Consumer's Behavior

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It covers..

- Meaning of utility and utility analysis
- Approaches/ theories of utility analysis
- Cardinal Utility Analysis
- Assumptions of cardinal utility analysis
- Basic terminologies/concepts used in cardinal utility analysis
- Relationship between Total Utility and Marginal Utility
- Law of diminishing marginal utility
- Law of substitution

Meaning of Utility

- The concept of utility was introduced by ***British Philosopher Jeremy Bentham in 1789.***
- The term utility refers to the want satisfying power of goods and services.
- In economics, the term utility refers to *'the pleasure or satisfaction that individuals get from their economic activity.'*
- It is essentially subjective and psychological phenomenon and differ from person to person, place to place and time to time.
- All those goods and services which have the capacity to satisfy human wants are said to contain utility in the viewpoint of economics.

Meaning of Utility Analysis

- Economics assumes consumers are rational in the sense that they always attempt to maximize their utility subject to budget constraint.
- Utility analysis is a study of consumer's behavior related to maximization of utility (satisfaction) by consuming goods/services with limited income. (How they are maximizing their utility – techniques)

Theories on Utility Analysis/ Approaches

1. **Cardinal Approach/Cardinal utility analysis**
2. **Ordinal Approach/Ordinal utility analysis**

Cardinal Utility Analysis (Cardinal Approach to Consumer Behavior)

- **German economist Hermann Heinrich Gossen** had developed the concept of cardinal utility analysis at the first.
- **Other classical economists like, William S. Jevons, Leon Walras and Karl Manger** have further contributed to establish it.
- Finally, this analysis has **been popularized by Alfred Marshall and A.C. Pigou.** This approach is also popularly known as *"Marshallian Utility Analysis."*
- According to this concept, it is possible to measure and compare the utilities obtained from consumption in terms of mathematical numbers.

Assumptions Of Cardinal Approach

The cardinal measurement of consumer's preference is based on following assumptions;

- ***Rationality:*** It is assumed that consumer is rational in the sense that, consumer tries to maximize his satisfaction at given level of budget constraint.
- ***Cardinal utility measurement*:** The utility obtained from consumption of goods and services can be measured in terms of mathematical numbers. Thus, utility become cardinal concept.
- ***Constant marginal utility of money:*** Marginal utility of money should remain constant, and it is used as a measuring rod of utility. Alfred Marshall measured marginal utility obtained from any good or service in terms of money by assuming constant marginal utility of money even with the change in the price of the commodity.

- **Diminishing marginal utility**: If a consumer consumes the successive units of the same commodity one after another, the satisfaction which is derived from the additional units of the commodity goes on diminishing.
- **Independent utility:** It refers to a condition under which utility received from a good does not affect the utility received from another good. Because of this assumption, substitutes and complements are ignored from the theory.
- **Utility is additive:** This approach assumed that utility obtained from each commodity is additive. Suppose that a basket consists of commodities $X_1, X_2, X_3, \ldots, X_n$

Total utility obtained from $X_1 = U_{x1}$

Total utility obtained from $X_2 = U_{x2}$

Total utility obtained from $X_3 = U_{x3}$

Total utility obtained from $X_n = U_{xn}$

$TU = U_{x1} + U_{x2} + U_{x3} + \ldots\ldots\ldots + U_{xn}$

Basic terminologies/concepts

Total Utility (TU)

- Total satisfaction obtained by the consumer from consuming all the available units of the commodity is called total utility.
- It is the sum of all the marginal utilities associated with each units of consumption.
- Hence if we sum the utilities obtained from the consumption of different units of a particular commodity at a given time period then we get the numerical value of total utility.

Total Utility….

Mathematically,

$TU = \sum MU = MU_1 + MU_2 + \ldots\ldots\ldots + MU_n$

Where TU= Total Utility; MU_1= Marginal utility obtained from consumption of 1st unit of a particular commodity (so on…..n)

For example, if A consumes 3 biscuits and obtains 5, 4 and 3 units of utility from first, second and third biscuits respectively then the total utility is 5+4+3=12 units

Marginal Utility

- It is the additional utility derived from additional unit of a commodity.
- Hence, it is the change in total utility while consuming one more unit of commodity.
- In other words, it is the ratio of change in total utility with the change in units of commodity (normally one unit).

Mathematically,

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

Where ΔTU= change in total utility; ΔQ = change in unit of commodity consumed by consumer

Marginal Utility…

Alternatively,

MU= TU_n- TU_{n-1}

Where TU_n= total utility at n unit of consumption; TU_{n-1}= total utility at n-1 unit of consumption

For example, a consumer obtains 100 units of total utility from consumption of three biscuit and if he consumes fourth biscuit total utility becomes 105 units then his marginal utility= 105-100= 5 units. (TU_n= 4^{th} biscuit and TU_{n-1}=3^{rd} biscuit)

Average Utility

- Per unit utility derived from consumption of given units of the commodity is called average utility.
- It is the outcome of total utility divided by units of commodity consumed.

Mathematically,

$$AU = \frac{TU}{Q}$$

Where AU= average utility; TU= total utility; Q= unit of commodity consumed

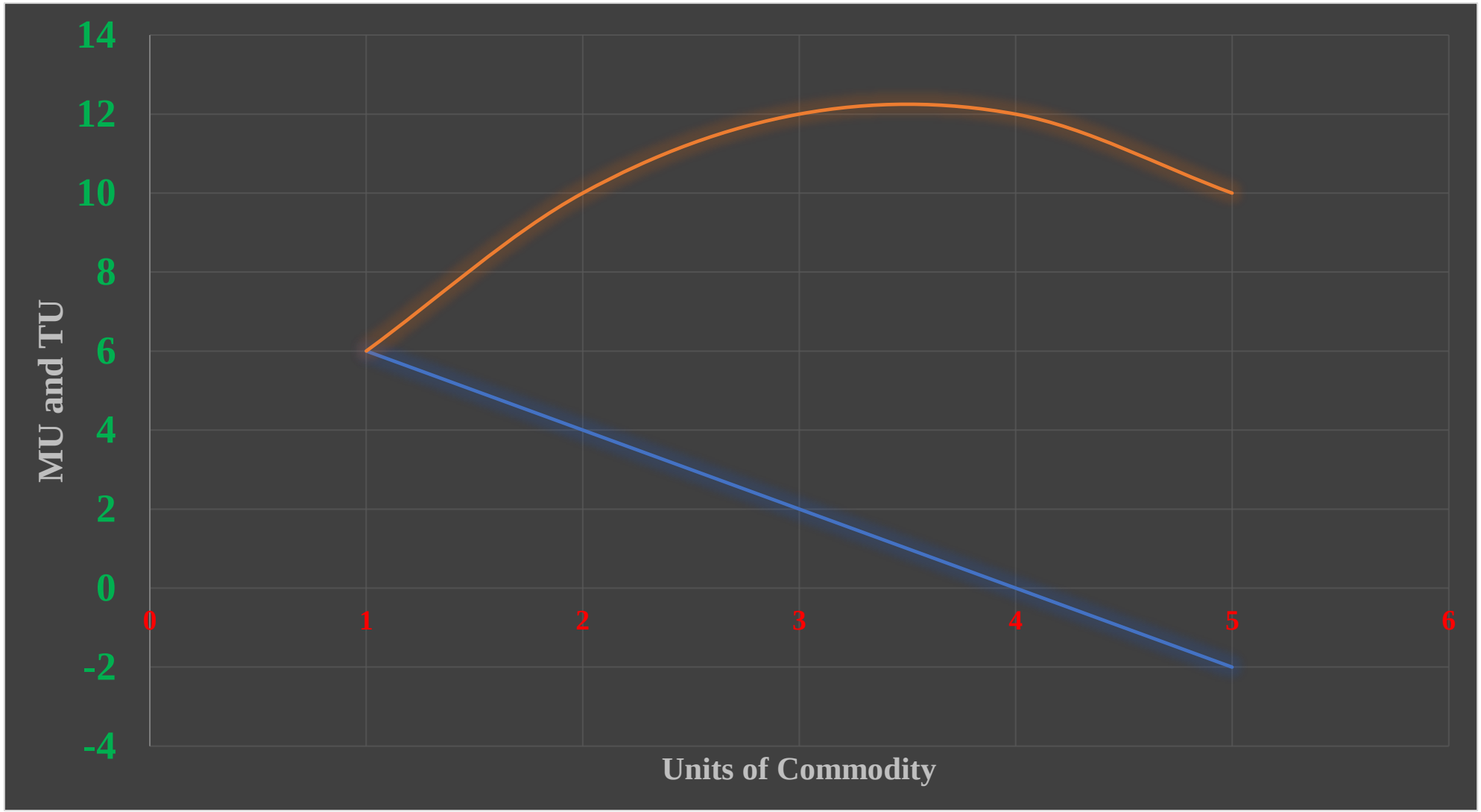
Relationship between TU and MU

- There is direct relationship between total utility and marginal utility.
- Total utility is always based on marginal utility as TU is summation of MUs.
- The relationship between TU and MU can be explained with help of following table;

Commodity (In units)	TU (In units)	MU (In units)	Forms of marginal utility
1	6	6	Positive MU & TU is increasing
2	10	4	
3	12	2	
4	12	0	Zero MU & TU is maximum
5	10	-2	Negative MU & TU is decreasing

- In the above table, there are three forms of MU (positive, zero, and negative)
- Up to 3 units of consumption, MU is decreasing and remains positive. If MU remains positive, TU increases at decreasing rate.
- When a consumer consumes the 4^{th} unit of the commodity, he gets no utility or there is zero utility and as a result, TU remains constant and becomes maximum.
- After the 4^{th} unit, if the consumer keeps consuming or if he consumes the 5^{th} unit of the commodity, MU becomes negative and with negative MU, total utility starts to decline.

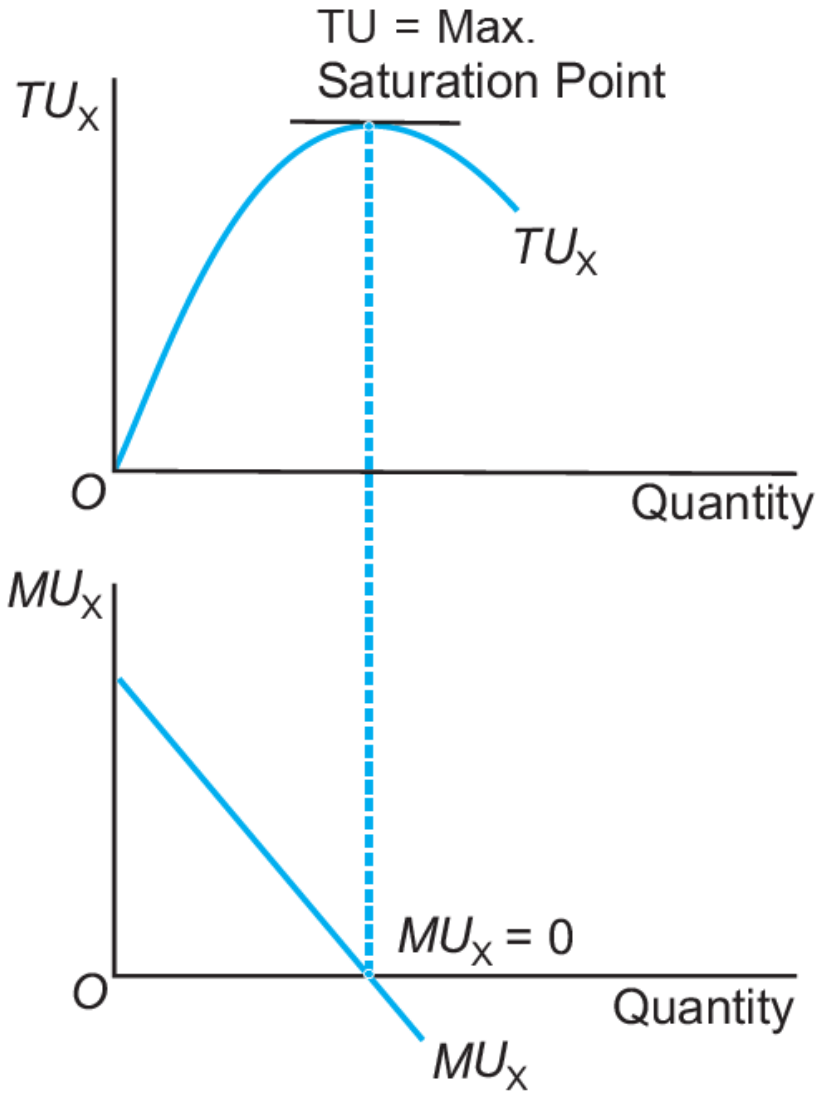
Diagrammatic Presentation



Therefore,

- When Marginal Utility is positive, Total Utility will be increasing at decreasing rate,
- When Marginal Utility is zero, Total Utility will be maximum,
- When Marginal Utility is negative, Total Utility will be decreasing,
- Total Utility is the summation of marginal utilities (TU= $\sum MU = MU_1 + MU_2 + \ldots\ldots\ldots + MU_n$)
- Total utility is maximum when the marginal utility becomes zero, but marginal utility is maximum when it is equal to total utility,
- Marginal utility can be zero and negative, but the total utility cannot be zero and negative.

Diagrammatic Presentation: Alternatively



The relationship between TR and MR can be expressed below.

(*a*) *TU* curve starts from the origin, increase at a decreasing rate, reaches a maximum and then starts falling.

(*b*) *MU* curve is the slope of the *TU* curve and given by $\frac{\Delta TU_X}{\Delta Q_X}$

(*c*) When *TU* is maximum, ***MU* is zero**, it is called **saturation point**. (since slope of *TU* curve at that point is zero). Units of the good are consumed till the saturation point.

(*d*) As long as *TU* curve is concave, *MU* curve is downward sloping and remains above the *x*-axis.

(*e*) When *TU* curve is falling, *MU* curve becomes negative.

(*f*) The falling *MU* curve shows the law of diminishing marginal utility.

The Law of Diminishing Marginal Utility

- This law was initially developed by a German economist Hermann Heinrich Gossen in 1854. So, the law is also known as the first law of Gossen.
- It was systematically formulated and made popularized by Alfred Marshall in his book 'Principle of Economics' in 1890.
- The law states that as a consumer consumes more and more units of a commodity, marginal utility derived from each successive unit goes on diminishing.

The Law of Diminishing Marginal Utility….

- A stage comes when marginal utility becomes zero. At this point total utility becomes maximum. If the consumer consumes beyond this stage, marginal utility becomes negative and total utility falls. It means that consumer starts getting disutility i.e., dissatisfaction instead of getting satisfaction. Since, economists believe that a consumer is a rational being, he wants to maximize his satisfaction. A consumer would not like to go beyond zero marginal utility.
- According to Marshall, *"The additional benefit which a person derives from a given increase of his stock of a thing diminishes with every increase in stock that he already has."*

The Law of Diminishing Marginal Utility….

Assumptions

The law of diminishing marginal utility is based on the following assumptions.

- The consumer should be rational
- There is cardinal measurement of utility
- Units of a product are homogeneous
- Constant marginal utility of money
- No time gap in consumption
- Taste, habit and performances of a consumer remain the same
- Units in consumption are suitable in size
- Mental and social condition of the consumer must be normal.

The Law of Diminishing Marginal Utility….

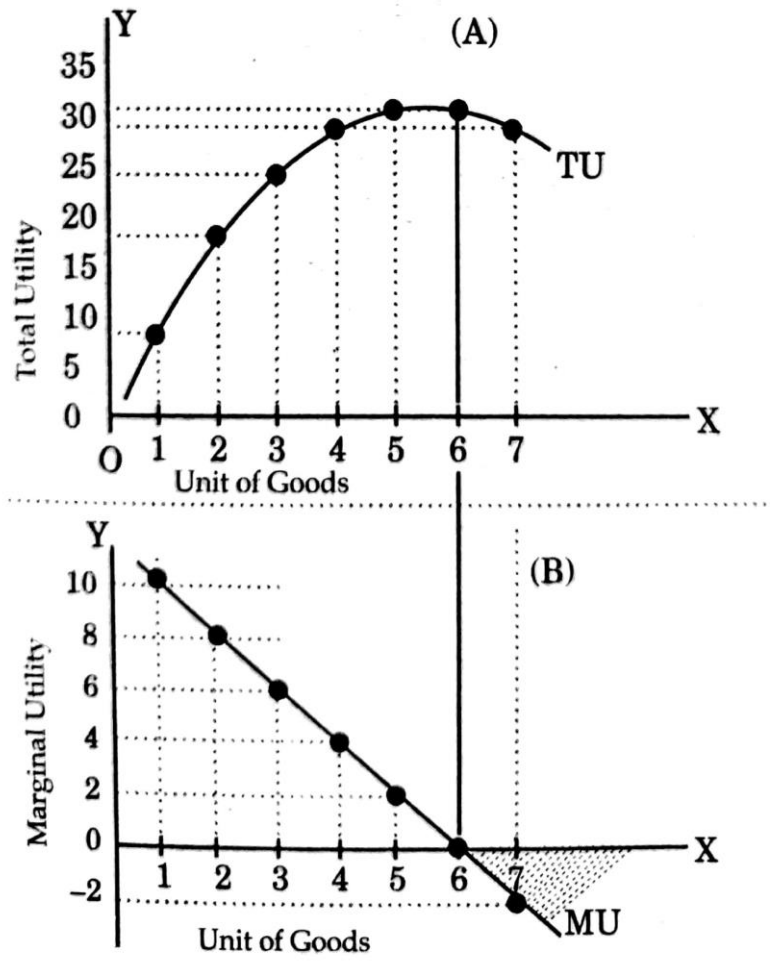
Based on the above assumptions, the law of diminishing marginal utility can be explained with help of the following schedule.

Units of good consumed	Total utility (TU) in utils	Marginal utility (MU) in utils
1	10	10
2	18	18-10=8
3	24	24-18=6
4	28	28-24=4
5	30	30-28=2
6	30	30-3-=0
7	28	28-30=-2

The table shows that when a consumer consumes first unit of a commodity, he/she obtains 10 utils of total utility. As the second units is consumed, MU is 8 units whereas TU is increased to 18 from 10 utils. In the same way, as the consumer consumes 3rd to 5th unit of goods over the time, TU increases at decreasing rate. At sixth unit of consumption, MU is zero and TU is maximum. When seventh unit is consumed, MU is negative by -2 and TU declines to 28 utils from 30 utils.

This law is also illustrated by following figure.

The Law of Diminishing Marginal Utility….



- In the diagram, TU is total utility curve and MU is marginal utility curve.
- As consumer consumes first unit of commodity, he obtains 10 utils of utility. Here both TU and MU are the same.
- When the consumer consumes unit of goods, TU increases to 18 utils from 10 utils and MU decreases to 8 utils. By adding MUs TU is obtained.
- Accordingly, when consumer consumes 6^{th} unit of good, MU decreases to zero where TU becomes maximum (30 utils).
- Beyond 6^{th} unit consumption of good, MU is negative (-2) and due to negative MU, total utility declines to 28 utils from 30 utils.
- Thus, consumer gets maximum satisfaction when MU is zero and that point is known as point of saturation.

The Law of Diminishing Marginal Utility….

Limitations/Exceptions to the Law

- If units of a commodity consumed are not of same size and shape, the law does not hold good.
- The law does not hold good when there is enough time gap between consumption of two units. For instance, if we take second apple after a long gap of time, we may feel hungry and hence satisfaction will increase instead of falling.
- The taste of consumer should not change for the law to hold good. It means that the person should consume all units of a good by same desire and pleasure.
- The law does not apply to money as it is said that more money a person has, the more he wants.
- Change in income of the consumer will falsify the law. If money income of the consumer increases or decreases during the time of consumption of a particular set of goods, the marginal utility will not fall as explained above.
- The law is applied only in the case of normal commodities but it is not valid for the rare and curious commodities like diamonds, rare paintings, ancient coins etc.

Importance of the Law of Diminishing Marginal Utility

- ***Basis of economic laws***: the law of demand, the law of substitution etc. are based on law of diminishing marginal utility.
- ***Basis of theory of taxation***: the progressive taxation principle is based on this law.
- ***Basis of price determination***: increase in supply lowers the price. This is based on the law of diminishing marginal utility.
- ***Basis for consumer's spending***: consumer stops their spending in any good at MU=Price and optimizes their spending.
- ***Basis of distribution of wealth***: more wealth in the hand of rich people is not so useful socially and if it is transferred to the poor then it will generate more utility as the marginal utility of money for the poor is greater than that of rich people.

The Law of Substitution/Law of Equi-marginal Utility

- The law of substitution also known as the law of equi-marginal utility or law of maximum satisfaction was first developed by H.H. Gossen (so it is known as the second law of Gossen) in 1854. This law is further developed and popularized by Prof. Alfred Marshall.
- According to this law, the consumer allocates her/her limited money income among various goods for getting maximum satisfaction. And the consumer gets maximum satisfaction only when s/he obtains equal marginal utilities from the consumption of different commodities.
- The law of substitution states that a consumer spends his limited income on two or more goods in such a way that the ratio of marginal utility to the price of each commodity should be equal and should be equal with the marginal utility of money.

The Law of Substitution/Law of Equi-marginal Utility…

- Algebraically, it can be stated

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \overline{MU_m}$$

Where

MU_x= Marginal utility derived from X-commodity; MU_y= Marginal utility derived from Y-commodity; P_x= Price of commodity-X; P_y= Price of commodity-Y; MU_m is Marginal utility of money

- For more than two commodity case, the required condition is

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \ldots\ldots \frac{MU_n}{P_n} = \overline{MU_m}$$

Where MU_n is marginal utility derived from nth commodity and P_n is price of nth commodity.

The Law of Substitution/Law of Equi-marginal Utility…

- If $\frac{MUx}{Px} > \frac{MUy}{Py}$ the consumer increases consumption of commodity-X until the ratio of marginal utility to price of two goods are equal as $\frac{MUx}{Px} = \frac{MUy}{Py}$ and attains equilibrium.
- On the contrary, if $\frac{MUx}{Px} < \frac{MUy}{Py}$, the consumer reduces quantity of commodity-X and increases consumption of commodity-Y until $\frac{MUx}{Px} = \frac{MUy}{Py}$ and attains equilibrium.
- This indicates that consumer continuously substitutes one commodity having higher marginal utility by another commodity having lower marginal utility until it becomes equal. Hence, this law is called substitution.

The Law of Substitution/Law of Equi-marginal Utility…

Assumptions

This law is based on the following assumptions

- *Cardinal measurement of utility*
- *Consumers are rational*
- *Income of the consumer remains constant*
- *Marginal utility of money remains constant*
- *Prices of the commodities remain constant*
- *Commodities are divisible into small units*
- *Consumption takes place at a given time period*

Based on the above assumptions, the law can be explained with the help of the following table and graph.

The Law of Substitution/Law of Equi-marginal Utility…

Suppose that a consumer wants to spend Rs. 40 on the purchase of commodity X and Y, the prices of which are Rs. 5 and Rs. 10, respectively. The table below depicts the marginal utilities of these two goods X and Y.

Units	MU_x $(utils)$	MU_y $(utils)$	$\frac{MU_x}{P_x}$ $(utils)$	$\frac{MU_y}{P_y}$ $(utils)$
(1)	(2)	(3)	(4)	(5)
1	50	80	10	8
2	45	70	9	*7*
3	40	60	8	6
4	35	50	*7*	5
5	30	40	6	4
6	25	30	5	3

The Law of Substitution/Law of Equi-marginal Utility…

- Observing the above table, column (2) shows and (3) give marginal utility of X and Y. Column (4) and (5) give the ratios of marginal utility to price of two commodities (marginal utility of a rupee spent on the purchase of two goods).
- Marginal utility per rupee spent on each good diminishes, which occurs because marginal utility of each good diminishes as we consume more of it.
- From the table, the condition $\frac{MUx}{Px} = \frac{MUy}{Py}$, can be fulfilled at many points, such as 3X and 1Y, 4X and 2Y, 5X and 3Y, 6X and 4Y.
- To purchase these different combinations of X and Y, the consumer will be required to inure different amounts of expenditure as shown in the following table.

The Law of Substitution/Law of Equi-marginal Utility…

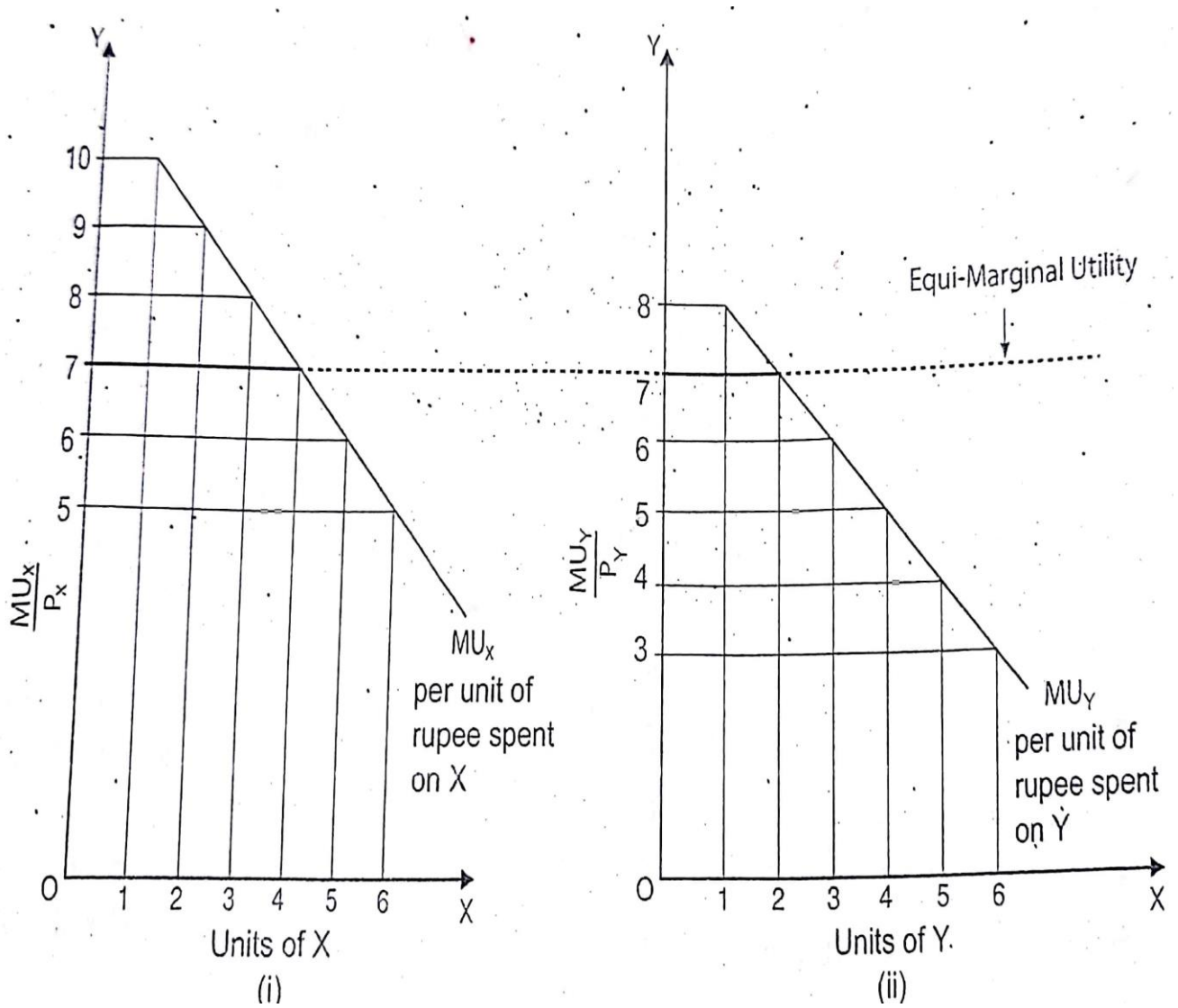
Combinations	Total Expenditure
(1)	(2)
(i) 3X +1Y	Rs. (3*5+1*10=25)
(ii) 4X+2Y	Rs. (4*5+2*10=40)
(iii) 4X+3Y	Rs. (5*5+3*10= 55)
(iv) 6X+4Y	Rs. (6*5+4*10= 70)

- Since consumer has to spend Rs. 40 on the purchase of good X and Y. If he purchases combination (i), s/he will be able to spend Rs. 25 only. If he purchases combination (iii) and (iv), s/he is required to spend Rs. 55 and Rs. 70 respectively, which are out of his reach, given the budget.
- It is only when s/he purchases combination (ii) that s/he will be able to acquire an expenditure of Rs. 40. Thus, the consumer is in equilibrium when s/he buys 4 units of X and 2 units of Y and thereby spend a sum of Rs. 40. So, the consumers equilibrium condition is when MUx/Px= MUy/Py; and at the same time, the consumer must spend the entire income on he purchase of the two commodities.

The Law of Substitution/Law of Equi-marginal Utility…

- For determining total utility that consumer has obtained from his/her income of Rs. 40, we can add the marginal utilities obtained from the purchases of each product.
- Referring the table, we can see the marginal utilities for first four units of good X are 50+45+40+35= 170 utils. Similarly, the marginal utilities for the first two units of Y are 80+70= 150 utils.
- When 4 units of X and 2 units of Y are purchased, the consumer will obtain 170+ 150= 320 utils of utility. No other combinations of X and Y can give this much utility when income is Rs. 40.
- This can be explained with help of the following diagram.

The Law of Substitution/Law of Equi-marginal Utility…



- MUx curve in Panel (i) shows the marginal utility per unit of rupee spent on commodity X corresponding to different units of X, MUy curve in Panel (ii) shows the marginal utility per unit of rupee spent on commodity Y.
- These two curves are negatively sloped because of the diminishing marginal utilities of each good.
- It is cleared from the graph that when the consumer buys 4 units of commodity X and 2 units of commodity Y, MUx/Px=MUy/Py is equal to 7 utils.
- The dotted line in the graph shows equal marginal utility (7 utils) from the last unit of rupee spent on both goods.

The Law of Substitution/Law of Equi-marginal Utility…

Limitations/Exceptions to the Law

- It is difficult to know marginal utilities from different commodities because they can not be measured.
- In many cases, consumers may be guided by habits and customs and therefore their decisions with regard to purchasing of different commodities are directed more by these considerations rather than economic considerations.
- Many consumers are ignorant and so, they may not be able to arrive at the equilibrium position due to their ignorance.
- In the case of expensive and indivisible commodities like cars, refrigerators, etc. it is not possible to equate the marginal utility of a rupee spent on the purchase of a car or a refrigerator. Thus this law is not applied in the case of goods which are not been divisible into small units.
- In real life utility obtained from different commodities is not independent as goods are substitutes or complements.
- When there is a change in tastes, preferences, fashions, etc. due to different factors such as the size of the population, social and economic conditions, etc.

References and Suggested Readings

- Shrestha, P.P., Adhikari, D.B., Khadka, P., & Shrestha, K. (2020). *Economics-XI*. Kathmandu: Advakce Saraswati Prakashan.
- Adhikari, R.P., Acharya, K.R., Lamichhane, B., & Gyawali, S. (2020). *Economics*. Kathmandu: Asmita Books Publisher & Distributers Pvt. Ltd.
- Ahuja, H.L. (1998). Microeconomic Theory. New Delhi: Kornark Publishers Pvt. Ltd.
- Sethi, D.K., & Andrews, U. (2018). *Economics*. New Delhi: Frank Bros. & Co.