

ENGINEERING ECONOMICS

Lesson plan -1

•Economics

-Economics studies how man utilizes his limited resources for the satisfaction of his unlimited wants.

Definition

Economics as a science, that deals with the problem of allocation of scarce resources among the competing ends and giving maximum satisfaction at minimum cost.

Traditionally Economics is divided as

1. Consumption
2. Production
3. Exchange
4. Distribution
5. Public Finance
6. Economic Planning

Consumption

•Consumption Refers to the satisfaction of human wants by using Goods and services

Production

•Production refers to the creation of goods and services by using the different factors of production

Exchange

•Exchange refers to transfer of goods and services for consumption.

Distribution

- Distribution refers to rewarding the factors of production
- It is the study of distribution of national income among factors in the form of Rent, wages, Interest and profit.

Public Finance

•Public Finance refers to the financial activities of the government and local bodies.

Economic Planning

- Economic Planning Refers to Coordination of Economic Activities Usually by the central Authority
- In economic Planning Study is made about objectives of planning, models and techniques of planning.

Modern Economist Divide the Subject of Economics into

1. Microeconomics
2. Macroeconomics

According to Ragnar Frisch In the year 1920.

Microeconomics

- the term Microeconomics is derived from the Greek word “MIKROS” which means Small
- In microeconomics attention is concentrated on a very small part of Individuals.

Definitions

- K. E Boulding – “Microeconomics is the study of particular Firms, Particular Household, individual prices, wages, incomes, Individual industries, particular commodities.

Definitions

- Prof. Hansen – “Microeconomics is that Branch of Economics which is concerned with individual firms, their output and costs, the production and pricing of single commodities, wages of Individuals etc.

Definitions •

Prof. Mc Connel – “In Microeconomics we examine the Trees, and not the Forest. Microeconomics is useful in achieving worm’s eye view of some very specific component of our economic system.

Features of Microeconomics

1. Study of Individual aspects
 - It studies about individual behavior, firms, prices of products, equilibrium of consumers and producers.
2. Use of Partial Equilibrium
 - It deals with the equilibrium of a consumer or a producer or a firm at a time.
3. Price theory
 - Price theory is the central part of microeconomics
 - It considers price as the cause for the both consumption and production
 - It analyses the determination of price in the product market and factor market.
4. Study of isolated Variables
 - It studies about individuals and firms
 - It does not make any study of the aggregates like income and employment
5. Unrealistic assumptions
 - Microeconomics depends on some unrealistic assumptions like ceteris paribus

6. Does not consider time
 - Influence of time neglected
 - . • So, it is static in nature
7. Analysis of factor and Product prices
 - Microeconomics studies factor prices and product prices separately
8. Provides Worm's Eye View
 - Microeconomics Provides Worm's Eye View of Economic Activities.

Scope of Microeconomics

•Gardner Ackley – “Price and Value Theory of household, the firm and the Industry, most of the production and welfare theories are of Microeconomic variety.”

Scope of Microeconomics consists of

Theory of Product Pricing

Theory of Factor Pricing

Theory of Economic Welfare

Theory of Product Pricing

It consists of the theories of consumption and demand and theories of production and cost.

It also deals with market equilibrium.

Microeconomics tries to solve three fundamental problems

- A. How the resources are allocated for production of goods and services?
- B. How are the goods services are distributed among the people?
- C. How efficiently are Goods and Services are Distributed?

- The allocation of Resources is determined by relative prices of goods and services
- Price determines the allocation of resources
- Price is determined by demand and supply

Microeconomics analyses price determination and resource allocation in Three Stages

1. The equilibrium of individual consumers and Producers
2. The equilibrium of a single market
3. The simultaneous equilibrium of all market

An Individual is in equilibrium- when his satisfaction from the consumption is maximized.

Producer is in equilibrium- When he is capable of getting maximum profit.

Market

Market is a place where goods and Services are exchanged.

- Markets are broadly classified as

1. Product Market

- Product Market Deals with Products/Goods.
- Product Market is in equilibrium when goods supplied are equal to goods demanded.
- Product Market is a place where products are brought and sold
- Buying and selling both depends on price

2. Factor Market

- Factor Market Deals with factors of Production
- Factor market equilibrium implies the equality of factor supply and factor demanded.
- Factor Market is a place where the Factors of Production are dealt with
- Prices of Factors of Production also depend on Demand and Supply

Theory of Factor Pricing

- It is rewarding factors of Production
- It includes the Theories of Rent, Wages, Interest and Profit
- It Shows the Relative Share of Factors in National Income Microeconomics also studies the interrelation between product and Factor Market.

Welfare Economics

- Microeconomics also studies the efficient allocation of Scarce Resources among the people of a country
- Efficiency in Resource allocation is a part of welfare economics
- It includes individual welfare and social welfare
- Individual welfare Refers to the Welfare of Both the consumer's and Producer's
- Consumer's welfare is Maximized when, with any reallocation of resources, he is made better off, without making any other person worse off
- A Producer's welfare is maximized when, with any reallocation of the resources in the production of a commodity, he is able to increase the output without reducing the output of some other commodity.
- Social Welfare refers to the overall efficient reallocation of resources.
- Social Welfare increases when with any reallocation of resources, society as a whole, is made better off without making any individual worse off.

USES OF MICROECONOMICS

1. Helps to understand the working of the economy
2. Helps to understand the price determination
3. Helpful in resource allocation
4. Guides the business executive
5. Provides tools to frame policies
6. Helpful in International Trade
7. Helpful in Public Finance
8. Helpful in examine welfare Conditions
9. Provides Base for Productions
10. Helpful in Model Building.

LIMITATIONS OF MICROECONOMICS

1. It Provides Partial Picture of the Economy
2. Wrong assumption of Full Employment
3. Belief in Laissez Faire Policy is not applicable
4. Inadequacy

Macroeconomics

The term Macroeconomics is derived from the Greek word “MAKROS” which means large. Macroeconomics studies the economy in a wide phenomenon (in a Large Scale). Here

Macroeconomics is a branch of economics that studies how an overall economy (the market or other systems) operate on a large scale. Macroeconomics studies economy in a wide phenomenon such as inflation, price levels, rate of economic growth, national income, gross domestic product (GDP), and changes in unemployment as a whole.

- Macroeconomics is the branch of economics that deals with the structure, performance, behavior, and decision-making of the whole, or aggregate, economy.
- The two main areas of macroeconomic research are long-term economic growth and shorter-term business cycles.
- Macroeconomics in its modern form is often defined as starting with John Maynard Keynes and his theories about market behavior and governmental policies in the 1930s; several schools of thought have developed since.
- In contrast to macroeconomics, microeconomics is more focused on the influences on and choices made by individual actors in the economy (people, companies, industries, etc.).

Limits of Macroeconomics

- Macroeconomic theories are often created in a vacuum and lack certain real-world details like taxation, regulation, and transaction costs.
- The real world is also decidedly complicated and includes matters of social preference and conscience that do not lend themselves to mathematical analysis.

Differences between Micro and Macroeconomics

MICROECONOMICS

1. It is the study of Individual Units
2. Uses Partial Equilibrium techniques
3. Price theories is the central part
4. Deals with small parts or section of the system
5. Deals with Micro Variables
6. Basically deals with the Problem of Pricing and Distribution

7. Major areas Covered – Theory of Value and Economic Welfare
8. Provides Worm's Eye View

MACROECONOMICS

1. Study of the behavior of the economy as a whole
2. Uses General Equilibrium techniques
3. Income theories is the Central Part
4. It embraces the entire economic system
5. Deals with Macro Variables
6. Pertains to the problems of the size of National Income, Economic Growth and General Price Level
7. Major areas Covered – Income and Employment and Monetary Theory
8. Provides Bird's Eye View
- 9.

Functional Relationships

Constants and Variables

Economics is a science which studies the relationship among the variables.

Functional relationship explains the CAUSE and EFFECT relationship among Variables.

Functional Relationship explains the dependence of one variable on the other

Example-

$$D=f(P)$$

Here Demand is the function of Price

Demand is the DEPENDENT variable and Price is the INDEPENDENT variable

USES OF FUNCTIONAL RELATIONSHIPS

1. To Find Out the Relationships
2. To Find out Determinants
3. To Simplify Description
4. To Present Diagrammatically
5. To Increase Clarity and Accuracy

Constants and Variables

- Economics deals with measurable quantities
- The quantities which remain the same throughout the analysis are called constant
- Those quantities which change their values in the analysis are known as variables

Example $D=f(P)$

In this both Demand and Price are Variable

In Some Cases either

Demand or Price remains Constant. Then that becomes Constant

Introduction

History:-

Before 1940s, all the engineers were mainly concerned with the design, construction, operation of machines, structure, processes. They paid little attention to human resources.

But time to time scientific discoveries and scientific inventions contributed to the expansion of engineering responsibilities and the concerns.

Engineers are now expected to generate novel technological solutions, along with making skillful financial analysis, analysis of work safety, environmental effects, consumer protection, resource conservations etc.

This thinking suggests that the main mission of engineers is to transfer the natural resources for the benefits of human race.

DEFINATION:-ENGINEERING ECONOMICS as such an economics which deals with the methods that enables one to make economic decisions towards evaluation of design and engineering alternatives, it helps in examining the relevance of a project, estimating its value, and justifying it from engineering point of view.

In other word engineering economics is the application of economic techniques to the evaluation of design and engineering alternatives.

Role of engineering economy

Following are some examples where engineering economy plays a crucial role:

1. Choosing the best design from various types of design.
2. Should the now in use be replaced with a new one?

3. With limited capital available, which investment alternative should be accepted?
4. How many units of production have to be sold before a profit can be made?
5. Is there any differential cash flow pattern which is preferable?
6. Are the benefits from the project is large enough to make its

ECONOMIC GOALS

1. *Sustainable employment*: People willing to work should be able to find jobs reasonably quickly. Widespread unemployment is demoralized and it represents an economic waste. Society forgoes the goods and services that the unemployed could have produced.
2. *Price stability*: It is desirable to avoid rapid increases or decreases in the average level of price.
3. *Efficiency*: When we work, we want to get as much as we reasonably can take out of our productive efforts. For this, efficient technology becomes quite useful.
4. *An equitable distribution of income*: When many live in affluence, no group of citizens should suffer stark poverty. Given this, developing countries are strategic goals like participatory growth and inclusive growth.
5. *Growth*: Continuing growth, which would make possible an even higher standard of living in the future, is generally considered an important objective.
6. *Economic freedom and choice*: Any economy should grow and develop in such a manner that people should get more choices and there should not be any outside pressure on their choices.
7. *Economic welfare*: Economic policies should be pursued in such a manner that welfare of the people or the social benefits get maximized.

8, *Sustainable development*: It has become a major challenge for economists to carry on the process of economic growth in such a manner that the resources are optimally utilized not only for intergenerational equity but also for sustainable development in quite

NATURE & SCOPE OF ENGINEERING ECONOMICS:-

It covers topic like law of demand & supply, demand & supply elasticity , concept of short run & long run cost , law of variable proportion , return to scale, time value of money, interest formulas , engineering alternatives , annual equivalence method and cost benefit analysis, variance analysis, process costing , break even analysis , function of commercial bank and RBI , money market and export import policy.

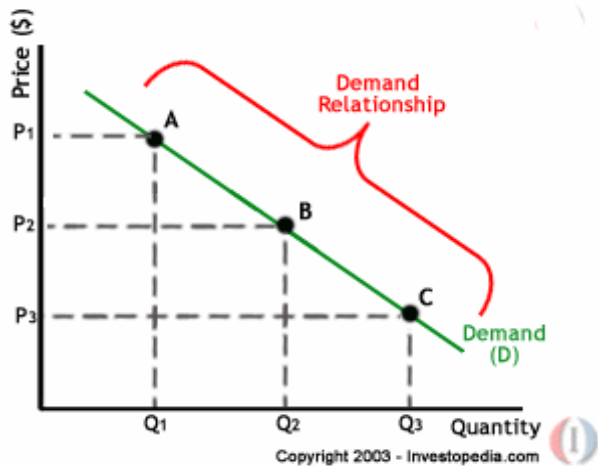
Lesson plan -2

THEORY OF DEMAND

The demand in economics means both the desire to purchase as well as the ability to pay for the good and willingness to use it.

Demand is the quantities of goods or services that the buyers are willing and able to buy at alternative prices during the given period of time whereas quantity demanded is a specific amount that buyers are willing and able to buy at on price.

Nature of demand for a product



With the normal goods the demand has a negative relationship. It means as the price of a Commodity falls the quantity demanded for the product goes up.

Individual Demand & Market Demand

The consumer equilibrium condition determines the quantity of each good the individual consumer will demand. As the example above illustrates, the individual consumer's demand for a particular good—call it good X—will satisfy the law of demand and can therefore be depicted by a downward sloping individual demand curve.

However, many participants in the market for good X. The market demand curve for good X includes the quantities of good X demanded by *all* participants in the market for goods X. The market demand curve is found by taking the horizontal summation of all individual demand curves. For example, suppose that there were just two consumers in the market for good X, Consumer 1 and Consumer 2. These two consumers have different individual demand curves corresponding to their different preferences for good X. The two individual demand curves are shown in the Figure, along with the market demand curve for good X.

The market demand curve for good X is found by summing together the quantities that both consumers demand at each price. For example, at a price of \$1, Consumer 1 demands 2 units while Consumer 2 demands 1 unit; so, the market demand is $2 + 1 = 3$ units of goods X.

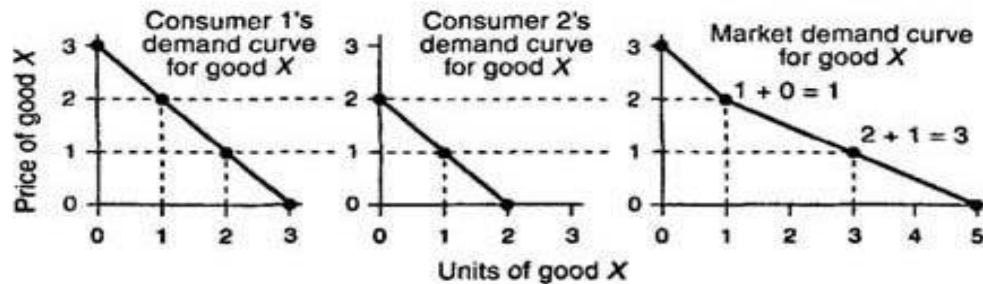


Figure 1 Derivation of the market demand curve from consumers' individual demand curves

In more general settings, where there are more than two consumers in the market for some good, the same principle continues to apply; the market demand curve would be the horizontal summation of all the market participants' individual demand curves.

Determinants of demand

The demand for X commodity is affected by the following factors

Price of the commodity

Prices of related goods

Income of the consumer

Tastes and preferences of the consumer

Expectation of a price change of the commodity

Population

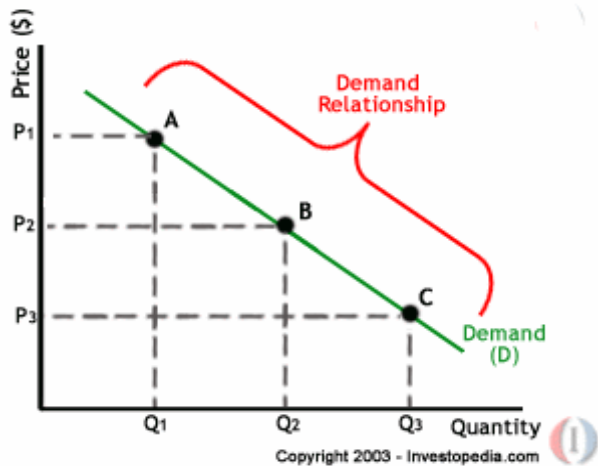
Income distribution

Lesson plan -3-'Law of Demand'

DEFINITION of 'Law of Demand'

A microeconomic law that states, all other factors being equal, as the price of a good or service increases, consumer demand for the good or service will decrease, and vice versa. The law of demand says that the higher the price, the lower the quantity demanded, because consumers' opportunity cost to acquire that good or service increases, and they must make more tradeoffs to acquire the more expensive product.

The chart below depicts the law of demand using a demand curve, which is always downward sloping. Each point on the curve (A, B, C) reflects a direct correlation between quantity demanded (Q) and price (P). So, at point A, the quantity demanded will be Q1 and the price will be P1, and so on.



The law of demand summarizes the effect price changes have on consumer behavior. For example, a consumer will purchase more pizzas if the price of pizza falls. The opposite is true if the price of pizza increases consumer will purchase less.

The law of demand is one of the most fundamental concepts in economics. It works with the law of supply to explain how market economies allocate resources and determine the prices of goods and services.

Exceptions of the law.

1. Geffen goods:

Some special varieties of inferior goods are termed as Giffen goods. Cheaper varieties of this category like bajra, cheaper vegetable like potato come under this category. Sir Robert Giffen first observed that people used to spend more their income on inferior goods like potato and less of their income on meat. But potatoes constitute their staple food. When the price of potato increased, after purchasing potato they did not have so many surpluses to buy meat. So the rise in price of potato compelled people to buy more potato and thus raised the demand for potato. This is against the law of demand. This is also known as Giffen paradox.

2. Conspicuous Consumption:

this doctrine was propounded by Thorsten Veblen. A few goods like diamonds etc are purchased by the rich and wealthy sections of the society. The prices of these goods are so high that they are beyond the reach of the common man. The higher the price of the diamond the higher the prestige value of it. So when price of these goods falls, the consumers think that the prestige value of these goods comes down. So quantity demanded of these goods falls with fall in their price. So the law of demand does not hold good here.

3. Conspicuous necessities:

Certain things become the necessities of modern life. So we have to purchase them despite their high price. The demand for T.V. sets, automobiles and refrigerators etc. has not gone down in spite of the increase in their price. These things have become the symbol of status. So they are purchased despite their rising price. These can be termed as “U” sector goods.

4. Ignorance:

A consumer's ignorance is another factor that at times induces him to purchase more of the commodity at a higher price. This is especially so when the consumer is haunted by the phobia that a high-priced commodity is better in quality than a low-priced one.

5. Emergencies:

Emergencies like war, famine etc. negate the operation of the law of demand. At such times, households behave in an abnormal way. Households accentuate scarcities and induce further price rises by making increased purchases even at higher prices during such periods. During depression, on the other hand, no fall in price is a sufficient inducement for consumers to demand more.

6. Future changes in prices:

Households also act speculators. When the prices are rising households tend to purchase large quantities of the commodity out of the apprehension that prices may still go up. When prices are expected to fall further, they wait to buy goods in future at still lower prices. So quantity demanded falls when prices are falling.

7. Change in fashion:

A change in fashion and tastes affects the market for a commodity. When a broad toe shoe replaces a narrow toe, no amount of reduction in the price of the latter is sufficient to clear the stocks. Broad toe on the other hand, will have more customers even though its price may be going up. The law of demand becomes ineffective.

Why the demand curve slopes downward?

Demand curve has got a negative slope. It slopes downwards from left to right. Because of

. (1) Law of diminishing marginal utility:

A consumer always equalises marginal utility with price. The law states that a consumer derives less and less satisfaction (utility) from the every additional increase in the stock of a commodity. When price of a commodity falls the consumer's price utility equilibrium is disturbed i.e. price becomes smaller than utility. In order to restore the new equilibrium between price and utility, he buys more of it so that the marginal utility falls with the rise in the amount demanded. So long the price of a commodity falls, the consumer will go on buying more amount of it so as to reduce the marginal utility and make it equal with new price.

(2) Income effect:

Another cause behind the operation of law of demand is income effect. As the price of a commodity falls, the consumer has to buy the same amount of the commodity at less amount of money. After buying his required quantity he is left with some amount of money.

This constitutes his rise in his real income. This rise in real income is known as income effect. This increase in real income induces the consumer to buy more of that commodity. Thus income effect is one of the reasons why a consumer buys more at falling prices.

(3) Substitution effect:

When the price of a commodity falls, it becomes relatively cheaper than other commodities. The consumer substitutes the commodity whose price has fallen for other commodities which becomes relatively dearer.

For example with the fall in price of tea, coffees. Price being constant, tea will be substituted for coffee. Therefore the demand for tea will go up.

(4) New consumers:

When the price of a commodity falls many other consumers who were deprived of that commodity at the previous price become able to buy it now as the price comes within their reach. For example the units of colour TV. increases with a remarkable fall in price of it. The opposite will happen with a rise in prices.

(5) Multiple use of commodity:

There are some commodities which have multiple uses. Their uses depend upon their respective, prices. When their prices rise they are used only for certain selected purposes. That is why their demand goes down.

For example electricity can be put to different uses like heating, lighting, cooling, cooking etc. If its price falls people use it for other uses other than that. A rise in price of electricity will force the consumer to minimise its use. Thus with a fall and rise in price of electricity its demand rises and falls accordingly

Lesson plan -4 Elasticity of demand

ELASTICITY OF DEMAND

Elasticity of demand may be defined as the degree of responsiveness or sensitiveness of quantity demand of goods to responsiveness or sensitiveness of demand determinants

Elasticity of demand *is defined as Responsiveness* change in quantity demanded by Responsiveness change in demand determinants such as price of the goods, Income of the customer, and the price of the related goods.

Determinants of Ed are

1. Price elasticity.
2. Income elasticity.
3. Cross elasticity
4. Promotional elasticity.

Price elasticity of demand.

Price elasticity of demand is the degree of responsiveness of demand to a responsiveness of change price.

Price elasticity of demand=

$$\frac{\% \text{ change in quantity demanded}}{\% \text{ change in price}}$$

Symbolically it can be represented as:

E_p =elasticity of price

P =original price

Q =original quantity

Δq =change in quantity

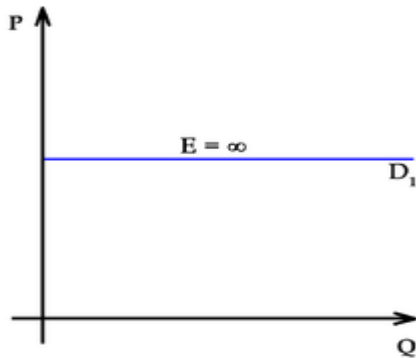
Δp =change in price

$$E_p = \frac{\% \text{ change in } q}{\% \text{ change in } p} = \frac{\Delta q / q}{\Delta p / p} = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$

Price elasticity can be of following types

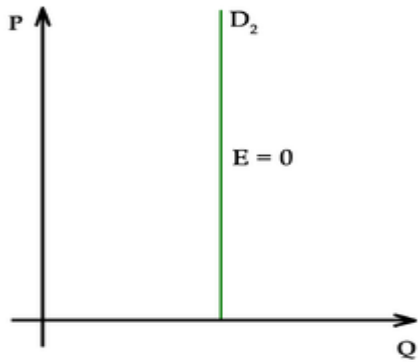
1. Perfectly elastic demand:

The demand is said to be perfectly elastic when a very insignificant change in price leads to an infinite change in quantity demanded. A very small fall in price causes demand to rise infinitely. Likewise a very insignificant rise in price reduces the demand to infinite level. This case is theoretical which is never found in real life.



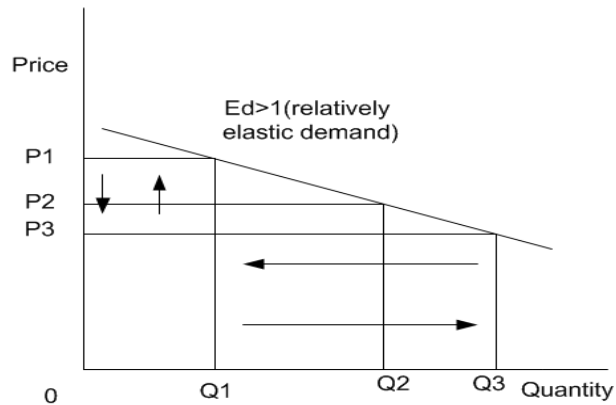
2. Perfectly inelastic demand:

The demand is said to be perfectly inelastic when a change in price produces no change in the quantity demanded of a commodity. In such a case quantity demanded remains constant regardless of change in price. The amount demanded is totally unresponsive of change in price. The elasticity of demand is said to be zero.



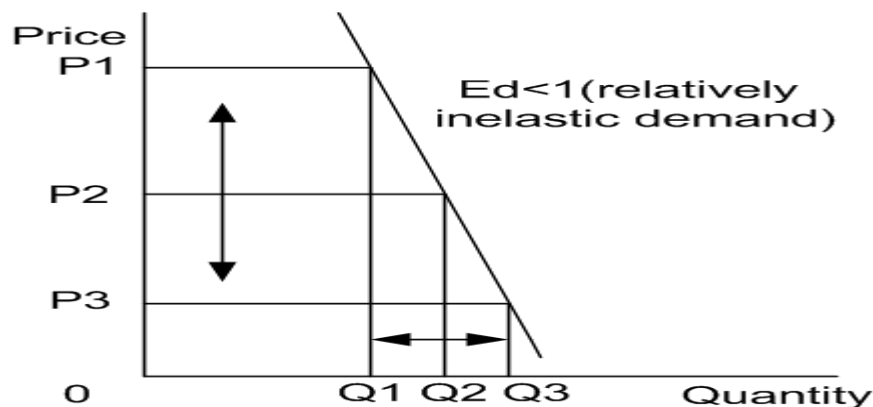
3. Relatively more elastic demand:

The demand is relatively more elastic when a small change in price causes a greater change in quantity demanded. In such a case a proportionate change in price of a commodity causes more than proportionate change in quantity demanded. If price changes by 10% the quantity demanded of the commodity change by more than 10% i.e. 25%. The demand curve in such a situation is relatively flatter.



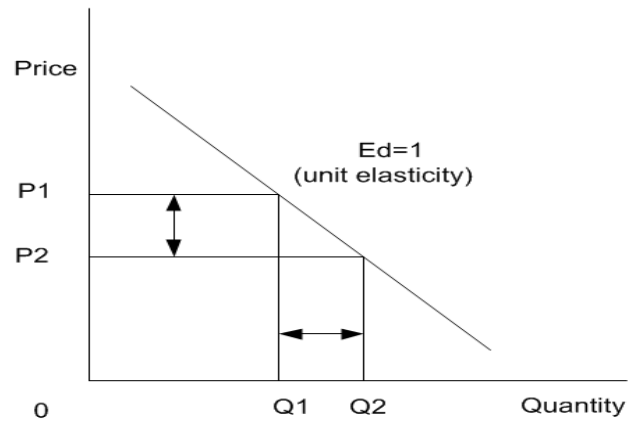
4. Relatively inelastic demand:

It is a situation where a greater change in price leads to smaller change in quantity demanded. The demand is said to be relatively inelastic when a proportionate change in price is greater than the proportionate change in quantity demanded. For example If price falls by 20% quantity demanded rises by less than 20% i.e 15%.



5. Unitary elastic demand:

The demand is said to be unit when a change in price produces exactly the same percentage change in the quantity demanded of a commodity. In such a situation the percentage change in both the price and quantity demanded is the same. For example if the price falls by 25% the quantity demanded rises by the same 25%. It takes the shape of a rectangular hyperbola. Numerically elasticity of demand is said to be equal to 1. ($e_d = 1$).



Lesson plan-5-Measurement of elasticity of demand

1) The Percentage Method:

The price elasticity of demand is measured by its coefficient E_p . This coefficient E_p measures the percentage change in the quantity of a commodity demanded resulting from a given percentage change in price. Thus

$$E_p = \frac{\% \text{ change in } q}{\% \text{ change in } p} = \frac{\Delta q / q}{\Delta p / p} = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$

Where q refers to quantity demanded p to price and Δ to change. If $E_p > 1$, demand is elastic. If $E_p < 1$, demand is inelastic, if $E_p = 1$ demand is unitary elastic.

This shows elastic demand or elasticity of demand greater than unitary.

Note: The formula can be understood like this:

$\Delta q = q_2 - q_1$ where q_2 is the new quantity (30 kgs.) and q_1 the original quantity (10 kgs.)

$\Delta p = p_2 - p_1$ where p_2 is the new price (Rs. 3) and p_1 the original price (Rs. 5)

In the formula, p refers to the original price (p_1) and q to original quantity (q_1). The opposite is the case in example (ii) below, where Rs. 3 becomes the original price and 30 kgs. as the original quantity.

(ii) Let us measure elasticity by moving in the reverse direction. Suppose the price of X rises from Rs. 3 per kg. to Rs. 5 per kg. and the quantity demanded decreases from 30 kgs. to 10 kgs. Then

$$E_p = \frac{\Delta q}{\Delta p} \times \frac{p}{q} = \frac{(30 - 10)}{(3 - 5)} \times \frac{5}{10} = \frac{20}{-2} \times \frac{5}{10} = -5 \text{ or } > 1.$$

2) The Point Method:

Prof. Marshall devised a geometrical method for measuring elasticity at a point on the demand curve. Let RS be a straight line demand curve in Figure 11.2. If the price falls from PB(=OA) to MD(=OC). The quantity demanded increases from OB to OD.

So Elasticity of price (E_p) at the point p is

$$= \frac{\% \text{ change in } q}{\% \text{ change in } p} = \frac{\Delta q / q}{\Delta p / p} = \frac{\Delta q}{\Delta p} \times \frac{p}{q} \text{ -----(1)}$$

Let us look at the diagram

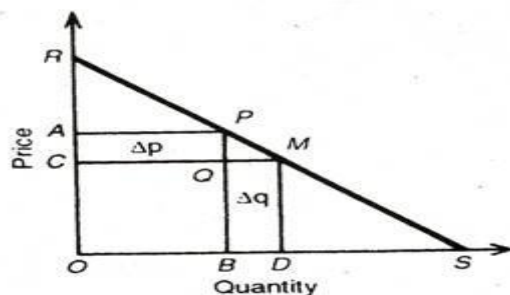


Figure 11.2

From Figure 11.2

$$\Delta q = BD = QM$$

$$\Delta p = AC = PQ$$

$$q = OB$$

$$P = OA = PB$$

Substituting these values of the elasticity in the equation (1)

We get

$$E_p = \frac{QM}{PQ} \times \frac{PB}{OB} \text{ -----(2)}$$

Let us take ΔPQM and ΔPBS

$$\angle PQM = \angle PBS \quad (\text{right angle})$$

$$\angle PMQ = \angle PSB \quad (\text{Corresponding Angle})$$

$\angle BPS$ is Common for both the Triangles

Hence $\Delta PQM = \Delta PBS$

So according to the equation of similar triangles

$$\frac{QM}{PQ} = \frac{BS}{PB}$$

By substituting the value in equation (ii)

$$\text{We get } \therefore \frac{BS}{PB} \times \frac{PB}{OB} = \frac{BS}{OB}$$

Now in Triangle ROS BP is a perpendicular drawn from OS to the point P

Here $BP \perp OR$

And the equation states that the ratios between the both sides are similar

$$\text{so } \frac{BS}{OB} = \frac{PS}{PR} = \frac{\text{Lower Segment}}{\text{Upper Segment}}$$

With the help of the point method, it is easy to point out the elasticity at any point along a demand curve. Suppose that the straight line demand curve DC in Figure 11.3.

Five points L, M, N, P and Q are taken on this demand curve. The

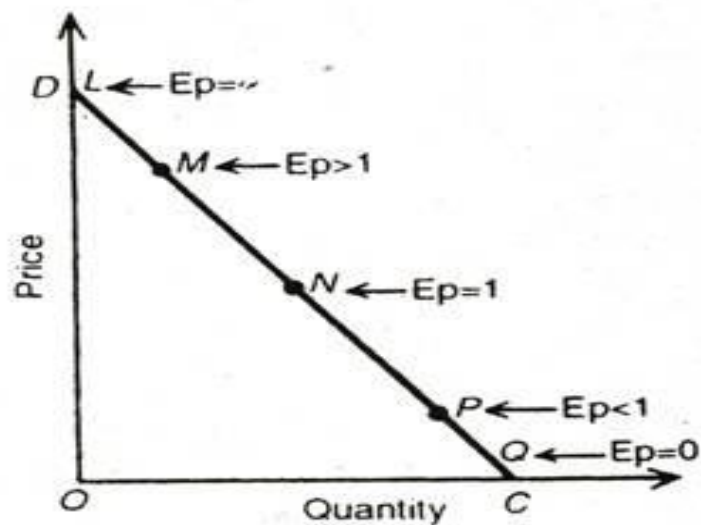


Figure 11.3

3) The Arc Method:

We have studied the measurement of elasticity at a point on a demand curve. But when elasticity is measured between two points on the same demand curve, it is known as arc elasticity. In the words of Prof. Baumol, “Arc elasticity is a measure of the average responsiveness to price change exhibited by a demand curve over some finite stretch of the curve.”

Any two points on a demand curve make an arc. The area between P and M on the DD curve in Figure 11.4 is an arc which measures elasticity over a certain range of price and quantities. On any two points of a demand curve the elasticity coefficients are likely to be different depending upon the method of computation. Consider the price-quantity combinations P and M as given in Table.

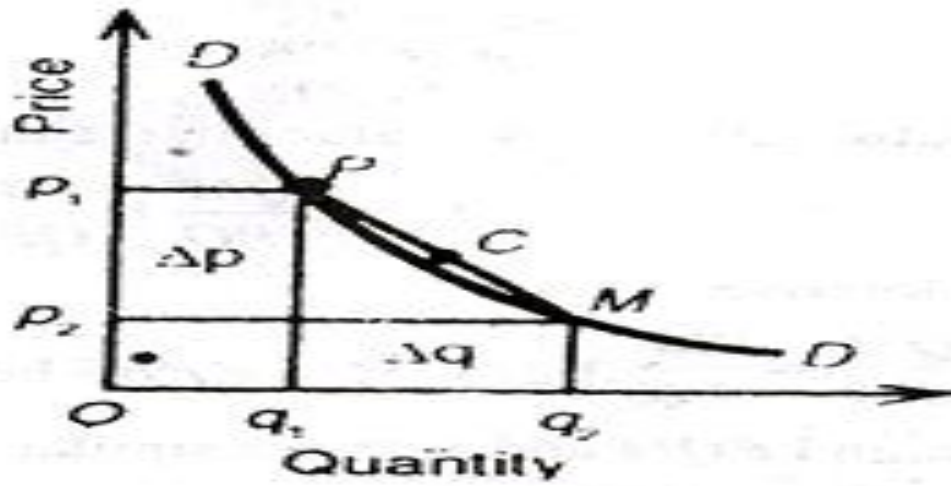


Figure 11.4

Table 11.4: Demand Schedule:

Price (Rs.)

Quantity (Kg)

8

10

6

12

If we move from P to M, the elasticity of demand is:

$$\text{At point P Ed} = \frac{\% \text{ change in } q}{\% \text{ change in } p} = \frac{\Delta q/q}{\Delta p/p} = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$

$$= 2/2 \times 8/10 = 4/5$$

$$\text{At point point M Ed} = \frac{\% \text{ change in } q}{\% \text{ change in } p} = \frac{\Delta q/q}{\Delta p/p} = \frac{\Delta q}{\Delta p} \times \frac{p}{q}$$

$$= 2/2 \times 6/12 = 1/2$$

Thus the point method of measuring elasticity at two points on a demand curve gives different elasticity coefficients because we used a different base in computing the percentage change in each case.

To avoid this discrepancy, elasticity for the arc (PM in Figure 11.4) is calculated by taking the average of the two prices $[(p_1 + p_2)/2]$ and the average of the two quantities $[(q_1 + q_2)/2]$. The formula for price elasticity of demand at the mid-point (C in Figure 11.4) of the arc on the demand curve is

$$E_p = \frac{\frac{Q_2 - Q_1}{(Q_1 + Q_2)/2}}{\frac{P_2 - P_1}{(P_1 + P_2)/2}}$$

Again

$$E_p = \frac{\frac{\Delta Q}{(Q_1 + Q_2)/2}}{\frac{\Delta P}{(P_1 + P_2)/2}}$$

$$= 2/2 \times (8+6)/(10+12)$$

$$= 2/2 \times 14/22 = 7/11 = 0.64$$

Lesson plan -6-Theory of supply

Definition: Law of supply states that other factors remaining constant, price and quantity supplied of a good are directly related to each other. In other words, when the price paid by buyers for a good rises, then suppliers increase the supply of that good in the market.

Description: Law of supply depicts the producer behavior at the time of changes in the prices of goods and services. When the price of a good rises, the supplier increases the supply in order to earn a profit because of higher prices.

Supply Schedule - A Supply Schedule is a table which shows how much one or more firms will be willing to supply at a particular price.

It is a table listing or showing the exact quantities of a single type of goods or services that potential sellers would offer to sell at varying prices during a particular time period.

Example of Supply Schedule

Table A

Price	Quantity Supplied
1	12
2	28
3	42

4	52
5	60

We can also say that Supply Schedule is a depiction in tabular form, of price and quantity supplied at a point of time keeping other* factor constant. (*Price of related goods, Condition/Technology in Production, Seller's Expectations etc.)

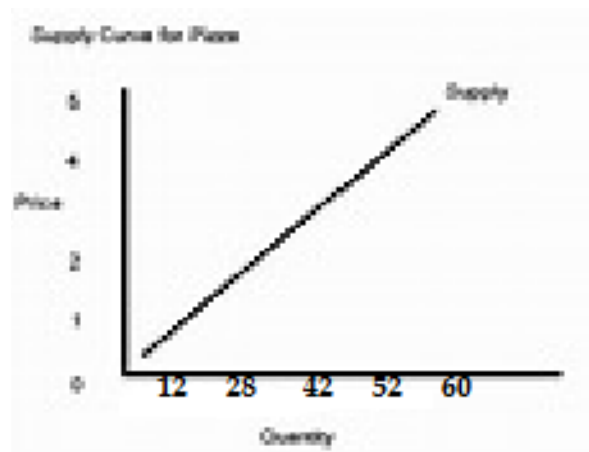
Supply Curve

It is a curve that shows relationship of price and quantity supplied graphically or we can say the relationship of price and quantity supplies that can be exhibited graphically is termed as Supply Curve.

Keeping other factors constant the Supply Curve depicts the relationship between two variables only. These are:

- Price
- Quantity Supplied.

For example: - By plotting the data given above in Table A (Supply Schedule), we can get or draw a supply Curve which is as follows.



There are a number of factors that influence the quantity that producers plan to supply to the market at a given time. **Determinants of supply are as follows.**

- 1. **Price of the product (P)**
- 2. **Prices of factors of production (C)**
- 3. **Technology (T)**
- 4. **Prices of related products (Pn)**
- 5. **Producer’s expectations (Ex)**
- 6. **Number of producers in the market (N)**
- 7. **Government Policies (G)**
- 8. **Other factors (O)**

Let’s discuss the factors one by one. First of all we need to create the supply function. A supply function can write by identifying the quantity of goods supplied as the dependent variable and the factors mentioned above as independent variables that affect it.

Supply Function

$$Q_s = f(P, C, T, P_n, E_x, N, G, O)$$

In this function, let us consider how the quantity of supply is determined by the independent variables other than the price of the item under consideration.

Determinants of Supply

- Prices of factors of production (C)
- Determinants of Supply: Technology (T)
- Prices of related products (Pn)
- Producer’s expectations (Ex)
- Number of producers in the market (N)
- Government Policies (G)
- Determinants of Supply: Other factors (O)
- Weather conditions

Prices of factors of production (C)

The supply curve of an institution is the curve that expresses the minimum price at which the producer willing to supply the product.

As the price of the factors of production increases, the minimum price that the producer willing to provide also increases. So the supply decreases and the supply curve shifts to the left.

For example, seeds of the cacao tree use to made chocolate. If cacao seed prices increased, the cost of producing chocolate increase as well. As a result of that supply decreases.

Determinants of Supply: Technology (T)

Technology refers to the methodology by which resources are used to produce goods. Production costs go down if more efficient techniques are found and used to produce a product.

As a result of that the supply increases and the supply curve shifts to the right. Technological improvements help reduce production cost and increase profit as well.

Prices of related products (P_n)

The prices of goods and substitutes goods produced by a firm affect the supply of the relevant product. It means, If another good that a firm could produce rises in price, firms will produce more of it and less of what they used to produce.

Goods that can be produced using the same resources are called substitute goods in the production process.

For example, when the price of green gram is relatively high, the land used for maize cultivation can be used for green gram cultivation. Then the supply of corn decreases.

Producer's expectations (Ex)

Changes in the expectations of the producers affect the current supply of the product. It is not clear how price expectations will affect the current supply as it will vary depending on the nature of the goods.

For example, producers are expanding their supply, thinking that the future price of industrial products will be higher.

Expectations of a change in any factor affecting future profitability affect current supply. Expectations of business tax and import restrictions are some examples.

Number of producers in the market (N)

The number of suppliers in the market also affects the supply of the market. When the number of suppliers increases, the supply increases and when the number of suppliers decreases, the supply decreases.

Government Policies (G)

Government policies can be pointed as a determinant of supply. Various regulations, taxes and production subsidies imposed by the government also affect the supply. For example, taxes on goods will increase the marginal cost of production. On the other hand, Production subsidies will reduce marginal costs. Thus the minimum price at which the goods are to be supplied is also increased or decreased.

Determinants of Supply: Other factors (O)

Under this, changes in supply due to the influence of nature and the Internet can be pointed out. Disasters, such as epidemics, droughts, and floods, cause changes in supply.

LESSION-7 Elasticity of supply

Price Elasticity of Supply measures the responsiveness of quantity supplied to change in price, as percentage change in Quantity Supplied induced by percentage change in Price.

Percentage–Change Method

According to this method Price Elasticity of supply (Es) is measured as under:-

Price Elasticity of Supply (Es)= $\frac{\% \text{ Change in Quantity Supplied}}{\% \text{ Change in Price}}$

Where

$$\frac{\% \text{ Change in Quantity Supplied}}{\% \text{ Change in Price}} = \frac{\frac{\text{Change in Quantity Supplied}}{\text{Initial Supply}} \times 100}{\frac{\text{Change in Price}}{\text{Initial Price}} \times 100} = \frac{\frac{Q_1 - Q}{Q} \times 100}{\frac{P_1 - P}{P} \times 100} = \frac{\frac{\Delta Q}{Q} \times 100}{\frac{\Delta P}{P} \times 100}$$

$$E_s = \frac{\Delta Q}{Q} \times \frac{P}{\Delta P}$$

$$E_s = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$$

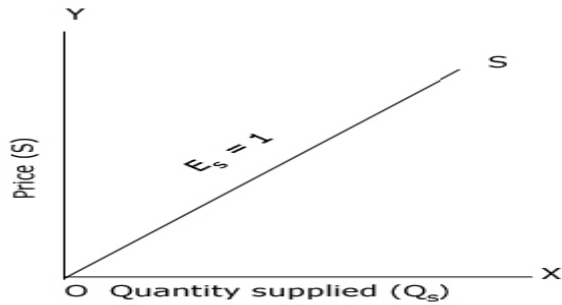
Where

ΔQ – Change in Quantity supplied Q – initial Quantity Supplied

ΔP – Change in Price P - Initial Price

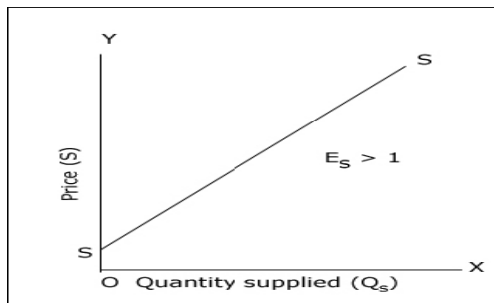
a) Unitary Elasticity or $E_s=1$

In this situation the supply curve slopes upward in a straight line which starts from point of origin. This shows the percentage change in Quantity supply is exactly equals to percentage change in price.



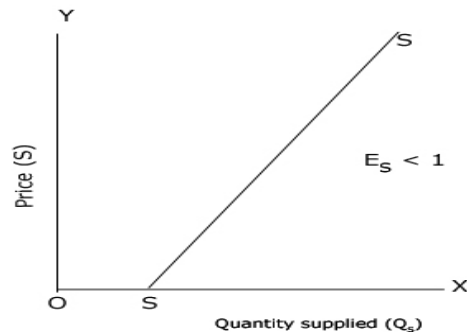
b) Greater than Unitary Elasticity or $E_s \geq 1$

When a straight line upward sloping curve starts from Y-axis, then this is a case of Unitary Elasticity. This depicts that percentage change in quantity supplied is greater than percentage change in price.



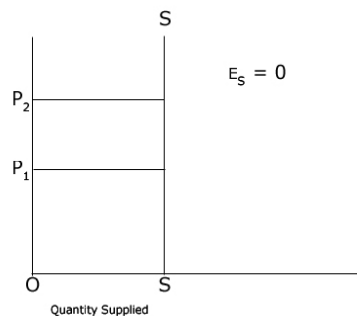
c) Less than Unitary Elasticity or $E_s \leq 1$

When a straight line upward sloping curve starts from X-axis then this is a case of less than Unitary Elasticity. This represents that percentage change in quantity supplied is less than percentage change in price.



(d) Perfectly Inelastic Supply or $E_s = 0$

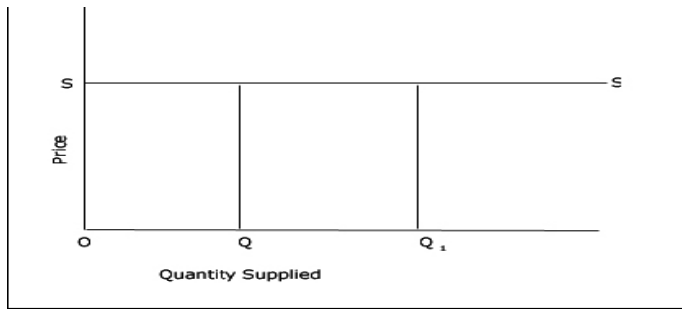
It is a situation where there is no change in supply regardless of change in price. It shows that supply remain unchanged with the change in price. In such situation supply curve is vertical straight line curve.



e) Perfectly Elastic Supply or $E_s = \infty$

In this situation supply is infinite corresponding to a particular price of the commodity. Accordingly a slightest fall in price caused an infinite change in supply, reducing it to zero. In this case supply curve is horizontal straight line.

$E_s = \infty$



Lesson plan-8

Market structure

Definition of Market

"Economist understands by the term market, not any a particular market place in which things are bought and sold, but the whole of any region in which buyers and sellers are in such close contact with one another that prices of the same goods tend to equality, easily and quickly."

Types of Market

On the basis of degree of competition markets are classified as follows:

a) Perfect competition

In economic theory, perfect competition occurs when all companies sell identical products, market share does not influence price, companies are able to enter or exit without barrier, buyers have “perfect” or full information, and companies cannot determine prices. In other words, it is a market that is entirely influenced by market forces. It is the opposite of imperfect competition, which is a more accurate reflection of a current market structure.

1. Large number of sellers
2. Large number of buyers
3. Free entry and exist
4. Homogeneous product
5. Single Price
6. Both producers and consumers have perfect knowledge on Market
7. Factor inputs are mobile

b) Pure competition- Competition

Pure competition is a part and parcel of perfect competition. According to Chamberlin, "a market becomes pure when monopoly is kept away."

Pure competition has certain conditions of perfect competition. They are

- 1) Large number of sellers
- 2) Large number of buyers
- 3) Free entry and exist
- 4) Homogeneous product
- 5) Single Price

c) **Monopoly- Monopoly – Meaning and its Features**

'Mono' means single and poly means 'seller'. Thus monopoly means single seller who has complete control over the supply of the commodity. There is no close substitute of the commodity. Due to absence of competition, monopolist is a price maker and not a price taker.

According to H.L. Ahuja, "Monopoly is said to exist when one firm is the sole producer or seller of a product which has no close substitute."

According to Chamberlin, "A monopoly refers to a single firm, which has control over the supply of a product, which has no close substitute.

- 1) Single seller
- 2) No close substitute
- 3) Barriers to entry
- 4) No distinction between firm and industry

- 5) Control over the market supply
- 6) Price maker
- 7) Profit maximization
- 8) Price discrimination

d) **Monopolistic competition-**

According to Chamberlin, "Monopolistic competition refers to competition among a large number of sellers producing close but not perfect substitute."

"When markets, which have a large number of producers producing differentiated products which are close substitute to each other, engage in non price competition, we call it as a Monopolistic Competitive market."

Following are the features of Monopolistic Competition

- 1) Fairly large number of buyers
- 2) Fairly large number of sellers
- 3) Product differentiation
- 4) Close substitute
- 5) Selling cost
- 6) Free entry and exit
- 7) Demand curve of the seller
- 8) Concept of group

e) Oligopoly competition

A monopoly is one firm, a duopoly is two firms and an oligopoly is two or more firms. There is no precise upper limit to the number of firms in an oligopoly, but the number must be low enough that the actions of one firm significantly influence the others.

An oligopoly is a type of market structure where two or more firms have significant market power. Collectively, they have the ability to dictate prices and **supply**

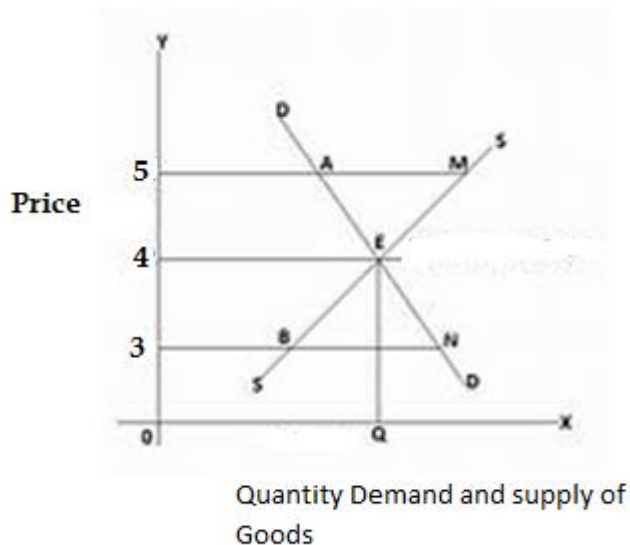
Generally, a market is considered an oligopoly when 50 percent of the market is controlled by the leading 4 firms.

Characteristics

1. A Few Firms with Large Market Share. ...
2. High Barriers to Entry. ...
3. Interdependence. ...
4. Each Firm Has Little Market Power In Its Own Right. ...
5. Higher Prices than Perfect **Competition**. ...
6. More Efficient.
7. Leading firms are price maker
8. Market is the price taker.

Price determination under perfect competitions

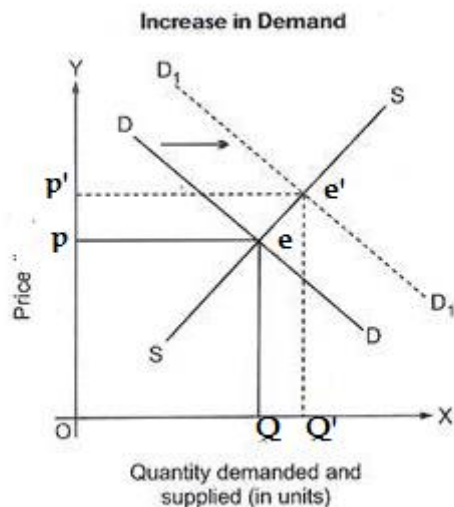
Under perfect competition, the industry determines the price following the same route of adjustment as described above with the help of twin market forces of demand and supply. Firms have to accept the price determined by the industry and offer their output at this price. When quantity supplied is more than quantity demanded at a particular price of the goods, the suppliers are worried to sell their goods, as they know that because of excess supply, all of their goods might not be sold. Everybody knows it that supplier always wants to ensure his goods are not left unsold. In a bid to ensure this, the supplier, tries to lure consumers by lowering the price per kg or unit.



Let us look at the figure, when quantity supplied is more than quantity demanded at price of ₹ 5 per kg., the suppliers are now worried as they know that because of excess supply, all of their goods might not be sold. We all know that every supplier always wants to ensure that his goods are not left unsold. In a bid to ensure this, the supplier, tries to attract the consumer by lowering the price per kg and other suppliers are also doing precisely the same. So, the price effectively falls per kg. But even at this relatively lower price, supply still exceeds demand, the seller again reduces the price level to adjust between the demand and supply of the goods. This will continue till the price reaches the level of ₹ 4 per kg where quantity demanded equals quantity supplied. At this price, suppliers have no reason to offer a lower price, as they know that at this price all their goods are going to be sold. So the equilibrium in this case has been brought about by decrease in price, which also contracts supply and expands demand.

(i) Effect of Increase in demand

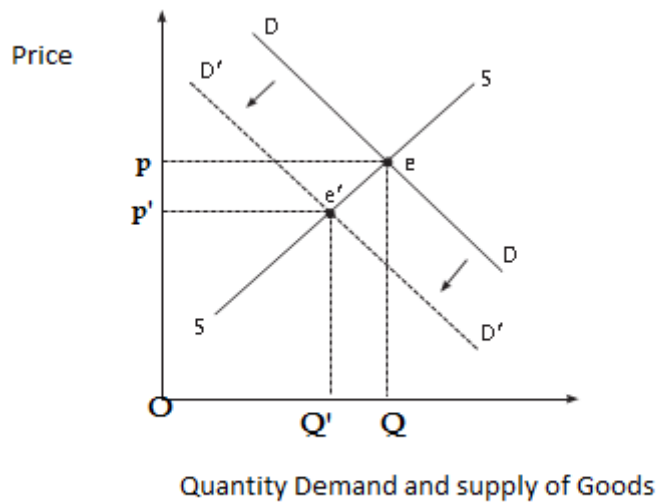
When due to any external factor such as rise in population, rise in income of people, demand for a commodity increases (for every price level), the demand curve shifts rightwards. As a result, it now intersects the supply curve at a new, higher level, which causes the price to rise. As shown in the figure below, initial demand curve DD intersects supply curve SS at point e



The equilibrium price is OP and the equilibrium quantity demanded and supplied are OQ . Now, suppose demand increases and as a result, demand curve shifts rightwards. This new demand curve $D'D'$ intersects the supply curve SS at point e' . At new equilibrium point between demand and supply the price is OP' , which is higher than the earlier Price OP . It may also be noted that the equilibrium quantity demanded and supplied have also risen from OQ to OQ' .

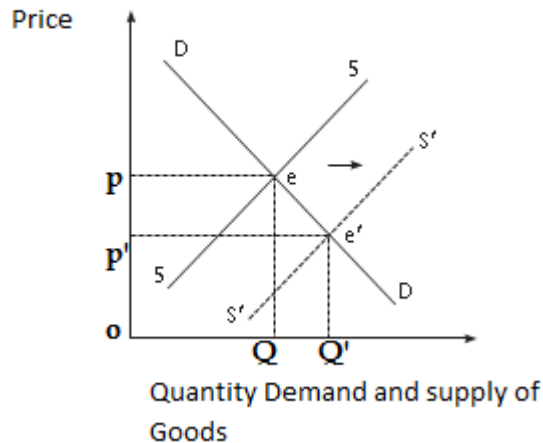
(ii) Effect of Decrease in Demand

When due to any external event such as fall in income level, demand for a commodity falls, the demand curve shifts leftwards. So, this new demand curve intersects supply curve at a lower level which causes the price to fall. As shown in the figure 22.8, initial demand curve DD intersects the supply curve SS at point e . Now, suppose demand decreases and as a result, demand curve shift leftwards. This new demand curve $D'D'$ intersects the supply curve SS at point e' . So, the new equilibrium price is OP' which is lower than the earlier price OP . It may also be noted that the equilibrium quantity demanded and supplied have also decreased from OQ to OQ' .



(iii) *Effect of increase in Supply*

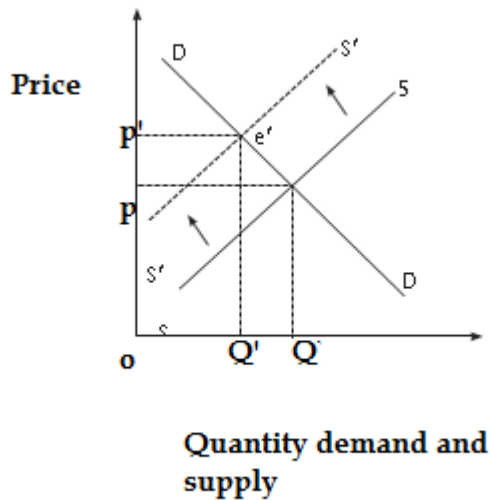
When due to any external factor such as a bumper crop, supply of a commodity increases (for every price level), the supply curve shifts rightwards. As a result, it now intersects the demand curve at a new, lower level, which causes the price to fall. As shown in the figure below, demand curve DD intersects the initial supply curve SS at point e .



The equilibrium price is OP and the equilibrium quantity demanded and supplied are OQ . Now, suppose, supply increases and as a result, supply curve shifts rightwards. This new supply curve $S'S'$ intersects demand curve DD at point e' . So, the new equilibrium price is OP' which is higher than the earlier price OP . It may also be noted that the equilibrium quantity demanded and supplied have fallen from OQ to OQ' .

(iv) Effect of Decrease in Supply

When due to any external event such as paucity of raw material or say, floods or drought, supply for a commodity falls, the supply curve shifts leftwards. So, this new supply curve intersects demand curve at a higher level which causes the price to rise. As shown in the figure 22.10 demand curve DD intersects the initial supply curve SS at point e .



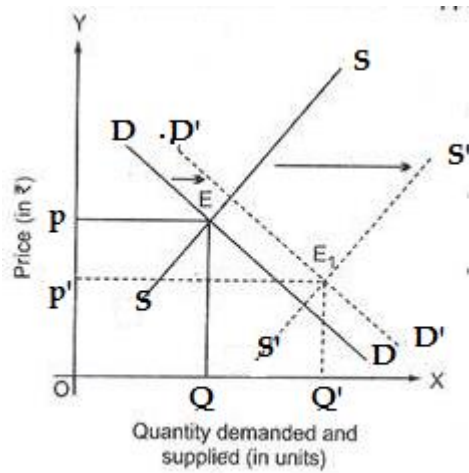
The equilibrium price is OP and the equilibrium quantity demanded and supplied are OQ . Now, suppose supply decreases and as a result, supply curve shifts leftwards. This new supply curve $S'S'$ intersects the demand curve DD at point e' . So the new equilibrium price is OP' which is higher than the earlier price OP . It may also be noted that the equilibrium quantity demanded and supplied have also decreased from OQ to OQ' .

(v) Increase in Both Demand and Supply

The three possible cases when both demand and supply are increasing can be explained as follows:

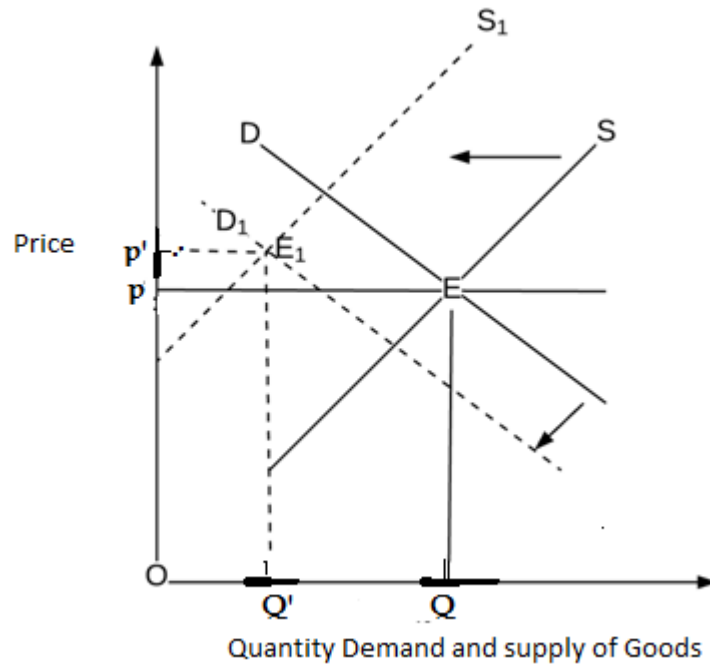
Increase in Demand = Increase in Supply

The upward effect of increase in demand on price equals downward effect of increase in supply. Here the price level decreases. (In case both the forces are equal in magnitude, price level remains the same). This is shown in the figure 22.11.



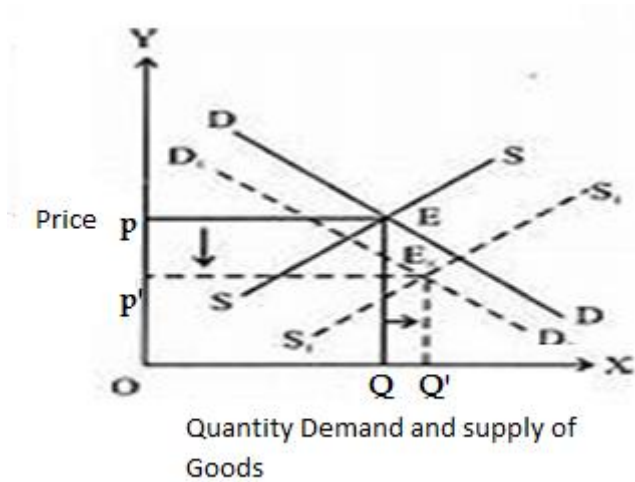
(vi) Decrease in Demand and decrease in Supply

As in this case, the downward effect of decrease in demand on price is greater than that of leftward effect of decrease in supply. As a result, price level rises. This is shown in the figure below



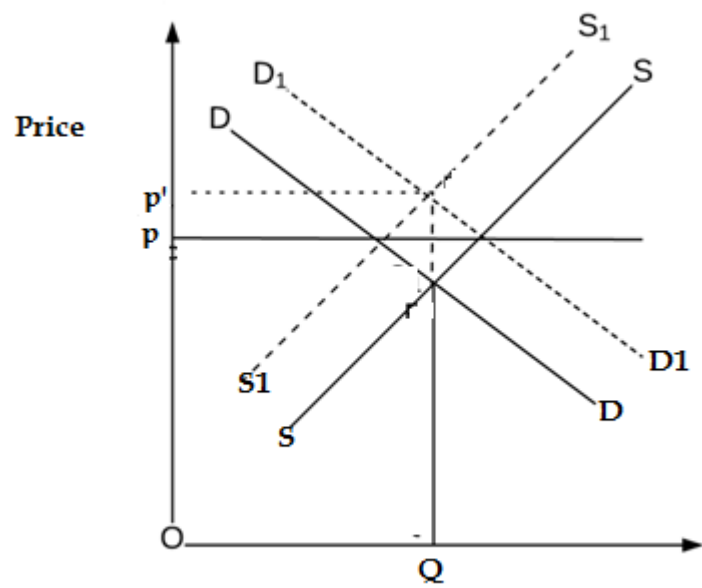
(vii) *Decrease in Demand < Increase in Supply*

In this case, the downward effect of decrease in demand on price is less than that of rightward effect of increase in supply. As a result, price level falls. This is shown in the figure 22.13.



(viii) Increase in Demand and decrease in Supply

In this case, the upward effect of increase in demand on price is greater than that of leftward effect of decrease in supply. As a result, price level rises. This is shown in the figure 22.14.



Behavior of the firm under perfect competition

The perfect competition is the structure of market in which there are large no. of buyers and sellers. They produce or sell homogenous product. In this market, firm is price taker and market is price maker because price of commodity is determined on the basis of market demand and supply. So, the price of particular commodity remains same everywhere in an economy.

Characteristics / Assumptions of perfect competition market:

Large no. of sellers and buyers:

In this market there is assumed large no. of buyers and sellers. A buyer and seller in the very small part and seller cannot influence in the market price.

Products homogeneity:

The products produced in the industry are supposed to be homogeneous. Different units of a commodity are similar in content, quality, price, smell, packaging, etc.

Free entry and exit of firm:

There is no barrier on entry of a new firm to the industry and there is no any restriction on exit of firm from the industry.

Profit maximization:

In this market, all firm wants to maximize its profit.

No government regulation:

Government doesn't influence in this market. There is no licensing system, no tax and subsidy. Government has no role in this type of market.

Perfect mobility of factors of production:

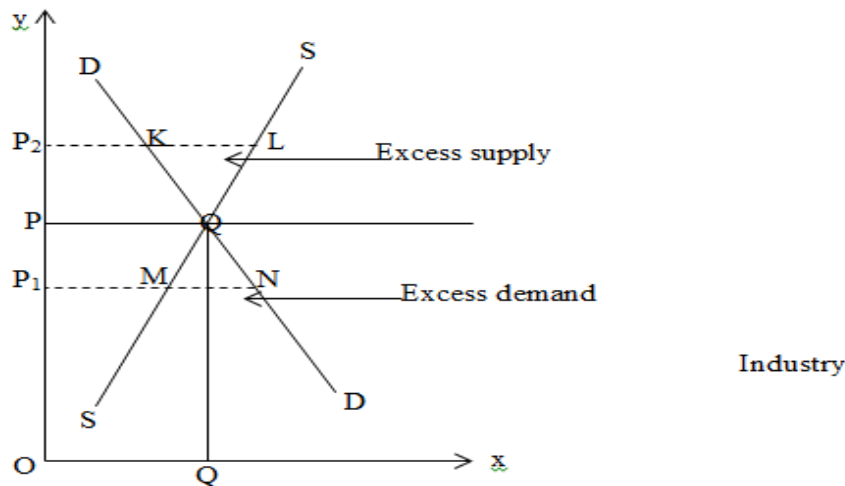
There is assumed that factor of production are free to move from one place to other, one industry to other and one occupation into another.

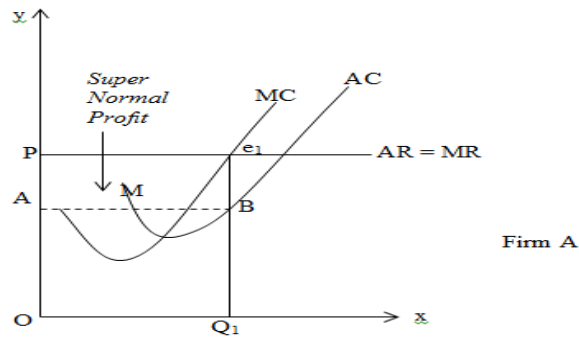
Perfect knowledge:

It assumes that under perfect competition market buyers and sellers are aware about prevailing market prices. They are also aware of future market condition.

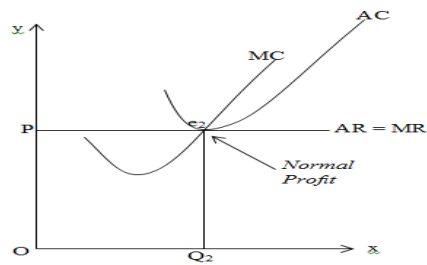
Price and Output determination under perfect competition market:

In the perfect competition market there is large no. of buyers and sellers. Price is determined by market forces and industry. It means market price is determined on the basis of market demand and market supply. The price determined by market/industry is accepted by all the firms. They just adjust their output according to the equilibrium position of firms. The process of price and output determination is explained by the help of given figures.

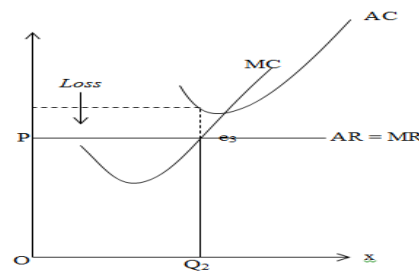




Firm A



Firm B



Firm C

On the given figure, first of all price and output determination of industry is shown. In the first figure, demand and supply curves are intersected at point E. That point determines the equilibrium price of industry i.e. OP and equilibrium price of output of industry i.e. OQ . Suppose, when the price increases from P to P_2 then demand is P_2K and supply is P_2L , it means there is excess supply of goods. So, price tends to decline at OP . On the other hand, when price decreases from P to P_1 there is excess demand equal to area MN . It tends to increase price OP so that equilibrium price of market price is OP . The market price is accelerated by all the firms but they are capable to adjust their output according to the equilibrium price of a firm. So, in short run, firm may obtain super normal profit or normal profit or loss.

The firm A, by producing equilibrium output i.e. OQ_1 at OP price; the firm has been obtaining super normal profit. Firm B, by producing OQ_2 output at OP has been obtaining normal profit. The firm C, by producing OQ_3 output at OP price has been obtaining loss. But in the long run, every firm always obtains only the normal profit.

Lesson plan 9:

Time analysis

Short Period-Short Run-time duration within 1 year

Long Period-Long Run-time duration is more than one year

Long Run Costs

Long run costs are accumulated when firms change production levels over time in response to expected economic profits or losses. In the long run there are no fixed factors of production. The land, labor, capital goods, and entrepreneurship all vary to reach the long run cost of producing a good or service. The long run is a planning and implementation stage for producers. They analyze the current and projected state of the market in order to make production decisions. Efficient long run costs are sustained when the combination of outputs that a firm produces results in the desired quantity of the goods at the lowest possible cost. Examples of long run decisions that impact a firm's costs include changing the quantity of production, decreasing or expanding a company, and entering or leaving a market.

Short Run Costs

Short run costs are accumulated in real time throughout the production process. Fixed costs have no impact of short run costs, only variable costs and revenues affect the short run production. Variable costs change with the output. Examples of variable costs include employee wages and costs of raw materials. The short run costs increase or decrease based on variable cost as well as the rate of production. If a firm manages its short run costs well over time, it will be more likely to succeed in reaching the desired long run costs and goals.

Differences

The main difference between long run and short run costs is that there are no fixed factors in the long run; there are both fixed and variable factors in the short run. In the long run the general price level, contractual wages, and expectations adjust fully to the state of the economy. In the short run these variables do not always adjust due to the condensed time period. In order to be successful a firm must set realistic long run cost expectations. How the short run costs are handled determines whether the firm will meet its future production

Fixed Costs (FC). The costs which don't vary with changing output. Fixed costs might include the cost of building a factory, insurance and legal bills. Even if your output changes or you don't produce anything, your fixed costs stay the same. In the above example, fixed costs are always £1,000.

Variable Costs (VC). Costs which depend on the output produced. For example, if you produce more cars, you have to use more raw materials such as metal. This is a variable cost.

Semi-Variable Cost. Labour might be a semi-variable cost. If you produce more cars, you need to employ more workers; this is a variable cost. However, even if you didn't produce any cars, you may still need some workers to look after empty factory.

Total Costs (TC) – Fixed + Variable Costs

Marginal Costs – Marginal cost is the cost of producing an extra unit. If the total cost of 3 units is 1550, and the total cost of 4 units is 1900. The marginal cost of the 4th unit is 350.

Opportunity cost – Opportunity cost is the next best alternative foregone. If you invest £1 million in developing a cure for pancreatic cancer, the opportunity cost is that you can't use that money to invest in developing a cure for skin cancer.

Economic Cost. Economic cost includes both the actual direct costs (accounting costs) plus the opportunity cost. For example, if you take time off work to a training scheme. You may lose a weeks pay £350, plus also have to pay the direct cost of £200. Thus the total economic cost = £550.

Accounting Costs – this is the monetary outlay for producing a certain goods. Accounting costs will include your variable and fixed costs you have to pay.

Sunk Costs. These are costs that have been incurred and cannot be recouped. If you left the industry you cannot reclaim sunk costs. For example, if you spend money on advertising to enter an industry, you can never claim these costs back. If you buy a machine, you might be able to sell if you leave the industry.

Avoidable Costs. Costs that can be avoided. If you stop producing cars, you don't have to pay for extra raw materials and electricity. Sometimes known as an escapable cost.

Social Costs. This is the total cost to society. It will include the private costs plus also the external cost (cost incurred by a third party). May also be referred to as 'True costs'

External Costs. This is the cost imposed on a third party. For example, if you smoke, some people may suffer from passive smoking. That is the external cost.

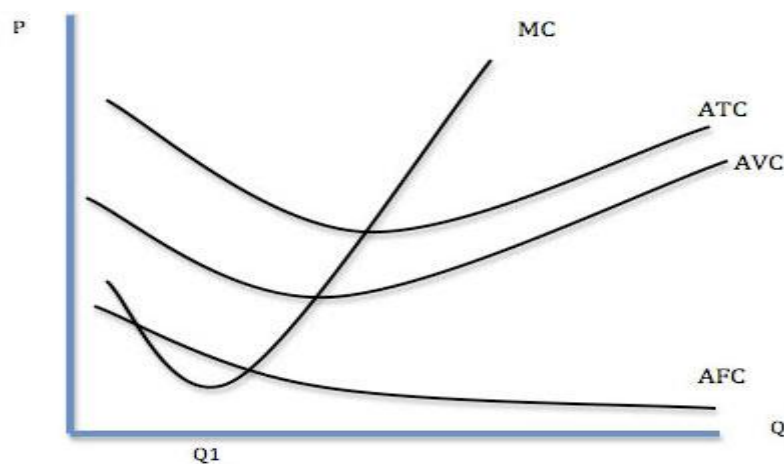
Private costs. The costs you pay. E.g. the private cost of a packet of cigarettes is £6.10

Social Marginal Cost. The total cost to society of producing one extra unit. Social Marginal Cost (SMC) = Private marginal cost (PMC) + External marginal Cost (XMC)

Diagram of Costs

For diagrams of costs see: Diagrams of cost curves

Average Cost Curves



ATC (Average Total Cost) = Total Cost / quantity

AVC (Average Variable Cost) = Variable cost / quantity

AFC (Average Fixed Cost) = Fixed cost / quantity

REVENUE CONCEPT

Meaning of Revenue:

Revenue refers to the amount received by a firm from the sale of a given quantity of a commodity in the market.

Revenue is a very important concept in economic analysis. It is directly influenced by sales level, i.e., as sales increases, revenue also increases.

The amount of money that a producer receives in exchange for the sale proceeds is known as revenue. For example, if a firm gets Rs. 16,000 from sale of 100 chairs, then the amount of Rs. 16,000 is known as revenue.

Concept of Revenue:

The concept of revenue consists of three important terms; Total Revenue, Average Revenue and Marginal Revenue.



Total Revenue (TR):

Total Revenue refers to total receipts from the sale of a given quantity of a commodity. It is the total income of a firm. Total revenue is obtained by multiplying the quantity of the commodity sold with the price of the commodity.

Total Revenue = Quantity \times Price

For example, if a firm sells 10 chairs at a price of Rs. 160 per chair, then the total revenue will be: 10 Chairs \times Rs. 160 = Rs 1,600

Average Revenue (AR):

Average revenue refers to revenue per unit of output sold. It is obtained by dividing the total revenue by the number of units sold.

Lesson plan -10

Production function

The relation between inputs and output of a firm has been called the 'Production Function'. Thus, the theory of production is the study of production functions. The production function of a firm can be studied by holding the quantities of some factors fixed, while varying the amount of other factors.

Isoquants

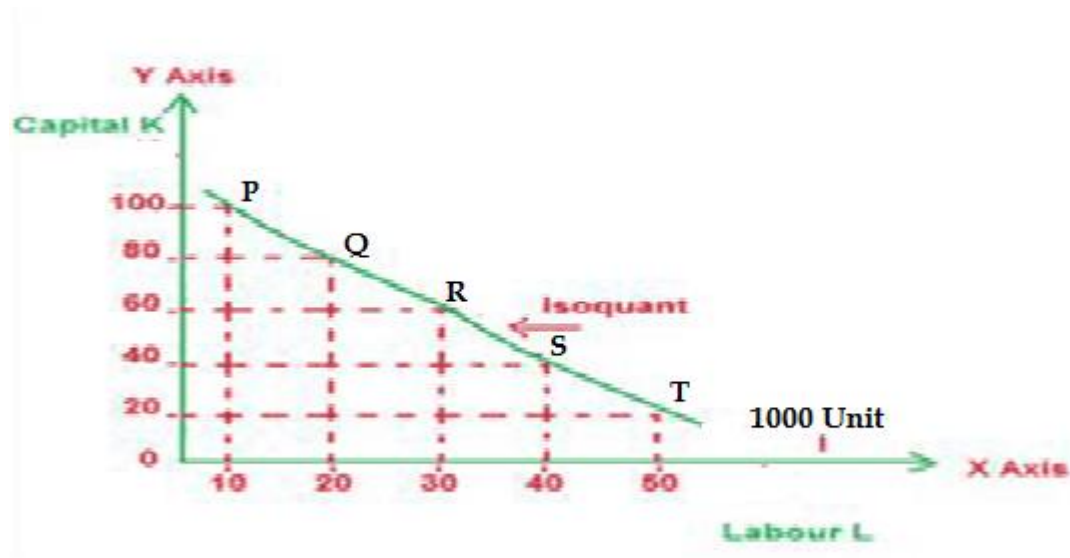
Isoquants are termed as equal product curves and are similar to the indifference curve of the thesis of consumer's behavior. An Isoquant depicts all those input combinations which are competent of manufacturing the same level of productivity.

The concept of Isoquant can be adequately known from the below presentation. It is assumed that two aspects labor and capital are being employed to produce a commodity. Each of the aspect combinations P, Q, R, S and T manufactures the same level of productivity. Each of the aspect with factor combination P comprising of 10 units of labor and 100 units of capital manufactures the offered 1000 units of productivity.

Likewise, combination Q comprising of 20 units of labor and 80 units of capital, R combination comprising of 30 units of labor and 60 units of capital, combination S comprising of 40 units of labor and 40 units of capital whilst combination T comprises of 50 units of labor and 20 units of capital are competent of producing the same volume of productivity.

The diagrams represents the plotted points of the given combinations and by combining them we procure an Isoquant depicting that each combination depicted on it can manufacture 1000 units of productivity.

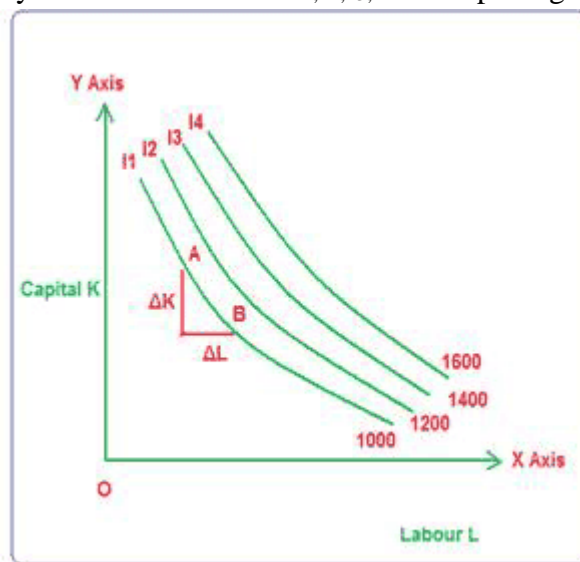
Factor Combination	Labour	Capital
P	10	100
Q	20	80
R	30	60
S	40	40



An indifference curve depicts all those combinations of two commodities which provide the same units of productivity to a producer .

Isoquant Map

This is the reason why normally label indifference curves by ordinal numbers as I_1, I_2, I_3, I_4 etc depicting that a higher indifference curve



depicting a greater level of productivity than a lower one,

Alternatively, we can label Isoquants in the physical units of productivity without any complexity. Manufacturing of a decent being a physical occurrence tends itself meagerly to complete measurement in physical units. Since every Isoquant depicts definite level of manufacturing, it is feasible to say by how much one Isoquant depicts higher or lesser output than another.

In the second diagram we have drawn an Isoquant map or equal product map with a set of four Isoquants which represent 1000, 1200, 1400 and 1600 units of productivity correspondingly. Then, from this group of Isoquants it is very simple to decide by how much manufacture level on one Isoquant curve is higher or lesser than another.

PROPERTIES OF ISOQUANT

1. *An isoquant lying above and to the right of another isoquant represents a higher level of output.*

This is because of the fact that on the higher isoquant, we have either more units of one factor of production or more units of both the factors. This has been illustrated in figure 3. In figure 3, points A and B lie on the isoquant IQ_1 and IQ_2 respectively.

2. *Two isoquants cannot cut each other.*

Just as two indifference curves cannot cut each other, two isoquants also cannot cut each other. If they intersect each other, there would be a contradiction and we will get inconsistent results. This can be illustrated with the help of a diagram as in figure 4. 3. Isoquants are convex to the origin

3. *An isoquant must always be convex to the origin.*

This is because of the operation of the principle of diminishing marginal rate of technical substitution. MRTS is the rate at which marginal unit of an input can be substituted for another input making the level of output remain the same.

4. *No isoquant can touch either axis.*

If an isoquant touches the X-axis it would mean that the commodity can be produced with OL units of labor and without any unit of capital.

5. *Isoquants are negatively sloped.*

An isoquant slopes downwards from left to right. The logic behind this is the principle of diminishing marginal rate of technical substitution. In order to maintain a given output, a reduction in the use of one input must be offset by an increase in the use of another input.

Lesson plan 11

The law of variable proportions

The law of variable proportions states that as the quantity of one factor is increased, keeping the other factors fixed, the marginal product of that factor will eventually decline. This means that up to the use of a certain amount of variable factor input, marginal product of the factor input may increase and after a certain stage it starts diminishing. When the variable factor becomes relatively abundant, the marginal product may become negative.

Assumptions: The law of variable proportions holds well under the following conditions:

Constant State of Technology: First, the state of technology is assumed to be given and unchanged. If there is improvement in the technology, then the marginal product may rise instead of diminishing.

Fixed Amount of Other Factors: Secondly, there must be some inputs whose quantity is kept fixed. It is only in this way that we can alter the factor proportions and know its effects on output. The law does not apply if all factors are proportionately varied.

Possibility of Varying the Factor proportions: Thirdly, the law is based upon the possibility of varying the proportions in which the various factors can be combined to produce a product. The law does not apply if the factors must be used in fixed proportions to yield a product.

Illustration of the Law:

The law of variable proportion is illustrated in the following table and figure. Suppose there is a given amount of land in which more and more labour (variable factor) is used to produce wheat.

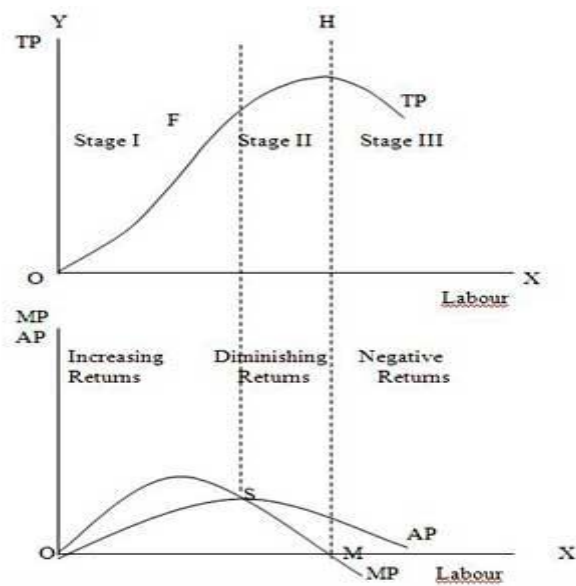
Units of Labor	Total Product	Marginal Product	Average Product
1	2	2	2
2	6	4	3
3	12	6	4
4	16	4	4
5	18	2	3.6
6	18	0	3
7	14	-4	2
8	8	-6	1

It can be seen from the table that the marginal product of labor initially rises and beyond the use of three units of labor, it starts diminishing. The use of six units of labor does not add anything to the total production of wheat. Hence, the marginal product of labor

has fallen to zero. Beyond the use of six units of labor, total product diminishes and therefore marginal product of labor becomes negative. Regarding the average product of labor, it rises up to the use of third unit of labor and beyond that it is falling throughout.

Three Stages of the Law of Variable Proportions: These stages are illustrated in the following figure where labor is measured on the X-axis and output on the Y-axis.

Stage I. Stage of Increasing Returns: In this stage, total product increases at an increasing rate up to a point. This is because the efficiency of the fixed factors increases as additional units of the variable factors are added to it. In the figure, from the origin to the point F, slope of the total product curve TP is increasing i.e. the curve TP is concave upwards up to the point F, which means that the marginal product MP of labor rises. The point F where the total product stops increasing at an increasing rate and starts increasing at a diminishing rate is called the point of inflection. Corresponding vertically to this point of inflection marginal product of labor is maximum, after which it diminishes. This stage is called the stage of increasing returns because the average product of the variable factor increases throughout this stage. This stage ends at the point where the average product curve reaches its highest point.



Stage 2. Stage of Diminishing Returns: In this stage, total product continues to increase but at a diminishing rate until it reaches its maximum point H where the second stage ends. In this stage both the marginal product and average product of labour are diminishing but

are positive. This is because the fixed factor becomes inadequate relative to the quantity of the variable factor. At the end of the second stage, i.e., at point M marginal product of labor is zero which corresponds to the maximum point H of the total product curve TP. This stage is important because the firm will seek to produce in this range.

Stage 3. Stage of Negative Returns: In stage 3, total product declines and therefore the TP curve slopes downward. As a result, marginal product of labor is negative and the MP curve falls below the X-axis. In this stage the variable factor (labor) is too much relative to the fixed factor.

Importance and Applicability of the Law of Variable Proportion:

The Law of Variable Proportion has universal applicability in any branch of production. It forms the basis of a number of doctrines in economics. The Malthusian theory of population stems from the fact that food supply does not increase faster than the growth in population because of the operation of the law of diminishing returns in agriculture.

Ricardo also based his theory of rent on this principle. According to him rent arises because the operation of the law of diminishing return forces the application of additional doses of labor and capital on a piece of land. Similarly the law of diminishing marginal utility and that of diminishing marginal physical productivity in the theory of distribution are also based on this theory.

Lesson plan 12

Laws of return to scale

The Laws of Returns to Scale:

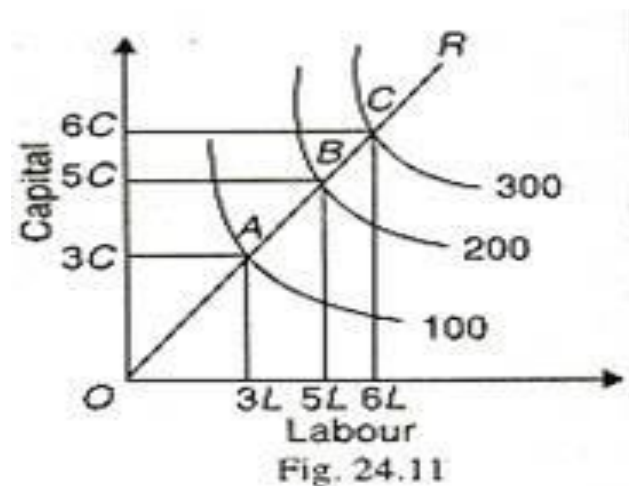
The laws of returns to scale can also be explained in terms of the isoquant approach. The laws of returns to scale refer to the effects of a change in the scale of factors (inputs) upon output in the long-run when the combinations of factors are changed in some proportion. If by increasing two factors, say labor and capital, in the same proportion, output increases in exactly the same proportion, there are constant returns to scale. If in order to secure equal increases in output, both factors are increased in larger proportionate units, there are decreasing returns to scale. If in order to get equal increases in output, both factors are increased in less than smaller proportionate units, there are increasing returns to scale.

The returns to scale can be shown diagrammatically on an expansion path “by the distance between successive ‘multiple-level-of-output’ isoquants, that is, isoquants that show levels of output which are multiples of some base level of output, e.g., 100, 200, 300, etc.”

Increasing Returns to Scale:

Figure shows the case of increasing returns to scale where to get equal

Increases in output, lesser proportionate increases in both factors, labour and capitals are required.



It follows that in the figure:

100 units of output require $3C + 3L$

200 units of output require $5C + 5L$

300 units of output require $6C + 6L$

So that along the expansion path OR,

$OA > AB > BC$. In this case, the production function is homogeneous of degree greater than one.

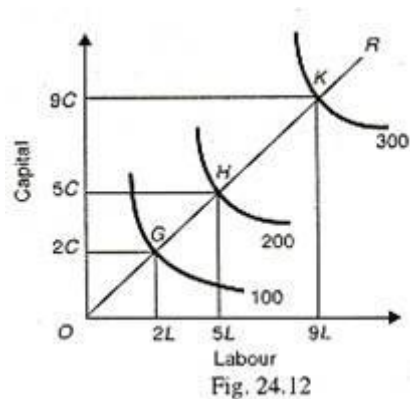
The increasing returns to scale are attributed to the existence of indivisibilities in machines, management, labor, finance, etc. Some items of equipment or some activities have a minimum size and cannot be divided into smaller units. When a business unit expands, the returns to scale increase because the indivisible factors are employed to their full capacity.

Increasing returns to scale also result from specialization and division of labor. When the scale of the firm expands there is wide scope for specialization and division of labor. Work can be divided into small tasks and workers can be concentrated to narrower range of processes. For this, specialized equipment can be installed. Thus with specialization, efficiency increases and increasing returns to scale follow.

Further, as the firm expands, it enjoys internal economies of production. It may be able to install better machines, sell its products more easily, borrow money cheaply, procure the services of more efficient manager and workers, etc. All these economies help in increasing the returns to scale more than proportionately.

Decreasing Returns to Scale:

Figure shows the case of decreasing returns where to get equal increases in output, larger proportionate increases in both labor and capital are required.



It follows that:

100 units of output require $2C + 2L$

200 units of output require $5C + 5L$

300 units of output require $9C + 9L$

So that along the expansion path OR, $OG < GH < HK$.

In this case, the production function is homogeneous of degree less than one.

Returns to scale may start diminishing due to the following factors. Indivisible factors may become inefficient and less productive. The firm experiences internal dis-economies. Business may become unwieldy and produce problems of supervision and coordination. Large management creates difficulties of control and rigidities

.

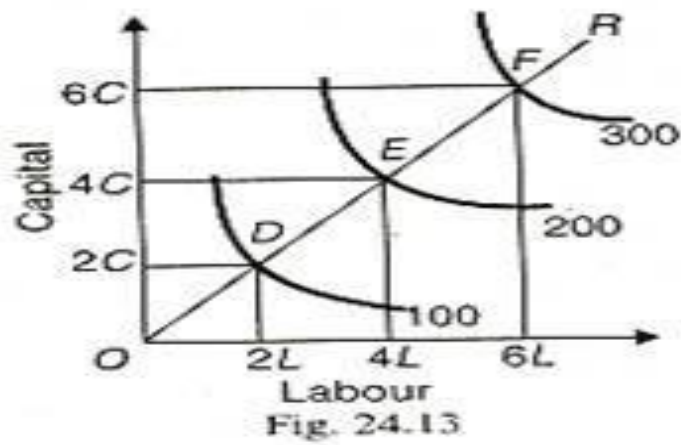
To these internal dis-economies are added external dis-economies of scale. These arise from higher factor prices or from diminishing productivities

Constant Returns to Scale:

Figure shows the case of constant returns to scale. Where the distance between the isoquants 100, 200 and 300 along the expansion path OR is the same, i.e., $OD = DE = EF$.

It means that if units of both factors, labor and capital, are doubled, the output is doubled.

To treble output, units of both factors are trebled.



It follows that:

100 units of output require 1 $(2C + 2L) = 2C + 2L$

200 units of output require 2 $(2C + 2L) = 4C + 4L$

300 its of output require 3 $(2C + 2L) = 6C + 6L$

In OR expiation line $OD = DE = EF$.

The returns to scale are constant when internal economies enjoyed by a firm are neutralized by internal dis-economies so that output increases in the same proportion. Another reason is the balancing of external economies and external dis-economies. Constant returns to scale also result when factors of production are perfectly divisible, substitutable, and homogeneous and their supplies are perfectly elastic at given prices. That is why, in the case of constant returns to scale, the production function is homogeneous of degree one.

LESSION-26

Depreciation

Meaning of Depreciation:

“The term Depreciations means a fall in the value of an asset with use and passage of time for the fixed assets like plant, machinery, building, furniture fixtures etc. there is a decline in the value due to use and it is termed as Depreciation.”

Most of the fixed assets are worn out while in use over a period of time. This wear and tear is bound to occur but it can be minimized up-to some extent by proper care and maintenance

Depreciation refers to the continuous decline in the book value of fixed assets. It does not occur because of any one specific reason but it is a combination of various factors that work together which eventually lead to depreciation.

Depreciation occurs due to normal wear and tear, regular consumption, passage of time or obsolescence of technology. These are some of the major causes of depreciation. It is charged every year to the Profit and Loss account so that cost of asset is equally divided over the years.

Depreciation is that part of the original cost of a fixed asset that is consumed during period of use by the business. The annual charge to profit and loss account/income statement for depreciation is based upon an estimate of how much of the overall economic usefulness of a fixed asset has been

used up in that accounting period. It is an expense for services consumed in the same way as expenses are incurred for items such as wages, rent or electricity. Because it is charged as an expenses to the profit and loss account/income statement, depreciation reduces net profit.

For example, if a PC cost \$600 and was expected to be used for three years, it might be estimated at the end of the first year that a third of its overall usefulness had been consumed. Depreciation would then be charged at an amount equal to one third of the cost of the PC, i.e. \$200. Profit would be reduced by \$200 and the value of the PC in the balance sheet would be reduced from \$600 to \$400.

Using an example of a van and the petrol it consumes, you can see that the only real difference between the expense of depreciation for the van and the expense of petrol incurred in order to use the van, is that the petrol expense is used up in a day or two, whereas the expense for use of the van is spread over several years. Both are expenses of the business.

Causes of depreciation

Depreciation is a ratable reduction in the carrying amount of a fixed asset. Depreciation is intended to roughly reflect the actual consumption of the underlying asset, so that the carrying amount of the asset has been greatly reduced to its salvage value by the time its useful life is over. But why do we need depreciation at all? The causes of depreciation are:

1. Physical Deterioration:

Wear and Tear:

When a motor vehicle or machinery or fixtures and fittings are used they eventually wear out. Some last many years, others last only a few year. This is also true of buildings, although some may last for a long time.

Erosion, Rust, Rot and Decay:

Land may be eroded or wasted away by the action of wind, rain, sun and other elements of nature. Similarly, the metals in motor vehicles or machinery will rust away. Wood will not eventually. Decay is a process which will also be present due to the elements of nature and the lack of proper attention.

2. Depreciation due to economic factor

This arises when an asset is no longer used because of the growth and changes in the size of the business. For example, a small ferryboat that is operated by a business at a coastal resort will become entirely inadequate when the resort becomes more popular. Then it will be found that it would be more efficient and economical to operate a large ferryboat, and so the smaller boat will be put out of use by the business. In this case also it does not mean that the ferryboat is no longer in good working order, nor that it is obsolete. It may be sold to a business at a smaller resort.

3. Depreciation due to Time Factor:

Obviously time is needed for wear and tear, erosion, etc., and for obsolescence and inadequacy to take place. However, there are fixed assets to which the time factor is connected a different way. These assets which have a legal life fixed in terms of years. For instance, you may agree to rent some buildings for ten years. This is normally called a lease. When the years have passed, the lease is worth nothing to you, as it has finished. Whatever you paid for the lease is now of no value.

A similar asset is where you buy a patent so that only you are able to produce something when the patent's time has finished it then has no value.

4. Technological Depreciation

Obsolescence means being “out-of-date”. With improvement in technology, a better quality asset replaces the existing assets every now and then. The emergence of newer and more efficient assets make the older ones outdated. This poses the need to depreciate the asset as it has become less valuable. It occurs due to these factors:

- Better technological changes;
- Improvements in production methods;
- Change in tastes of customer causing a fluctuation in market demand for the product;
- Legal factors or other descriptions.

5. Abnormal Factors

There are certain factors which do not cause continuous or gradual decline in the value of assets. Such factors are known as abnormal factors. For eg – fire outbreak, earthquakes or any other natural calamity. These cause a permanent diminution in the value of fixed assets and therefore need to be accounted as and when they occur.

6. Depreciation Due to Deferred Maintenance

If the instructions of maintenance recommended by the manufacturer are not followed properly by the user the value of asset may be reduced and depreciation in value because of this reduction is known as depreciation due to deferred maintenance and neglect.

7. Functional Depreciation

This type of depreciation results not from a deterioration in the assets ability to perform duties of its intended purpose but from a change in demand for the services it can render. Such a change may occur because of the fact that the asset is no more profitable to use. Depreciation resulting from a

change in the need for the service of an asset/equipment may be result of technological developments these developments cause obsolescence of the existing assets.

8. Depletion

Other assets are of wasting character, perhaps due to the extraction of the raw materials from them. These materials are then either used by the business to make something else, or are sold in their raw state to other businesses. Natural resources such as mines, quarries and oil wells come under this heading. To provide for the consumption for an asset of a wasting character is called depreciation for depletion.

Thus the main objectives providing depreciation as follows:

- To keep annual depreciation of various assets in operation.
- To provide reserve fund for the proper repair and maintenance of plant and equipment.
- To provide depreciation data for policy formulation.
- To provide depreciation for replacement of old assets
- To know the financial position of the firm

(a) Estimated life of the equipment/asset in years.

(b) Estimated scrap value of the asset.

(c) Cost the equipment required for replacement.

Factors Affecting Depreciation

- Must be used for business purpose
- Having estimated life period
- Its value gradually decreases

LESSON PLAN -27

Depreciation methods based on time

Straight line method

Declining balance method

Sum-of-the-years'-digits method

◆ Depreciation based on use (activity)

Straight line method

$$\text{Depreciation} = (\text{Cost} - \text{Residual value}) / \text{Useful life}$$

[Example, Straight line depreciation]

On April 1, 2011, Company A purchased an equipment at the cost of \$140,000. This equipment is estimated to have 5 year useful life. At the end of the 5th year, the salvage value (residual value) will be \$20,000. Company A recognizes depreciation to the nearest whole month. Calculate the depreciation expenses for 2011, 2012 and 2013 using straight line depreciation method.

Depreciation for 2011

$$= (\$140,000 - \$20,000) \times 1/5 \times 9/12 = \$18,000$$

Depreciation for 2012

$$= (\$140,000 - \$20,000) \times 1/5 \times 12/12 = \$24,000$$

Depreciation for 2013

$$= (\$140,000 - \$20,000) \times 1/5 \times 12/12 = \$24,000$$

Declining balance method

Depreciation = Book value x Depreciation rate

Book value = Cost - Accumulated depreciation

Example, declining balance depreciation method

On April 1, 2011, Company purchased equipment at the cost of \$140,000. This equipment is estimated to have 5 year useful life. At the end of the 5th year, the salvage value (residual value) will be \$20,000. Company A recognizes depreciation to the nearest whole month. Calculate the depreciation expenses for 2011, 2012 and 2013 using declining balance depreciation method.

$$(*1) \$140,000 \times 20\% \times 9/12 = \$21,000$$

$$(*2) \$119,000 \times 20\% \times 12/12 = \$23,800$$

$$(*3) \$95,200 \times 20\% \times 12/12 = \$19,040$$

$$(*4) \$76,160 \times 20\% \times 12/12 = \$15,232$$

$$(*5) \$60,928 \times 20\% \times 12/12 = \$12,185.60$$

Depreciation rate for double declining balance method
= Straight line depreciation rate \times 200%

Depreciation rate for 150% declining balance method
= Straight line depreciation rate \times 150%

Example, Double declining balance depreciation]

On April 1, 2011, Company A purchased an equipment at the cost of \$140,000. This equipment is estimated to have 5 year useful life. At the end of the 5th year, the salvage value (residual value) will be \$20,000. Company A recognizes depreciation to the nearest whole month. Calculate the depreciation expenses for 2011, 2012 and 2013 using double declining balance depreciation method.

Useful life = 5 years --> Straight line depreciation rate = $1/5 = 20\%$ per year

Depreciation rate for double declining balance method
= $20\% \times 200\% = 20\% \times 2 = 40\%$ per year

Depreciation for 2011
= $\$140,000 \times 40\% \times 9/12 = \$42,000$

Depreciation for 2012
= $(\$140,000 - \$42,000) \times 40\% \times 12/12 = \$39,200$

Depreciation for 2013
= $(\$140,000 - \$42,000 - \$39,200) \times 40\% \times 12/12 = \$23,520$

Double Declining Balance Depreciation Method

Year	Book Value at the beginning	Depreciation Rate	Depreciation Expense	Book Value at the year-end
2011	\$140,000	40%	\$42,000 (*1)	\$98,000
2012	\$98,000	40%	\$39,200 (*2)	\$58,800
2013	\$58,800	40%	\$23,520 (*3)	\$35,280
2014	\$35,280	40%	\$14,112 (*4)	\$21,168
2015	\$21,168	40%	\$1,168 (*5)	\$20,000

(*1) $\$140,000 \times 40\% \times 9/12 = \$42,000$

(*2) $\$98,000 \times 40\% \times 12/12 = \$39,200$

(*3) $\$58,800 \times 40\% \times 12/12 = \$23,520$

(*4) $\$35,280 \times 40\% \times 12/12 = \$14,112$

(*5) $\$21,168 \times 40\% \times 12/12 = \$8,467$

--> Depreciation for 2015 is \$1,168 to keep book value same as salvage value.

--> $\$21,168 - \$20,000 = \$1,168$ (At this point, depreciation stops.)

[Example, 150% declining balance depreciation]

On April 1, 2011, Company A purchased an equipment at the cost of \$140,000. This equipment is estimated to have 5 year useful life. At the end of the 5th year, the salvage value (residual value) will be \$20,000. Company A recognizes depreciation to the nearest whole month. Calculate the depreciation expenses for 2011, 2012 and 2013 using double declining balance depreciation method.

Useful life = 5 years --> Straight line depreciation rate = $1/5 = 20\%$ per year

Depreciation rate for double declining balance method

= $20\% \times 150\% = 20\% \times 1.5 = 30\%$ per year

Depreciation for 2011

$$= \$140,000 \times 30\% \times 9/12 = \$31,500$$

Depreciation for 2012

$$= (\$140,000 - \$31,500) \times 30\% \times 12/12 = \$32,550$$

Depreciation for 2013

$$= (\$140,000 - \$31,500 - \$32,550) \times 30\% \times 12/12 = \$22,785$$

Lesson plan- Break-even point analysis

Explanation of break-even point:

The point at which total of fixed and variable costs of a business becomes equal to its total revenue is known as break-even point (BEP). At this point, a business neither earns any profit nor suffers any loss. Break-even point is therefore also known as no-profit, no-loss point or zero profit point. Calculation of break-even point is important for every business because it tells business owners and managers how much sales are needed to cover all fixed as well as variable expenses of the business or the sales volume after which the business will start generating profit. The computation of sales volume required to break-even is known as ***break-even analysis***. The concept explained above can also be presented as follows:

When there is a profit:

$$\text{Revenues} > \text{Variable cost} + \text{fixed cost}$$

At break-even point (BEP):

$$\text{Revenues} = \text{Variable cost} + \text{fixed cost}$$

When there is a loss:

$$\text{Revenues} < \text{Variable cost} + \text{fixed cost}$$

Assumptions-

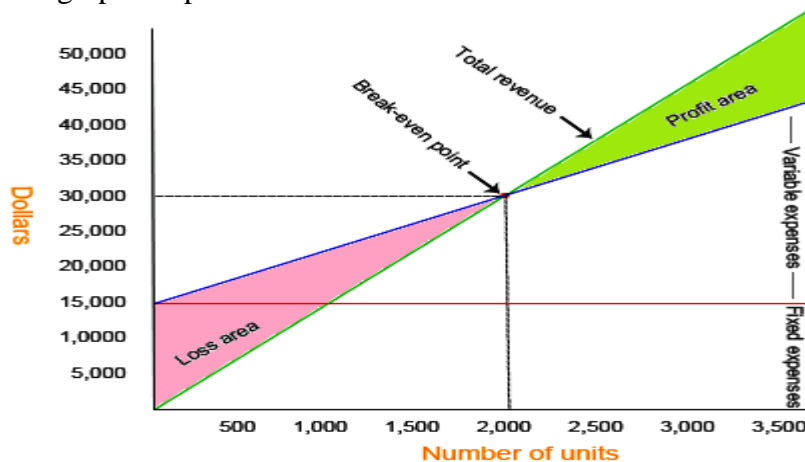
1. It assumes that fixed costs remain the same at different level of activity
2. It assumes that the total cost line is shown as a straight line when in actual fact, costs do not usually vary in direct proportion to volume. Each unit produced and sold may not necessarily incur the same variable cost as attempts to sell more units may increase the variable cost at a faster rate than activity
3. It assumes that revenue is perfectly variable with activity, showing a straight line on the break-even chart which is unrealistic as very often in order to increase sales volume, it may be necessary to give extra discount or reduce the selling price. The sale revenue line will therefore no longer be linear but curved.
4. Break-even charts are only true within the minimum and maximum ranges of activity. Any attempt to determine figures outside this range of activity is not valid.
5. Break-even analysis assumes that all units produced are sold
6. Break-even chart has a life span as the nature of variable and fixed cost change with time. It would then be necessary to construct new charts based on different circumstances

7.0 In a multi-product firm, each possible product mix will tend to incur different costs so that with any change in the product mix, a new break-even chart is required. Thus in a break-even chart of such firm, the sales mix is assumed to remain constant throughout its level of activity

8. It assumes as in conventional accounting that monetary values are stable. In order to establish the break-even point in real terms it may be necessary to adjust revenues and costs to current purchasing powers.

Graphical presentation (Preparation of break-even chart)

The graphical presentation of dollar and unit sales needed to break-even is known as break-even chart



Explanation of the graph:

The number of units have been presented on the X-axis (horizontally) where as dollars have been presented on Y-axis (vertically).

The straight line in red color represents the total annual fixed expenses of \$15,000.

The blue line represents the total expenses. Notice that the line has a positive or upward slop that indicates the effect of increasing variable expenses with the increase in production.

The green line with positive or upward slop indicates that every unit sold increases the total sales revenue.

The total revenue line and the total expenses line cross each other. The point at which they cross each other is the ***break-even point***. Notice that the total expenses line is above the total revenue line before the point of intersection and below after the point of intersection. It tells us that the business suffers a loss before the point of intersection and makes a profit after this point. The break-even point in the above graph is 2,000 units or \$30,000 that agrees with the break-even point computed using equation and contribution margin methods above.

The difference between the total expenses line and the total revenue line before the point of intersection (BE point) is the ***loss area***. The loss area has been filled with pink color. Notice that this area reduces as the number of units sold increases. It means every additional unit sold before the break-even point reduces the loss.

The difference between the total expenses line and the total revenue line after the point of intersection (BE point) is the profit area. The profit area has been filled with green color. Notice that this area increases as the number of units sold increases. It means every additional unit sold after the break-even point increases the profit of the business.

Limitations-

First and foremost limitation of this analysis is that it does not take into account demand side related problems and in this competitive world the emphasis should first on demand and then decision should be taken whether to produce that product or not. So for example if breakeven point of a particular product is coming 150 units and company produces 200 units taking into account breakeven point but future demand for that product falls to 100 units than whole exercise of this analysis becomes futile.

Fixed costs are assumed to be constant irrespective of production while doing this analysis which sometimes can lead to wrong estimate as fixed costs sometimes changes with changes in production.

It requires a separate department or team of people to carry this operation leading to extra expenditure for an organization.

If a company does not focus on sales but keep focusing on cost side issues than it can never grow, it's like a salaried individual who keeps thinking about how to reduce personal expenditure instead of thinking how to increase sources of income.

If complete data on cost structure of a product is not available than there is no benefit of doing this analysis as it would yield incorrect result.

Importance of Break-Even Analysis

- **Manages the size of units to be sold:** With the help of break-even analysis, the company or the owner comes to know how many units need to be sold to cover the cost. The variable cost and the selling price of an individual product and the total cost are required to evaluate the break-even analysis.
- **Budgeting and setting targets:** Since the company or the owner knows at which point a company can break-even, it is easy for them to fix a goal and set a budget for the firm accordingly. This analysis can also be practised in establishing a realistic target for a company.
- **Manage the margin of safety:** In a financial breakdown, the sales of a company tend to decrease. The break-even analysis helps the company to decide the least number of sales required to make profits. With the margin of safety reports, the management can execute a high business decision.
- **Monitors and controls cost:** Companies' profit margin can be affected by the fixed and variable cost. Therefore, with break-even analysis, the management can detect if any effects are changing the cost.
- **Helps to design pricing strategy:** The break-even point can be affected if there is any change in the pricing of a product. For example, if the selling price is raised, then the quantity of the product to be sold to break-even will be reduced. Similarly, if the selling price is reduced, then a company needs to sell extra to break-even.

Components of Break-Even Analysis

- **Fixed costs:** These costs are also known as overhead costs. These costs materialise once the financial activity of a business starts. The fixed prices include taxes, salaries, rents, depreciation cost, labour cost, interests, energy cost, etc.
- **Variable costs:** These costs fluctuate and will decrease or increase according to the volume of the production. These costs include packaging cost, cost of raw material, fuel, and other materials related to production.

Uses of Break-Even Analysis

- **New business:** For a new venture, a break-even analysis is essential. It guides the management with pricing strategy and is practical about the cost. This analysis also gives an idea if the new business is productive.
- **Manufacture new products:** If an existing company is going to launch a new product, then they still have to focus on a break-even analysis before starting and see if the product adds necessary expenditure to the company.
- **Change in business model:** The break-even analysis works even if there is a change in any business model like shifting from retail business to wholesale business. This analysis will help the company to determine if the selling price of a product needs to change.

Lesson plan-32

Algebra or Mathematical Equation Method As mentioned above

The BREAK EVEN POINT can be calculated by

1. In terms of physical unit (in quantity)

Q =physical output of the firm

Q_{BEP} =output at BEP

P =price per unit/average revenue

TR =total revenue= $P*Q$

TFC = total fixed cost

TVC =total variable cost= $Q*AVC$

TC = total cost= $TFC+TVC$

AFC =average fixed cost

AVC =average variable cost

AC =average cost= $AVC+AFC$

We know that at BEP

$TR=TC$

Applying $TR=P*Q_{BEP}$ and $TC=TFC+TVC$ we get

$P*Q_{BEP}=TFC+TVC$

$=TFC+(Q_{BEP}*AVC)$ (since $TVC=Q_{BEP}*AVC$)

$$P \cdot Q_{\text{BEP}} - Q_{\text{BEP}} \cdot \text{AVC} = \text{TFC}$$

$$Q_{\text{BEP}}(P - \text{AVC}) = \text{TFC}$$

$$Q_{\text{BEP}} = \text{TFC} / (P - \text{AVC}) = \text{TFC} / \text{ACM}$$

Hence the break-even quantity will be

$$Q_{\text{BEP}} = \text{Total Fixed Cost} / \text{Average Contribution Margin}$$

For Example-1:

The fixed cost of producing Moto-E mobile is ₹1, 00,000 and variable cost per Moto-E mobile is ₹3,500 and the selling price of the same is ₹4,500. Company's break event quantity (Q) as per equation -1 will be calculated as follow;

$$Q_{\text{BEP}} = \frac{\text{FC}}{P - \text{AVC}} = 1, 00,000 / (4,500 - 3,500) = 100 \text{ units}$$

2. In terms of sales value.

To calculate the break-even point in terms of revenue divide the contribution margin by sales price or represent the contribution margin to sales ratio i.e.

$$S_{\text{BEP}} = \text{Total Fixed Cost} / \text{Contribution Margin to sales ratio}$$

Or

$$\text{Break-Even Sales} = \text{Fixed Costs} / \text{Contribution Margin Percentage}$$

Or

$$\text{Break-Even Sales} = \text{Fixed Costs} * \text{Sales} / (\text{Sales} - \text{Variable Costs})$$

Symbolically

$$\text{or } S_{\text{BEP}} = \frac{\text{TFC}}{\frac{\text{P-AVC}}{\text{P}}}$$

$$\text{or } S_{\text{BEP}} = \frac{\text{TFC} * \text{P}}{\text{P-AVC}}$$

$$\text{or } S_{\text{BEP}} = \frac{\text{TFC}}{\text{P/V Ratio}}$$

$$\text{BEP } (S_{\text{BEP}}) = \text{TFC} / 1 - (\text{TVC} / \text{TR})$$

[Applying $P = (\text{TR} / Q)$ and $\text{AVC} = (\text{TVC} / Q)$]

Example

Let us take the example of a company that is engaged in the business of leather shoe manufacturing. According to the cost accountant, last year the total variable costs incurred add up to be \$1,300,000 on sales revenue of \$2,000,000. Calculate the break-even sales for the company if the fixed costs incurred during the year stood at \$500,000.

- Break-Even Sales = $\$500,000 * \$2,000,000 / (\$2,000,000 - \$1,300,000)$
- Break-Even Sales = **\$1,428,571**

3. BEP as percentage of capacity

We all know that at BEP the capacity is not the full capacity of firm

It is below the full capacity of firm

So

$$\text{Percentage BEP} = \frac{Q_{BEP}}{Q_{MAX}} \times 100$$

Example

Full capacity of plant is 200 units; the break even capacity of plant is 100 units find Percentage of full capacity of plant.

$$\text{Percentage BEP} = \frac{Q_{BEP}}{Q_{\max}} \times 100$$

$$\text{Percentage BEP} = 100/200 \times 100 = 50\%$$

Other important things are:

1. P/V Ratio

What is Profit Volume ratio?

The Profit Volume (P/V) Ratio is the measurement of the rate of change of profit due to change in volume of sales. It is one of the important ratios for computing profitability as it indicates contribution earned with respect of sales.

$$\text{P/V ratio} = \frac{\text{sale} - \text{variable cost}}{\text{sales}} \times 100$$

Or

$$\text{P/V Ratio} = \frac{\text{P} - \text{AVC}}{\text{P}}$$

Or

$$\text{P/V Ratio} = \frac{\text{Change in Profit}}{\text{Change in Sales}} \times 100$$

3. Calculation of Volume of Sales to Attain Target Profit:

Break-Even analysis is used to know the volume of sales necessary to achieve a given profit. Required volume of sales is calculated with the help of the following formula:

For achieving the target profit

$$\text{Sales Volume for target profit} = \frac{\text{TFC} + \text{Target Profit}}{\text{P} - \text{AVC}} \text{ in Units}$$

For Example: The fixed cost of producing Moto-E mobile is Rs 1, 00,000 and variable cost per Moto-E mobile is Rs 3,500 and the selling price of the same is Rs 4,500. What should be the sales volume of the company to get Rs 20, 000 profits?

$$\begin{aligned}\text{Volume of sales for target profit} &= \frac{1,00,000 + 20,000}{4,500 - 3,500} \\ &= \frac{1,20,000}{1,000} = 1,200 \text{ Unit}\end{aligned}$$

For Sales Volume

For achieving the target profit

$$\text{Sales Volume for target profit} = \frac{\text{TFC} + \text{Target Profit}}{\text{P/V Ratio}}$$

4. **Margin of Safety**

The margin of Safety represents the difference between the sales at breakeven point and the total actual sales i.e

Margin of Safety = Actual Sales- Break Even Sales

It is the limit to which the sales may fall yet the firm may have no fear of loss.

Three method of measuring of margin of safety are as follow;

$$1. \text{ Mos} = \frac{\text{Profit} \times \text{Sales}}{\text{P/V Ratio}}$$

$$2. \text{ MOS} = \frac{\text{Actual Sales} - \text{BEP Sales}}{\text{Actual Sales}}$$

$$3. \text{ MOS} = \frac{\text{Profit}}{\text{P/V Ratio}}$$

$$4. \text{ M.S.} = \frac{\text{Profit} + \text{contribution}}{\text{sales}}$$

$$5. \text{ M.S as a percent of sales} = \frac{\text{M.S}}{\text{sales}} \times 100$$

The margin of safety can be increased

- (i) by increasing the selling price in case the demand for the product is inelastic,
- (ii) by increasing the production or sales up to capacity of the plant or by reducing selling price in case demand is elastic and
- (iii) by reducing fixed costs or variable costs or having a product mix with greater share of one having relatively more contribution per unit or higher PV ratio.

Exercise-1

Ex-

A company has the following details:

Fixed cost = Rs. 20,00,000

variable cost per unit = Rs. 100

selling price per unit = Rs. 200

Find (a) the break-even sales quantity.

(b) the break-even sales

(c) the contribution and margin of safety, if the actual production quantity is

60,000
Given that: F = Rs.20,00,000, V = Rs. 100 | unit

P = Rs. 200 | unit.

Q = actual sales = 60,000 units

$$(a) \text{ Break-even quantity} = \frac{F}{P - V} = \frac{\text{Rs.}20,00,000}{\text{Rs.}200 - \text{Rs.}100} = 20,000 \text{ units.}$$

$$(b) \text{ Break-even sales} = \frac{F}{1 - V/P} = \frac{\text{Rs.}20,00,000}{1 - \frac{\text{Rs.}100}{\text{Rs.}200}} = \text{Rs. } 40,00,000$$

$$(c) \text{ Contribution} = \text{Sales} - \text{Variable cost} = P.Q - V.Q = (P - V)Q \\ = (\text{Rs. } 200 - \text{Rs. } 100) \times 60,000 = \text{Rs. } 60,00,000$$

(d) margin of safety

$$= \text{Sales} - \text{Break-even sales} = \text{Rs.}200 \times 60,000 - \text{Rs. } 40,00,000 = \text{Rs.}80,00,000$$

EX-2

Example.14. 10. Konark Ltd. has provided the following information:

Fixed cost = Rs. 8,000

BEP = Rs. 20,000

Variable cost = Rs. 60 per unit

Calculate:

a) P/V ratio

b) Profit when sales are Rs. 40,000

c) New BEP if selling price is reduced by 10%

Soln.
$$P/V \text{ ratio} = \frac{F}{BEP} = \frac{Rs. 8,000}{Rs. 20,000} = 40\%$$

$$\text{Profit} = (\text{sales} \times P/V \text{ ratio}) - \text{Fixed Cost} = (Rs. 40,000 \times 40\%) - Rs. 8,000 = Rs. 8,000$$

$$\text{Selling price} = \frac{v}{1 - P/V \text{ ratio}} = \frac{Rs. 60}{1 - 0.40} = Rs. 100$$

If price is to reduce by 10%, then new price will be $Rs. 100 - (10\% \text{ of } Rs. 100) = Rs. 90$

$$\text{New BEP} = \frac{F}{1 - \frac{v}{p}} = \frac{Rs. 8,000}{1 - \frac{Rs. 60}{Rs. 90}} = Rs. 24,000$$

Example. 14.11. *Utkal Ltd. provides the following data for the year ended 31st March 2009*

Selling price = Rs. 10/-

Production and sales = 400 units

Variable cost per unit = Rs. 5/-

Fixed cost = Rs. 100/-

You are required to show the impact of the following actions on the P/V ratio,

BEP and Margin of Safty

- (a) The variable cost increases to Rs. 6 per unit*
- (b) The fixed cost increases to Rs. 1,500*
- (c) The selling price increases to Rs. 20 per unit.*

Soln. $P/V \text{ ratio} = \frac{SP - VC}{SP} = \frac{Rs.10 - Rs.5}{Rs.5} = 50\%$

$$BEP (\text{Sales}) = \frac{\text{fixed cost}}{P/V \text{ ratio}} = \frac{Rs.1,000}{0.5} = Rs.2,000$$

$$BEP (\text{Units}) = \frac{BE \text{ Sales}}{SP} = \frac{Rs.2,000}{Rs.10} = 200 \text{ units}$$

$$\text{Margin of Safety} = \text{Actual Sales} - BE \text{ Sales} = (400 \times Rs.10) - Rs.2,000 = 2,000/-$$

a) Impact of increase in variable cost to Rs.6 per unit:

$$P/V \text{ ratio} = \frac{Rs.10 - Rs.6}{Rs.10} = 40\%$$

$$BE \text{ Sales} = \frac{\text{fixed cost}}{P/V \text{ ratio}} = \frac{Rs.1,000}{40\%} = Rs.2,500$$

$$BE \text{ Quantity} = \frac{Rs.2500}{Rs.10} = 250 \text{ units}$$

$$\text{Margin of Safety} = (400 \times Rs.10) - Rs.2,500 = Rs. 1,500$$

(b) Impact of increase in fixed cost to Rs.1,500:

$$P/V \text{ ratio} = 50\%$$

$$BE \text{ Sales} = \frac{\text{fixed cost}}{P/V \text{ ratio}} = Rs.3,000$$

$$BE \text{ Quantity} = 300 \text{ units}$$

$$\text{Margin of Safety} = (400 \times Rs.10) - Rs.3,000 = Rs. 1,000$$

c) Impact of increase in selling price to Rs. 20 per unit:

$$P/V \text{ ratio} = 75\%$$

$$BE \text{ Sales} = \frac{\text{fixed cost}}{P/V \text{ ratio}} = Rs.1,333.33$$

$$BE \text{ Quantity} = 66.67 \text{ units}$$

$$\text{Margin of Safety} = (400 \times Rs.10) - Rs.1,333.33 = Rs. 6,666.67$$

Example.14. 9. The following figures relate to a manufacturing company:

	2007 (Rs)	2008 (Rs)
Sales	50,000	80,000
Profit	10,000	25,000

Find out:

- P/V ratio
- Fixed cost
- BEP
- Margin of safety in 2008

Soln. $P/V \text{ ratio} = \frac{\Delta P}{\Delta S} \times 100 = \frac{15,000}{30,000} \times 100 = 50\%$

Fixed cost = (sales x P/V ratio) – profit = Rs. 15,000

$BEP = \frac{F}{P/V \text{ ratio}} = \frac{Rs.15,000}{50\%} = Rs.30,000$

Margin of safety = [Actual Sales – BES] = Rs.50,000

Example.14.8. Utkal Ltd. has provided the following information

Year	Sales (Rs)	Cost (Rs)
2007	1,20,000	1,11,000
2008	1,40,000	1,27,000

Assuming that the cost structure and the selling prices remain the same,
Find out

- BEP
- P/V ratio
- Fixed Cost
- Sales required to earn a profit of Rs.20,000/-

Soln. Profit for 2007 is Rs.1,20,000 – Rs.1,11,000 = Rs. 9,000/-

Profit for 2008 is Rs. 1,40,000 – Rs. 1,27,000 = Rs. 13,000/-

$$\text{BEP} = \frac{F}{P/V \text{ ratio}} = \frac{\text{Rs. } 15,000}{20\%} = \text{Rs. } 75,000$$

$$P/V \text{ ratio} = \frac{\Delta \text{profit}}{\Delta \text{sales}} \times 100 = \frac{13,000 - 9,000}{1,40,000 - 1,20,000} \times 100 = \frac{4000}{20000} \times 100 = 20\%$$

Fixed cost = (sales x P/V ratio) – profit

$$= (\text{Rs. } 1,20,000 \times 20\%) - \text{Rs. } 9,000 = \text{Rs. } 15,000/-$$

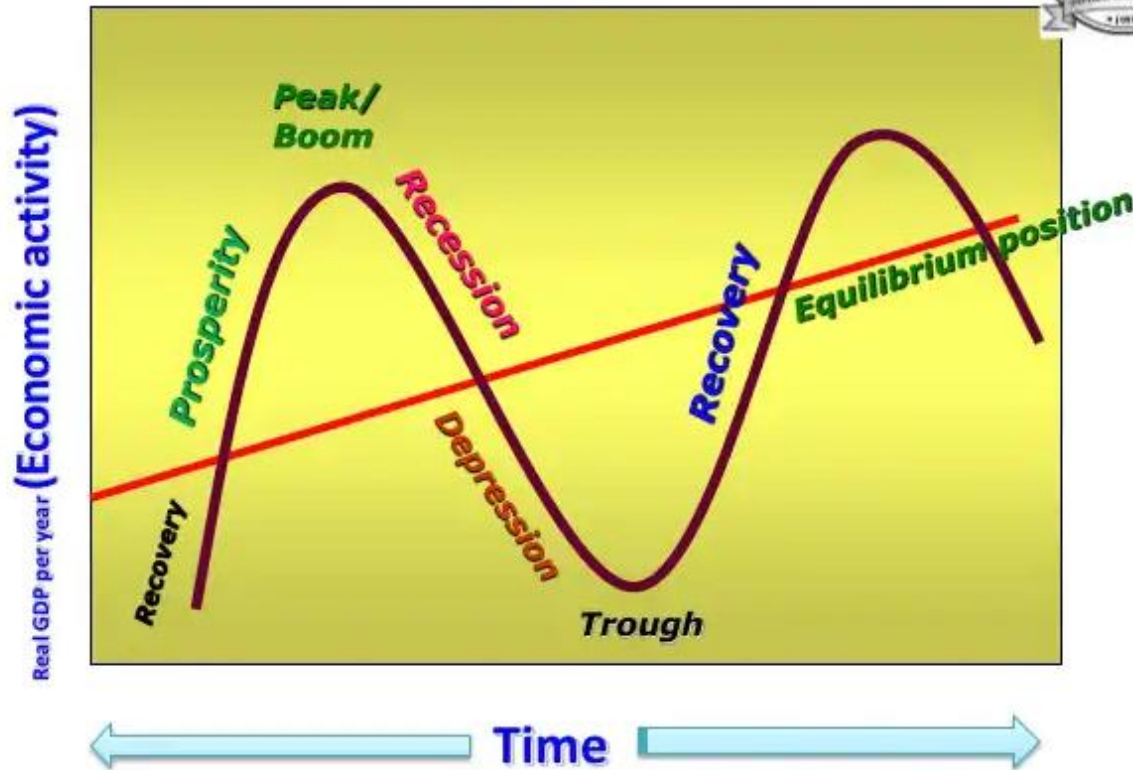
Sales required to earn a profit of Rs. 20,000/- is

$$= \frac{\text{fixed cost} + \text{desired profit}}{P/V \text{ ratio}}$$

$$= \frac{\text{Rs. } 15,000 + \text{Rs. } 20,000}{20\%} = \frac{\text{Rs. } 35,000}{0.5} = \text{Rs. } 1,75,000$$

Business Cycle

Business Cycle



INFLATION

“Inflation is a state of economy in which the value of money is falling in terms of real goods and services due to explanation of money supply.

There are two kinds of inflation:

1. Demand pull inflation:

Some economists believe that inflation is caused by increase in aggregate demand for goods. They say that demand may rise due to many causes including increased money supply for example; people may reduce savings and spend more. As aggregate demand rises for goods and services, firms try to increase production. To this they need more workers, more machines and more raw materials. If these resources are not available because they are already full employed, the firms will not be able to increase output. In this case, rising demand causes inflation.

2. Cost push inflation:

Some economists think that inflation occurs due to rising costs. When the firms pass on their increased costs to consumers in the form of higher prices inflation starts. Important sources of rise in cost include workers demand for higher wages, increase in taxes.

Causes of inflation:

a. Population explosion:

Our population is rising at a very fast that is 3%. On other hand the rate of growth of GNP is not very high that is 7.4%. Thus increase in national output is insufficient to solve the problem of scarcity of goods. Since independence, our population has increase four times.

b. Political instability:

A country's economy depends upon political stability. Political instability discourages investment and encourages speculation. Under such circumstances, the industrialist and businessman feel insecure and cannot make good plans. The government also cannot adopt affective measures to control rise in prices.

c. Imported inflation:

A very important cause of inflation in India is the existence of inflation in their countries. Since 1970's most countries are experiencing inflation. The result in the India has to import machinery, raw material and other goods at higher prices.

d. Nationalization:

Due to nationalization of industrial in 1992, people were discouraged to make investment in industrial. Moreover in India the nationalization industrial did not perform well. They become centers of insufficient production, high prices and poor quality goods were result.

e. Wages increases:

The increase in wages of workers has also contributed to inflation. Increase in wages result in higher cost of production of goods. So their price rises.

f. Climatic factors:

Indian economies heavily depend upon agriculture but due to weather condition many crops fall short of target, thus pushing up prices. For example cotton production remain stagnant and below target during previous years. Wheat production has also not kept pace with rising demand.

g. Oil crises:

The oil prices in 1973 created by a large quantity of inflation throughout the world. Import of oil is a high burden on our foreign exchange resources. At present 25 percent of our exports are used to pay for oil. From time to time, oil exporting countries increase price of oil, which raises transport cost.

h. Artificial scarcity of goods:

Frequent artificial scarcity of essential items is created (cement, ghee, oil, sugar, etc) and huge profits are charged. Similarly through smuggling, large quantity of essential goods is sent to Afghanistan and Pakistan.

Remedies of inflation:

It is the main objective of every government to take measures to control inflation.

The main measures which are used to control inflation are:

1. Monetary policy.
2. Fiscal policy.
3. Direct measures and other measures.

1. Monetary policy:

Monetary policy is a policy that influences the economy through changes in money supply and available credit. Monetary policy is adopted by central bank of country. The various monetary measures which are used to control inflation are grouped under heads.

- a. Qualitative control.
- b. Quantitative control.

There are:

1. Open market operations

2. Variation in bank rates
3. Credit rationing
4. Varying reserve requirements.

2. Fiscal policy:

Fiscal policy is the deliberate change in either government spending or taxes to simulate or slow down the economy. It is the budgetary policy of government relating to taxes, public expenses, public borrowing and deficit financing.

Fiscal policy is based upon demand management examples, raising or lowering the level of aggregate demand by controlling various. Expenses, government expenses, consumption expenses.

3. Direct measures:

It means the step of government like rationing of goods and freezing of prices and wages. The government can also increase voluntary savings of people by giving them various incentives.

Other measure:

a. Increase in output:

The most effective method to control inflation is to increase the supply of goods. For this purpose, industrial and agricultural output should be increased.

b. Control of smuggling:

All steps should be adopted to check these evils through publicity as well as punishment. Large quantity of wheat, ghee, and other essential commodities being smuggled to Afghanistan should be controlled.

c. Industrial peace:

Industrial peace should be controlled to maintain the supply of goods and avoid the danger of scarcity.

d. Control of money supply:

Volume of credit and money supply should be controlled. This can be done if tight monetary policy is followed. Decrease in money supply means less purchasing power with the people.

e. No deficit financing:

Deficit financing should be discontinued. The development expenses should be met through taxation, savings. Excessive issue of currency should not be used to meet budget deficit.

f. Population control:

Measure should be adopted to decrease the rate of population growth. The campaign of population planning has already started showing some success.

g. Simple living:

Luxurious life style should be discouraged and simple living should be adopted. The political leaders should themselves adopt simple living and provide an example for others.

NATIONAL INCOME

National income means the total value of goods and services produced annually in a country.

Or

The total amount of income accruing to a country from economic activities in a year's time is known as national income. It includes payments made to all resources in the form of wages, interest, rent and profits.

Definitions of National Income:

According to Marshall: "The labor and capital of a country acting on its natural resources produce annually a certain net aggregate of commodities, material and immaterial including services of all kinds.

Simon Kuznets has defined national income as "the net output of commodities and services flowing during the year from the country's productive system in the hands of the ultimate consumers."

Concepts of National Income and Methods of Measuring National Income:

There are four methods of measuring national income. Which method is to be used depends on the availability of data in a country and the purpose in hand.

(1) Product Method:

According to this method, the total value of final goods and services produced in a country during a year is calculated at market prices. It includes agricultural products, woods received from forests, minerals received from mines, commodities produced by industries, the contributions from transport, communications, insurance companies, lawyers, doctors, teachers, etc. are collected and assessed at market prices but the intermediary goods and services are left out

(2) Income Method:

The sum of net income received by all citizens of a country in a particular year. it includes net rents, net wages, net interest and net profits but incomes received in the form of transfer payments are not included in it.

(3) Expenditure Method:

Under this method, the total expenditure incurred by the society such as personal consumption expenditure, net domestic private investment, government expenditure on goods and services and net foreign investment.

(4) Value Added Method:

According to this method the difference between the value of material outputs and value of inputs at each stage of production is added. If all such differences are added up for all industries in the economy, we arrive at the gross domestic product.

Three Approaches to GNP:

1. Income Method to GNP:

GNP according to the Income Method = Wages and Salaries + Rents + Interest + Dividends + Undistributed Corporate Profits + Mixed Income + Direct Taxes + Indirect Taxes + Depreciation + Net Income from abroad.

2. Expenditure Method to GNP:

GNP according to the Expenditure Method = Private Consumption Expenditure (C) + Gross Domestic Private Investment (I) + Net Foreign Investment (X-M) + Government Expenditure on Goods and Services (G) = $C + I + (X - M) + G$.

3. Value Added Method to GNP:

GNP by value added = Sum of Gross value at each stage of production + net income from abroad.

Calculation of NI

Gross Domestic Product (GDP) - is the total money value of all final goods and services produced within the geographical boundaries of the country during a given period of time.

Gross Domestic Product (GDP) at Market Price –GDP at market prices means the gross value at market price of all final goods and services produced annually in a country

(1) Gross national Product (GNP) at Market Prices:

GNP at market prices means the gross value of final goods and services produced annually in a country plus net income from abroad.

GNP at Market Prices = GDP at Market Prices + Net Income from Abroad.

(2) GNP at Factor Cost:

(GNP at factor cost is the sum of the money value of the income produced by and accruing to the various factors of production in one year in a country.

GNP at market prices always includes indirect taxes levied by the government on goods which raise their prices.

GNP at factor cost is the income which the factors of production receive in return for their services alone. It is the cost of production.

Thus GNP at market prices is always higher than GNP at factor cost. Therefore, in order to arrive at GNP at factor cost, we deduct indirect taxes from GNP at market prices.

In order to protect such producers, the government helps them by granting monetary help in the form of a subsidy and to reduce the price level to market price.

Thus in order to arrive at GNP at factor cost, subsidies are added to GNP at market prices.)Thus

GNP at Factor Cost = GNP at Market Prices – Indirect Taxes + Subsidies.

indirect taxes-indirect taxes levied by the government on goods which raise their prices.

Subsidy -In order to protect such producers, the government helps them by granting monetary support in the form of a subsidy and to reduce the price level to market price.

(3) Net National Product (NNP):

NNP includes the value of total output of consumption goods and investment goods. But the process of production uses up a certain amount of fixed capital. Some fixed equipment wears out, due to damage or deterioration, and obsolete through technological changes (termed as depreciation or capital consumption allowance). In order to arrive at NNP, we deduct depreciation from GNP. So

$NNP = GNP - \text{Depreciation}$.

Depreciation- Some fixed equipment wears out, due to damage or deterioration, and obsolete through technological changes termed as depreciation or capital consumption allowance.

(4) NNP at Market Prices:

Net National Product at market prices is the net value of final goods and services evaluated at market prices in the course of one year in a country. If we deduct depreciation from GNP at market prices, we get NNP at market prices. So $NNP \text{ at Market Prices} = GNP \text{ at Market Prices} - \text{Depreciation}$.

(5) NNP at Factor Cost:

Net National Product at factor cost is the net output evaluated at factor prices such as wages and salaries, rents, profits, etc. This measure differs NNP at factor cost from NNP at market prices in the form of indirect taxes are deducted and subsidies are added to NNP at market prices in order to arrive at NNP at factor cost. Thus

$NNP \text{ at Factor Cost} = NNP \text{ at Market Prices} - \text{Indirect taxes} + \text{Subsidies}$

or

$= GNP \text{ at Market Prices} - \text{Depreciation} - \text{Indirect taxes} + \text{Subsidies}$.

$= \text{National Income}$.

Normally, NNP at market prices is higher than NNP at factor cost because indirect taxes exceed government subsidies. However, NNP at market prices can be less than NNP at factor cost when government subsidies exceed indirect taxes.

(6) Domestic Income:

Income generated (or earned) by factors of production within the country from its own resources is called domestic income or domestic product.

Domestic income includes:

(i) Wages and salaries, (ii) rents, including imputed house rents, (iii) interest, (iv) dividends, (v) undistributed corporate profits, including surpluses of public undertakings, (vi) mixed incomes consisting of profits of unincorporated firms, self-employed persons, partnerships, etc., and (vii) direct taxes.

Domestic Income = National Income - Net income earned from abroad. Thus $\text{National Income} = \text{Domestic Income} + \text{Net income earned from abroad}$.

But the net national income earned from abroad may be positive or negative. If exports exceed imports, net income earned from abroad is positive. In this case, national income is greater than domestic income. On the other hand, when imports exceed exports, net income earned from abroad is negative and domestic income is greater than national income.

(7) Private Income:

Private Income = National Income (or NNP at Factor Cost) + Transfer Payments + Interest on Public Debt — Social Security — Profits and Surpluses of Public Undertakings.

(8) Personal Income:

Personal Income = Private Income – Undistributed Corporate Profits – Profit Taxes

(9) Disposable Income:

Disposable income or personal disposable income means the actual income which can be spent on consumption by individuals and families. . Thus $\text{Disposable Income} = \text{Personal Income} - \text{Direct Taxes}$.

But the whole of disposable income is not spent on consumption and a part of it is saved. Therefore $\text{Disposable Income} = \text{Consumption Expenditure} + \text{Savings}$.

$\text{Disposable Income} = \text{National Income} - \text{Business Savings} - \text{Indirect Taxes} + \text{Subsidies} - \text{Direct Taxes on Persons} - \text{Direct Taxes on Business} - \text{Social Security Payments} + \text{Transfer Payments} + \text{Net Income from abroad}$.

(P) Real Income:

Real NNP = NNP for the Current Year x Base Year Index (=100) / Current Year Index

Suppose 1990-91 is the base year and the national income for 1999-2000 is Rs. 20,000 corers and the index number for this year is 250. Hence, Real National Income for 1999-2000 will be = $20000 \times 100/250$ = Rs. 8000 corers. This is also known as national income at constant prices.

(Q) Per Capita Income:

(The average income of the people of a country in a particular year is called Per Capita Income for that year. This concept also refers to the measurement of income at current prices and at constant prices. For instance, in order to find out the per capita income for 2001, at current prices,)

National income of a country/ Total number of population of the country in that year.

Lesson plan-

Commercial bank

A commercial bank is a type of **bank** that provides services such as accepting deposits, making business loans, and offering basic investment products.

Commercial bank can also refer to a bank or a division of a bank that mostly deals with deposits and loans from corporations or large businesses, individual members of the public (**retail banking**).

Contents

The name *bank* derives from the Italian word *banco* "desk/bench", used during the Renaissance era by Florentine bankers, who used to make their transactions above a desk covered by a green table cloth.

Some have suggested, in Ancient Roman Empire, where moneylenders would set up their stalls in the middle of enclosed courtyards called *macella* on a long bench called a *bancu*, from which the words *banco* and *bank* are derived.

Role of commercial banks;

Commercial banks engage in the following activities:

- **Processing payments via telegraphic transfer, EFTPOS, internet banking, or other**
- Issuing bank drafts and bank cheques
- **Accepting money on term deposit**
- Lending money by overdraft, installment loan, or other
- Providing documentary and study, guarantees, **performance bonds**, securities underwriting commitments and other forms of off-balance sheet exposure.
- Cash management and treasury
- **merchant banking and private equity financing**
- Traditionally, large commercial banks also underwrite bonds, and **make markets** in currency, interest rates, and credit-related securities, but today large commercial banks usually have an **investment bank** arm that is involved in the **aforementioned activities**

Functions

Commercial banks perform various functions:

A. Commercial banks accept deposits-

Commercial banks accept deposits from public especially from its clients, including

1. Current deposit-in case of current deposit one can withdraw many times from the account and bank does not give any interest against the deposit on current account.
2. saving account deposits-in this type of deposit certain restriction on withdrawals and interest is very low than fixed deposit
3. recurring account deposits, -money in this account is deposited in installment basis for a fixed period and repaid to depositor along with interest on the date of maturity.
4. Fixed deposits. -it is a one time deposit and can not be withdrawn before maturity. The interest on such deposit is very high than other types of deposit.
5. Home safe deposit-under this scheme a safe is supplied to the depositor to keep it at home and put this small saving in it periodically the safe is taken to the bank where the amount is kept in it is credited to his account

B. Provides loan

Commercial banks provide loans and advances of various forms, they are

1. **Money at call-loan** -are sanctioned at a short notice, of one day to 14 day. Generally made to other banks
2. **overdraft**- facility-some time bank gives such facility to its customer and interest charged on overdraft amount.
3. **Cash credit**, -is granted against current assets such as share bonds, stocks. Interest is charged only on amount withdrawn.
4. **Bill of discount**,
5. **term loan**-some time bank grants medium and long term loans to its customer and the loan period is more than one year and the interest is charged on entire amount of loan

etc. They also give demand and demand and term loans to all types of clients against proper security.

- C. **Credit creation** -Credit creation is most significant function of commercial banks. While sanctioning a loan to a customer, they do not provide cash to the borrower. Instead, they open a deposit account from which the borrower can withdraw. In other words, while sanctioning a loan, they automatically create deposits, known as a credit creation from commercial banks.

- D. Agency functions

Along with primary functions, commercial banks perform several secondary functions, Agency functions are

- To collect and clear cheques, dividends and interest warrant.
- To make payments of rent, dividends and insurance premium, etc.
- To deal in foreign exchange transactions.
- To purchase and sell securities.
- To act as trustee, attorney, correspondent and executor.
- To accept tax proceeds and tax returns.

E. Utility functions include:

- To provide safety locker facility to customers.
- To provide money transfer facility.
- To issue traveler's cheque.
- To act as referees.
- To accept various bills for payment: phone bills, gas bills, water bills, etc.
- To provide merchant banking facility.
- To provide various cards: credit cards, debit cards, smart cards, etc.

F. Other Functions

Some of the initiatives taken by Banks include:

- restructuring of the system of bank inspections
- introduction of off-site surveillance,

- strengthening of the role of statutory auditors and
- strengthening of the internal defenses of supervised institutions.
- Current Focus
- supervision of financial institutions
- consolidated accounting
- legal issues in bank frauds
- divergence in assessments of non-performing assets and
- Supervisory rating model for banks.

Lesson plan-34

Role of commercial bank in developing economy

The Banking Sector has for centuries now formed one of the pillars of economic prosperity. Land, Labor, capital and entrepreneurs are the basic economic resources available to business. However, to make the use of these resources, a business requires finance to purchase of the land, hire labor, pay for capital goods and pay for individuals with specialized skills. Detail role of commercial banks in economic development is given below:

1. Trade Development

The commercial banks provide capital, technical assistance and other facilities to businessmen according to their need, which leads to development in trade.

2. Agriculture Development

Commercial banks finance the most important sector of the developing economics i.e. agriculture. short, medium and long-term loans are provided for the purchase of seeds and fertilizer, installation of tube wells, construction of warehouses, purchase of tractor and thresher etc.

3. Industrial Development

The countries, which concentrated on industrial sector made rapid economic development. South Korea, Malaysia, Taiwan, Hong Kong and Indonesia have recently developed their industrial sector with the help of commercial banks. People deposit their saving in the banks, so the scattered money becomes a huge amount in the way, which can be used for different projects in a proper way.

4. Capital Formation

Commercial banks help in increasing the rate of capital formation in a country. Capital formation means increase in number of production units, technology, plant and machinery. They finance the projects responsible for increasing the rate of capital formation.

5. Development of Foreign Trade

Commercial banks help the traders of two different countries to undertake business. Letter of credit is issued by the importer's bank to the exporters to ensure the payment. The banks also arrange foreign exchange.

6. Transfer of Money

Commercial banks provide the facility of transferring funds from one place to another which leads to the growth of trade.

8. More Production

A good banking system ensures more production in all sectors of the economy. It increases the production capabilities of the economy by strengthening capital structure and division of labor

9. Development of Transport

The commercial banks financed the transport sector. It has reduced unemployment on one hand and increased the transport facility on the other hand. Remote areas are linked to main markets through developed transport system.

10. Safe Custody

The business concerns and individuals can make themselves tension free by depositing their surplus money in banks. The banks also provide them the facility of lockers to keep their precious articles and necessary documents safe.

11. Increase in Saving

Commercial banks persuade the people to save more. Different saving schemes with attractive interest rates are introduced for this purpose. Number of bank branches is opened in urban and rural areas.

Construction of Houses

Commercial banks provide credit facilities to their customers for the purchase or construction of houses.

12. Assistance to Government

By providing funds to government for development programs, the commercial banks share the government for economic stability.

13. Increase in Employment

A country's economic prosperity depends on the development of trade, commerce industry, agriculture, transport and communication etc. These sectors are financed by the commercial banks and employment opportunities are increasing.

14. Saving in Metallic Reserve

Cheques and drafts etc works like money. In this way the need of precious metals to make coins reduces and metallic reserve of the country can be utilized on other important matters

15. Credit Creation

Commercial banks are called the factories of credit. They advance much more than what they collect from people in the form of deposits. Through the process of credit creation, commercial banks provide finance to all sectors of the economy thus making them more developed than before.

16. Financial Advices

Commercial banks also give useful financial advices to promote the business of their customers, besides credit facilities.

17. Increase in Investment

Commercial banks mobilize savings of the people. They make them available to the farmers, traders and industrialists for the development of agriculture, trade and industry.

18. Success of Monetary Policy

Under the supervision of central bank, all scheduled commercial banks make effort for the success of monetary policy. This joined effort of commercial banks makes the economic development possible.

19. Use of Modern Technology

The use of modern technology in less developed countries is only possible in the presence of developed commercial banking as it can be the main source of their funds.

These funds are utilized for the import of modern technology from developed countries.

20. Export Promotion Cells

In order to boost the exports of the country, the banks have established export promotion cells for the information and guidance to the exporters.

21. Economic Prosperity

Economic prosperity of a country depends on number of factors including the development of commercial banking. A sound banking system promotes the economic status of the people by providing them short, medium and long-term loans.

Sound Banking System for Underdeveloped Countries

A sound and efficient banking system, which undertakes the responsibility of promoting economic growth in underdeveloped economies, must possess the following features:

- (i) The system of branch banking is most suitable for the underdeveloped countries. More and more branches should be opened in rural and backward areas to encourage saving as well as banking habits in these areas.
- (ii) The system of unit banking may be developed in the limited area, particularly in bigger cities to meet the local financial requirements of trade and industries. This will, on the one hand, reduce pressure on big banks and, check concentration of financial power in the hands of a few banks.

- (iii) The banking system in the less-developed countries must aim at encouraging capital formation by increasing the rates of savings and investment in these economies.
- (iv) The banking system in the underdeveloped countries should provide easy and cheap remittance facilities to enable the movement of fund from one place to another so as to promote trade and industry.
- (v) The loan policy of banks in the underdeveloped countries should be rationalised in such a way that loans for productive purposes should be encouraged and loans for conspicuous consumption and for speculative activities should be discouraged.
- (vi) The loan policy in underdeveloped countries should also not be restricted to short-term loans alone. The banks should also provide medium-term and long-term loans to developmental activities in these countries.
- (vii) The banks should meet the different and changing needs of the underdeveloped countries. Credit facilities should be extended to the priority sectors, like agriculture and small-scale industries.
- (viii) Efficient functioning of the banks will inspire public confidence in the banking system and popularize banking activities. This requires trained and efficient banking staff.

In short, comprehensive structural and functional changes in the banking system of the underdeveloped countries are needed. Only after these changes, the banks can be expected to play a prop types of banks in indiaer

Types of banks in India

Although banking is said to have originated in the affluent cities of Italy in the 14th century, it was introduced in India in the late 18th century. The first banks to come up in the country were Bank of Hindustan (1770), The General Bank of India (1786), and the State Bank of India (1806). The banking system has come along way and the banking sector has witnessed a rapid growth in the country in the past few decades. The Reserve Bank of India functions as the central bank and has a control over all the nationalized banks of the country.

There are various types of banks and they can be divided into some of the following categories:

- **Savings banks:** These banks function with the intention to culminate saving habits among people, especially those who belong to low income groups or those who are salaried. The money these people deposit in the banks are invested in securities, bonds etc. These days, many commercial banks perform the dual functions of savings bank. The postal department is also in a way a saving bank.

- **Commercial banks:** These banks function to help the entrepreneurs and businesses. They give financial services to these businessmen like debit cards, banks accounts, short term deposits, etc. with the money people deposit in such banks. They also lend money to businessmen in the form of overdrafts, credit cards, secured loans, unsecured loans and mortgage loans to businessmen. The commercial banks in the country were nationalized in 1969. So the various policies regarding the loans, rates of interest and loans etc are controlled by the Reserve Bank. These days, the commercialized banks provide some services given by investment banks to their clients.

- The commercial banks can be further classified as: public sector bank, private sector banks, foreign banks and regional banks.

The public sector banks are owned and operated by the government, who has a major share in them. The major focus of these banks is to serve the people rather than earn profits. Some examples of these banks include State Bank of India, Punjab National Bank, Bank of Maharashtra, etc.

The private sector banks are owned and operated by private institutes. They are free to operate and are controlled by market forces. A greater share is held by private players and not the government. For example, Axis Bank, Kotak Mahindra Bank etc.

The foreign banks are those that are based in a foreign country but have several branches in India. Some examples of these banks include; HSBC, Standard Chartered Bank etc.

- **Regional rural banks** were brought into operation with the objective of providing credit to the rural and agricultural regions and were brought into effect in 1975 by RRB Act. These banks are restricted to operate only in the areas specified by government of India. These banks are owned by State Government and a sponsor bank. This sponsorship was to be done by a nationalized bank and a State Cooperative bank. Prathama Bank is one such example, which is located in Moradabad in U.P.
- **Cooperative banks:** These banks are controlled, owned, managed and operated by cooperative societies and came into existence under the Cooperative Societies Act in 1912. These banks are located in the urban as well in the rural areas. Although these banks have the same functions as the commercial banks, they provide finance to farmers, salaried people, small scale industries, etc. and their rates of interest are lower as compared to other banks.
- There are three types of cooperative banks in India, namely:
 - **Primary credit societies:** These are formed in small locality like a small town or a village. The members using this bank usually know each other and the chances of committing fraud is minimal.

- **Central cooperative banks:** These banks have their members who belong to the same district. They function as other commercial banks and provide loans to their members. They act as a link between the state cooperative banks and the primary credit societies.
- **State cooperative banks:** these banks have a presence in all the states of the country and have their presence throughout the state.
- **Investment banks:** These are financial institutions that provide financial and advisory assistance to their customers. Their clients can be individuals, businesses, or government organizations. They assist their customers to raise funds when required. These banks act as the underwriters for their customers when they want to raise capital by issuing securities. In some cases, they also help their customers to issue securities.

When there is a merger or an acquisition, they provide their customers with the necessary support like marketing, foreign trading, foreign exchange, sale of equities, fixed income instruments etc. Apart from raising capital, these banks render valuable financial advice to their customers and various kinds of businesses. Some examples of these banks include, Bank of America, Barclays Capital, Citi Bank, Deutsche Bank etc.

- **Specialized banks:** These provide unique services to their customers. Some such banks include, foreign exchange banks, development banks, industrial banks, export import banks etc. These banks also provide huge financial support to businesses and various kinds projects and traders who have to import or export their goods or services.
- **Central bank:** The central bank is also called the banker's bank in any country. In India, the Reserve Bank of India is the central bank. The Federal Reserve in USA and the Bank of England in UK function as the central bank. This bank makes various monetary policies, decides the rates of interest, controlling the other banks in the country, manages the foreign exchange rate and the gold reserves and also issues paper currency in a country. The monetary control is the primary function of a central bank in most countries and so they are considered as the lender of last resort to various commercial banks.
- **Foreign banks:**
RBI has been keen on allowing foreign banks a larger role in the Indian banking system since February 2005, when it first issued the road map for presence of foreign banks in India. In May 2012, the government also facilitated the process by proposing to exempt foreign banks from the 30 per cent tax on capital gains and stamp duty while converting branches into a new entity. RBI has also mandated foreign banks with 20 and more branches to achieve priority sector targets and sub-targets at par with their domestic counterparts.

Lesson plan

Central bank

In every country there is one organization which works as the central bank. The function of the central bank of a country is to control and monitor the banking and financial system of the country. In India, the Reserve Bank of India (RBI) is the Central Bank.



The RBI was established in 1935. It was nationalised in 1949. The RBI plays role of regulator of the banking system in India. The Banking Regulation Act 1949 and the RBI Act 1953 has given the RBI the power to regulate the banking system. The RBI has different functions in different roles. Below, we share and discuss some of the functions of the RBI.

Departments of the Reserve Bank of India

To carry out its functions/operations smoothly and efficiently, the Reserve Bank of India has the following departments.

1. Banking Department:

The Banking Department is responsible for rendering the bank's services as a banker to the Government and to the banks. It consists of four subdivisions: (i) Public Accounts Department; (ii) Public Debt Department; (iii) Deposit Accounts Department; and (iv) Securities Department. There are 14 branches of the Banking Department, each headed by a Joint/Deputy Manager.

2. Issue Department:

The Issue Department is concerned with the proper and efficient management of the note issue. For the conduct of monetary transactions, the country has been divided into 14 circles of issue, each having an Office of Issue — the branch of the Issue Department. Each branch of the Issue Department consists of: (i) the General Department and (ii) the Cash Department controlled by the currency officer. The General Department deals with resource operations, i.e., arrangement of supply of notes and coins from the presses and Government Mints. The Cash Department deals with the cash transactions

This department is concerned with the forecasting of the long-term requirements of the currency, indenting and allocation of currency notes to various branches of the Issue Department taking into account the demand pattern, storage facilities, etc. It is headed by the Chief Officer.

3. Department of Expenditure and Budgetary Control:

This department is concerned with the preparation of the bank's budget and monitoring of the expenditure of the different units. It is headed by the Financial Controller.

4. Department of Government and Bank Accounts:

This department is concerned with the maintenance and supervision of the bank's accounts

in the Issue and the Banking Departments and the compilation of weekly statements of affairs and the Annual Profits & Loss Account and Balance Sheet. It is headed by the Chief Accountant.

5. Exchange Control Department:

The Exchange Control department is responsible for controlling foreign exchange transactions and maintaining exchange rate stability.

6. Department of Banking Operations and Development:

This Department was entrusted with the responsibility of the supervision, control and development of the commercial bank system in the country.

Till July 1982, it was also concerned with the Lead Bank Scheme and bank credit to the priority sectors.

7. Industrial Credit Department:

The Industrial Finance Department is basically concerned with the administration of the Credit Guarantee Scheme for small scale industries or as agent of the Government of India, with the operational and organisational aspects of the State Financial Corporation's (SFCs), work connected with the Industrial Development Bank of India (IDBI), data collection about financing of small-scale industries and other relevant problems.

It also deals with the operation and administration of the Credit Authorization Scheme.

8. Agricultural Credit Department:

This department is mainly responsible for building up of a sound cooperative credit structure in rural financing, supplementing the financial resources of state co-operative banks, providing financial assistance to State Governments to strengthen the co-operative structure, advising Central

and State Governments on agricultural and rural credit, formulating policies for taking over of PACs for financing by commercial banks, coordinating the long-term credit activities of State Land Development Banks, etc.

The department also keeps liaison with the Agricultural Refinance and Development Corporation, the Agricultural Finance Corporation, SCBs and LDBs.

With the establishment of the NABARD now, all functions of the Agricultural Credit Department have been transferred to this new institution, except for the supervision and control over the operations of the primary (urban) co-operative banks. The responsibility of supervision and control of PCBs are now shifted to the Department of Banking Operations and Development.

9. Rural Planning and Credit Department:

This department was established in 1982. It is basically concerned with issues like District Credit Plans, Lead Bank Scheme, provision of expert guidance/assistance and processing and sanction of general lines of credit for short-term advances to the NABARD, special studies for promoting IRDP, and for framing the Reserve Bank's policy on rural development.

10. Department of Non-Banking Companies:

This department administers and controls as well as regulates deposits of non-banking financial companies.

11. Credit Planning Cell:

The Credit Planning and Banking Development Cell have been constituted for the formulation and monitoring of credit policies as well as the developmental aspects of commercial banking.

It chalks out macro-level monetary budgets of the country.

12. Department of Economic Analysis and Policy:

This department conducts economic research and reviews financial and banking conditions in the country. The Economic Department comprises five units: (i) the Internal Finance Unit; (ii) International Finance Unit; (iii) Prices, Production and General Unit; (iv) Analysis of National Economic Parameters Unit; and (v) General Unit.

The Economic Department prepares the Bank's Annual Report, the Report on Trend and Progress of Banking in India, the Report on Currency and Finance, and the Reserve Bank of India Bulletins. It also undertakes ad hoc studies on emerging aspects of banking and other important issues.

13. Department of Statistical Analysis and Computer Services:

Its main function involves the generation, collection, processing and compilation of statistical data relating to the banking and financial sectors from the operational as well as research point of view.

14. Legal Department:

It tenders legal advice on various matters referred to it by the Bank.

15. Inspection Department:

It carries out internal inspections of the offices and departments of the bank.

16. Reserve Bank of India Service Board:

Its functions involve conducting of examinations/interviews for the selection and promotion of staff in the Reserve Bank.

17. Training Establishments:

The Reserve Bank has set-up three prominent training institutions for imparting training in different areas of banking

FUNCTIONS OF RBI

RBI performs many functions, some of them are:-

1. Issue of Currency Notes:-

Under section 22 of RBI Act, the bank has the sole right to issue currency notes of all denominations except one rupee notes. The one-rupee notes and small coins are issued by Central Government and their distribution is undertaken by RBI as the agent of the government. The RBI has a separate issue department which is entrusted with the issue of currency notes.

2. Banker To The Government:-

The RBI acts as a banker agent and adviser to the government. It has obligation to transact the banking business of Central Government as well as State Governments. E.g.:- RBI receives and makes all payments on behalf of government, remits its funds, buys and sells foreign currencies for it and gives it advice on all banking matters. The bank makes ways and meets advances of the government. On behalf of central government it sells treasury bills and thereby provides short-term finance.

3. Banker's bank And Lender off Last Resort:-

RBI acts as a banker to other banks. It provides financial assistance to scheduled banks and state co-operative banks in form of rediscounting of eligible bills and loans and advances against approved securities.

RBI acts as a lender of last resort. It provides funds to bank when they fail to get it from other sources. It also acts as a clearing house. Through RBI, banks make interbanks payments.

4. Controller of Credit:-

RBI has power to control the volume of credit created by banks. The RBI through its various quantitative and qualitative techniques regulates total supply of money and bank credit in the interest of economy. RBI pumps in money during busy season and withdraws money during slack season.

5. Custodian Of Foreign Reserve:-

RBI has the responsibility of maintaining fixed exchange rates with all member countries of IMF. For this, RBI has centralized all foreign exchange reserves (FOREX). RBI functions as custodian of nation's foreign exchange reserves. It has to maintain external value of Rupee. RBI achieves this aim through appropriate monetary fiscal and trade policies and exchange control.

6. Collection and Publication Of Data:-

The RBI collects and compiles statistical information on banking and financial operations of the economy. The Reserve Bank Of India' Bulletin is a monthly publication. It not only provides information, but also results of important studies and investigations conducted by reserve bank are given. 'The Report on currency and finance' is an annual publication. It provides review of various developments of economic and financial importance.

7. Regulatory and Supervisory Functions:-

The RBI has wide powers of supervision and control over commercial and co-operative banks, relating to licensing, establishment, branch expansion, liquidity of Assets, management and methods of working, amalgamation, re-construction and liquidation. The supervisory functions of RBI have helped a great in improving the standard of banking in India to develop on sound lines and to improve the methods of their operation.

8. Clearing House Functions:-

The RBI acts as a clearing house for all member banks. This avoids unnecessary transfer of funds between the various banks.

9. Development And Promotional Functions :-

The RBI has helped in setting up Industrial Finance Corporations of India (IFCI), State Financial Corporations (SFCs), Deposit Insurance Corporation, Agricultural Refinance and Development Corporation (ARDC), units Trust of India (UTI) etc. these institutions were set up to mobilize savings, promote saving habits and to provide industrial and agricultural finance.

RBI has a special Agricultural Credit Department (ACD) which studies the problems of agricultural credit. For this Regional Rural banks, Co-operative, NABARD etc. were established. The RBI has also taken measures to promote organized bill market to create elasticity in Indian Money Market in order to satisfy seasonal credit needs.

Thus RBI has contributed to economic growth by promoting rural credit, industrial financing, export trade

RBI is the Regulator of Financial System

The RBI regulates the Indian banking and financial system by issuing broad guidelines and instructions. The objectives of these regulations include:

Controlling money supply in the system,

Monitoring different key indicators like GDP and inflation,

Maintaining people's confidence in the banking and financial system, and

Providing different tools for customers' help, such as acting as the "Banking Ombudsman."

Monetary Policy Lesson plan-

The RBI formulates monetary policy twice a year. It reviews the policy every quarter as well. The main objectives of monitoring monetary policy are:

Inflation control

Control on bank credit

Interest rate control

The tools used for implementation of the objectives of monetary policy are:

Cash Reserve Ratio (CRR) and Statutory Liquidity Ratio (SLR),

Open market operations,

Different Rates such as repo rate, reverse repo rate, and bank rate.

. Discuss the objectives of RBI's Monetary policy

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MONETARY POLICY

Monetary policy / monetary management is regarded as an important tool of economic management in India. RBI controls the supply of money and availability of bank credit and cost of money, that is, the rate of Interest in the country.

OBJECTIVES OF MONETARY POLICY OF INDIA :-

The main objective of monetary policy in India is 'growth with stability'. Monetary Management regulates availability, cost and use of money and credit. It also brings institutional changes in the financial sector of the economy. Following are the main objectives of monetary policy in India:-

1. Growth With Stability:-

Traditionally, RBI's monetary policy was focused on controlling inflation through contraction of money supply and credit. This resulted in poor growth performance. Thus, RBI have now adopted the policy of 'Growth with Stability'. This means sufficient credit will be available for growing needs of different sectors of economy and at the same time, inflation will be controlled within a certain limit.

2. Regulation, Supervision and Development of Financial Stability:-

Financial stability means maintaining confidence in financial system instead of shocks. Threats to financial stability can come from internal and external shocks. Such shocks can destabilize by the country's financial system. Thus, the role of RBI is to role in maintaining confidence in financial system through proper regulation and controls, without sacrificing the objective of growth. Therefore, RBI is focusing on regulation, supervision and development of financial system.

3. Promoting Priority Sector:-

Priority sector includes agriculture, export and small scale enterprises and weaker section of population. RBI with the help of bank provides timely and adequately credit at affordable cost of weaker sections and low income groups. RBI, along with NABARD, is focusing on microfinance through the promotion of Self Help groups and other institutions.

4. Generation of Employment:-

Monetary policy helps in employment generation by influencing the rate of investment and allocation of investment among various economic activities of different labor Intensities.

5. External Stability:-

With the growth of imports and exports India's linkages with global economy are getting stronger. Earlier, RBI controlled foreign exchange market by determining exchange rate. Now, RBI has only indirect control over external stability through the mechanism of 'managed Flexibility', where it influences exchange rate by buying and selling foreign currencies in open market.

6. Encouraging Savings and Investments:-

RBI by offering attractive interest rates encourages savings in the economy. A high rate of saving promotes investment. Thus the monetary management by influencing rates of interest can influence saving mobilization in the country.

7. Redistribution Of income And Wealth:-

By control of inflation and deployment of credit to weaker sectors of society the monetary policy may redistribute income and wealth favoring to weaker sections.

8. Regulation of NBFIs:-

Non – Banking Financial Institutions (NBFIs), like UTI, IDBI, IFCI plays an important role in deployment of credit and mobilization of savings. RBI does not have any direct control on the functioning of such institutions. However it can indirectly affects the policies and functions of NBFIs through its monetary policy.

etc.

Police of credit control

In India, the legal framework of RBI's control over the credit structure has been provided

Under Reserve Bank of India Act, 1934 and the Banking Regulation Act, 1949. Quantitative credit controls are used to maintain proper quantity of credit or money supply in market. Some of the important general credit control methods are:-

1. Bank Rate Policy :-

Bank rate is the rate at which the Central bank lends money to the commercial banks for their liquidity requirements. Bank rate is also called discount rate. In other words bank rate is the rate at which the central bank rediscounts eligible papers (like approved securities, bills of exchange, commercial papers etc) held by commercial banks.

Bank rate is important because it is the pace setter to other market rates of

Interest. Bank rates have been changed several times by RBI to control inflation

and recession. By 2003, the bank rate has been reduced to 6% p.a.

2. Open market operations:-

It refers to buying and selling of government securities in open market in order to expand or contract the amount of money in the banking system. This technique is superior to bank rate policy. Purchases inject money into the banking system while sale of securities does the opposite. During last two decades the RBI has been undertaking such operations. These involve the purchase of one loan against the sale of another or, vice-versa. This policy aims at preventing unrestricted increase in liquidity.

3. Cash Reserve Ratio (CRR)

The cash Reserve Ratio (CRR) is an effective instrument of credit control. Under the RBI Act of 1934 every commercial bank has to keep certain minimum cash reserves with RBI. The RBI is empowered to vary the CRR between 3% and 15%. A high CRR reduces the cash for lending and a low CRR increases the cash for lending. The CRR has been brought down from 15% in 1991 to 7.5% in May 2001. It further reduced to 5.5% in December 2001. It stood at 5% on January 2009. In January 2010, RBI increased the CRR from 5% to 5.75%. It further increased in April 2010 to 6% as inflationary pressures had started building up in the economy. As of March 2011, CRR is 6%.

4. Statutory Liquidity Ratio (SLR)

Under SLR, the government has imposed an obligation on the banks to maintain a certain ratio to its total deposits with RBI in the form of liquid assets like cash, gold and other securities. The RBI has power to fix SLR in the range of 25% and 40% between 1990 and 1992

SLR was as high as 38.5%. Narasimham Committee did not favour maintenance of high SLR. The SLR was lowered down to 25% from 10th October 1997. It was further reduced to 24% on November 2008. At present it is 25%.

5. Repo And Reverse Repo Rates

In determining interest rate trends, the repo and reverse repo rates are becoming important. Repo means Sale and Repurchase Agreement. Repo is a swap deal involving the immediate Sale of Securities and simultaneous purchase of those securities at a future date, at a predetermined price. Repo rate helps commercial banks to acquire funds from RBI by selling securities and also agreeing to repurchase at a later date.

Reverse repo rate is the rate that banks get from RBI for parking their short term excess funds with RBI. Repo and reverse repo operations are used by RBI in its Liquidity Adjustment Facility. RBI contracts credit by increasing the repo and reverse repo rates and by decreasing them it expands credit.

II) SELECTIVE CREDIT CONTROL METHODS :-

Under Selective Credit Control, credit is provided to selected borrowers for selected purpose, depending upon the use to which the control try to regulate the quality of credit - the direction towards the credit flows. The Selective Controls are :-

1. Ceiling On Credit

The Ceiling on level of credit restricts the lending capacity of a bank to grant advances against certain controlled securities.

2. Margin Requirements:-

A loan is sanctioned against Collateral Security. Margin means that proportion of the value of security against which loan is not given. Margin against a particular security is reduced or increased in order to encourage or to discourage the flow of credit to a particular sector. It varies from 20% to 80%. For agricultural commodities it is as high as 75%. Higher the margin lesser will be the loan sanctioned.

3. Discriminatory Interest Rate (DIR)

Through DIR, RBI makes credit flow to certain priority or weaker sectors by charging concessional rates of interest. RBI issues supplementary instructions regarding granting of additional credit against sensitive commodities, issue of guarantees, making advances etc. .

4. Directives:-

The RBI issues directives to banks regarding advances. Directives are regarding the purpose for which loans may or may not be given.

5. Direct Action

It is too severe and is therefore rarely followed. It may involve refusal by RBI to rediscount bills or cancellation of license, if the bank has failed to comply with the directives of RBI.

6. Moral Suasion

Under Moral Suasion, RBI issues periodical letters to bank to exercise control over credit in general or advances against particular commodities. Periodic discussions are held with authorities of commercial banks in this respect.

Policy of credit expansion

In India, during the planning period, the aim of the monetary policy of the Reserve Bank has been to meet the needs of the planned development of the economy.

With this broad aim, the monetary policy has been pursued to achieve the twin objectives of the economic policy of the government:

- (a) To accelerate the process of economic growth with a view to raise national income, and
- (b) To control and reduce the inflationary pressures in the economy.

Thus, the monetary policy of the Reserve Bank during the course of planning has been appropriately termed as that of 'controlled expansion'. It aims at adequately financing of economic growth and, at the same time, ensuring reasonable price stability in the country.

Policy of Credit Expansion:

The overall trend in the economy during the planning period has been that of continuous expansion of currency and credit with an objective of meeting the developmental needs of the economy.

This expansion has been achieved by adopting the following measures:

i. Revision of Open Market Operations:

The Reserve Bank revised its open operations policy in October 1956, according to which it started giving discriminatory support to the sale and purchase of government securities. Between 1948-51 the Bank made large purchases of government securities.

In the subsequent period, the Bank's sales of the government securities to the public exceeded its purchases. This excess sales method was discontinued between 1964 and 1969 with a purpose of expanding currency and credit in the economy.

ii. Liberalisation of the Bill Market Scheme:

Through the bill market scheme, the commercial banks receive additional funds from the Reserve Bank to meet the increasing credit requirements of their borrowers. Since 1957, the Reserve Bank has extended the bill market scheme to include export bills in order to help the commercial banks to provide credit to exporters liberally

iii. Facilities to Priority Sectors:

The Reserve Bank continues to provide credit facilities to priority sectors such as small-scale industries and cooperatives, even though the general policy of the Bank is to control credit expansion.

For instance, in October 1962, the banks were allowed to borrow additional funds from the Reserve Bank in order to provide finance to small scale industries and cooperatives. The Reserve Bank has also been providing short-term finance to the rural cooperatives.

iv. Refinance and Rediscounting Facilities:

In recent years, the Reserve Bank has been following a policy of providing selective refinance and rediscounting facilities. At present, the banks are permitted to refinance equal to one per cent of the demand and time liabilities at the rate of 10 per cent per annum. Refinance facilities are also available for food procurement credit and export credit.

v. Credit Facilities through Financial Institutions:

The Reserve Bank has also been instrumental in the establishment of various financial institutions like Industrial Development Bank of India (IDBI), Industrial Finance Corporation of India (IFCI), Industrial Reconstruction Corporation of India (IRCI), Industrial Credit and Investment Corporation of India (ICICI), State Finance Corporations (SFCs).

Agricultural Refinance and Development Corporation (ARDC) and National Bank for Agriculture and Rural Development (NABARD). Through these institutions, the Reserve Bank provides medium-term and long-term credit facilities for development.

vi. Deficit Financing:

Continuous increase in money supply in the country has been caused by adopting the method of deficit financing to finance the budgetary deficit of the government. This has been made possible through changes in the reserve requirements of the Reserve Bank.

The reserve system was made more flexible by making two changes:

(a) By dropping proportional reserve system which required keeping of 40 per cent of reserves in gold (coins and bullion) and foreign securities, with the provision that the value of gold would not be less than Rs. 40 crore.

(b) Modifying the minimum reserve system so that the Reserve Bank need keep only gold worth Rs. 115 crore with the provision that the minimum requirement of keeping foreign securities of the value of Rs. 85 crore can be waived during extreme contingency.

vii. Anti-Inflationary Fiscal Policy:

The Seventh Five Year Plan prefers an anti-inflationary fiscal policy to an anti- inflationary monetary policy and emphasises a positive, promotional and expository role for monetary policy. It is believed that “a fiscal policy that keeps the budget deficit down would give greater autonomy to monetary policy.”

In the seventh plan, the amount of deficit financing (i.e., net Reserve Bank Credit to the government) has been fixed at a level considered just sufficient to generate the additional money supply needed to meet expected increase in the demand for money, such an anti-inflationary fiscal policy will liberate the Reserve Bank for its anti-inflationary responsibilities and will enable it to extend sufficient credit facilities for the development of industry and trade.

viii. Allocation of Credit:

The pattern of allocation of credit is in accordance with the plan priorities. The major part of the total credit available goes to the public sector through statutory requirements and other means. A certain minimum of credit at concessional rates of interest is ensured for the priority sectors through selective credit control and the differential rate of interest scheme. Private industries can secure funds for investment purposes through public financial institutions.

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Time value of money

Lesson No. 31

Time value of money

The idea that money available at the present time is worth more than the same amount in the future due to its potential earning capacity is called the time value of money. This core principle of finance holds that, provided money can earn interest, any amount of money is worth more the sooner it is received. Thus, at the most basic level, the time value of money demonstrates that, all things being equal, it is better to have money now rather than later.

But why is this? An Rs100 bill now has the same value as a Rs100 bill one year from now, doesn't it? Actually, although the bill is the same, you can do much more with the money if you have it now because over time you can earn more interest on your money.

By receiving Rs10,000 today (Option A), you are poised to increase the future value of your money by investing and gaining interest over a period of time. If you receive the money three years down the line (Option B), you don't have time on your side, and the payment received in three years would be your future value. To illustrate, we have provided a timeline:

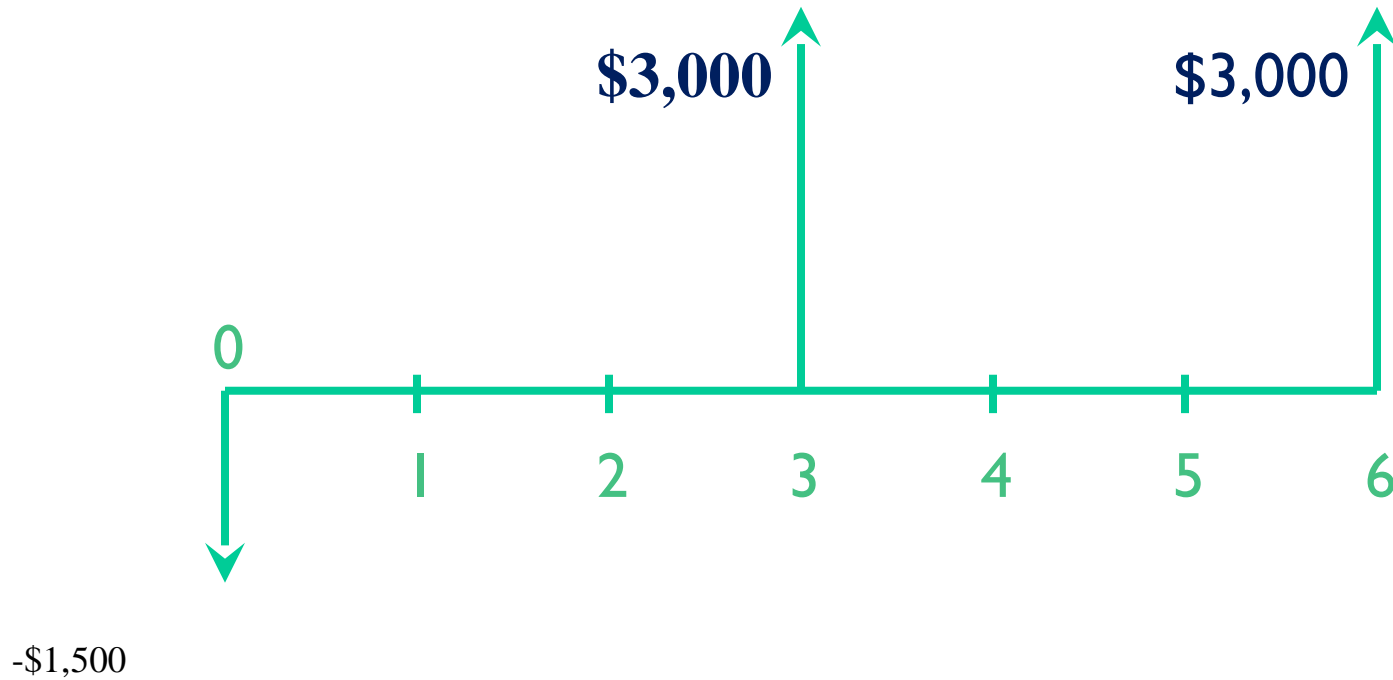
A cash flow diagram presents the flow of cash as arrows on a time line scaled to the magnitude of the cash flow, where expenses are down arrows and receipts are up arrows.

Cash-Flow

- Cash flow refers to the money entering or leaving a project or business during a specific period of time.
- When analyzing the economic feasibility of a project or design, you will compare its cash flow with the cash flow of other alternatives.
- The following table shows the cash flow for a simple 6-month project. The project starts on January 1 with a small initial investment and receives income in two installments.

Cash-Flow Diagram

- A cash flow diagram shows a visual representation of a cash flow (receipts and disbursements).
- For instance, here is the cash flow diagram for the cash flow described in the table on the previous slide.



Cash-Flow Diagram—Details

- The horizontal axis represents time. It is divided into equal time periods (days, months, years, etc.) and stretches for the duration of the project.
- Cash inflows (income, withdraws, etc.) are represented by upward pointing arrows.
- Cash outflows (expenses, deposits, etc.) are represented by downward pointing arrows.
- Cash flows that occur within a time period (both inflows and outflows), are added together and represented with a single arrow at the end of the period.
- When space allows, arrow lengths are drawn proportional to the magnitude of the cash flow.
- Initial investments are shown at time 0.

Cash-Flow Diagram—Perspective

- Cash flow diagrams are always from some perspective.
- A transfer of money will be an inflow or outflow depending on your perspective.
- Consider a borrower that takes out a loan for \$5,000 at 6% interest. From the borrower's perspective, the amount borrowed is an inflow. From the lender's perspective, it is an outflow.

Cash-Flow Diagram—Example

- A lawn mower will cost \$600. Maintenance costs are expected to be \$180 per year. Income from mowing lawns is expected to be \$720 a year. The salvage value after 3 years is expected to be \$175.

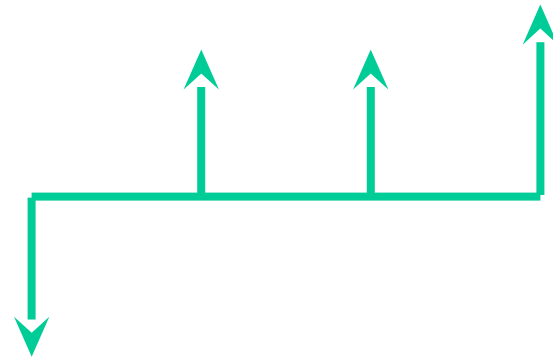
+\$720

+\$720

+\$720

OR

\$175



+\$540 +\$540 +\$715

-\$600

-\$600

Simplified cash flow diagram with net cash-flow shown at the end of each time period.

Time Value of Money

- \$100 received today is worth more than \$100 received one year from now.
- If you don't believe this, give me \$100 and I will gladly give you back \$100 in one year.
- That would be a bad deal for you because:
 - I could invest the money and keep the interest earned on your money.
 - If there was inflation in the economy during the time I was holding onto your money, the purchasing power of the \$100 I give back will be less than the \$100 you gave me.
 - There is a risk I won't return the money.
- For all these reasons, when discussing cash flows over time you have to take into account the time value of money.

Interest

- Because of the time value of money, whenever money is loaned, the lender expects to get back the money loaned plus interest.
- Interest is the price paid for the use of borrowed money. As with any financial transaction, interest is either something you pay (a disbursement) or something you earn (a receipt) depending on whether you are doing the borrowing or the lending.
- Interest earned/paid is a certain percentage of the amount loaned/borrowed.

Simple Interest

- With simple interest, interest accrues only on the principle amount invested.
- Example. What is the value of \$100 after 3 years when invested at a simple interest rate of 10% per year?

$$\$100 * 10\% = \$10$$

$$\$100 * 10\% = \$10$$

$$\$100 * 10\% = \$10$$

$$\$30$$

$$\$100 + \$30 = \$130$$

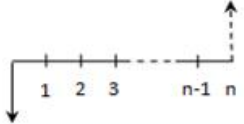
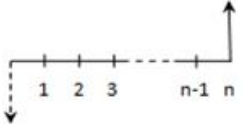


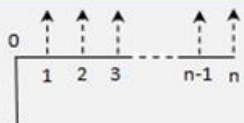
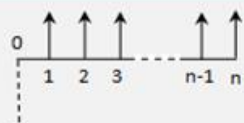
Compound Interest

- With compound interest, interest is earned on interest.
- Example. What is the value of \$100 after 3 years when invested at a compound interest rate of 10% per year?

$$\text{\$100.00} * 10\% = \text{\$10.00}$$

$$\text{\$110.00} * 10\% = \text{\$11.00}$$

$$\text{\$121.00} * 10\% = \text{\$12.10}$$

Name	Symbol	Cash Flow Diagram	What question does it answer?
Single-Payment Compound-Amount	$F = P(F/P, i, n)$		If you invest \$P at i% interest. How much will you have after n years?
Single-Payment Present-Worth	$P = F(P/F, i, n)$		How much do you need to invest today if you want \$F after n years, assuming an interest rate of i%?
Equal-Payment-Series Compound-Amount	$F = A(F/A, i, n)$		If you invest \$A every year for n years, how much will you have after n years, assuming an interest rate of i%?
Equal-Payment-Series Sinking-Fund	$A = F(A/F, i, n)$		If you want to have \$F in n years, how much do you need to set aside each year, assuming an interest rate of i%?
Equal-Payment-Series Capital-Recovery	$A = P(A/P, i, n)$		What are the yearly payments on \$P borrowed assuming n payments and an interest rate of i%?
Equal-Payment-Series Present-Worth	$P = A(P/A, i, n)$		How much is a series of n \$A payments worth today, assuming an interest rate of i%?

Definition of symbols used

P = Present Worth (Present sum of money)

F = Future Worth (Future sum of money)

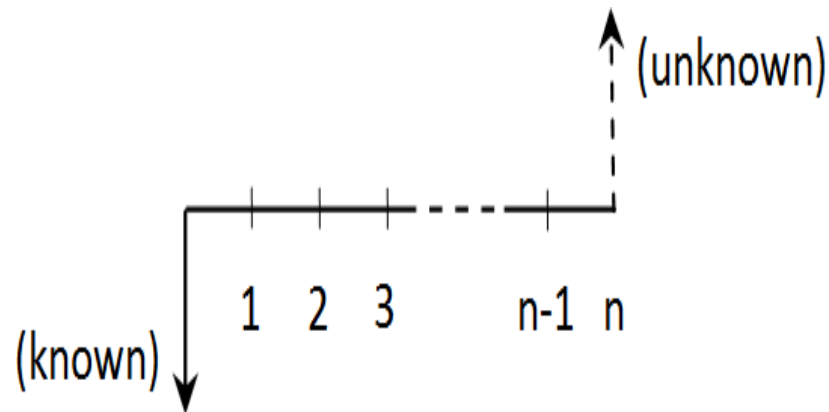
n = Number of interest periods

i = Interest rate per period

A = Amount of a regular end-of-period payment

Single-Payment Compound-Amount

- Formula: $F = P(F/P, i, n)$
- This formula can be used to calculate the compounded interest on a single payment. It tells how much a certain investment earning compound interest will be worth in the future.
- Cash flow diagram:



Example

You are considering a project that will require a \$300,000 investment. A viable alternative that must be considered is to “do nothing” and bank the money that would have been invested in the project. What is the value of \$300,000 after 8 years assuming an interest rate of 6% ? In shorthand notation:

$$F_n = P(1+i)^n$$

$(1+i)^n$ is called the single-payment compound amount factor, SPCAF or the

F/P factor.= (F/P, 6%, 8)

$$F = \$300,000 * (F/P, 6\%, 8)$$

Using the formula derived earlier:

$$F = \$300,000 * (1 + .06)^8$$

$$F = \$478,154$$

Using the interest table at the right:

$$F = \$300,000 * 1.5938$$

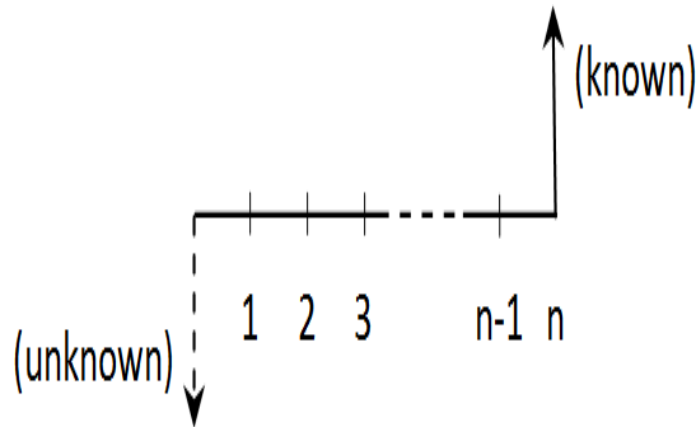
$$F = \$478,140$$

Single-Payment Present-Worth

$$\text{Formula: } P = F(P/F, i, n)$$

The previous formula computed F given P. This formula computes P given F. It tells the present value of some future amount. In English, it tells how much needs to be invested today order to have a certain sum in the future.

Cash flow diagram:



Example

You are writing a proposal for a science experiment that will be launched into space in 6 years. The cost of the launch is expected to be \$500,000. How much do you need to set aside today, in order to have \$500,000 in 6 years assuming an interest rate of 5%?

$$P = \$500,000 * (P/F, 5\%, 6)$$

$$P = F[1/(1+i)^n] ,$$

P/F is called the single payment present worth factor, SPPWF, or the P/F factor.

Using the formula derived earlier:

$$P = \$500,000 * 1/(1+.05)^6$$

$$P = \$500,000 * 0.7835$$

$$P = \$373, 10$$

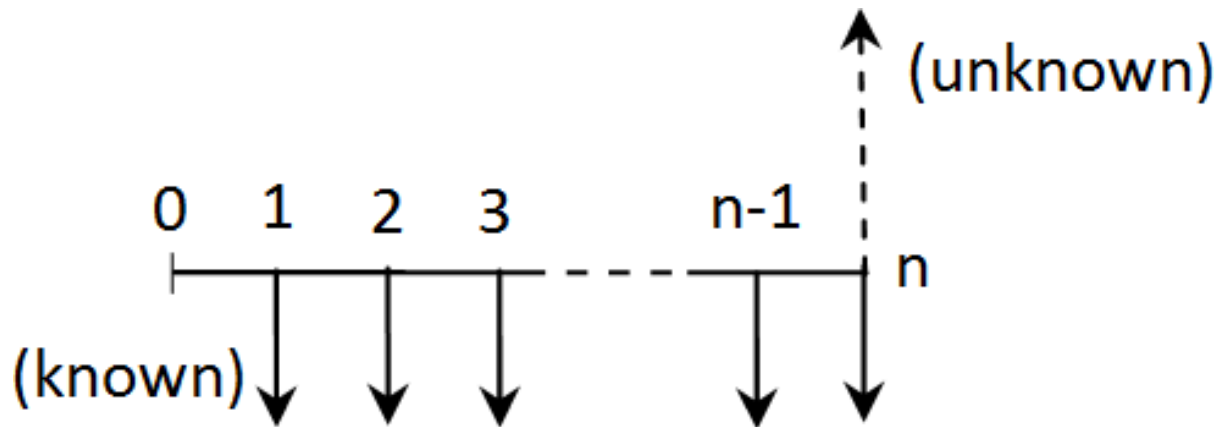
Equal-Payment-Series Compound-Amount

Formula: $F = A (F/A, i, n)$

Symbol of Equal payment series Compound-Amount factor= $(F/A, i, n)$

This formula can be used to calculate the future value of a number of equal payments.

Cash flow diagram:



Example

You do a budget after starting a new job and calculate you have \$230 left over each year after paying expenses. How much will you have after 3 years if you invest \$230 each month assuming a yearly interest rate of 4%?

$$F = \$230 * (F/A, 4\%, 3)$$

$$F = A [(1+i)^n - 1] / i$$

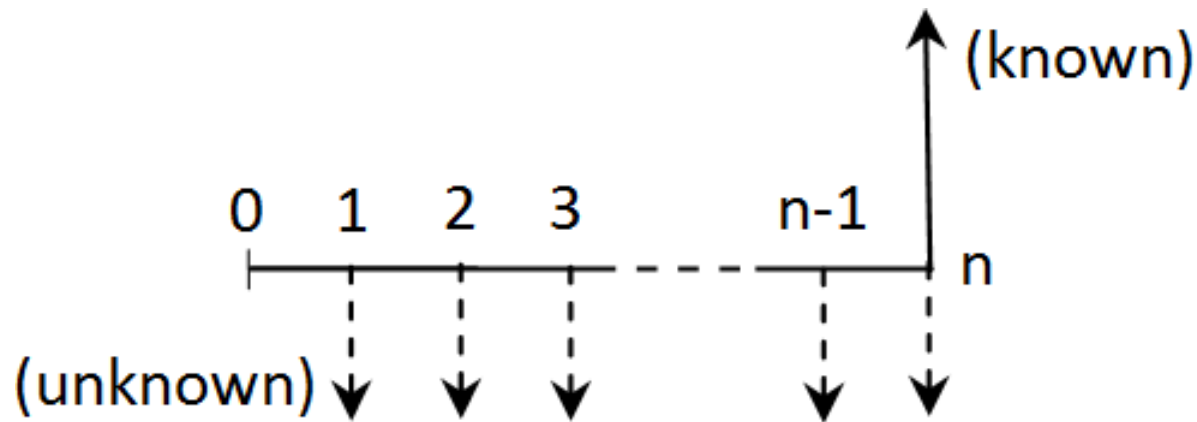
$$F = \$230 * [(1+0.4)^3 - 1] / 0.4$$

$$F = \$230 * 3.112$$

$$F = \$8,781$$

Equal-Payment-Series Sinking-Fund

- Formula: $A = F(A/F, i, n)$
- This formula calculates the inverse of the previous. This formula tell you how much you need to set aside each year/month/etc in order to have a certain amount of money at the end of the equal payments.
- Cash flow diagram:



Example

You just got a new job and are trying to decide whether to begin saving for retirement now or in a few years. You are 25 years old and expect to retire when you are 65. You feel you can save \$300000 a month toward retirement. Using the previous formula and assuming an interest rate of 6%,

$$A = F \left[\frac{i}{(1+i)^n - 1} \right]$$

$$A = 300\,000 * \left(\frac{A/F, 6\%, 40}{1} \right)$$

$$A = 300000 \left[\frac{0.6}{(1+0.6)^{40} - 1} \right]$$

$$A = 300000 * 0.0065$$

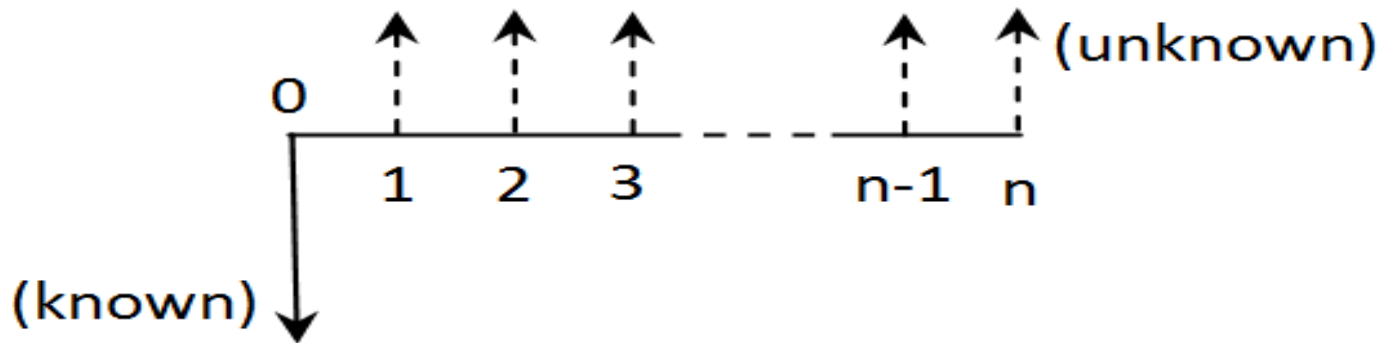
$$A = 1950$$

Equal-Payment-Series Capital-Recovery

Formula: $A = P(A/P, i, n)$

This is the standard formula for calculating the payments on a loan. It tells the amount of equal payments needed to recover an initial amount of capital.

Cash flow diagram:



You borrow \$50,000 to purchase a rack mounted server which you plan to pay off in 7 years. What are the yearly payments assuming a compound interest rate of 8%?

$$A = P(A/P, i, n)$$

$$A = \$50,000 * (A/P, 8\%, 7)$$

$$A = P[i(1+i)^n / (1+i)^n - 1]$$

$$A = 50,000[0.8(1+0.8)^7 / (1+0.8)^7 - 1]$$

$$A = 50000 \times 0.1921$$

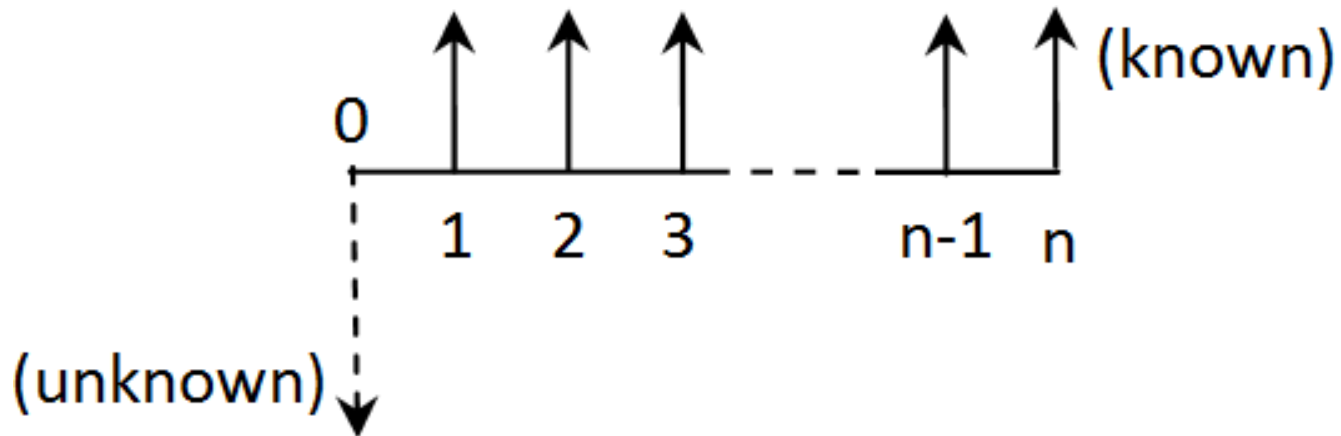
$$A = 9605$$

Equal-Payment-Series Present-Worth

Formula: $P = A(P/A, i, n)$

This formula is the inverse of the previous. It gives the current value of a series of future equal payments.

Cash flow diagram:



Example

You are currently paying \$800 a month in rent. What amount of money borrowed would equal \$800 for 30 years at 5% interest?

$$P = A[(1+i)^n - 1 / i(1+i)^n]$$

$$P = \$50,000 * (P/A, 5\%, 30)$$

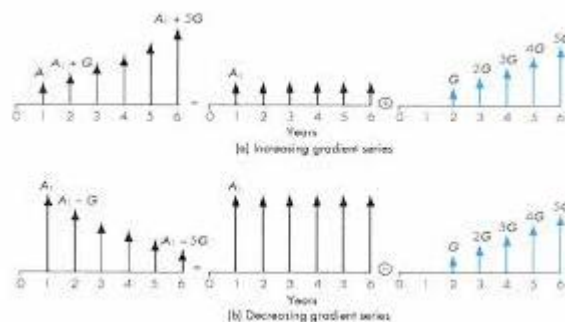
$$A = 50,000[(1+0.5)^{30} - 1 / 0.5(1+0.5)^{30}]$$

$$A = 50,000(15.3724)$$

$$= 7,68,520$$

Arithmetic Gradient Factors, A/G

An arithmetic gradient is a cash flow series that either increases or decreases by a constant amount, the gradient. The cash flow changes by the same amount each period. Each year-end amount is different although the increase is constant.



Example-a series of payment would be uniformly increasing in Rs200,Rs250,Rs300 and Rs350 occurring at the end of the first,second,third and fourth year respectively similarly, decreasing series will be rs200,Rs150,Rs100,Rs50 occurring at the end of the

first, second, third and fourth year respectively in each case the equal payment series provides the base with a constant annual increase/decrease at the end of each year.

And can be illustrated as $A', A+G', A+2G', \dots, A+(N-1)G$.

Here N is the duration of the series ($N=4$.) The uniform series can be evaluated by calculating F or P of each individual payment. And the result should be added. In another method the calculation can be made simple by converting the series to an equivalent annuity of equal payments A .

The present worth at year 0 of only the gradient is equal to the sum of the present worth of the individual values, where each value is a future amount.

$$A = A_1 + G (A/G, i, n)$$

$$A = A_1 + G (A/G, 12\%, 10)$$

$$A = A_1 + G [1/i - n/(1+i)^n - 1]$$

$$A = 10000 + 5000 [1/0.12 - 10/(1+0.12)^{10} - 1]$$

$$A = 10000 + 5000(3.5847)$$

$$A = 10000 + 17500$$

$$A = 27500$$

$$F = A [(1+i)^n - 1] / i$$

$$F = 27500 [(1+0.12)^{10} - 1] / 0.12$$

$$F = 27500(17.549) = 482597.5$$

Project Evaluation

In most of the practical decision environments, executives will be forced to select the best alternative from a set of competing alternatives.

Let us assume that an organization has a huge sum of money for potential investment and there are three different projects whose initial outlay and annual revenues during their lives are known. The executive has to select the best alternative among these three competing projects.

There are several bases for comparing the worthiness of the projects. These bases are:

1. Present worth method
2. Future worth method
3. Annual equivalent method
4. Rate of return method

PRESENT WORTH METHOD

✓ In this method of comparison, the cash flows of each alternative will be reduced to time zero by assuming an interest rate i .

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✓ Then, depending on the type of decision, the best alternative will be selected by comparing the present worth amounts of the alternatives.

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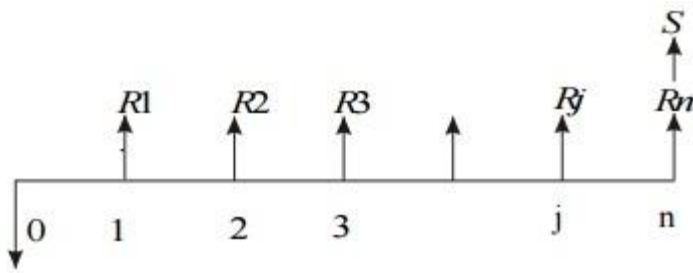
In a cost dominated cash flow diagram, the costs (outflows) will be assigned with positive sign and the profit, revenue, salvage value (all inflows), etc. will be assigned with negative sign.

✓ In a revenue/profit-dominated cash flow diagram, the profit, revenue, salvage value (all inflows to an organization) will be assigned with positive sign. The costs (outflows) will be assigned with negative sign.

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a. Revenue-Dominated Cash Flow Diagram

A generalized revenue-dominated cash flow diagram to demonstrate the present worth method of comparison is presented in Fig.



To find the present worth of the above cash flow diagram for a given interest rate, the formula is

$$PW(i) = -P + R1[1/(1+i)^1] + R2[1/(1+i)^2] + \dots \\ + Rj[1/(1+i)^j] + Rn[1/(1+i)^n] + S[1/(1+i)^n]$$

or

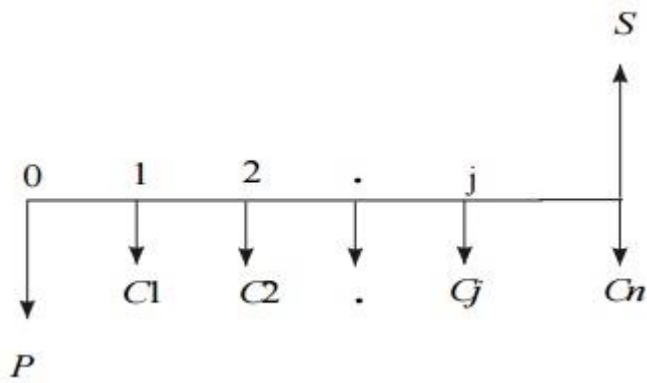
In case of uniform payment/Receipt series.

$$PW(i) = -P + R \frac{\{(1+i)^n - 1\}}{i(1+i)^n} + S \frac{1}{(1+i)^n}$$

$$PW(i) = -P + R(P/A, i, n) + S(P/F, i, n)$$

b. Cost-Dominated Cash Flow Diagram

A generalized cost-dominated cash flow diagram to demonstrate the present worth method of comparison is presented in Fig.



To compute the present worth amount of the above cash flow diagram for a given interest rate i , we have the formula

$$PW(i) = P + C_1[1/(1+i)^1] + C_2[1/(1+i)^2] + \dots + C_j[1/(1+i)^j] + C_n[1/(1+i)^n] - S[1/(1+i)^n]$$

In case of uniform payment/Receipt series.

$$PW(i) = -P - C \frac{\{(1+i)^n - 1\}}{i(1+i)^n} + S \frac{1}{(1+i)^n}$$

$$PW(i) = -P - C(P/A, i, n) + S(P/F, i, n)$$

EXAMPLE

Alpha Industry is planning to expand its production operation. It has identified three different technologies for meeting the goal. The initial outlay and annual revenues with respect to each of the technologies are summarized in Table 1. Suggest the best technology which is to be implemented based on the present worth method of comparison assuming 20% interest rate, compounded annually.

Table 1

	Initial outlay (Rs.)	Annual revenue (Rs.)	Life (years)
Technology 1	12,00,000	4,00,000	10
Technology 2	20,00,000	6,00,000	10
Technology 3	18,00,000	5,00,000	10

Solution

In all the technologies, the initial outlay is assigned a negative sign and the annual revenues are assigned a positive sign.

TECHNOLOGY 1

Initial outlay, $P = \text{Rs. } 12,00,000$

Annual revenue, $A = \text{Rs. } 4,00,000$

Interest rate, $i = 20\%$, compounded annually

Life of this technology, $n = 10$ years

The cash flow diagram of this technology is as shown in Fig. 4.3.

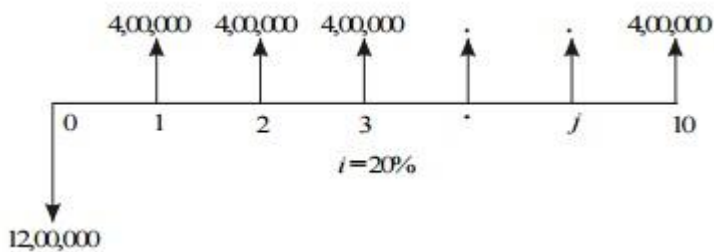


Fig. Cash flow diagram for technology 1.

The present worth expression for this technology is

$$PW(20\%)_1 = -12,00,000 + 4,00,000 (P/A, 20\%, 10)$$

$$= -12,00,000 + 4,00,000 (4.1925)$$

$$= -12,00,000 + 16,77,000$$

$$= \text{Rs. } 4,77,000$$

TECHNOLOGY 2

Initial outlay, $P = \text{Rs. } 20,00,000$

Annual revenue, $A = \text{Rs. } 6,00,000$

Interest rate, $i = 20\%$, compounded annually

Life of this technology, $n = 10$ years

The cash flow diagram of this technology is shown in Fig. 4.4.

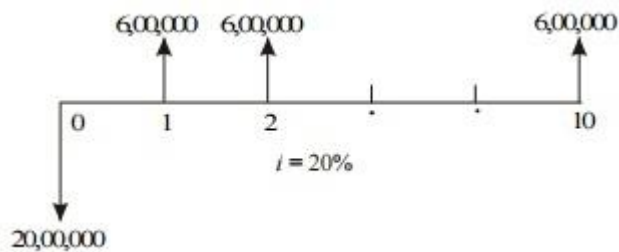


Fig. Cash flow diagram for technology 2.

The present worth expression for this technology is

$$PW(20\%)_2 = -20,00,000 + 6,00,000 (P/A, 20\%, 10)$$

$$= -20,00,000 + 6,00,000 (4.1925)$$

$$= -20,00,000 + 25,15,500$$

$$= \text{Rs. } 5,15,500$$

TECHNOLOGY 3

Initial outlay, $P = \text{Rs. } 18,00,000$

Annual revenue, $A = \text{Rs. } 5,00,000$

Interest rate, $i = 20\%$, compounded annually

Life of this technology, $n = 10$ years

The cash flow diagram of this technology is shown in Fig. 4.5.

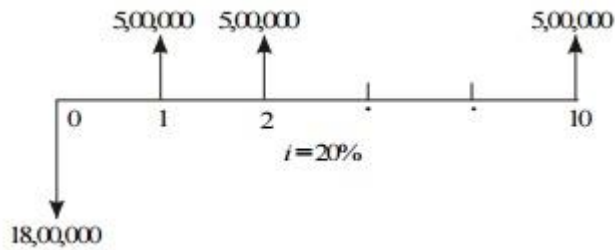


Fig. Cash flow diagram for technology 3.

The present worth expression for this technology is

$$PW(20\%)_3 = -18,00,000 + 5,00,000 (P/A, 20\%, 10)$$

$$= -18,00,000 + 5,00,000 (4.1925)$$

$$= -18,00,000 + 20,96,250$$

$$= \text{Rs. } 2,96,250$$

From the above calculations, it is clear that the present worth of technology 2 is the highest among all the technologies. Therefore, technology 2 is suggested for implementation to expand the production.

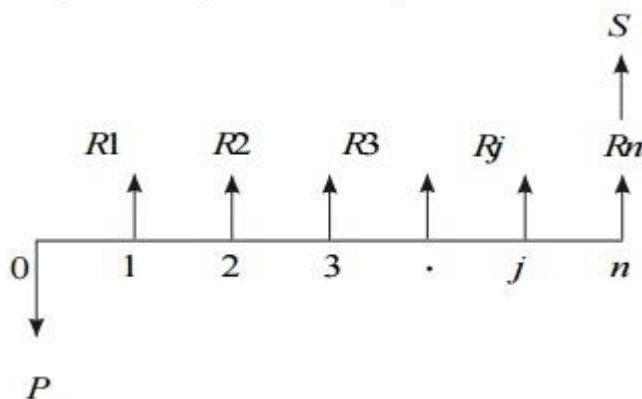
FUTURE WORTH METHOD

- ✓ In the future worth method of comparison of alternatives, the future worth of various alternatives will be computed.

- ✓ Then, the alternative with the maximum future worth of net revenue or with the minimum future worth of net cost will be selected as the best alternative for implementation.

i.Revenue-Dominated Cash Flow Diagram

A generalized revenue-dominated cash flow diagram to demonstrate the future worth method of comparison is presented in Fig.



In Fig. P represents an initial investment, R_j the net-revenue at the end of the j th year, and S the salvage value at the end of the n th year.

The formula for the future worth of the above cash flow diagram for a given interest rate, i is

$$FW(i) = -P(1+i)^n + R_1(1+i)^{n-1} + R_2(1+i)^{n-2} + \dots \\ + R_j(1+i)^{n-j} + \dots + R_n + S$$

In case Uniform series cash flow

$$FW(i) = -P(1+i)^n + R \left[\frac{(1+i)^n - 1}{i} \right] + S$$

In the above formula, the expenditure is assigned with negative sign and the revenues are assigned with positive sign.

ii. Cost-Dominated Cash Flow Diagram

A generalized cost-dominated cash flow diagram to demonstrate the future worth method of comparison is given in Fig.

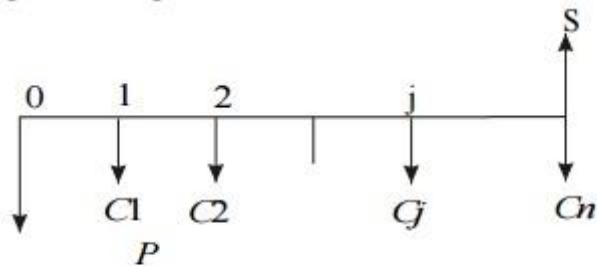


Fig. Cost-dominated cash flow diagram.

In Fig. 5.2, P represents an initial investment, C_j the net cost of operation and maintenance at the end of the j th year, and S the salvage value at the end of the n th year.

The formula for the future worth of the above cash flow diagram for a given interest rate, i is

$$FW(i) = P(1+i)^n + C_1(1+i)^{n-1} + C_2(1+i)^{n-2} + \dots + C_j(1+i)^{n-j} + \dots + C_n - S$$

In case Uniform series cash flow

$$FW(i) = -P(1+i)^n - C \left\{ \frac{(1+i)^n - 1}{i} \right\} + S$$

EXAMPLE

Consider the following two mutually exclusive alternatives:

Alternative	End of year				
	0	1	2	3	4
A (Rs.)	-50,00,000	20,00,000	20,00,000	20,00,000	20,00,000
B (Rs.)	-45,00,000	18,00,000	18,00,000	18,00,000	18,00,000

At $i = 18\%$, select the best alternative based on future worth method of comparison.

Solution Alternative A

Initial investment, $P = \text{Rs. } 50,00,000$

Annual equivalent revenue, $A = \text{Rs. } 20,00,000$

Interest rate, $i = 18\%$, compounded annually

Life of alternative A = 4 years

The cash flow diagram of alternative A is shown in Fig.

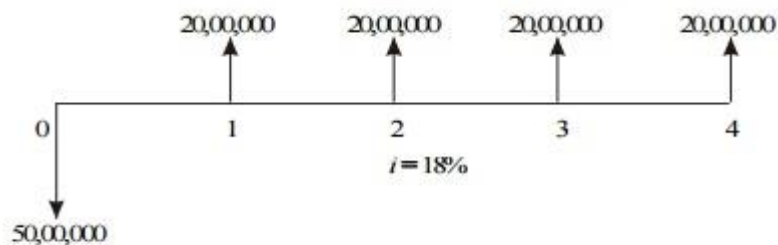


Fig. Cash flow diagram for alternative A.

The future worth amount of alternative B is computed as

$$FWA(18\%) = -50,00,000(F/P, 18\%, 4) + 20,00,000(F/A, 18\%, 4)$$

$$= -50,00,000(1.939) + 20,00,000(5.215)$$

$$= \text{Rs. } 7,35,000$$

Alternative B

Initial investment, $P = \text{Rs. } 45,00,000$

Annual equivalent revenue, $A = \text{Rs. } 18,00,000$

Interest rate, $i = 18\%$, compounded annually

Life of alternative B = 4 years

The cash flow diagram of alternative B is illustrated in Fig..

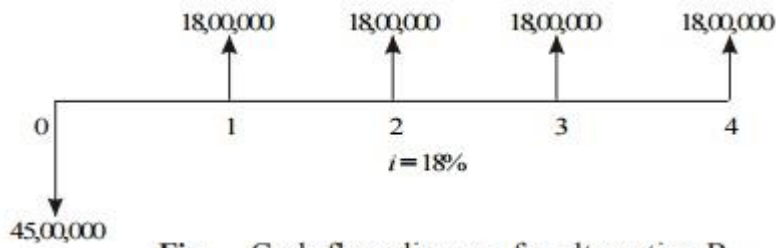


Fig. Cash flow diagram for alternative B.

The future worth amount of alternative B is computed as

$$\begin{aligned}
 FWB(18\%) &= -45,00,000(F/P, 18\%, 4) + 18,00,000 (F/A, 18\%, 4) \\
 &= -45,00,000(1.939) + 18,00,000(5.215) \\
 &= \text{Rs. } 6,61,500
 \end{aligned}$$

ANNUAL EQUIVALENT METHOD

- ✓ Find out the Present worth of capital flows

$$PW(i) = -P + R \frac{\{(1+i)^n - 1\}}{i(1+i)^n} + S \frac{1}{(1+i)^n}$$

- ✓ Multiply the value of PW by Capital recovery factor

$$\text{(ii) } A = PW \frac{i(1+i)^n}{(1+i)^n - 1}$$

i.Revenue-Dominated Cash Flow Diagram

A generalized revenue-dominated cash flow diagram to demonstrate the annual equivalent method of comparison is presented in Fig.

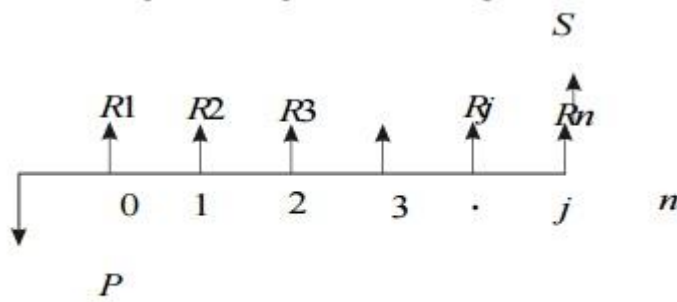


Fig. Revenue-dominated cash flow diagram.

Fig. Revenue-dominated cash flow diagram.

In Fig. P represents an initial investment, R_j the net revenue at the end of the j th year, and S the salvage value at the end of the n th year.

The first step is to find the net present worth of the cash flow diagram using the following expression for a given interest rate, i :

$$PW(i) = -P + R_1/(1+i)^1 + R_2/(1+i)^2 + \dots \\ + R_j/(1+i)^j + \dots + R_n/(1+i)^n + S/(1+i)^n$$

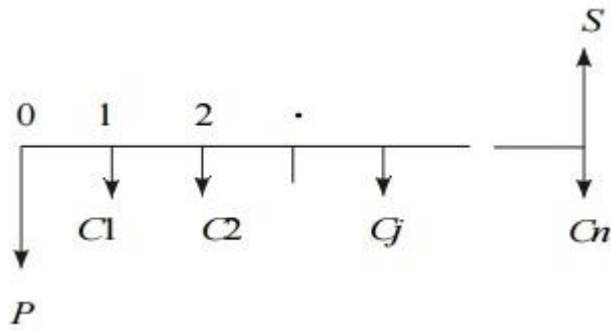
OR

$$PW(i) = -P + R \frac{\{(1+i)^n - 1\}}{i(1+i)^n} + S \frac{1}{(1+i)^n}$$

In the above formula, the expenditure is assigned with a negative sign and the revenues are assigned with a positive sign.

ii. Cost-Dominated Cash Flow Diagram

A generalized cost-dominated cash flow diagram to demonstrate the annual equivalent method of comparison is illustrated in Fig.



In Fig, P represents an initial investment, C_j the net cost of operation and maintenance at the end of the j th year, and S the salvage value at the end of the n th year.

The first step is to find the net present worth of the cash flow diagram using the following relation for a given interest rate, i .

$$PW(i) = P + C_1/(1+i)^1 + C_2/(1+i)^2 + \dots$$

$$+ C_j/(1+i)^j + \dots + C_n/(1+i)^n - S/(1+i)^n$$

OR

$$PW(i) = -P - C \frac{\{(1+i)^n - 1\}}{i(1+i)^n} + S \frac{1}{(1+i)^n}$$

EXAMPLE

Alpha Industry is planning to expand its production operation. It has identified three different technologies for meeting the goal. The initial outlay and annual revenues with respect to each of the technologies are summarized in Table 1. Suggest the best technology which is to be implemented based on the present worth method of comparison assuming 20% interest rate, compounded annually.

Table 1

	Initial outlay (Rs.)	Annual revenue (Rs.)	Life (years)
Technology 1	12,00,000	4,00,000	10
Technology 2	20,00,000	6,00,000	10
Technology 3	18,00,000	5,00,000	10

Solution

In all the technologies, the initial outlay is assigned a negative sign and the annual revenues are assigned a positive sign.

TECHNOLOGY 1

Initial outlay, $P = \text{Rs. } 12,00,000$

Annual revenue, $A = \text{Rs. } 4,00,000$

Interest rate, $i = 20\%$, compounded annually

Life of this technology, $n = 10$ years

The cash flow diagram for this technology is as shown in Fig. 4.3.

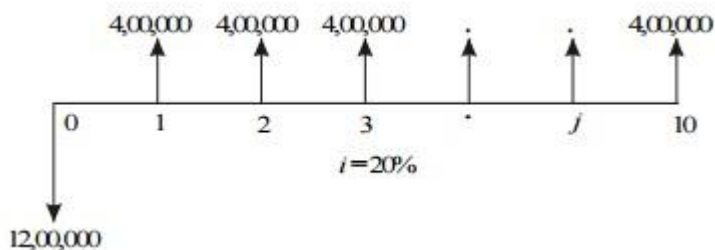


Fig. Cash flow diagram for technology 1.

The present worth expression for this technology is

$$\begin{aligned} \text{PW}(20\%)_1 &= -12,00,000 + 4,00,000 (P/A, 20\%, 10) \\ &= -12,00,000 + 4,00,000 (4.1925) \\ &= -12,00,000 + 16,77,000 \\ &= \text{Rs. } 4,77,000 \end{aligned}$$

(ii) $\text{EAW} = \text{PW} \frac{i(1+i)^n}{(1+i)^n - 1}$

$$\begin{aligned} \text{EAW} &= 477000 \{ 0.20(1+0.20)/(1+0.20)^{10} - 1 \} \\ &= 477000(0.2385) \\ &= 113764.00 \end{aligned}$$

TECHNOLOGY 2

Initial outlay, $P = \text{Rs. } 20,00,000$

Annual revenue, $A = \text{Rs. } 6,00,000$

Interest rate, $i = 20\%$, compounded annually

Life of this technology, $n = 10$ years

The cash flow diagram of this technology is shown in Fig. 4.4.

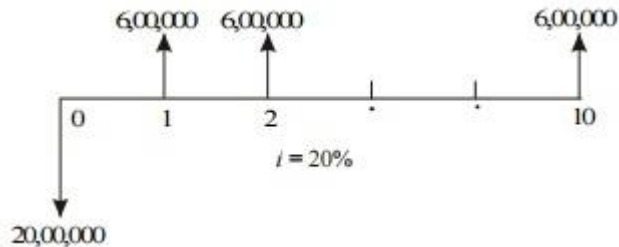


Fig. Cash flow diagram for technology 2.

The present worth expression for this technology is

$$\begin{aligned} PW(20\%)_2 &= -20,00,000 + 6,00,000 (P/A, 20\%, 10) \\ &= -20,00,000 + 6,00,000 (4.1925) \end{aligned}$$

$$= -20,00,000 + 25,15,500$$

$$= \text{Rs. } 5,15,500$$

$$(ii) \text{ EAW} = PW \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$\begin{aligned} \text{EAW} &= 5,15,500 \{ 0.20(1+0.20)/(1+0.20)^{10} - 1 \} \\ &= 5,15,500(0.2385) \\ &= 122946.00 \end{aligned}$$

TECHNOLOGY 3

Initial outlay, $P = \text{Rs. } 18,00,000$

Annual revenue, $A = \text{Rs. } 5,00,000$

Interest rate, $i = 20\%$, compounded annually

Life of this technology, $n = 10$ years

The cash flow diagram of this technology is shown in Fig. 4.5.

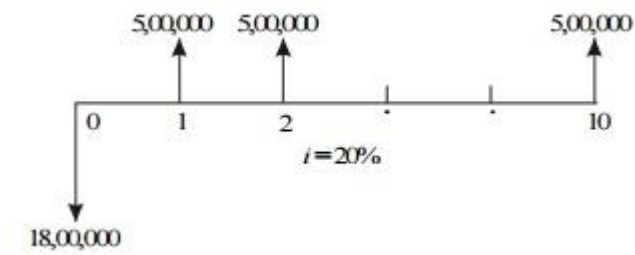


Fig. Cash flow diagram for technology 3.

The present worth expression for this technology is

$$\begin{aligned}
 PW(20\%)_3 &= -18,00,000 + 5,00,000 (P/A, 20\%, 10) \\
 &= -18,00,000 + 5,00,000 (4.1925) \\
 &= -18,00,000 + 20,96,250 \\
 &= \text{Rs. } 2,96,250
 \end{aligned}$$

(ii) $EAW = PW \frac{i(1+i)^n}{(1+i)^n - 1}$

$$\begin{aligned}
 EAW &= 296250 \{0.20(1+0.20)/(1+0.20)^{10} - 1\} \\
 &= 296250(0.2385) \\
 &= 70665.00
 \end{aligned}$$

From the above calculations, it is clear that the present worth of technology 2 is the highest among all the technologies. Therefore, technology 2 is suggested for implementation to expand the production.

Internal Rate Of Return Method

1. The **Minimum Acceptable Rate of Return (MARR)** is the rate set by an organization to designate the lowest level of return that makes an investment acceptable.
2. The **Internal Rate of Return (IRR)** is the rate on the unrecovered balance of the investment in a situation where the terminal balance is zero. It is a discount rate at which NPW equals to zero.
3. The **External Rate of Return (ERR)** is the rate of return that is possible to obtain for an investment under the current economic conditions. For example, suppose the analysis of an investment shows that it will realize an IRR of 50 per cent. Rationally, it is not reasonable to expect that we can invest in the external market and get that high a rate. In engineering economics studies, the external interest rate most often will be set to the MARR.

6.5.1 Minimum Acceptable Rate of Return

The (MARR) also known as minimum attractive rate of return, is a lower limit for investment acceptability set by organizations or individuals. It is a method designed to make the best possible use of a limited resource, i.e. money. Rates vary widely according to the type of organization. They even vary within the organization. Historically, government agencies and regulated public utilities have utilized lower required rates of return than have competitive industrial enterprises. Within a given enterprise, the required rate may be different for various divisions or activities. These variations usually reflect the risks involved. For instance, the rate of return required for cost reduction proposals may be lower than that required for research and development projects where there are less certainty about the prospective cash flows.

about the prospective cash flows.

6.5.2 Internal Rate of Return (IRR)

The IRR is the best known and most widely used rate of return method. It is also known as the **true rate of return method** and the **discounted cash flow method**. The IRR represented by i in the traditional interpretation of interest rates, is the rate of interest earned by an alternative investment on the unrecovered balance of an investment.

The IRR can be calculated by equating the annual, present, or future worth of cash flow to zero, and solving for the interest rate (IRR) that allows equality. It should be added that solving for the interest rate in this manner results in a polynomial equation, a function of i , which may result in multiple roots of the equation. In such cases, the IRR may or may not be one of the equation roots.

Although both the EAW and the FW approaches are legitimate, the rate of return is often defined in terms of present worth, under the constraints of possible i^* roots, where IRR is

- the interest rate at which the present worth of the cash flow of a project is zero, or,
- to restate this in another way the rate which when employed in computing the present worth of all costs and present worths of all returns will make both equal.

As the rate of return computations usually begin with a problem expressed in terms of present worth or annual worth, it is necessary to pay attention to the guidelines for EAW and PW methods. In particular, mutually exclusive alternatives (where selection of one precludes the selection of another) must be compared on the basis of equivalent outcomes. In the case of independent alternatives (the choice of one does not affect the choice of another, except for limited capital availability), all costs and benefits must be explicitly stated.



Therefore, the rate of return for the new business is 15.252 per cent.

EXAMPLE 6.15

A company is trying to diversify its business in a new product line. The life of the project is 10 years with no salvage value at the end of its life. The initial outlay of the project is Rs. 2,000,000 and annual net profit is Rs. 350,000. Find the rate of return for the new business.

Solution

Life of the product line(n) = 10 years
 Initial outlay = Rs. 2,000,000
 Annual net profit = Rs. 350,000
 Scrap value after 10 years = 0

The cash flow diagram for this situation is shown in Figure E6.15.1.

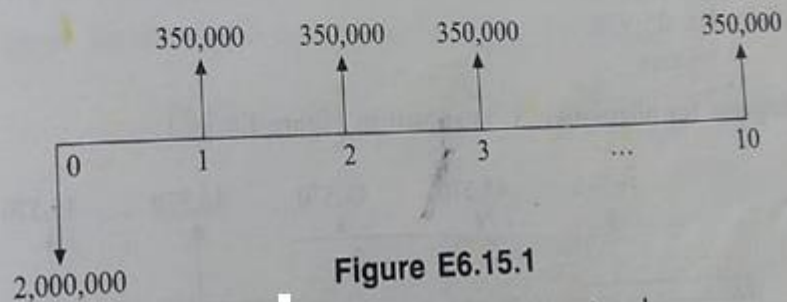


Figure E6.15.1

The formula for the net present worth function of the situation is

$$PW = -P + R(P/A, i, n)$$

$$PW(i) = -2,000,000 + 350,000(P/A, i, 10)$$

When $i = 10\%$,

$$\begin{aligned} PW(10\%) &= -2,000,000 + 350,000(P/A, 10\%, 10) \\ &= -2,000,000 + 350,000(6.1446) \\ &= \text{Rs. } 150,610. \end{aligned}$$

When $i = 12\%$

$$\begin{aligned} PW(12\%) &= -2,000,000 + 350,000(P/A, 12\%, 10) \\ &= -2,000,000 + 350,000(5.6502) \\ &= \text{Rs. } -22,430 \end{aligned}$$

$$IRR = i_a + \frac{NPW_a}{NPW_a - NPW_b} (i_b - i_a)$$

$$\begin{aligned} i &= 10\% + \frac{150,610 - 0}{150,610 - (-22,430)} \times (2\%) \\ &= 11.74\% \end{aligned}$$

Therefore, the rate of return of the new product line is 11.74 per cent.

RATE OF RETURN METHOD

- ✓ The rate of return of a cash flow pattern is the interest rate at which the present worth of that cash flow pattern reduces to zero.
- ✓ In this method of comparison, the rate of return for each alternative is computed. Then the alternative which has the highest rate of return is selected as the best alternative.
- ✓ A generalized cash flow diagram to demonstrate the rate of return method of comparison is presented in Fig

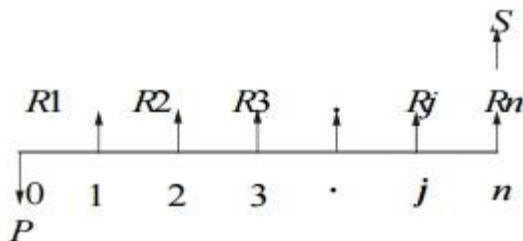


Fig. Generalized cash flow diagram.

In the above cash flow diagram, P represents an initial investment, R_j the net revenue at the end of the j th year, and S the salvage value at the end of the n th year.

The first step is to find the net present worth of the cash flow diagram using the following expression at a given interest rate, i .

$$PW(i) = -P + R_1/(1+i)^1 + R_2/(1+i)^2 + \dots$$

$$+ R_j/(1+i)^j + \dots + R_n/(1+i)^n + S/(1+i)^n$$

EXAMPLE

A person is planning a new business. The initial outlay and cash flow pattern for the new business are as listed below. The expected life of the business is five years. Find the rate of return for the new business.

Period	0	1	2	3	4	5
Cash flow (Rs.)	-1,00,000	30,000	30,000	30,000	30,000	30,000

Solution

Initial investment = Rs. 1,00,000 Annual equal revenue = Rs. 30,000 Life = 5 years

The cash flow diagram for this situation is illustrated in Fig.

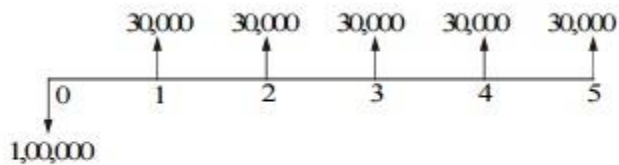


Fig. Cash flow diagram.

Fig. Cash flow diagram.

The present worth function for the business is

$$PW(i) = -1,00,000 + 30,000(P/A, i, 5)$$

When $i = 10\%$,

$$\begin{aligned} PW(10\%) &= -1,00,000 + 30,000(P/A, 10\%, 5) \\ &= -1,00,000 + 30,000(3.7908) \\ &= \text{Rs. } 13,724. \end{aligned}$$

When $i = 15\%$,

$$PW(15\%) = -1,00,000 + 30,000(P/A, 15\%, 5)$$

$$= -1,00,000 + 30,000(3.3522)$$

$$= \text{Rs. } 566.$$

When $i = 18\%$,

$$PW(18\%) = -1,00,000 + 30,000(P/A, 18\%, 5)$$

$$= -1,00,000 + 30,000(3.1272)$$

$$= \text{Rs. } -6,184$$

$$i = 15\% + \frac{566 - 0}{566 - (-6184)} \quad (3\%)$$

$$i = 15\% + 0.252\% = 15.252\%$$

Therefore, the rate of return for the new business is 15.252%.

Cost Benefit Analysis Method

Project Report Preparation

The preparation of a report on a project is a complex task which requires the services of both engineers and economists. Prior to the preparation of a project report, a 'pre-feasibility study' is carried out by the appropriate authority. The pre-feasibility study states, in broad terms, the objectives, and defines the alternative means (sizes, designs, location, etc.) which the report appraisal team is expected to examine. The project report is generally known as 'feasibility report'. It has now become the main basis on which authorities decide whether a particular project is to be accepted, modified or rejected. Project reports are not prepared on uniform lines and often differ considerably in their presentation. However, one can identify the following six main components of these reports:

1. **Terms of reference:** They are based on the pre-feasibility study and provide guidelines for the project appraisal team. These include the definition of the objectives of the study, outline of the project alternatives, etc.
2. **Engineering study:** Its purpose is to determine the technical feasibility of the project. Engineering study covers the physical characteristics of the project, the design of construction and plant, the technical aspect of output, time schedule for the project execution, etc.
3. **Financial study:** It provides cost estimates of the project in budgetary terms. Financial study examines the direct costs of construction of a plant at market prices and presents financial evaluation on an accounting basis.
4. **Cost-benefit analysis:** This analysis includes appraisal of the economic costs and benefits of the project and alternatives, and its impact on the economy and on the welfare of the people who are directly or indirectly affected by it. This analysis, thus, provides the basis on which the project should be accepted, modified or rejected.
5. **Implementation:** It examines the social and environmental implications of the project.
6. **Recommendation:** It presents a brief summary of the project with specific recommendations for consideration at the decision-making level. This report is usually submitted to the planning authority, the relevant ministry and also to the project financing agency. If the project is accepted, it may be undertaken. It will usually pass through the three main stages: viz. the *design stage*, the *construction* and the *entry into the operation*.

6.6.1 Cost-Benefit Analysis

The question to which cost-benefit analysis addresses itself is whether it is socially desirable to undertake a number of investment projects A, B, C, D, etc. and if investible funds are limited, then how many of these should be selected. Since the choice involves maximization, we have to discuss what it is that investment planners wish to maximize. In general terms, an investment planner wants to maximize the present value of all benefits less that of all costs, subject to specific constraints. This general formulation raises the following specific questions, the answers to which provide the general principles of cost-benefit analysis:

- In project appraisal which costs and which benefits are to be considered?
- How are these costs and benefits to be valued?
- How can profitability of a project be measured?
- What is the relevance of uncertainty in project appraisal?
- What are the relevant constraints?

There is certainly some arbitrariness in the choice of these questions. In evaluating alternatives of private organizations, the criterion is to select the alternative with the maximum profit. Profit

maximization is the main goal of private organizations besides providing goods/services as per specifications to their customers. But the same criterion cannot be used while evaluating public alternatives. Examples of some public alternatives are: constructing bridges, roads, dams, establishing public utilities.

The main objective of any public alternative is to provide goods/services to the public at the minimum cost. In this process, one should see whether the benefits of the public activity are at least equal to its costs. If yes, then the public activity can be undertaken for implementation. Otherwise, it can be cancelled. This is nothing but making a decision based on Benefit-Cost ratio (BC) given by

$$BC \text{ ratio} = \frac{\text{Equivalent benefits}}{\text{Equivalent costs}}$$

The benefits may occur at different time periods of the public activity. For the purpose of comparison, these are to be converted into a common time base (present worth, future worth or annual equivalent). Similarly, the costs consist of initial investment, yearly operation and maintenance cost. These are to be converted to a common time base as done in the equivalent benefits. Now, the ratio between the equivalent benefits and the equivalent costs is known as the 'benefit-cost ratio'. If this ratio is at least one, the public activity is justified; otherwise, it is not justified. Let

- B_P = Present worth of the total benefits
- B_F = Future worth of the total benefits
- B_A = Annual equivalent of the total benefits
- P = Initial investment
- P_F = Future worth of the initial investment
- P_A = Annual equivalent of the initial investment
- C = Yearly cost of operation and maintenance
- C_P = Present worth of yearly cost of operation and maintenance
- C_F = Future worth of yearly cost of operation and maintenance

$$BC \text{ ratio} = \frac{B_P}{P + C_P} + \frac{B_F}{P_F + C_F} + \frac{B_A}{P_A + C}$$

- Cost-benefit analysis should normally be undertaken for any project which involves policy development, capital expenditure, use of assets or setting of standards. Depending on the nature of the issue, it will sometimes be very quick and easy. At other times it will require complex economic analysis best conducted by a professional evaluator experienced in CBA techniques.
- The best cost-benefit analyses take a broad view of costs and benefits, including indirect and longer-term effects, reflecting the interests of *all* stakeholders who will be affected by the programme. It is thus important to ensure the analysis is as comprehensive as possible.
- Cost-benefit analysis (CBA) is traditionally based on conventional welfare economics, which provides a utilitarian account of value which relies on individual self-interest. In practice, people express preferences for a much wider set of public goals. Techniques such as CBA rarely give proper recognition to these wider public preferences. Consideration should be given therefore to the prevailing understanding of the public good and how this is best served.

- In carrying out a CBA, it is critical to begin with an exhaustive list of all the different costs and benefits that could arise - even if some are later excluded. Otherwise, important aspects of the analysis could be overlooked.
- Information on costs, benefits and risks is rarely known with certainty, especially when one looks to the future. This makes it essential that sensitivity analysis is carried out, testing the robustness of the CBA result to changes in some of the key numbers.

Example

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Initial cost	= Rs. 80,000,000
Annual power sales	= Rs. 6,000,000
Annual flood control savings	= Rs. 3,000,000
Annual irrigation benefits	= Rs. 5,000,000
Annual recreation benefits	= Rs. 2,000,000
Annual operating and maintenance costs	= Rs. 3,000,000
Life of the project	= 50 years

Check whether the state government should implement the project (assume $i = 12\%$).

Solution

Initial cost	= Rs. 80,000,000
Annual power sales	= Rs. 6,000,000
Annual flood control savings	= Rs. 3,000,000
Annual irrigation benefits	= Rs. 5,000,000
Annual recreation benefits	= Rs. 2,000,000
Annual operating and maintenance costs	= Rs. 3,000,000
Life of the project	= 50 years, and $i = 12\%$

Total annual benefits

$$= \text{Flood control savings} + \text{Irrigation benefits} + \text{Recreation benefits}$$

$$= \text{Rs. } 3,000,000 + \text{Rs. } 5,000,000 + \text{Rs. } 2,000,000$$

$$= \text{Rs. } 10,000,000$$

Present worth of the benefits = Total annual benefits $\times (P/A, 12\%, 50)$

$$= 10,000,000 \times (8.3045)$$

$$= \text{Rs. } 83,045,000$$

Present worth of costs = Initial cost + Present worth of annual operation and maintenance

Present worth of power sales

$$= \text{Rs. } 80,000,000 + 3,000,000 \times (P/A, 12\%, 50) - 6,000,000 (P/A, 12\%, 50)$$

$$= \text{Rs. } 80,000,000 + 3,000,000 \times 8.3045 - 6,000,000 \times 8.3045$$

$$= \text{Rs. } 55,086,500$$

BC ratio = $\frac{\text{Present worth of benefits}}{\text{Present worth of costs}} = \frac{83,045,000}{55,086,500} = 1.508$

Since the BC ratio is more than 1, the state government can implement the hydroelectric

EXAMPLE 6.18

In a particular locality of a state, the vehicle users take a roundabout route to reach certain places because of the presence of a river. This results in excessive travel time and increased fuel cost. So, the state government is planning to construct a bridge across the river. The estimated initial investment for constructing the bridge is Rs. 4,000,000. The estimated life of the bridge is 15 years. The annual operation and maintenance cost is Rs. 150,000. The value of fuel savings due to construction of the bridge is Rs. 600,000 in the first year and it increases by Rs. 50,000 every year thereafter till the end of the life of the bridge. Check whether the project is justified based on BC ratio by assuming an interest rate of 12 per cent, compounded annually.

Solution

Initial investment	= Rs. 4,000,000
Annual operation and maintenance	= Rs. 150,000
Annual fuel savings during the first year	= Rs. 600,000
Equal increment in fuel savings in the following years	= Rs. 50,000

Present worth of Initial cost

$$PW = P + C \{ (1+i)^n - 1 / i(1+i)^n \}$$

$$PW \text{ of cost} = 40,00,000 + 150,000 \{ (1+0.12)^{15} - 1 / 0.12(1+0.12)^{15} \}$$

$$PW \text{ of cost} = 40,00,000 + 150,000(6.1944)$$

$$PW \text{ of cost} = 40,00,000 + 9,26,160$$

$$= 49,26,160$$

Then PW Of Benefits=

$$A = A_1 + G (A/G, i, n)$$

$$A = A_1 + G [1/i - n/(1+i)^n - 1]$$

$$A = A_1 + G (A/G, 12\%, 15)$$

$$A = 6,00,000 + 50,000(4.9803)$$

$$A = 8,49,015$$

$$PW \text{ Of Benefits} = A \{ (1+i)^n - 1 / i(1+i)^n \}$$

$$= 8,49,015 \{ (1+0.12)^{15} - 1 / 0.12(1+0.12)^{15} \}$$

$$= 8,49,015(6.1944)$$

$$=5259138$$

BC Ratio = PW of Benefits / PW of Cost

$$=5259138/4926160$$

$$=1.067$$

$$\text{BC Ratio} = 1.067$$