

Debre Berhan University
College of Business and
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UNIT ONE

THEORY OF CONSUMER BEHAVIOR AND DEMAND

1.1. Introduction

- ❖ The theory of consumer choice lies on the assumption of the consumer being rational to maximize level of satisfaction.
- ❖ The consumer makes choices by comparing bundle of goods.
- ❖ There are two approaches to analyze consumer's decision making process. These are, the cardinal and ordinal utility approaches.

Consumer Preferences and Choices

1.1 Consumer Preference

- ❖ Given any two consumption bundles,
 - ✓ the consumer can either decide that one of consumption bundles is strictly better than the other,
 - ✓ or decide that he is indifferent between the two bundles.

□ **Strict preference** :- Given any two consumption bundles (X_1, X_2) and (Y_1, Y_2) , if

□ **Weak preference:-** Given any two consumption bundles (X_1, X_2) and (Y_1, Y_2) , if the consumer is indifferent between the two commodity bundles or if $(X_1, X_2) \succeq (Y_1, Y_2)$, the consumer would be equally satisfied if he consumes (X_1, X_2) or (Y_1, Y_2) .

□ **Completeness :-** For any two commodity bundles X and Y , a consumer will prefer X to Y , Y to X or will be indifferent between the two.

- ❑ **More is better than less:-** Consumers always prefer more of any good to less and they are never satisfied or satiated.
- However, bad goods are not desirable and consumers will always prefer less of them.

- ❑ **Definition:-**Utility is the level of satisfaction that is obtained by consuming a commodity or undertaking an activity.
- ❑ *The concept of utility is characterized with the following properties:*
 - **‘Utility’ and ‘Usefulness’ are not synonymous.** For example, paintings by Picasso may be useless functionally but offer great utility to art lovers.

- **Utility is subjective.** The utility of a product will vary from person to person. That means, the utility that two individuals derive from consuming the same level of a product may not be the same.
- **The utility of a product can be different at different places and time.** For example, the utility that we get from meat during fasting is not the same as any time else.

1.3 Approaches to Measure Utility

- ❖ There are two major approaches of measuring utility. These are Cardinal and ordinal approaches.

1.3.1 The Cardinal Utility theory

❑ Assumptions of Cardinal Utility theory

- **Rationality of Consumers.** The main objective of the consumer is to maximize his/her satisfaction given his/her limited budget or income. Thus, in order to maximize his/her satisfaction, the consumer has to be rational.

- **Utility is Cardinal Measurable.** According to this approach, the utility or satisfaction of each commodity is measurable. Money is the most convenient measurement of utility.
- ✓ In other words, the monetary unit that the consumer is prepared to pay for another unit of commodity measures utility or satisfaction.
- **Constant Marginal Utility of Money.** According to the above assumption, money is the most convenient measurement of utility.
- ✓ However, if the marginal utility of money changes with the level of income (wealth) of the consumer, then money can not be considered as a measurement of utility.

- **Limited Money Income.** The consumer has limited money income to spend on the goods and services he/she chooses to consume.
- **Diminishing Marginal Utility (DMU).** The utility derived from each from each successive units of a commodity diminishes.
- ✓ In other words, the marginal utility of a commodity diminishes as the consumer acquires larger quantities of it.

- **The total utility of a basket of goods depends on the quantities of the individual commodities.**
- ✓ If there are n commodities in the bundle with quantities, the total utility is given by: $TU = f(X_1, X_2, \dots, X_n)$

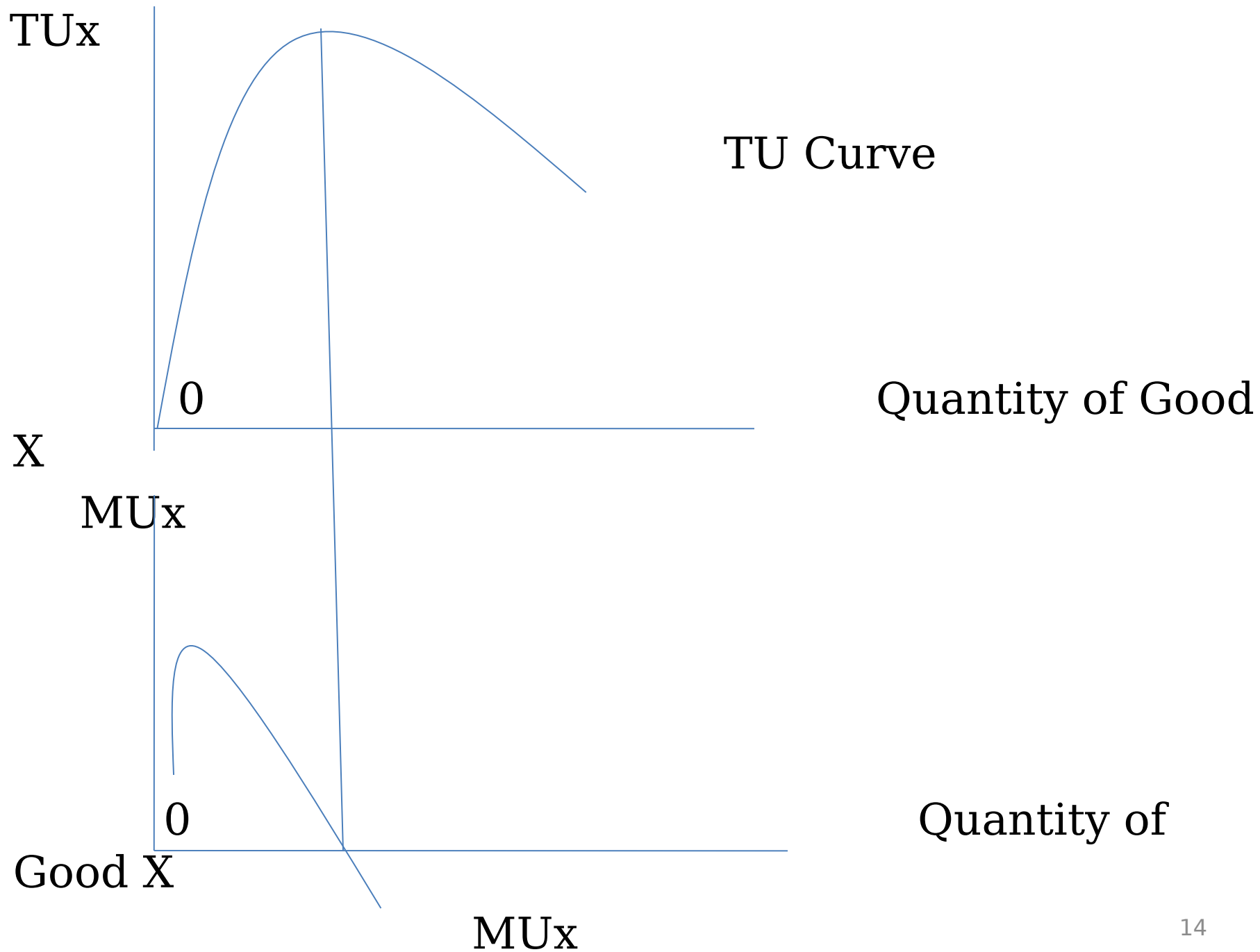
Total and Marginal Utility

- ❖ **Total Utility (TU):** It refers to the total amount of satisfaction a consumer gets from consuming or possessing some specific

- However, there is a saturation point for that commodity in which the consumer will not be capable of enjoying any greater satisfaction from it.
- ❖ **Marginal Utility (MU):** It refers to the additional utility obtained from consuming an additional unit of a commodity.
- In other words, marginal utility is the change in total utility resulting from the consumption of one or more unit of a product per unit of time.
- Graphically, it is the slope of total utility, and mathematically, the formula for marginal utility is:
$$MU = \Delta TU / \Delta Q$$
Where, ΔTU is the change in Total Utility, and ΔQ is change in the amount of product consumed.

Law of diminishing marginal Utility (LDMU)

- The utility that a consumer gets by consuming a commodity for the first time is not the same as the consumption of the good for the second, third, fourth, etc.
- ❖ *The Law of Diminishing Marginal Utility States that as the quantity consumed of a commodity increases per unit of time, the utility derived from each successive unit decreases, consumption of all other commodities remaining constant.*
- The LDMU is best explained by the MU curve that is derived from the relationship between the TU and total quantity consume



- ❖ In the above figures, as the consumer consumes more of a good per time period, the total utility increases, at an increasing rate when the marginal utility is increasing and then increases at a decreasing rate when the marginal utility starts to decrease and reaches maximum when the marginal utility is Zero.
- ❖ The point where the MU curve reaches its maximum point is called an inflexion point or the point of Diminishing Marginal utility.

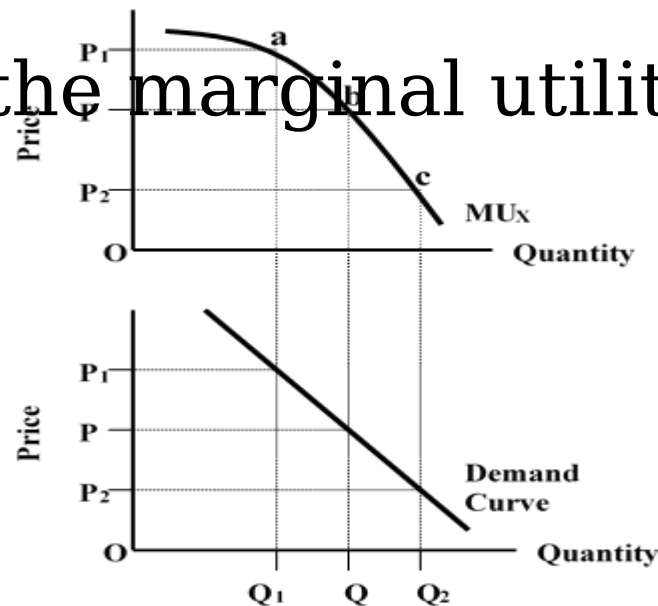
Equilibrium of a Consumer

- ❖ A consumer that maximizes utility reaches his/her equilibrium position when allocation of his/her expenditure is such that the last birr spent on each commodity yields the same utility.
- ❖ For example, if the consumer consumes a bundle of n commodities i.e. $x_1, x_2, \dots, x_n$, he/she would be in equilibrium or utility is maximized if and only if:
- ❖ $MU_{x1}/P_{x1} = MU_{x2}/P_{x2} = \dots MU_{xn}/P_n = MUm$
- ❖ **Where: MUm -marginal utility of money**

- ❖ Mathematically, the equilibrium condition of a consumer that consumes a single good X occurs when the marginal utility of X is equal to its market price. i.e. $MU_x = P_x$
- ❖ Proof :- The utility function is: $U = f(X)$
- ❖ If the consumer buys commodity X, then his expenditure will be $Q_x P_x$.
- ❖ Thus, the consumer wants to maximize the difference between his/her utility and expenditure: $\text{Max}(U - P_x Q_x)$
- ❖ The necessary condition for maximization is equating the derivative of a function with zero.
- ❖ Thus, $dU_x/dQ_x - d(P_x Q_x)/dQ_x = 0 = dU_x/dQ_x - P_x = 0 = MU_x = P_x$

Derivation of the Cardinalist Demand

- ❖ The derivation of demand curve is based on the concept of diminishing marginal utility.
- ❖ If the marginal utility is measured using monetary units the demand curve for a commodity is the same as the positive segment of the marginal utility curve.



1. The assumption of cardinal utility is doubtful because utility may not be quantified.
2. Utility can not be measured absolutely (objectively). The satisfaction obtained from different commodities can not be measured objectively.
3. The assumption of constant MU of money is unrealistic because as income increases, marginal utility of money changes.

- ❖ In this approach, utility cannot be measured absolutely but different consumption bundles are ranked according to preferences.
- ❖ The concept is based on the fact that it may not be possible for consumers to express the utility of various commodities they consume in absolute terms, like, 1 util, 1 util, or 3 util,
- ❖ But it is always possible for the consumers to express the utility in relative terms.
- ❖ It is practically possible for the consumers to rank commodities in the order of their preference as 1st, 1nd

Assumptions of Ordinal Utility theory

1. The Consumers are rational-they aim at maximizing their satisfaction or utility given their income and market prices.
2. Utility is ordinal, i.e. utility is not absolutely (cardinally) measurable. Consumers are required only to order or rank their preference for various bundles of commodities.
3. Diminishing Marginal Rate of Substitution (MRS): The marginal rate of substitution is

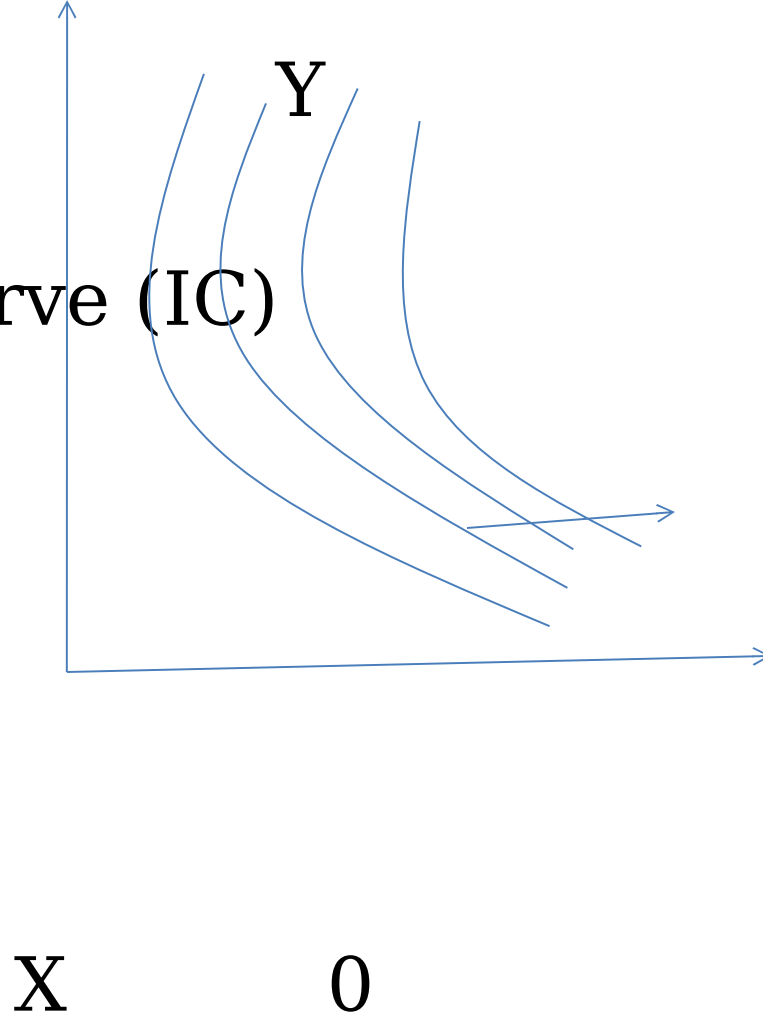
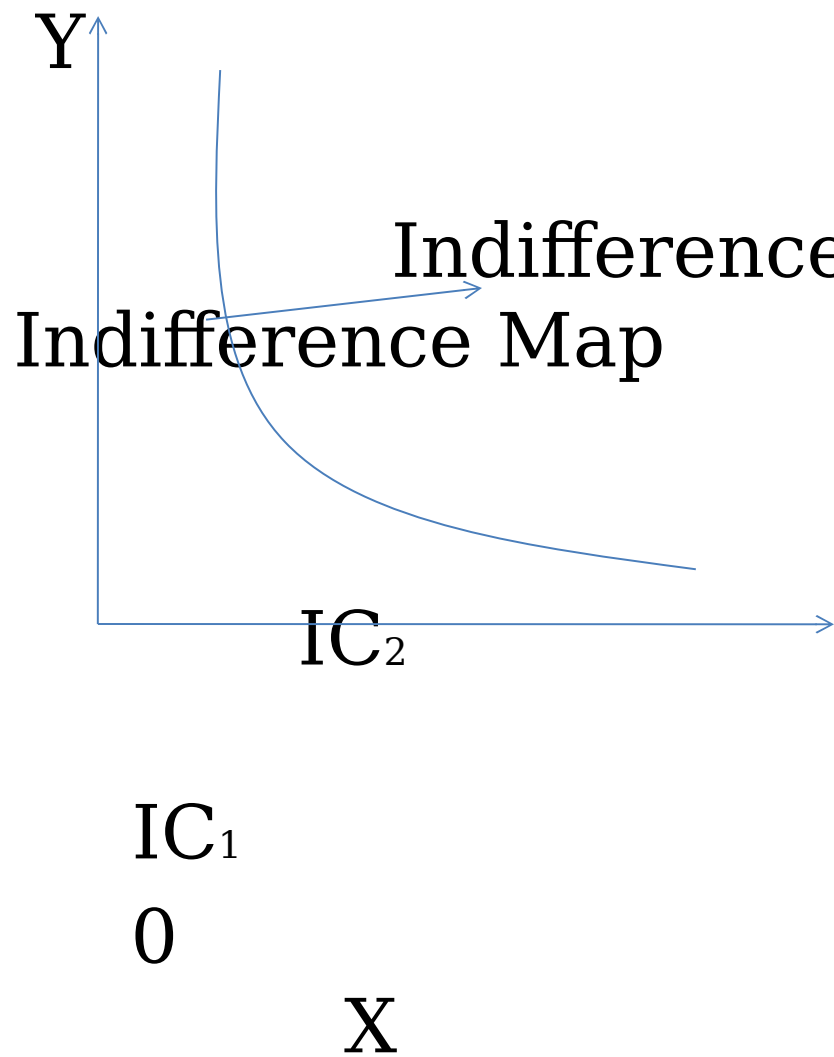
- When a consumer continues to substitute X for Y the rate goes decreasing and it is the slope of the Indifference curve.
4. The total utility of the consumer depends on the quantities of the commodities consumed, i.e., $U = f(X_1, X_2, \dots, X_n)$
 5. Preferences are transitive or consistent:
 - It is transitive in the senses that if the consumer prefers market basket X to market basket Y, and prefers Y to Z, and then the consumer also prefers X to Z.
 - When we said consistent it means that If market basket X is greater than market basket Y ($X > Y$) then Y not greater than X (Y not $> X$).

- ❖ Since the ordinal utility uses indifference curves to study the consumer's behavior, the ordinal utility theory is also known as the Indifference Curve Analysis.

Indifference Set, Curve and Map

- ❖ Indifference Set/ Schedule: It is a combination of goods for which the consumer is indifferent, preferring none of any others.
- It shows the various combinations of goods from which the consumer derives the same level of utility.

- ❖ Indifference Curves: an indifference curve shows the various combinations of two goods that provide the consumer the same level of utility or satisfaction.
- It is the locus of points (particular combinations or bundles of good), which yield the same utility (level of satisfaction) to the consumer, so that the consumer is indifferent as to the particular combination he/she consumes.



- ❖ Indifference Map: is a set of indifference curves.
- ❖ In other words it is the entire set of indifference curves
- ❖ It reflects the entire set of tastes and preferences of the consumer.
- ❖ A higher indifference curve refers to a higher level of satisfaction and a lower indifference curve shows lesser satisfaction. IC_2 reflects higher level of utility than that of IC_1 .
- ❖ Any consumer has lots of indifference curves, not just one.

Properties of Indifference Curves:

1. Indifference curves have negative slope (downward sloping to the right):-this is because in order to keep the utility of the consumer constant the consumption level of one commodity can be increased only by reducing the consumption level of the other commodity.
2. Indifference curves do not intersect each other.
Intersection between two indifference curves is inconsistent with the reflection of indifference curves.
➤ If they did, the point of their intersection would mean two different levels of satisfaction, which is impossible

3. A higher Indifference curve is always preferred to a lower one.
- The further away from the origin an indifferent curve lies, the higher the level of utility it denotes:
 - Baskets of goods on a higher indifference curve are preferred by the rational consumer, because they contain more of the two commodities than the lower ones.
4. Indifference curves are convex to the origin. This implies that the slope of an indifference curve decreases (in absolute terms) as we move along the curve from the left downwards to the right.
- This assumption implies that the commodities can substitute one another at any point on an indifference curve, but are not perfect substitutes

The Marginal rate of substitution (MRS)

- ❖ **Definition:** 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 of X so that the consumer maintains the same level of satisfaction.
- ❖ $MRS_{x,y} = \text{Number of units of Y given up} / \text{Number of Units of X gained}$
- ❖ It is the negative of the slope of an indifference curve at any point of any two commodities such as X and Y, and is given by the slope of the tangent at that point:

- i.e. Slope of IC=MRS $x,y = \Delta Y / \Delta X$
- The diminishing slope of the indifference curve means the willingness to substitute X for Y diminishes as one move down the curve.

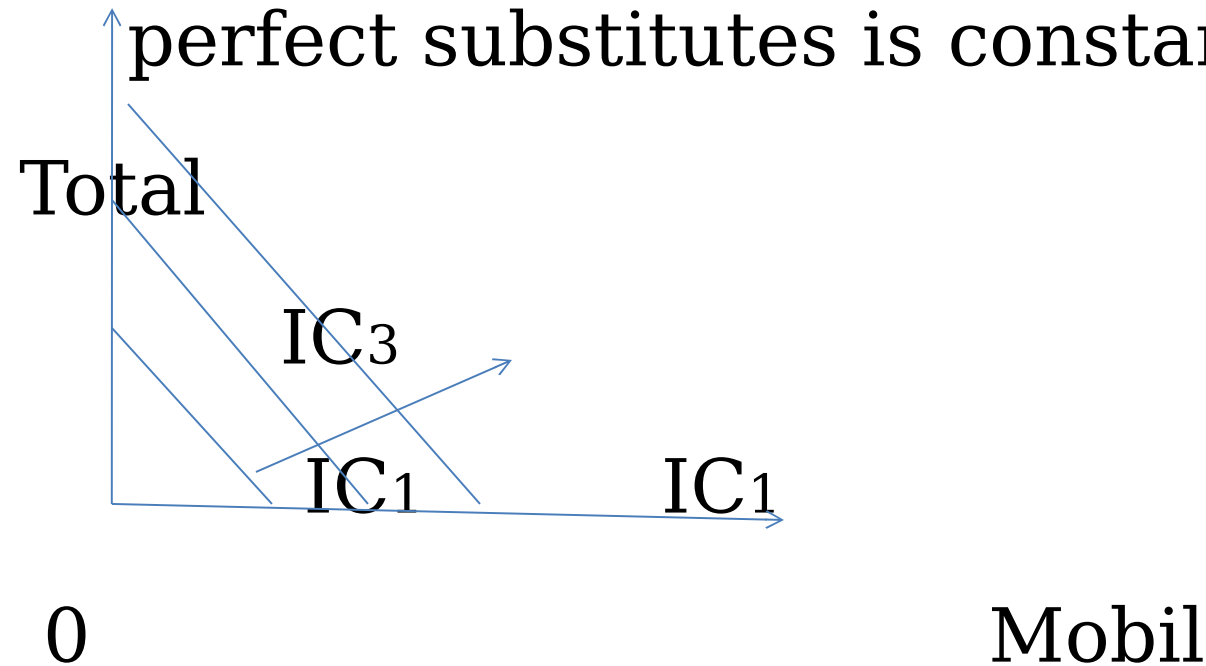
Marginal Utility and Marginal Rate of Substitution

- ❖ $MRS_{x,y} = MU_x / MU_y$
- ❖ Proof:- Suppose the utility function for two commodities X and Y is defined as: $U = f(X, Y)$
- ❖ Since utility is constant on the same indifference curve, the total differential of the utility function is zero,
 - i.e. $dU = \partial U / \partial X (dX) + \partial U / \partial Y (dY) = 0 = MU_x dX + MU_y dY = 0 = MU_x / MU_y = -dY / dX = MRS_{x,y}$, or $MU_y / MU_x = -dX / dY = MRS_{y,x}$

❖ **Example:-** Suppose a consumer's utility function is given by $U = 5[X^4 / Y^{-1}]$, Compute the MRS x,y

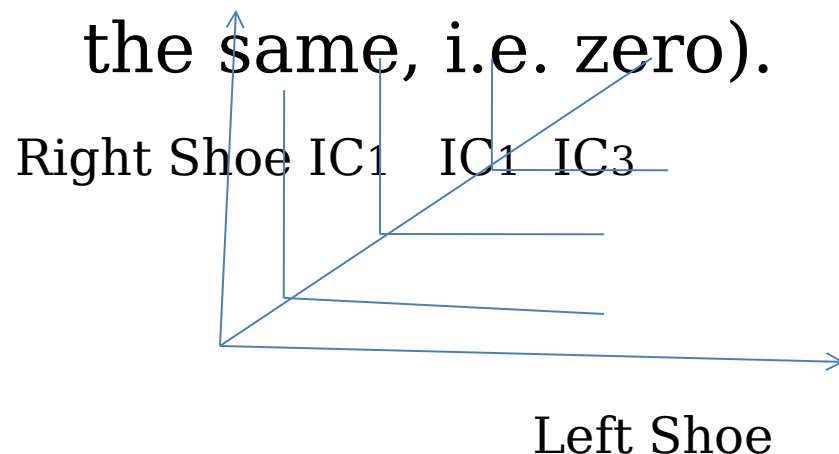
Special Indifference Curves

- 1. Perfect substitutes:** If two commodities are perfect substitutes (if they are essentially the same), the indifference curve becomes a straight line with a negative slope. MRS for perfect substitutes is constant.



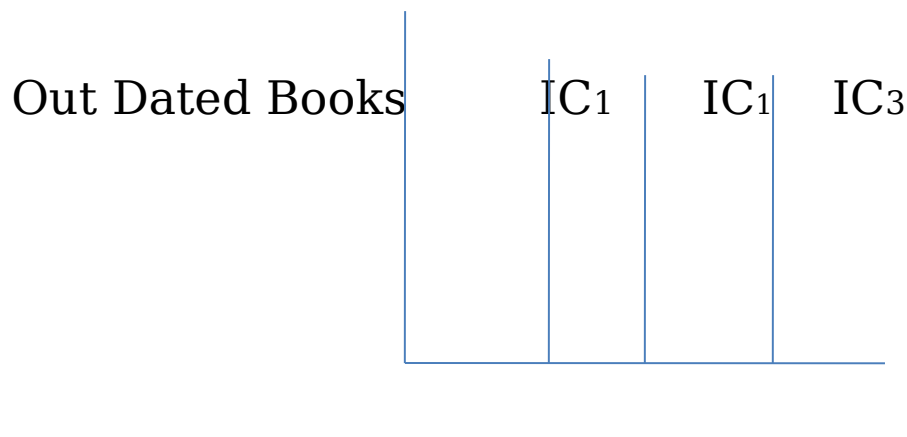
1. Perfect complements: If two commodities are perfect complements the indifference curve takes the shape of a right angle.

❖ For example, if an individual has two pairs of shoes, additional right or left shoes provide no more utility for him/her. MRS for perfect complements is zero (both MRS_{xy} and MRS_{yx} is the same, i.e. zero).



3. A useless good: Since they are totally useless, increasing purchases of them does not increase utility. This person enjoys a higher level of utility only by getting additional good goods consumption.

➤ For example, the vertical indifference curve IC_1 shows that utility will be IC_1 as long as this person has some units of food no matter how many out dated books he/she has.



1.4 The Budget Line or the Price line

- ❖ Indifference curves only tell us about the consumer's preferences for any two goods
- ❖ But they can not tell us which combinations of the two goods will be chosen or bought..
- ❖ In reality, the consumer is constrained by his/her money income and prices of the two commodities.
- ❖ In other words, individual choices are also affected by budget constraints that limit people's ability to consume in light of prices they must pay for various goods and services.

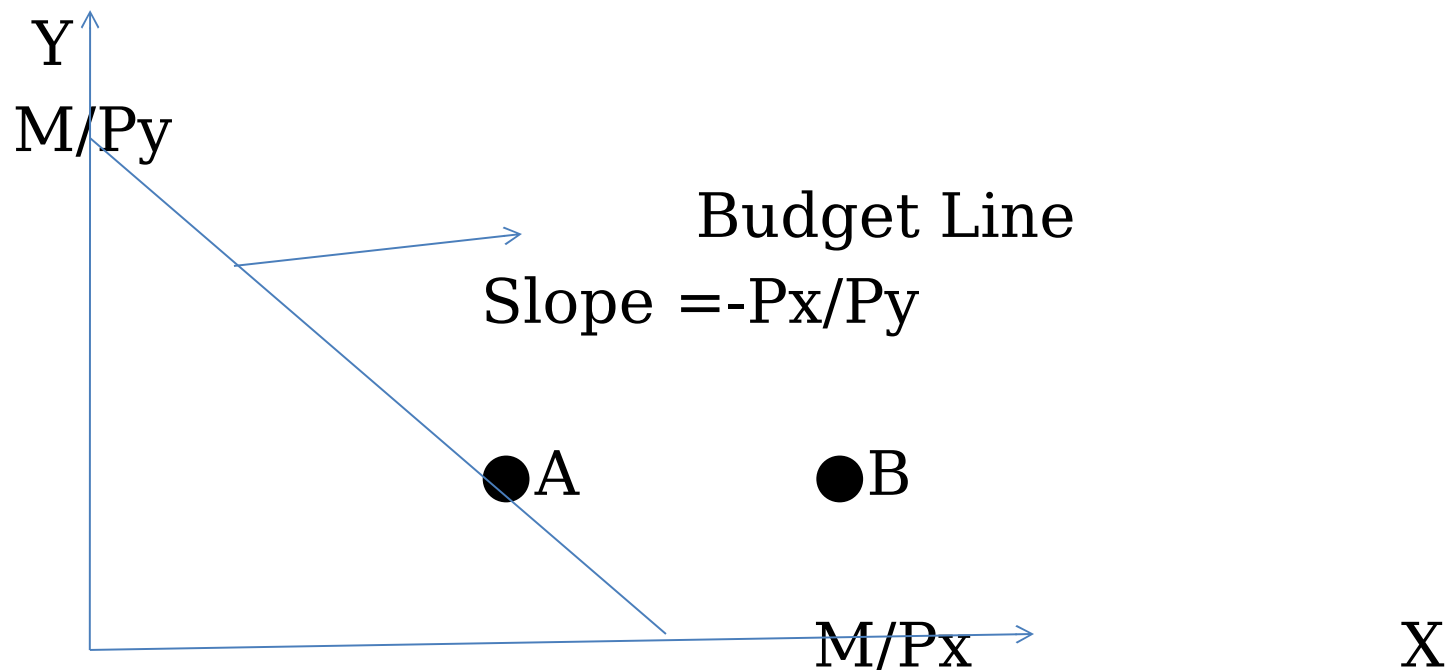
- ❑ **The budget line:-** is a line or graph indicating different combinations of two goods that a consumer can buy with a given income at a given prices.
- In other words, the budget line shows the market basket that the consumer can purchase, given the consumer's income and prevailing market prices.

Assumptions for the use of the budget line

- ❖ In order to draw the budget line facing the consumer, we consider the following assumptions:
 1. There are only two goods, X and Y, bought in quantities X and Y;
 2. Each consumer is confronted with market determined prices, P_x and P_y , of good X and good Y respectively; and

- ❖ By assuming that the consumer spends all his/her income on two goods (X and Y), we can express the budget constraint as:-
- ❖ $M = P_x X + P_y Y$, Where, P_x = price of good X,
 P_y = price of good Y, X = quantity of good X, Y = quantity of good Y, M = consumer's money income
- ❖ This means that the amount of money spent on X plus the amount spent on Y equals the consumer's money income.

- ❖ We represent the income constraint graphically by the budget line whose equation is derived from the budget equation.
- ❖ $M = P_x X + P_y Y \rightarrow M - P_x X = P_y Y \rightarrow Y = M/P_y - (P_x/P_y)X$
- ✓ $M/P_y =$ Vertical Intercept (Y-intercept), when $X=0$.
- ✓ $(-P_x/P_y) =$ slope of the budget line (the ratio of the prices of the two goods)
- ✓ The horizontal intercept (i.e., the maximum amount of X the individual can consume or purchase given his income) is given by: $-X = M/P_x$



- ❖ Therefore, the budget line is the locus of combinations or bundle of goods that can be purchased if the entire money income is spent.

Line

1. Effects of changes in income

- ❖ If the income of the consumer changes (keeping the prices of the commodities unchanged) the budget line also shifts (changes).
- ❖ Increase in income causes an upward shift of the budget line that allows the consumer to buy more goods and services and decreases in income causes a downward shift of the budget line that leads the consumer to buy less

- ❖ It is important to note that the slope of the budget line (the ratio of the two prices) does not change when income rises or falls.
- ❖ The budget line shifts from B to B1 when income decreases and to B1 when income rises.

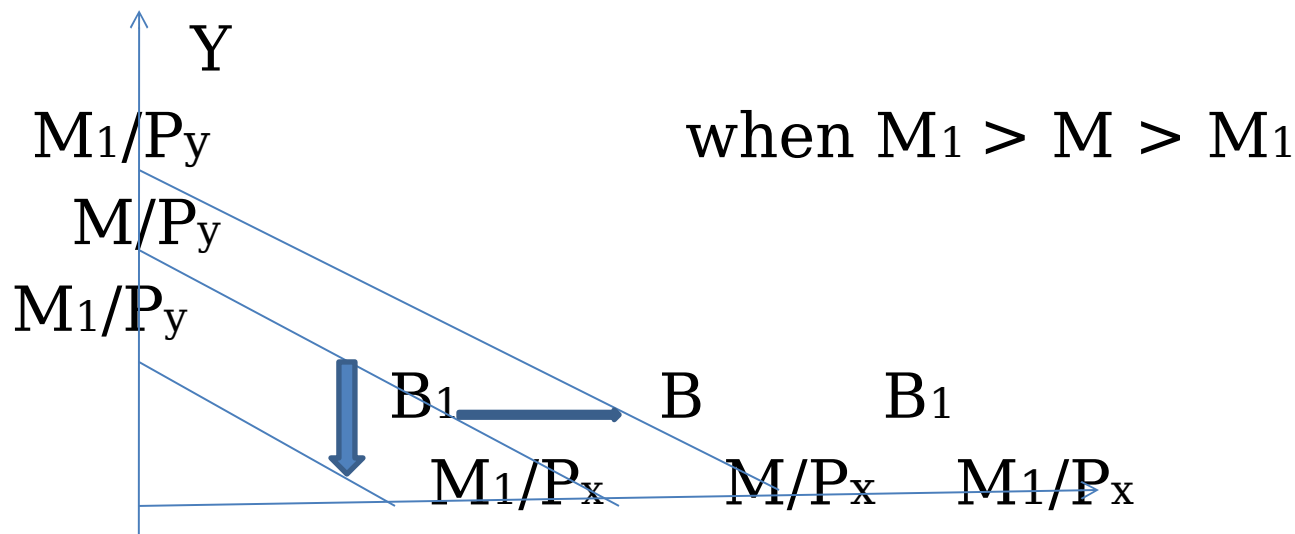
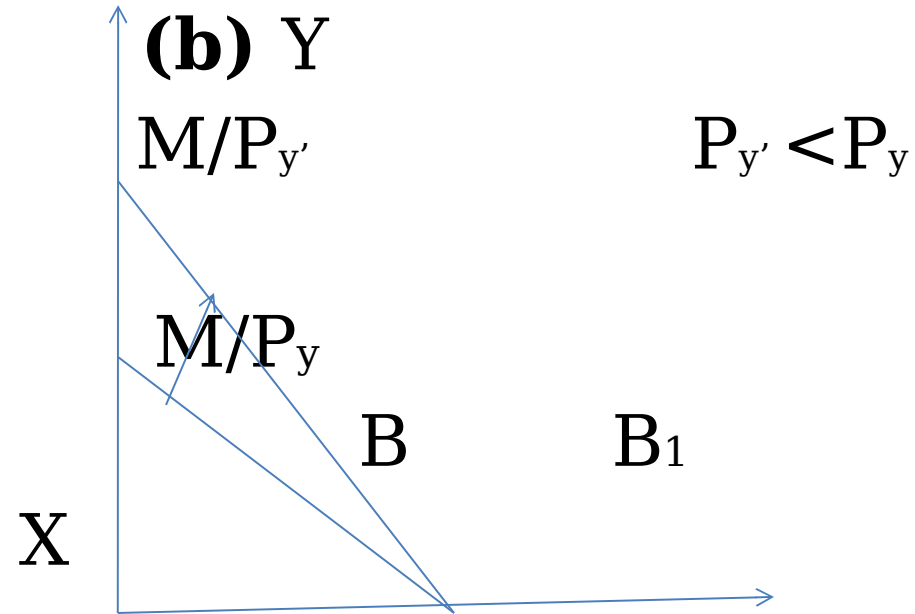
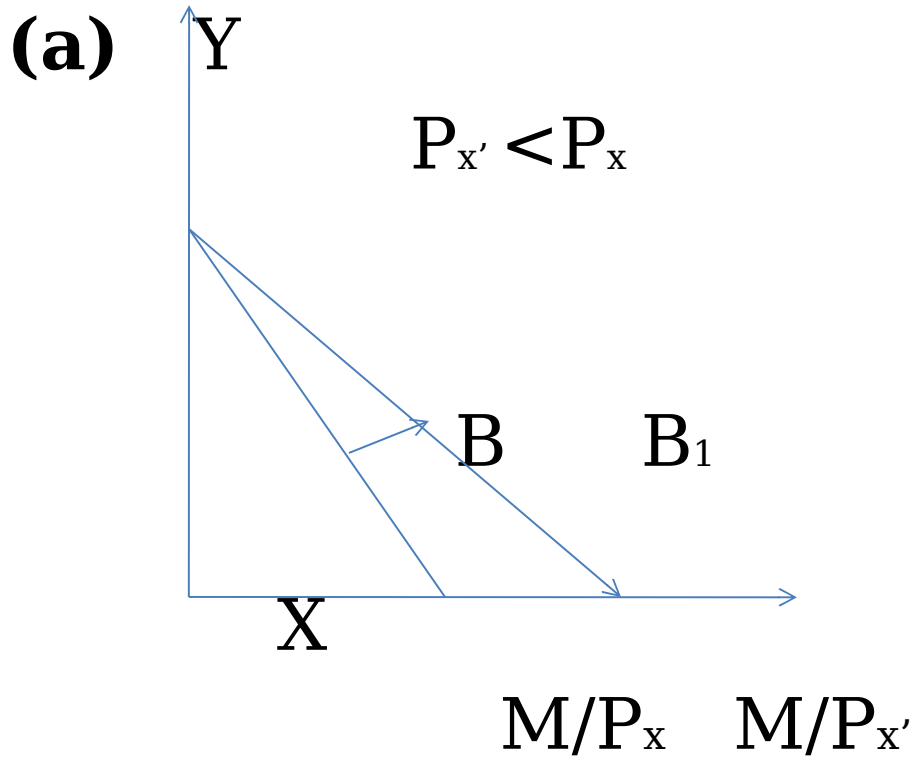


Fig :-Effects of Change in Income

Effects of Changes in Price of the commodities



- Changes in the prices of X and Y is reflected in the shift of the budget lines.
- In the above figures (fig.**a**) a price decline of good X results in the shift from B to B_1 .

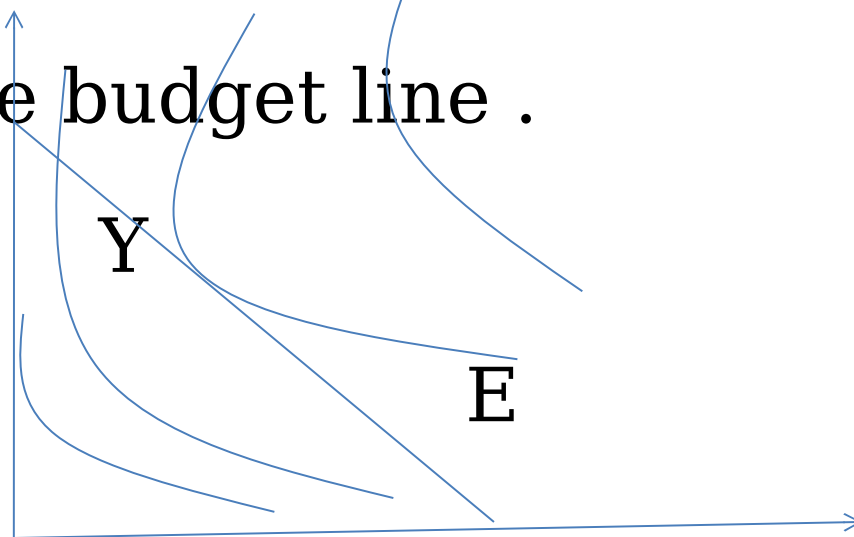
- A fall in the price of good Y in figure (b) is reflected by the shift of the budget line from B to B1.
- We can notice that changes in the prices of the commodities change the position and the slope of the budget line.
- But, proportional increases or decreases in the price of the two commodities (keeping income unchanged) do not change the slope of the budget line if it is in the same direction.

1.5 Optimum of the Consumer

- A rational consumer seeks to maximize his utility or satisfaction by spending his or her income.
- It maximizes the utility by trying to attain the highest possible indifference curve, given the budget line.
- This occurs where an indifference curve is tangent to the budget line so that the slope of the indifference curve ($MRS_{x,y}$) is equal to the slope of the budget line (P_x/P_y).

❖ Thus, the condition for utility maximization, consumer optimization, or consumer equilibrium occurs where the consumer spends all income (i.e. he/she is on the budget line) and the slope of the indifference curve equals to the slope of the budget line .

❖ Graphically:-



- ❖ Mathematically, consumer optimum (equilibrium) is attained at the point where:
- $(MRS_{x,y}) = (P_x/P_y)$, but we know that $MU_x/P_x = MU_y/P_y = \dots \dots MU_x P_y = MU_y P_x = MU_x/MU_y = P_x/P_y$

Mathematical derivation of equilibrium

- ❖ The maximization problem will be formulated as follows:-Maximize $U=f(X, Y)$ subject to $P_xX + P_yY=M$
- ❖ We can rewrite the constraint as follows:- $M- P_xX - P_yY= 0$
- ❖ Multiplying the constraint by Lagrange multiplier (λ) gives $\lambda(M- P_xX - P_yY)= 0$
- ❖ Forming a composite function gives as the Lagrange function:- $L= U(X,Y) + \lambda(M- P_xX - P_yY)= 0$ or
$$L= U(X,Y) - \lambda(P_xX + P_yY-M)= 0$$

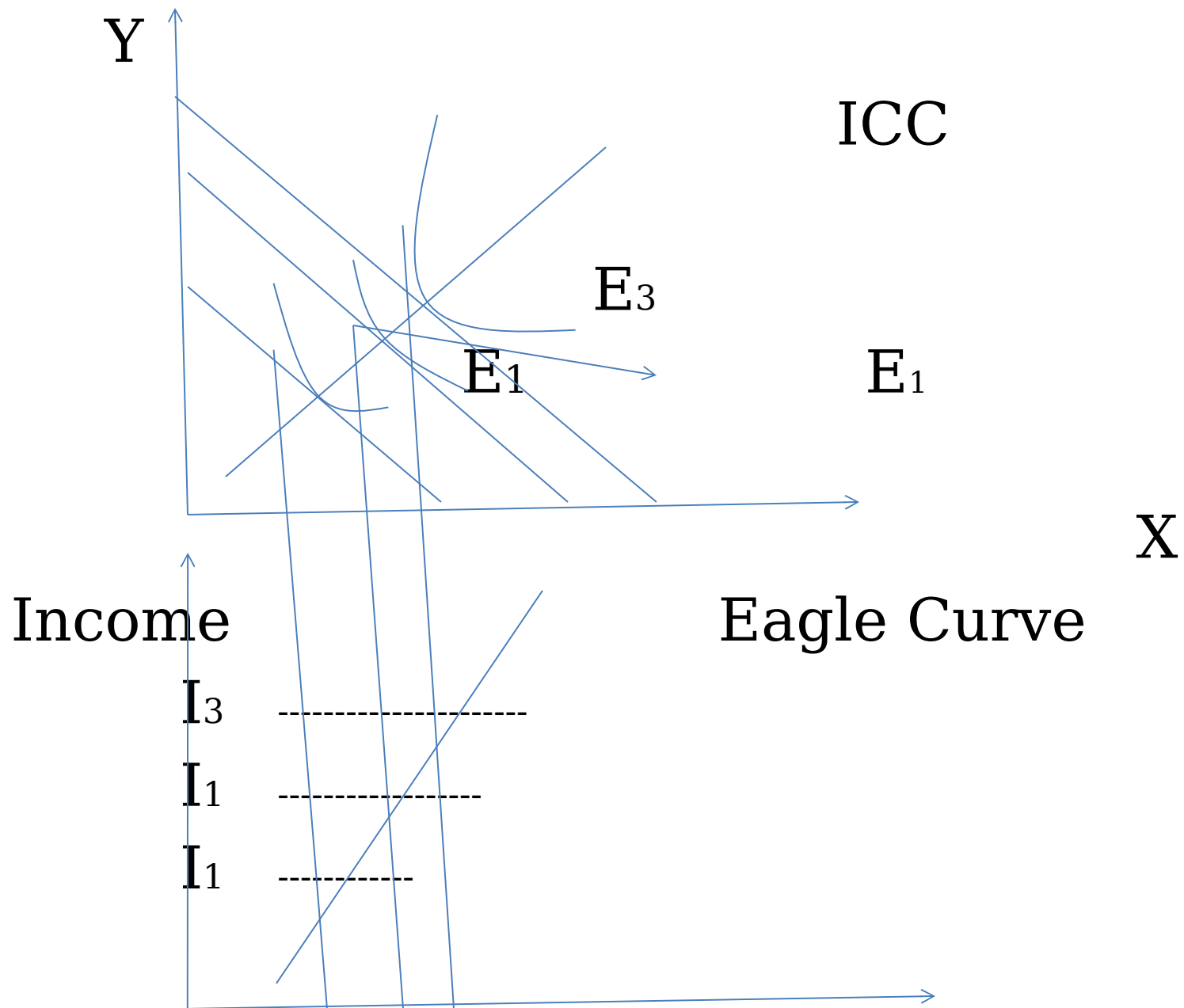
- ❖ The first order condition requires that the partial derivatives of the Lagrange function with respect to the two goods and the langrage multiplier be zero.
- ❖ $\partial L / \partial X = \partial U / \partial X - \lambda P_x = 0$; $\partial L / \partial Y = \partial U / \partial Y - \lambda P_y = 0$ and $\partial L / \partial \lambda = -(P_x X + P_y Y - M) = 0$
- ❖ From the above equations we obtain that:- $\partial U / \partial X = \lambda P_x$ and $\partial U / \partial Y = \lambda P_y$ and $\partial U / \partial X = MU_x$ and $\partial U / \partial Y = MU_y$
- ❖ Therefore, substituting and solving for λ we get the equilibrium condition:- $\lambda = MU_x / P_x = MU_y / P_y$
- ❖ By rearranging we get:- $MU_x / MU_y = P_x / P_y$

- ❖ The second order condition for maximum requires that the second order partial derivatives of the Lagrange function with respect to the two goods must be negative
 - $\partial L^1 / \partial X^1 = \partial U^1 / \partial X^1 < 0$ and $\partial L^1 / \partial Y^1 = \partial U^1 / \partial Y^1 < 0$
- ❖ **Example:-** A consumer consuming two commodities X and Y has the following utility function, $U = XY + 1X$. If the price of the two commodities are 4 and 1 respectively and his/her budget is birr 60.
 - a. Find the quantities of good X and Y which will

A. Changes In Income: Income Consumption Curve and the Engel Curve

- ❖ An increase in the consumer's income (all other things held constant) results in an upward parallel shift of the budget line.
- ❖ And when the consumer's income falls, *ceteris paribus*, the budget line shifts downward, remaining parallel to the original one.

- ❖ If we connect all of the points representing equilibrium market baskets corresponding to all possible levels of money income, the resulting curve is called the ***Income consumption curve (ICC)*** or ***Income expansion curve (IEC)***.
- ❖ The Income Consumption Curve is a curve joining the points of consumer optimum (equilibrium) as income changes (ceteris paribus).
- ❖ Or, it is the locus of consumer equilibrium points resulting when only the consumer's income varies.



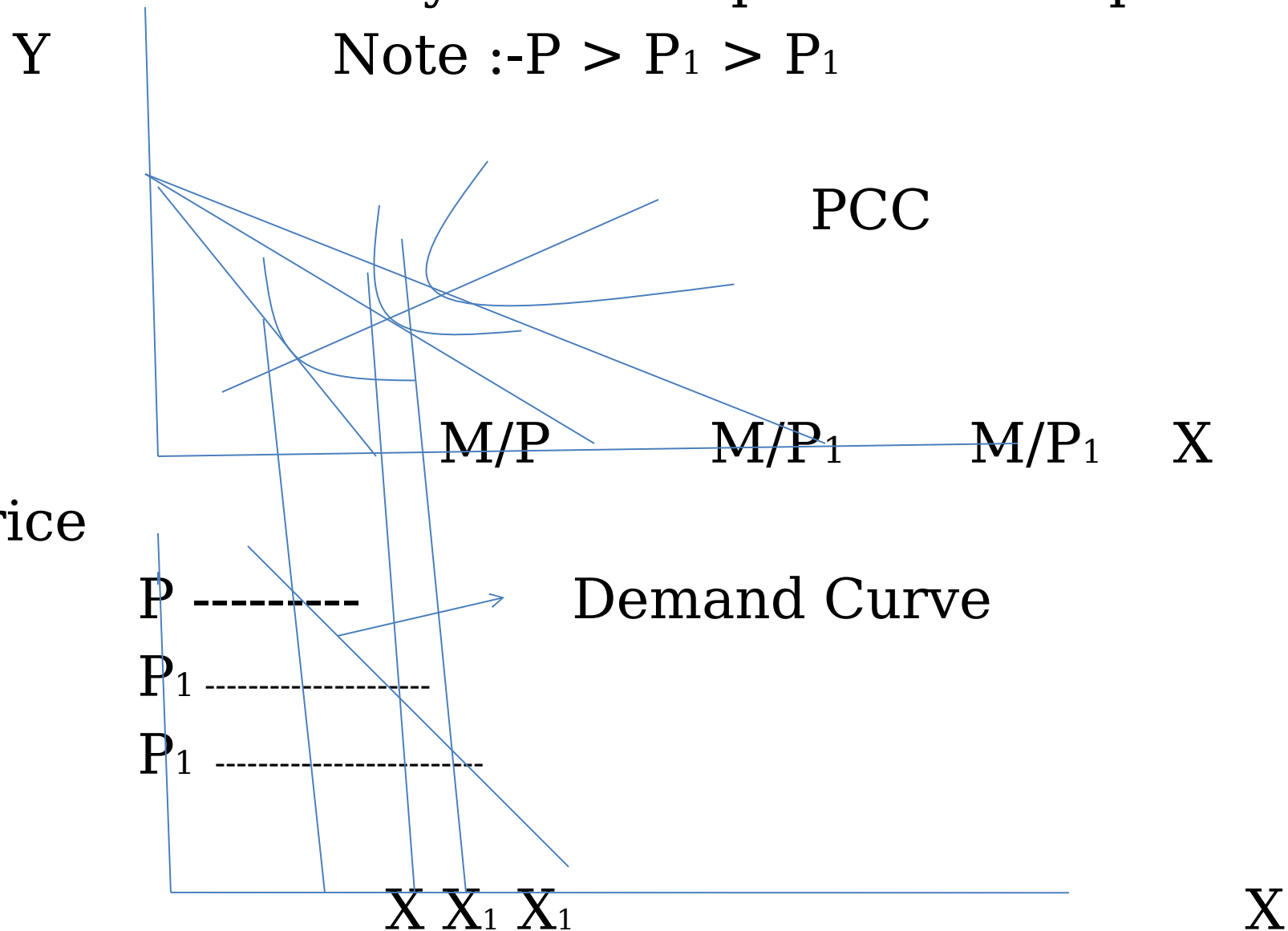
- ❖ From the Income Consumption Curve we can derive the Engle Curve.
- ❖ The Engle curve is named after Ernest Engel, the German Statistician who pioneered studies of family budgets and expenditure positions .
- ❖ **The Engle Curve:-** is the relationship between the equilibrium quantity purchased of a good and the level of income.
- ❖ It shows the equilibrium (utility maximizing) quantities of a commodity, which a consumer will purchase at various levels of income; (ceteris paribus) per unit of time.

- ❖ In relation to the shape of the income-consumption and Engle curves goods can be categorized as normal (superior) and inferior goods.
- ❖ Thus, commodities are said to be normal, when the income consumption curve and its Engle curve are positively sloped; meaning that more of the goods are purchased at higher levels of income.
- ❖ On the other hand, commodities are said to be inferior when the income consumption curve and Engle curve is negatively sloped, i.e. their purchase decreases when income increases.

B. Changes in Price: Price Consumption Curve (PCC) and Individual Demand Curve

- ❖ The decrease in the price of x will result in out ward shift of the budget line that makes the consumer to buy more of good x .
- ❖ If we connect all the points representing equilibrium market baskets corresponding to each price of good X we get a curve called ***price-consumption curve***.
- ❖ ***The price-consumption curve:-*** is the locus of the utility-maximizing combinations of products that result from variations in the price of one commodity when other product prices, the money income and other factors are held constant.

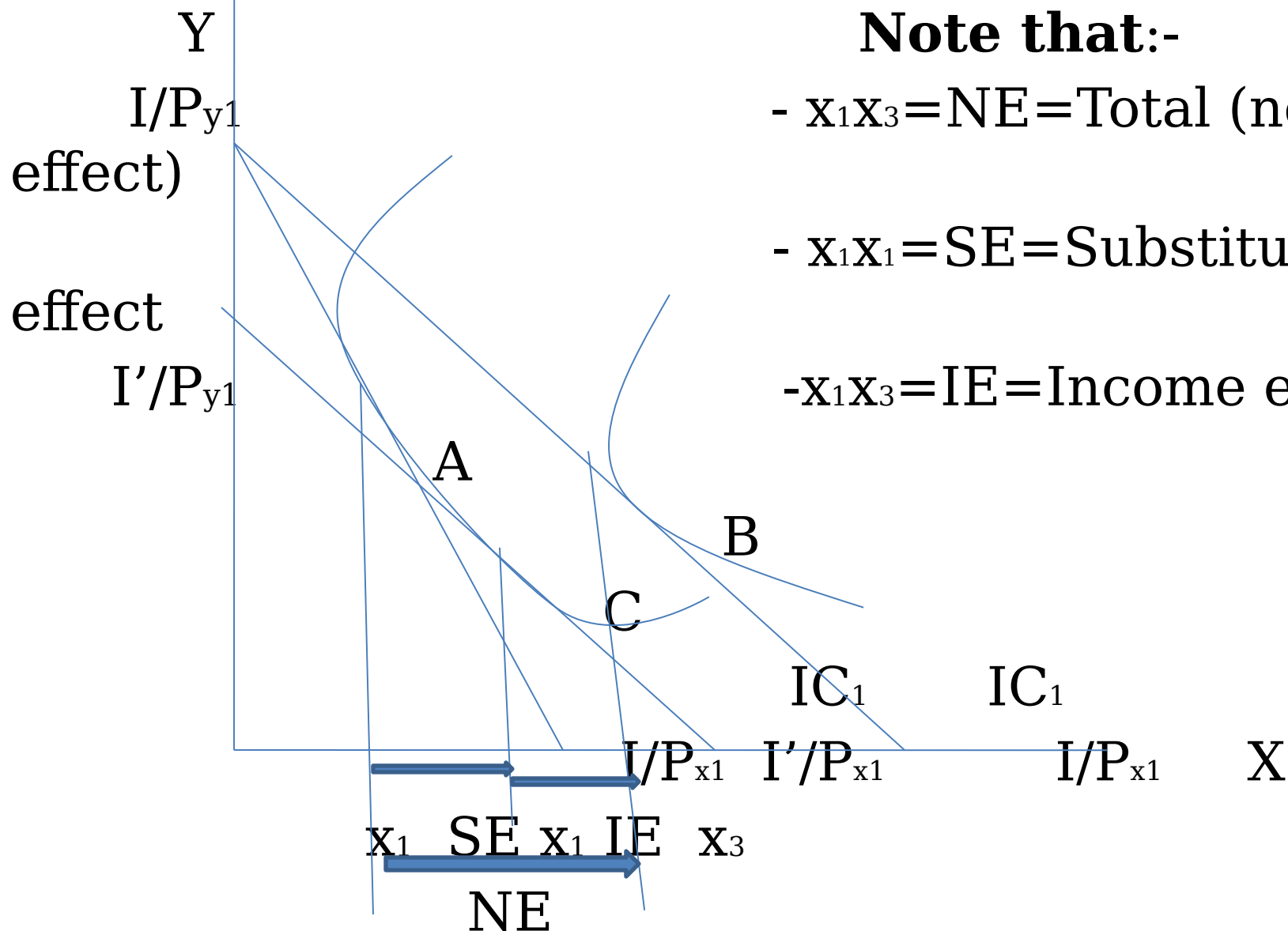
- ❖ We can derive the demand curve of an individual for a commodity from the price consumption curve.



- ❖ There are two types of effects of a price change.
- ❖ If price falls (rises), the good becomes cheaper (more expensive) relative to other goods; and consumers substitute toward (away from) the good. This is the substitution effect.
- ❖ Also, as price falls (rises), the consumer's purchasing power increases (decreases).
- ❖ Since the set of consumption opportunities increases (decreases) as price changes, the consumer changes the mix of his or her consumption bundle. This effect is called the income effect.

- ❖ First a decrease in price increases the consumer's real income (purchasing power), thus enhancing the ability to buy more goods and services to some extent.
- ❖ Second, a decrease in the price of a commodity induces some consumers (the consumer) to substitute it for others, which are now relatively expensive (higher price) commodities.
- ❖ The 1st effect is known as the income effect, and the 1nd effect is known as the substitution effect. The combined effect of the two is known as the total effect (net effect).

Fig:- Income and Substitution Effect



- ❖ Suppose initially the income of the consumer is I , price of good Y is P_{Y_1} , and Price of good X is P_{X_1} , we have the budget line with y-intercept I/P_{Y_1} and X-intercept I/P_{X_1} .
- ❖ The consumer's equilibrium is point **A** that indicates the point of tangency between the budget line and indifference curve.
- ❖ As a result of a decrease in the price of X from P_{X_1} to P_{X_2} the budget line shifts outward with y-intercept I/P_{Y_1} & X-Intercept I/P_{X_2} .

- ❖ The total change in the quantity purchased of commodity X from the 1st equilibrium point at A to the 1nd equilibrium point at B shows the Net effect or total effect of the price decline (change).
- ❖ The total effect of the price change can be conceptually decomposed into the substitution effect and income effect.

The Substitution Effect

- ❖ The substitution effect refers to the change in the quantity demanded of a Commodity resulting exclusively from a change in its price when the consumer's real income is held constant; thereby restricting the consumer's reaction to the price change to a movement along the original indifference curve.
- ❖ The decline in the price of X results in an increase in the consumer's real income, as evidenced by the movement to a higher indifference curve even though money income remains fixed.

- ❖ Now, imagine that we decrease the consumer's income by an amount just sufficient to return to the same level of satisfaction enjoyed before the price decline.
- ❖ Graphically, this is accomplished by drawing a fictitious (imaginary) line of attainable combinations with a slope corresponding to new ratio of the product price P_{x_1}/P_{y_1} so that it is just tangent to the original indifference curve .

- ❖ The movement from point **A** to the imaginary intermediate equilibrium at point **C**, which shows increase in consumption of X from X_1 to X_1 is the substitution effect.
- ❖ In other words, the effect of a decrease in price encourages the consumer to increase consumption of X than Y.

The Income Effect

- ❖ The income effect is determined by observing the change in the quantity demanded of a commodity that is associated solely with the change in the consumer's real income.
- ❖ In the figure, letting the consumer's real income rise from its imaginary level (defined by the line of attainable combinations tangent to point **C**) back to its true level (defined by the line of attainable combinations tangent to point

- ❖ Thus, the income effect is indicated by the movement from the imaginary equilibrium at point **C** to the actual new equilibrium at point **B**, the increase in the quantity of X purchased from X_1 to X_3 is the income effect.
- ❖ The income effect of a change in the price of good shows the change in quantity demanded via change in real income, while the relative price ratio remains constant.
- ❖ This movement does not involve any change⁶ in

- ❖ It is due to a change in total satisfaction and such a change is a movement from one indifference curve to another.
- ❖ The magnitude of the substitution effect is greater than that of the income effect. The reason is that:
 - Most goods have suitable substitutes and when the price of good falls, the quantity of the good purchased is likely to increase very much as consumers substitute the now cheaper good for

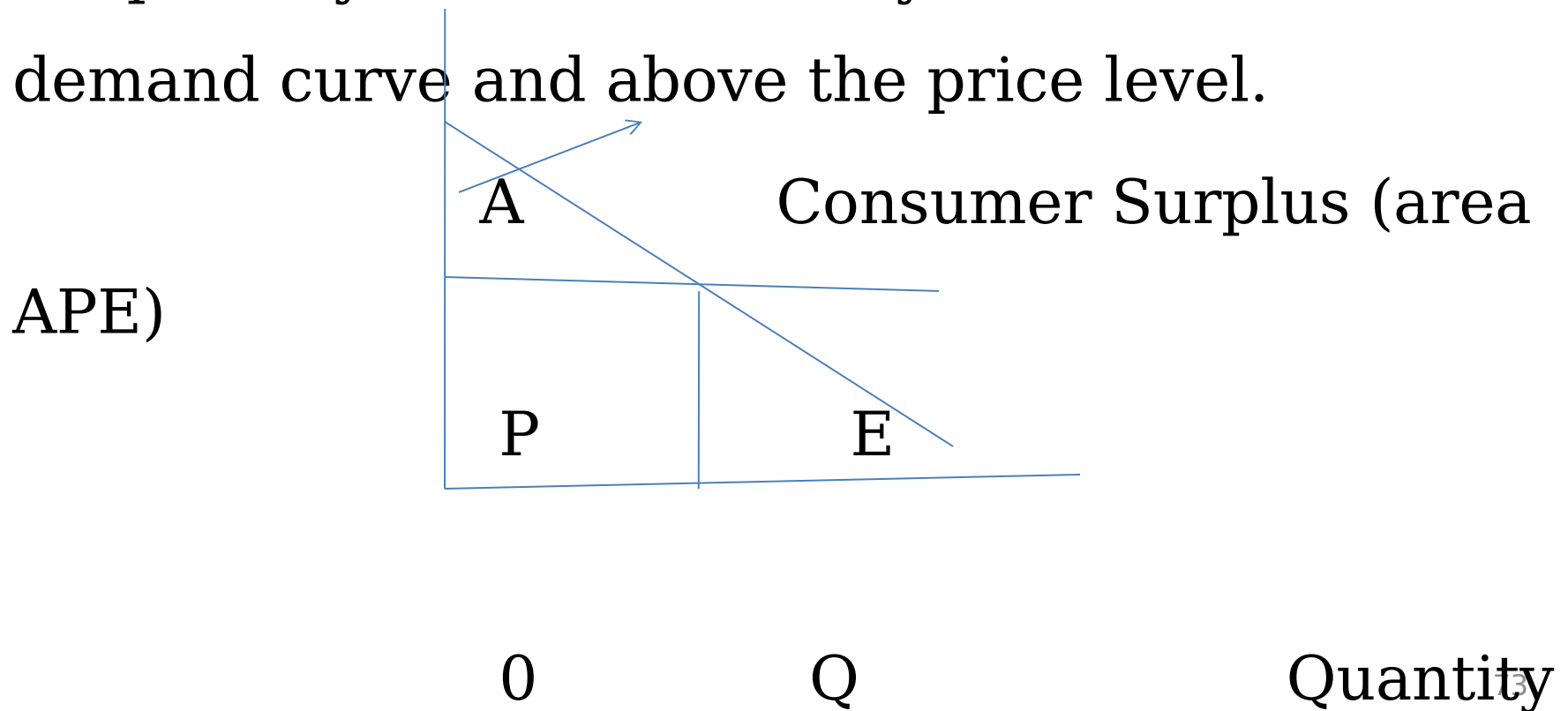
- Spending only a small fraction of his /her income, i.e. with the consumers purchasing many goods and spending only a small fraction of their income on any one good, the income effect of a price change of any one good is likely to be small.

- ❖ In short in the case of normal goods, the income effect and the substitution effect operate in the same direction –they reinforce each other.
- ❖ But not all goods are normal, Some goods are called inferior goods because the income effect is the opposite (of that of a normal good) for them-they operate in opposite direction.
- ❖ For an inferior good, a decrease in the price of the commodity causes the consumer to buy 71

- ❖ But at the same time the higher real income of the consumer tends to cause him to reduce consumption of the commodity (the income effect).
- ❖ We usually observe that the substitution effect still is the more powerful of the two; even though the income effect works counter to the substitution effect, it does not override it.
- ❖ Hence, the demand curve for inferior goods is still negatively sloped.

The Consumer Surplus

- ❖ ***Consumer surplus*** is the difference between what a consumer is willing to pay and what he actually pays.
- ❖ Graphically, it is measured by the area below the demand curve and above the price level.



Numerical Example

- ❖ Suppose the demand function of a consumer is given by: $Q=15-P$
- ❖ Compute the consumer surplus when the price of the good is 1
- ❖ Compute the consumer surplus when the price of the good is 4
- ❖ Compute the change in consumer surplus when the price changes from 1 to 4.

Elasticity

- ❖ Elasticity is the measure of responsiveness of the dependent variable with a unit change in the independent variable ,or
- ❖ It measures the percentage change in the dependent variable when the independent variable changes by one percent.

1. Price elasticity of Demand [Ed]

Ed measures the percentage change in quantity demanded of a commodity when its price changes by one percent.

$$Ed = [\% \Delta Q_d] / [\% \Delta P]$$

It is always negative

Decision on Demand

❖ $E_d > 1$, elastic, $E_d < 1$, inelastic and $E_d = 1$ unitary elastic

a) Point price elasticity of demand

- ❖ It measures elasticity of the demand function at a point
- ❖ $E_d = \% \Delta Q_d / \% \Delta P = [\Delta Q_d / \Delta Q_o * 100\%] / [\Delta P / P_o * 100\%] = [\Delta Q_d / \Delta P] * [P_o / Q_o] = [\partial Q_x / \partial P_x] * P_o / Q_o$

b) Arc Price Elasticity of Demand

- ❖ It measures the average elasticity between two points on a demand function.

$$\begin{aligned}
 \text{❖ } E_d &= \% \Delta Q_d / \% \Delta P = \\
 &= \left[\left\{ (\Delta Q_d) / (Q_1 + Q_0) / 1 \right\} * 100\% \right] / \\
 &= \left[\left\{ (\Delta P) / (P_1 + P_0) / 1 \right\} * 100\% \right] = (\Delta Q_d / \Delta P) * (P_1 + P_0) / (Q_1 + Q_0) \\
 &= \partial Q_d / \partial P * (P_1 + P_0) / (Q_1 + Q_0)
 \end{aligned}$$

2. Income Elasticity of Demand [E_I]

- ❖ It measures the percentage change in quantity demanded of a commodity when income changes by one percent.
- ❖ It is usually applied to analyze Engle Curve.
- ❖ $E_I = \% \Delta Q_d / \% \Delta I$

Decision on the nature of the good

- ❖ $E_I > 0$,Normal good , $0 < E_I < 1$,necessity good
- ❖ $E_I < 0$,inferior good and $E_I > 1$,Luxury good

3. Cross Price Elasticity of Demand [E_{xy}]

- ❖ It measures the percentage change in quantity demanded of one good when the price of the other good changes by one percent.
- ❖ $E_{xy} = \% \Delta Q_y / \% \Delta P_x = [\Delta Q_y / \Delta P_x] * [P_x / Q_y]$
$$= [\partial Q_y / \partial P_x] * P_x / Q_y$$
- ❖ **Decision on goods:-** $E_{xy} > 0$,substitutes , $E_{xy} < 0$, complements and if $E_{xy} = 0$,unrelated.

4. Price Elasticity of Supply [Es]

- ❖ It measures the percentage change in quantity supplied of a commodity when its price changed by one unit.
- ❖ It is always positive.
- ❖ $E_s = \% \Delta Q_s / \% \Delta P$
- ❖ **Decision on elasticity of supply:**
 - $E_s > 1$,elastic
 - $0 < E_s < 1$,inelastic
 - $E_s = 1$ unitary elastic