CHAPTER 3

THEORY OF CONSUMER BEHAVIOR

Introduction

- Consumer behavior is the explanation of how consumers allocate their income to purchase different goods and services
- Utility describe the satisfaction or enjoyment derived from the consumption of goods or service.
- Utility is the level of satisfaction that is obtained by consuming a commodity.

Properties of utility

- Utility' and 'Usefulness" are not synonymous.

E.g. watching football may be useless functionally but offer great utility for football lovers.

- Utility is subjective: The utility of a product will vary from person to person.

E.g. non-smokers do not derive any utility from cigarettes

- The utility of a product can be different at different places and time. E.g. women gets high utility when they drink coffee in their house than from cafe ,

- E.g. Eating Enjera on breakfast may be boring for some people

Approaches Of Measuring Utility

- There are two approaches of Measuring Utility

  Cardinal utility approach

  Ordinal Utility approach

- The cardinalist school postulated that utility can be measured objectively /in cardinal

- According to the ordinalist school, utility is not measured in numbers rather the consumer can rank or order the utility he derives from different goods and services.

Assumptions of cardinal approach

1. Rationality of consumers

- The main objective of the consumer is to maximize his/her satisfaction given his/her limited budget or income.

2. Utility is a cardinal concept/cardinally measurable

- According to cardinal approach, the utility of each commodity is measurable. Utility is measured in subjective units called **utils**.
- 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.

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3. Constant Marginal Utility of Money.

- According to assumption number two, 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 cannot be considered as a measurement of utility.
- The essential feature of a standard unit of measurement is that it is constant.

Cont..

4. Diminishing Marginal Utility (DMU).

- The utility derived from each successive units of a commodity diminishes. .

5. The total utility of a basket of goods depends on the quantities of the individual commodities.

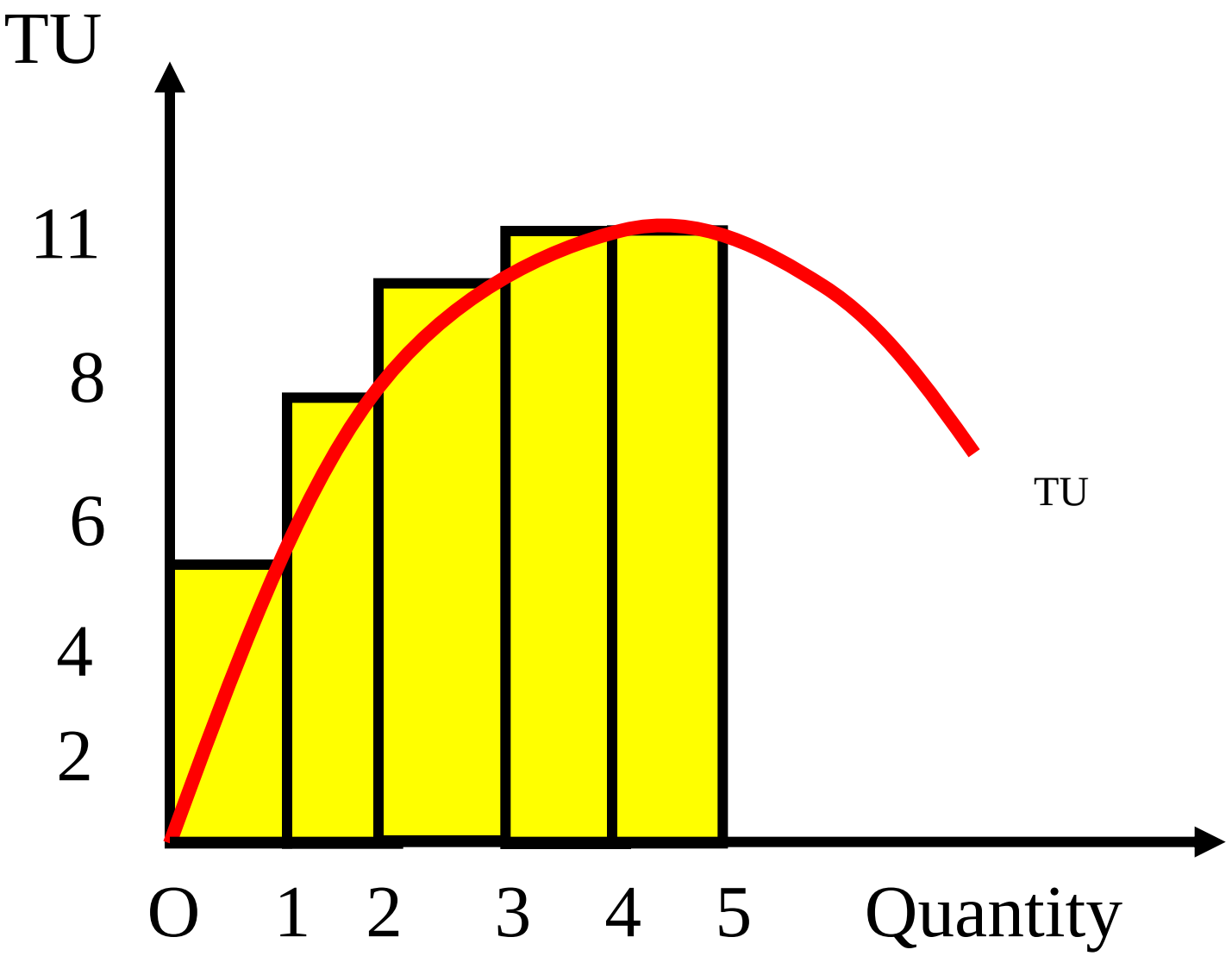
- If there are n commodities in the bundle with quantities X1, X2... Xn, the total utility is given by TU = f (X1, X2,…Xn)

Total and Marginal Utility

- Total Utility: refers to the total amount of satisfaction a consumer gets from consuming or possessing some specific quantities of a commodity at a particular time.
- For example if a consumer consumes 4 units of a commodity and derives U_1, U_2, U_3 and U_4 from the successive units consumed, the TU = $U_1+U_2+U_3+U_4$.
- As the consumer consumes more of a good per time period, his/her total utility increases.
- However, there is a saturation point for that commodity beyond which the consumer will not be capable of enjoying any greater satisfaction from it.
- **E.g. Utility Schedule for banana**

Qty of Banana Consumed	0	1	2	3	4	5	6
TU	0	5	8	10	11	11	10

Graphical representation of total utility



Marginal Utility (MU)

- It can be defined as total utility derived from, the last unit of a commodity consumed.
- It is the change in the total utility resulting from unit change in commodity consumed
- It is the slope of total utility,

$$\mathbf{MU = \Delta TU / \Delta Q}$$

- ΔTU = Change in Total Utility
- ΔQ = Change in quantity consumed

To explain the relationship between TU and MU, let us consider the following hypothetical example.

Table 3.1: Total and marginal utility

Quantity	Total utility (TU)	Marginal utility (MU)
0	0	-
1	10	10
2	18	8
3	24	6
4	28	4
5	30	2
6	30	0
7	28	-2

Marginal Utility (MU)

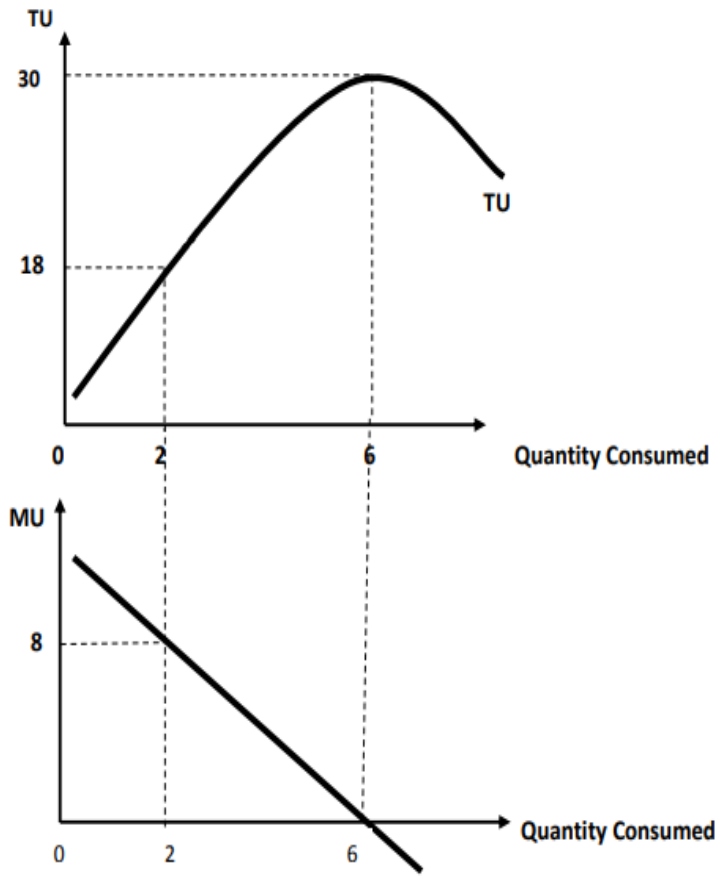


Figure 3.1: Total and marginal utility curves

As it can be observed from the this graph,

- ✓ When TU is increasing, MU is positive.
- ✓ When TU is maximized, MU is zero.
- ✓ When TU is decreasing, MU is negative.

Law of diminishing marginal utility (LDMU)

- The *LDMU states that as the quantity consumed of a commodity* increases per unit of time, the utility derived from each successive unit decreases, ceteris paribus.
- In other words, the extra satisfaction that a consumer derives declines as he/she consumes more and more of the product in a given period of time.

Equilibrium of a consumer

A) the case of one commodity

- 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.

  $Mu_x = P_x$

- Suppose the consumer's utility function is given as

  U =f (X)

- his/her total income spent (expenditure) on commodity X – Total Expenditure would be: TE = QxPx
- where Qx is amount of commodity x and
- Px is price of good X.

Equilibrium of a consumer

- The consumer would like to maximize the difference between the utility (satisfaction) and expenditure (sacrifice).
- The problem is a simple maximization of the function.

$$U = f(X)$$

- The necessary condition (First Order Condition) for maximum, require that the derivative of the function with respect to independent variable (Q_x) must be equal to zero.

Proof

Given the utility function

$U = f(X)$

- If the consumer buys commodity X, then his expenditure will be $Q_X P_X$.

$$\frac{dU}{dQ_X} - \frac{d(Q_X P_X)}{dQ_X} = 0$$

⇨ MUx - Px =0

⇨ $MU_X = P_X$

$$\frac{MUx}{Px} = 1$$

Equilibrium of a consumer

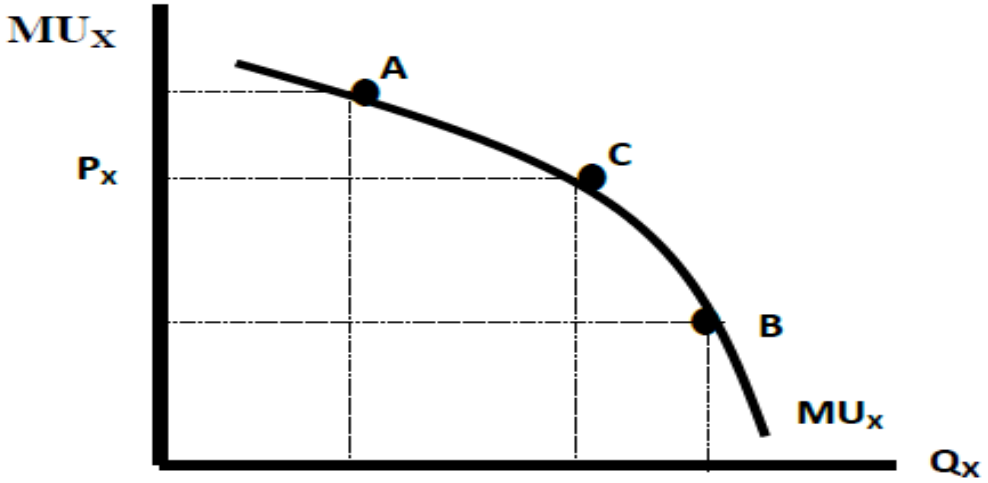


Figure 3.2: Equilibrium condition of consumer with only one commodity

- At any point above point C (like point A) where $MU_X > P_X$, it pays the consumer to consume more.
- When $MU_X < P_X$ (like point B), the consumer should consume less of X.
- At point C where $MU_X = P_X$ the consumer is at equilibrium.

B) The case of two or more commodities

- In reality, however, a consumer consumes a large number of goods.
- The MU schedules of different commodities may not be the same.
- A utility maximizing consumer consumes commodities in order of their utilities.
- He picks up the commodity, which yields the highest marginal utility followed by the commodity yielding the second highest marginal utility and so on.
- He switches his expenditure from one commodity to another in accordance, with their marginal utility.

Cont…

- He continues to switch his expenditure from one commodity to the other till he reaches a stage where MU of each commodity is equal per unit of expenditure
- Therefore, the consumer optimum follows the law of equi-marginal utility.
- We can use a single commodity case to determine the general case.
- For commodity X, equilibrium occurs when $MU_x = P_x$
- $MU_x = P_x$ and this can be written as
- $MU_x / P_x = 1$

Cont…

- For the case of two or more goods, the consumer‘s equilibrium is achieved when the marginal utility per money spent is equal for each good purchased and his money income available for the purchase of the goods is exhausted. That is,
- if the consumer consumes a bundle of n commodities i.e $X_1, X_2, X_3 \ldots\ldots X_n$ he/she would be in equilibrium or utility is maximized if and only if:

$$\frac{MU_{X1}}{P_{X_1}} = \frac{MU_{X_2}}{P_{X_2}} = \ldots\ldots\ldots = \frac{MU_{X_n}}{P_{X_n}}$$

- Exercise: Consider a consumer having only birr 11 in his pocket to buy bread and banana

If the Price of banana is birr 4/kg and price of bread is birr one per unit determine.

i. His marginal utility schedule for the two commodities
ii. Determine his optimum consumption of these two goods
iii. The total utility at optimum consumption

Solutions

Bread , Price=birr 1/unit				*Banana, Price=4birr/kg*			
Qty	*TU*	*Mu*	*MU/P*	*Qty*	*TU*	*MU*	*MU/P*
0	*0*	-	-	*0*	*0*	-	-
1	*6*	6	6	*1*	12	12	3
2	*10*	4	4	*2*	*20*	8	2
3	*12*	2	2	*3*	*24*	4	1
4	*12*	0	0	*4*	*24*	0	0
5	*10*	-2	-1	*5*	*20*	-4	-1
6	*7*	-3	-3	*6*	*12*	-8	-2

Ordinal Utility Approach

- The ordinalist school argue that utility is not cardinally measurable,
- but it is an ordinal in magnitude.
- That is, the consumer may not know the specific unit of utility derived from different commodity.
- But he is able to rank or order different basket of good in utility.
- The modern theory of consumer's behavior is on the basis of consumers preference

What is preference?

- Given any two consumption bundles,
- the consumer can choose or prefer one of consumption bundles than the other.
- Goods and services however differ in their ability to satisfy a want.
- An individual may prefer coffee to tea. Another person may prefer tea to coffee but both consumers will derive some level of satisfaction by consuming the good they have chosen.

A. Strict preference

- Given any two consumption bundles (X_1, X_2) and (Y_1, Y_2), if$(X_1, X_2) > (Y_1, Y_2)$ or
- if he chooses (X_1, X_2) when (Y_1, Y_2) is available the consumer definitely wants the X-bundle than Y.
- The consumer prefers the X bundles than the Y bundles. That is strictly better than the other,
- Commodities are desired because of their ability to satisfy wants

B. 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) (Y_1, Y_2), the consumer would be equally satisfied if he consumes (X_1, X_2) or (Y_1, Y_2).

Assumption Of Ordinal Approach

- The ordinal utility approach is also on the basis of the following assumptions:-

1. Rationality: The consumer is assumed to be rational aiming at maximizing his utility
2. Utility is Ordinal: The consumer can rank or order his preferences . In other words, any two bundles of goods A and B can be compared in preferences by the consumer .

✍ Comparison lead to one of the following outcome.

- Bundle A is preferred to basket B or (A > B)
- Bundle B is preferred to bundle A or (B > A)
- A and B are equally preferred (A = B) The consumer cannot simply say, I can not compare A and B

Cont…

Consistence of Choice: If he preferred bundle A to B, he will not choice bundle B over A another time. Thus, if A is preferred to B then B is not preferred over A.

3. The consumer's choice is transitive:

- For any three bundle, A, B, and C, if A is preferred to B and B is preferred to C then A is preferred to C
- Similarly, if A is indifferent to B and B is indifferent to C, then A is indifferent to C.

Cont…

4. Diminishing Marginal Rate of Substitution (MRS):

- The marginal rate of substitution is the rate at which a consumer is willing to substitute one commodity (x) for another commodity (y) so that his total satisfaction remains the same.
- The rate at which one good can be substituted for another in consumer‘s basket of goods diminishes as the consumer consumes more and more of the good.
- Generally, ordinalist school simply argue that,
  - individual tends to make consistent choice,
  - that is the law of preference represents a good approximation of actual behavior of consumer
  - and thus, the law of preference are rules of rational choice.
  - The ordinal utility approach is explained with the help of indifference curves. The ordinal utility theory is also known as the *indifference curve approach.*

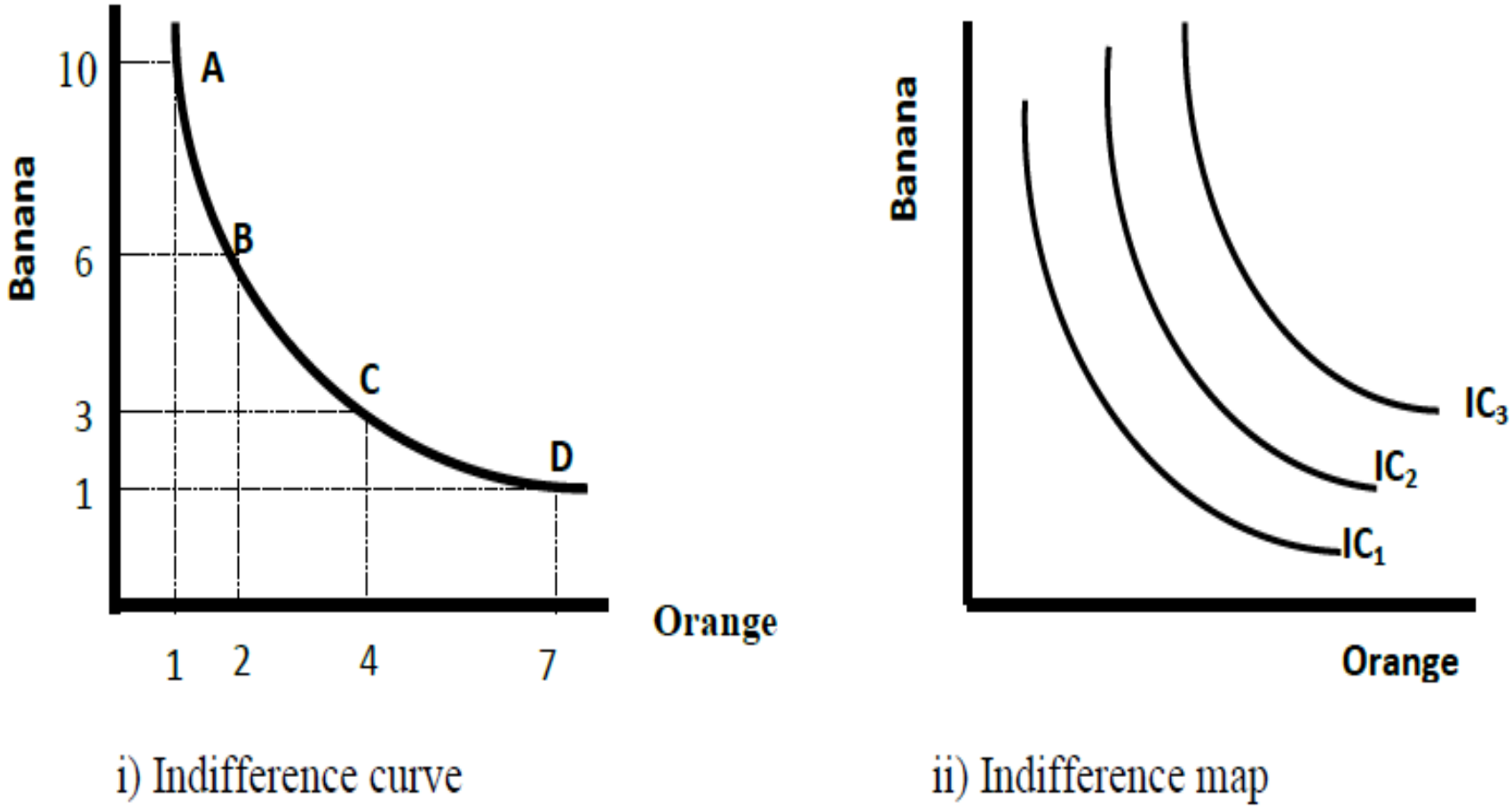
Indifference set, curve and map

- ***Indifference set/schedule*** *is a combination of goods for which the consumer is indifferent.*
- *It* shows the various combinations of goods from which the consumer derives the same level of utility.
- Consider a consumer who consumes two goods X and Y (table 3.3).

Table 3.3: Indifference schedule

Bundle	A	B	C	D
Orange	1	2	4	7
Banana	10	6	3	1

- In table 3.3 above, each combination of good X and Y gives the consumer equal level of total utility. Thus, the individual is indifferent whether he consumes combination A, B, C or D.
- **Indifference curve:** When the indifference set/schedule is expressed graphically, it is called an *indifference curve.*
- *An indifference curve shows different combinations of two goods*-yield same utility to the consumer.
- A set of indifference curves is called **indifference map.**



i) Indifference curve

ii) Indifference map

Figure 3.3: Indifference curve and indifference map

Properties of indifference curves

1. **Indifference curves (ICs) have negative slope.**

   ICs are negatively sloped as consumption level of one good can be increased only by reducing the consumption level of the other. i.e., to keep utility of the consumer constant, as the quantity of one good is increased the quantity of the other must be decreased.

2. **Indifference curves are convex to the origin.**

   → the slope of an IC decreases as we move along the curve from left to right. The convexity of ICs is reflection of the diminishing marginal rate of substitution. This assumption → the goods can substitute one another at any point on an IC but are not perfect substitutes.

3. **A higher IC is always preferred to a lower one.** *The further away from the* origin an IC lies, the higher the level of utility it denotes. Baskets of goods on higher ICs are preferred by the rational consumer since they contain more of the two commodities than the lower ones.
4. **ICs never cross each other (cannot intersect).** The assumptions of consistency and transitivity will rule out the intersection of ICs. Figure 3.4 shows the violations of the assumptions of preferences due to the intersection of ICs.

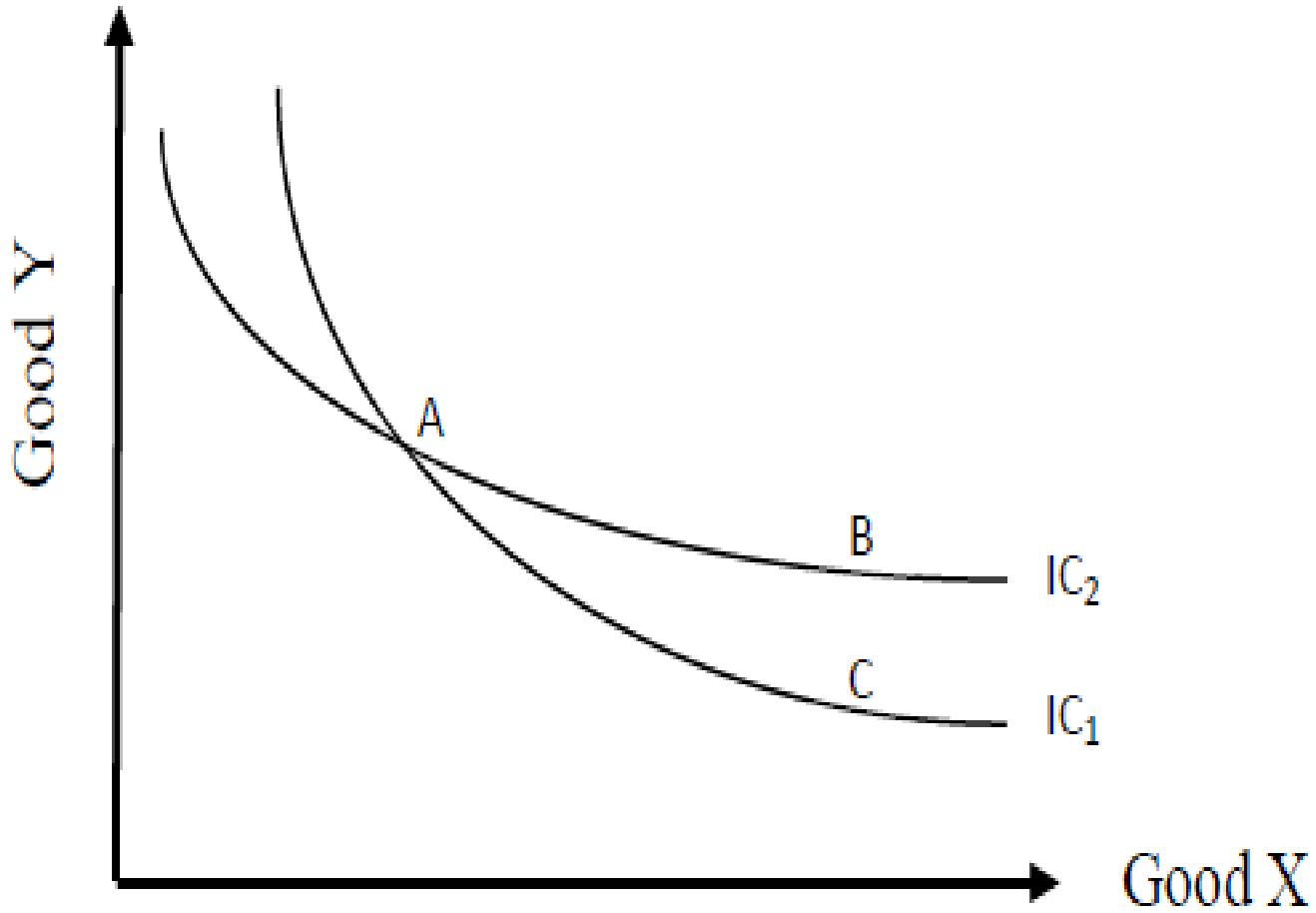


Figure 3.4: Intersection of indifference curves

Marginal rate of substitution (MRS)

- Marginal rate of substitution is a rate at which consumers are willing to substitute one good for another in such a way that the consumer remains on the same indifference curve.
- It shows a consumer‘s willingness to substitute one good for another while he/she is indifferent b/n the bundles.

- 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 on the same level of satisfaction.
  Since one of the goods is scarified to obtain more of the other good, the MRS is negative. Hence, usually we take the absolute value of the slope.

$$MRS_{X,Y} = \frac{Number\ of\ units\ of\ Y\ given\ up}{Number\ of\ units\ of\ X\ gained} = -\frac{\Delta Y}{\Delta X}$$

To understand the concept, consider the following indifference curve.

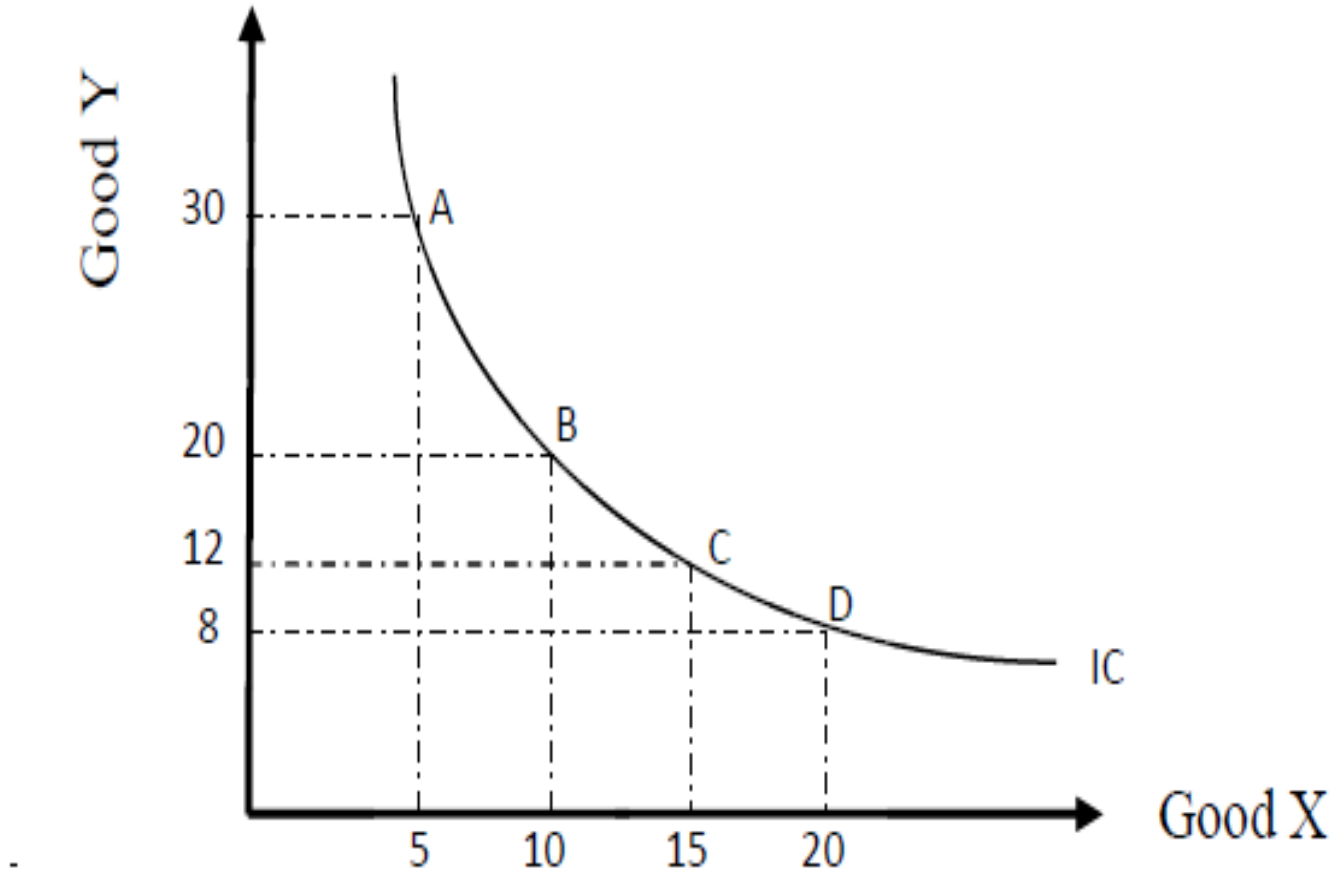


Figure 3.5: Indifference curve for two products X and Y

- From the above graph, $MRS_{X,Y}$ associated with the movement from point A to B, point B to C and point C to D is 2.0,1.6, and 0.8, respectively.
- i.e., for the same increase in the consumption of good X, the amount of good Y the consumer is willing to scarify diminishes.
- This principle of MRS is reflected by the convex shape of the IC and is called diminishing MRS.
- It is also possible to derive MRS using the concept of marginal utility.
- *$MRS_{X,Y}$ is related to* MU_X and MU_Y as follows.

$$MRS_{X,Y} = \frac{MU_X}{MU_Y}$$

Proof: Suppose the utility function for two commodities X and Y is defined as:

$$U = f(X, Y)$$

Since utility is constant along an indifference curve, the total differential of the utility function will be zero.

$$dU = \frac{\partial U}{\partial X} dX + \frac{\partial U}{\partial Y} dY = 0$$

$$MU_X dX + MU_Y dY = 0$$

$$\frac{MU_X}{MU_Y} = -\frac{dY}{dX} = MRS_{X,Y} \qquad \text{Similarly, } \frac{MU_Y}{MU_X} = -\frac{dX}{dY} = MRS_{Y,X}$$

Example: Suppose a consumer's utility function is given by $U(X,Y)=X^4Y^2$. Find $MRS_{X,Y}$

Solution: $MRS_{X,Y}=\frac{MU_X}{MU_Y}$

$$MU_X=\frac{\partial U}{\partial X}=4X^3Y^2 \quad and\ MU_Y=\frac{\partial U}{\partial Y}=2X^4Y \quad \text{Hence, } MRS_{X,Y}=\frac{MU_X}{MU_Y}=\frac{4X^3Y^2}{2X^4Y}=\frac{2Y}{X}$$

The budget line or the price line

- ICs only tell us about consumer preferences for any two goods
- they cannot show which combinations of the two goods will be bought
- In reality, the consumer is constrained by his/her income and prices of the two commodities.
- This constraint is often presented with the help of the budget line.
- The *budget line is a set of the commodity bundles that can be purchased if the entire income is* spent.

- It is a graph which shows the various combinations of two goods that a consumer can purchase given his/her limited income and prices of the two goods.
- ***To draw a budget line facing a consumer, we consider the following assumptions.***
  - There are only two goods bought in quantities, say, X and Y.
  - Each consumer is confronted with market determined prices, P_X and P_Y.
  - The consumer has a known and fixed money income (M).

- Assuming that the consumer spends all his/her income on the two goods (X and Y), we can express the budget constraint as:

$$M = P_X X + P_Y Y$$

- By rearranging the above equation, we can derive the following general equation of a budget line.

$$Y = \frac{M}{P_Y} - \frac{P_X}{P_Y} X$$

Graphically,

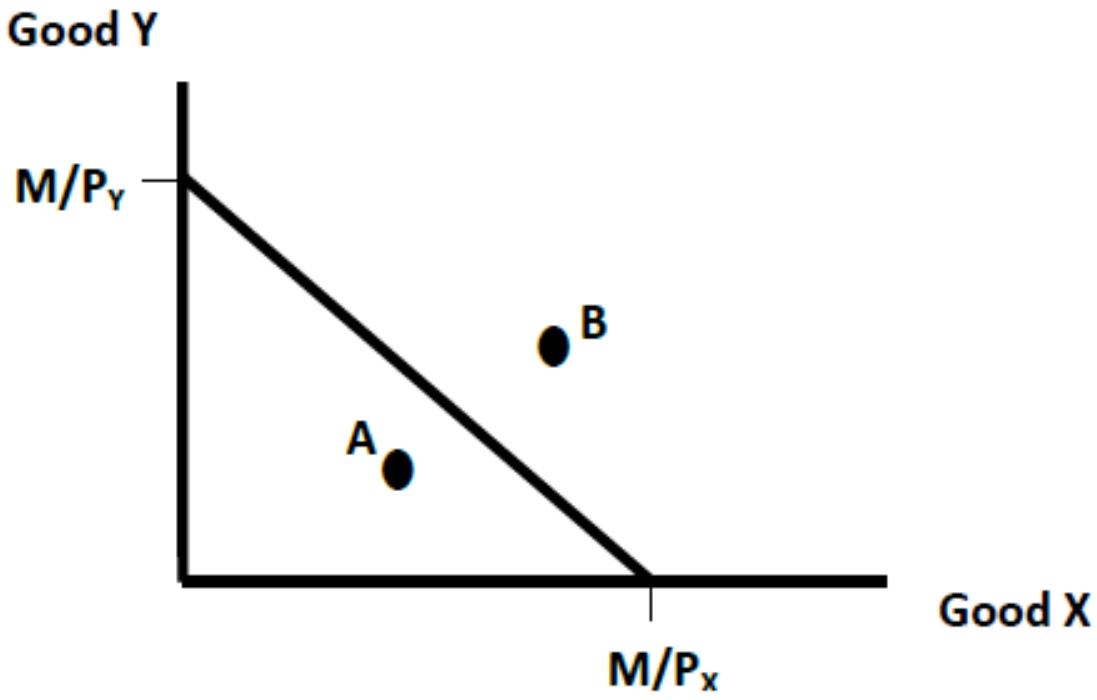


Figure 3.6: The budget line

Note that:

- The slope of the budget line is given is by $-P_X/P_Y$ (the ratio of the prices of the two goods).
- Any combination of the two goods within the budget line (such as point A) or along the budget line is attainable.
- Any combination of the two goods outside the budget line (such as point B) is unattainable (unaffordable).
- **Example:** A consumer has Birr 120 to spend on two goods X and Y with prices Birr 4 and 6, respectively. Derive the equation of the budget line and sketch the graph.

Solution: The equation of the budget line can be derived as follows.

$P_X X + P_Y Y = M$

$4X + 6Y = 120$

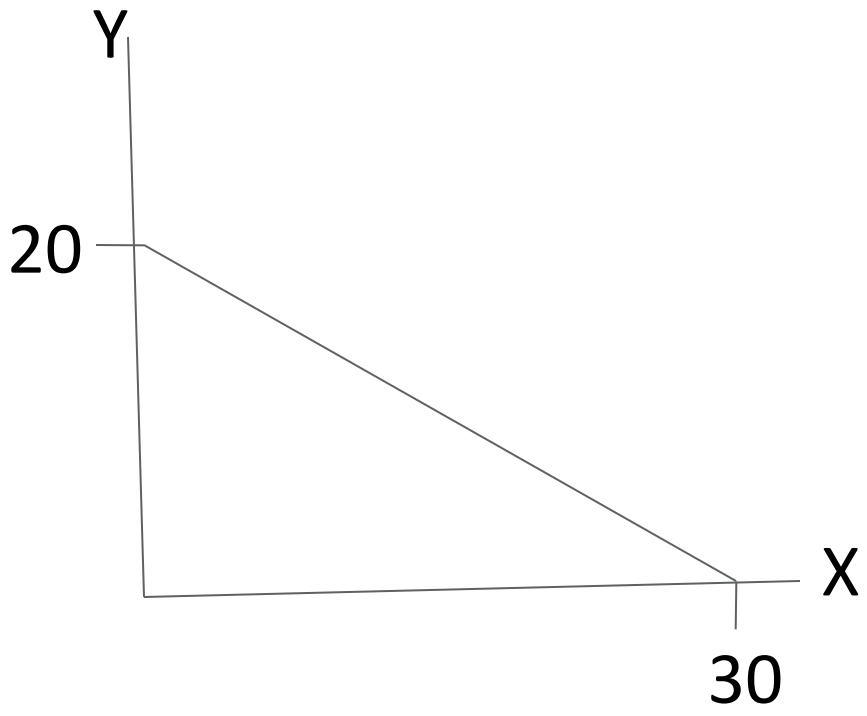
$6Y = 120 - 4X$

$Y = 120/6 - 4X/6$

$Y = 20 - 2X/3$

$X = 0 \Rightarrow Y = 20$

$Y = 0 \Rightarrow X = 30$



- When the consumer spends all of his/her income on good Y, we get the Y- intercept (0, 20).
- Similarly, when the consumer spends all of her income on good X, we obtain the X- intercept (30, 0).
- Using these two points we can sketch the graph of the budget line.
- Recall that a budget is drawn for given prices and fixed consumer‘s income.
- Hence, the changes in prices or income will affect the budget line.

Change 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/outward shift in the budget line that allows the consumer to buy more goods and services
- Decrease in income causes a downward/inward shift in the budget line that leads the consumer to buy less quantity of the two goods.
- 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.

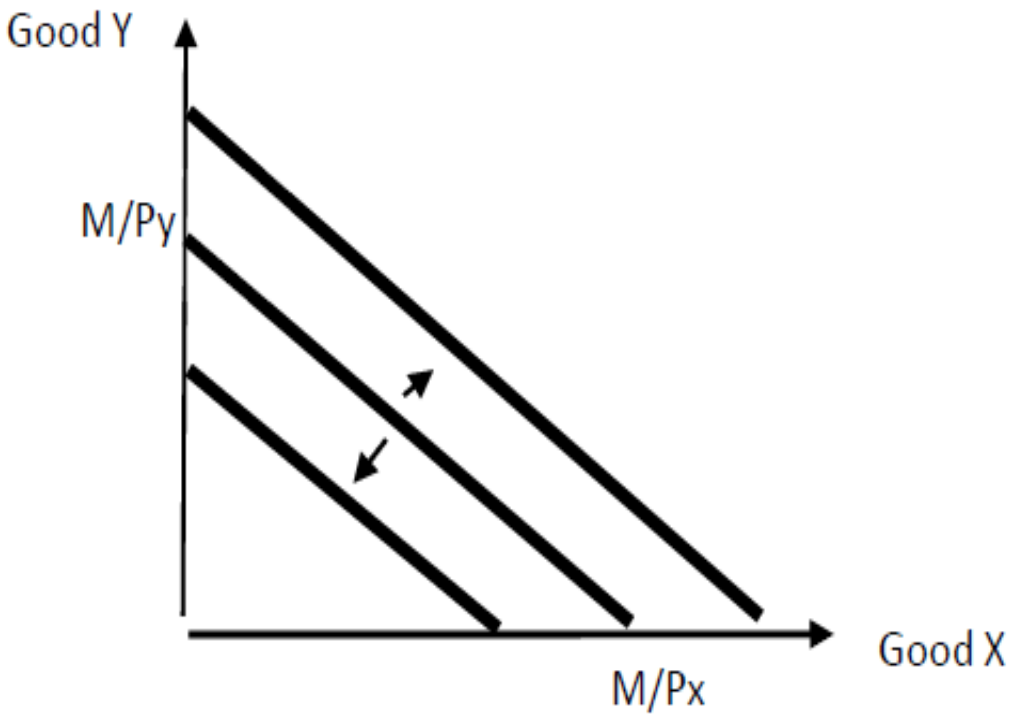


Figure 3.7: *Effects of increase (right) and decrease (left) in income on the budget line*

Change in prices: An equal increase in the prices of the two goods shifts the budget line inward.

- Since the two goods become expensive, the consumer can purchase lesser amount of the goods.
- An equal decrease in the prices of the two goods, one the other hand, shifts the budget line out ward.
- Since the two goods become cheaper, the consumer can purchase more amounts of the two goods.
- Any increase/decrease in the price of one of the two goods, keeping the price of the other good and income constant, changes the slope of the budget line by affecting only the intercept of the commodity that records the change in the price.

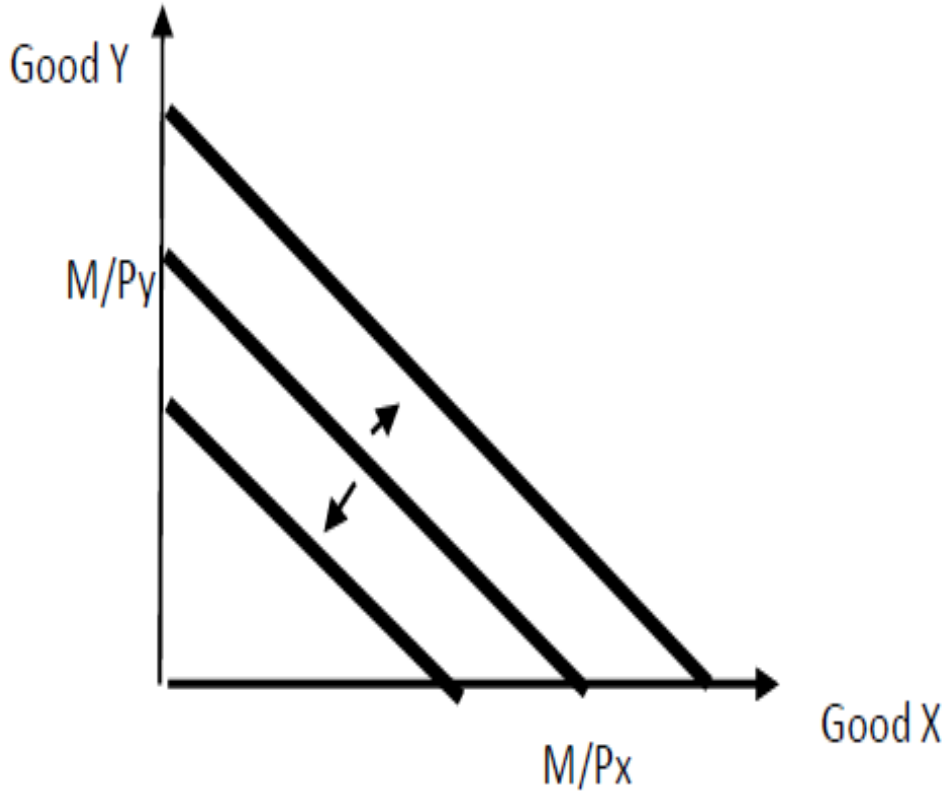


Figure 3.8: *Effect of proportionate increase (inward) and decrease (out ward) in the prices of both goods*

- e.g., if the price of good X decreases while both the price of good Y and consumer‘s income remain unchanged, the horizontal intercept moves outward and makes the budget line flatter.
- The reverse is true if the price of good X increases.
- On the other hand, if the price of good Y decreases while both the price of good X and consumer‘s income remain unchanged, the vertical intercept moves upward and makes the budget line steeper.
- The reverse is true for an increase in the price of good Y.

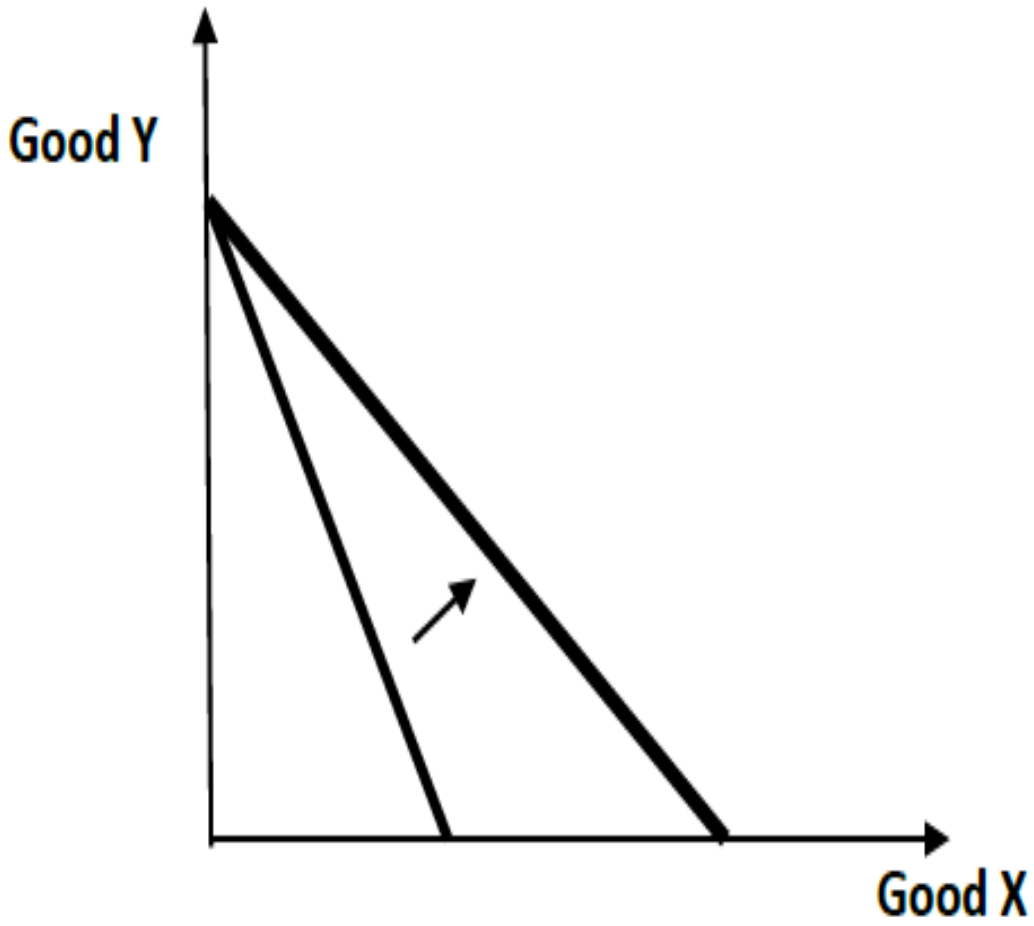


Figure 3.9: Effect of decrease in the price of only good X on the budget line

Equilibrium of the consumer

- Preferences of a consumer are indicated by the IC.
- The budget line specifies different combinations of two goods (X and Y) the consumer can purchase with the limited income.
- So, a rational consumer tries to attain the highest possible IC, given the budget line.
- This occurs at the point where the IC is tangent to the budget line so that the slope of the IC ($MRS_{X,Y}$) *is equal to the slope of the budget line* (P_X / P_Y).
- *In figure 3.10, the equilibrium* of the consumer is at point E where the budget line is tangent to the highest attainable IC (IC2).

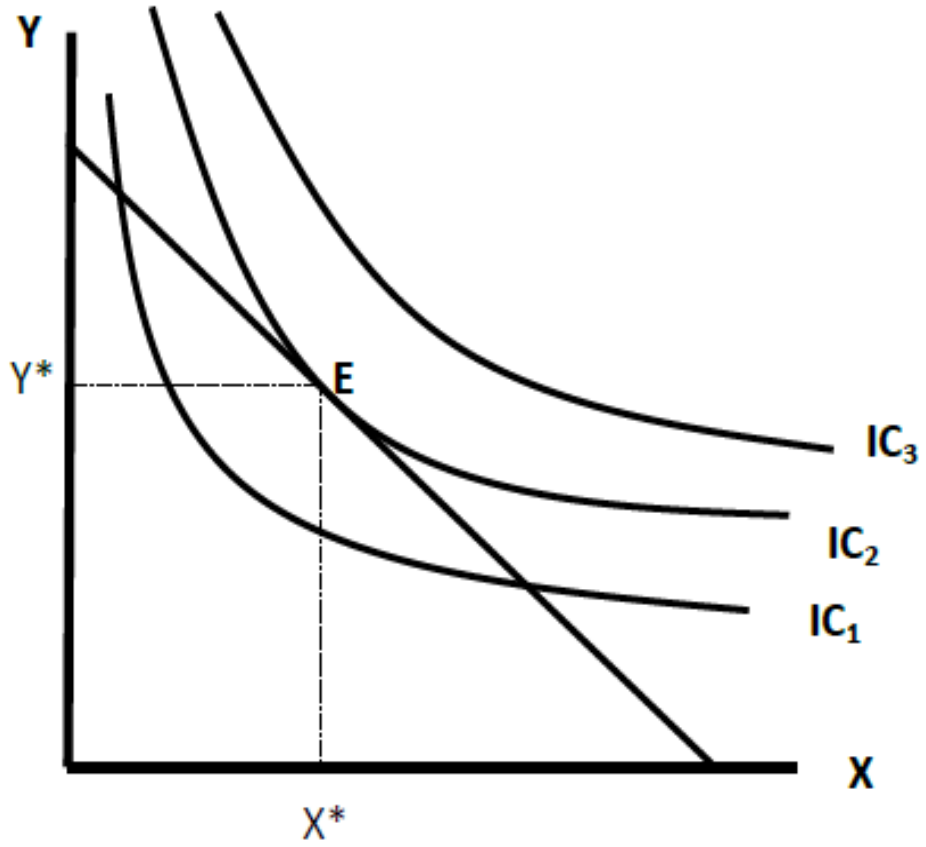


Figure 3.10: Consumer equilibrium under indifference curve approach

Mathematically, consumer optimum (equilibrium) is attained at the point where:

Slope of indifference curve = Slope of the budget line

$$MRS_{XY} = \frac{P_X}{P_Y}$$

$$\Rightarrow \frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

Example: *A consumer consuming two commodities X and Y has the utility function* $U(X, Y) = XY + 2X$ *. The prices of the two commodities are 4 Birr and 2 Birr, respectively. The* consumer has a total income of 60 birr to be spent on the two goods.

a) Find the utility maximizing quantities of good X and Y.

b) Find the $MRS_{X,Y}$ at equilibrium.

Solution

a) The budget constraint of the consumer is given by:

$P_X.X + P_Y.Y = M$

$4X+2Y= 60$ ..... (i)

Moreover, at equilibrium

$$\frac{MU_X}{MU_Y} = \frac{P_X}{P_Y}$$

$$\frac{Y+2}{X} = \frac{4}{2}$$

$$\frac{Y+2}{X} = 2$$

$$Y = 2X - 2 \quad \text{..... (ii)}$$

Substituting equation (ii) into (i), we obtain $Y = 14 \quad and \quad X = 8.$

b) $MRS_{X,Y} = \frac{MU_X}{MU_Y} = \frac{Y+2}{X} = \frac{14+2}{8} = 2$

Thanks for Your Attention!!