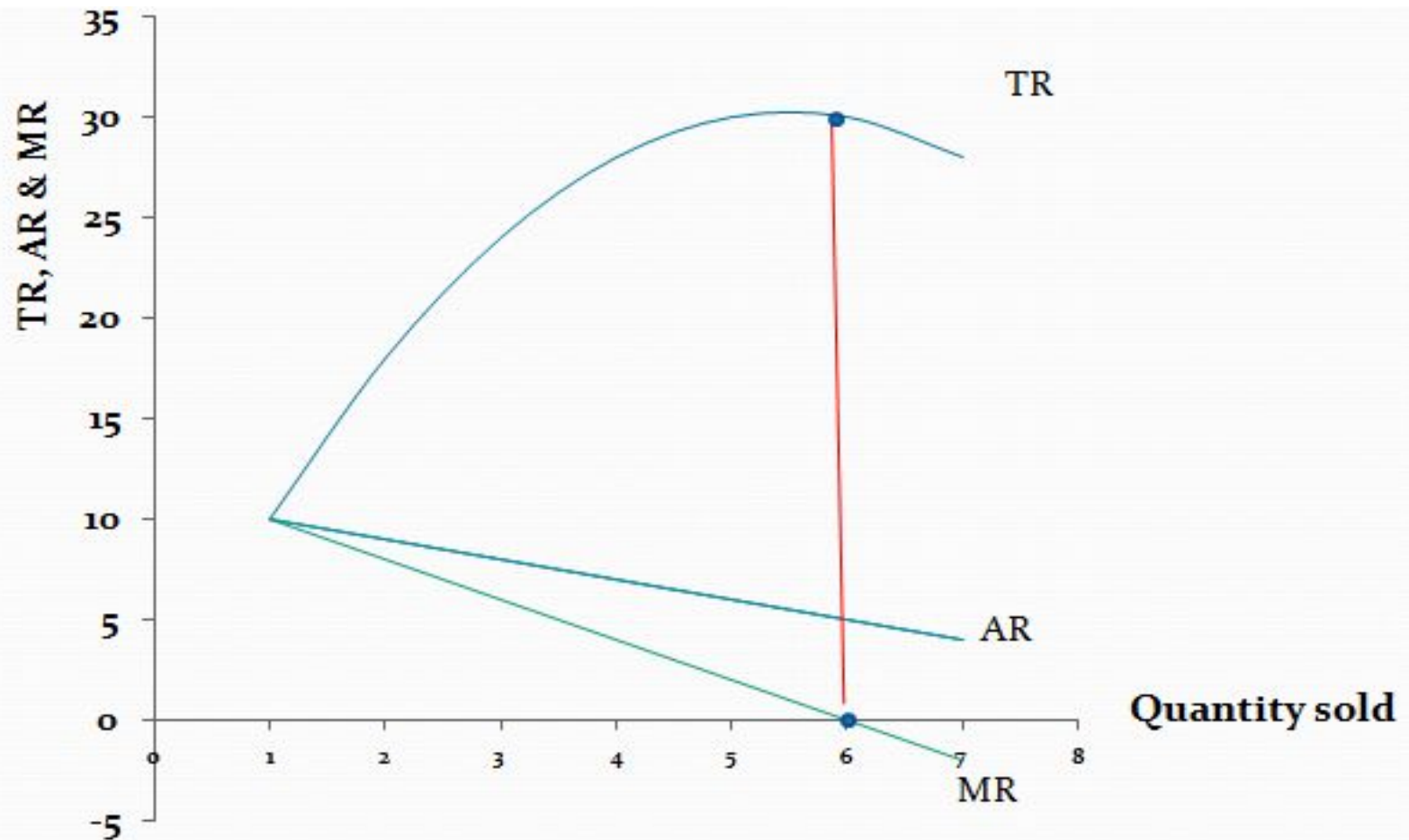
Revenue curves (TR, AR & MR) under imperfect competition

- The imperfect competition is the situation of market failure in which, unlike the situation of perfect competition, the law of supply and demand is not freely used to determine prices, but in which there must be a balance in the prices determined.
- There are various imperfect competition like monopoly, monopolistic, oligopoly, duopoly etc.
- **Under imperfect competition higher quantity is sold by decreasing the price**, which can be seen in the table in next slide.
- **Relationship between AR, MR & TR in imperfect competitive market**
 - $AR = P$, but $AR > MR$ in the imperfect competitive market,
 - TR is maximum when $MR = 0$

Table :AR, MR TR MR in imperfect Competition market

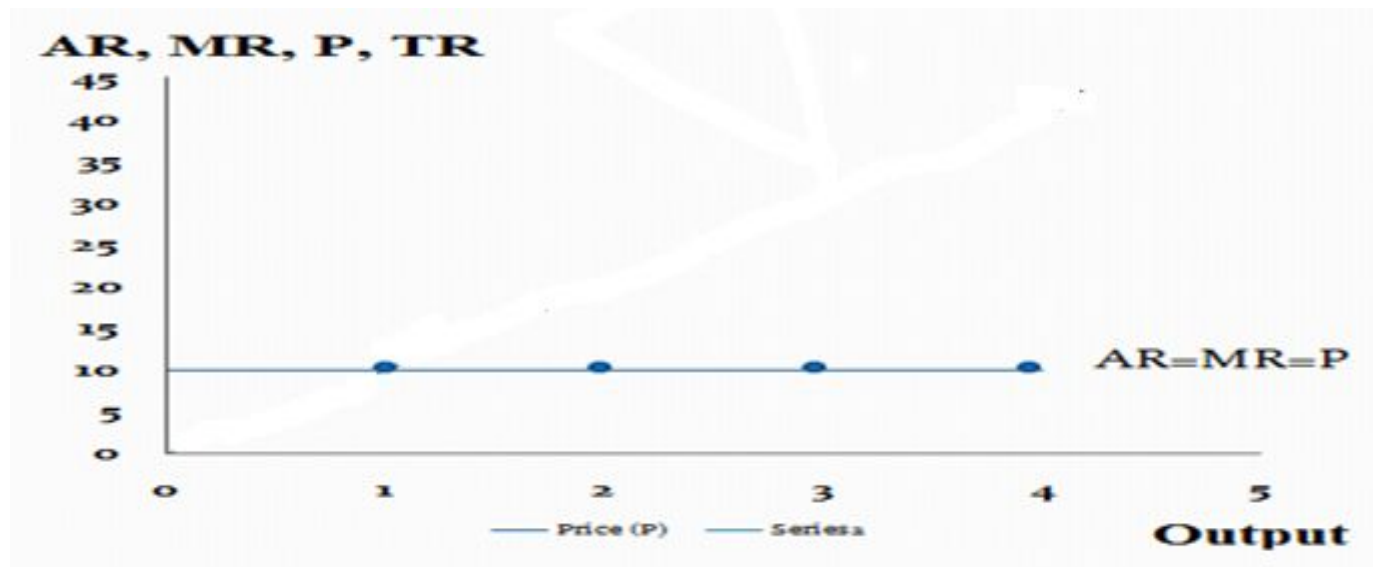
Quantity sold (Q)	Price (P)	TR = P×Q	AR = TR/ Q	MR = TR _n - TR _{n-1}
1	10	10	10	10
2	9	18	9	8
3	8	24	8	6
4	7	28	7	4
5	6	30	6	2
6	5	30	5	0
7	4	28	4	-2

TR, AR, MR curves in imperfect competition



Relation Between AR, MR, in various Market.

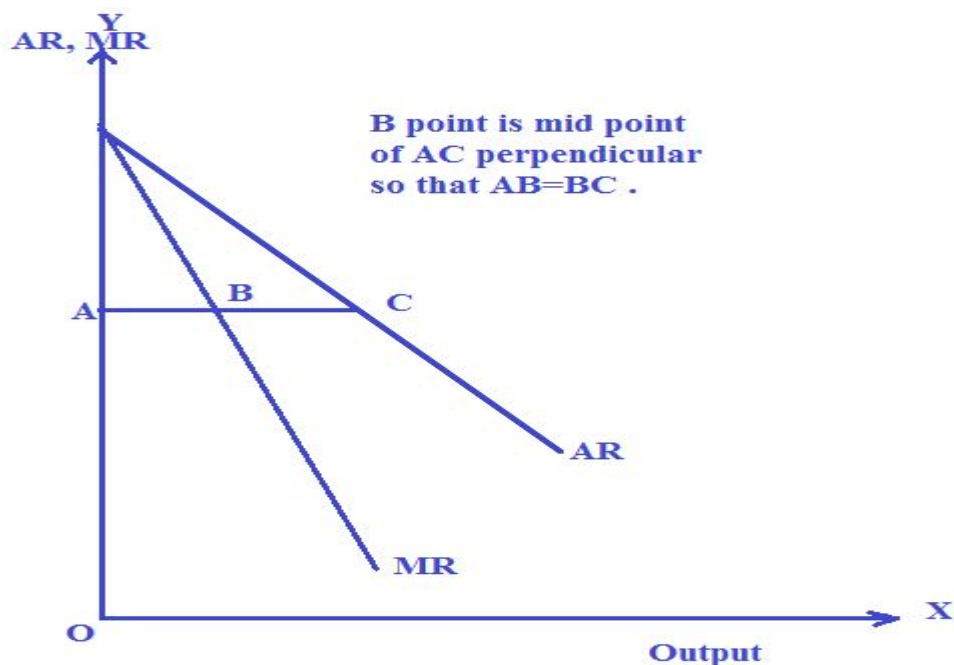
- Relationship between AR and MR curves under perfect competition:
- As firm are price taker because seller firm cannot influence the price of the product and sell at existing market price. So, price or Average Revenue (AR) curve is same and Marginal Revenue (MR) curve is coincide with AR because additional unit are sold at the existing same market price. So, $AR=MR$ in perfect competitive market



Relationship between AR and MR curves under imperfect competitive market:

Condition 1: When both AR and MR curve are straight line:

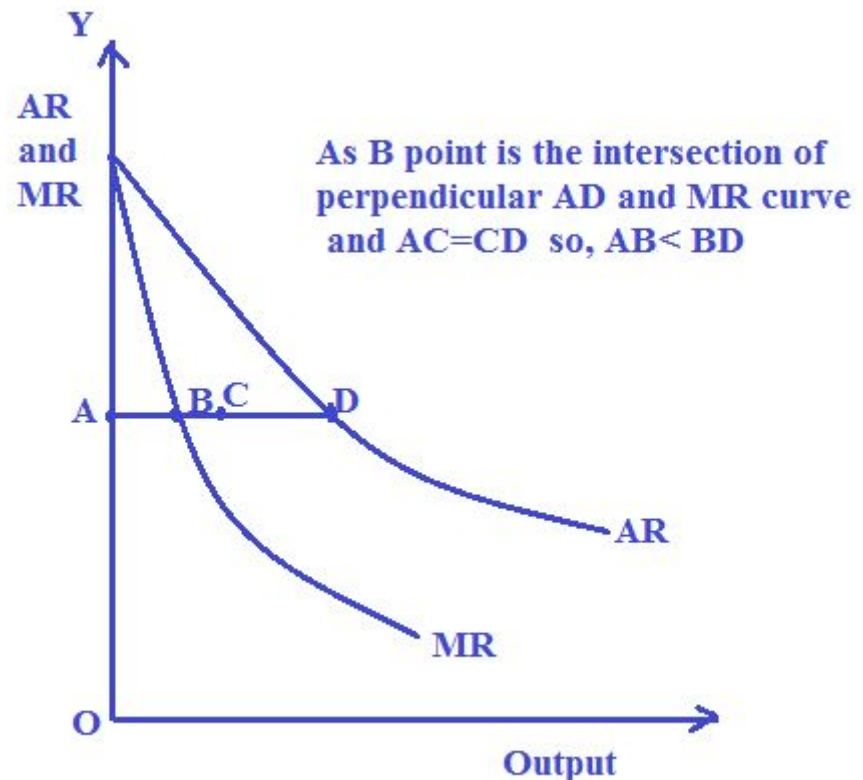
AR and MR curve are downward sloping and straight line, MR lies below or inside the AR curve and if a perpendicular line is drawn from any point of AR curve to Y-axis, MR curve cuts that perpendicular at midway.



Condition 2: When both AR and MR curve are convex to the Origin:

When both AR and MR curve are convex to the Origin, if a perpendicular line is drawn from any point of AR curve to Y-axis, MR curve cuts that perpendicular more than half way from AR. Which can

Seen in figure:



Condition 3: When both AR and MR curve are concave to the Origin:

- When both AR and MR curve are concave to the Origin, if a perpendicular line is drawn from any point of AR curve to Y-axis, MR curve cuts that perpendicular less than half way from AR.

