UNIT -1
Introduction to Managerial Economics

1. *INTRODUCTION TO MANAGERIAL ECONOMICS*

Managerial Economics refers to the firm's decision-making process. It could be also interpreted as "Economics of Management" or "Industrial economics" or "Business economics". This field combines economic theory with managerial tools to analyse business problems and develop strategies.

1.1. *Nature of Managerial Economics*

Managerial Economics is characterized by the following features:

- **Applied Economics:** It applies economic principles to real-world business situations.
- **Decision-Oriented:** Focuses on decision-making processes within firms.
- **Microeconomic in Focus:** Primarily deals with individual firms and markets.
- **Normative and Positive:** It involves both descriptive analysis (positive) and prescriptive recommendations (normative).

1.2. *Scope of Managerial Economics*

Managerial economics refers to its area of study. Managerial economics provides management with a strategic planning tool that can be used to get a clear perspective of the way the business world works and what can be done to maintain profitability in an ever-changing environment.
Managerial economics is primarily concerned with the application of economic principles and theories to five types of resource decisions made by all types of business organizations.
a. The selection of product or service to be produced.
b. The choice of production methods and resource combinations.
c. The determination of the best price and quantity combination
d. Promotional strategy and activities.
e. The selection of the location from which to produce and sell goods or service to Consumer

1. Demand Analysis and Forecasting

➢ Demand analysis also highlights for factors, which influence the demand for a product. This helps to manipulate demand. Thus demand analysis studies not only the price elasticity but also income elasticity cross elasticity as well as the influence of advertising Expenditure with the advent of computers.

➢ Demand forecasting has become an increasingly important function of managerial economics. A firm can survive only if it is able to the demand for its product at the right time, within the right quantity. Understanding the basic concepts of demand is essential for demand forecasting

2. Cost and Production Analysis

➢ Production analysis is in physical terms.

➢ while the cost analysis is in monetary terms cost concepts and classifications, cost-output relationships, economies and diseconomies of scale and production functions are some of the points constituting cost and production analysis.

3. Pricing Decisions, Policies, and Practices

➢Pricing decisions have been always within the preview of managerial economics. Price theory helps to explain how prices are determined under different types of market conditions.

➢Managerial economics provides the analytical framework and data to help managers set appropriate prices by considering production costs, competitive strategies, and customer perceptions to maximize profit and achieve business goals.

4. Capital Management

➢Capital is the foundation of business. Lack of capital may result in small size of operations. Availability of capital from various sources like equity capital, institutional finance etc. may help to undertake large-scale operations. Hence efficient allocation and management of capital is one of the most important tasks of the managers.

➢The major issues related to capital analysis are:

1. The choice of investment project
2. Evaluation of the efficiency of capital
3. Most efficient allocation of capital.

Knowledge of capital theory can help very much in taking investment decisions. This involves, capital budgeting, feasibility studies, analysis of cost of capital etc.

5. Profit Management

➢ Profit making is the major goal of firms. There are several constraints here an account of
competition from other products, changing input prices and changing business environment hence in spite of careful planning, there is always certain risk involved.

1.3 MARGINAL ANALYSIS

Marginal analysis is a decision-making tool that compares the additional cost of one more unit of a good, service, or activity (marginal cost) with the additional benefit (marginal benefit) to maximize profits. By comparing marginal cost (MC) and marginal revenue (MR), businesses can determine the optimal level of production or resource allocation by increasing output as long as MR exceeds MC.

Key Concepts:

Marginal Cost (MC): The extra cost incurred by producing one more unit of a good or service.

Marginal Benefit (MB): The extra benefit gained from one more unit of a good or service.

Marginal Revenue (MR): The additional revenue generated by selling one more unit of a product.

Marginal Profit: The change in total profit from selling one more unit.

How It Works

1. **Comparison of Costs and Benefits:** Managers examine whether the additional benefit of an action or decision is greater than the additional cost.
2. **Profit Maximization:** The optimal level of production is reached when marginal revenue equals marginal cost (MR = MC).
3. **Decision Rule:**
    - If ***MR > MC***, increasing production or activity will increase profit.
    - If ***MR < MC***, decreasing production or activity will increase profit.
    - If ***MR = MC***, the firm is at its profit-maximizing output level.

Examples in Business

- **Production Decisions:** A company decides whether to produce one more unit of a commodity by comparing the cost of producing that unit with the revenue it will generate.

- **Hiring Decisions:** A firm evaluates the additional cost of hiring another worker against the additional revenue the worker will bring in.
- **Advertising:** A business analyzes if the incremental revenue from increased advertising justifies the additional advertising expenditure.

1.4 Determination of Consumer's Equilibrium through Utility and Indifference Curve Approach

CONSUMER EQUILIBRIUM:

- **Definition**: Consumer's equilibrium is the state where a rational consumer achieves maximum satisfaction or utility from their expenditure, given their limited income and the market prices of goods and services.
- At this point, the consumer has no incentive to reallocate their spending**.**

1.4.1 Approach 1: Cardinal Utility Analysis

This approach, pioneered by Alfred Marshall, assumes that utility is quantifiable and can be measured in units called "utils". The analysis relies on the **Law of diminishing marginal utility** (DMU), which states that the marginal utility (extra satisfaction) derived from consuming each successive unit of a commodity decreases.

- **Condition for equilibrium**

  A. Single commodity case:

  A consumer is in equilibrium when the marginal utility (MU) of the last unit consumed is equal to its price (P).

  Condition: $MU_x = P_x$

- **Explanation:**
  - If $\mathbf{MU_x > P_x}$, the consumer is gaining more utility than the price paid, so they will continue to purchase more. As more units are consumed, MU_x falls due to the law of DMU, until it equals P_x.
  - If $\mathbf{MU_x < P_x}$, the consumer is paying more than the utility they receive, so they will reduce consumption, causing MU_x to rise until it equals P_x.

B. In the case of two or more commodities:

This is based on the **Law of Equi-Marginal Utility**, which states that a consumer is in equilibrium when the ratio of the marginal utility to the price is the same for each commodity.

- **Condition:** MUx / Px = MUy / Py
- **Explanation:** The consumer allocates their expenditure so that the last dollar spent on each good yields the same amount of marginal utility.

Example: Imagine you have ₹500 to spend on pizza and burgers.

- **Goal**: Get the most happiness (utility) from your ₹500.
- **How**: You buy a mix of pizza and burgers. You keep switching until the last rupees spent on pizza gives you the same happiness as the last rupees spent on burgers.
- **Result**: You feel satisfied and don't want to change your mix of pizza and burgers.

1.4.2. Approach 2: Indifference Curve Approach

The *indifference curve approach (or ordinal approach)* is based on the assumption that a consumer can rank their preferences for different combinations of goods, but cannot measure the specific utility derived. This approach was propounded by **Hicks &Allen**. It explains consumer behavior in terms of his preferences or rankings for different combinations of two goods, say X and Y. An indifference Curve is drawn from the indifferent schedule of the consumer. This approach uses indifference curves and a budget line.

- An **indifference curve** shows all the combinations of two goods that provide a consumer with equal satisfaction.
- An **indifference schedule** is a list of combinations of two commodities that yields equal satisfaction
- The **budget line** represents all the combinations of two goods a consumer can purchase, given their income and the prices of the goods.

Basic Assumptions of an Indifference Curve Analysis

- The first assumption of an indifference curve analysis is that utility is ordinal. It means that the utility gained from the consumption of a good cannot be measured in cardinal numbers like 1, 2, 3, etc. It is, therefore, measured in

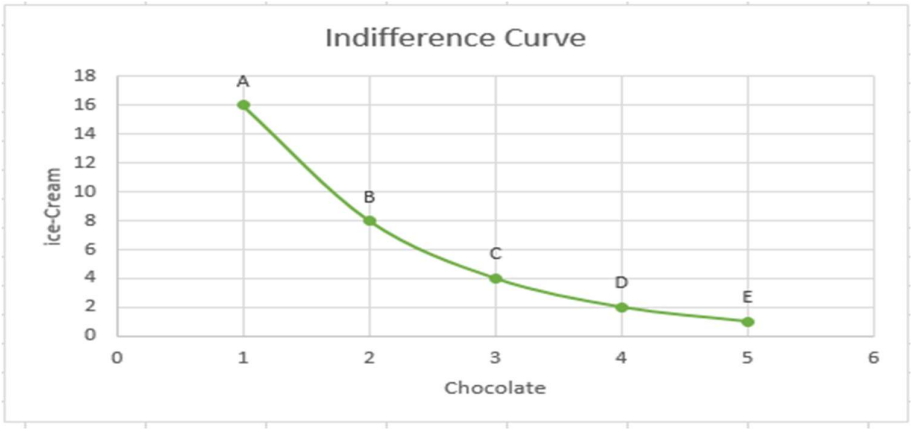
ordinal numbers like 1st, 2nd, 3rd, etc. With cardinal numbers, one can easily compare the different levels of satisfaction by ranking the preferences.

- The consumer consuming the two goods is assumed to be rational. In other words, the basic motive of the consumer is to maximize his/her satisfaction level through the consumption of two goods.
- There are only two goods purchased and consumed by a consumer. It is because a graph has only two axes, and the representation of two goods will be easy.
- The consumer is fully aware and has complete knowledge about the price of both goods in the market.
- The price of both the goods is already given.
- The taste, income and habits of a consumer remain the same all the time.
- The preferences of a consumer are transitive. It means that if a consumer prefers Good X over Good Y and Good Y over Good Z, then he/she prefers Good X over Good Z.

Example:
Nisha is consuming two goods Chocolate and Ice-Cream, and is willing to consume different combinations of these goods to gain an equal level of satisfaction with each combination. These combinations are given in the below indifference schedule. Prepare an indifference curve for the same.

Combinations	Chocolate	Ice-Cream
A	1	16
B	2	8
C	3	4
D	4	2
E	5	1

Solution:



In the above graph, points or combinations A, B, C, D, and E provide the same satisfaction level to Nisha. It can also be seen that as Nisha is consuming one additional quantity of chocolate, she has to sacrifice or give up some quantity of ice cream. Therefore, when Nisha moves from Combination A to B to consume one extra chocolate, she has to sacrifice 8 units of ice-creams. Similarly, to move from Combinations B to C, C to D, and D to E, she has to sacrifice 4, 2, and 1 unit of ice-creams, respectively, for the consumption of one extra unit of chocolate at each

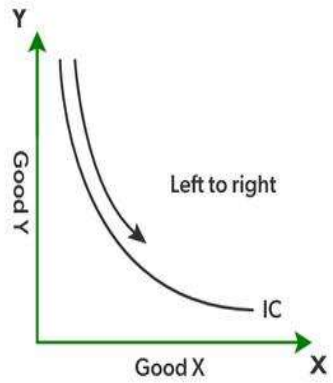
Marginal Rate of Substitution *can be defined as the amount of Good Y sacrificed to obtain an additional unit of Good X without affecting the total satisfaction level.*

$$MRS = \frac{\Delta GoodX}{\Delta GoodY}$$

movement. This sacrifice of units of a good to gain an additional unit of another good is known as the **Marginal Rate of Substitution.**

Properties of Indifference Curve:

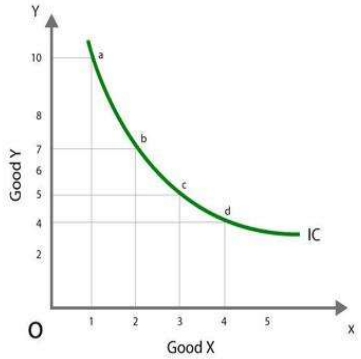
1. Indifference Curve always slopes downwards from left to right



An indifference curve is defined as a curve that gives an equal level of satisfaction to a consumer at every possible combination. It is possible when a consumer is willing to sacrifice some quantity of a good to gain an additional unit of another good. If a consumer is having more of a good without any fall in another good, the consumer will achieve a higher satisfaction level instead of equal. This fall in units of one good to gain more of another good gives a downward slope to the indifference curve.

2. <u>Indifference Curves are always convex to the point of origin</u>

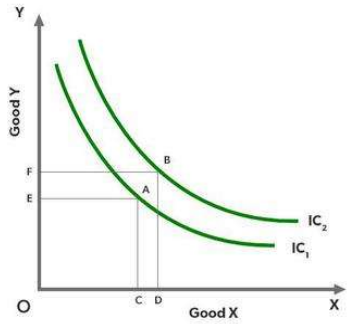
The shape of an indifference curve is based on the **Diminishing Marginal Rate of Substitution.** It means that to gain a single extra unit of a good, a consumer is willing to sacrifice more of another good. As in the case of Nisha (example above), to gain one more unit of chocolate, she is willing to sacrifice more units of ice-creams. This diminishing marginal rate of substitution gives a convex shape to an indifference curve.



3. <u>Higher Indifference Curves represent a higher level of satisfaction</u>

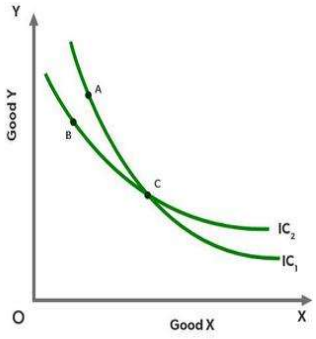
A higher indifference curve represents a higher level of satisfaction, or we can say that an indifference curve to the right of another gives more satisfaction. This property of the indifference curve is based on the assumption of monotonic preference. **Monotonic Preference** means that a consumer will always prefer a larger

bundle, as it gives him/herhigher satisfaction level. In other words, as a consumer prefers more goods, and a higher indifference curve will give a higher satisfaction level.



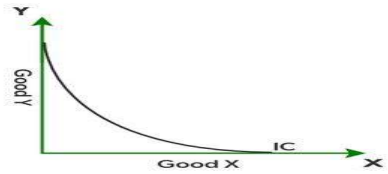
4. Two Indifference Curves cannot intersect each other

An indifference curve consists of different combinations of two goods giving the same satisfaction level to a consumer. It means that every point on an indifference curve gives the same satisfaction to the consumer. Also, an indifference map consists of different indifference curves with different satisfaction levels in each curve. If two indifference curves intersect with each other, it would mean that one point on each curve gives the same level of satisfaction which contradicts the meaning of an indifference map. Therefore, two indifference curves never intersect each other.



An Indifference Curve never touches either of the axes

Indifference curves do not touch the axes because they assume a consumer desires a positive quantity of both goods, as each good is assumed to contribute to utility. If a curve touched an axis, it would imply zero consumption of one good, contradicting this fundamental assumption of consumer theory and **utility maximization**



1.5. Theory of Demand

INTRODUCTION: Demand in common parlance means the desire for an object This means that the demand becomes effective only it if is backed by the purchasing power in addition to this there must be willingness to buy commodity. Thus, demand has three essentials – price, quantity demanded and time.

DEMAND DEFINITION: Demand means the various quantities of goods that would be purchased at a particular price and not merely the desire of a thing.

DEMAND FUNCTION: The Demand Function shows the relationship between the quantity of a good demanded and the factors that affect it. It tells us how much of a product consumers are willing and able to buy at different prices, keeping other factors constant.
It can be written as:

$$Q_d = f(P, Y, P_r, T, E)$$

Where,

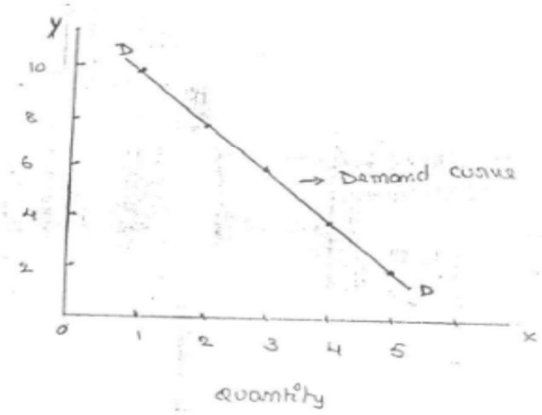
- **Qd** = Quantity demanded
- **P** = Price of the good
- **Y** = Income of the consumer
- **Pr** = Price of related goods (substitutes or complements)
- **T** = Taste and preferences
- **E** = Consumer expectation

1.5.1 **LAW OF DEMAND:** The Law of Demand states that when the price of a good falls, the quantity demanded increases, and when the price rises, the quantity demanded decreases, other things remaining constant (ceteris paribus).In simple words, price and demand have an inverse relationship.
The law of demand may be explained with the help of the following demand schedule:

Demand Schedule.

Price of Apple (In. Rs.)	Quantity Demanded
10	1
8	2
6	3
4	4
2	5

When the price falls from Rs. 10 to 8 quantity demand increases from 1 to 2. In the same way as price falls, quantity demand increases on the basis of the demand schedule we can draw the demand curve.



The demand curve DD shows the inverse relation between price and quantity demand of apple. It is downward sloping.

Assumptions to Law Of Demand:

Law is demand is based on certain assumptions

1. This is no change in consumers taste and preferences.
2. Income should remain constant.
3. There should be no substitute for the commodity
4. The commodity should not confer at any distinction
5. The demand for the commodity should be continuous
6. People should not expect any change in the price of the commodity.

EXCEPTIONS TO THE LAW OF DEMAND:

1. *Giffen paradox:* These are inferior goods that make up a major part of the consumer's budget, often seen in staple foods like bread, rice, or potatoes consumed by low-income households. If the price of a Giffen good rises, such households may purchase more of it and less of other expensive foods.Eg- When the price of chapati rises, poor people buy more chapati and less vegetables, because they can't afford other foods. Hence, chapati becomes a Giffen good.

2. *Veblen or Demonstration effect:* 'Veblen' has explained as rich people buy certain good because it gives social distinction or prestige for example diamonds arebought by the richer class for the prestige.

3. *Ignorance*: Sometimes, the quality of the commodity is judged by its price. Consumers think that the product is superior if the price is high. As such they buy more at a higher price.

4.*Speculative*: If the price of the commodity is increasing the consumers will buy more of it because of the fear that it increases still further, Thus, an increase in price may not be accomplished by a decrease in demand.

5. *Fear of shortage:* During the times of emergency of war People may expect shortage of a commodity. At that time, they may buy more at a higher price to keep stocks for the future.

FACTORS AFFECTING THE DEMAND:

▪ *Price of the Commodity:* The relation between price and demand is called the Law of Demand. It is not only the existing price but also the expected changes in price, which affect demand.

▪ *Income of the Consumer:* The second most important factor influencing demand is consumer income. The demand for abnormal commodity goes up when income rises and falls down when income falls. But in case of Giffen goods the relationship is the opposite.

▪*Prices of related goods:* The demand for a commodity is also affected by the changes in prices of the related goods also. Related goods can be of two types:

(**i). Substitute goods** which can replace each other in use; for example, tea and coffee are substitutes. The change in price of a substitute has effect on a commodity's demanding the same direction in which price changes. The rise in price of coffee shall raise the demand for tea.

(ii). Complementary goods are those which are jointly demanded, such as pen and ink. If the price of pens goes up, their demand is less as a result of which the demand for ink is also less. The price and demand go in opposite direction. The effect of changes in price of a commodity on amounts demanded of related commodities is called Cross Demand.

▪*Tastes of the Consumers:* The amount demanded also depends on consumer's taste. Tastes include fashion, habit, customs, etc. A consumer's taste is also affected by advertisement. If the taste for a commodity goes up, its amount demanded is more even at the same price. This is called increase in demand. The opposite is called decrease in demand.

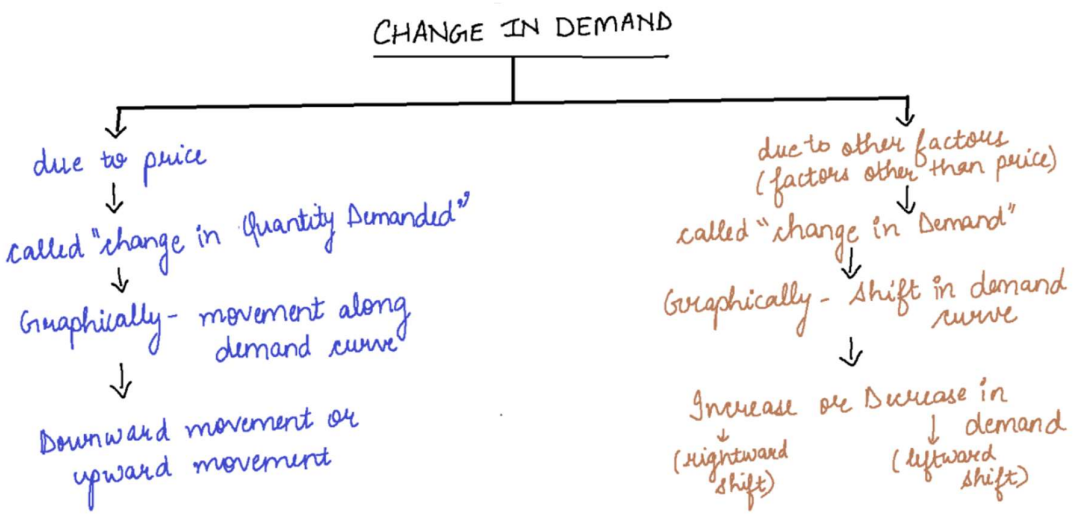
▪*Population:* Increase in population increases demand for necessaries of life. A change in composition of population has an effect on the nature of demand for different commodities

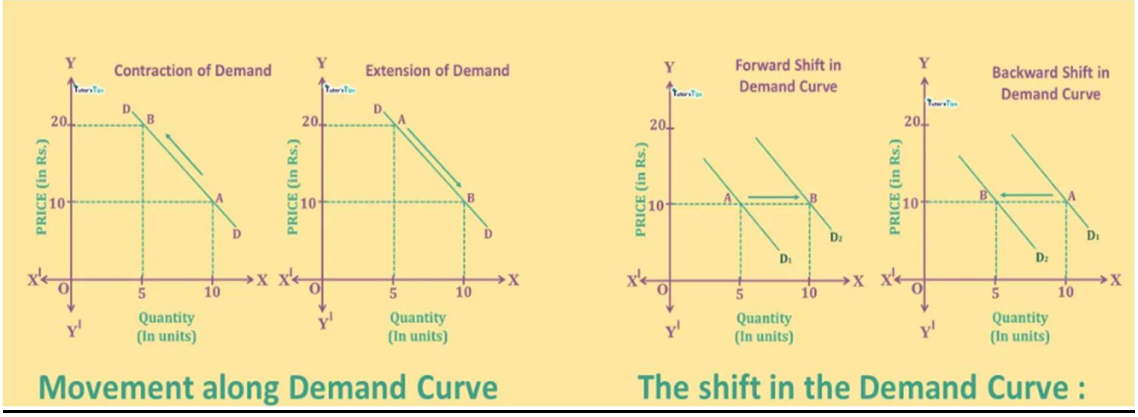
▪*Government Policy*: Government policy affects the demands for commodities through taxation. Taxing commodity increases its price and the demand goes down. Similarly, financial help from the government increases the demand for a commodity while lowering its price.

▪*Expectations Price in the future:* If consumers expect changes in price of commodity in future, they will change the demand at present even when the present price remains the same.

▪*Climate and weather:* The climate of an area and the weather prevailing there has a decisive effect on consumer's demand. In cold areas woolen cloth is demanded. During hot summer days, ice is very much in demand. On a rainy-day, ice cream is not so much demanded.

1.5.2 CHANGE IN DEMAND





1.5.3 ELASTICITY OF DEMAND

Elasticity of demand explains the relationship between a change in price and consequent change in amount demanded.
Elastic demand: A small change in price may lead to a great change in quantity demanded. In this case, demand is "elastic".
In-elastic demand: If a big change in price is followed by a small change in the quantity demanded, then the demand in "inelastic".

Types of Elasticity of Demand:

1. **Price elasticity of demand:**
Marshall was the first economist to define price elasticity of demand. Price elasticity of demand measures changes in quantity demand to a change in Price. It is the ratio of percentage change in quantity demanded to a percentage change in price

$$Price\ elasticity = \frac{proportionate\ change\ in\ the\ quantity\ demand\ of\ commodity}{proportionate\ change\ in\ the\ price\ of\ commodity}$$

There are five cases of price elasticity of demand

- Perfectly elastic demand
- Perfectly inelastic
- Relatively elastic demand
- Relatively inelastic demand
- Unitary demand

2**. Income elasticity of demand**: Income elasticity of demand shows the change in quantity demanded as a result of a change in income.

$$income\ elasticity = \frac{proportionate\ change\ in\ the\ quantity\ demand\ of\ commodity}{proportionate\ change\ in\ the\ income}$$

3. **Cross elasticity of Demand:** A change in the price of one commodity leads to a

change in the quantity demanded of another commodity.

$$income\ elasticity = \frac{proportionate\ change\ in\ the\ quantity\ demand\ of\ commodity\ x}{proportionate\ change\ in\ the\ \text{price of commodity y}}$$

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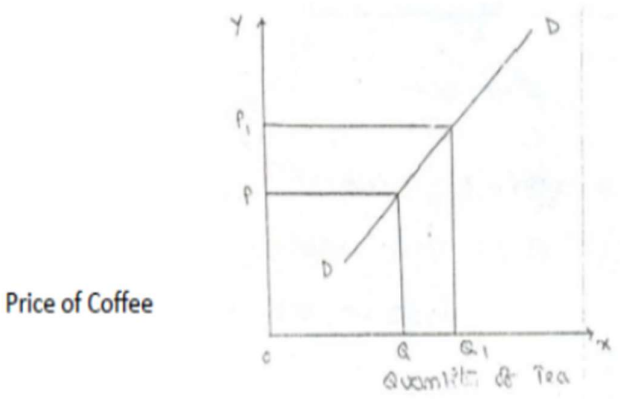
a. In case of substitutes, cross elasticity of demand is positive. Eg: Coffee and Tea

When the price of coffee increases, Quantity demanded of tea increases. Both are substitutes.



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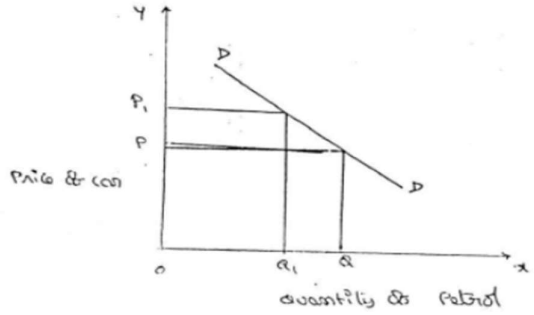
b. Incase of compliments, cross elasticity is negative. If increase in the price of one commodity leads to a decrease in the quantity demanded of another and vice versa.

When price of car goes up from OP to OP!, the quantity demanded of petrol decreases from OQ to OQ!.



$$E_c = \frac{\%\ \Delta Q_1}{\%\ \Delta P_1}\ (negative)$$

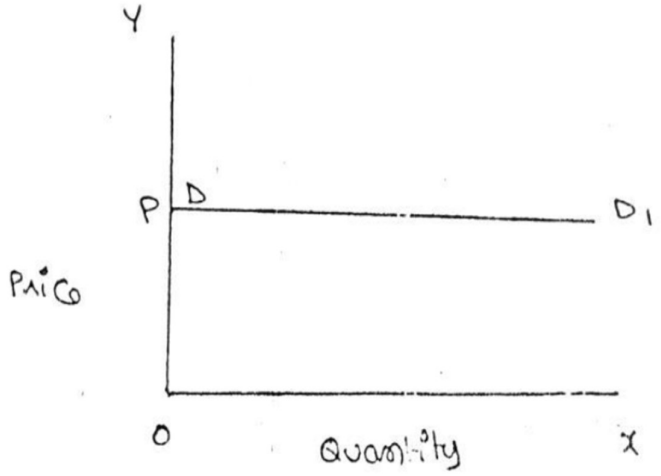
The cross-demanded curve has negative slope.

Advertisement elasticity of Demand: A change in the advertisement cost for a commodity leads to the change in the quantity demanded for commodity.

$$dvertisementelasticity = \frac{proportionate\ change\ in\ the\ quantity\ demanded\ of\ commodity}{proportionate\ change\ in\ the\ advertisement\ of\ commodity}$$

A. <u>PERFECTLY ELASTIC DEMAND:</u>

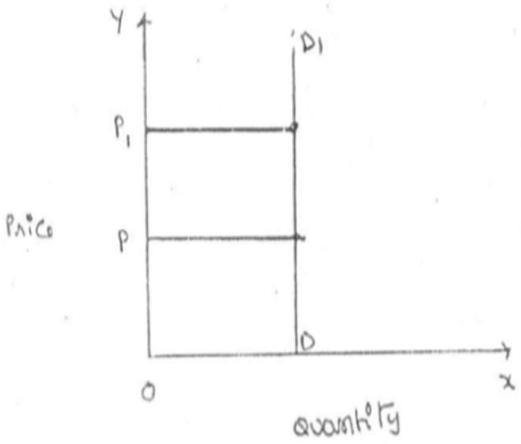
When small change in price leads to an infinitely large change is quantity demand, it is called perfectly elastic demand. In this case (E=∞), The demand curve DD1 is horizontal straight line. It shows the at "OP" price any amount is demand and if price increases, the consumer will not purchase the commodity.



B. Perfectly Inelastic Demand

In this case, even a large change in price fails to bring about a little or no change in quantity demanded.

When price increases from 'OP' to 'OP', the quantity demanded remains the same. In other words the response of demand to a change in Price is nil. In this **case ('E'=0)**

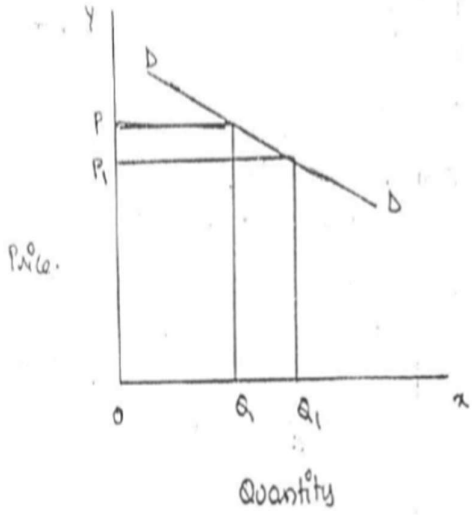


C. Relatively elastic demand:

Demand changes more than proportionately to a change in price. i.e. a small change in price loads to a very big change in the quantity demanded. In this case

(E > 1). This demand curve will be flatter.

When price falls from 'OP' to 'OP1', amount demanded in crease from "OQ' to "OQ1' which is larger than the change in price

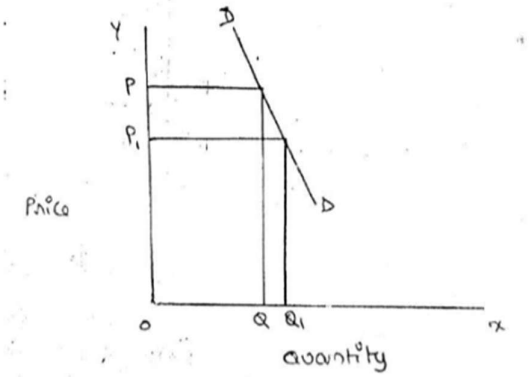


D. Relatively in-elastic demand.

Quantity demanded changes less than proportional to a change in price. A large change in price leads to small change in amount demanded. Here(E < 1)

Demanded carve will be steeper.

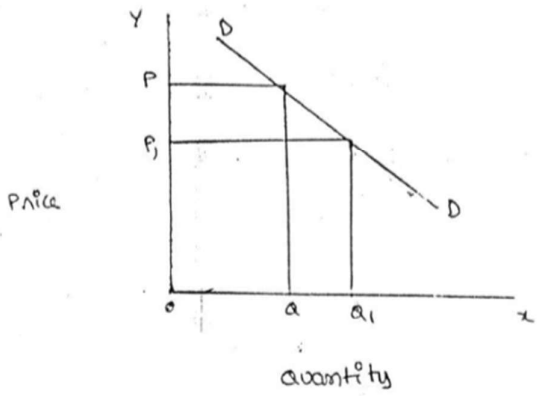
When price falls from "OP' to 'OP1 amount demanded increases from OQ to OQ1, which is smaller than the change in price.



E. Unit elasticity of demand:

The change in demand is exactly equal to the change in price. When both are equal E=1 and elasticity if said to be unitary.

When price falls from 'OP' to 'OP1' quantity demanded increases from 'OP' to 'OP1', quantity demanded increases from 'OQ' to 'OQ1'. Thus a change in price has resulted in an equal change in quantity demanded so price elasticity of demand is equal to unity.



SIGNIFICANCE OF ELASTICITY OF DEMAND

The concept of elasticity is very useful to the producers and the policy makers. It is very valuable tool to decide the extent of increase or decrease in price for a desired change in the quantity demanded for the products and services in the firm or the economy.

The following are its applications;

a. To fix the prices of factors of production.
b. To fix the prices of goods and services provided rendered
c. To formulate or revise govt policies.
d. To forecast demand
e. To plan the level of output and price.

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UNIT- 2
COST AND PRODUCTION ANALYSIS

2.1. COST ANALYSIS

Meaning of Cost: In economics, *cost* refers to the total expenditure incurred by a firm in producing and selling goods and services.
Types of costs are:

- **Explicit Cost:** Actual cash payments made to outsiders for inputs (like wages, rent, raw materials, etc.).
  Example: Salary paid to workers – ₹50,000 per month.
- **Implicit Cost:** The cost of using resources owned by the firm itself, for which no cash payment is made.
  Example: Interest the owner could have earned on his own invested capital.
- **Opportunity Cost:** Opportunity cost is the value of the next best alternative that you give up when you make a choice.
  Example: If a company uses its land to build a factory instead of renting it out, the rent forgone is the opportunity cost of using the land for production.
- **Short-Run Costs:** In the short run, some factors (like plant, machinery, building) are fixed, while labor and raw materials can be changed. Firms can increase output by using more variable inputs, but not by changing plant size.
  Example: A bakery can hire more workers or buy more flour, but it cannot expand its shop immediately.
- **Long-Run Costs:** In the long run, all factors are variable. Firms can change the size of the plant or production scale.
  Example: The same bakery can open a new branch or buy bigger ovens in the long run.
- **Fixed Costs (FC):** Do not change with output. They exist even if output is zero.
  Examples: Rent, salaries of permanent staff, insurance.
- **Variable Costs (VC):** Change directly with the level of output.
  Examples: Raw materials, wages of casual workers, electricity.

- **Total Costs (TC):** The sum of fixed and variable costs at each level of output.
  Total Cost = Fixed Cost + Variable Cost
- **Average Costs (AC):** Cost per unit of output
  Example: If TC = ₹3000 and output = 100 units → AC = ₹30 per unit.
  Average Cost = AC = Total Cost / Quantity
- **Marginal Costs (MC):** The additional cost of producing one more unit of output.
  Example: If producing 10 units costs ₹2000 and 11 units cost ₹2100, then MC = ₹100.
  Marginal Cost = Change in TC / Change in Q
- **Incremental Cost:** The extra cost a firm incurs due to a business decision, such as expanding output or adding a new product.
  Example: If a company adds a new product line and total cost rises from ₹5 lakh to ₹6 lakh, the incremental cost = ₹1 lakh.
- **Sunk Cost:** Costs that have already been incurred and cannot be recovered, no matter what decision is made**.**
  Example: Money spent on advertising or R&D that cannot be refunded is a sunk cost.

2.2 COST-OUTPUT RELATIONSHIP

The cost-output relationship plays an important role in determining the optimum level of production. Knowledge of the cost-output relation helps the manager in cost control, profit prediction, pricing, promotion etc. The relation between cost and its determinants is technically described as the cost function.

C= f (S, O, P, T ….)

Where:

- C= Cost (Unit or total cost)
- S= Size of plant/scale of production
- O= Output level
- P= Prices of inputs
- T= Technology

Considering the period the cost function can be classified as (1) short-run cost function and (2) long-run cost function. In economics theory, the short-run is defined as that period during which the physical capacity of the firm is fixed and the output can be increased only by using the existing capacity allows to bring changes in output by physical capacity of the firm.

2.2.1Cost-Output Relationship in the Short-Run

In the short-run a change in output is possible only by making changes in the variable inputs like raw materials, labor etc. Inputs like land and buildings, plant and machinery etc. are fixed in the short-run. It means that short-run is a period not sufficient enough to expand the quantity of fixed inputs. Thus, Total Cost (TC) in the short-run is composed of two elements – Total Fixed Cost (TFC) and Total Variable Cost (TVC).

TFC remains the same throughout the period and is not influenced by the level of activity. The firm will continue to incur these costs even if the firm is temporarily shut down. Even though TFC remains the same fixed cost per unit varies with changes in the level of output. On the other hand, TVC increases with increase in the level of activity, and decreases with decrease in the level of activity. If the firm is shut down, there are no variable costs. Even though TVC is variable, variable cost per unit is constant. So, in the short-run an increase in TC implies an increase in TVC only. Thus:

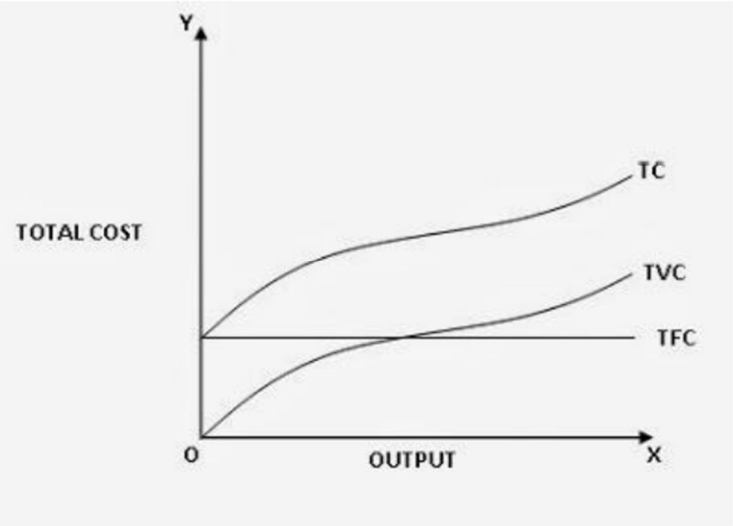
TC = TFC + TVC

TFC = TC – TVC

TVC = TC – TFC

TC = TFC when the output is zero.

The graph below shows Short-run cost output relationship

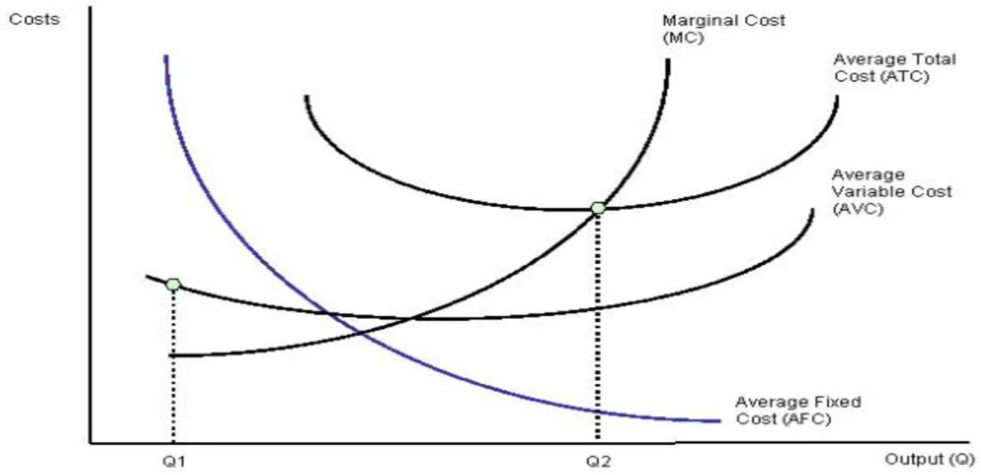


In the graph X-axis measures output and Y-axis measures cost. TFC is a straight line parallel to X-axis, because TFC does not change with increase in output. TVC curve is upward rising from the origin because TVC is zero when there is no production and increases as production increases. The shape of TVC curve depends upon the productivity of the variable factors. The TVC curve above assumes the Law of Variable Proportions, which operates in the short-run.

TC curve is also upward rising not from the origin but from the TFC line. This is because even if there is no production the TC is equal to TFC.

It should be noted that the vertical distance between the TV curve and TC curve is constant throughout because the distance represents the amount of fixed cost which remains constant. Hence TC curve has the same pattern of behavior as TVC curve.

Short-run Average Cost and Marginal Cost



In the above graph the "AFC' curve continues to fall as output rises on account of its spread over more and more units Output. But AVC curve (i.e. variable cost per unit) first falls and then rises due to the operation of the *law of variable proportions*. The behavior of "ATC' curve depends upon the behavior of 'AVC' curve and 'AFC' curve. In the initial stage of production both 'AVC' and 'AFC' decline and hence 'ATC' also decline. But after a certain point 'AVC' starts rising. If the rise in variable cost is less than the decline in fixed cost, ATC will still continue to decline otherwise AC begins to rise. Thus, the lower end of 'ATC' curve thus turns up and gives it a U-shape. That is why '*ATC' curve are U-shaped*. The lowest point in 'ATC' curve indicates the least-cost combination of inputs. Where the total average cost is the minimum and where the "MC' curve intersects 'AC' curve, it is not be the maximum output level rather it is the point where per unit cost of production will be at its lowest.

The relationship between 'AVC', 'AFC' and 'ATC' can be summarized up as follows:

- If both AFC and AVC fall ATC will also fall because ATC = AFC + AVC
- When AFC falls and AVC rises:

(a) ATC will fall where the drop in AFC is more than the rise in AVC

(b) ATC remains constant if the drop in AFC = the rise in AVC, and

(c) ATC will rise where the drop in AFC is less than the rise in AVC.

- ATC will fall when MC is less than ATC and ATC will rise when MC is more than ATC. The lowest ATC is equal to MC

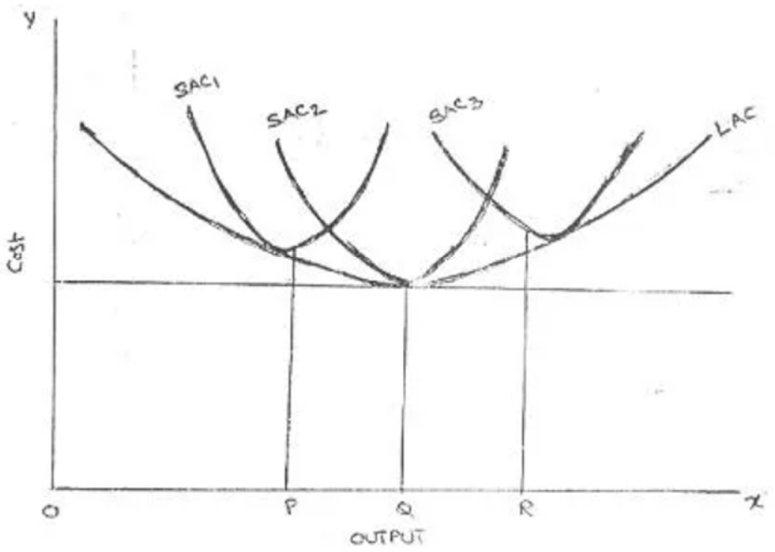
2.2.2 Cost-Output Relationship in the Long-Run

In the short-run. In the long run a firm can change its output according to its demand. Over a long period, the size of the plant can be changed, unwanted buildings can be sold staff can be increased or reduced. The long run enables the firms to expand and scale of their operation by bringing or purchasing larger quantities of all the inputs. Thus, in the long run all factors become variable.

The long-run cost-output relations therefore imply the relationship between the total cost and the total output. In the long-run cost-output relationship is influenced by the law of returns to scale.

In the long run a firm has a number of alternatives in regards to the scale of operations. For each scale of production or plant size, the firm has an appropriate short-run average cost curves. The short-run average cost (SAC) curve applies to only one plant whereas the long-run average cost (LAC) curve takes in to consideration many plants.

The long-run cost-output relationship is shown graphically with the help of "LCA' curve.



To draw on 'LAC' curve we have to start with a number of 'SAC' curves. In the above figure it is assumed that technologically there are only three sizes of plants — small, medium and large, 'SAC', for the small size, 'SAC2' for the medium size plant and 'SAC3' for the large size plant. If the firm wants to produce 'OP' units of output, it will choose the smallest plant. For an output beyond 'OQ' the firm wills optimum for medium size plant. It does not mean that the OQ production is not possible with small plant. Rather it implies that cost of production will be more with small plant compared to the medium plant.

For an output 'OR' the firm will choose the largest plant as the cost of production will be more with medium plant. Thus, the firm has a series of 'SAC' curves. The 'LCA' curve drawn will be tangential to the entire family of 'SAC' curves i.e. the 'LAC' curve touches each 'SAC' curve at one point, and thus it is known as envelope curve. It is also known as planning curve as it serves as guide to the entrepreneur in his planning to expand the production in future. With the help of 'LAC' the firm determines the size of plant which yields the lowest average cost of producing a given volume of output it anticipates.

2.3 PRODUCTION ANALYSIS

2.3.1 Meaning of Production:

In Managerial Economics, Production means the process of transforming inputs (resources or factors of production) into outputs (goods or services) that satisfy human wants. Production does not only mean creating goods, but also adding utility (usefulness) to goods or services.

Example: A tailor converts cloth into clothes — creating *form utility*.
A transporter moves goods from one place to another — creating *place utility*.
A retailer makes products available when needed — creating *time utility*.
Definition: Production is the process of transforming inputs into outputs, thereby creating utility in goods and services.

2.3.2 PRODUCTION FUNCTION

The Production Function is a technical relationship that shows the maximum output that can be produced from a given set of inputs, with available technology.
Mathematical Expression:

$$Q = f(L, K)$$

Where:

- Q= quantity of output
- L= labor input
- K= capital input
- f= functional relationship between inputs and output

This means output (Q) depends on the quantity and efficiency of inputs (L and K).

Types of Production Function

(A) Short-Run Production Function

- In the short run, one factor is variable and others are fixed.
- Example: $Q = f(L, \bar{K})$→ only labour varies while capital is fixed.
- Described by the Law of Variable Proportions (or Returns to a Factor).

(B) Long-Run Production Function

- In the long run, all factors are variable.
- Example: $Q = f(L, K)$→ both labour and capital can change.
- Described by Returns to Scale.

2.3.3 Cobb–Douglas Production Function

The Cobb–Douglas production function is a specific mathematical form of the production function that shows the relationship between output and two main inputs — usually labor (L) and capital (K)

General Formula:

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

Where:

- Q= Output
- L= Labour input
- K= Capital input
- A= Efficiency (technology) constant
- $\alpha$and β= Output elasticities of labour and capital, respectively (they show how output responds to a change in each input)
- α tells us the percentage change in output resulting from a 1% change in labour, keeping capital constant.
- βtells us the percentage change in output due to a 1% change in capital, keeping labour constant.

Key Features:

1. Represents a realistic relationship between inputs and output.
2. Shows substitutability between labor and capital.
3. Helps in estimating productivity and efficiency of inputs.
4. Commonly used in empirical studies of firms and industries.

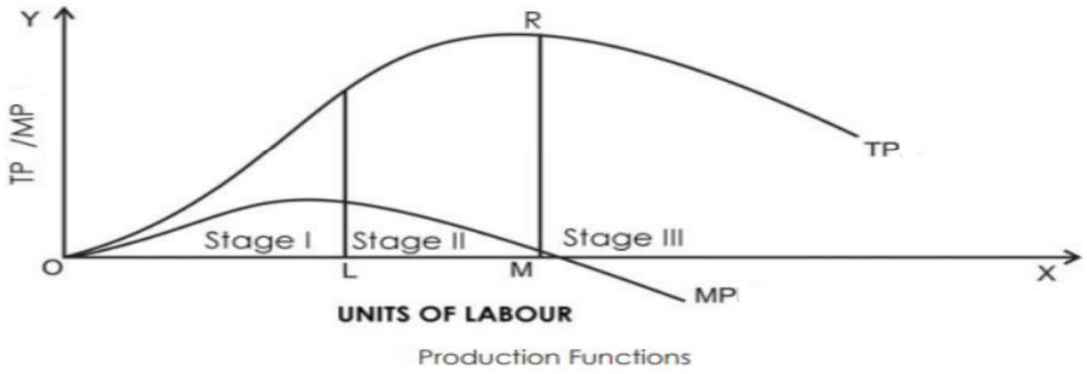
2.4 RETURNS TO A FACTOR (Law of Variable Proportions)

The Law of Variable Proportions states that as more and more units of a variable factor are applied to a fixed factor, total output increases at first at an increasing rate, then at a diminishing rate, and eventually may decline. It is also known as the *Law of Variable Proportions* or *Law of Diminishing Returns*.

Assumptions:

1. One factor is variable; others are fixed.
2. Technology remains constant.
3. All units of variable factor are homogeneous.
4. The law operates in the short run.

THREE STAGES OF THE LAW



Production Functions

Stage	Behavior of Total Product (TP)	Behavior of Marginal Product (MP)	Return Type
I	Increases at increasing rate	Rises	**Increasing Returns to a Factor**
II	Increases at decreasing rate	Falls but positive	**Diminishing Returns to a Factor**
III	Decreases	Becomes negative	**Negative Returns to a Factor**

Any rational producer avoids the first as well as third stages of production. Therefore, producers prefer Stage II – the stage of diminishing returns. This stage is the most relevant stage of operation for a producer according to the law of variable proportions.

EXPLANATION OF THE LAW OF VARIABLE PROPORTION

CAUSES OF INCREASING RETURNS TO SCALE:

1. Fuller utilization of fixed resources
2. Increase in efficiency

CAUSES OF DIMINISHING RETURNS

1. Disturbing the optimum proportion
2.Imperfect substitutability of factors of production

CAUSES OF NEGATIVE RETURN

1. Overcrowding
2. Management problem

Conclusion:

The Returns to a Factor or Law of Variable Proportions explains the short-run production behavior of firms. It helps managers decide the optimum combination of inputs to achieve maximum efficiency and output.

2.5 RETURNS TO SCALE

Returns to Scale refer to the change in output when all inputs (factors of production) are increased in the same proportion in the long run.
Unlike the short run, here no factor is fixed — all can be varied.
Assumptions:
1. All inputs are variable.
2. Technology remains constant.
3. The firm operates efficiently.
4. Returns are measured in the long run.

Type	Explanation	Example
1. Increasing Returns to Scale (IRS)	When output increases **more than proportionately** to the increase in inputs.	Inputs ↑ 100%, Output ↑ 150%
2. Constant Returns to Scale (CRS)	When output increases **exactly in the same proportion** as inputs.	Inputs ↑ 100%, Output ↑ 100%
3. Decreasing Returns to Scale (DRS)	When output increases **less than proportionately** to the increase in inputs.	Inputs ↑ 100%, Output ↑ 80%

- Initially, as the firm expands, it experiences **increasing returns to scale** due to specialization and efficient use of resources.

- Later, **constant returns** occur when efficiency stabilizes.
- Finally, **decreasing returns** arise due to management and coordination difficulties in large-scale operations

Conclusion:
The **Returns to Scale** explain the **long-run production behaviour** of a firm when all factors change together.
It helps managers plan expansion, design plant size, and achieve **optimal scale of production** for maximum efficiency.

2.6 PROFIT AND SALES MAXIMIZATION

1. Profit Maximization

Profit maximization is the primary objective of most firms. It means earning the highest possible profit by balancing total revenue and total cost.

- A firm maximizes profit when Marginal Cost (MC) = Marginal Revenue (MR).
- The difference between total revenue and total cost is at its maximum at this point.
- This helps firms ensure long-term survival, growth, and shareholder satisfaction.

Example:
If producing 100 units gives the highest difference between revenue and cost, the firm will produce 100 units for **maximum profit.**

2. Sales Maximization

Proposed by **Prof. W.J. Baumol**, this theory states that some firms aim to maximize sales revenue rather than profit.

- The goal is to increase the market share and sales volume while maintaining a minimum profit level.
- Firms may reduce prices to attract more customers and expand their presence in the market.

Example:
A company like Amazon may focus on increasing total sales and customer base even if profits are low initially.
Conclusion:

While profit maximization ensures financial gain and efficiency, sales maximization helps in market expansion and long-term growth. Many modern firms try to balance both objectives for sustainable success.

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