ADDIS ABABA UNIVERSITY

DEPARTMENT OF ECONOMICS

Microeconomics

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CHAPTER ONE

Theory of Consumer Behavior

1.1 The Theory of Consumers Behavior and Demand

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 (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.

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

Basic assumptions

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.

Transitivity

It means that if a consumer prefers basket A to basket B and to basket C, then the consumer also prefers A to C.

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.

Utility

Definition

Utility is the level of satisfaction that is obtained by consuming a commodity or undertaking an activity.

In defining strict preference, we said that given any two consumption bundles (X_1, X_2) and (Y_1, Y_2), the consumer definitely wants the X bundle than the Y bundle if (X_1, X_2) > (Y_1, Y_2).This means, the consumer preferred bundle (X_1, X_2) to bundle (Y_1, Y_2) if and only if the utility (X_1, X_2) is larger than the utility of (Y_1, Y_2).

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. For example, no-smokers do not derive any utility from cigarettes.
- 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.

A Consumer considers the following points to get maximum utility (satisfaction):

- How much satisfaction he gets from buying and then consuming an extra unit of a good or service.
- The price he pays to get the good.
- The satisfaction he gets from consuming alternative products.
- The prices of alternative goods and services.

1.2: Approaches to Consumer Optimum

There are two major approaches of measuring utility. These are Cardinal and ordinal approaches. This sub unit is divided into two Sections. In this Section will be discussed these two approaches.

A. The Cardinal Utility theory

Neo classical economists argued that utility is measurable like weight, height, temperature and they suggested a unit of measurement of satisfaction called utils. A util is a cardinal number like 1, 2, 3 etc. simply attached to utility. Hence, utility can be quantitatively measured.

Assumptions of Cardinal Utility theory

1. **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.
2. **Utility is Cardinally 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.
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.
4. **Limited Money Income.** The consumer has limited money income to spend on the goods and services he/she chooses to consume.
5. **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.
6. 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, $X_1, X_2, ...X_n$ the total utility is given by:

$$TU=f(X_1, X_2 .....X_n)$$

Total Utility (TU): It refers to the total amount of satisfaction a consumer gets from consuming or possessing some specific quantities of a commodity at a particular time. 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 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.

The 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.

Table1.1 Hypothetical table showing TU and MU of consuming Oranges (X)

Units of Quantity(x) consumed	**0 Unit**	**1st Unit**	**2nd unit**	**3rd unit**	**4th unit**	**5th Unit**	**6th Unit**
TU_X	0 util	10 utils	16 utils	20 utils	22 utils	22 utils	20 utils
MU_X	0	10	6	4	2	0	-2

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 consumed.

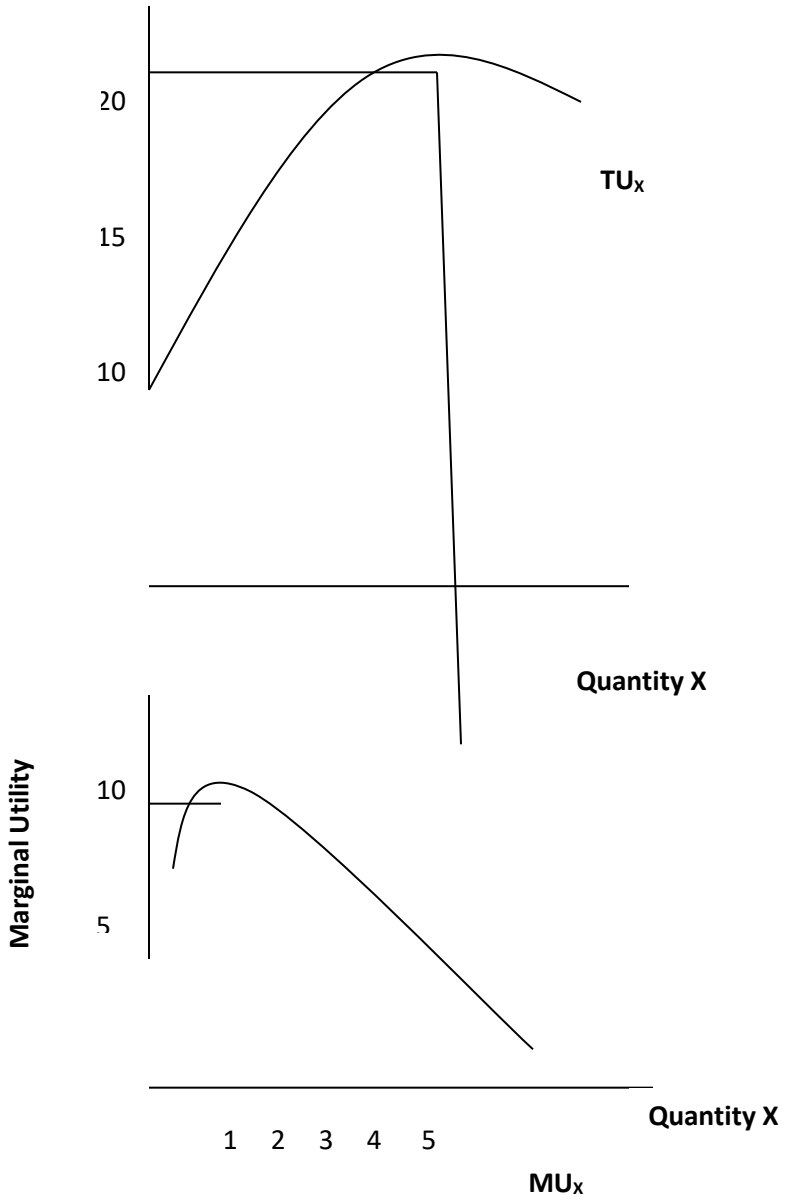


Fig.1.1Derivation of marginal utility from total utility

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 total utility curve reaches its pick point (Saturation point) at point A. This Saturation point indicates that by consuming 5 oranges, the consumer attains its highest satisfaction

of 11 utils. However, consumption beyond this point results in dissatisfaction, because consuming the 6th and more orange brings a lesser additional utility than the previous orange. Point B 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 $X_1, X_2, \ldots, Xn$, he/she would be in equilibrium or utility is maximized if and only if:

$$\frac{MU_{X1}}{P_{X_1}} = \frac{MU_{X_2}}{P_{X_2}} = \ldots\ldots\ldots = \frac{MU_{X_n}}{P_{X_n}} = MU_m$$ Where: MUm –marginal utility of money

Table 1.2 Utility schedules for a single commodity

Quantity of Orange	Total utility	Marginal utility	Marginal utility per Birr(price=2 birr)	Marginal utility of money
0	0	-	-	1
1	6	6	3	1
2	10	4	2	1
3	12	2	1	1
4	13	1	0.5	1
5	13	0	0	1
6	11	-2	-1	1

For consumption level lower than three quantities of oranges, since the marginal utility of orange is higher than the price, the consumer can increase his/her utility by consuming more quantities of oranges. On the other hand, for quantities higher than three, since the marginal utility of orange is lower than the price, the consumer can increase his/her utility by reducing its consumption of oranges.

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. $MU_X = P_X$

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

$$Max(U - Q_X P_X)$$

The necessary condition for maximization is equating the derivative of a function with zero. $\frac{dU}{dQ_X} - \frac{d(Q_X P_X)}{dQ_X} = 0$

$$\frac{dU}{dQ_X} - P_X = 0 \Rightarrow MU_X = P_X$$

Table 1.3 Utility schedule for two commodities

Orange, Price=2birr				***Banana, Price=4birr***			
Quantity	***TU***	***MU***	***MU/P***	***Quantity***	***TU***	***MU***	***MU/P***
0	***0***	***-***	***-***	***0***	***0***	***-***	***-***
1	***6***	***6***	***3***	***1***	***6***	***6***	***6***
2	***10***	***4***	***2***	***2***	***22***	***16***	***4***
3	***12***	***2***	***1***	***3***	***32***	***12***	***3***
4	***13***	***1***	***0.5***	***4***	***40***	***8***	***2***
5	***13***	***0***	***0***	***5***	***45***	***5***	***1.85***
6	***11***	***-2***	***-1***	***6***	***48***	***3***	***0.75***

Utility is maximized when the condition of marginal utility of one commodity divided by its market price is equal to the marginal utility of the other commodity divided by its market price **MU i.e.** $\frac{MU_1}{P_1} = \frac{MU_2}{P_2}$

Thus, the consumer will be at equilibrium when he consumes 2 quantities of Orange and 4 quantities of banana, because $\frac{MU_{orange}}{P_{orange}} = \frac{MU_{banana}}{P_{banana}} = \frac{4}{2} = \frac{8}{4} = 2$

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.

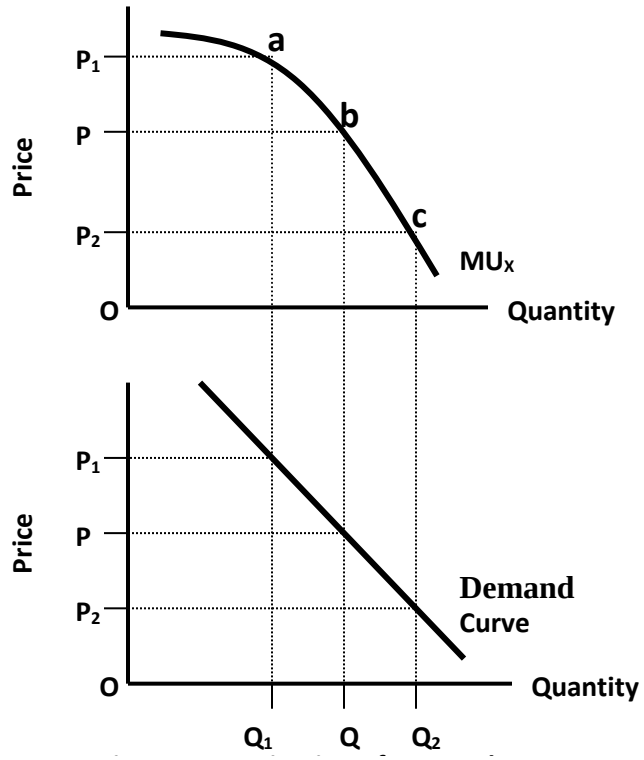


Fig.1.2 Derivation of Cardinalist Demand curve

Limitation of the Cardinalist approach

The Cardinalist approach involves the following three weaknesses:

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

B. The Ordinal Utility Theory

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, 2 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 $1^{st}2^{nd}3^{rd}$ and so on.

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 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. 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, X_3, …)
5. Preferences are transitive or consistent:
    - It is transitive 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 >Y).

The ordinal utility approach is expressed or explained with the help of indifference curves. An indifference curve is a concept used to represent an ordinal measure of the tastes and preferences of the consumer and to show how he/she maximizes utility in spending income. Since it uses ICs to study the consumer's behavior, the ordinal utility theory is also known as the Indifference Curve Analysis.

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.

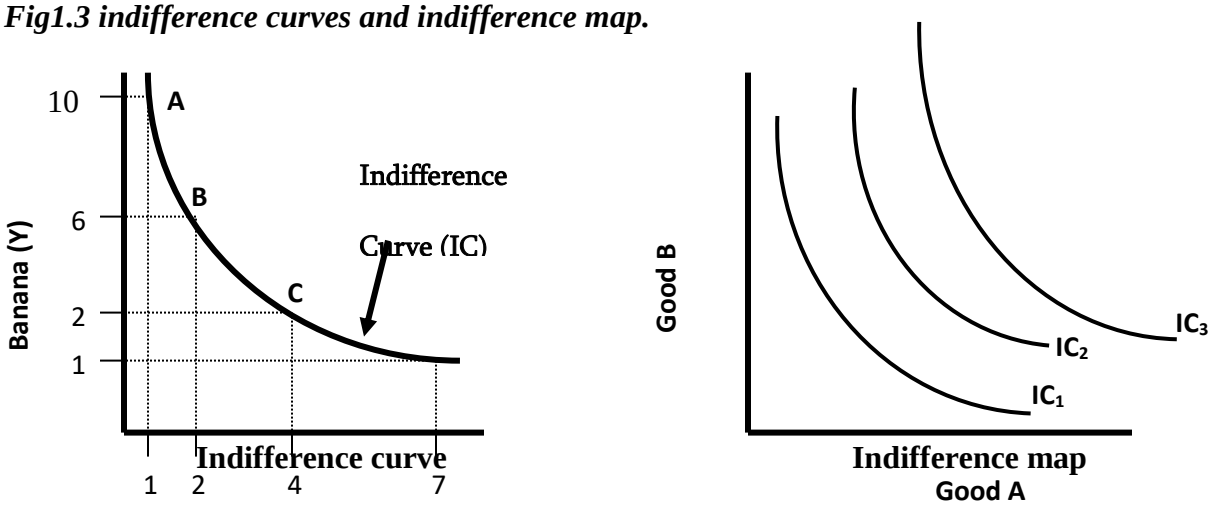
Table 1.4 Indifference Schedule

Bundle (Combination)	A	B	C	D
Orange(X)	1	2	4	7
Banana (Y)	10	6	3	1

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 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.

Fig1.3 indifference curves and indifference map.

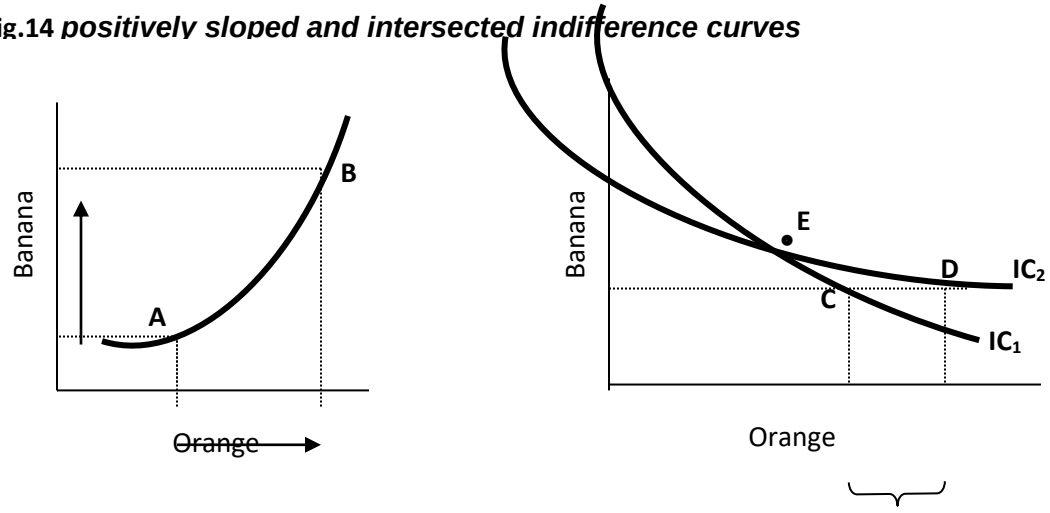


Indifference Map: To describe a person's preferences for all combinations potato and meat, we can graph a set of indifference curves called an indifference map. In other words it is the entire set of indifference curves is known as an indifference map, which reflects the entire set of tastes and preferences of the consumer. A higher indifference curve refers to a higher level of satisfaction and a lower indifference curve shows lesser satisfaction. IC2 reflects higher level of utility than that of IC1.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). It is because the consumption level of one commodity can be increased only by reducing the consumption level of the other commodity. That means, if the quantity of one commodity increases with the quantity of the other remaining constant, the total utility of the consumer increases. On the other hand, if the quantity of one commodity decreases with the quantity of the other remaining constant, the total utility of the consumer reduces. Hence, in order to keep the utility of the consumer constant, as the quantity of one commodity is increased, the quantity of the other must be decreased.
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.

Fig.14 ***positively sloped and intersected indifference curves***



As we discussed earlier, Indifference curves cannot intersect each other. If they did, the consumer would be indifferent between C and E, (Right panel of figure 2.6) since both are on indifference curve one (IC1). Similarly, the consumer would be indifferent between points D and E, since they are on the same indifference curve, IC2. By transitivity, the consumer must also be indifferent between C and D. However, a rational consumer would prefer D to C because he/she can have more Orange at point D (more Orange by an amount of X).

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.

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

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 indifference curve, $\frac{\Delta y}{\Delta x} = MRS_{X,Y}$

In other words, MRS refers to the amount of one commodity that an individual is willing to give up to get an additional unit of another good while maintaining the same level of satisfaction or remaining on the same indifference curve. The diminishing slope of the indifference curve means the willingness to substitute X for Y diminishes as one move down the curve.

$MRS_{X,Y}$ measures the downward vertical distance (the amount of y that the individual is willing to give up) per unit of horizontal distance (i.e. per additional unit of x required) to remain on the same indifference curve. That is, $MRS_{X,Y} = -\frac{\Delta Y}{\Delta X}$ because of the reduction in Y, MRS is negative. However, we multiply by negative one and express $MRS_{X,Y}$ as a positive value.

The rationale behind the convexity, that is, diminishing MRS, is that a consumer's subjective willingness to substitute A for B (or B for A) will depend on the amounts of B and **A** he/she possesses.

Table1.5 level of consumption of good X and Y

Bundle (Combination)	A	B	C	D
Orange(X)	1	2	4	7
Banana (Y)	10	6	3	1

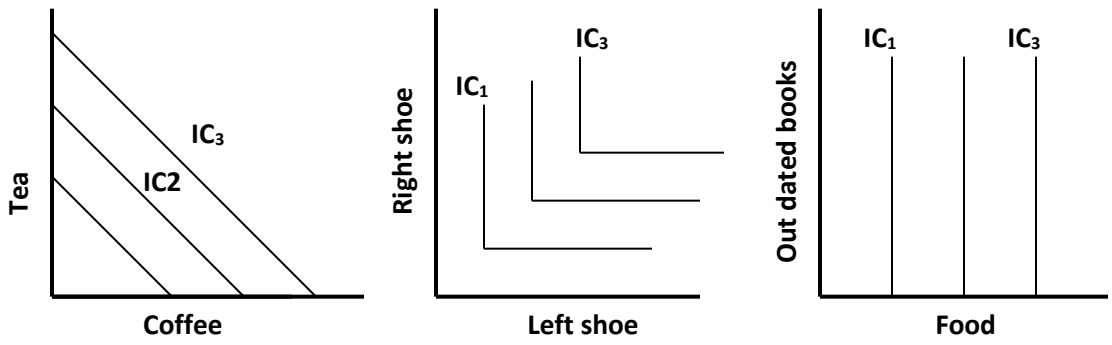
$$MRS_{X,Y}(between\ points\ A\ and\ B = \frac{\Delta Y}{\Delta X} = \frac{4}{1} = 4$$

It means the consumer is willing to forgo 4 units of Banana to obtain 1 more unit of Orange. If the consumer moves from point B to point C, he is willing to give up only 2 units of Banana(Y) to obtain 1 unit of Orange (X), so the MRS is 2($\Delta Y/\Delta X$ =4/2). Having still less of Banana and more of Orange at point D, the consumer is willing to give up only 1 unit of Banana so as to obtain 3 units of Orange. In this case, the MRS falls to ⅓. In general, as the amount of Y increases, the marginal utility of additional units of Y decreases. Similarly, as the quantity of X decreases, its marginal utility increases. In addition, the MRS decreases as one move downwards to the right.

Special Indifference Curves

I. 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. (Panel a)

Fig.1.5 Special cases of indifference curves



II. Perfect complements: If two commodities are perfect complements the indifference curve takes the shape of a right angle. Suppose that an individual prefers to consume left shoes (on the horizontal axis) and right shoes on the vertical axis in pairs. 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_{XY} is the same, i.e. zero).

III.A useless good (Neutral): Panel C in the above figure shows an individual's indifference curve for food (on the horizontal axis) and an out-dated book, a useless good, (on the vertical axis). Since they are totally useless, increasing purchases of out-dated books does not increase utility. This person enjoys a higher level of utility only by getting additional food consumption. For example, the vertical indifference curve IC_2 shows that utility will be IC_2 as long as this person has some units of food no matter how many out dated books he/she has.

IV. Bads: A **bad** is a commodity that the consumer doesn't like. For example, let's assume that we pick a bundle ($x1$, $x2$) consisting of some good and some bad. Then, if we give the consumer more bad, we have to give him some extra good to compensate him for having to put up with the bad. Thus, this consumer must have indifference curves that slope up and to the right. The direction of increasing preference is down and to the right—that is, toward the direction of decreased bad consumption and increased good consumption.

***graph

1.3 The Budget Line or the Price line

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, Px and Py, of good X and good Y respectivley; and
3. the consumer has a known and fixed money income (M).

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.

Suppose for example a household with 30 Birr per day to spend on banana (X) at 5 Birr each and Orange(Y) at 2 Birr each. That is, $P_X = 5, P_Y = 2, M = 30 birr$.

Therefore, our budget line equation will be: $5X + 2Y = 30$

Table 1.6 Alternative purchase possibilities of the two goods

Consumption Alternatives	**A**	**B**	**C**	**D**	**E**	**F**
Kgs of banana (X)	0	1	2	3	4	6
Kgs of Orange(Y)	15	12.5	10	7.5	5	0
Total Expenditure	30	30	30	30	30	30

At alternative A, the consumer is using all of his /her income for good Y. Mathematically it is the y-intercept (0, 15). And at alternative F, the consumer is spending all his income

for good X. mathematically; it is the x-intercept (6, 0). We may present the income constraint graphically by the budget line whose equation is derived from the budget equation.

$$M = P_X X + P_Y Y$$
$$M - XP_X = YP_Y$$

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

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

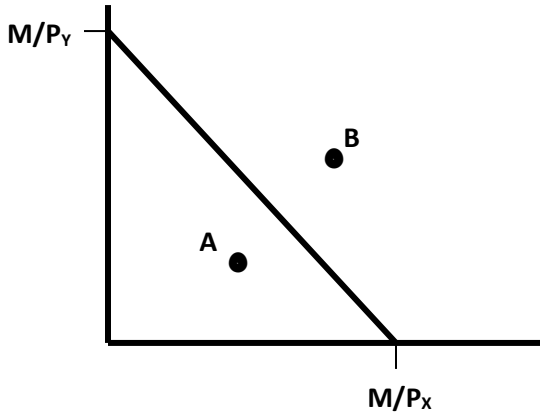


Fig.1.6 Derivation of the Budget Line

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

Factors Affecting the Budget Line

Changes in income

If the income of the consumer changes (keeping the prices of the commodities unchanged) the budget line also shifts (changes).

Changes in Price of the commodities

Disproportional 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.

1.4 Optimum of the Consumer

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_{XY}) 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 $MRS_{XY} = P_X / P_Y$.

The preferences of the consumer (what he/she wishes) are indicated by the indifference curve and the budget line specifies the different combinations of X and Y the consumer can purchase with the limited income. Therefore, the consumer tries to obtain the highest possible satisfaction with in his budget line. However, the consumer cannot purchase any bundle lying above and to the right of the budget line. Because Indifference curves above the region of the budget line are beyond the reach of the consumer and are irrelevant for equilibrium consideration. The question then arises as to which combinations of X and Y the rational consumer will purchase.

Graphically, the consumer optimum or equilibrium is depicted as follows:

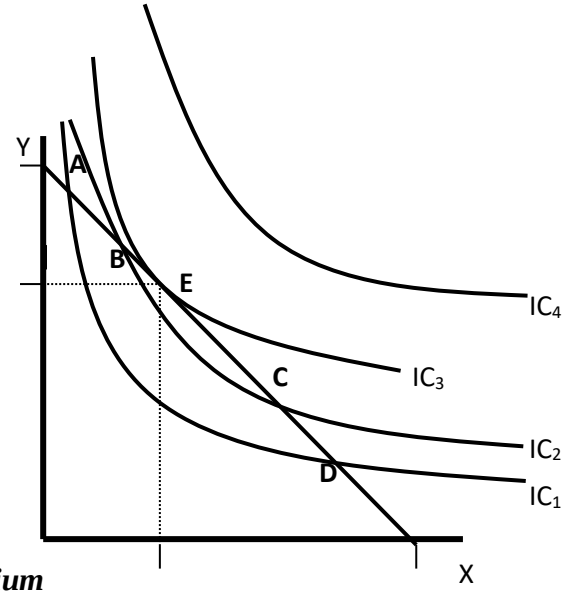


Figure1.12 Consumer equilibrium

At point 'A' on the budget line, the consumer gets IC_1 level of satisfaction. When he/she moves down to point 'B' by reallocating his total income in favor of X he/she derives greater level of satisfaction that is indicated by IC_2. Thus, point 'B' is preferred to point 'A'. Moving further down to point 'E', the consumer obtains the greatest level of satisfaction (IC3) relative to other indifference curves.

Therefore, point 'E' (which represents combination X and Y) is the most preferred position by the consumer since he/she attains the highest level of satisfaction within his/her reach and point 'E' is known as the point of consumer equilibrium (or consumer optimum). This equilibrium occurs at the point of tangency between the highest possible indifference curve and the budget line. Put differently, equilibrium is established at the point where the slope of the budget line is equal to the slope of the indifference curve.

******Mathematical derivation of equilibrium*- to be discussed in *class***

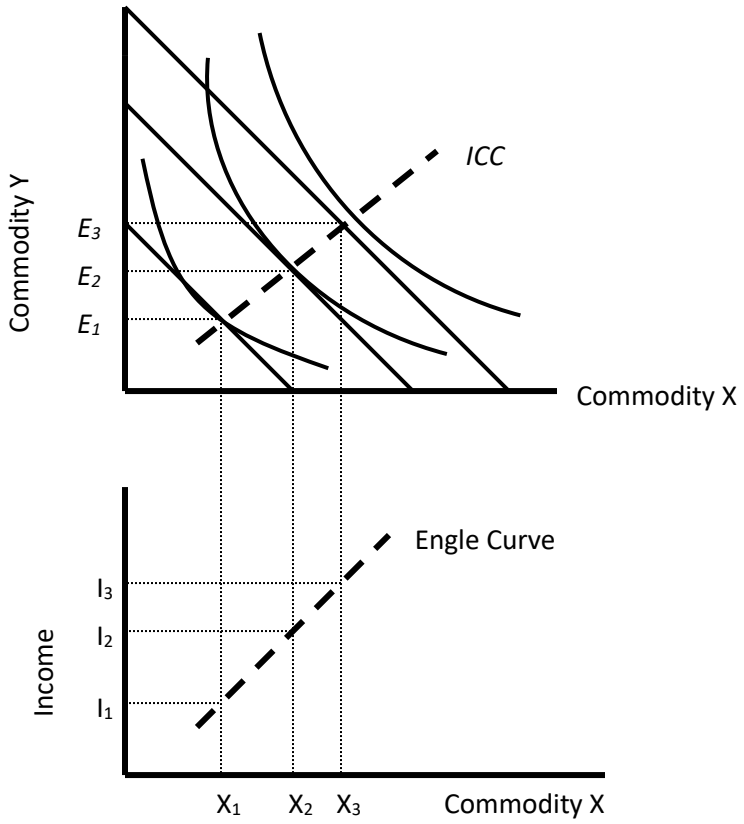
1.5 Effects of Changes in Income and Prices on Consumer Optimum

I. Changes in Income: Income Consumption Curve and the Engel Curve

In our previous discussion, we noted that an increase in the consumer's income (all other things held constant) results in an upward parallel shift of the budget line. This allows the consumer to buy more of the two goods. 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; (all other things remaining the same) 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.

For example, in the figure below good Y is a normal good while good X is a normal good until the person's level of income reaches M_2 .Thus, when income increases beyond M_2, the person will buy less of good X as his income increases. Therefore, good X is a normal good Up to point A and becomes an inferior good as the income consumption curve bends backward.

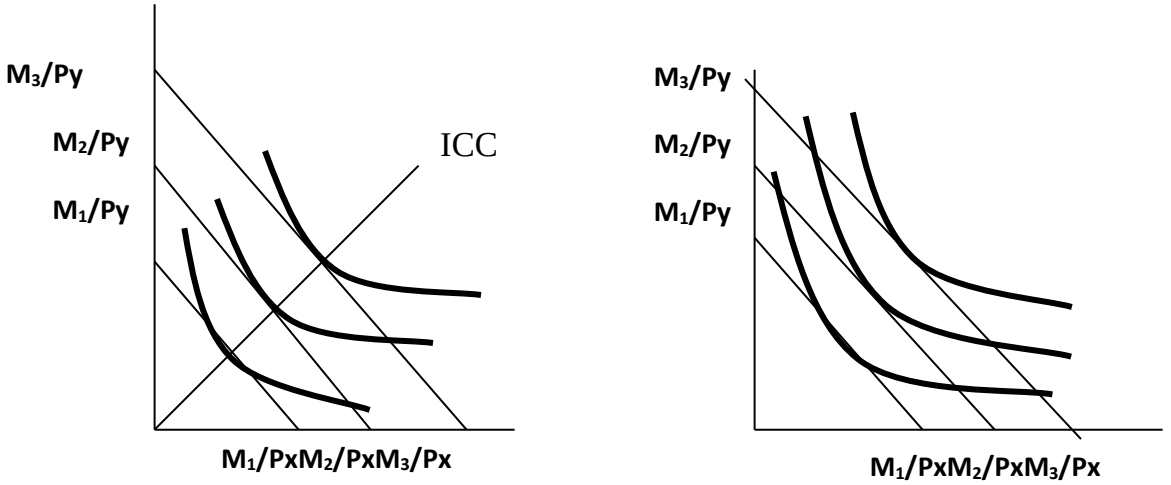


Figure 1.14 income consumption curves

I. Changes in Price: Price Consumption Curve and Individual Demand Curve

We now look at the second factor that affects the equilibrium of the consumer that is price of the goods. The effect of price on the consumption of good is even more important to economists than the effect of changes in income. Here, we hold money income constant and let price change to analyze the effect on consumer behavior.

In our earlier previous discussion, we have seen that an increase in the price of good X, for example, increases the absolute value of the slope of the budget line, but it does not affect the vertical (Y) intercept of the line. Thus, the change 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.

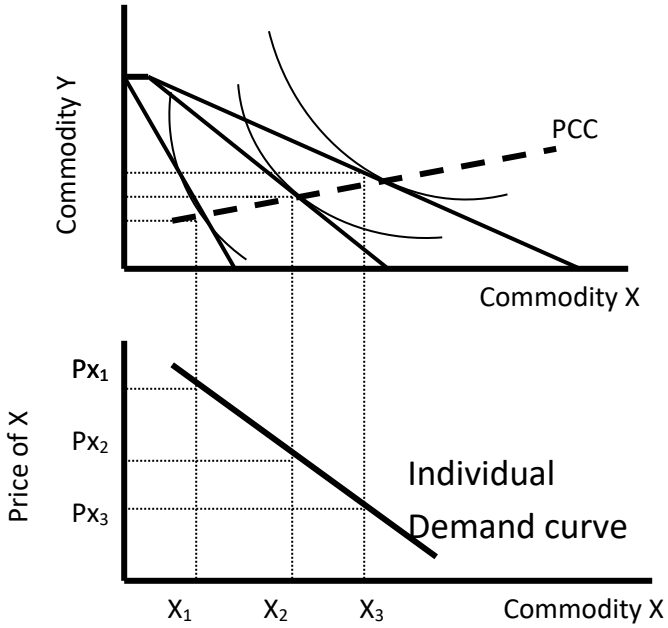


Figure1.15 the PPC and derivation of the demand curve

1.6 Elasticity of demand

Law of demand indicates only the direction of change in quantity demanded in response to a change in price. This does not tell us by how much or to what extent the quantity demanded of a good will change in response to change in its price. This information as to how much or to what extent the quantity demanded of a good will change as a result of a change in its price is provided by the concept of elasticity of demand. The concept of elasticity of demand refers to the degree of responsiveness of quantity demanded of a good to a change in its price, consumer's income and prices of related goods.

Accordingly, there are three concepts of demand elasticity:

- Price elasticity
- Income elasticity
- Cross elasticity

I. Price elasticity of Demand

It indicates the degree of responsiveness of quantity demanded of a good to the change in its price, other factors such as income, price of related commodities that determine demand are held constant. And mathematically can be calculated as:

Price elasticity of demand (e_p) $= \frac{percenatage\ change\ in\ quantity\ demanded}{percentage\ chnage\ in\ price}$

$E_p = \%\Delta Q_d / \%\Delta P$

$$\frac{\%\Delta Qd}{\%\Delta P} = \frac{(Q1-Qo)/Qo*100}{(P1-Po)/Po*100} = \frac{(Q1-Qo)*Po}{(P1-Po)*Qo} = \frac{(Q1-Qo)}{(P1-Po)}*\frac{Po}{Qo}$$

where, Ep = price elasticity of demand

ΔQd = change in quantity demanded

ΔP = change in price

$NB: -Ep = Ed$

Ep = ΔQd/ΔP * Po/Qo — It is known as point price elasticity of demand

We also use another formula to determine price elasticity of demand if the change in price is substantially large. This is called Arc price elasticity of demand or mid-point elasticity of demand. And measures the average responsiveness of quantity demanded between two points on the demand curve to change in price other things remaining constant.

Mathematically,

$E_p = \frac{\%\Delta Qd}{\%\Delta P}$

$= \left(\frac{Q1-Q0}{Q1+Q0}\right)*100\% \Big/ \frac{P1-P0}{P1+P0})*100\%$

$= (\frac{Q1-Q0}{Q1+Q0})*(\frac{P1+P0}{P1-P0}) = (\frac{Q1-Q0}{P1-P0})*(\frac{P1+P0}{Q1+Q0})$

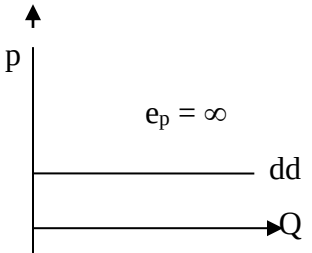
$E_p = \left(\frac{\Delta Qd}{\Delta P}\right)*)*(\frac{P1+P0}{Q1+Q0})$

NB: - when the change in price is quite large, say more than 5 percent, and also when we want to measure elasticity between two points then accurate measure of price elasticity of demand can be obtained by taking the average of original price and subsequent price as well as average of the original quantity and subsequent quantity as the basis of measurement of percentage changes in price and quantity. Moreover

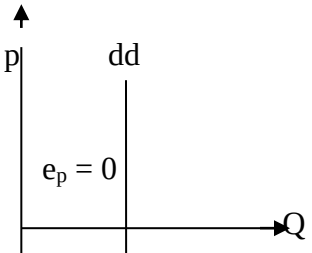
- ✓ E_p is unit free because it is a ratio of percentage change
- ✓ E_p is usually a negative number because of the law of demand i.e. negative relationship between price and quantity demand. So we can take the absolute value of /Ep/.

The main reason for differences in elasticity of demand is the possibility of substitution i.e. the presence or absence of competing substitutes. The greater the ease with which substitutes can be found for a commodity or with which it can be substituted for other commodities, the greater will be the price elasticity of demand of that commodity. The demand for salt is inelastic since it satisfies a basic human want and no substitutes for it are available. People would consume almost the quantity of salt whether it become slightly cheaper or dearer than before.

Perfectly elastic and perfectly inelastic: in perfectly inelastic whatever the price, quantity demanded of the commodity remains unchanged. An approximate example of perfectly inelastic demand is the demand of acute diabetic patient for insulin. Because he/she has to get the prescribed doze of insulin per week whatever its price. In perfectly elastic demand the horizontal demand curve for a product implies that a small reduction in price would cause the buyers to increase the quantity demanded from zero to all they could obtain. On the other hand, a small rise in price of the product will cause the buyers to switch completely away from the product so that its quantity demanded falls to zero. The perfectly elastic demand curve found for the product of an individual firm working under perfect competition. Products of different firms working under perfect competition are completely identical. If any perfectly competitive firm raises the price of its product, it would lose all its customers who would switch over to other firms and if it reduces its price somewhat it would get all the customers to buy the product from it.



a) Perfectly elastic dd curve



b) Perfectly Inelastic dd curve

II. Cross elasticity of demand

Degree of responsiveness of demand for one good in response to the change in prices of another good represents the cross elasticity of demand of one good for the other.

We can measure the responsiveness or sensitivity in the quantity purchased of commodity X as a result of a change in the price of commodity Y by the cross elasticity of demand (E_{xy}). This is given by:

Coefficient of cross elasticity = $\frac{percentage\ change\ in\ the\ quantity\ demanded\ of\ X}{percentage\ change\ in\ the\ price\ of\ good\ Y}$

Exy = $\frac{\Delta Qx}{\Delta P_Y} . P_{Y_0} \big/ Qx_0$ ---------- point formula

Exy = $\frac{\Delta Q_x}{\Delta P_Y} . \left(\frac{Py_1 + Py_2}{Qx_1 + Q_2} \right)$ ---------- Arc Formula

- ✓ Substitute goods, Exy>0.
- ✓ Complement goods, Exy< 0
- ✓ Unrelated goods ,Exy = 0,

III. Income Elasticity (E1)

Income elasticity of demand shows the degree of responsiveness of quantity demanded of a good to a small change in the income of consumers. And this is measured by:

Income elasticity = $\frac{percentage\ change\ in\ the\ quantity\ demanded}{percentage\ change\ in\ income}$

$E_I = \frac{\%\Delta Qd}{\%\Delta I} = \left(\frac{Q_1 - Q_0}{I_1 - I_0} \right) \left(\frac{I_0}{Q_0} \right) = \frac{\Delta Qd}{\Delta I} * \frac{I_0}{Q_0}$ …….. Point income elasticity of demand

$\overline{E}_I \left(\frac{Q_1 - Q_0}{I_1 - I_0} \right) \left(\frac{I_1 + I_0}{Q_1 + Q_0} \right)$ ……Arc income elasticity of demand formula

The result for income elasticity can be:

a) Positive ($E_I > 0$): if it is Normal Goods that Consumption of the goods varies directly (positively) with income i.e. when income increases consumption of these goods also increases& vice Versa.
   - ✓ A good having income elasticity more than one and which therefore bulks larger in consumer's budget as he becomes richer is called a luxury.
   - ✓ A good with an income elasticity less than one and which claims declining proportion of consumer's income as he becomes richer is called a necessity.
   - ✓ When income elasticity of demand for a good is equal to one, then proportion of income spent on the good remains the same as consumer's income increases.

b) Negative ($E_I < 0$): if it is inferior goods in such increase in income will lead to the fall in quantity demanded of the goods.

c) $E_I = 0$, means consumption of the good does not vary with income, e.g. salt