

# Microeconomic Analysis

Prieti Gupta

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# CONTENTS

<b>S.No.</b>	<b>Page</b>
1. Theory of Consumer Behaviour : Basic Themes .....	1
2. Theory of Demand .....	9
3. Theory of Demand : Some Recent Developments .....	22
4. Theory of Production .....	29
5. Theory of Cost .....	37
6. Production Economics .....	47
7. Perfect Competition .....	55
8. Monopoly .....	60
9. Monopolistic Competition .....	69
10. Oligopoly .....	76
11. Partial and General Equilibrium Approaches : Pure Exchange Model .....	88
12. General Equilibrium with Production .....	100
13. Pigovian Vs. Paretian Approach .....	110
14. Social Welfare Function .....	118
15. Imperfect Market Externality and Public Goods .....	127
16. Social Choice and Welfare .....	137

<b>S.No.</b>	<b>Page</b>
17. Choice in Uncertain Situations .....	145
18. Insurance Choice and Risk .....	155
19. Economics of Information .....	163
20. Perfect Informative Game .....	177
21. Perfect Informative in Active Game – Applications .....	184
22. Perfect Informative Active Game .....	192
23. In Active Game with Insufficient Information .....	203
24. Dynamic Game with Imperfect Information : Pure Bayesian Equilibrium .....	209
25. Signaling Game and their Applications .....	214
26. Modification of Pure Bayesian Equilibrium .....	219

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# MICROECONOMIC ANALYSIS

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## Theory of Consumer Behaviour : Basic Themes

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### **INTRODUCTION**

Market aggregate demand curve for a commodity is downward sloping in a situation where market prices are given to consumers and they cannot influence the market prices by changing their consumption. Here, we will investigate the economic rationality behind this for a commodity of all individual consumers. This chapter will enable you to determine the optimum choice of a consumer, explain how the price effect can be decomposed into income effect and substitution effect and determine the individual demand curve. The market demand mainly depends on the nature of demand for a commodity by individual consumers and the demand for a commodity of an individual consumer depends upon the behaviour of the consumer. Now we will begin with the analysis of consumer behaviour to clearly investigate the economic rationality behind the law of demand.

### **CHAPTER AT A GLANCE**

#### **THE BASIC THEMES**

The consumer behaviour can be analysed through different approaches. In all approaches, it is assumed that the consumer is rational and derives maximum utility from a given amount of money. He compares the marginal utility derived from one commodity bundle with the marginal utility derived from another commodity bundle and chooses one commodity bundle from among all the commodity bundles. The consumer distributes the resources which are with him in such a way that he derives maximum satisfaction.

The assumption will be based on the condition that the consumer has a fixed income and the prices of all goods are given and are fully known to the consumer.

#### **CONSUMER CHOICE CONCERNING UTILITY**

Every commodity which a consumer consumes yields some utility and the utility is a measurable

concept. The consumer cannot maximize his satisfaction unless he measures utility of a commodity. Utility can be measured differently by different approaches. However, there are two main approaches:

**1. Cardinal Theory : An Introduction**

**2. Ordinal Theory : A Short Note**

#### **1. Cardinal Theory: An Introduction**

The cardinal utility approach is also known as marginal utility analysis. In this approach, utility derived from each commodity is measured on a cardinal scale or numerically in terms of money. It is a short period analysis and here the consumer knows which commodity is preferred and the price of that commodity.

Following are the main assumptions of the cardinal utility approach.

1. Consumer is rational. He aims at maximizing his utility by selecting one of the commodity bundles at given prices of commodities and money income.
2. The total utility of the consumer depends on the quantity of consumption, if the taste and preferences are given.
3. Goods are good. The marginal utility is positive. It means if 'U' is utility level of the consumer and 'x' the consumption level, as 'x' increases (decreases), 'U' increases (decreases).
4. Marginal utility of 'x' is diminishing or downward sloping. It means a 'x' increases (decreases), the  $MU_x$  (marginal utility of the consumption) decreases (increases).
5. Utility is measured cardinally or numerically in terms of money. Therefore, the consumer knows which commodity bundle is preferred and by how much amount.
6. The Marginal Utility of money ( $MU_m$ ) is positive and constant. The validity of this assumption is that the money is used as a measuring rod of utility. Thus  $MU_m = \lambda$ , where  $\lambda$  is positive and constant. It means as money income increases (decreases) by one unit, utility increases (decreases) by  $\lambda$  unit.

**Consumer Equilibrium**

As per the assumption, the gross utility the consumer gets is  $U(q)$  for 'q' unit of consumption of the commodity. Here, the consumer must spend  $p_q \cdot q$  units of money income if  $p_q$  is the cost of the commodity 'q', which is given to the consumer. Thus, the net utility  $(N(q))$  of the consumer will be  $N(q) = U(q) - \lambda p_q \cdot q$ , where  $\lambda$  and  $p_q$  are provided to the consumer and  $\lambda$  represents fall in utility due to one unit fall in money income.

The consumer's objective is to maximize net utility  $N(q)$  by choosing 'q'. For that, we can take the first

derivative of  $N(q)$  and set that equal to zero,  $\frac{dN(q)}{dq}$

= 0. Or, consumer equilibrium, we get  $\frac{dU(q)}{dq} - \lambda p_q$

= 0. From the first order condition, we can derive the maximum value of 'q' which is (say)  $q^* = q^*(p_q, \lambda)$ . The second order condition for utility optimization needs

$\frac{\partial^2 N(q)}{\partial q^2} = \frac{\partial^2 U(q)}{\partial q^2} < 0$ , which is ensured by the assumption of falling  $MU_q$ .

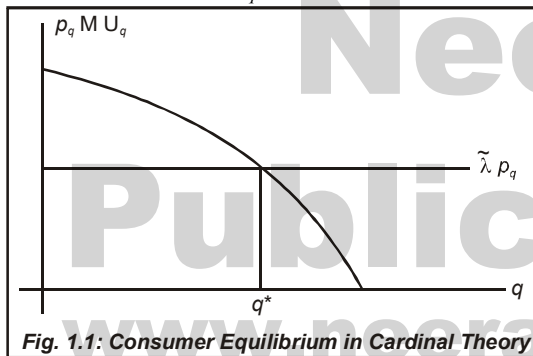


Fig. 1.1: Consumer Equilibrium in Cardinal Theory

**2. Ordinal Theory: A Short Note**

In ordinal method, utility of a commodity is measured ordinarily or qualitatively and not quantitatively or numerically. Here, the consumer can rank his preferences alternatively as per the order he wants to compare but not in terms of different amounts. Thus, it is more realistic measurement of utility. There are two types of approaches to measure utility in ordinal theory:

- 1. Indifferent Curve Approach
- 2. Revealed Preference Approach.

**1. Indifferent Curve Approach:** Indifference curve is made by taking utility level constant. Thus, different indifferent curves denote different level of utility for some consumers. The equilibrium is obtained when indifferent curve become tangent to the budget line or price line.

**2. Revealed Preference Approach:** In this approach, consumer equilibrium is obtained by ranking different bundle of goods in the commodity space. The consumer picks the best bundle for which his utility will optimize. Famous economist Paul A Samuelson is the founder of this method.

**INTRODUCTION TO DEMAND ANALYSIS**

Market demand curve or aggregate individual demand curves, is generally downward sloping. Individual demand curve is made by combining different consumer equilibrium for different prices. Here, the market price is fixed and given to the consumer. In neo-classical theory, demand curve can be obtained if the price is changed exogenously and join all the equilibrium points. In the following section, we will find the individual demand curve by using ordinal theory and taking indifferent curve approach.

**ORDINAL THEORY: INDIFFERENCE CURVE APPROACH**

In indifference curve approach, the objective of consumer is to maximize his utility by choosing a bundle of commodities among all other available commodity bundles (under budget constraint) where total utility depends on quantity of consumption given his taste and preferences. In a two-commodity world, (if we take  $x_1$  and  $x_2$ ) utility function is given by  $U = U(x_1, x_2)$  and it depends on the consumer's taste and preferences, which is specified by the following axioms:

**1. Axiom of Reflexiveness:** Consumer's choice is reflexiveness.

If there are two commodities  $x_1$  and  $x_2$  and  $x_1$  is weakly preferred to  $x_2$ , we can say  $x_2 R x_1$  (R stands for weak preference relation). It implies that either  $x_1$  is strictly preferred over  $x_2$  ( $x_1 P x_2$ ) or  $x_1$  is indifference to  $x_2$  ( $x_1 I x_2$ ). Here, P and I stand for strict preference relation and indifference respectively.

Any commodity bundle is either strictly preferred or indifferent over any other commodity bundle. Consumer can choose any commodity bundle. So choice set of this specified by the commodity set 'X'.

**2. Axiom of Completeness:** Consumer choice is complete.

Consumer, being a rational, must have a unique preference relation. It means the consumer choice will be either  $x_2 R x_1$  or  $x_1 R x_2$ . Consumer choice is also consistent or comparable. Consumer choice must be transitive because of unique preference relations. Thus, it can be  $x_1 R x_2, x_2 R x_3$  or  $x_1 R x_3$ .  $x_3$  is another commodity.

**3. Axiom of Continuity:** Consumer's preference relation (R) is continuous. Consumer looks for better one continuously, comparing one with the other commodity. Thus, it is a continuous process. Following three axioms can be included under this:

(a) **Axiom of Non-satiation:** Consumer's choice is non-satiated in all goods.

It implies that larger the consumption of a commodity leads to larger satisfaction or utility and lower the consumption lower is the satisfaction or

utility. It also denotes that “goods are good” and “more is better”. Thus, A will be preferred over B (APB) if A has larger quantity than B ( $A > B$ ).

(b) **Axiom of Convexity:** The indifference curve for consumer choice is strictly convex to the origin. So the utility is quasi-concave.

(c) **Axiom of Selfishness:** Consumer choice is selfish. Consumer choice is self-guarded and it is not influenced by any other consumer.

**Concept of Preference, Utility Function and Indifference Curve**

As specified by the above axioms, consumer preference (‘R’) can be represented by a function where total utility (‘U’) depends upon the quantity consumption ( $x_1, x_2$ ) which satisfied all other axioms. Utility function is  $U(x_1, x_2)$  which is otherwise U, which the consumer aims to optimize.

**Meaning and Definition of Indifference Curve:**

Indifference curve is a graphical tool to solve the consumer utility maximization problem. Indifference curve is constructed in commodity – commodity plane by joining different goods along which the consumer is indifferent (or he has same level of utility). Therefore, along the indifference curve utility or satisfaction remains unchanged.

**Existence of Indifference Curve:** Indifferent curve may exist anywhere in the commodity space. It is because consumer may be indifferent between any commodity bundles and such a choice might be continuous. Also, because of axiom of reflexiveness consumer can choose a commodity bundle over another commodity bundle and such a choice might be continuous.

**Derivation of Indifference Curve and its Properties**

**Graphical Presentation**

In the diagram given below, there are good I ( $x^0_1$ ) and Good II ( $x^0_2$ ), from which the consumer gets some utility ( $U_0$ ). Here, we compare the two commodity bundles and for which we divide the commodity plane into four phases.

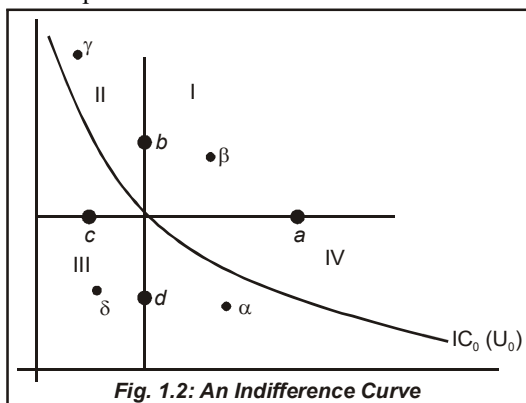


Fig. 1.2: An Indifference Curve

Take any point in Phase I ( $\beta$ ), there is larger quantity of both  $x_1$  and  $x_2$  compared to point ‘A’. Similarly for

any point in ‘b’ in vertical axis, we have larger  $x_2$  with same  $x_1$ . It means in Phase I, including the borderlines, there is large quantity of at least one good and no less quantity of any other good compared to ‘A’. Thus, we have larger utility in Phase I including the borderlines compared to ‘A’.

By similar logic, we have lower consumption of at least one good and no large consumption of any other good in Phase III including the borderlines compared to point ‘A’. Hence, there is lower level of utility in Phase III including the borderlines compared to ‘A’ by the axiom of non-satiation for all commodities.

It is clear that utility is not constant between the good bundles compared to point ‘A’ in phases I and III, including borderlines. Therefore, indifference curve (along which utility is constant) cannot pass through phases I and III including their borderlines.

Take any point in phase IV, excluding borderlines ( $\alpha$ ), we have larger  $x_1$  (for which utility is larger) and lower  $x_2$  (for which utility is lower) compared to ‘A’. Since both the goods are non-satiated, utility of point  $\alpha$  may be larger, lower or equal compared to point ‘A’. In the same way, for any point in phase II, excluding the borderlines ( $\delta$ ), there is larger consumption of  $x_2$  but lower of  $x_1$  compared to point ‘A’. So, by axiom of non-satiation in all goods, utility at point  $\delta$  may be larger, lower or equal compared to point ‘A’.

It is clear that only in Phases II and IV, excluding the borderlines, there is a possibility of the same level of utility between the bundles compared to point ‘A’. So indifference curve, along which utility remains constant, must pass through Phases II and IV, excluding their borderlines. Hence, indifference curve is necessarily downward sloping where all goods are non-satiated given that a consumer choice is reflexive, continuous and complete.

**Mathematical Presentation**

If the utility function is  $U = U(x_1, x_2)$ , by differentiating we get:

$$dU = U_1 dx_1 + U_2 dx_2 = 0 \text{ (as along the indifference$$

curve utility is unchanged,  $dU = 0$ ). So  $\frac{dx_2}{dx_1}$

$$= \frac{U_1(x_1, x_2)}{U_2(x_1, x_2)}$$

is the slope of the indifference curve. It is negative since  $U_1(x_1, x_2) > 0$  and  $U_2(x_1, x_2) > 0$  by axiom of non-satiation of all commodities. Therefore, indifference curve is downward sloping as all goods are non-satiated and choice is continuous, reflexive and complete.

**Economic Meaning**

All goods are non-satiated that means larger (lower) assumption leads to larger (lower) utility. So, for given  $x_2$ , as  $x_1$  increases, utility rises. Hence, to maintain the same level, utility must be reduced, which is possible



4 / NEERAJ : MICROECONOMIC ANALYSIS

by cutting  $x_2$ . So, as  $x_1$  increases,  $x_2$  must fall to maintain the same level of satisfaction. Because of that indifference curve is downward sloping.

**Properties of Indifference Curve**

**Property I:** Higher indifference curve gives higher utility.

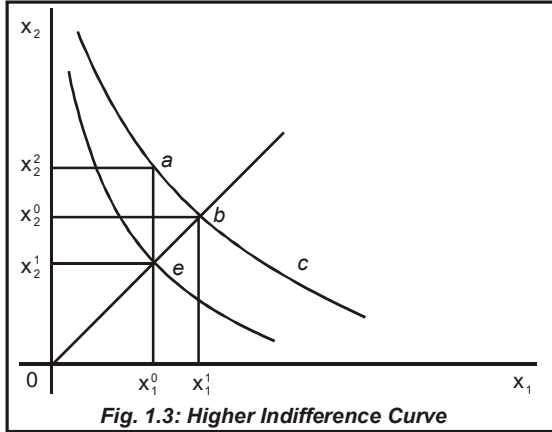


Fig. 1.3: Higher Indifference Curve

**Explanation:** Since all goods are non-satiated, larger consumption of any good leads to larger utility. Hence, a commodity bundle, which has larger quantity of at least one good and no less consumption of any other goods, provides larger utility compared to any other commodity bundles. In results, higher indifference curve stands for higher consumption of at least one good and no less consumption of any other goods.

**Property II:** Indifference curves cannot intersect with each other.

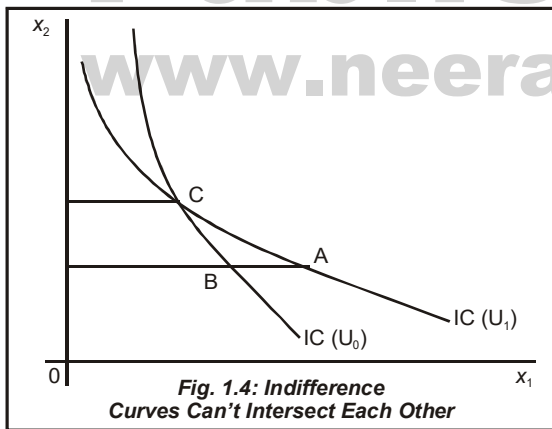


Fig. 1.4: Indifference Curves Can't Intersect Each Other

**Explanation:** Suppose two indifference curves intersect each other. By definition, utility is unchanged along the indifference curve, Thus, consumer is indifferent between points 'A' and 'C' that lie on the same indifference curve. Similarly, consumer is indifferent between points 'B' and 'C', as they also lie on the same indifference curve. So AIC and BIC, where 'I' implies indifference. Now, from transitivity there is AIB, that

means point 'A' and 'B' give the same utility to the consumer. But for given  $x_2$ ,  $x_1$  is larger in point 'A' compared to point 'B'. So, by the assumption of non-satiation, we have point 'A' that provides larger utility to consumer as compared to point 'B'. This is a contradiction on the fact that point 'A' and 'B' gives the same level of utility to the consumer (as we have proved above). Thus, when all goods are non-satiated and transitivity holds, indifference curves cannot intersect.

**Utility Maximization**

**Graphical Presentation:** Suppose there are two commodity world,  $x_1$  and  $x_2$  representing commodity I and II respectively. Prices, given to the consumer, of good I and II are  $p_1$  and  $p_2$  respectively. Prices here are exogenously given and consumer cannot change them. The consumer's money income ( $M$ ) is also exogenously given to the consumer. Note that  $p_1x_1 + p_2x_2$  is the total expenditure of the consumer when he consumes  $x_1$  units of good I and  $x_2$  units good II. The total expenditure of the consumer cannot exceed his money income, thus

$$p_1x_1 + p_2x_2 \leq M \quad \dots(a)$$

Equation (a) is the consumer's budget constraint.

Let  $U = U(x_1, x_2)$  is the utility function of the consumer. So, consumer must solve the following optimization problem (UMP):

**Problem UMP:** Max  $U(x_1, x_2)$

Subject to  $x_1 > 0$

$x_2 > 0$

and  $p_1x_1 + p_2x_2 \leq M$

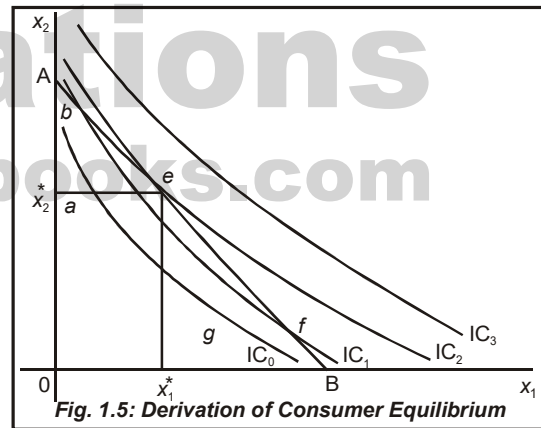


Fig. 1.5: Derivation of Consumer Equilibrium

As consumer aims to optimize his utility and as longer consumption results in larger utility, he always wants to have more of any goods. But he also has to spend some amount of his income to consume larger amount of goods. So, ultimately in equilibrium he will spend all her income and  $M = p_1x_1 + p_2x_2$ .

Now if the line segment AB stands for the price line or budget line. Along AB  $p_1x_1 + p_2x_2 = M$  holds. Suppose, initial indifference curve of the consumer is  $IC_0$ . In  $IC_0$ , there are many points along that indifference curve such that  $p_1x_1 + p_2x_2 \leq M$  holds. Thus, utility optimizing consumer will spend more as he moves to