INTRODUCTION

This course provides the student with an introduction to the basic elements of modern microeconomics. The course provides coverage of the institutional background and the history of significant microeconomic ideas and issues in Kenya and around the world. It will develop an understanding of how microeconomics relates to practical life. Students are expected to apply the knowledge in other economics units. The study employs extensive use of diagrams and mathematical expressions in the illustration of concepts.

On successful completion of this unit, students should be able to:

1. Demonstrate understanding of the fundamental methodology and principles of Microeconomic theory and practice;
2. Comprehend and critically appraise economic decisions made by governments, Businesses and households;
3. Use a range of skills to access, interpret and apply economic information in real world situations
4. Use and apply mathematical skills as appropriate – data analysis, graphs; etc;
5. Have a basis for further undergraduate study in economics and business

1: Introduction

- Meaning of economics
- Scarcity and choice
- The concept of opportunity cost
- Scope of economics
- Economic methodology
- Distinction between microeconomics and macroeconomics

Topic 2: The price theory

- Theory of demand
- Theory of supply
- The concept of equilibrium
- Application of price theory

Topic 3: Theory of the consumer

- The cardinal utility theory
- The ordinal/indifference curve theory
- Substitution and income effects
- Revealed preference hypothesis
- The consumer surplus
- Derivation of a household's demand curve

Topic 4: Theory of the firm

- Theory of production
- Theory of costs

Topic 5: Market structures

- Perfect/pure competition
- Monopoly
- Monopolistic competition
- Oligopoly

THE MEANING OF ECONOMICS.

Economics is a social science that has been in existence for about two centuries. Various economists have tried to define it differently. Three types of definition can be identified.

a) Wealth definition

b) Welfare definition

c) Scarcity definition

a) Wealth definition

Adam smith and his disciples J.B. Say, Walker, J.S. Mill defined economics as **an inquiry into the nature and courses of wealth of nations.** Such a definition has been criticized as follows.

(i) The definition is very selfish: it restricts economics to the study of wealth alone. The definition does not state clearly how man comes into the study.

(ii) Since economics is defined in terms of material commodity, it doesn't consider service e.g. services offered by doctors, teachers, etc.

b) Material welfare definition of economics

Alfred Marshall and his disciples, Pigou and Cannon defined economics as the study of **man's activities in the ordinary business of life.** It tries to study how man acquires and uses his resources aimed at improving the welfare of mankind. In this definition, it can be noted that on the one hand, economics is the study of wealth and on the other hand, and more important, a study of man.

Critism of the definition

(i) The definition excludes the study of services, that is, it only takes human material welfare.

(ii) Speaks of study of man's activities during ordinary business of life. The question remains, how about during extra ordinary business life?

c) Scarcity definition of economics

Leonel Robbin (1933) improved upon the above definition and explained economics as the study of human behavior (**as a relationship between scarce resources which have alternative uses)**

The definition has characteristics that are currently addressed in economics namely

- Limited/scarce resources
- Alternative uses
- Unlimited wants

Scarcity: when we say that a resource is scarce, it means that it is there but cannot meet the demand. The scarce productive resource would include, land, labor, capital, entrepreneurship, and by extension technology used in the production process.

Alternative uses: some resources may be having more than one use. For example milk can make butter, cheese, chocolate etc.

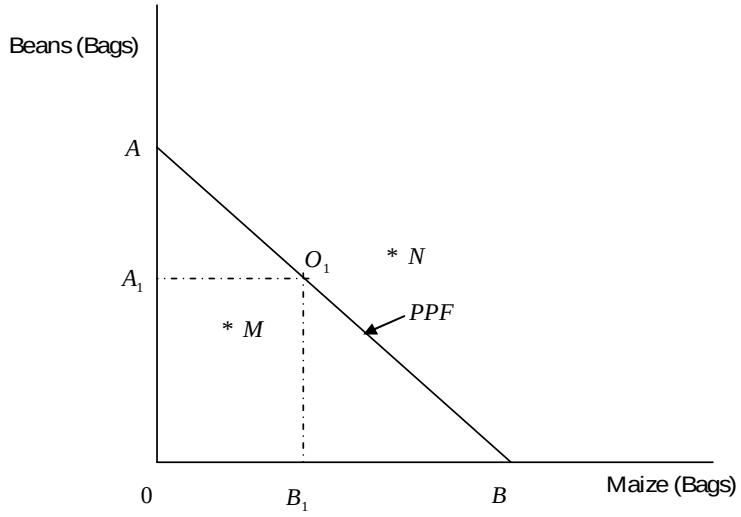
Unlimited wants: human needs are unlimited and they are recurrent in that when you satisfy a need today, the same need has to be satisfied tomorrow. They are also competitive in that they compete for the limited resources.

Based on the above definition, economists today agree on a general working definition of the discipline. They conclusively define economics as **the study of how man can use his scarce resources to satisfy his needs.**

Thus, we study economics in order to solve economic problem, which is that of allocating scarce resources among competing and unlimited wants in such a manner that greatest satisfaction is derived. To do this, the society will have to make a choice on what combination of goods and services to produce and what therefore to sacrifice. The quality that one foregoes/sacrifices in order to consume more of another is what is known as opportunity cost.

The concept of scarcity and opportunity cost.

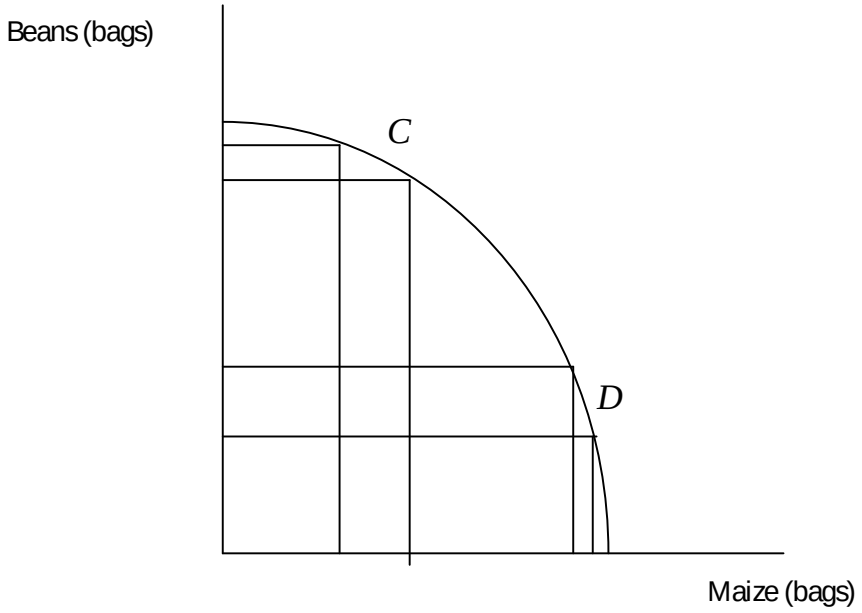
Here we shall illustrate how two goods would be produced using the available scarce resources.



The slope of the PPF is marginal rate of transformation (MRT)

The straight PPF represents constant opportunity cost. This means that factors of production can be usedin production of the two commodities equally efficiently

For increasing opportunity Cost, the following diagram is used;



Illustrated by a PPF concave to the origin.

- For simplicity assume that a country has same resources to enable her produce only two goods, namely beans and maize. If all resources are used to produce beans, OA units will be realized worth zero (0) units of maize. On the other hand, if all resources are used to produce maize, OB units will be produced with zero (0) units of beans. Thus the line joining point A and B is the production possibility frontier (PPF) or curve. **The frontier joins together different combinations of goods (beans and maize) which a country can produce using all available resources and efficiently.**
- All points inside PPF like M are attainable though they reflect under utilization or inefficiency in the use of resources.
- All points outside PPF like N are unattainable because resources are scarce.
- Thus points along AB are attainable and reflect efficient production.
- Suppose initially production was at point A, then only beans would be produced, to produce OB, units of maize would thus require OA units of beans be sacrificed. Quantity OA, units of beans which has to be forgone to produce OB units of maize is the opportunity cost of producing the maize. Sacrificing of production of one good for the other is as a result of scarcity of resources.

The nature and scope of economics.

(i) Scope of economics

Question; how does economics differ from other subjects? Economics involves the study of the problem of production, consumption, exchange and distribution of wealth as well as the determination of the values of goods and services. Besides, economics makes an inquiry into the possible causes and remedies of poverty, unemployment, underdevelopment, inflation etc.

The subject consists of a body of general principals and theories which may be applied to the interpretation of all economic problems, post and present. The fundamental economic problem of all nations seeks to address the following issues.

- What goods and services to produce
- How to produce them
- For whom to produce

(ii) Methodology of economics.

There are two approaches to the study of economics namely **positive and normative** analysis.

Positive analysis (deductive): is more central to micro-economics and it is concerned with what is, what was, and what will be. That is it is more specific and objective. It employs economic theory in explaining and predicting circumstances. The economic theories are tested against observations and are used to construct models from which prediction are made.

A theory therefore is a reasoned assumption intended to explain an occurrence or a phenomenon. A model on the other hand is a mathematical representation based on the economic theory.

Incase of controversies in positive analysis, we refer to economic theories that have been proven through empirical observations.

Normative analysis (inductive): goes beyond theory to ask questions like "what is best, what ought to be" etc. it is subjective meaning that it depends on value judgment on what is desirable.

Incase of controversies, individual policy choices will rule. It is concerned with alternative policy actions that helps in illuminating and sharpening debates.

Example to help distinguish between positive and normative.

Government imposes tax on a good; effect of this would be

- Increase price of commodity
- Good expensive than competing product
- As quantity demanded falls, firms to decrease number of workers employed.

  (Positive analysis; what is, what will be)

Normative analysis: For the firm on whom the product has been imposed they would ask; what should they do to improve their sales?

How should they improve competitiveness (normative – what ought to be)

BRANCHES OF ECONOMICS

Economics is divided into two main branches:- microeconomics and macroeconomics.

Microeconomics

- Deals with the behaviors of individual economic units. These units include consumers, workers, investors, owners of; land, business firms, infact any individual or entity that plays a role in the function of our economy.
- Microeconomics explains how and why these units make economic decisions. For example, it explains how consumers make purchasing decision and how their choices are affected by changing prices and income
- It also explains how firms decide how many workers to hire and how workers decide where to work and how much work to do.
- Another important concern of microeconomics is how economic units interact to form large units-markets and industries. By studying the behavior and interaction of individual firm and

  consumers, microeconomics reveal how industries and markets operate and evolve, why they differ from one another, and how they are affected by government policies and global economic conditions.

Macroeconomics

By contrast, macroeconomics, the other major branch of economics, deals with aggregate economic quantities, such as the level and growth rate of national output, interest rates, unemployment and inflation.

- But the boundary between macroeconomics has become less and less distinct in the recent years. The reason is that macroeconomics also involves the analysis of markets for goods and services and for labour.
- To understand how these aggregate markets operate, one must first understand the behavior of the firms, consumers, workers, and investors who make up these markets. Thus macroeconomists have become increasingly concerned with microeconomics foundation of aggregate economic phenomena and much of macroeconomics is actually an extension of microeconomic analysis.

THE ELEMENTARY PRICE THEORY: DEMAND AND SUPPLY

By the end of the lecture, the learner should be able to:

- Define demand and supply.
- Determine the factors affecting demand and supply.
- Define the laws of demand and supply
- Distinguish the concept of movement along and shift of the demand and supply curves.

DEMAND

Demand is defined as, the amount of a commodity people are **willing and able** to buy at all **possible prices** and in a **given time.**

There is a difference between demand and wants, in that demand are human desires that are fully backed by the ability to pay. On the other hand, wants are human needs that are not backed by ability to pay.

FACTORS THAT INFLUENCE QUALTITY DEMANDED

- Price of the commodity itself
- Price of other commodities which are related to the good in question (be they substitute or complementary) (Py)
- Consumer income (y)
- Consumer taste and preference for the good (T)
- Advertisement (A)
- Consumer expectation about future prices (E)
- Size of population and its composition (N)
- Credit availability (C)
- Other factors (Z)

Using a functional notation we come up with the following demand function

$$D_x = f(p_x, p_y, y, T, A, E, N, C, Z) \quad \ldots\ldots(1)$$

This simply states that the individual demand for good X is a function of all the factors listed in the brackets.

i) **The price of the commodity itself**

In order to analyze the effects of price on quantity demanded of the commodity, we hold all other factors fixed. the relationship between price and demand can be explained by the help of the **law of demand.** According to Alfred Marshall this law is defined as, "**other things being equal, with a fall in price, the demand for the commodity is extended (increases), and with a rise in the price, the demand is contracted (decreased)"**

This law can be explained with the help of a demand schedule and diagram.

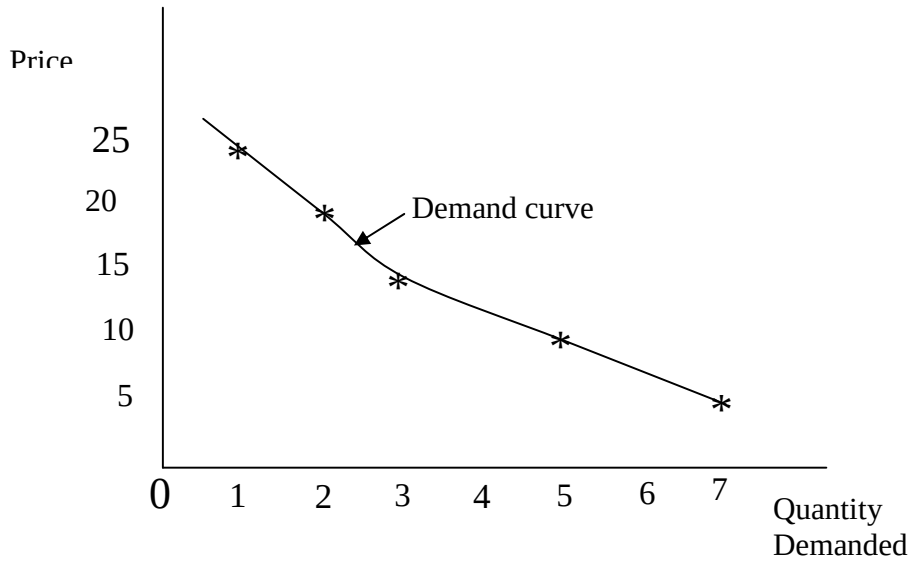
Demand Schedule: is a tabular representation of the quantity demanded of a good at given price level and at a given point in time.

Demand diagrams on the other hand is a graphical representation of the content of the demand schedule.

Demand schedule

Price in Kshs	**Quantity demanded**
25	**1**
20	**2**
15	**3**
10	**5**
5	**7**

From this demand schedule, a demand curve can be plotted as shown below.



In the above diagram it is seen that the demand curve slopes downwards from left to right showing that at higher prices less is demanded and at low prices more is demanded. We can thus say that for **normal demand curve,** less is demanded at higher prices and more is demanded at low prices.

REASONS FOR THE DOWNWARD SLOPING DEMAND CURVE.

i) Lowering prices brings in new buyers who were not able to buy at the previous price.

ii) Reduction of price may coax out some extra purchases by each of the initial consumers of the goods, while a rise in price may lead to less purchases. Naturally, consumers will try to substitute the commodity with another cheaper one.

Note also that a fall in price implies a rise in real income, hence the ability to purchase more of the same good.

iii) Whenever a commodity becomes expensive its consumption normally will be left for only very important uses. For instance a consumer may opt to use electricity lighting only, and not for cooking if its prices sky rocket. The vice versa is also true.

EXCEPTION TO THE LAW OF DEMAND

There exists cause where demand may slope upwards instead of downwards from left to right.

In the case of Giffen goods:- Giffen goods (named after the economist Sir Robert Giffen) are very inferior goods for which demand increase as price rises and decrease as price falls. This applies to poor communities.. e.g. In Asia people's stable food is rice. If price of rice was to fall, consumers may reduce their demand for rice or consume the same amount of rice.

$$\frac{\partial Q}{\partial p} > 0$$

(i) Veblen good (goods of ostentation)

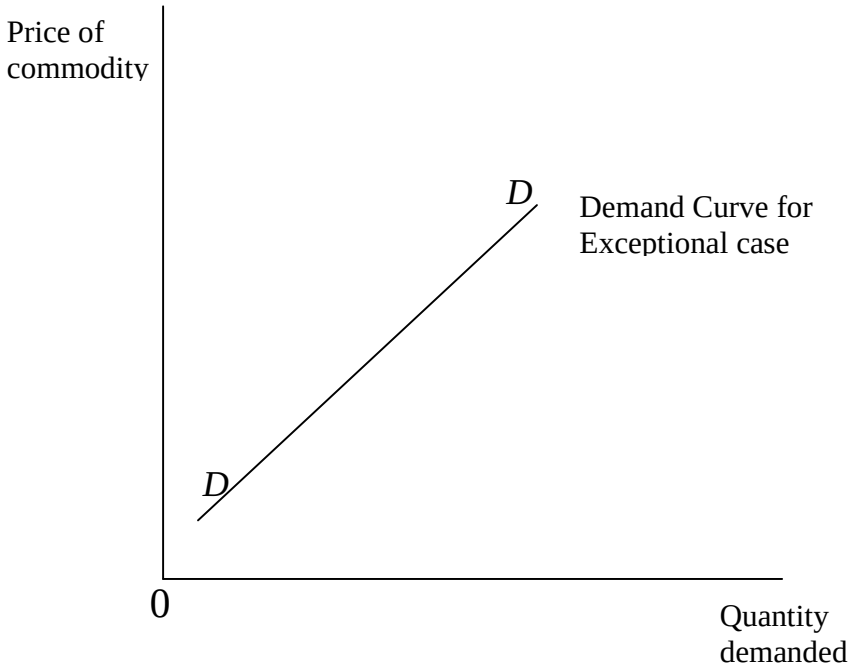
Goods associated with the rich, luxury goods such as jewellery, luxurious vehicles etc. the value of such goods (quality) is measured by how much expensive it is. For such goods, the higher the price, the higher will be the demand.

$$\frac{\partial Q}{\partial p} > 0$$

(ii) Fear of future rise in price

fear of future rise in price makes consumers buy more quantities of different goods even at higher prices than before because they know that if they dent buy more now, they will have to pay much higher prices in future.

The existence of such goods and factors explain why under exceptional case the demand curve may be positively sloped as below.


Price of
commodity
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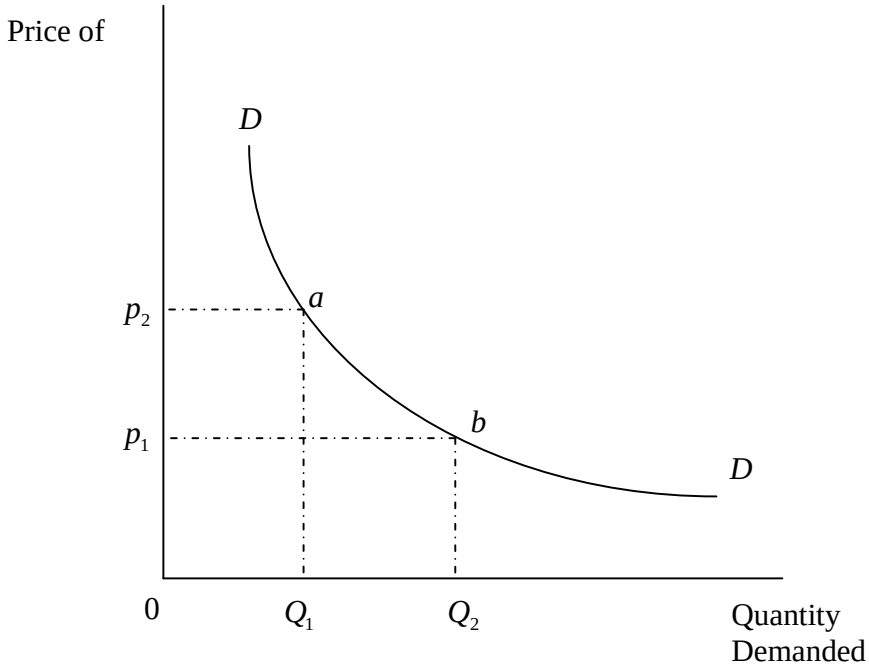
CONCEPT OF MOVEMENT ALONG DEMAND CURVE AND SHIFT OF DEMAND CURVE

A movement along a given demand curve is coursed by **change in the price of the commodity.** An upwards movement is caused by an increase in prices while a downwards movement is caused by a fall in prices. This can be shown as below.

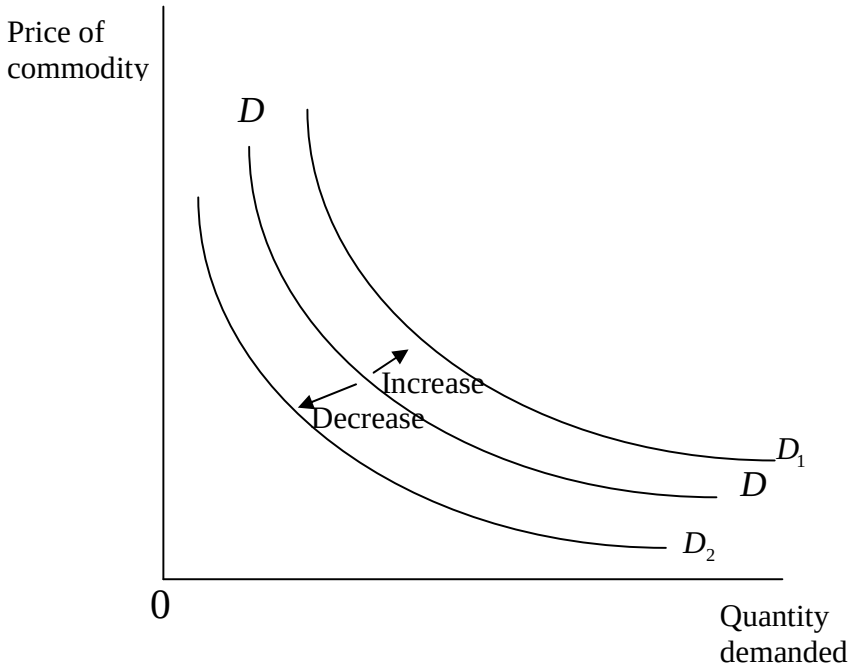


A movement from **b** to **a** is caused by a (rise) change in price prom p_1 to p_2 and a movement form a to b is caused by a fall in prices from p_2 to p_1.

Note: as price falls from p_2 to p_1, quantity demanded rises from Q_1 to Q_2.

A shift of the demand curve is caused by **change in other factors influencing demand other than price of the commodity.** The impact of these other factors shall be observed later.

A shift of the demand curve can either be to the right or left depending on the direction on which a change has taken place. A shift to the right shows an increase in demand while a shift to the left shows a decline in demand.



In the diagram above D_1D_1 represents an increase in demand while D_2D_2 represents a decline in demand.

OTHER FACTORS THAT INFLUENCE DEMAND

2) price of other commodities which are related to the good in question:

There are two possible relations between the demand of one commodity and the price of other commodity.

A fall in price of one commodity (X) may lower the quantity demanded of good Y, the two commodities x and y, are said to be **substitutes.**

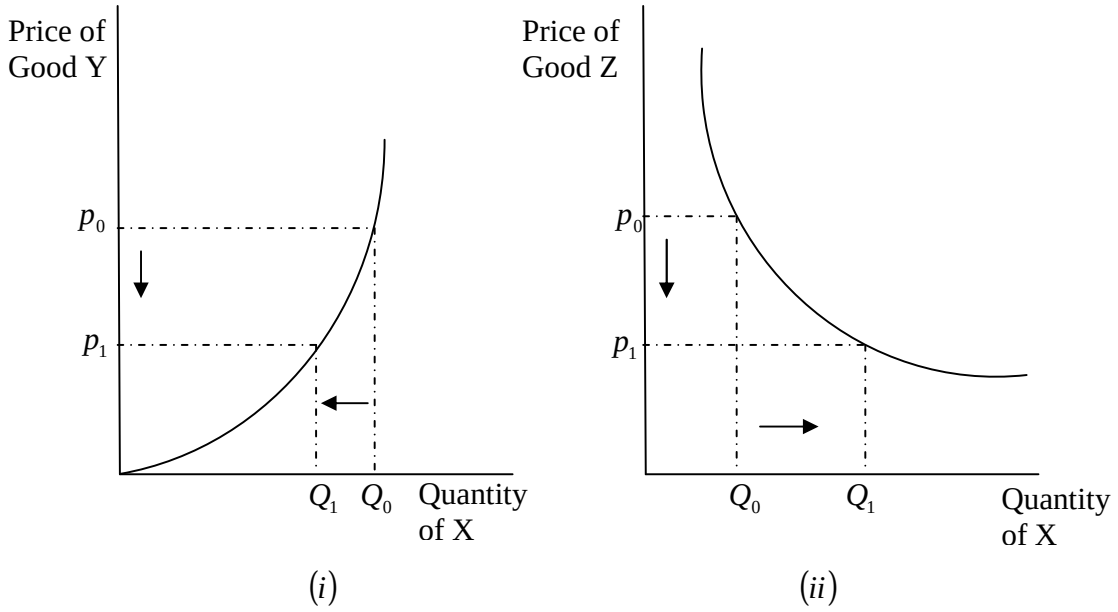
When prices of one commodity fall, the household buys more of it and less of commodities that are substitutes for it.

Example:

- **a.** Butter and Margarine
- **b.** Sukuma wiki and Cabbage
- **c.** Beef and Fish

If a fall in price of one commodity raises the quantity demanded of another commodity the two are said to be **complements.**

When the price of one commodity falls, more of it is consumed and more of those commodities that are complementary to it are consumed also. Example, motor cars and petrol, butter and bread etc.



Graph 1: curve sloped upwards indicating that as price of a substitute falls, the quantity demanded of good x falls. So good y, and x, are substitutes.

Graph 2: curve slopes downwards, indicating that when the price of a complement falls there is a rise in the quantity of good x demanded.

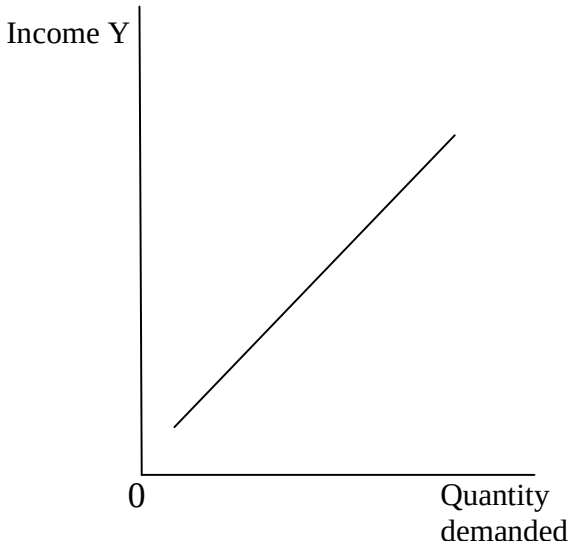
3) Consumer income

We would expect a rise in income to be associated with a rise in the quantity of a good demanded. Goods obeying this rule are called **normal goods.** In some cases a change in income might leave the quantity demanded completely unaffected. This will be the case with goods for which desire is completely satisfied after a level of income is obtained.

Example: if one used to eat salt, the consumption of it will not change even though his income rises, unless his income is very low.

Incase of other commodities, rise of income beyond a certain level may lead to a fall in the quantity that the household demand. If the demand for a commodity falls as income rises, the good is called **inferior good.**

The relation between income and quantity demanded can be shown by the use of **Engels curve**



The curve shows the relationship between income and demand, holding other factors constant. Engel curve for normal good slopes upwards, implying that as income rises, quantity demanded will also increase. Incase of inferior good, if Y increases Q decreases. In this case the Engels curve will slope downwards from left to right.

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DISTINCTION BETWEEN GIFFEN GOOD AND INFERIOR GOOD

Giffen good; relates to behavior of quantity demanded in relation to **price**.

Inferior good: relates to behavior of quantity demanded in relation to **income.**

4) **Consumers tastes and preferences**

When the tastes for a commodity are favorable, consumers will prefer more of that commodity to other commodities thereby increasing the demand for the commodity.

For example, in the beauty, would the taste of women have moved towards colored hair products such as pony tail or dyeing of hair. So the demand of such products would hike.

5) **Advertisement:**

As a producer advertises his product, he creates awareness that his products exist, and he tries to show the superiority of his product over others in the market. If we hold

other factors constant, we expect that an increase in advertisement expenditure will lead to an increase in demand.

Advertising is

- Informative
- Persuasive on price, availability, performance.
- **Consumers expectations about future prices:**

If consumers expect the price of a commodity to rise in future, they will buy more of the commodity now and store it. In this case quantity demanded increases. However, should they expect a fall in price in future they will buy less on the commodity now hoping to buy more in future after the price has fallen. In this case quantity demanded becomes less.

- **The size of population and its composition.**

The greater the size of population to satisfy, the greater the quantity consumers will be willing to demand. The fewer the consumer in the market, the less the quantity demanded will be.

When we talk of composition of population we are talking of the sex proportion and age group. Certain commodities are manufactured for certain age group and sex. For instance, cosmetics are meant to be used by women, napkins by infants, shaving cream by men. So producers consider these factors before deciding how much to produce. Who shall be his target market?

SUPPLY

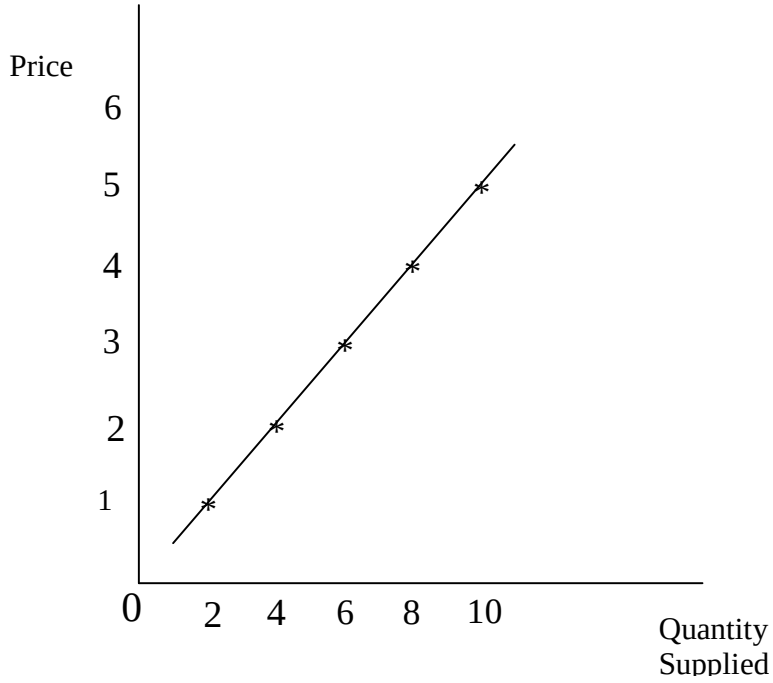
- Supply as a commodity is defined as the quantity of that commodity sellers are willing to put in the market at a given price and at a given time.
- Supply should be distinguished from stock, whereas stock is the total quantity of a commodity which is available at any specific time, supply is that part of stock which is offered for sale at any price.
- For example, the supply of oil is not the estimated resources of all the world's oil fields, but only that amount which particular price will bring into the market.
- Supply will always change with price changes. This relationship between supply and price is called **the law of supply.**
- The Law states that **other things remaining constant, when price rises, supply increases and when price falls, supply decreases.**

Supply schedule.

Is defined as table showing quantities sellers are willing to put in the market at all possible prices. This is shown below.

Price per unit	Quantity
1	2
2	4
3	6
4	8
5	10

From a supply schedule a supply curve can be drawn as shown below.



In the above diagram, it can be seen that the supply curve slopes upwards from left to right showing that sellers are willing to supply more at higher prices and to supply less at lower prices. It follows therefore that the supply curve for a normal good slopes upwards from left to right.

Factors that influence supply

1. The price of the commodity
2. Objectives of the firm
3. The technology used
4. The cost of production incurred by producers
5. Taxation policies of the government
6. Weather condition
7. Subsidies
8. Price of competing products
9. Peace and stability
10. Infrastructure

$$Q_s = f(p_0, p_1, tech, O, T, W, S)$$

1. **The price of commodity**

   At higher prices products are motivated to produce more thereby increasing the supply of the commodity under consideration. At lower prices less is supplied because producers see no reason why they should produce more because profitability will be negatively affected.

2. **Objective of the firm**

   A firm can have various objectives. For example profit maximization; to maximize profit will require that more be supplied at higher price. However, some welfare organization doesn't follow this law. For example, the supply of drugs; supply of drugs may rise depending on the prevailing situation even though prices are low.

3. **Technology used**

   If better methods of production are used, we again expect output to be economically produced and so the supply of the commodity in question will increase. More can be supplied at some price because per unit cost of production would be lower than in the case where worse methods of production are used.

4. **Cost of production**

   Increase in the cost of production will lower quantity supplied because producers will find it very expensive to increase output. However, with low cost of production more

is likely to be supplied since the producer will find easy and cheaper ways of producing more of the commodity in question.

5. **Taxation policies of the government**

   The taxation policies of the government also influence quantity supplied because if the government raises taxes, the cost of production goes up thereby reducing quantity supplied. Taxes make commodities be more expensive than competing products e.g. East African breweries has been urging the government to lower taxes on its products so that they could compete well against the south African Breweries products.

6. **Subsidies**

   When the government subsidizes the production of a given good, the supply of that good also increases because the cost of production is reduced by the subsidies given. Government may decide to incur part of the overall cost of production as a way of motivating production of certain goods which otherwise would have been very expensive to produce. Why South Africa goods compete effectively against other counties' goods is because of support in the form of subsidies the producers receive from South Africa government.

7. **Weather condition**

   This commonly affect agricultural produce. When weather condition are good, more is produced and hence supplied and vice versa.

8. **Price of competing products**

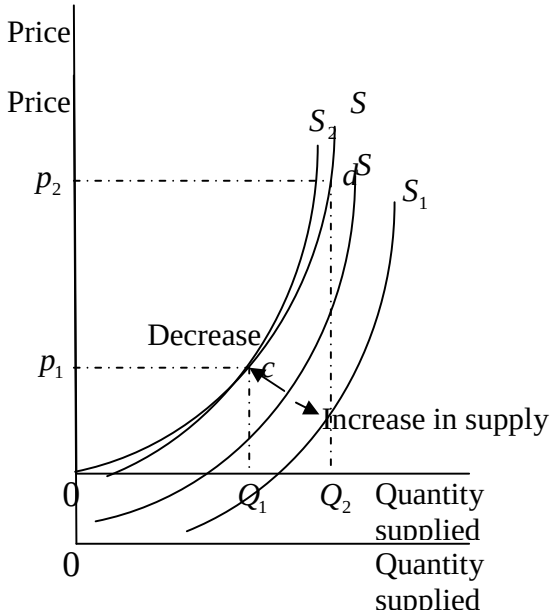
   - For example Kenyan beer Vs South African beer or Aerial soap Vs Omo
   - Manufacturers of thee products from Kenya have been complaining of unfair competition that has been posed by such imported products. Such imported products have led to the collapse of many local industries. For example, Mitumba (second hand cloths) whose prices are much lower than locally produced cloths have led to many textile industries closing down.
   - Recall also the closure of Bata Shoes Company of Limuru because of competition from cheap imported shoes and Jua kali made shoes.
   - This is a clear example of how prices of competing products would affect supply.

9. **Peace And Security**

10. Development of infrastructure particularly transport and communication.

MOVEMENT ALONG A GIVEN SUPPLY CURVE AND SHIFT OF A SUPPLY CURVE.

A movement along a given supply curve is caused by changes in the prices of the commodity. An upward movement is caused by an increase in price while a downward movement is caused by a fall in prices.



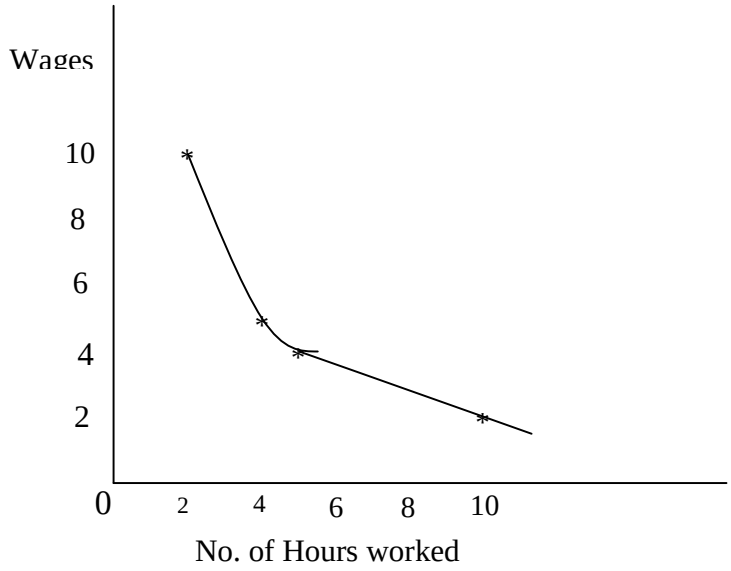
A movement from C to D is caused by a rise in price from p_1 to p_2 and a movement from D to C is caused by a fall in price from p_2 to p_1.

- A shift of the supply curve is caused by change in other factors influencing supply other than price of the commodity. A shift of the supply curve can either be to the right or left depending on the direction on which a change has taken place. A shift to the right shows an increase in supply while a shift to the left shows a decline in supply

ABNORMAL SUPPLY CURVES

There are cases where the law of supply may fail to be obeyed, and more may be supplied as prices fall and less as prices rises. A case at hand is the one of **target workers.** The supply curve of labor for target workers is a downward sloping curve showing that at higher wages rates, target workers are willing to work for less hours while at low wage rates target workers are willing to work are willing to work for more hours. This is because target workers normally set for themselves a target and

after achieving that target they don't bother to go ahead with work. This is shown below.



- Here it is assumed that out target workers has set themselves a target of sh. 20 everyday. At wage rate of sh. 2 per hour. He shall be willing to work for 10 hours in order to get sh. 20 per day. When the wage rate is increased to sh. 4 per hour, he is willing only to work for 5 hours in order to sustain his income of sh. 20 per day. As the wage rate is increased further to sh. 10 per hour he reduces his working hours further to 2 hours only. This gives us a downwards sloping supply curve of labor. The higher the wage rate, the lesser will be the labor supplied and vice versa.
- One reason why this would be possible is that as wage rate increases, the laborer is able to realize his target within a short time and the rest of his time is spent on leisure.

Summary

The lecture has captured the concept of demand and supply and the factors affecting them respectively. It is worth noting that a movement along a given demand or the supply curve is caused by changes in the prices of the commodity while a shift of the either the demand supply curve is caused by change in other factors influencing demand or supply other than price of the commodity

- The law of demand is defined as, "other things being equal, with a fall in price, the demand for the commodity is extended (increases), and with a rise in the price, the demand is contracted (decreased)"
- The Law of supply states that other things remaining constant, when price rises, supply increases and when price falls, supply decreases.

- Nicholson, W. (1992): Microeconomic Theory: Basic principles and extensions, 5th edition, San Diego, Dryden Press
- Koutsoyiannis, A. (1979): Modern Microeconomics, 2nd edition, Macmillan
- Mansfield, E, (1991): Microeconomic theory/applications, 7th edition, New York, Norton

EQUILIBRIUM/DISEQUILIBRIUM & ELASTICITIES OF DEMAND AND SUPPLY

LECTURE OBJECTIVES

At the end of the lecture, the student should :

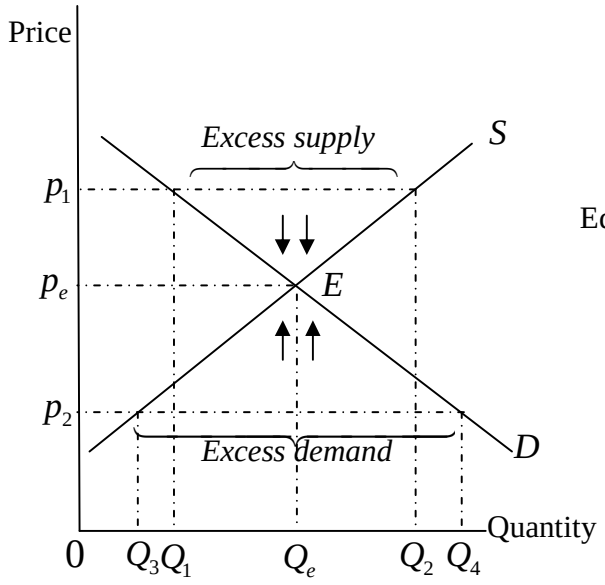
- Describe the nature of market equilibrium/disequilibrium
- Explain changes in market equilibrium/ disequilibrium
- Understand the concept of price elasticity of demand (define, measure, interpret and apply)
- Explain the determinants of elasticity

EQUILIBRIUM

In studying equilibrium, our objective is to determine the market price and quantity and try to identify the forces that influence such a price and quantity.

- Equilibrium can be defined as a state of rest. It is a situation whereby quantity demanded (Q_d) is equal to quantity supplied (Q_s) i.e. $Q_d = Q_s$
- In this case, we say that the market is clearing and there are no economic forces generated to change this point hence it is stable.

We determine this graphically by the interpretation point of the demand and supply curves as below



Equilibrium price = p_e

Equilibrium Quantity = Q_e

In the above diagram it can be seen that the forces of demand and supply determine the price in the market, i.e. a price at which both consumers and sellers are happy and where quantity supplied equals quantity demanded. That price is known as the **equilibrium price.**

- In the diagram, should the price be above the equilibrium price, forces of demand and supply will work together and lower the price towards the equilibrium price until the equilibrium price is reached. For example at p_1 consumers will only be willing to buy $0Q_1$ from the market while sellers will by willing to supply $0Q_2$. In this case an excess supply equals to Q_1Q_2 will be created. Because of this excess supply, sellers will have to reduce the price in an attempt to encourage consumers to buy more.

Prices will be reduced until p_e is reached where quantity demanded equals quantity supplied.

- Should the price be below the equilibrium price (e.g. at p_2) again the forces of demand and supply will work together to ensure p_e is restored. At p_2 suppliers are willing to supply only Q_3 because they consider p_2 to be very low. On the other hand, consumers will be willing to buy Q_4 since very many of them can afford to pay p_2. In this case an excess demand (shortage) equal to Q_3Q_4 will be created. Because of shortages, consumers will compete among themselves for the little that is available and because of this competition, prices will be pushed upwards towards p_e until eventually p_e is reached.

MATHEMATICAL DERIVATION OF EQUILIBRIUM

Demand function: $Q_d = 3550 - 266p$

Supply function: $Q_s = 1526 + 240p$

Question: determine the equilibrium market price and quantity.

Solution

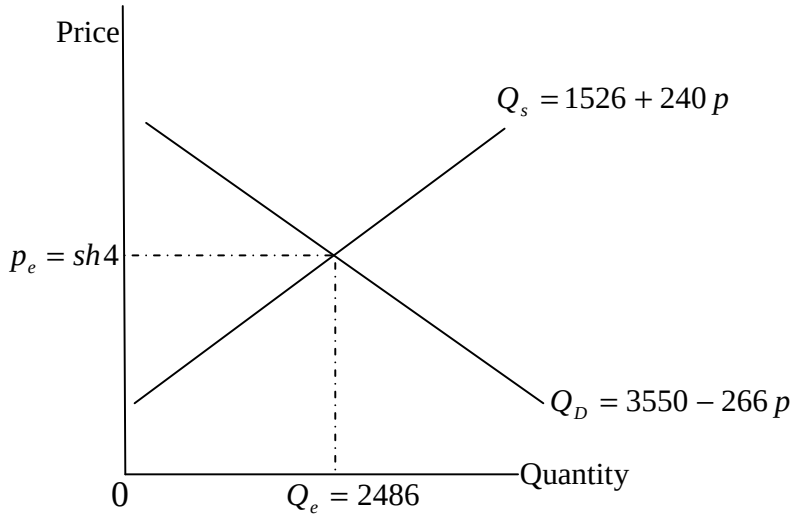
At equilibrium $Q_d = Q_s$

Thus. $3550 - 266p = 1526 + 240p$

$2024 = 506p$

$$p_e = \frac{2024}{506} = sh.4$$

$$\left.\begin{aligned} Q_s &= 1526 + 240(4) = 2486 \ units \\ Q_d &= 3550 - 266(4) = 2486 \ units \end{aligned}\right\} Q_e = 2486 \ units$$



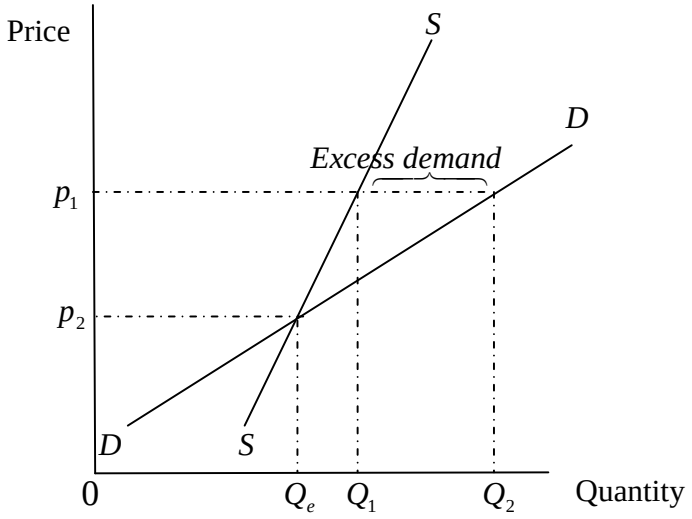
TYPES OF EQUILIBRIUM

1. Stable equilibrium
2. Unstable equilibrium
3. Neutral equilibrium

Stable equilibrium: if there is a force that disrupts the market equilibrium, then there would be adjustments that bring back to the initial equilibrium. This type of equilibrium is well explained in the previous section.

Unstable equilibrium: this occurs when the deviation from the equilibrium position tend to push the market further away from the equilibrium conditions of unstable equilibrium occurs when the demand curve is positively sloped as in the case of a giffen good or when the supply curve is negatively sloped as in the case of labor supply.

Illustration using demand for a giffen good

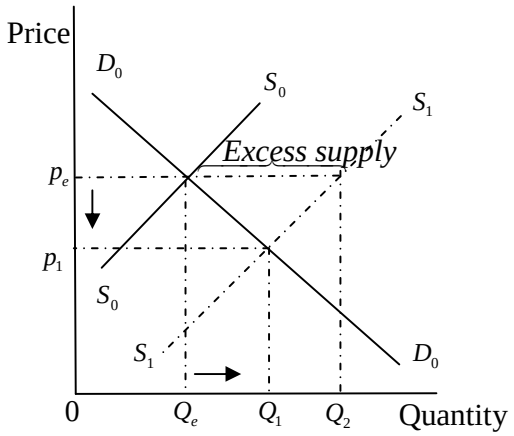


- Equilibrium point is $p_e Q_e$
- If price increases from p_e to p_1, excess demand over supply is created as shown by the quantity $Q_2 - Q_1$
- Because of excess demand prices will continue going up and for away from equilibrium point, hence unstable equilibrium.

Neutral equilibrium:- this occurs when the initial equilibrium is disturbed and the forces of disturbances lead to a new equilibrium point. It may occur due to shift of either demand or supply curve, and through effects of taxes etc.

Effects of shifts of demand/supply curve on equilibrium

The equilibrium price will fall or increase depending on the direction in which the shift have taken place.



- An increase in supply is represented by a shift to the right.
- Initial equilibrium price and output is p_e and Q_e, respectively
- At this initial price p_e with an increase in supply means output increasing to Q_2 while demand remains Q_e.
- Therefore we shall have excess supply.
- To encourage consumers to consume more of the good, adjustment will be such that prices decline. Prices will continue to decline until a new equilibrium price p_1 is realized.
- Therefore the new equilibrium prices and output will be $p_1 Q_1$
- Notice, because of all in prices to p_1, quantity demanded will increase from Q_e to Q_1.

Therefore we can conclude by saying that an increase in supply leads to low price and to increase in quantity demanded

This is a situation where quantity demanded is not equal to quantity supplied. $(Q_d = Q_s)$, and the market does not clear. Hence both consumers and suppliers will have to change their behavior.

Conditions for disequilibrium

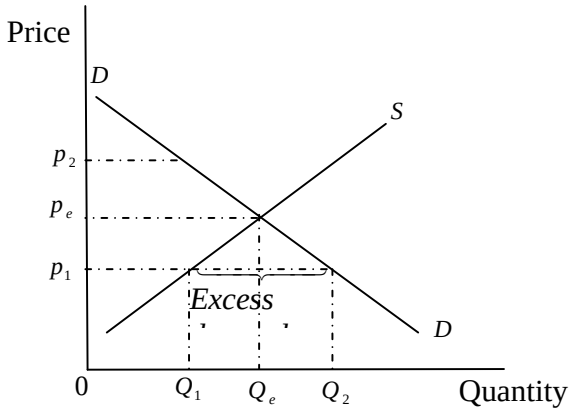
i) Price restriction by government

Government from time to time control prices of different commodities through maximum price policies and minimum price policies.

Maximum (ceiling) price policy

Most countries use them in apartment rentals. Here prices are set below equilibrium price because sometimes the equilibrium price might be regarded as being too high for the poor consumers to afford essential commodities. In an effort to protect poor consumers from exploitation, the government fixes a

maximum (ceiling) price so that commodities that are regarded as essential can be within easy reach of the poor consumer. This can be shown in the diagram below.



In the above diagram it can be seen that a maximum price p_1 has been set below, the equilibrium price p_e. As a result excess demand represented by Q_1Q_2 is created since at p_1 supplier is willing to supply only Q_1 while consumers are willing to buy Q_2.

However if the ceiling is above p_e, say p_2, it will serve no purpose since the equilibrium p_eQ_e will still be maintained. At p_2 there will be excess supply and the producer would be better off reducing the price to p_e to reduce wastage as a result of over production.

Consequences of maximum price policy

1) Shortages can be created since demand will exceed supply.
2) Search time to find the appropriate good is increased since the supply is too small.
3) The government might be forced to ration the little that is available in order to ensure that at least everybody gets something.

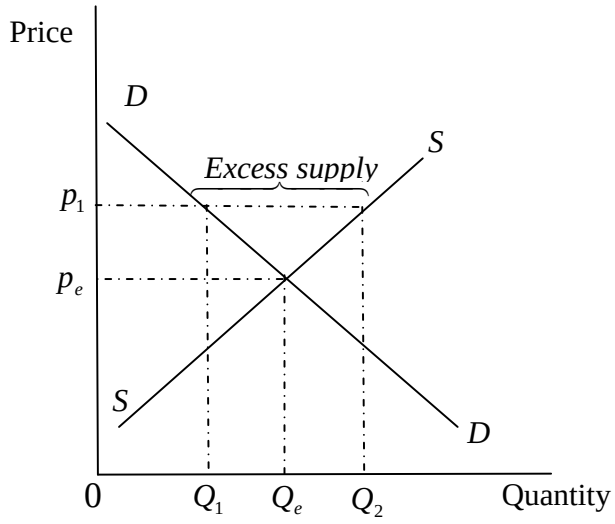
Activities like black marketing, smuggling and hoarding are likely to take place because the price below equilibrium level might be regarded as too low by the producers

1) The level of investment is likely to be discouraged because of low business profit private business will be getting very low profits to plough back into their business.
2) Due to low investment, there might be unemployment. i.e. very few jobs will be created because there won't be enough investment to stimulate growth of the economy.
3) On the positive side we can say that the welfare of the consumer is likely to increase since the consumer will be able to afford the prices in the market.

Minimum (floor) price policies

This happens eg for agricultural goods and wages/labor. Here price are set above the equilibrium price, the reason being that the government might consider the equilibrium price to be a very low to motivate producers to continue production effectively. Done in order to encourage producers to produce more. The government sets a minimum price.

Minimum price are mainly found in the agricultural sector since the agricultural sector often suffers from price fluctuation. Below is a diagram which illustrates the working of minimum price policies.



In the diagram it can be seen that a result of fixing a minimum price (p_1) above the equilibrium price (p_e) excess supply Q_1Q_2 is created since consumers are willing to be buy Q_1, while suppliers are willing to supply Q_2

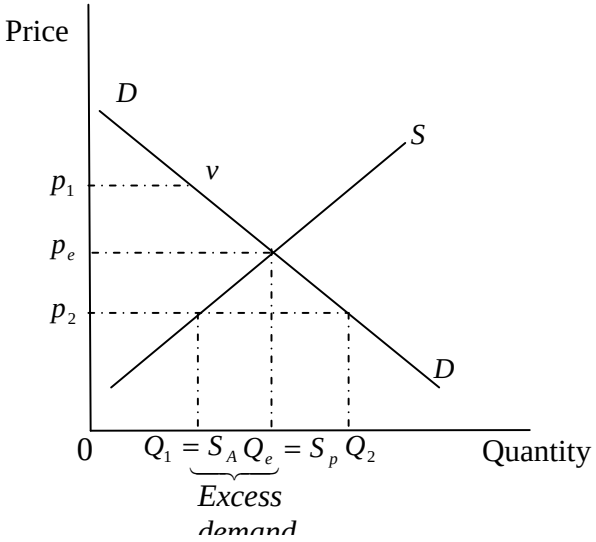
In this case the government has to purchase the excess supply and either store it so that it can be re-supplied during the period of shortage or export to the outside market on order to earn the country foreign exchange.

2) **Failure to meet production target as another condition to disequilibrium**

Failure to meet production target especially in the agricultural sector due to unfavorable climatic condition among other could lead to disequilibrium in the market. Let

S_p = Planned production

S_A = Actual production

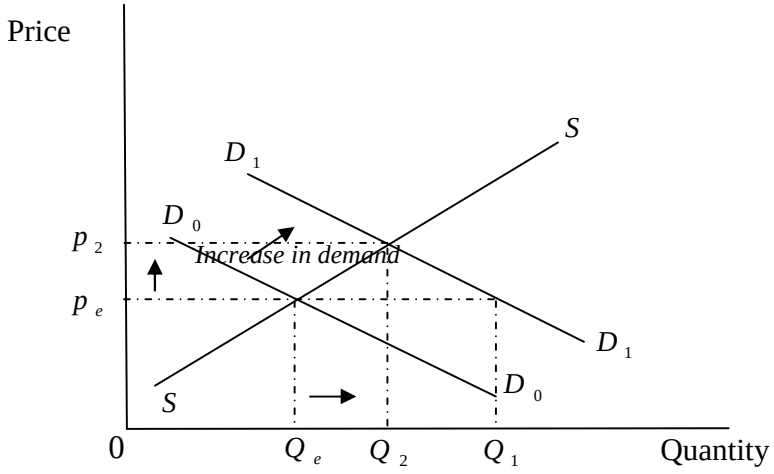


Let $S_P = S_A$. That is, owing to unfavorable climatic condition, supposing the producer fails to meet his targeted production of S_P and instead he realizes only S_A. This would imply that there would be shortage as demand would exceed supply $(Q_e > S_A)$. Because of this excess demand (shortage) the prices will move upwards. The consumers will be willing to pay a price p_1 for S_A units of output. This is shown as point $V(p_1Q_1)$ along the demand curve.

On the other hand, if $S_P < S_A$, this implies more production than planned, there would be excess supply and prices would be pushed down wards below the equilibrium.

However, this situation of disequilibrium may not be permanent. Once conditions improve, equilibrium may be attained. That would be in the long run.

3) Lagged responses as a cause of disequilibrium



- Suppose we assume that consumer income has increased. This will lead to the shift of demand curve to the right from D_0D_0 to D_1
- The effects will be the disturbance of equilibrium from p_eQ_e and creation of excess demand over supply $(Q_1 - Q_e)$
- This is so because it will take the producers time before the they produce enough to meet this excess demand.
- Because of this short-term shortages prices will be pushed upwards towards p_2
- From the law of demand and supply we know that as price increase demand will decline and supply increase.
- This will continue until a new equilibrium point is attained (p_2Q_2)
- It should be noted that before this new equilibrium point was attained there was a lag. This could be because of inferior technology that could not allow production to take place on time to avoid shortage. Another reason could be imperfect knowledge about the market conditions. If consumers could have perfect knowledge on alternative sources of product such shortage could not arise.

How disequilibrium concept is applied

The disequilibrium concept can be applied on the cob- Web model.

THE COBWEB THEORY

This model is used to trace the path from disequilibrium to position of equilibrium. In our previous discussion, we said that one cause of disequilibrium is lagged responses.

The cobweb model assumes that producers output plans are fulfilled but with a time lag. That is, if a producer is a farmer, he cannot within the short-run increase his output just because the market is offering very good prices.

This is so because of the nature of the products. The time between planting and harvesting is long enough for risk and uncertainty to prevail.

Thus, producers are assumed to base their production decisions on the previous period's prices. However demand depends on the prevailing prices in the market.

Therefore, what is consumed presently is what must have been planted in the previous period.

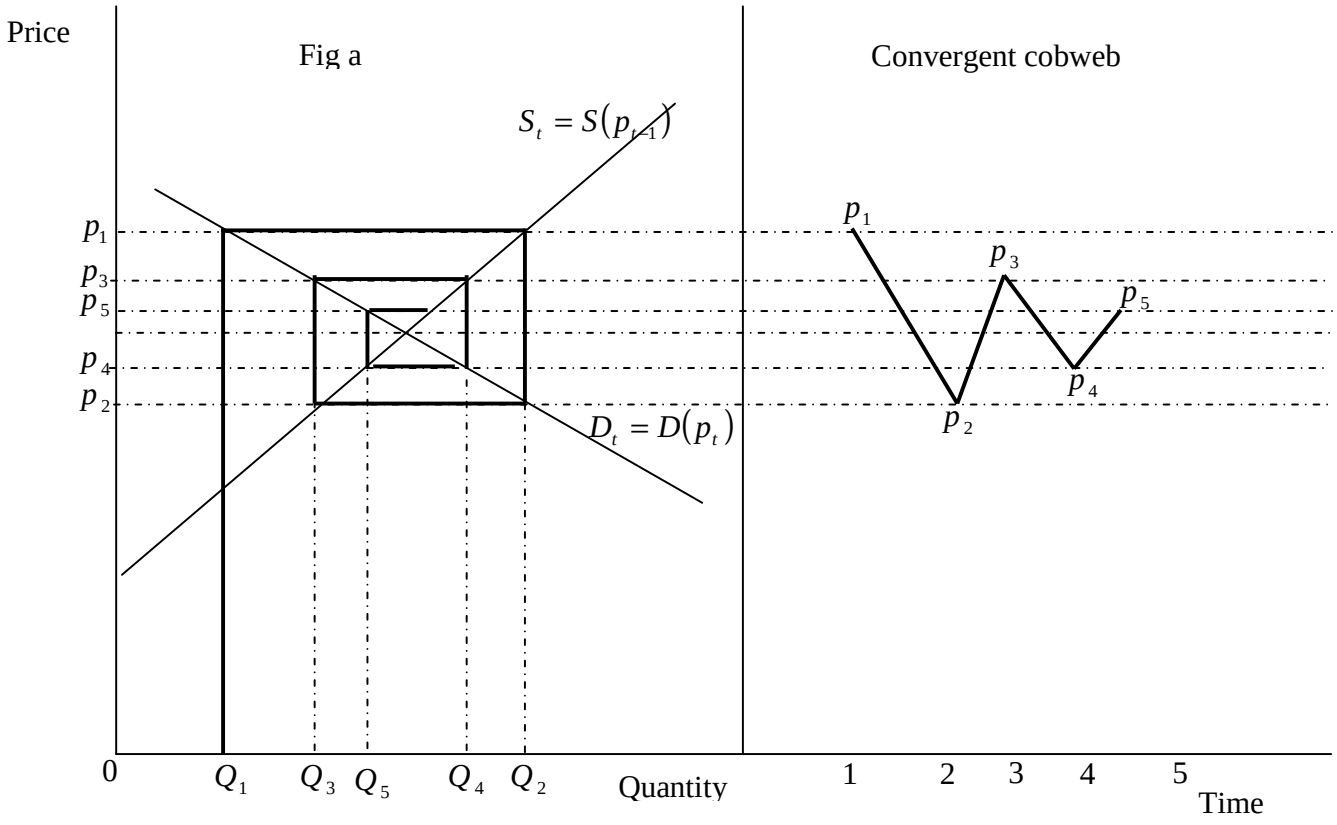
$$D_t = f(p_t) \quad \ldots\ldots(1)$$
$$S_t = f(p_{t-1}) \quad \ldots\ldots(2)$$

Where p_t is price in the current year.

p_{t-1} is price in the previous year.

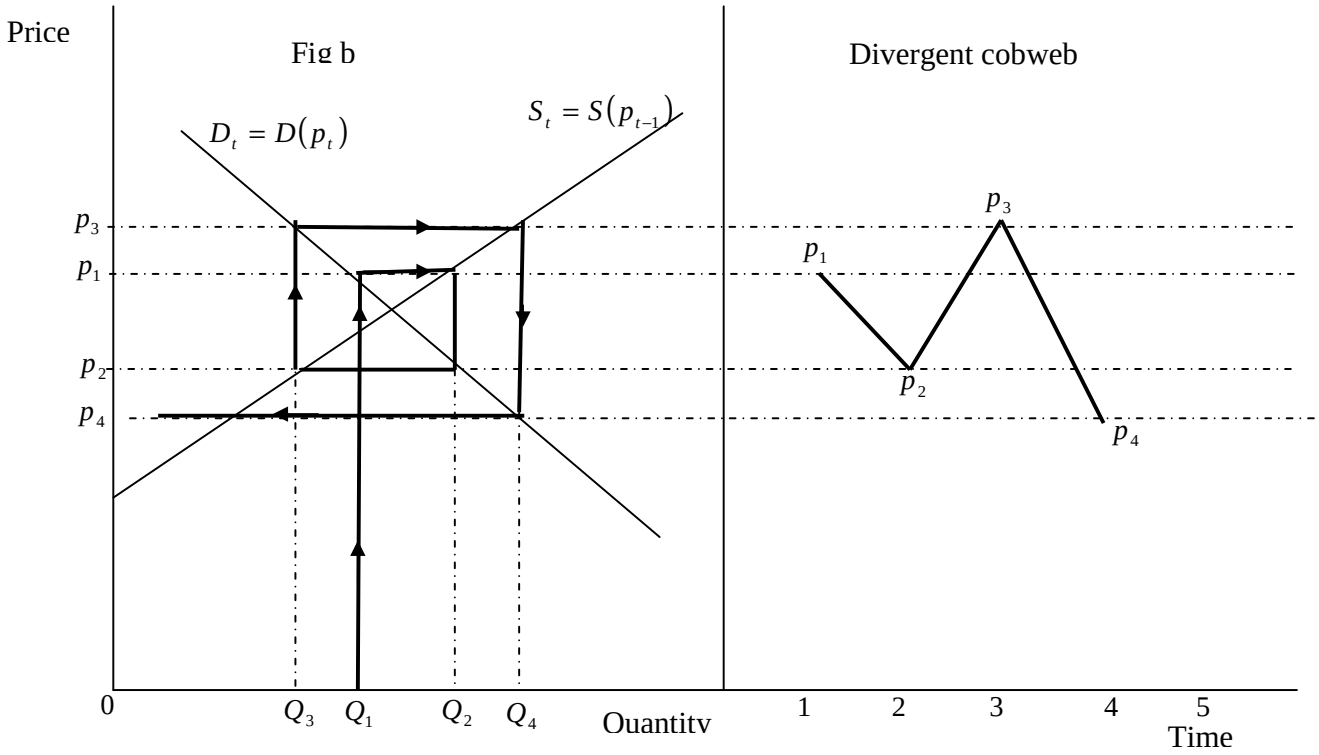
The cobweb model always begins with a situation of disequilibrium in the market due to unplanned variation in the supply.

The following diagram can be used to illustrate what the cobweb theory is all about.



- Suppose the prevailing price in the market is p_1, quantity demanded will be Q_1.
- Farmers will base their production decision for period 2 on the price of period 1 (p_1).
- Therefore in period 2 farmers will produce output Q_2.
- From the diagram, it can be seen that consumers are willing to buy that quantity at p_2.
- If farmers base their production decision for the third period on the present price p_2, they will cut down production to Q_3 because they consider the price to be too low.
- With this quantity in the market p_3 will be offered by the consumer.
- Again if farmers base their decision for the fourth period on the present price i.e. p_3, they will produce Q_4, but with Q_4 produced, consumers will be willing to pay only p_4.
- This process goes on as shown in the diagram until eventually equilibrium price is achieved.
- From the diagram, it can be seen that the fluctuation tend to converge towards the equilibrium, hence, this situation is known as convergent or a situation of **stable equilibrium.**

Just like we have convergent fluctuation we can also have divergent fluctuation.



From the same procedure as in figure a, fluctuation in price tend to become wider over successive period. In other words, the fluctuation tends to run away from equilibrium prices. Such a situation is known as divergent situation in that it diverges from the equilibrium price. Such a situation is known as a divergent situation in that it diverges from the equilibrium price. It has also been called by some economists a situation of **unstable equilibrium.**

WEAKNESSES OF COBWEB THEORY

1. It assumes that products (former) are irrational and hence base their production decision on the previous prices without thinking of price changes but this is rather unrealistic because in reality farmers always think about changes in prices in the future.
2. The theory also assumes that all the quantity produced is sold in the market but this is also unrealistic because in the true sense some agricultural products are assumed for subsistence needs while others are stored waiting for sale in the future when prices are considered high.

It is thus clear from the previous discussion that the elasticity of demand depends not only on the ratio of price to quantity demanded, but also on the slope of the demand curve.

DISTINCTION BETWEEN POINT ELASTICITY AND ARC ELASTICITY OF DEMAND.

There are two different ways of computing elasticity of demand.

1. **Point elasticity**

   Point elasticity is the proportionate change in quantity demanded resulting from a proportionate change in price at a **particular point** along the demand curve.

   When calculating point elasticity, it is assumed that the slope of the demand function is known.

   From the formula for elasticity,

   $$\ell_{pp} = \frac{\partial Q}{\partial p} \cdot \frac{p}{Q}$$

   As noted earlier $\frac{\partial Q}{\partial p}$ is the reciprocal of the slope of the demand function.

   Given a demand function $Q = b_0 - b_1 p$.

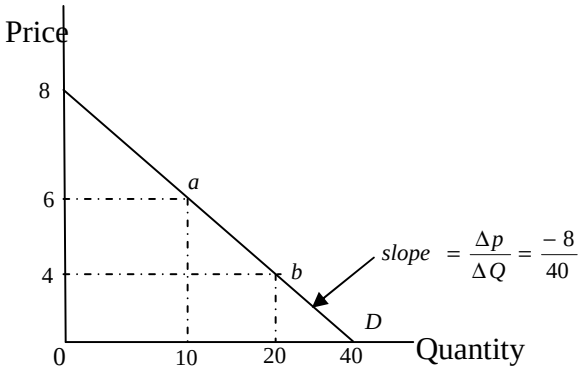
   $\frac{\partial Q}{\partial p}$ is found by getting first derivative of Q with respect to p

   Thus point of elasticity $\ell_{pp} = -b_1 \cdot \frac{p}{Q}$

   Example

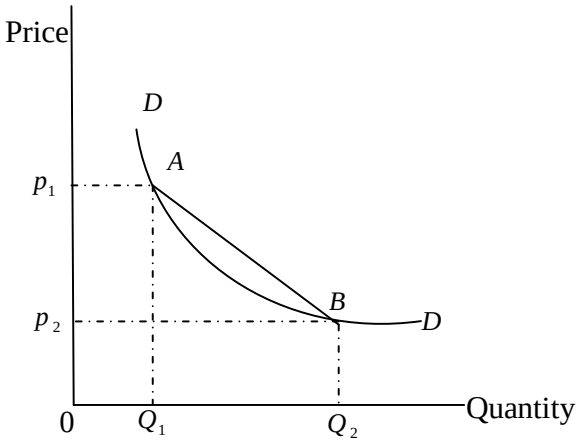
   Demand schedule

Price	**Quantity**
0	40
1	35
2	30
3	25
4	20
5	15
6	10
7	5
8	0



Arc Elasticity

Arc elasticity is a measure of the average elasticity; i.e. the elasticity at the mid point of the chord that connects 2 points (A and B) along the demand curve defined by the initial and the new price levels.



Using example in above demand schedule, assume initial price $p_1 = 5$, which then increases to $p_1 = 6$

p_1	Q_1
5	15
p_2	Q_2
6	10

$\Delta Q = Q_2 - Q_1 = 10 - 15 = -5$

$\Delta p = p_2 - p_1 = 6 - 5 = 1$

$p_1 + p_2 = 11$

$Q_1 + Q_2 = 25$

$\therefore E_p = \frac{-5}{1} \times \left(\frac{11}{25}\right) = -2\frac{1}{5}$

Income Elasticity of Demand

This can be defined as the responsiveness of quantity demanded to change in income in % term it can be defined as:

$$E_Y = \frac{\%\ change\ in\ quantity\ demanded}{\%\ change\ in\ Income}$$

So that $E_I = \frac{\partial Q}{\partial Y} \cdot \frac{Y}{Q}$

Where

ΔQ is change in quantity demanded.

Q is original quantity demanded.

ΔY is change in income

Y is original income.

Arc income elasticity of demand can be calculated as:

$$E_Y = \frac{\partial Q}{\partial Y} \cdot \frac{(Y_1 + Y_2)}{(Q_1 + Q_2)}$$

- Income elasticity of demand for most commodities is positive, indicating higher purchases at higher income. Income elasticity for a few commodities is known as inferior goods.
- Degree of income elasticity varies in accordance with the nature of commodities consumers consume in general. Where the commodity id a basic necessity, the demand is not very responsive to change in income. Basic necessities like food are usually bought in fairly constant amount and on regular basis. In this case $E_Y < 1$
- However, in the case of luxuries, the demand is very responsive to change in income. Sales of such goods increase rapidly with increase in income. In this case $E_Y > 1$

Cross elasticity of Demand

- The demand for one product can be influenced by the demand. For example, the demand for beef depends on the demand for pork, mutton and fish etc. if the price of beef rises while prices of substitutes (pork, mutton and fish) remains unchanged, consumers will substitute beef with the cheaper product.
- In some cases, an increase in price of one product can lead to s reduction in demand for other products. This is true of complementary products e.g. electricity and electronic gadget, petrol to automobile etc. in this case the products are considered to be complementary or used together rather the substitutes.
- Therefore, cross elasticity is the percentage change in quantity demanded of good x due to 1 % change in the price of good Y it measures the degree of responsiveness of

demand for one product to changes of the price of its substitutes or complementary goods

- For instance, cross elasticity of demand for tea (T) is the percentage change in its quantity demanded with respect to one (1) percent change in price of its substitute coffee (C).

Point cross elasticity is calculated by the formula

$$E_{t,c} = \frac{\partial Q_T}{\partial p_c} \cdot \frac{p_c}{Q_T}$$

Where

p_C is price of coffee

Q_T is quantity of tea.

Cross elasticity of demand can either be positive or negative.

- A **high positive cross elasticity** means that the commodities are cross substitutes. If price of butter increases, the price of its substitutes (margarine) held constant, the quantity demanded of margarines would increase.
- A **negative cross elasticity** means that the goods are complementary in the market, thus a decrease in the price of one stimulates the sale of the other.
- A cross elasticity of zero means that the goods are independent of each other in the market.

Numerical example

$$Y = 5000 - 0.5p_Y - 2.3p_W + 0.2p_X + 0.000001p_Z + 0.0037I$$

Compute different price elasticity and state the relationships between the commodities Y, W, X and Z given that, Py = \$2, P_W = 1\$, Pz = \$1000,000, Px = \$20, and I =\$10000.

Solution

$$\frac{\partial Q_Y}{\partial p_W} * p_W \Big/ Q_Y = -2.3 * \frac{1}{5038.7} = 0.0004565$$

$$\frac{\partial Q_Y}{\partial p_Z} * p_Z \Big/ Q_Y = 0.000001 * 1000000 \Big/ 5038.7 = 198.46$$

$$\frac{\partial Q_Y}{\partial p_X} * p_X \Big/ Q_Y = 0.2 * 20 \Big/ 5038.7 = 0.000794$$

From this example it is clear that good y and w are complementary goods since $E_{y,w}$ is negative.

$E_{y,x}$, is positive implying that x and y are substitutes.

DETERMINANTS OF PRICE-ELASTICITY OF DEMAND

The following are the main determinants of price elasticity of demand.

- Availability of close substitutes to the commodity.
- Nature of a commodity
- Proportion of income which consumers spend on a particular commodity.
- Range of uses of a commodity.
- Habits

1. Availabity of close substitutes-The higher the degree of the closeness of the substitutes, the greater the elasticity of demand of the good or service. For instance, coffee and tea may be considered as close substitute for each other. Therefore, 1 percent increase in price of say coffee, would lead to more than proportionate decline in quantity demanded of coffee.
2. Nature of a commodity-Demand for luxury goods (e.g. refrigerator, TV etc) is more elastic because their consumption can be dispersed with or postponed when their prices rise. On the other hand, consumption of necessities (e.g. foodstuffs), essential for life, cannot be postponed and so their demand is inelastic.
3. Proportion of income which consumers spend on a particular commodity-If proportion of income spent on a commodity is large, its demand will be more elastic, and vice versa. A classic example of such commodities is salt, which claims a very small proportion of income whereas clothes and other durable consumer goods claim a large proportion of income.
4. Range of uses of a commodity- The wider the range of uses of a product, the higher the elasticity of demand. As the price of a multi-use commodity decreases, people extend their consumption to its other uses, thereby increasing the demand. For instance, milk can be taken as it is, it may be converted into cheese, ghee and butter. The demand for milk will therefore be highly elastic.
5. Habit: some goods are consumed because of habit e.g. smoking; in this case we find that price changes leave quantity demanded more or less unaffected. In this case their demand is said to inelastic.

Elasticity of supply

- This is the percentage change in the quantity supplied of a commodity resulting from a 1% change in price.
- Elasticity of supply is usually positive because a higher price gives producers an incentive to increase output.
- Like elasticity of demand, elasticity of supply can also be referred with respect to such variables as interest rates, wage rates, price of raw materials and other intermediate goods etc.
- Symbolically, elasticity of supply (E_{sp}) can be expressed as follows.

$$E_{sp} = \frac{\partial Q_s}{\partial p} \cdot \frac{p}{Q}$$

- When a small change in price bring about a very big change in quantity supplied, then we say that quantity supplied is elastic. On the other hand, if a big change in price brings about a small change in quantity supplied, then we say that supply is inelastic.

Determinants of elasticity of supply

1. **Availability of factors of productivity**

   This can be looked at as the ease with which factors of production could be shifted from one use to another.It can also be looked at as the number of available resources. When factors of production are available, supply will highly be elastic and vice versa. Suppliers will be able to meet demand in good times.

2. **Excess capacity of unsold stock (Buffer-stock)**

   if there exist a lot of stock, incase prices increase, supplier would be able to respond very fast by increasing supply. In such a case supply is said to be highly elastic.

3. **Time factor**

   This refers to the time it takes to produce and supply a product in the market. In the short run, supply of most items that take a long time to produce is inelastic. But, in the long run supply is inelastic.

4. **Nature of a commodity**

   Durable/ stockable commodities such as clothes etc. have greater elasticity of supply than perishable goods such as milk. This is so because, incase the price of perishable items is low, producers will still be forced to supply the items because they cannot be stored for future sale when the prices would increase.

Usefulness of the concept of elasticity

1. **Useful in taxation.**

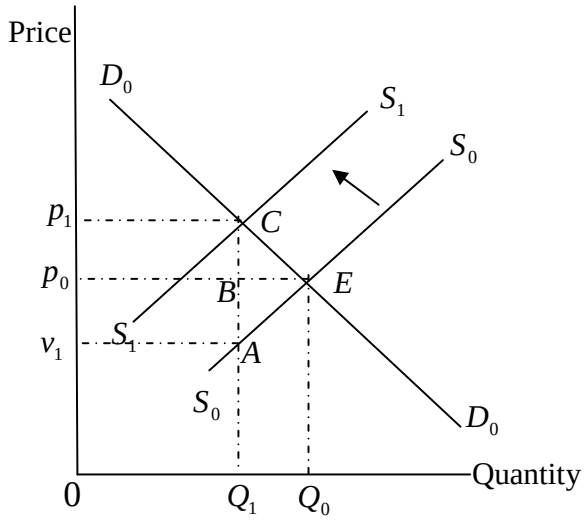
   If it is the aim of the government to raise revenue it has to put into consideration elasticities of the commodities to be taxed, especially price elasticity of demand.

   In order to raise revenue the government has to impose heavy taxes on goods which have inelastic demand e.g. cigarettes and beer. This is because after taxes are imposed on such goods consumers will continue to demand the goods in large quantities as before and therefore the government is able to collect more revenue.

   On top of this, the burden of taxes on goods which have inelastic demand falls more on consumers because sellers are able to pass a greater part of the tax to the consumers through high prices.

This leaves the production of such goods more or less un affected thus making it possible for the government to raise enough revenue.

This is shown in the diagram below.



The original equilibrium price before the imposition of tax was p_0 and the new equilibrium price after tax is p_1.

Distance AC on the diagram represents the tax imposed on the good.

AB of the tax is met by the consumers.

It can be seen from the diagram that the quantity in the market fell by a small proportion Q_1Q_0

It can thus be said that when a commodity has inelastic demand it pays the government to tax that commodity heavily because the greatest part of the tax is met by consumers, thus leaving the production of that good more or less unaffected, hence enabling the government to collect more revenue from that good.

2. Elasticity is important in international trade

Before a country devalues her currency so as to encourage export and discourage imports, it has to put into consideration the elasticity of demand and supply for her export and imports.

For devaluation to succeed, exports must be highly elastic so that after devaluation, greater quantities can be sold in the foreign market. Similarly, the export must have elastic supply in order to meet increased demand in foreign markets.

On the import side, imports must have elastic demand so that after devaluation greater quantities of imports can be abandoned.

We can therefore say that before any country devalues her currency, it is important to consider elasticity of demand and supply for export and imports.

3. **Elasticity also tells us the degree to which goods are related.**

   High cross elasticity between two commodities shows that the two commodities are very related. This is a useful concept especially for formulating pricing strategies. Such elasticity is especially important in studying how unfair competition of dumped goods affects performance of domestic industries. This would thus enable the government know how much import duty to impose on such goods as to protect local industries from collapsing.

   The cobweb theory model is used to trace the path form disequilibrium to position of equilibrium.

   The concept of elasticity is useful in various ways namely:

   - ♣ The relation of the goods
   - ♣ Taxation.
   - ♣ international trade
   - ♣ **Elasticity** is the percentage change in the quantity supplied/demanded of a commodity resulting from a 1% change in price.

THE CARDINALIST THEORY OF CONSUMER BEHAVIOR

At the end of the lecture, the students should:

- Understand the concept of utility.
- Derive of the equilibrium condition and the demand curve for the consumer.
- Understand the critique of the cardinalist approach

The **cardianalist** argue that utility can be measured. Some economists have suggested that where perfect knowledge of market condition and income level exist, utility can be measured in monetary units, by the amount of money the consumer is willing to pay (sacrifice) for another unit of a commodity. Others suggested the measurement of utility in subjective units called **utils.** (Subjective – depending on personal judgment/ imagination)

The cardinal utility theory

Cardinal approach could also be referred to as utility approach.

Concept of utility

Utility can be defined as satisfaction a consumer gets from consuming various goods and services. Utility here is assumed to be quantifiable (measurable)

It is very important to distinguish between total utility and marginal utility.

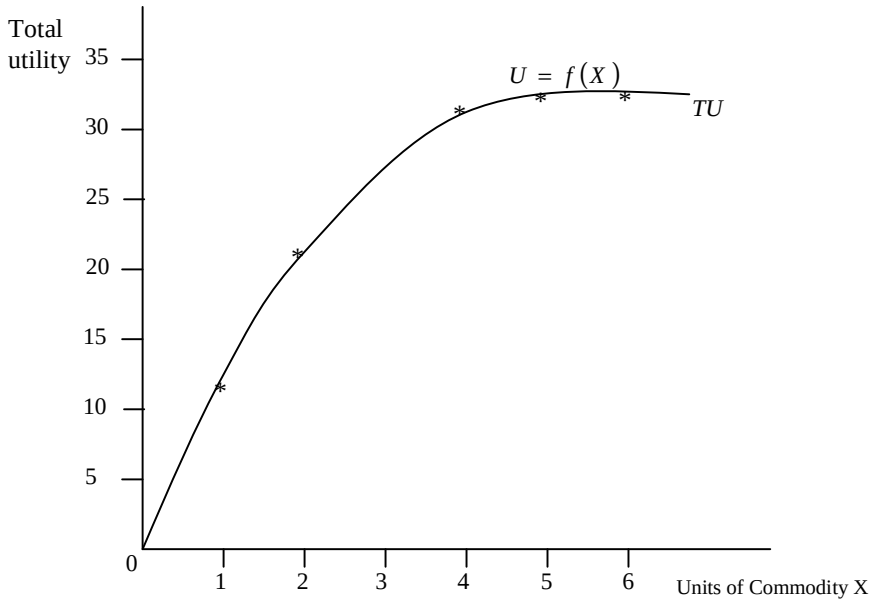
Total utility:- refers to the entire amount of satisfaction a consumer receives from consuming various goods. Given that consumers consume different types of goods, say $x_1 ... x_n$, total utility is $U = f(x_1, x_2, x_3, ..., x_n)$ The more of an item a consumer consumes per unit of time, the greater will be the total utility up to a certain point. When this point is reached, the commodity will no longer give the consumer any utility. Such a point is known as saturation point.

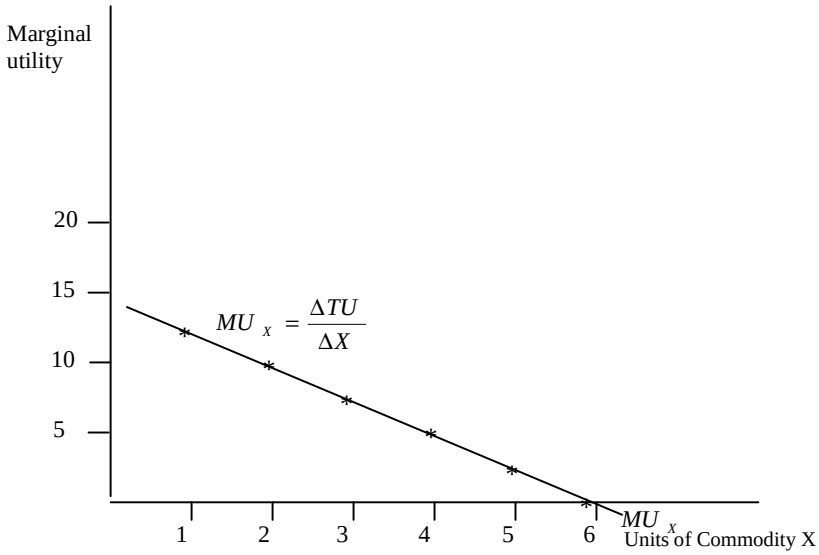
Marginal utility: - is the change in total utility resulting from a unit change in quantity of a given commodity consumed.

Under normal circumstances marginal utility fall as more additional units are consumed.

Tabular representation of total and marginal utility.

Units of comm. X.	**Total utility (Utils)**	**Marginal utility** $\frac{\partial TU}{\partial Q} = MU$
0	**0**	**-**
1	**12**	**12**
2	**22**	**10**
3	**28**	**6**
4	**32**	**4**
5	**34**	**2**
6	**34**	**0**





The following two figures show total utility and marginal utility curve, representative

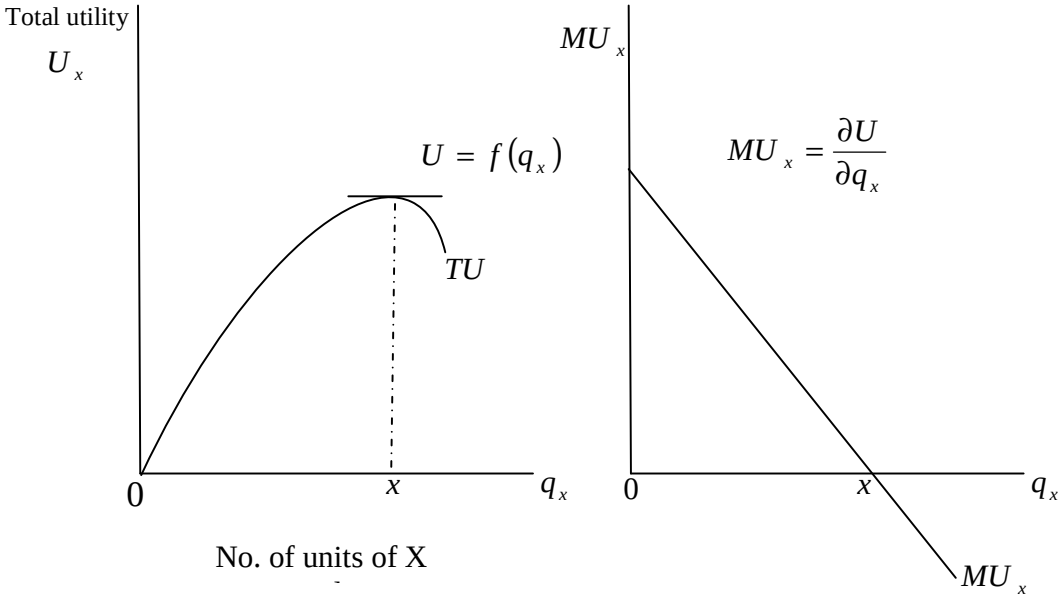


Fig a Fig b

To be able to draw the two diagrams we have assumed that total utility is derived from commodity x.

From fig. (a), total utility increased but at a decreasing rate, up to a quantity x, and then start decline.

From fig. (b), the marginal utility of commodity x may be depicted by a line with a negative slope. Marginal utility of x declines continuously and become zero at quantity x, and become negative beyond quantity x.

This leads us to the law of diminishing marginal utility which states that, as more quantities are consumed of a particular good, satisfaction derived from additional units goes on falling.

ASSUMPTIONS (AXIOM) MADE UNDER CARDINAL APPROACH

Axiom- statement that is accepted as true without further proof or argument

1. **Rationality:-** the consumer is rational and aims at maximizing his utility subject to the constraint imposed by his income level.
2. **Cardinal utility**:- utility of each commodity is measurable conveniently in monetary units by the amount of money the consumer is willing to pay for extra unit of commodity.
3. **Constant marginal utility of money**:- this assumption is necessary if the monetary unit is used as the measure of utility. The essential features of a standard unit of measurement are that it be constant. If marginal utility of money changes as income

increases (or decreases) the measuring- rod for utility becomes inappropriate for measurement.

4. **Diminishing marginal utility:-** this means that utility gained from larger/additional quantities of a commodity declines.
5. Total utility depends on the quantities of the individual commodities $(x_1, x_2, ..., x_n)$ the t make up the basket of goods. Hence, total utility $(U = f(x_1, x_2, ..., x_n))$

Derivation of the equilibrium condition for the consumer

- Consumer is said to be at equilibrium when he maximizes his utility.
- To derive the condition for utility maximization we start by considering a simple model of a single commodity x.

  $U = f(q_x)$ Here q_x means quantity of x.
- The consumer can either buy x or retain his money Y.
- If the consumer buys q_x, his expenditure will be $p_x \cdot q_x$
- Since utility is measured in monetary units, the consumer seeks to maximize the difference between his utility (U) and expenditure $(p_x \cdot q_x)$

  i.e. $U - p_x \cdot q_x$
- The necessary condition for a maximum is that the partial derivative of the function with respect to q_x be equal to zero.

  Thus $\frac{\partial U}{\partial q_x} - \frac{\partial (p_x \cdot q_x)}{\partial q_x} = 0$

  Simplifying we obtain

  $$\frac{\partial U}{\partial q_x} = p_x \text{ or } MU_x = p_x \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

- Equation (i) defines the equilibrium condition for the consumer and it states that the marginal utility of x is equated to market price of x.
- Thus, if $MU > p_x$, the consumer can increase his welfare by purchasing more units of x. notice, owing to law of diminishing marginal utility, as he consumes more of x, $MU_x < p_x$, the consumer can increase his total satisfaction by reducing quantity of x purchased, hence keeping more income unspent.
- If there are more commodities $(x, y...n)$, the condition for the equilibrium is the equality of the ratios of the marginal utilities of the individual commodities to their prices.

i.e $\frac{MU_x}{p_x} = \frac{MU_y}{p_y} = \frac{MU_n}{p_n} = \lambda$

λ represents marginal utility of money expenditure.

- In the above expression it can be observed that; utility derived from spending an additional unit of money must be the same for all commodities in the market.

Illustration/ Assignment

Question: determine the equilibrium quantities of commodities x and z for a consumer whose total utility (U) and other relevant variables are given below;

$U = 20x - 4z^2 + 40z - x^2$

Income level $Y = Ksh.48$

Price of $x(p_x) = ksh.2$

Price of $z(p_z) = ksh.4$

Be sure to obtain the maximum utility level.

Solution

Step 1: at equilibrium (utility maximization point)

$$\frac{MU_{lx}}{p_x} = \frac{MU_z}{p_z} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Step 2: $MU_x \frac{\partial U}{\partial x} = 20 - 2x = 0 \ldots\ldots\ldots\ldots\ldots(2)$

$$MU_z = \frac{\partial U}{\partial z} = 40 - 8z = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

Step 3: $\frac{MU_x}{p_x} = \frac{MU_z}{p_z} \Rightarrow \frac{20-2x}{2} = \frac{40-8z}{4}$

$10 - x = 10 - 2z$

Hence $x = 2z \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$

Step 4: but: if consumer buys q_z and q_x units of z and x, his expenditure would be:

$Y = p_x \cdot q_x + p_z q_z$

$48 = 2x + 4z \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(5)$

Step 5: substituting equation (4) into 5 we obtain:

$48 = 2(2z) + 4z$

$48 = 8z$

$\bar{z} = 6$ *units*

Step 6: substituting $\bar{z} = 6$ *units* in equation (4) to obtain.

$\bar{x} = 2(6) = 12$ *units*

Therefore equilibrium quantities are

$\bar{z} = 6$ *units* and $\bar{x} = 12$ *units*

DERIVATION OF THE DEMAND CURVE FOR THE CONSUMER

The derivation of demand is based on the axiom of diminishing marginal utility.

In our earlier discussion we saw that marginal utility of say commodity x may be depicted by a line with a negative slope.

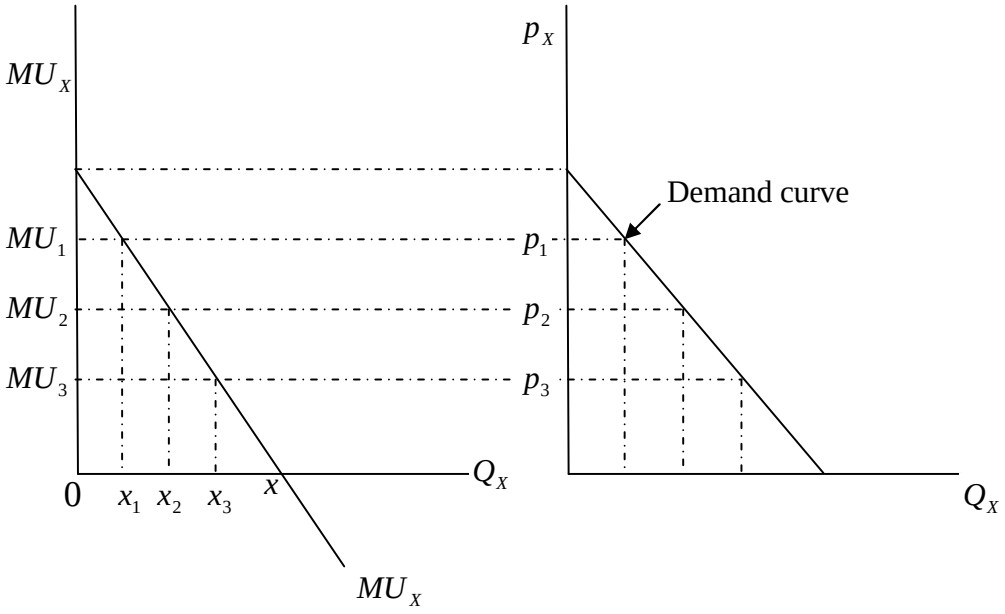


Fig a Fig b

- From Fig a, marginal utility of x declines continuously and becomes negative beyond quantity x.
- If the marginal utility is measured in monetary units, the demand curve for x is identical to the positive segment of the marginal utility curve.
- At equilibrium, $MU_x = p_x$
- Hence, at x_1, MU is MU_1. This is equal to p_1 in diagram (b)

- Similarly, at $x_2, MU_2 = p_2$ and so on.
  $x_3, MU_3 = p_3$
- Hence at p_1 the consumers demand x_1 quantity

  At p_2 - x_2

  At p_3 - x_3

- Thus, diagram b gives the demand curve for consumer, and it is defined by the positive segment of the marginal utility curve in figure a.
- The negative section of the MU curve does not form part of the demand curve, since negative quantities do not make sense in economics.

CRITIQUE OF THE CARDINAL APPROACH

1. Utility cannot be measured objectively. The attempt by an economist called Walras to use subjective units (utils) for utility measurement doesn't give satisfactory solution.
2. The assumption of constant utility for money is also unrealistic. As income increases the marginal utility of money changes. Thus, money cannot be used as a measuring-rod since its own utility changes.
3. The axiom of diminishing marginal utility is a psychological law that is a feeling that cannot be quantified.

In summary, it is clear that, the cardianalist theory of consumer behavior argues that utility can be measured. The derivation of demand is based on the axiom of diminishing marginal utility. The equilibrium condition for the consumer and it states that the marginal utility of x is equated to market price of x.

- Law of diminishing marginal utility which states that, as more quantities are consumed of a particular good, satisfaction derived from additional units goes on falling
- Consumer is said to be at equilibrium when he maximizes his utility

THE ORDINALIST THEORY OF CONSUMER BEHAVIOR

At the end of the lecture, the learner should:

- Understand the indifference curve theory.
- Determine the equilibrium of the consumer using the Indifference curve approach.
- Understand the concept of the budget constraint of the consumer.
- Derive the demand curve using the I.C approach.

Derive the Engels curve

THE INDIFFERENCE – CURVE THEORY

ASSUMPTIONS

1. **Rationality:-** consumer is assumed to be a utility maximizer, given his income and market prices. So, he will choose a combination of goods that maximize his utility.
2. **Utility of ordinal:-** the consumer is able to rank his preference (order the various baskets of goods) according to the satisfaction of each basket. Therefore the consumer need not measure utility to make his choices.
3. **Consistency of choice:-** it is assumed that the consumer is consistent in his choice, that is, if in one period he prefers bundle A to B, he will not choose B over A in another period. If both bundles are available to him. The consistency assumption may be symbolically written as follows:
4. **Transitivity of choice:-** if bundle A is preferred to B, and B is preferred to C, then bundle A, is preferred to C.

That is if and then

$A > B$
$B > C$
$A > C$

combination	**orange**	**Mangoes**
A	**10**	**6**
B	**11**	**6**
C	**12**	**7**

Installation axiom (not getting satisfied):- consumer will prefer a combination of goods that has more units than that with less units. For example.

The consumer will prefer combination C because it has the highest number of oranges and mangoes.

5. Total utility for the consumer depends on the quantity of the commodities consumed.

i.e. $U = f(q_1, q_2, ..., q_x, q_y, q_n)$

6. Diminishing marginal rate of substitution:-

Marginal rate of substitution refers to the slope of indifference curve. it measures how much of say good x, must a consumer give up in order to consume an additional unit of good y, holding utility constant (while still achieving the same level of satisfaction) as shall be seen in the discussion that follows, indifference curves are assumed to be **convex** to the origin, implying that their slopes decreases (in absolute terms) as we move along the curves from the left downwards to the right. Diminishing MRS simply means that, it becomes increasingly difficult to substitute x for y as we move along the indifference curve.

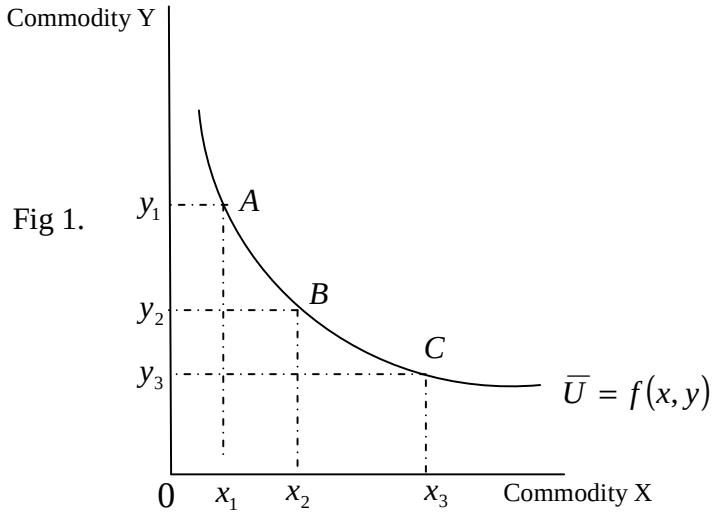
EQUILIBRIUM OF THE CONSUMER

Equilibrium of the consumer refers to the choice of the bundle of goods that maximize utility. To obtain this, we introduce the concept of indifference curves and of their slope (the Marginal rate of substitution), and the concept of the budget line.

Indifference curve

An indifference curve can be defined as a curve that joins combinations of two commodities which yield the same level of satisfaction (utility) to the consumer.

Fig 1.



Along the indifference curve utility is constant ($\overline{U}$) whether he consumes at point A, B, or C. so consumer is indifference about the different combinations.

Indifference map

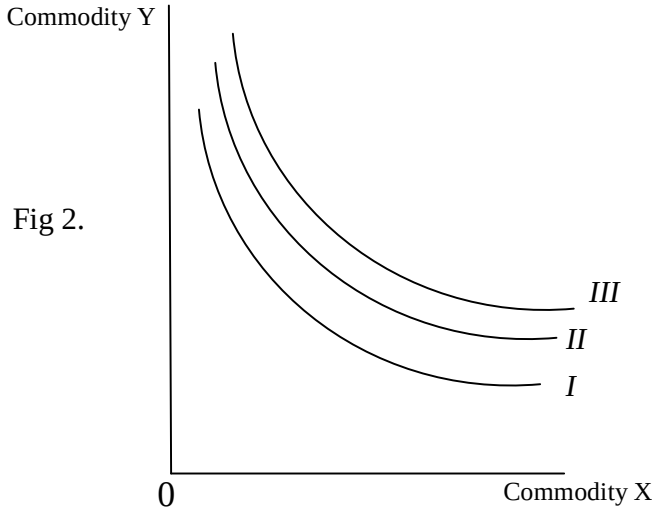


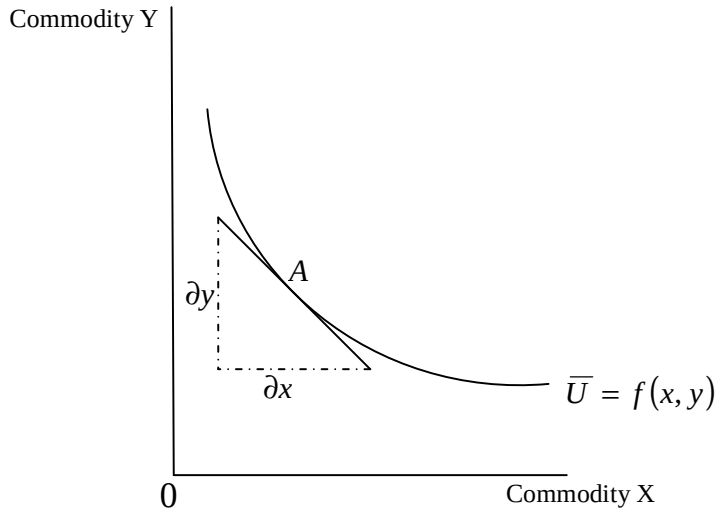
Fig 2.

An indifference map shows all the indifference curves which rank the preference of the consumer.

- Combinations of goods lying on a higher indifference curve (as III) yields higher level of satisfaction and are preferred to those on lower indifference curves (as I) which yield lower utility.
- In figure 1 it can be observed that the consumer must give up consuming some units of y if he must consume more units of x, while still realizing same utility level. That is, if he is at point A where he is consuming y, units of y and x_1 units of x, to consume x_3, he will reduce the consumption of y to y_3 (by y_1y_3)

  However, the indifference curve is assumed to be convex to the origin. This is a clear indication that, although commodities y and x could be substituted for each other, but this would only be to certain extent. Good x and y are not perfect substitutes
- **Marginal rate of substitution** of x for y is defined as the number of units of commodity y that must be given up in exchange for an extra unit of commodity x so that the consumer maintains the same level of satisfaction.

  It is given by the negative of the slope of an indifference curve at any point along the indifference curve



- Slope of indifference curve at point A is given by the slope of the tangent at point A.
- Therefore slope = $\frac{\partial Y}{\partial x}$
- The value of $\frac{\partial Y}{\partial x}$ is negative.
- Therefore, the absolute value of the slope of indifference curve is the $MRS_{x,y}$. To get absolute value, multiply $\frac{\partial Y}{\partial x}$ by (-1)
- Therefore $\left|\begin{matrix}slope\ of \\ indifference\ curve\end{matrix}\right| = -\frac{\partial Y}{\partial x} = MRS_{x,y}$
- Implicit in the definition of MRS is the concept of marginal utility and it can be proved that,

$$\frac{\partial y}{\partial x} = MRS_{x,y} = \frac{MU_x}{MU_y} \text{ or } \frac{-\partial x}{\partial y} = MRS_{y,x} = \frac{MU_y}{MU_x}$$

Proof

total utility function in the case of two commodities x and y is $U = f(x, y)$ the equation of an indifference curve is $U = f(x, y) = k(constant\ no\ change)$ take total differential of the utility function to obtain

$$\partial U = \frac{\partial U}{\partial y} \cdot \partial y + \frac{\partial U}{\partial x} \cdot \partial x$$
$$= MU_y \cdot \partial y + MU_x \partial x$$

This cam be read that total change in utility caused by change in y and x is approximately equal to the change in y multiplied by its marginal utility, plus the change in x multiplied by its marginal utility.

Rearrange to obtain

$$-MU_y \partial y = MU_x \partial x$$

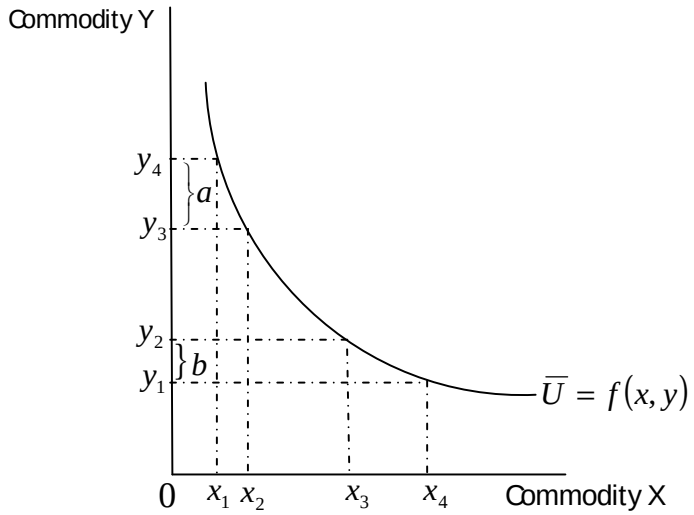
$$\frac{-\partial y}{\partial x} = \frac{MU_x}{MU_y} = MRS_{x,y} \quad \textbf{Or} \quad \frac{-\partial x}{\partial y} = \frac{MU_y}{MU_x} = MRS_{y,x}$$

PROPERTIES OF THE INDIFFRENCE CURVE

1. An indifference curve has a negative slope, which denotes that if the quantities of one commodity (y) decreases, the quantity of the other (x) must increase, if the consumer is to stay on the same level of satisfaction.
2. The further away from the origin an indifference curve lies, the higher the level of utility it denotes and the bundles of goods it represents are preferred by the rational consumer.
3. Indifference curves do not intersect.

   If indifference curve $\overline{U}_1$ and $\overline{U}_2$ intersect, it would mean that at point p, we could have two different levels of satisfaction, which is impossible. Point p has same satisfaction as point A since they both lie on the same indifference curve $\overline{U}_1$.Also note that to the left of point p, indifferent curve $\overline{U}_1$is above$\overline{U}_2$, and to the right it is the opposite case. Thus ranking of bundle of goods would be ambiguous.
4. Indifference curves are convex to the origin, implying that their slope decreases (in absolute terms) as we move down from left to right.

   This property is in line with the assumption of **diminishing marginal rate of substitution.** The number of units of y the consumer is willing to sacrifice in order to obtain an additional unit of x decreases as the quantity of x increases.



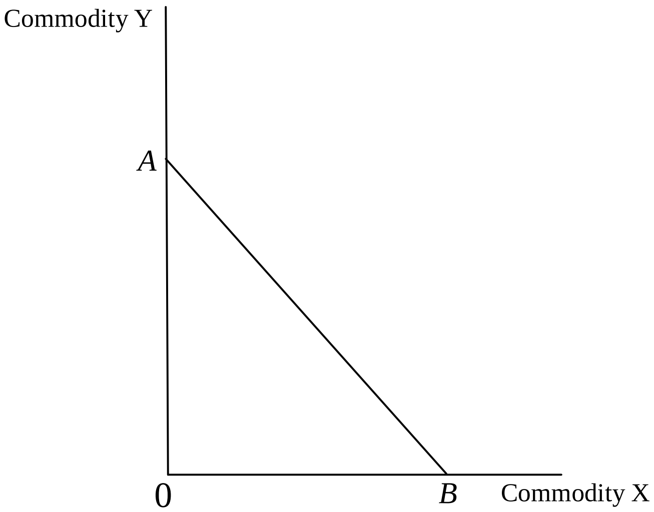
Notice as we move down the indifference curve, e.g. initially from x_1 to x_2 we give up a big margin (“a”) of y.

As we continue downwards, consumer continue to reduce the amount of y he would be willing to give up for x. that is why consumer continue to give up lesser quantities of y as he moves downwards the indifference curve.

That is, it becomes increasingly difficult to substitute one commodity for another as we move along the indifference curve.

Note:

If x and y are perfect substitutes, the indifference curve becomes a straight line with negative slope.



- At point A consumer can only consume y and zero units of x
- At point B, he consumes only x.
- This situation of consumer only consuming one type of good alone (monomalia situation) is unrealistic in real world situation, and one usually ruled out from the analysis of the behavior of the consumer.

THE BUDGET CONSTRAINT (LINE) OF THE CONSUMER

- A budget line can be defined as a line that joins all combinations of two commodities a consumer can buy using his entire income.
- It is assumed that consumers' income is fixed, say at I, and he tries to allocate this income between two commodities x and y.
- How many of the two commodities to consume would depend on the prices of each.
- Assume price of commodity x is p_x and of commodity y is p_y.
- If q_x units of commodity x is consumed and q_y units of commodity y.
- The income constraint, in the case of two commodities, may be written.

  $I = p_x q_x + p_y q_y$ ....(1)

- This can be presented graphically by the budget line whose equation is derived from equation (1) by solving for q_y

$$q_y = \frac{1}{p_y} I - \frac{p_x}{p_y} q_x \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

- Assigning successive values of q_x (given the income, I and the commodity prices, p_x, p_y), we may find the corresponding value of q_y.

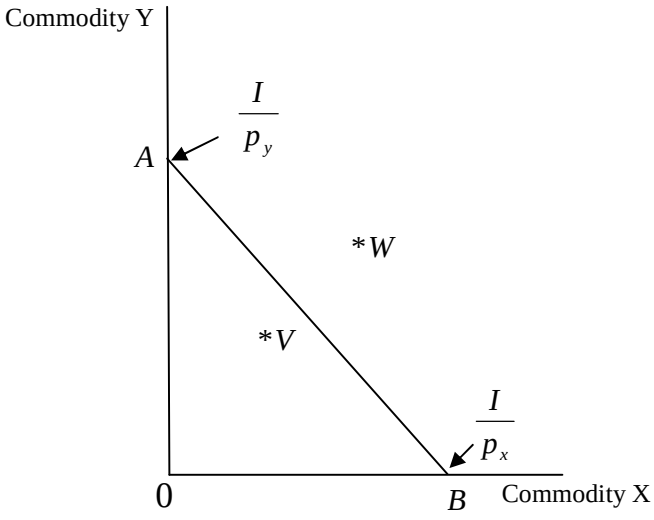
Thus:

If $q_x = 0$ then all the income I is spent on $\frac{I}{p_y}$ unites of y.

If $q_y = 0$, then all the income I is spent on $\frac{I}{p_x}$ units of x

These results are shown by points A and B in the figure represented below.

If we join these points with a line we obtain the budget line



- Geometrically the slope of the budget line is

$\frac{OA}{OB} = \frac{I/p_y}{I/p_x} = \frac{p_x}{p_y}$ Mathematically, the slope of the budget line is the derivative.

$\frac{-\partial q_y}{\partial q_x} = \frac{p_x}{p_y}$

- The negative sign shows that the budget line is negative sloped.
- Notice that the slope of the budget line is the ratio of price of x and y.
- The budget line can also be called **consumption possibility line.** It shows the region within which consumer could afford to consume. At point V, the consumer does not

utilize fully his income, and so he saves part of the income. At point W, he cannot afford because it is beyond his level of income.

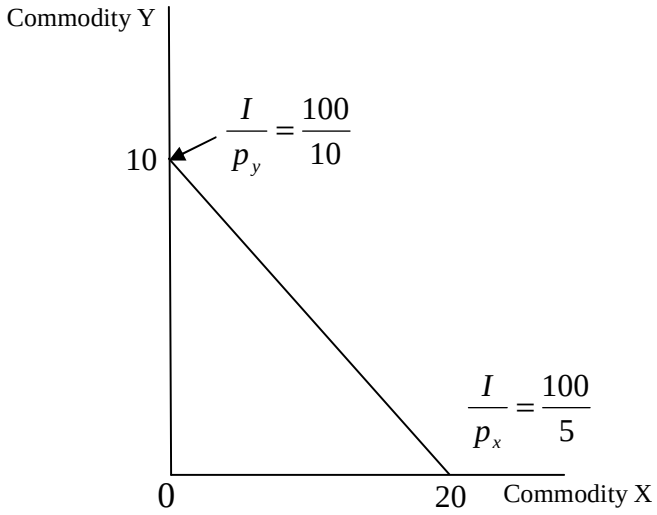
- The consumer can only operate in the shaded area called budget space which gives a set of all commodity bundle that may be purchased by spending some or whole of a given income level.

Changes in the budget line.

- It is important to note that changes in price of commodities concerned and changes in income level affect the budget line.
- Initially let $I = Ksh100,\ p_x = Ksh\,5,\ p_y = Ksh\ 10$

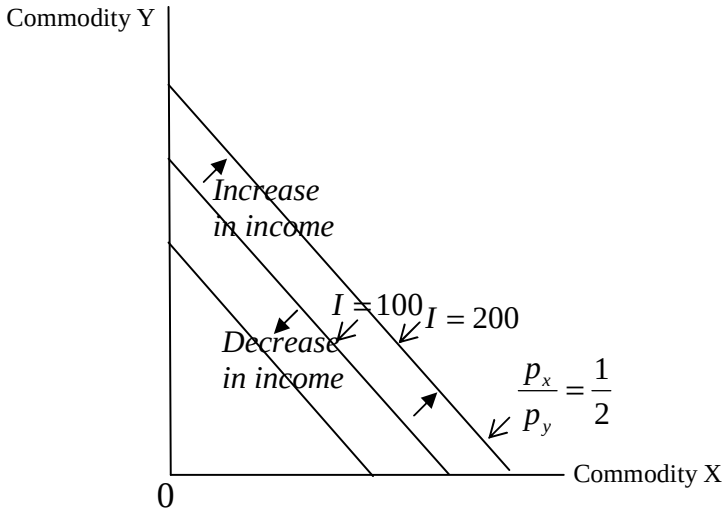
$$I = p_x \cdot x + p_y y$$
$$100 = 5x + 10y$$

Budget line = $$y = \frac{100}{10} - \frac{5}{10}x$$
$$y = 10 - \frac{1}{2}x$$



Case 1: increase in income

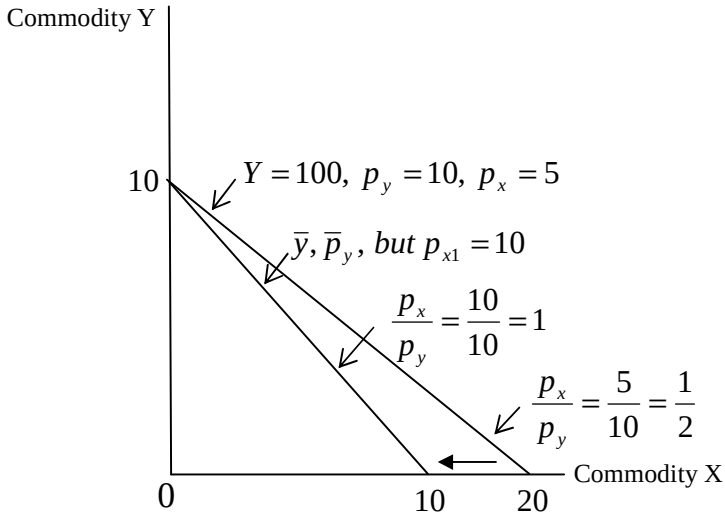
Let I increase to Kshs 200 with $\overline{p}_x$ and $\overline{p}_y$. Then the budget line shifts totally outwards to the right and double units of each commodity will be consumed as shown below,



- Notice change in income does not affect the slope of the budget line.
- It should also follow that if income declines, budget line will shift inwards to the left.

Case 2: change in price of one commodity holding income and price of the other commodity fixed.

Suppose p_x increases from $p_x = 5$ to $p_{x_1} = 10$ with $\bar{I}$ and $\bar{p}_y$ $I = 100$ $p_y = 10$



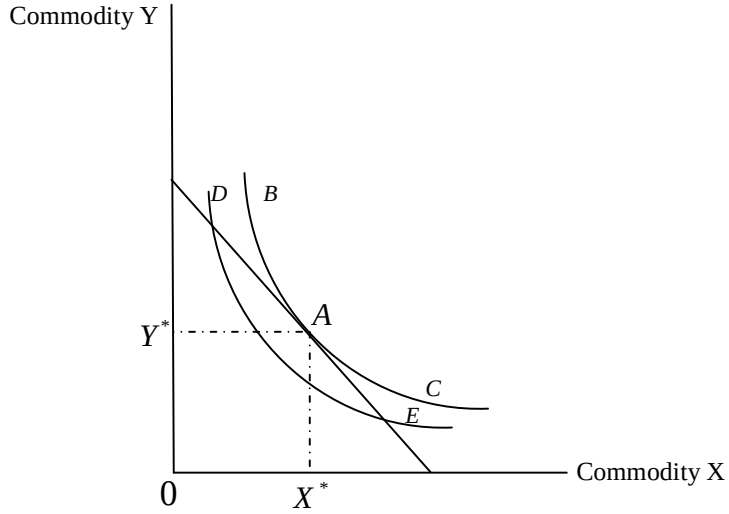
Therefore, increases in price of commodity x leads to less purchases of x worth the budget line swinging inwards. The new budget line becomes more steeper as can be observed in the price ratios. Hence price ratio $\frac{p_x}{p_y}$ in absolute terms increases.

i.e. $\frac{p_{x_1}}{p_y} > \frac{p_x}{p_y}$

$\frac{10}{10} = 1 > \frac{5}{10}$

DERIVATION OF EQUILIBRIUM OF CONSUMER

Using the indifference curve and the budget line, we can graphically show the point of equilibrium of the consumer.



- Consumer will maximize satisfaction where the budget line is tangent to the indifference curve.
- From the figure presented above, combination D and E give a consumer less satisfaction because they are on a lower indifference curve, even though the combination lie on the budget line and are affordable.
- Although combination A,B and C give higher satisfaction to the consumer than D and E. the consumer cannot afford B and C due to his limited income. Notice point B and C lie above the budget line.
- Therefore combination A is the one that maximizes satisfaction given that the consumers' income is fixed.

- Thus it follows that satisfaction is maximized where the budget line is tangent to indifference curve. that is, slope of indifference curve ($MRS_{x,y} = \frac{MU_x}{MU_y}$) equal the slope of budget line $\left(\frac{p_x}{p_y}\right)$ at point A

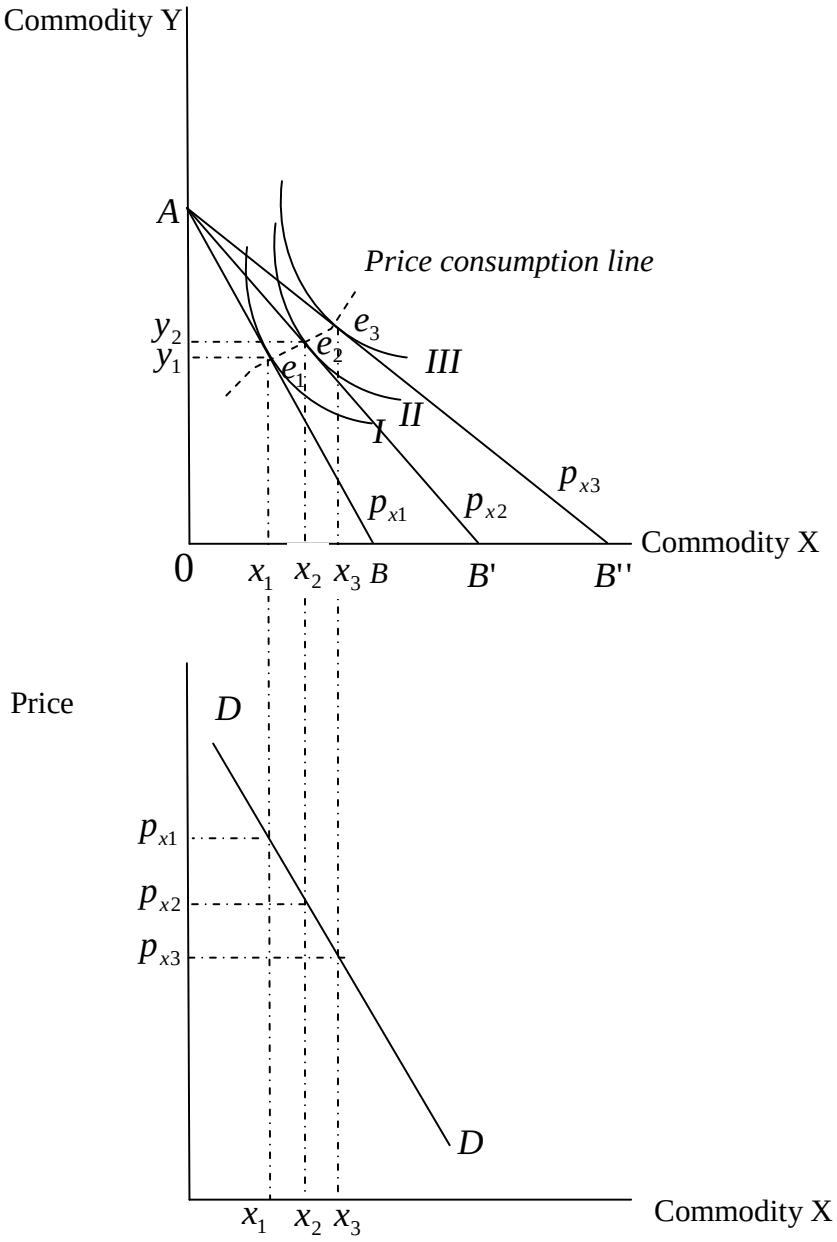
  $$\frac{MU_x}{MU_y} = \frac{p_x}{p_y}$$

- However the condition of tangency between the two curves is the first condition that must be fulfilled for the consumer to be in equilibrium. But, this condition alone is only a necessary but not sufficient condition for equilibrium.
- The second condition to be fulfilled is that the indifference curve be convex to the origin. This condition is fulfilled by the axiom of diminishing marginal rate of substitution of x for y, which states that the slope of the indifference curve decreases. (in absolute terms) as we move along the curve from the left downwards to the right.
- Since the two conditions are fulfilled, the consumer maximizes his utility by buying x^* and y^* units of the two commodities.

DERIVATION OF DEMAND CURVE USING THE INDIFFERENCE CURVE APPROACH

Graphical derivation of the demand curve.

- Suppose the price of commodity x falls, with price of commodity y and income level (I) remaining unchanged.
- The budget line will tilt outwards to the right from *AB* to *AB*' to *AB*'' as shown below.



- It can be noted that as price of commodity x falls from p_{x1} to p_{x2} to p_{x3}, more of good x is consumed because it becomes cheaper.
- The real income or purchasing power of income increases thus leading consumer to consume more of commodity y too. (see figure A)
- As can be observed also in figure A, the new budget lines associated with decreased prices are tangent to higher indifference curves (e.g. AB' is tangent to indifference curve II, and AB'' to indifference curve III.
- The new equilibrium occurs to the right of the original equilibrium (for normal goods) showing that as prices falls more of the commodity will be bought.

- The line joining equilibrium points e_1, e_2 and e_3 is called **Price Consumption Line/Curve (PCC).**
- From the PCC line, we can derive the demand curve for commodity x.
- It has been observed that ;

  At point e_1 the consumer buys quantity x_1 at price p_{x1}.

  At point e_2 the price p_{x2} is lower than p_{x1} and the quantity demanded has increased to x_2 and so on.
- This relationship between price and quantity shown in figure B to obtain a demand curve.
- The demand curve in figure B is downwards slopping, thus obeying the law of demand which states that, quantity bought increases as the price falls.

Engels curve

- Same approach could be used to derive the angels curve. recall from earlier discussion on demand that angels curve shows relationship between income and quantity of goods consumed.
- First consider that income increases prices of commodities x and y remaining unchanged.
- Constant increase in income causes budget line to shift to the right from AB to $A'B'$ to $A''B''$.

Notice increase in income will lead to increase in consumption of both good x and y

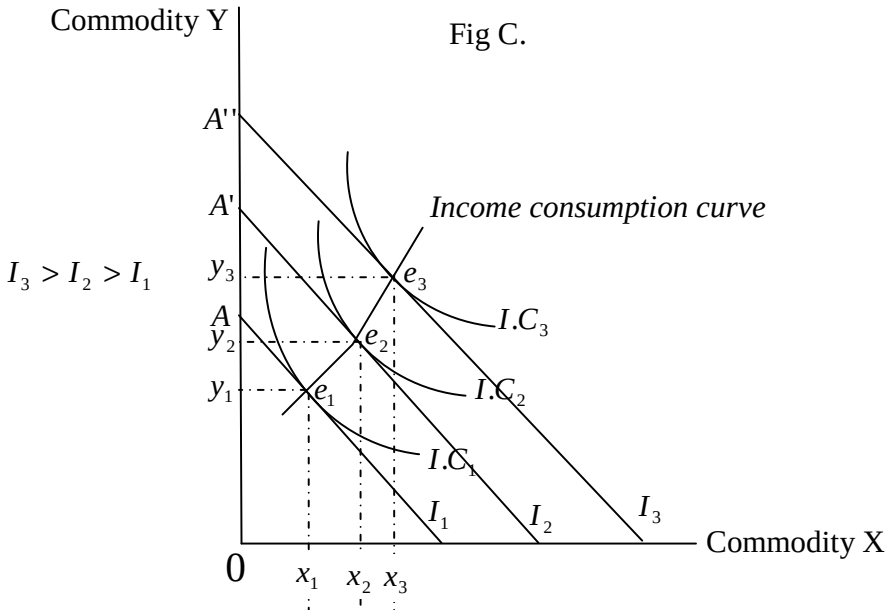


Fig C.

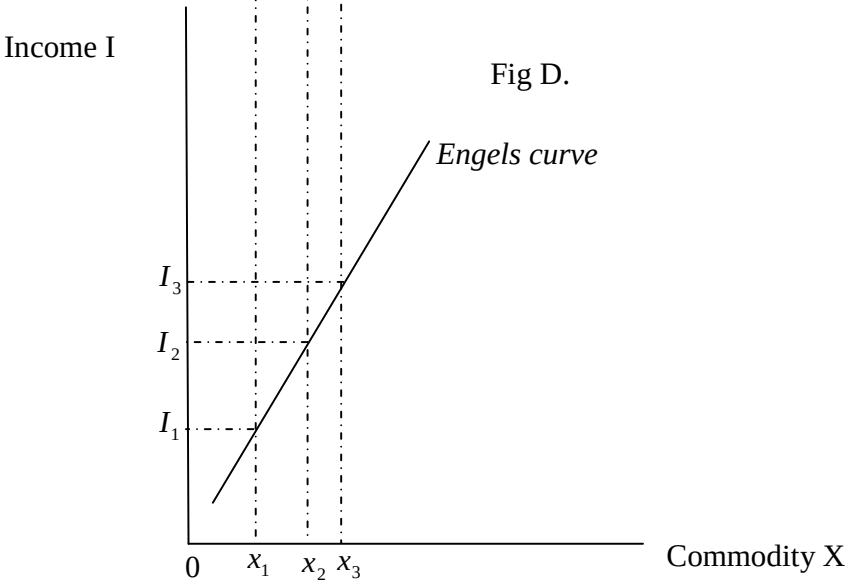
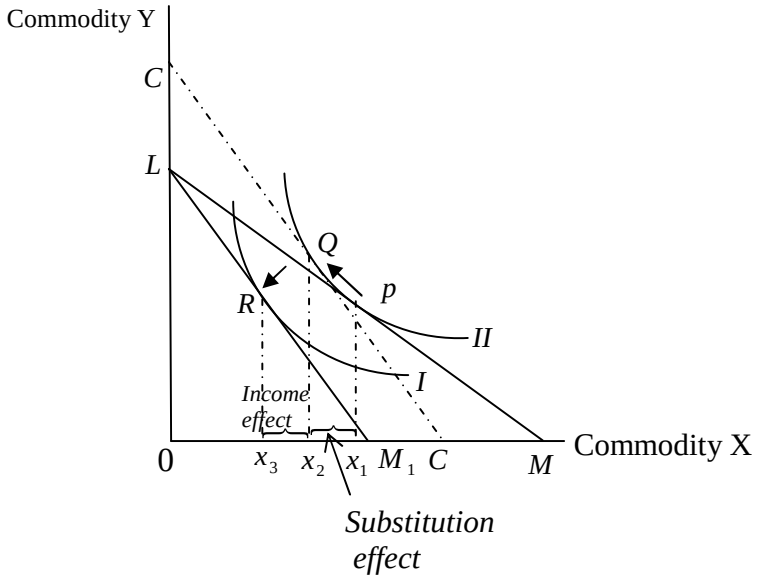


Fig D.

- The ICC shows equilibrium combinations of x and y consumed at various levels of income, with prices remaining constant.
- From fig c it can be observed that associated with higher income I_1, I_2, I_3 is higher levels of consumption x_1, x_2 and x_3.
- If we plot relationship between I and x, we obtain engels curve, which is positively sloped.
- In our discussion of demand, it was observed that for normal goods, engels curve will be positively sloped, and vice versa for inferior goods.

INCOME AND SUBSTITUTION EFFECT OF A PRICE CHANGE

CASE 1: substitution and income effects for normal good in case of a price rise



- We start by assuming that the consumer is at equilibrium at point p on indifference curve II purchasing units of x.
- Supposing the price of commodity x rises, the price of good y and money income remaining constant, the budget line will tilt inwards from LM to LM_1.
- The consumer will move to a new equilibrium position at R on indifference curve I. at this point quantity demanded decreases from Ox_1 to Ox_3
- The overall changes in quantity demanded from equilibrium position p to R is referred to as the **total effect of a price change.**
- The total effect is negative because quantity demanded is reduced from Ox_1 to Ox_3 as price rises.
- The total effect of a price change can be split into two effects.
    - (i) Substitution effect
    - (ii) Income effect
- In this example, whenever the price of x rises with price of y and money income remaining constant, two things happen.

(i) The consumer may be induced to substitute y for x because x is relatively expensive., so as to attain same level of satisfaction as before a price increase.

The opposite would take place incase of a fall in price of x. this is called **substitution effect of price change.**

The increase in price of x (money income remaining constant) cause the consumer's real income to decrease. The size of the bundle of goods and services a consumer can buy declines. He will thus be unable to consume more of x or y. the consumer's level of satisfaction must decline. The change in quantity demanded resulting exclusively from a change in real income, price of y and money income held constant is what is referred to as **income effect of price changes.**

SUBSTITUTION EFFECT

- From the figure as price of commodity x increases, the consumers real income declines. That is, level of satisfaction declines, as indicated by the movement from indifference curve II to indifference curve I.
- For the consumer to attain same level of satisfaction a s before an increase in the price of x, and a decline in real income, he must be given an additional money income just sufficient to compensate him for the loss in real income. That is, the consumer is given a **compensatory payment** just sufficient to remain on indifference curve II under new price regime.
- Since budget line LM_1 represent the new price regime, the compensatory payment is graphically shown by constructing a fictitious budget line tangent to the **original** indifference curve, but whose slope corresponds to the new price ratio.
- Line CC is the fictitious budget line, and it is tangent to the original indifference curve II at point Q. note also that CC is parallel to the new budget line LM_1 thereby reflecting the new price ratio.
- The substitution effect is represented by the movement from the original equilibrium position at P, to the imaginary equilibrium position at Q both points being situated on the original indifference curve. in terms of quantity, the substitution effect is the reduction in quantity demanded from Ox_1 to Ox_2 or by x_1x_2 units.
- Movement along same indifference curve simply shows that, consumers attempt to substitute away from the relatively expensive good to the cheaper one.
- If we were to explain the substitution effect when the price of x declines, we would assume that the consumer is compensated by decreasing his money income by an amount just sufficient to maintain real income constant at the new price ratio.

INCOME EFFECT

- In determining the substitution effect, one is constrained to movement along the original indifference curve.
- However, the total effect of a price change money income and the prices of other commodities held constant, always entails a shift from one indifference curve to another, or a change in real income.
- If consumers real income is to fall from the level represented by the fictitious budget line CC, the movement from the imaginary equilibrium position Q on indifference

curve II to the actual new equilibrium R on indifference curve I indicates the **income effect**.

- Note that since CC and LM_1 are parallel, the movement doesn't involve a change in the relative prices, it is a real income phenomenon.
- The reduction in quantity demanded from Ox_2 to Ox_3 measures change in quantity demanded attributable exclusively to the decline in real income, the change in relative price already having been accounted for by the substitution effect.
- In conclusion the total effect of a price change is the sum of the substitution and income effect.

Total effect = $SE + IE$

DISTINCTION BETWEEN SUBSTITUTION AND INCOME EFFECT IN THE CASE OF NORMAL, INFERIOR AND GIFFEN GOODS

CASE1: NORMAL GOOD

For normal good the income effect reinforces the substitution effect.

$\downarrow p \rightarrow \uparrow real\ income \rightarrow \uparrow Q_d$ income effect

$\downarrow p \rightarrow \uparrow Q_d$ because of substitution effect.

So both effects move in the same direction for normal good quantity demanded always varies inversely with hike.

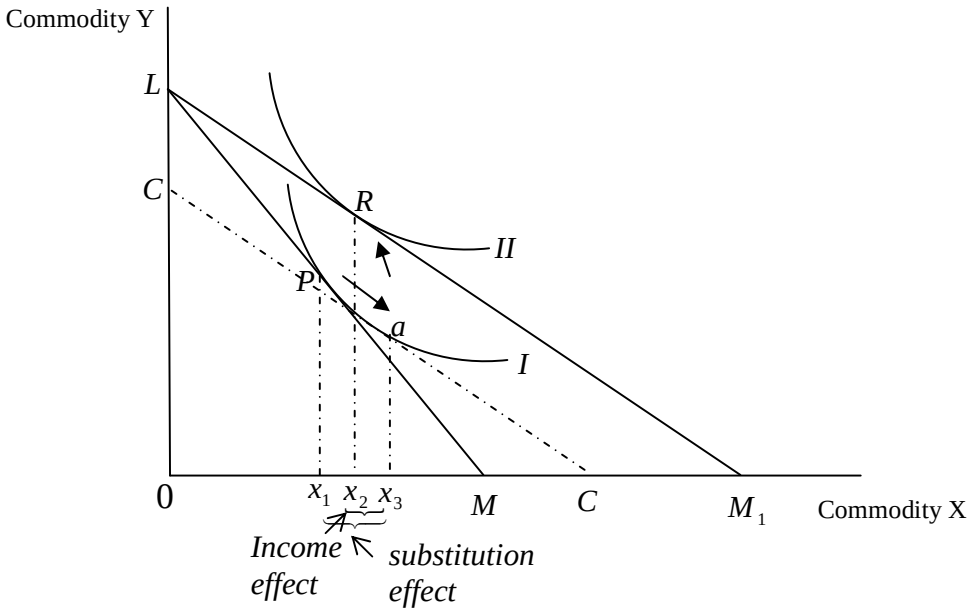
CASE 2: INFERIOR GOOD

An inferior good is one for which the quantity demanded varies inversely with real income.

$\uparrow real\ income \rightarrow \downarrow Q_d$

The substitution and income effect in this case will move in the opposite directions.

An income effect will be less than the substitution effect of a price change.



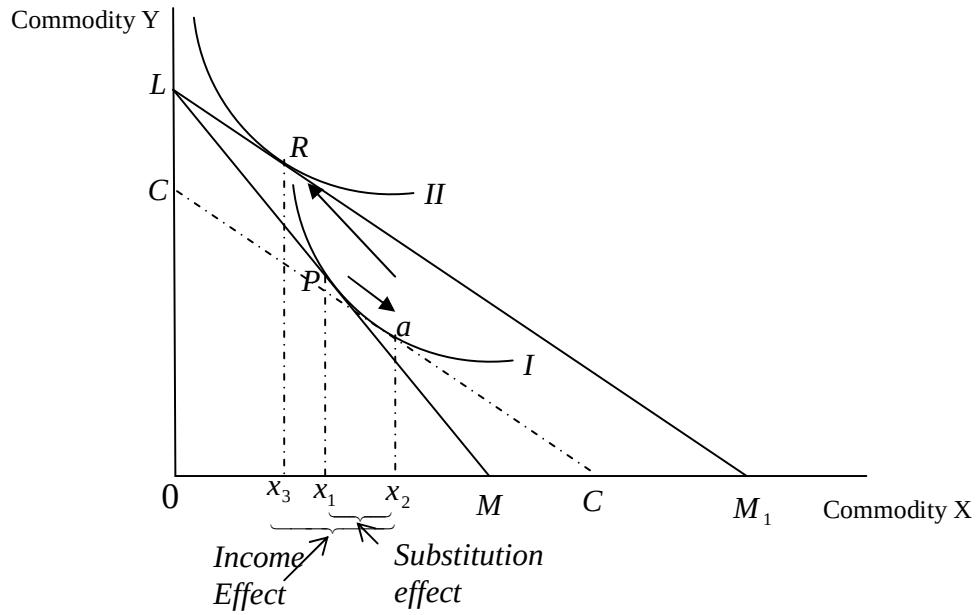
- As price of inferior good declines, budget line LM will tilt outwards to LM_1. The new equilibrium point becomes point R on indifference curve II.
- Total effect of price change is $Ox_3 - Ox_1 = x_1x_3$. Because the consumers real income has increased, we compensate him by decreasing his money income so that he remains on original indifference curve I. The decrease in money income is shown by drawing an imaginary budget line CC, which has same price ratio as LM_1 and which is parallel to the budget line .
- The substitution effect is represented by the movement from point p to Q along the same indifference curve. a fall in price of x causes the consumer to increase his consumption of the cheaper commodity x and reduce the consumption of commodity.
- Thus substitution effect associated with the fall in p_x is positive $(Ox_2 - Ox_1 > 0)$
- As a result of fall in price of good x, real income of consumer increases. The movements from the imaginary equilibrium position Q on indifference curve I to actual new equilibrium R on indifference curve II indicate **income effect.**
- For inferior goods, an increase in real income leads to a fall in quantity demanded from Ox_3 to Ox_2.
- Notice income effect associated with the fall in p_x is negative $(Ox_3 - Ox_2 < 0)$
- Since $SE > IE$, it will offset the negative income effect. So net effect of a price decline will be positive $Ox_3 - Ox_1 = x_1x_2 > 0$

(Total effect = SE+IE = $(Ox_2 - Ox_1) + (Ox_3 - Ox_2) = (Ox_3 - Ox_1) > 0$)

- So price and quantity demanded will be inversely related in the case of inferior goods.

CASE 3: GIFFEN GOODS

Quantity demanded increase with increase in price and vice versa.

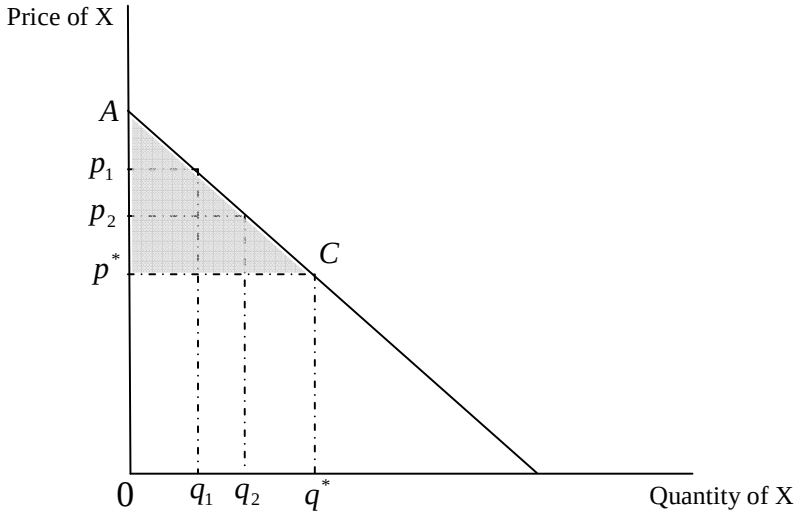


For giffen goods the income effect is so strong that it moves then offsets substitution effect.

- Substitution effect = $(Ox_2 - Ox_1 = x_1x_2 > 0)$ it is movement from P to Q.
- Income effect = $(Ox_3 - Ox_2 = x_2x_3 < 0)$ it is not only negative but large enough to offset positive substitution effect.
- Total effect = SE+IE = $(Ox_2 - Ox_1) + (Ox_3 - Ox_2) = Ox_3 - Ox_1 = x_3x_1 < 0$
- Thus in the case of giffen good the law of demand wont hold. A decrease in price leads to a decrease in quantity demanded. Thus demand curve will be positively sloped.

THE CONSUMER SURPLUS

- It was introduced by Marshall. It is defined as the difference between the actual market price and any price above the market price consumers will be willing to pay for a given commodity rather than do without it



Summary

The indifference curve indicates the various combinations of two goods which yield equal satisfaction to the consumer. By definition, an indifference curve shows all the various combinations of two goods that give an equal amount of satisfaction to a consumer . the ordinalist view that it is wrong to base the theory of consumption on two assumptions; (i) that there is only one commodity which a person will buy at one time, and (ii) the utility can be measured.

Consumer surplus- It is defined as the difference between the actual market price and any price above the market price consumers will be willing to pay for a given commodity rather than do without it

THE THEORY OF PRODUCTION AND COSTS

At the end of the lecture, the learner should:

- Understand the production theory.
- Identify the three stages of production.
- Understand the isoquant analysis.
- Be able to use the concept of the returns to scale.
- Determine the equilibrium of the firm.

Introduction

In the previous topics we looked at the demand side of the market. We analyzed how consumers decide on combination of goods and services to consume so as to maximize their level of satisfaction. We now switch over to the supply side of the market. In this topic we look at the most efficient and least costly way of producing goods and services. We start by looking at the at the theory of production, then the theory of costs.

THE PRODUCTION THEORY

Definition of production concept

(i) **Production:-** this is the creation of goods and services through the transformation of inputs into outputs.

(ii) **Inputs:-** these are the ingredients used by a firm to produce a good or service. Sometimes they are called factors of production or resources. These include land, capital, labour, entrepreneurs etc.

(iii) **Output:-** this is the end product of transforming input into goods or services. Output is thus a function of the various input expressed in the production function.

(iv) **Production function:-** a production function is a schedule (or table, or mathematical equation) showing the maximum amount of output that can be produced from any specified combination of inputs, given the existing technology.

In short the production function is like a "recipe book" showing what output are associated with which combination of inputs.

It may be represented as follows

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

Where :

Q is output

L is labour

K is capital

r are other input resources

(v) **Short run period:-** refers to the period of time during which it is impractical to change the employment levels of some inputs so as to immediately increase output.

Factors input that cannot be varied during this period are referred to as **fixed input** incase an immediate change in output is desired, it would be extremely costly to immediately vary such inputs. Such inputs include buildings, machinery, managerial personnel. Therefore changes in output must be accomplished exclusively by changes in the usage of **variable inputs. A variable input:-** is one whose quantity may be changed almost instantaneously in response to desired changes in output. Many types of labour services and the inputs of raw and processed materials fall in this category. Thus in short run period one factor is held fixed (e.g. capital) while other one variable (labour)

(vi) **Long run period:-** is defined as that period of time in which inputs are variable in the long run it may be economical to install additional productive facilities. In order to produce a certain level of output, we could use different combinations of labour and capital.

(vii) **Isoquant:-** is a curve that shows all the combinations of inputs that will produce a certain level of output, given same level of technology.

In the analysis of theory of production two approaches will be used.

1) Analysis of production: in the short run when one factor is variable and the other is fixed. (short run period function approach)
2) Isoquant analysis, which is long-run approach and which assumes that all factors are variable.

SIMILARITY AND DIFFRENCES BETWEEN CONSUMER BEHAVIOR & PRODUCTION THEORY

Objectives:- the consumer aims at maximizing utility while producer aims at maximizing output.

Constraint:- the consumer is constrained by the income level and prices of commodities while the producer is constrained by technology level and the cost of inputs.

Tools of analysis:- the analysis of consumer behavior employs indifference curves, while that of the production theory employs isoquant.

TYPES OF PRODUCTION CURVES

Here distinction is made between three types of production curves.

1) Total product curve

2) Marginal product curve

3) Average product curve

1) **Total Product (TP)**

In the short run, production function gives the total (maximum) output obtainable from different amounts of the variable inputs, given a specified amount of the fixed input.

In the short-run, production function is written as $Q = f(\overline{K}, L)$, where capital is fixed and labour is variable.

2) **Average Product (AP) or Average Physical Product (APP)**

The average product of an input is that product divided by the amount of the input used to produce this output.

$$AP_L = \frac{Q}{L} = \frac{f(\overline{K}, L)}{L}$$

This can be read as average product of the variable input labour.

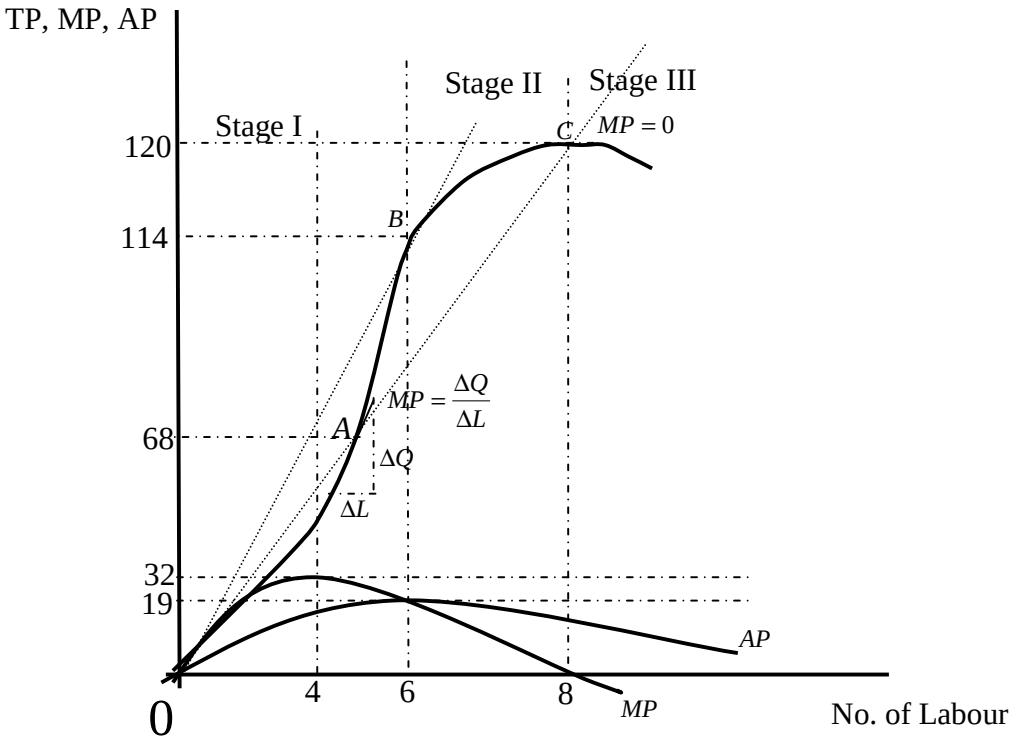
3) **Marginal Physical Product (MPP or MP)**

Is the change in total product that results from one unit change in the amount of variable inputs (e.g. labour), the fixed input remaining unchanged. (may also say, other inputs other than labour remaining unchanged)

Therefore marginal product of labour is the derivative of output with respect to labour.

$$MP_L = \frac{\partial Q}{\partial L} = \frac{\partial f(\overline{K}, L)}{\partial L}$$

No of capital	**No. of labour**	TP_L	$AP_L\left(\frac{TP}{L}\right)$	$MP_L\left(\frac{\Delta TP}{\Delta L}\right)$	**Stages**
1 unit	0.	0	0	0	
1 unit	1.	5	5	5	
1 unit	2.	16	8	11	I
1 unit	3.	36	12	20	
1 unit	4.	68	17	32	
1 unit	5.	95	19	27	
1 unit	6.	114	19	19	
1 unit	7.	119	17	5	II
1 unit	8.	119	14.875	0	
1 unit	9.	117	13	-2	
1 unit	10.	100	10	-17	II



This is a short run case whereby not all inputs are variable. Labour (L) is variable, while capital is fixed at 1 unit.

TP Curve

From the table and figure, total output increases with more employment of labour, reaches a maximum at $Q_x = 119$, and number of labour employed equal 8. as more and more laborers are employed beyond 8, output starts to decline.

MP Curve

As more laborers are employed, marginal product of labour increases, reaching maximum at $L = 4$, then declines reaching zero, when $L = 8$ beyond $L = 8$, MP_L becomes negative

AP Curve

Average product curve also increases initially as L increases, reaching maximum at $L = 6$ then start declining. AP_L remain positive as long as total product is positive.

RELATIONSHIP BETWEEN TP & MP

1) As long as MP_L is increasing, TP will continue to raise at an increasing rate. This is the case as labour increases up to 4.

Beyond $L = 4$ up to $L = 8, MP_L$ starts to decline although it is still positive. TP continues to increase but at a diminishing rate.

2) When MP_L reaches zero, TP reaches its maximum. At this point $TP = 119$ while $L = 8$.

3) When MP_L becomes negative, TP will start declining so any employment beyond $L = 8$ yield negative MP.

- This bring us to the **law of diminishing returns** which states that:-
- If more and more units of a variable input (in our case labour) are applied to a given quantity of fixed input, the total output may initially increase at an increasing rate, but beyond a certain level of output, the rate of increase in the total output diminishes.

The reason behind the operation of this law is that with increasing units of labour to a fixed factor (say capital) each additional worker has less and less tools and equipment to work with. Consequently, the productivity of the marginal worker eventually decreases. As a result, the total product increases at a diminishing rate beyond a point.

- For the law to hold the following two condition must be fulfilled.
  1) Some input(s) must remain fixed as the amount of the input in question, say labour is varied.
  2) Technology must remain unchanged, since a change in technical know-how would cause the entire TP curve to shift. An upwards shift in TP curve reflects a change to superior technology while a downwards shift reflects a change to inferior technology relative to existing one.

IMPORTANT RELATIONSHIP BETWEEN MPP_L & APP_L

1) $MPP_L > APP_L$ when APP_L is rising (MP_L is above AP_L)
2) $MPP_L = APP_L$ when APP_L is at maximum.
3) $MPP_L < APP_L$ when APP_L is declining (MP_L is below AP_L)

Proof

$Q = f(\overline{K}, L)$

$AP_L = \frac{Q}{L} = \frac{f(\overline{K}, L)}{L}$

Case 1: $MPP_L > APP_L$ when APP_L is rising

When APP_L is rising it means $\frac{\partial AP_L}{\partial L} > 0$

To use quotient rule to find $\frac{\partial AP_L}{\partial L} = \frac{\partial\left(\frac{Q}{L}\right)}{\partial L}$

Let $U = Q$

$V = L$

Quotient rule states that.

If $y = \frac{U(x)}{V(x)}$ then $\frac{\partial y}{\partial x} = \frac{\frac{V\partial U}{\partial x} - \frac{U\partial V}{\partial x}}{V^2}$

$\therefore \frac{\partial AP}{\partial L} = \frac{L\frac{\partial Q}{\partial L} - Q\frac{\partial L}{\partial L}}{L^2} > 0$

$L\frac{\partial Q}{\partial L} - Q > 0 \qquad L\frac{\partial Q}{\partial L} > Q$

$\therefore \frac{\partial Q}{\partial L} > \frac{Q}{L}$

Note that $\frac{\partial Q}{\partial L} = MP_L$ and $\frac{Q}{L} = AP_L$

Therefore we have proved that when AP_L is rising $MP_L > AP_L$

Assignment: to prove the other two. When AP_L is declining, $\frac{\partial AP_L}{\partial L} < 0$

When AP_L is at maximum, $\frac{\partial AP_L}{\partial L} = 0$

THE THREE STAGES OF PRODUCTION

Using figure 1 above, we can identify three stages of production.

Stage I:

- Marginal product continues to increase making total product increase at an increasing rate. Marginal product reaches maximum at $L = 4$
- It is a stage of increasing returns because output increases as you increases the use of the variable factor (Labour). Here fixed factors (capital) is under utilized. That is why as more and more workers are added utilization of machine increases and productivity of additional workers increases. At this stage it would be inefficient for firms to operate since there is still room for increased output and hence high profit.

Stage II:

- Is a stage of diminishing returns MP starts declining until it reaches zero. Total product increases but at a diminishing rate and reaches maximum when $MP = 0$.
- Once optimum capital-labour ratio is reduced additional workers have less and less tools to work with. Consequently, the productivity of the marginal worker eventually decreases.

Firms should operate in this stage because optimal utilization of factors is realized.

Stage III:

- It is the Stage of declining returns
- TP is declining and MP is negative.
- It will be very illogical for a firm to operate in this stage because employment of additional labour adds nothing to total product.
- Thus, stages I and III are irrational stages of operation. In stage I, capital is under utilized by small units of labour.
- In stage III, capital is over utilized/overburdened by large units of labour.

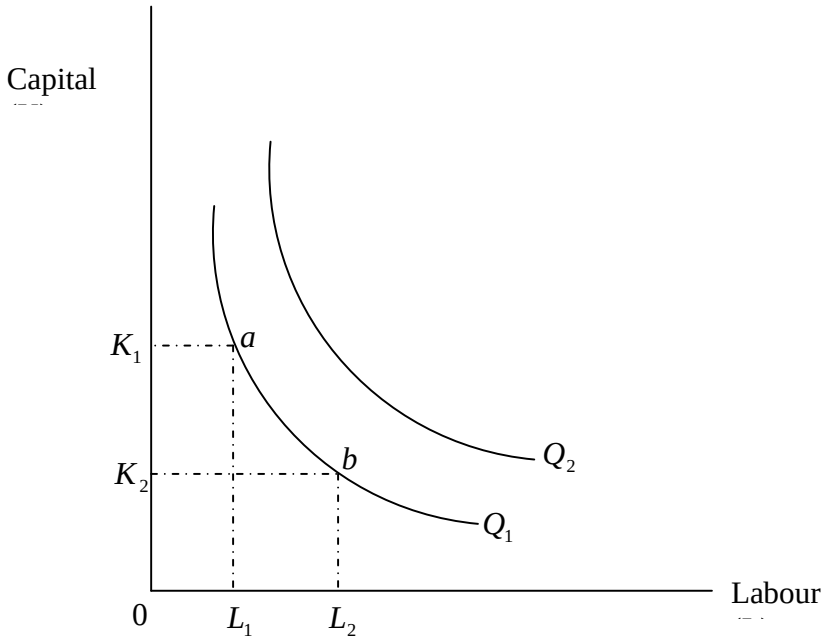
Both extremes are uneconomical to operate in firms will thus operate in stage II, where MP is positive for both variables & fixed factors of production.

ISOQUANT ANALYSIS

- In the short-run, we assume that one factor of production remain fixed as the other one varies that is $Q = f(\overline{K}, L)$
- However, in the long-run, all factors of production become variable so that $Q = f(\overline{K}, L)$. In isoquant analysis, all factors are assumed to be variable.

What is an isoquant?

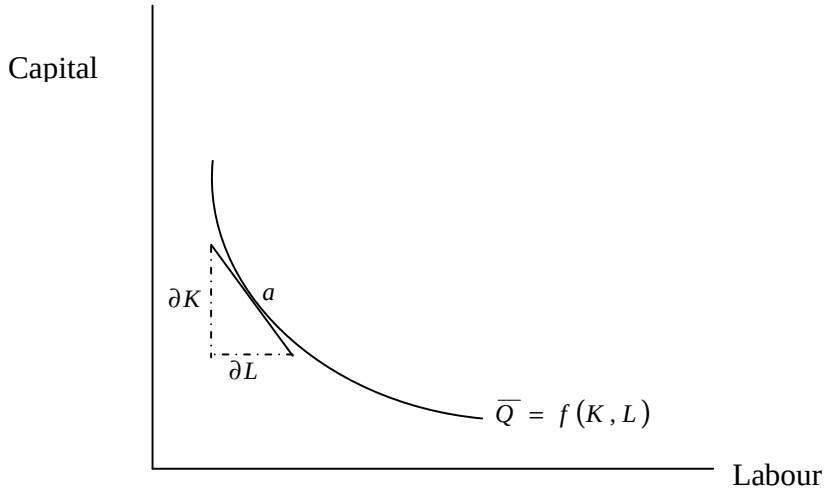
It can be defined as a curve joining various combinations of inputs that yield a given amount of output.



- Combination of inputs (a) and (b) yield same level of output.
- A higher isoquant to the right represents superior output $(Q_2 > Q_1)$
- The slope of the isoquant $\left(-\frac{\partial K}{\partial L}\right)$ defines the degree of substitutability of the factors of production (in our case, substitution between capital and labour)

Marginal rate of technical substitution (MRTS) of labour and capital.

Is the slope of isoquant it refers to the amount of capital (K) that firm must give up by increasing the amount employed of labour by one unit and still remain on the same isoquant (output level)



The slope of the isoquant at point (a) is given by the slope of the tangent at point (a)

Therefore slope = $\frac{\partial K}{\partial L}$

$$-\frac{\partial K}{\partial L} = MRTS_{K,L} = \frac{MP_L}{MP_K}$$

The above statement that MRTS is equal to the ratio of the marginal products of the factor can be proved

$$\overline{Q} = f(K, L)$$

$$\partial Q = \frac{\partial Q}{\partial K} \cdot \partial K + \frac{\partial Q}{\partial L} \cdot \partial L = 0$$

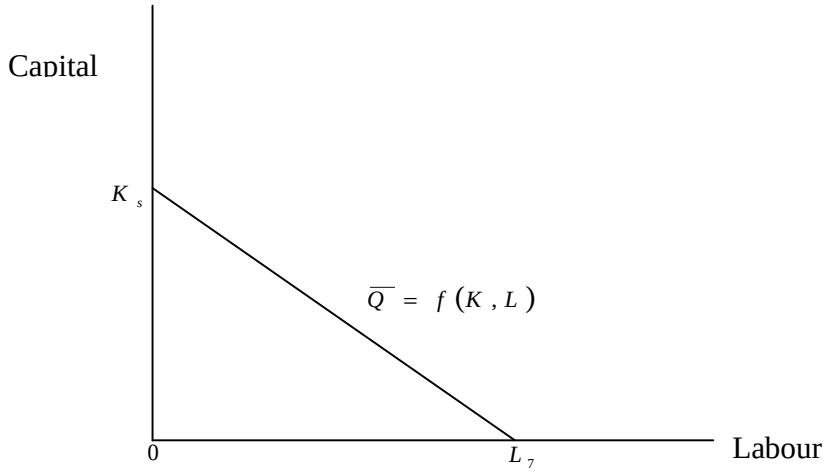
$$MP_K \partial K = MP_L \partial L$$

$$-\frac{\partial K}{\partial L} = \frac{MP_L}{MP_K}$$

SHAPES OF ISOQUANTS

Isoquants may assume various shapes depending on the degree of substitutability.

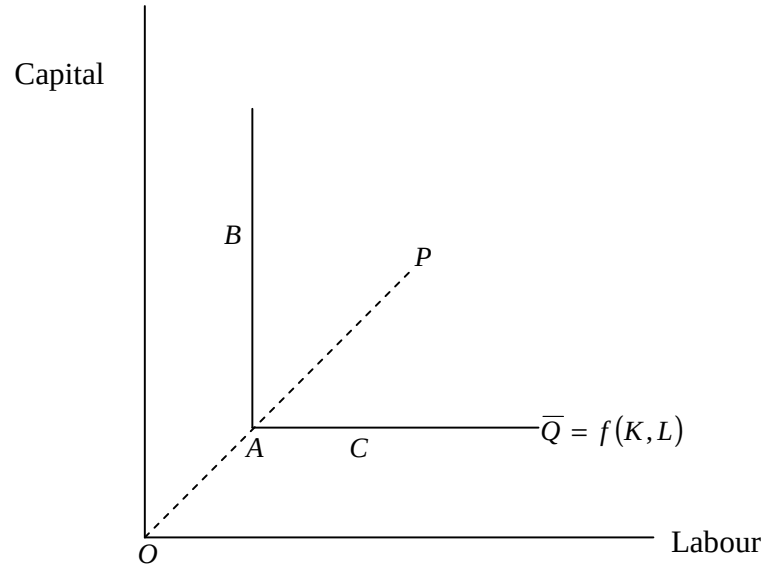
1) **Linear isoquant**



It reflects perfect substitution between factors of production i.e. Q could be produced wholly by using only capital and zero units of labor.

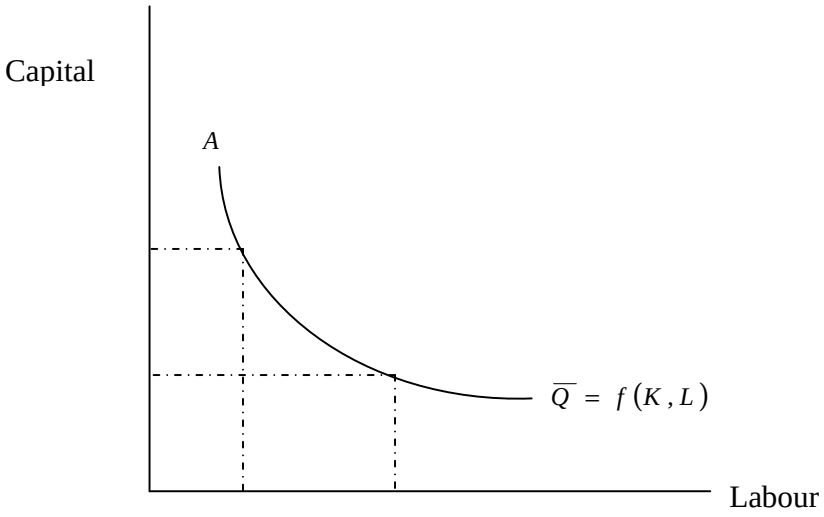
It represents infinite methods of production, which in economic analysis is unrealistic assumption.

2) **Input- output isoquant (Leontief isoquant)**



- In this group of isoquants input cannot be substituted for one another.
- There exists only one single production process (P).
- All efficient production must take place at the corner of the isoquant (point A). the input combination represented by points B and C yield the same output as point A, but the A combination enables the use of less capital than the B combination with the same labour, or less labour than the C combination with capital the same.

3) **Smooth convex isoquant**



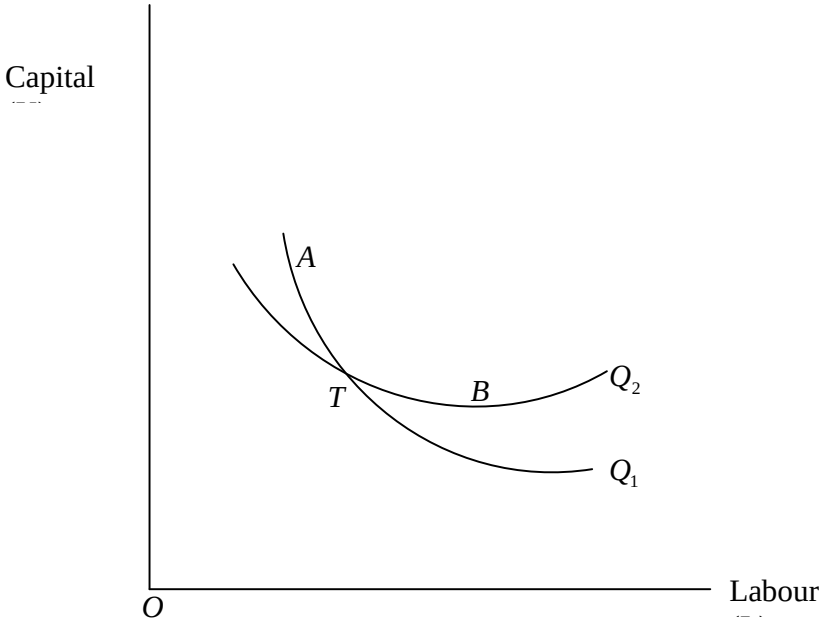
Assume continuous substitutability between K and L over a certain range AB, beyond which factors cannot substitute each other.

This type of isoquant is mostly adopted in economic theory because it is mathematically simpler to handle by the rules of calculus.

E.g. to get its slope we differentiate the equation $\frac{\partial K}{\partial L}$.

CHARACTERISTICS OF ISOQUANTS

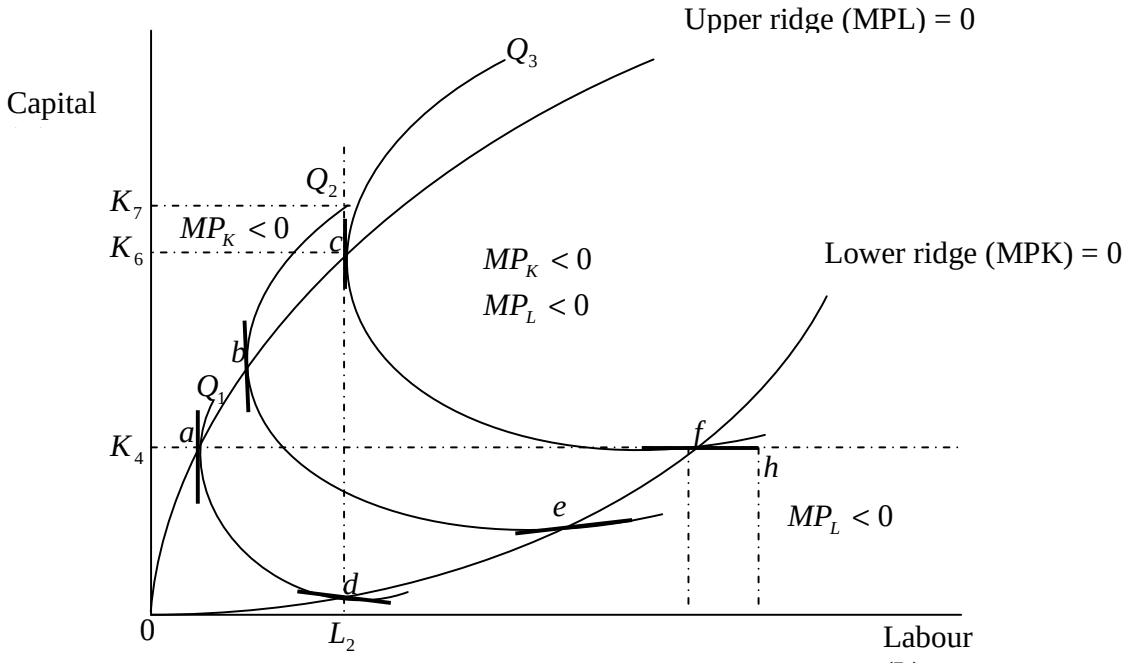
1) Are downwards sloping within the relevant range. Increasing one factor would require that the other factor be decreasing to yield same level of output.
2) Isoquants do not intersect.



If the two intersect it means that combination of K and L at point T would yield higher output Q_2 as well as Q_1 which may not be the case.

3) Superior isoquants are represented by those far away from the graph origin.
4) Isoquants are convex to the origin within the relevant range. This implies that the slope of the isoquant decreases (in absolute terms) as we move downwards along the isoquant, showing the increasing difficulty in substituting K for L.

PROVING THAT RELEVANT RANGE OF PRODUCTION IS IN THE SECTION OF THE ISOQUANT WHICH IS NEGATIVELY SLOPED AND CONVEX



- Outside the ridge line, the marginal products of factors are negative and the methods of production are inefficient, since they require more quantity of both factors for producing a given level of output.
- Suppose the quantity represented by isoquant Q_3 is to be produced using a **minimum** amount of labour (OL_2). With OL_2 units of labour, OK_6 units of capital must be used.
- Beyond this level of input, additional units of capital in combination with OL_2 units of labour (e.g. OK_7 units of capital would yield a smaller level of output Q_2.
- Notice point g in the figure lies on a lower isoquant than Q_3.
- Since an expansion of capital input beyond OK_6 in the face of the constant labour inputs OL_2, reduce total output, point c on Q_3 represent the intensive margin for capital. At point c $MP_l = 0$ but beyond point c, $MP_K < 0$ (negative)
- Hence MRTS of labour for capital is infinite. i.e.

$$MRTS, K = \frac{-\partial K}{\partial L} = \frac{MP_L}{MP_K} = \frac{MP_L}{0} = \infty(undefined)$$

This is shown by the vertical tangent at point c. At point c, capital has been substituted for labour to the maximum extent consistent with the level of output Q_3.

- Production above the upper ridge line is thus inefficient since $MP_K < 0$

- On the other hand, OK_4 is the lowest amount of capital needed to produce Q_3. OL_4 units of labour would be used. Additional unit of labor (OL_6) in combination with OK_4 units of capital yield lower level of output since point h lies on lower isoquant than Q_3. At point f, $MP_L = 0$, and beyond point f, $MP_K < 0$ (negative). **At point f.** $MRTS_{L,K} = \frac{-\partial K}{\partial L} = \frac{MP_L}{MP_K} = \frac{0}{MP_K} = 0$ **(shown by the horizontal tangent at point f)**
- The only efficient range of production is thus inside the ridge lines, hence the ridge lines separate the economic from uneconomic region of production.
- In the relevant range the isoquant is convex to the origin.

THE LAW OF RETURN TO SCALE

This is a long-term analysis of production it shows by how much total output will change as a result of a change in all factor inputs by same proportion.

Suppose we start from an initial level of input and output.

$X_0 = f(L, K)$

And we increase all the factors by the same proportion k. We will clearly obtain a new level of output X^*, higher than the original level X_0

$X^* = f(kL, kK)$

If X^* increases by the same proportion k as the input, we say that there are **constant returns to scale.**

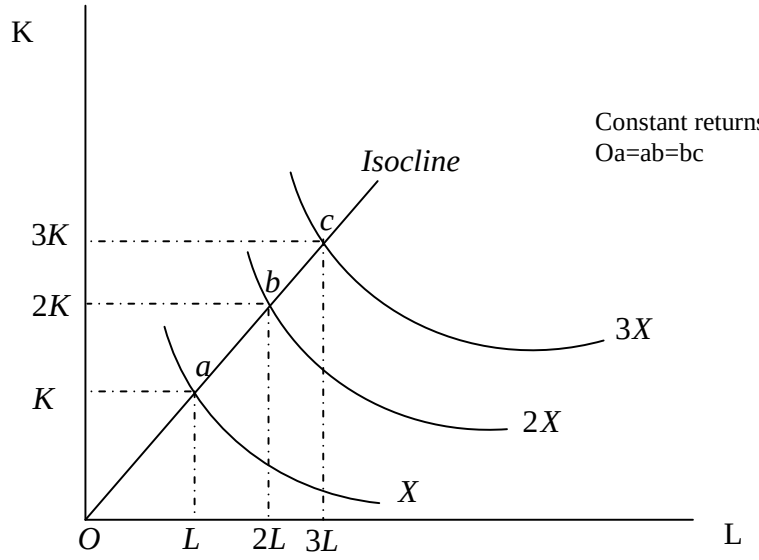
If X^* increases less than proportionally with the increase in the factors, we have **decreasing returns to scale.**

If X^* increases more than proportionally with the increase in the factors, we have **increasing returns to scale.**

GRAPHICAL PRESENTATION OF THE RETURNS TO SCALE

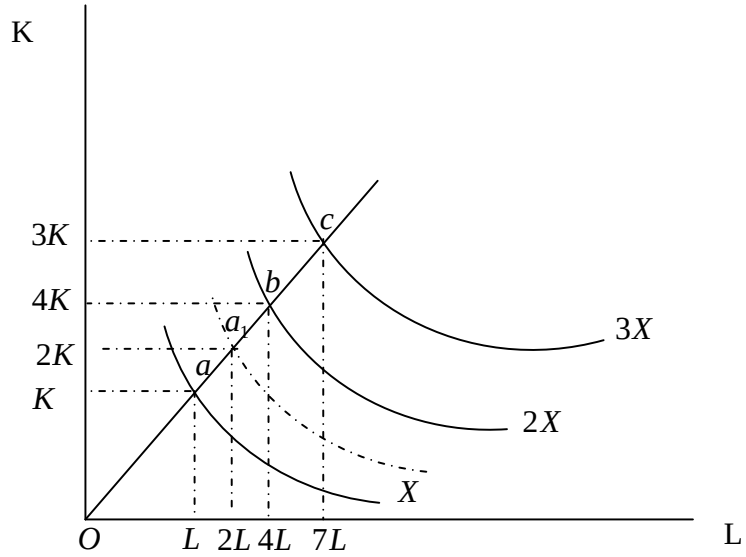
Returns to scale may be shown graphically by the distance between successive, multiple-level-of-output isoquant, that is, isoquant that show levels of output which are multiples of same base level of output, e.g. $X, 2X, 3X$ etc.

Constant returns to scale



- A line joining points a, b, c from origin is called an isocline. An isocline is a locus of points along which the marginal rate of technical substitution is constant.
- Doubling the factor inputs achieves double the level of initial output.
- Tripling inputs achieves triple output and so on.

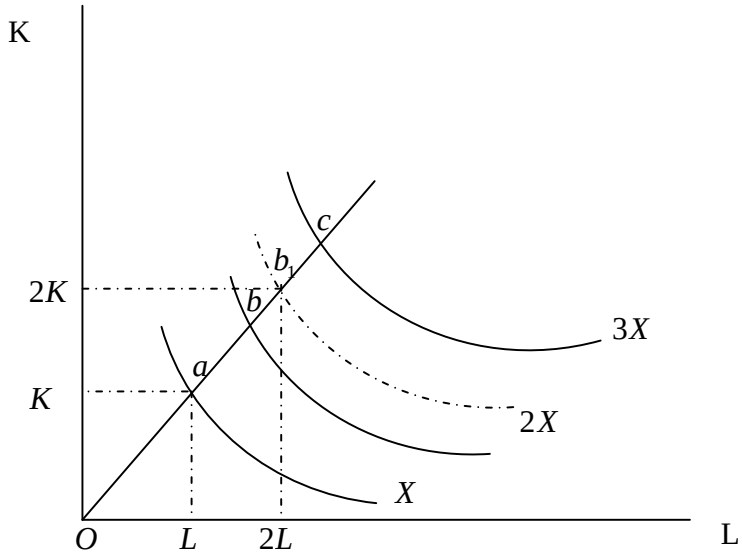
Decreasing returns to scale



- By doubling the inputs, output increases by less than twice its original level.
- The point a, defined by $2K$ and $2L$ lies on an isoquant below the one showing $2X$
- Distance between the consecutive multiple isoquant increases.

$Oa < ab < bc$

Increasing returns to scale



- When inputs are doubled output increases by more than double.
- Distance between consecutive multiple isoquant decreases. i.e. $Oa < ab < bc$
- This implies in order to realize the next multiple level of output less amount of inputs than the previous level will be required.

RETURNS TO SCALE AND HOMOGENEITY OF PRODUCTION FUNCTION

- A homogeneous function is a function such that if each of the inputs is multiplied by a constant (k) can be completely factored out of the function.
- e.g. take production function $X_0 = f(L, K)$
- increase both factors L and K by same proportion *k*
- new level of input $X^* = f(kL, kK)$

if *k* can be factored out so that

$X^* = k^v f(L, K)$

- We say that the function is homogeneous of degree *v*. that is the power *v* of *k* is called degree of homogeneity of the function and is a measure of the returns to scale.

- A production function is said to be homogeneous of degree *n*, if when inputs are multiplied by some constant say *k*, the resulting output is a multiple of k^n times the original output.

e.g. $X_0 = b_0 L^{b1} K^{b2}$

multiplying L and K by a constant *k*

$$X^* = b_0 (kL)^{b1} (kK)^{b2}$$

$$= b_0 k^{b1} k^{b2} \left(L^{b1}, K^{b2}\right)$$

$$= k^{(b1+b2)} \left(b_0 L^{b1}, K^{b2}\right)$$

$$= k^{(b1+b2)}, X_0$$

Here returns to scale is measured by the power of *k* which is $(b_1 + b_2)$

Notice b_1 and b_2 are powers of factor inputs too.

If $(b_1 + b_2) = 1$ constant returns to scale

This production function is sometimes called linear homogeneity

If $(b_1 + b_2) < 1$ decreasing returns to scale

If $(b_1 + b_2) > 1$ increasing returns to scale.

EQUILIBRIUM OF THE FIRM (CHOICE OF OPTIMAL COMBINATION OF FACTORS OF PRODUCTION

- The goal of any firm is to maximize profit.

  $\pi = R - C$

  Where

  R is revenue

  C is cost.

- The firm strives to choose an optimal combination of factors of production that would maximize profits.
- The problem facing the firm would be that of constrained profit maximization.
- Constrained profit maximization may take one of the following forms.

Case 1: **maximize output subject to a cost constraint**

Assumptions

i) Price of output is given $(\bar{p}_x)$

ii) Price of factor inputs are given

i.e. $\bar{w}$ is given wage rate (price of labour)

$\bar{r}$ is given price of capital

In the case total cost (c) is given.

Therefore $(\bar{c}, \bar{p}_x, \bar{w}, \bar{r})$, implying that the profit maximization problem can be stated as

$$Max\pi = R - \bar{c}$$
$$= \bar{p}_x \cdot x - \bar{c}$$

Clearly, maximization of π is achieved in this case if *x (output)* is maximized, since $\bar{c}$ and $\bar{p}_x$ are given constants.

Case b: maximizing profit π if output and price are given.

For example, a contractor want to build a ridge (*x* is given) with the maximum profit

In this case;

$Max\pi = \bar{p}_x \bar{x} - c$

Maximization of profit can only be achieved by minimizing cost.

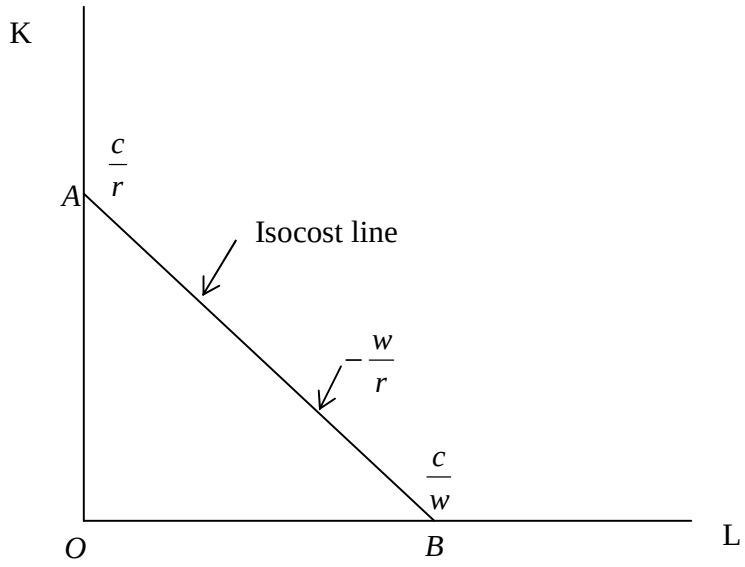
Cost function is

$C = w \cdot L + r \cdot K$

Isocost line

In the same way we derived a budget line fro consumers budget constraint, we can derive an isocost line from the cost function.

Isocost line is a locus of all combinations of factors the firm can purchase with a given monetary cost outlay.



When :

$K = 0$

$L = \frac{C}{w}$

When:

$L = 0$

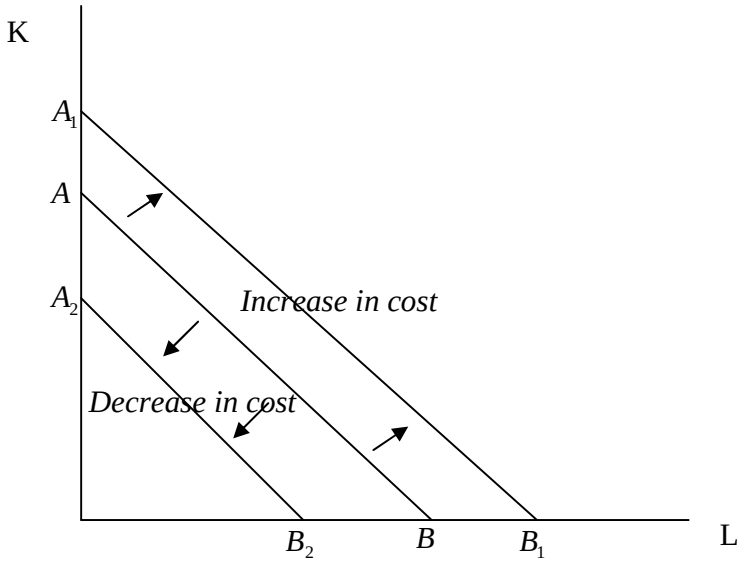
$K = \frac{C}{r}$

Slope = $\frac{OA}{OB} = \frac{-\frac{C}{r}}{\frac{C}{w}} = \frac{w}{r}$

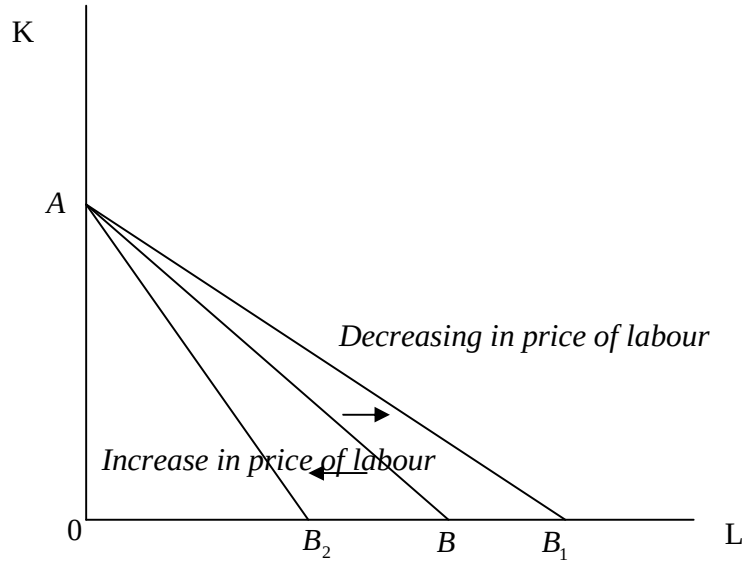
Slope of the isocost line is equal to the ratio of the prices of the factor of production.

Shifts of isocost lines

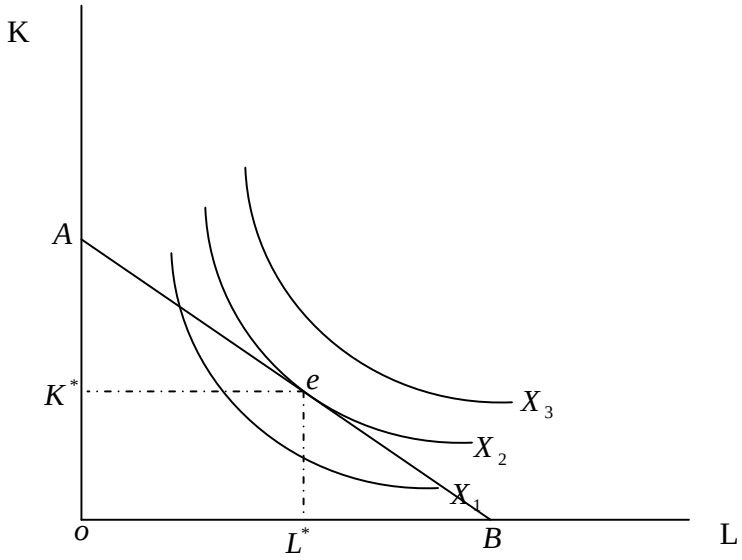
i) Due to change in expenditure or cost



ii) Due to change in price of labor, price of capital and cost being held constant.



EQUILIBRIUM OF THE FIRM



Firm is maximizing output subject to cost constraint.
Equilibrium is attained at the point of tangency between isocost line and the isoquant at point e.
The optimal combination of inputs that maximize output is $\left(K^*, L^*\right)$
The maximum level of output the firm can produce given cost constraint is x_2.
At point e, the slope of isocost line $\left(\frac{w}{r}\right)$ equal the slope of the isoquant $\left(\frac{MP_L}{MP_K}\right)$

i.e. $MRTS = \frac{MP_L}{MP_K} = \frac{w}{r}$ his constitute the first condition for equilibrium.

Second condition is that isoquant be convex to the origin.

The **law of increasing returns** is also called the law of diminishing costs, The *law of increasing return* states that when more and more units of a variable factor is employed, while other factor remain fixed, there is an increase of production at a higher rate. The tendency of the marginal return to rise per unit of variable factors employed in fixed amounts of other factors by a firm is called the law of increasing return. An increase of variable factor, holding constant the quantity of other factors, leads generally to improved organization. The output increases at a rate higher than the rate of increase in the employment of variable factor.

Isocost line is a locus of all combinations of factors the firm can purchase with a given monetary cost outlay.

At point equilibrium, the slope of isocost line $\left(\frac{w}{r}\right)$ equal the slope of the isoquant $\left(\frac{MP_L}{MP_K}\right)$

i.e. $MRTS = \frac{MP_L}{MP_K} = \frac{w}{r}$

TOPIC 5: THE THEORY OF COSTS

At the end of the lecture, the student should:

- Discuss the economic meaning of costs and profit
- Distinguish between the short run, long run, fixed and variable factors
- Explain the shape of the production function and Law of Diminishing Returns
- Explain short run costs (TC, AC, MC) and describe long run cost functions, scale and economies diseconomies of scale

Introduction

The total cost is a multivariable function ie it is determined by many factors. By way of symbolization we can represent the cost function as;

$C = f(X, T, P_f)$

Where c is total cost
X is output
T is technology
P_f is price fluctuations.

For simplicity, costs are graphically shown as a function of output, $C = f(X)$ ceteris paribus i.e. if other factors do not change their effect on costs as shown graphically by a shift in the cost curve.

TRADITIONAL THEORY OF COST

- Traditional theory distinguishes between the short run and the long run.
- The short run is the period during which some factor(s) is fixed, for example capital equipments and entrepreneurship. During such a period the usage of the fixed factors cannot be varied regardless of the level of output. Similarly, there are other inputs, variable inputs, whose usage can be changed, e.g. unskilled workers and raw materials.
- In the long run, on the other hand, all inputs are variable. The quantity of all inputs can be varied so as to obtain the most efficient input combination.

SHORT RUN COST

- In the short run, the firm incurs cost on fixed factors and variable factors are known as **fixed cost** while cost on variable factors are known as **variable cost.**

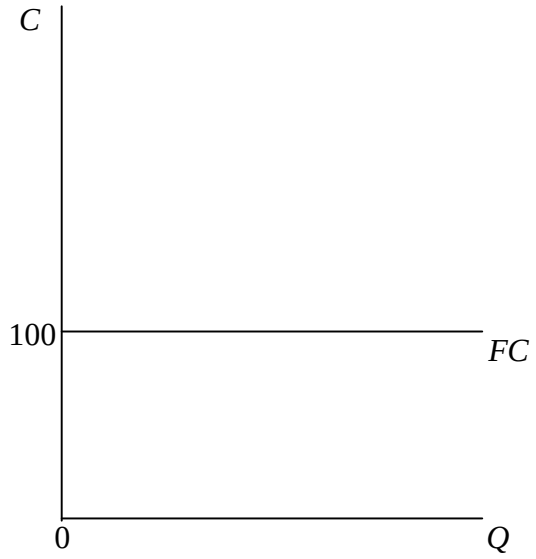
This implies that

$TC = TFC + TVC$

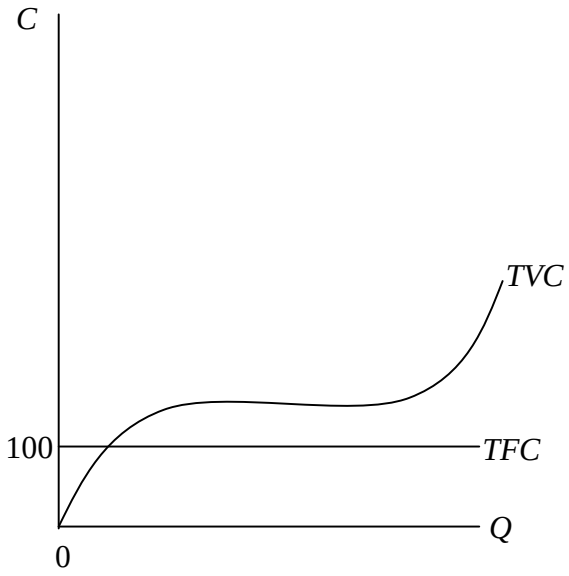
TFC - total fixed cost

TVC - total variable cost

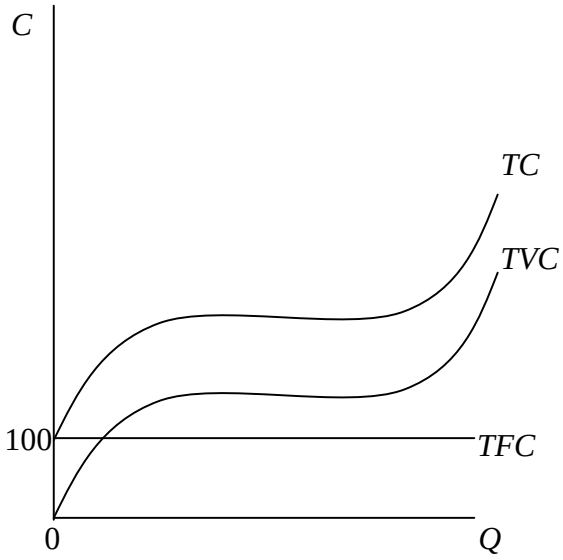
TFC does not vary with variation in the output between zero and a certain level of output.



- *TFC* is graphically denoted by a straight line parallel to the output axis.
- *TVC* vary with variations of output. When output is zero, $TVC = 0$. It starts from the origin and has an inverse S- shape.



Total cost curve shape



- Total cost have same shape as a total variable cost but doesn't start from the origin. Where it intersect the vertical axis depends on the value of the fixed cost.
- The TVC has an inverse S-shape it shows that the TVC first increases at a decreasing rate and then at an increasing rate with the increase in the total output. The pattern of change in the TVC stems directly from the law of increasing and diminishing returns to the variable inputs.
- According to this law, at the initial stage of production worth a given fixed input, additional variables factor is productive so that output increases at an increasing rate.

Taking total variable cost and dividing it by output would mean that average variable cost declines.

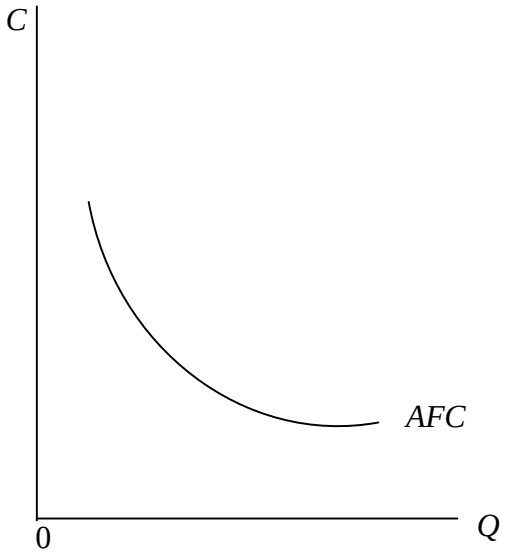
- At optimal combination of the fixed and variable factor, marginal productivity of additional variable factor reaches its maximum implying that average variable cost reaches its minimum.
- Beyond an optimal combination of the fixed and variable factor(s) increased employment of the variable factors causes productivity of the variable factor(s) to decline and thus average variable costs to rise. TVC increases at an increasing rate.

Concept of average and marginal costs

$ATC = AFC + AVC$

$AFC = \frac{TFC}{Q}$ *(fixed cost per unit of output)*

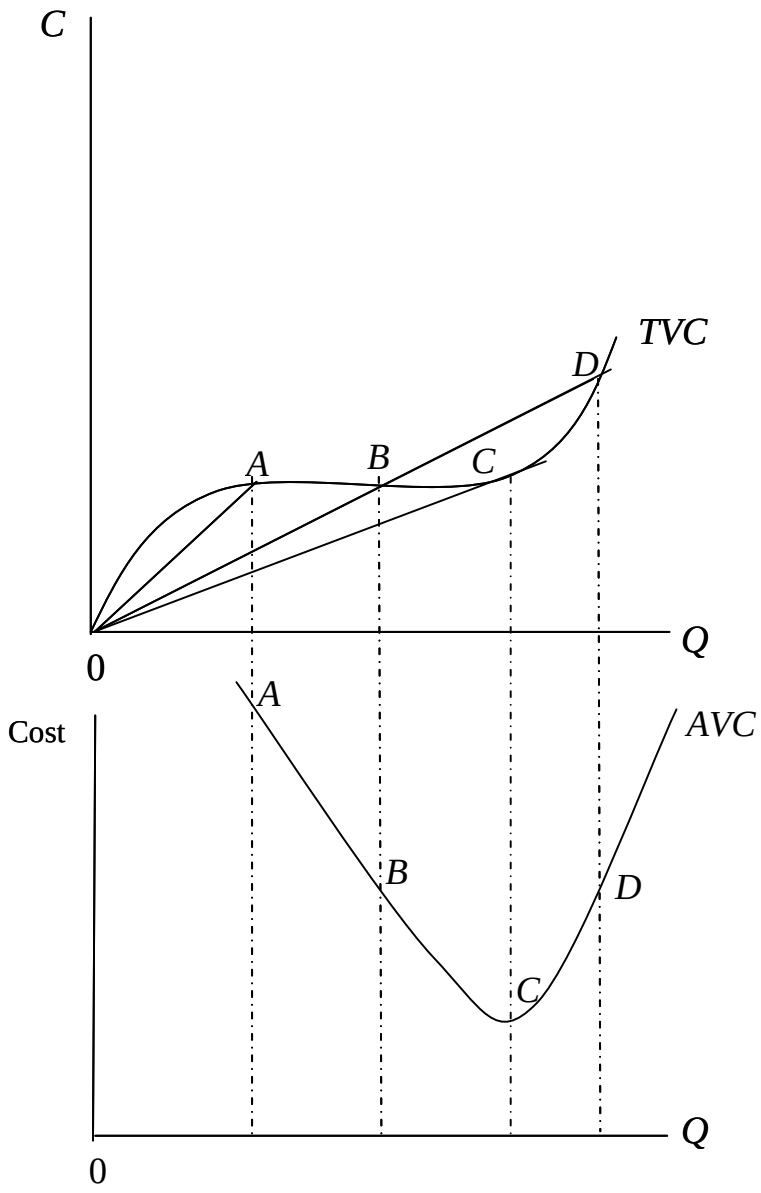
$AVC = \frac{TVC}{Q}$ *(average cost per unit of output*



AFC is a rectangular hyperbola

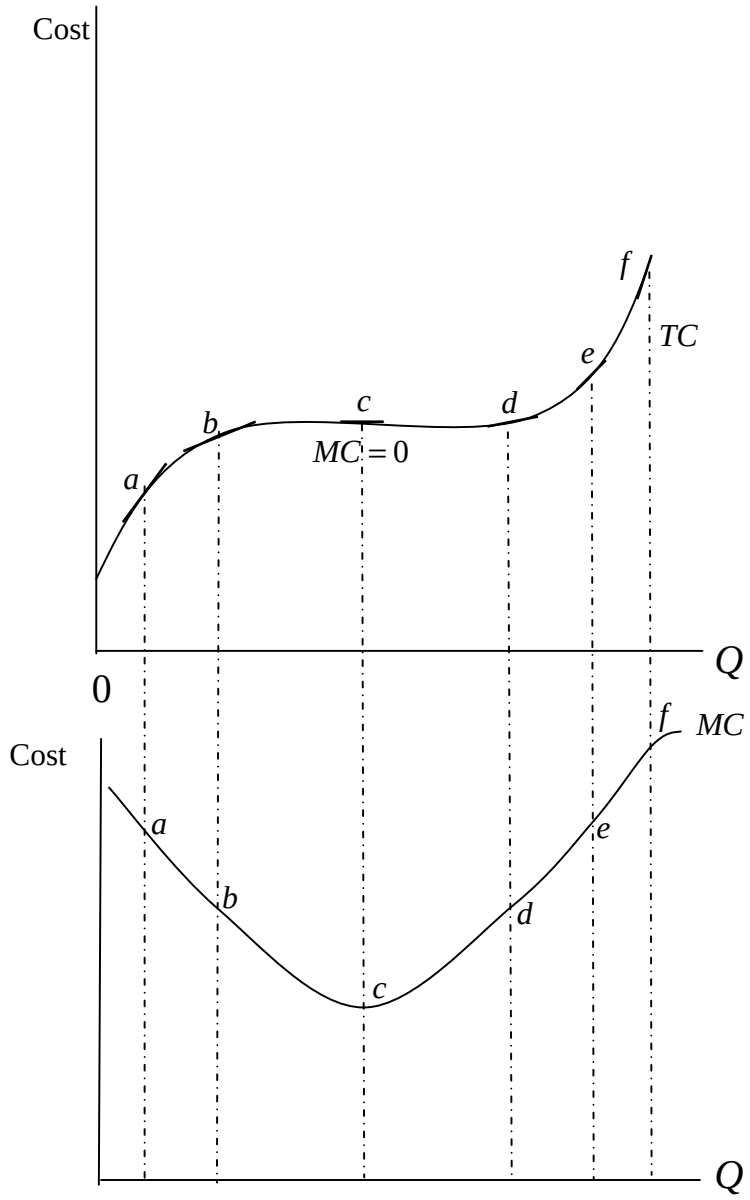
It never intersects the axis

SHAPE OF AVC



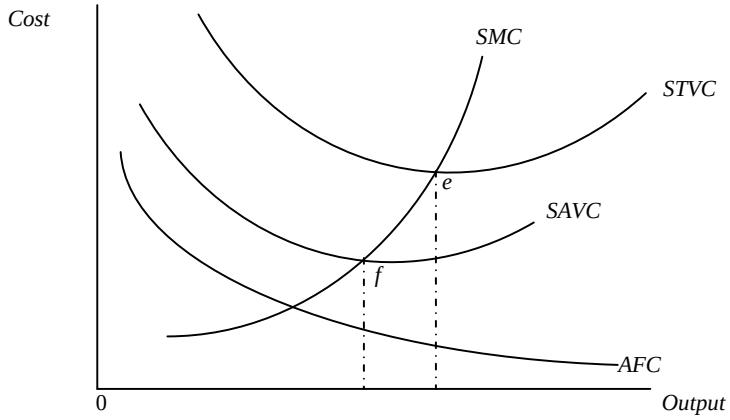
- To derive the AVC graphically, we get the slope of a line joining the origin and a point on TVC curve.
- Line OC has the lowest slope compared to all the other lines from origin.
- At point C, AVC is at its minimum
- To the left at point C, AVC is declining
- To the right of point C, AVC is increasing at increasing rate.
- ATC can be derived in the same way as the AVC curve from TC curve.

SHAPE OF MARGINAL COST CURVE



- The MC curve is derived by getting the slope of the TC curve (which is the same at any point as the slope of the TVC). The slope of TC is found by drawing tangent lines at different points along the TC curve.
- At point C, MC curve is at its minimum since the slope of TC = 0.
- To the left at point C, slope of TC is declining. Thus we expect MC to be declining.
- To the right of point C, the TC curve starts rising at increasing rate. Thus MC start rising.

RELATIONSHIP BETWEEN ATC, AVC & MC



MC curve cuts both AVC and ATC at their minimum

(i) So long as the MC lies below the ATC curve, ATC must decline as output expands

(ii) When MC is above ATC, the ATC will be rising

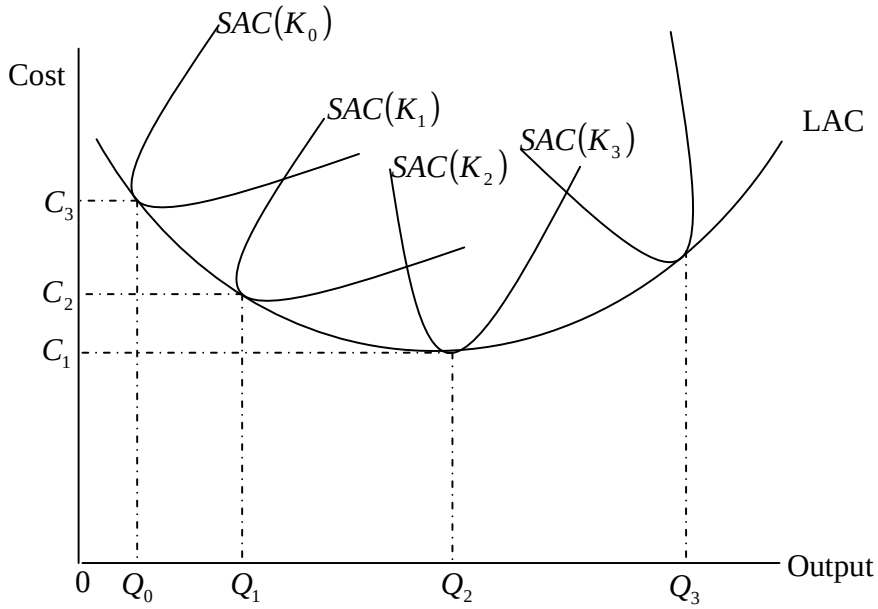
(iii) The MC cuts the ATC when ATC is at its minimum.

Same relationship can be observed between MC and AVC

- ATV and AVC do not reach their minimum at the same level of output. ATC reaches its minimum after the AVC.
- Minimum point of the ATC occurs to the right of the minimum point of the AVC.
- This is due to the fact that ATC includes AFC and the latter falls continuously with increases in output.
- After AVC has reached its lowest point and starts rising, its rise is over a certain range off set by the fall in AFC so that the ATC continues to fall.
- However the rise in AVC eventually becomes greater than the fall in the AFC so that the ATC starts increasing.

LONGRUN COSTS

LONGRUN AVERAGE COST CURVE



- In the long run planning period is long enough for a firm to be able to vary all factors of production it uses.
- A long run is composed of a series of short run alternative situations.
- Each situation comprises of a certain quantity of a fixed input (e.g. capital) which various units of variable inputs.
- $SAC\ (K_1)$ is a short run average cost curve associated with K_1 units of capital input. $SAC(K_0)$ is a short run average cost curve associated with a lower amount of capital.
- If we join the minimum point of the SAC curve, LAC curve is obtained.
- The LAC curve is also known as **envelope curve** or **planning curve** because it covers various short-run average cost curves.
- It shows the least possible cost per unit of producing various output using different sizes of plants (capital).

For instance, for the firm to produce Q_2 units of output, it would be appropriate to employ K_2 units of capital because it maximizes cost (SAC (K_1) is at its maximum). The firm would pay a higher cost if it tried to produce Q_2 with K_1 units of capital

Summary

Short run is a period of time over which at least one factor must remain fixed. For most of the firms, the fixed resource or factors which cannot be increased to meet the rising demand of the good is capital i.e., plant and machinery. In the long run there is no fixed resource. All the factors of production are variable

Total Fixed cost occur only in the short run. *Total Fixed cost* as the name implies is the cost of the firm's fixed resources, Fixed cost remains the same in the short run regardless of how many units of output are produced.

Total variable cost as the name signifies is the cost of variable resources of a firm that are used along with the firm's existing fixed resources.

Total cost is the sum of fixed cost and variable cost incurred at each level of output

$ATC = AFC + AVC$

$AFC = \frac{TFC}{Q}$ *(fixed cost per unit of output)*

$AVC = \frac{TVC}{Q}$ *(average cost per unit of output*

MARKET STRUCTURES

On completing this lecture, students should be able to:

- Discuss characteristics of perfect competition and explain why individual firms are price takers.
- Analyze short and long run profit maximization.
- Describe a monopolists demand curve
- Analyze short term and long term profit maximization for a monopolist
- Discuss inefficiency and price discrimination of the monopoly.

There are several forms of market structures which mainly depend on;

1. Degree of and concentration of buyers. Are they many, few etc?
2. The degree of product differentiation. Are goods identical, how different are they?
3. Are there barriers into the entry of the market?

Markets can be therefore be classified into four categories:

- Perfectly competitive
- Monopoly
- Monopolistic competition
- oligopoly

Profit maximization

The objective of firms is to maximize profits

$\pi = TR - TC$

For the firm to be able to maximize profits, the first order condition

$\frac{\partial \pi}{\partial Q} = 0$

$\frac{\partial \pi}{\partial Q} = \frac{\partial TR}{\partial Q} - \frac{\partial TC}{\partial Q} = 0$

But $\frac{\partial TR}{\partial Q}$ is marginal revevue

$\frac{\partial TC}{\partial Q}$ is marginal cost.

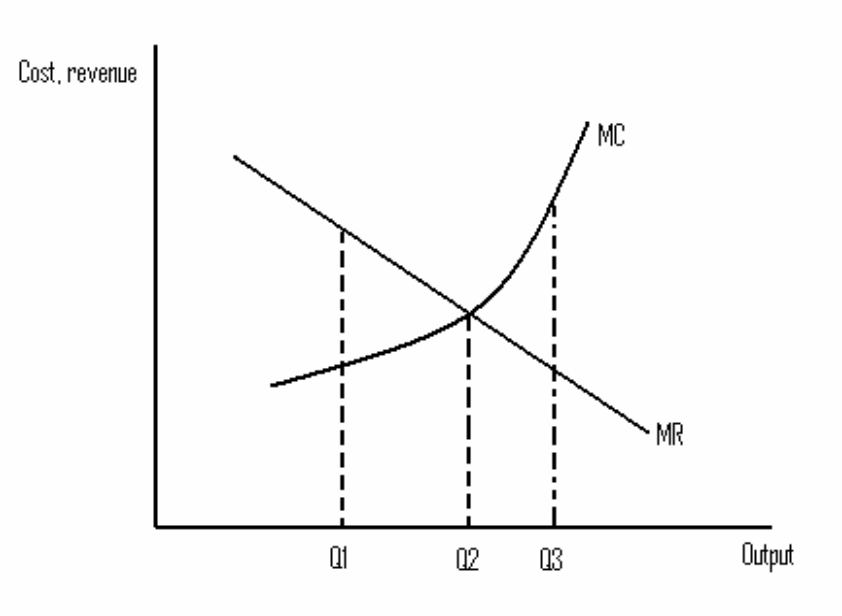
Therefore for profit maximization

$$\frac{\partial^2 \pi}{\partial Q^2} < 0$$

$$\frac{\partial^2 \pi}{\partial Q^2} = \frac{\partial MR}{\partial Q} - \frac{\partial MC}{\partial Q} < 0$$

$$\frac{\partial MR}{\partial Q} < \frac{\partial MC}{\partial Q}$$

The second condition simply implies that the slope of the marginal cost should be greater than the slope of marginal revenue.



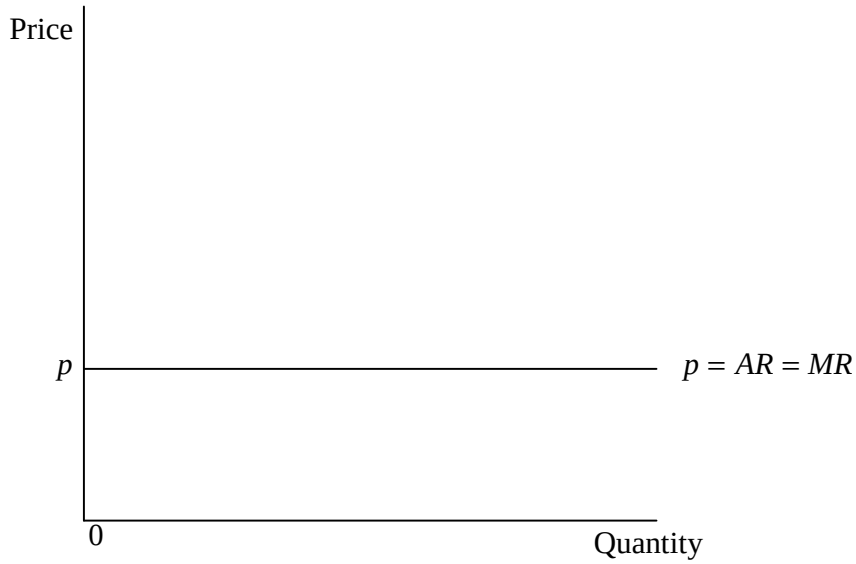
1. Q2 would be the equilibrium output because MR=Mc. It is the only point where π is maximized.
2. At Q1 MR>MC. If output is increased, it will add more to revenue than to the cost. This implies that increasing output would further increase profits. This implies that increasing output would further increase profits.
3. At Q3 MC>MR if output is increased, one adds more to the cost than revenue. Thus increasing output would reduce profits.

PERFECT COMPETITION

The following are the characteristics of perfect competition.

(a) Large numbers of sellers and buyers: each seller supplies only a small part of the total quantity offered in the market. Neither the buyer nor the seller can affect the

price in the market. Price is determined by market forces of demand and supply, and



each individual firm consider price as given.

Demand curve of individual firm would be infinitely elastic, indicating that the firm can sell any amount of output at the prevailing market price.

Marginal revenue of firm under perfect competition will normally equal to the price.

(b) Product homogeneity:- the product of any one seller (i.e. firm) is identical to the product of every other firm in the market. There is no way in which a buyer could differentiate among the products of different firms.

(c) Free entry and exit of firms:- there is no barrier to entry or exit from industry seller and buyers are free to join or leave the market whenever they want.

(d) Profit maximization:- all firms in the industry aim to maximize profit. No other goals are pursued.

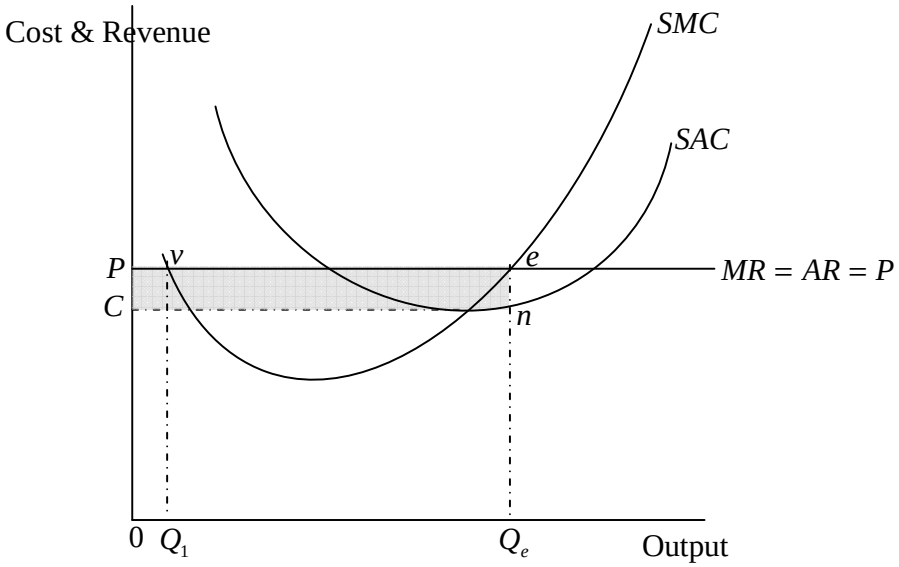
(e) No government regulation:- government does not interfere with the market through imposing tariffs, subsidies etc. the forces of demand and supply are the ones which are left to bring the market back to equilibrium.

(f) Free mobility of factors of production:- factors of production are free to move from one firm to another through out the economy. Labour is not unionized.

(g) Perfect knowledge. All sellers and buyers have complete knowledge of the conditions of the market. Information is free and costless. Under these conditions uncertainty about future development in the market is ruled out.

SHORT-RUN EQUILIBRIUM OF FIRM UNDER PERFECT COMPETITION.

The term equilibrium of the firm can be defined as a situation where the firm does not wish to change the size of its output (i.e.) it is satisfied with the amount it is producing and therefore there is no need to vary the size of its plant. It follows therefore that ht e point of equilibrium of a firm is where the firm is making the highest profit and this is at a point where marginal cost equals marginal revenue $(MC = MR)$



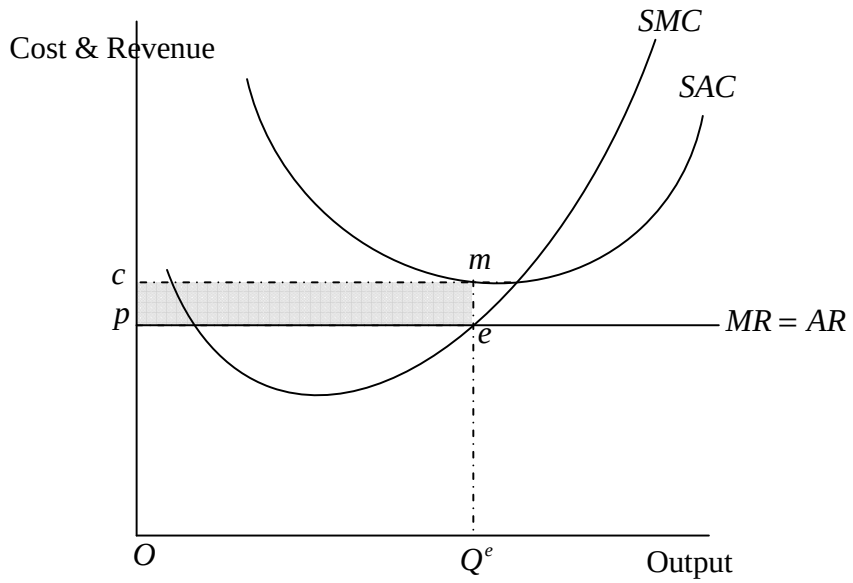
From Figure 3a, we note two points at which $MC = MR$, these are point v and point e. even though point v fulfills the condition $(MC = MR)$, it cannot be the equilibrium point of the firm. Since $MC > MR$ implying that additional output adds more cost than revenue and therefore loss. Therefore it is at point e that the producer would be at equilibrium.

The sufficient condition therefore is for the MC to cut the MR curve from below. that is, slope of MC must be greater than slope of MR.

In the short-run, depending on the position of the average cost curve, the firm can make excess profit or loss. In this example the firm makes excess profits represented by shaded region PCne.

Short run equilibrium price is therefore p, and equilibrium output is Q_e

In short run a firm could also make losses as shown in Figure 3b.



To show the loss, draw the SAC curve above the AR curve. Area CPEM represents the excess loss.

LONGRUN EQUILIBRIUM OF THE FIRM

Since entry into the industry is free in case of perfect competition, the existence of excess profits (sometimes called super normal profits) attract other firms to enter the industry.

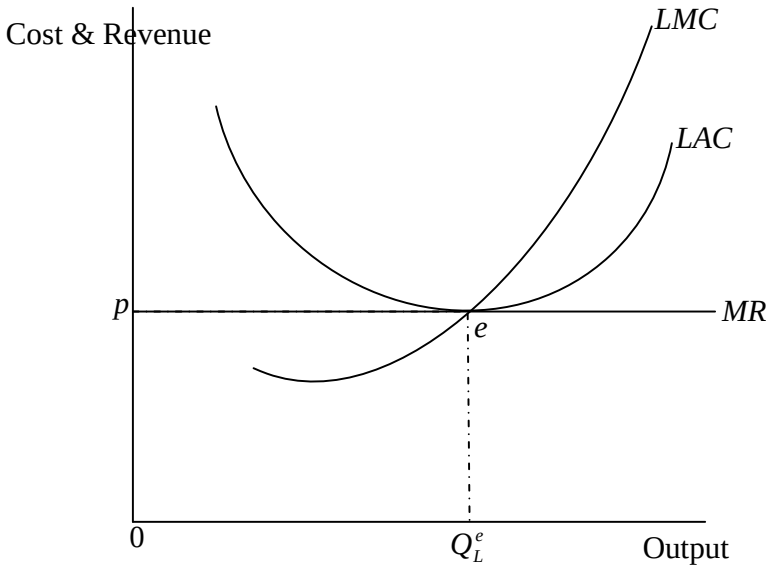
Or alternatively, existence of excess loss would cause some firms to exit the industry.

As new firms enter the industry, supply also increases. Due to the increased supply, the price in the market will fall and hence the price charged by the firm will also fall. The higher profits that were being enjoyed by the firms will start to drop.

In the long run, the firm will be at equilibrium when the excess profits have been exhausted and no new firms are attracted to enter the industry and when there are no loses to force the firm will be in the long run equilibrium when it is only enjoying normal profits.

A normal profit is defined as the rate of returns on capital just sufficient to provide capital investments necessary to develop and operate a firm.

The firm would enjoy normal profits where the long run marginal cost of the firm equals average cost and equal marginal revenue $(LMC = LAC = MR = P)$, that is, at the point where long run AC is at its minimum.

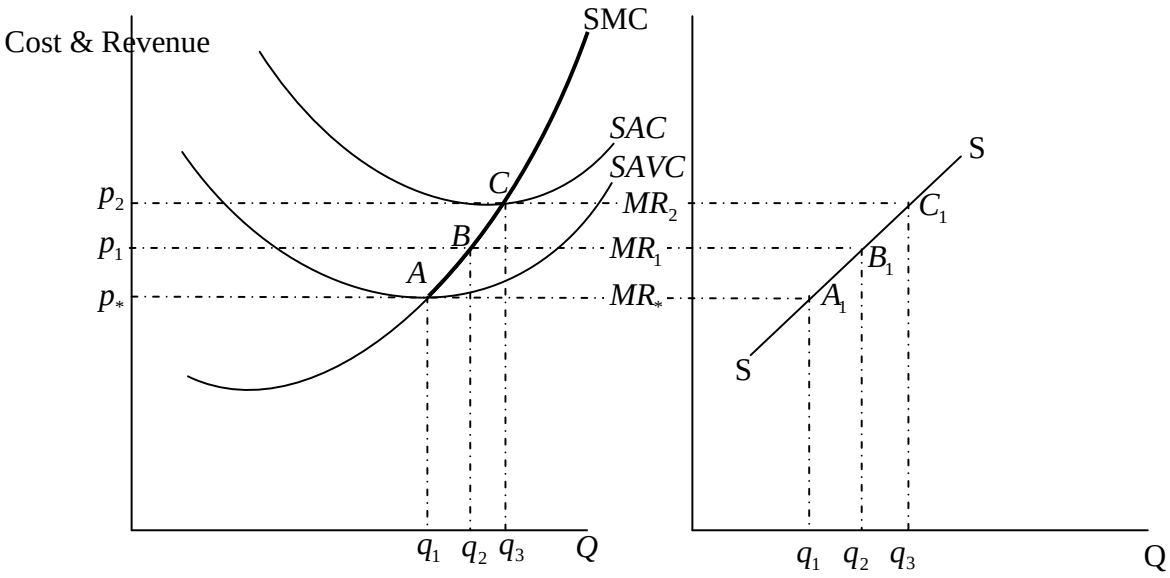


At point e, $(LMC = LAC = MR = P)$

Normal profit = $OpeQ_L^e$

Here the firm is earning enough to keep it in the industry.

SHORT RUN SUPPLY CURVE OF PERFECT COMPETITIVE FIRM



The supply curve of a firm is defined as the part of marginal cost curve that lies above the average variable cost curve. From fig 3d, supply curve of firm starts from point A.

At point A, the firm is able to meet all the variable costs of the firm, i.e. costs on variable factors of production e.g. raw materials, labour

The loss to the firm is only the fixed cost. E.g. cost on machines. If the firm stopped production at point A it would still have to meet the fixed cost. Thus the firm should produce something at point A because the revenue of the firms is enough for the variable cost.

At point B, revenue derived from a price p_1 (area Op_1Bq_2) meets all the variable cost and part of fixed costs. Firm is thus advised to continue producing. At price p_2, the firm covers all the costs (fixed and variable cost) and in fact makes a profit.

This brings us to the conclusion that the supply curve of the firm is that part of marginal cost curve that lies above the average variable cost curve.

MONOPOLY

CHARACTERISTICS

(a) There is a single seller

(b) The good produced has no close substitute

(c) There are barriers to entry.

Source of monopoly

(a) Ownership (sole owner) of strategic raw materials or exclusive knowledge of some production process.

(b) Government licensing only a single firm to produce a given product (e.g. electricity by KPLC) or the imposition of trade barriers to exclude foreign competition.

(c) Where production involves enormous economies of scale that can only be reaped by one firm e.g. in transport, electricity, communication and some cases of public utilities. This may be called natural monopoly.

(d) Limiting pricing e.g. price undercutting, heavy advertisement, continuous product differentiation etc. to create barriers to potential competition and make entry unattractive.

DEMAND AND REVENUE CURVES FOR MONOPOLIST

Unlike in perfect competition where a firm is a price taker, so that $P = MR = AR$, in the case of monopoly demand and marginal revenue will vary.

These will vary because the monopoly has the power to influence market price by deciding on the amount of output to offer in the market for sale.

Monopolist demand curve will be down ward sloping.

For simplicity assume a linear demand function of the form,

$$Q = b_0 - b_1 P \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

To plot it, make P subject of the formula.

$$P = \frac{b_0}{b_1} - \frac{-1}{b_1} Q \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (ii)$$

Total revenue for monopolist

$$TR = P \cdot Q \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iii)$$

Substitute (ii) into (iii) To obtain

$$TR = \frac{b_0}{b_1} Q - \frac{1}{b_1} Q^2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (iv)$$

$$AR = \frac{TR}{Q} = \frac{b_0}{b_1} - \frac{1}{b_1} Q \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (v)$$

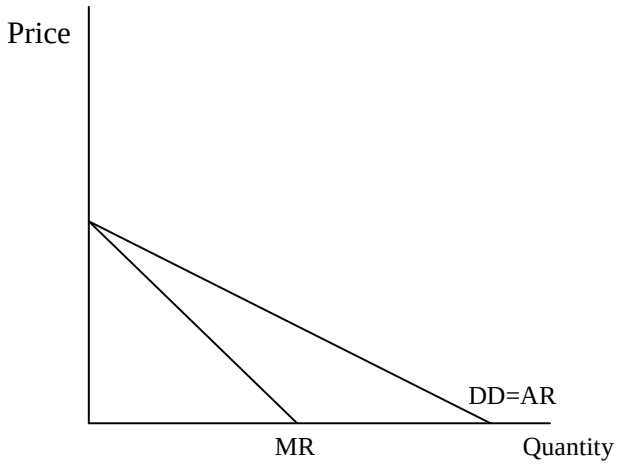
Note that $AR = P$ in the monopolist case.

$$MR = \frac{\partial TR}{\partial Q} = \frac{b_0}{b_1} - \frac{2}{b_1} Q \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (vi)$$

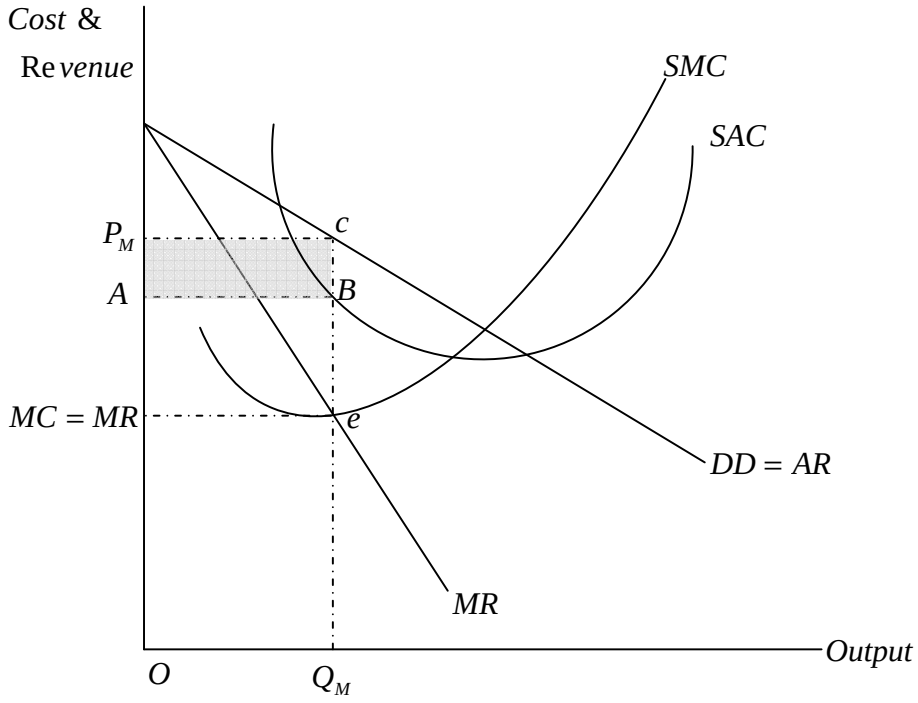
Note that the slope MR is twice the slope of AR. $\left(\frac{\partial MR}{\partial Q} = \frac{-2}{b_1} \;\&\; \frac{\partial AR}{\partial Q} = \frac{-1}{b_1} \right)$

Both intercept the price axis at $\frac{b_0}{b_1}$

GRAPHICAL PRESENTATION



SHORT RUN EQUILIBRIUM UNDER THE MONOPOLY



For monopolist to maximize his short run profit, that is be in equilibrium at point where $MR = MC$. This will be at output level Q_m. Price per unit charged by a monopolist is P_m

The firm makes supernormal profits represented by shaded area $P_m ABC$

LONG RUN EQUILIBRIUM UNDER MONOPOLY

In a pure monopoly, entrance into the market by potential competitor is not possible. Thus whether or not a monopolist earns a pure profit in the short run, no other producer can enter the market in the hope of sharing whatever pure profit exits. Therefore, pure economic or supernormal profit is not eliminated in the long run as it is in the case of perfect competition.

MONOPOLISTIC COMPETITION.

Monopolistically competitive market is similar to a perfectly competitive market in that it assumes many of its assumptions like existence of many firms/sellers and buyers, freedom of entry, exit etc.

However it differs from perfect competition in that the product is differentiated and not homogeneous. Each firm in the market sells a brand of the product that differs in quality, appearance or reputation, and it is the sole producer of its brand or of the particular brand.

Examples of the monopolistic competitive market may include markets for toothpaste, soap and detergents etc.

Summarized characteristics of monopolistic competition.

(a) Many sellers and buyers in the group

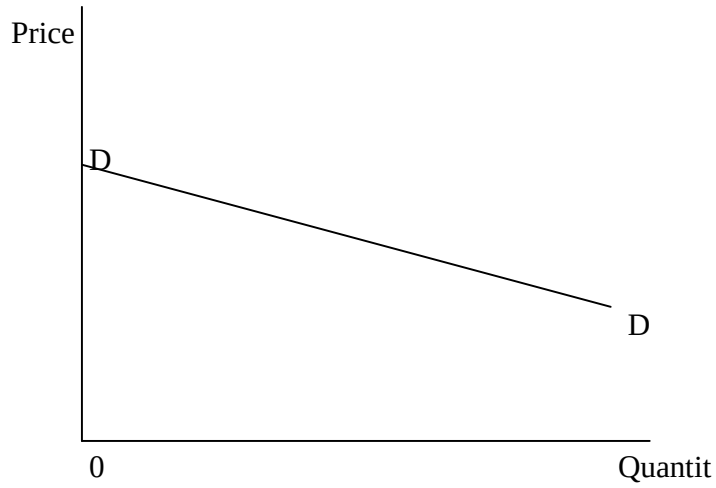
(b) Products of the sellers are differentiated but highly substitute.

(c) There is free entry and exit of firms in the group.

(d) The goal of the firm is profit maximization both in the short run and in the long run.

(e) Price of factors and technology are given.

The demand curve of a monopolistic competitive firm is highly elastic but not perfectly elastic.



Sellers can charge a different price from one another but these differences in prices are not big because the goods are close substitutes

SHORT-RUN AND LONG-RUN EQUILIBRIUM UNDER MONOPOLISTIC COMPETITION

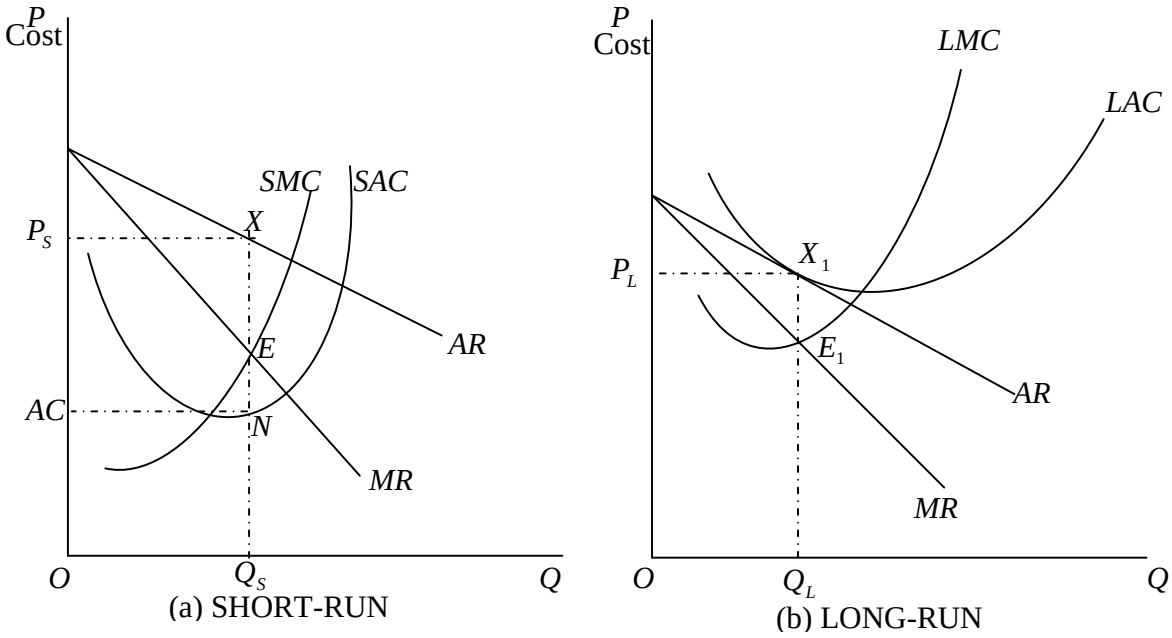


Figure 4(a) indicates the short-run equilibrium of a monopolistic firm. Here the behavior of the firm is just like a monopoly which maximizes profit by equating MR and MC. This would be at point E. the firm produces output OQ_s in the short-run, and charges a price OP_s. The firm makes supernormal profits represented by area $P_s XNAC$.

The firm isable to make supernormal profits in the short-run because its product is differentiated from rival products, and the time is short enough so that no rival firm could change its strategy in the short-run.
However this situation may not continue for longer period. Since entry into the industry is free, new firms will enter the market whenever they find occurrence of the short-run economic profit for the existing firms.

This results in a competitive adjustment process in the market which stops at the point when the profit margin completely vanishes from the market for every firm. (i.e. firms earn normal profits) this situation will be called the long-run equilibrium of the monopolistic firm.

Long-run equilibrium will be at point X_1 in figure 6(b), when the demand curve is tangent to the average cost curve, showing no profit no loss situation.

The tangency point showing the long-run equilibrium will be before the minimum of the average cost curve because the demand curve is downwards sloping though elastic in nature.

Unlike in perfect competition where long-run equilibrium condition was for $P = AC = MC = MR$, for monopolistic competitive firm, $MR = MC$ and $P = AC$. This means that just below point X_1 in figure 6 (b), the $MR = MC$ condition will be satisfied.

OLIGOPOLY MARKET STRUCTURE

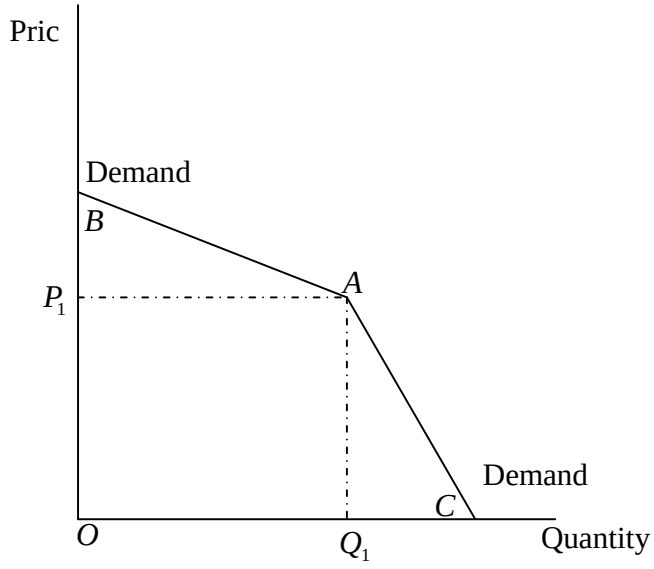
This is a market structure characterized by few large seller/form that supply the whole market. The product they sell may or may not be differentiated.

If it is differentiated, the market structure is called **differentiated oligopoly.** The products they sell are differentiated in the minds of customers by say branding but these products are close substitutes as is the case with monopolistic market structure/ competition.

If the products are identical, the market structure is called **pure or perfect oligopoly.** Buyers have little cause for preferring the product of one producer to that of another (e.g. petroleum products of different oil companies). Examples of markets under oligopoly include markets for aluminum processing, glass, petroleum, automobile assembling etc.

Characteristics

1. Few sellers in the market
2. Demand curve of oligopolistic producers is a kinked demand curve as shown in the diagram below



In the above diagram, it can be seen that the demand curve is kinked at point A and AB of the demand curve shows elastic demand situation, while AC shows an inelastic demand situation.

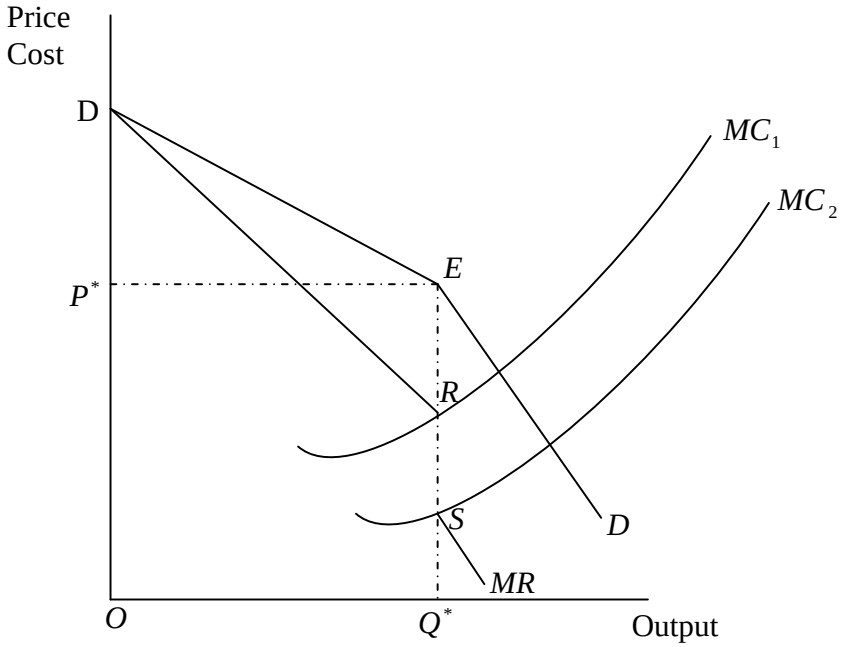
This is because under normal circumstances if an oligopolistic producer increased the price above P_1 the consumer will respond by cutting down the consumption of their

commodity by large amount and therefore AB of the demand curve has to show a fairly elastic demand situation.

On the other hand, if the oligopolistic producer decides to reduce his price below P_1 other sellers would also reduce their price such that he would not be able to increase his sale by a greater proportion hence the portion AC of demand curve has to show an inelastic demand situation.

3. There is price rigidity in oligopolistic market. This is mainly because an oligopolistic producer cannot predict the reaction of other producers in the market in case he raised or lowered the prices.
4. Because sellers are few sometimes they can come together and form one organization the aim being to be able to control price fall by controlling the supply of their commodities in the market. When sellers come in one organization with the aim of controlling supply we say that they have formed a cartel organization.
5. Oligopolistic producers normally try to influence the demand they face through vigorous advertisement campaign.

EQUILIBRIUM IN OLIGOPOLISTIC FIRM



- Due to the kink in the demand curve of the oligopolist, his MR curve is discontinuous at the level of output corresponding to the kink.
- The MR has two segments: segment DR corresponds to the upper part of the demand curve, while the segment from point S corresponds to the lower part of the kinked-demand curve.

- Equilibrium of the firm is defined by the point of the kink because at any point to the left of the kink MC is below the MR, while to the right of the kink the MC is larger than the MR. thus total profit is maximized at the point of the kink.
- However, this equilibrium is not necessary defined by the intersection of the MC and the MR curve. Intersection of the MC with the MR segment requires abnormal high or abnormally low cost, which are rather rare in practice. The discontinuity (between raids) of the MR curve implies that there is a range within which cost may change without getting the equilibrium P^* and Q^* of the firm.
- In the figure, as long as MC passes through the segment RS, the firm maximize its profits by producing P^* and Q^*. Thus the kink can explain why price and output will not change despite changes in cost (within the range RS defined by the discontinuity of the MR curve).