CHAPTER SIX THEORY OF CONSUMER BEHAVIOUR

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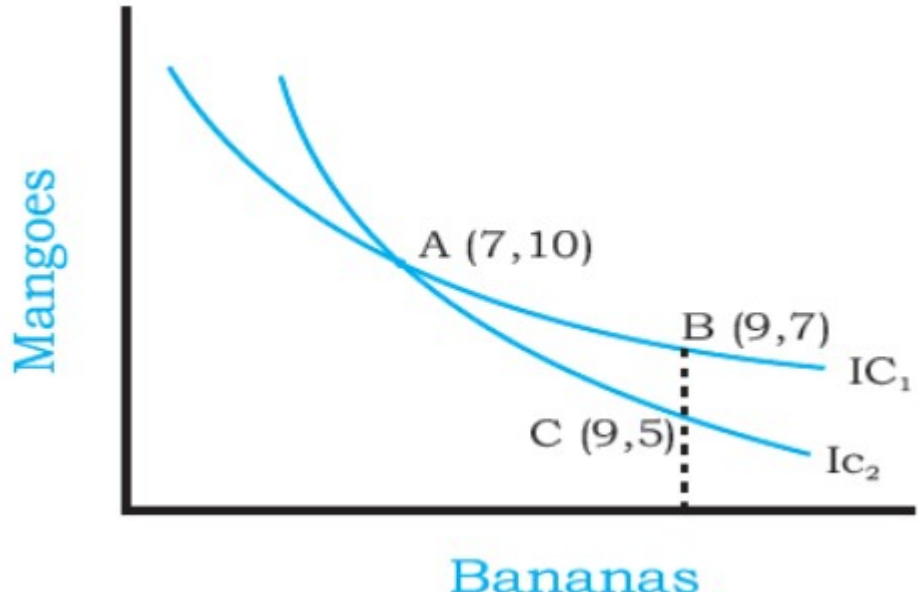
CHAPTER SIX

THEORY OF CONSUMER BEHAVIOUR



Expected Learning Outcomes

Upon completion of this chapter students should be able to:

i. Explain the idea of consumer behaviour using the ordinal approach;
ii. Differentiate between the substitution and income effects of a price change on quantity demanded;
iii. Explain the maximizing position of the consumer using the indifference curve approach;
iv. Describe the relationship between money and happiness;
v. Describe how consumer tastes or preferences can be inferred without asking the consumer;
vi. Explain different psychological theories applied in consumer behaviour study; and
vii. Trace social psychological theories of buyer behaviour;

6.0. Introduction[1]

A consumer is an individual or a household composed of one or more individuals. The consumer is the basic economic unit that determines which commodities are purchased and in what quantities. The study of consumer bahaviour is guided by a number of questions such as What guides individual consumer decisions? Why do consumers purchase some commodities and not others? How do they decide how much to purchase of each commodity? What is the aim of a rational consumer in spending income? These are some of the important questions to which one seek answers in this chapter. The theory of consumer behaviour and choice is the first step in the derivation of the market demand curve.

The study of the economic behaviour will begin with the consumer tastes. Consumers' tastes can be related to utility concepts or indifference curves. Thereafter, one examine the convergence of tastes internationally. One then introduce the budget line, which gives the constraints or limitations consumer's face in purchasing goods and services. Constraints arise because the commodities that the consumer wants command a price in the marketplace (i.e., they are not free) and the consumer has limited income. Because the consumer's wants are unlimited or, in any event, exceed his or her ability to satisfy them all, it is important that the consumer spend income so as to maximize satisfaction. Thus, a model is provided to illustrate and predict how a rational consumer maximizes satisfaction, given his or her tastes (indifference curves) and the constraints that the consumer faces (the budget line). The "At the Frontier" section presents a different way to examine consumer tastes and derive a consumer's indifference curves. The several real-world examples and important applications presented in this chapter demonstrate the relevance and usefulness of the theory of consumer behaviour and choice.

6.1. A Sound Theory of Consumer Behaviour[2]

Not all consumer behaviour theories are good or sound. Certain theories may be termed as sound in explaining consumer behaviour. How can one conclude that a theory is sound? Obviously there should have certain features in it to be considered as an ideal theory. Mr. John A. Howard, one of the leading authorities in this discipline has offered a number of criteria of a sound theory of buyer behaviour. If a consumer behaviour theory contains the features as offered by him, it may be called a good theory of consumer behaviour. A sound theory of buyer behaviour not only describes the behaviour, but also gives a reasonable description of that behaviour. Assume one

[1] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[2] http://docplayer.net/42360928-Consumer-behavior-theories.html

has developed a consumer behaviour theory on the behaviour of female customers of dress materials. In the said theory it is said that female customers of dress materials enjoy bargaining[3].

- This is **mere description of their behaviour**, not the explanation of the behaviour. On the contrary, **if the theory identifies which female customers enjoy bargaining**, what are the reasons of such a practice, this can be termed as an explanation of behaviour. So, a sound theory of buyer behaviour gives description of the behaviour, side by side its explanation.
- Consumer behaviour has been described as an interdisciplinary field of study, and hence, theories explaining consumer behaviour take help or borrow findings from a number of disciplines. When borrowing, theory developer must keep in mind that, the findings that he considers in theory building should resemble the mainstream discipline from which he borrows. Findings of a particular discipline resemble the mainstream thinking only when it is substantiated by the principal findings or avenues of research of the discipline concerned.
- Consumer behaviour theories help us to conduct research on different aspects of buyer behaviour. There are certain areas of behaviour which are well researched, and there are other areas which have not received much attention. A sound theory gives us pointers on the areas where research should be conducted, thus saving our time and resources which otherwise would be channelled in unrelated dimensions.
- A theory usually consists of a number of elements. To apply a theory in its proper perspective, one should understand what each of its parts or elements means. In addition, he should be able to measure the elements using certain yard-stick. But, what each of the elements of the theory stands for and what is the yard-stick? A sound theory of buyer behaviour gives answers to these two questions to the user of it. Therefore, a sound theory of consumer behaviour is that which fixes the precise meaning of its components and provides measuring devices to measure them.

The above mentioned four are the criteria of a sound theory of buyer behaviour as identified by Mr. John A. Howard. But, according to Mr. Mittelstaedt, following three are the basic criteria of a sound theory of consumer behaviour:

- A sound theory of buyer behaviour is that which includes known characters of buyer behaviour. For example, one of the known character of buyer behaviour is that it is affected by the principal norms of his culture. A theory which accounts for such known characters may be termed as a sound theory.

[3] http://docplayer.net/42360928-Consumer-behavior-theories.html

- Consumer behaviour theories are used to understand and predict behaviour of consumers. Marketers not only are interested in knowing the existing behavioural patterns that are influenced by different known regularities. Since societies and cultures are changing, there could be new characters observed in consumers which may influence their behaviours. A sound theory of buyer behaviour is that which highlights on such new characters that may be observed in consumers in future. For example, majority of Bangladeshi consumers do not enjoy selfservice shopping. But, time may come, when majority may behave otherwise. A sound theory of consumer behaviour always highlights on such future changes.
- A sound theory of buyer behaviour is one which is single unified theory. It is not based on eclectic borrowing.
- Efforts were made from very early times to explain the motivational processes that influence consumer behaviour. All social sciences including economics have contributed separate theories and tried to find out this phenomenon.

6.1.1. Economic Man[4]

As identified in section 1.1, early research regarded man as entirely rational and self interested, making decisions based upon the ability to maximise utility whilst expending the minimum effort. While work in this area began around 300 years ago (Richarme 2007), the term 'economic man' (or even *Homo economicus* (Persky 1995)) was first used in the late 19th century (Persky 1995) at the start of more sustained research in the area. In order to behave rationally in the economic sense, as this approach suggests, a consumer would have to be aware of all the available consumption options, be capable of correctly rating each alternative and be available to select the optimum course of action (Schiffman ANDKanuk 2007). These steps are no longer seen to be a realistic account of human decision making, as consumers rarely have adequate information, motivation or time to make such a 'perfect' decision and are often acted upon by less rational influences such as social relationships and values (Simon 1997). Furthermore, individuals are often described as seeking satisfactory rather than optimum choices, as highlighted by Herbert Simons Satisficing Theory (Simon 1997), or Kahneman and Tversky's Prospect Theory (Kahneman ANDTversky 1979) which embrace bounded rationality (Simon 1991).

[4] http://docplayer.net/10778805-Consumer-behaviour-theory-approaches-and.html

6.1.2. Economic theories - some insights[5]

Economists from even the Adam Smith's time developed theories that explain the behaviour of consumers. The trend continued thereafter and even the contemporary economists are constructing theories of buyer behaviour. Economic theories describe man as a rational buyer who has perfect information about the market and uses it to obtain maximum value for the buying effort and money. Consumers, according to the economic theories (particularly the classical ones) take purchase decisions purely based on self-interest. Price is considered to be the strongest motivation. Consumers compare all competing sellers' offerings, and buy the one with the lowest price. Number of economic factors influence consumer in the ways he spends his income for personal consumption. Purchasing power of the consumer is used to convert production into consumption. People do not spend all their income. Disposable personal income is used both for personal consumption and saving. If disposable personal income should rise businessmen would be interested in learning what proportion of the additional income the consumers might spend and what proportion they might save.

Marketing analysts are more interested in examining the effect of changes in income on spending and saving. In inflationary periods spending rises faster than income. In the same way size of family and family income is also important as they affect spending and saving patterns. The income that consumer expects to receive in the future has some bearing on his present spending pattern. In particular, spending for automobiles, furniture, major appliances and other expensive items tend to be influenced by consumers' optimism or pessimism about future incomes. In the same way consumers' liquid assets also affect buying plans. Cash and other assets readily convertible into cash such as balance in saving accounts, shares, etc. influence our purchases. Retired and unemployed individuals may use liquid assets to buy every day necessities. Other consumers may use liquid assets to meet major medical bills and other emergencies.

Availability of consumer credits strongly influences the pattern of consumer spending. Credit which allows one to buy now and pay later enables a consumer to command more purchasing power than that separated by his current income. Even small fluctuation in income causes sharp repercussion in consumer's purchases. The quick response of durable goods expenditure to income changes traces to the wide use installment credit in financing such purchases. Consumers are more willing to increase installment debt when income is rising and are more reluctant to incur additional indebtedness when income is declining. Quite a number of economic theories explain different aspects of buying behaviour described in the above few paragraphs. Here one shall take into consideration four major economic theories dealing with buyer behaviour. They are:

[5] https://www.iedunote.com/consumer-behavior-theories#:~:text=Consumer

- Marginal Utility Theory
- Indifference Theory
- Income and Savings Theory
- Rising Income Theory

The consumer has to decide how to spend her income on different goods[6]. Economists call this the problem of choice. Most naturally, any consumer will want to get a combination of goods that gives her maximum satisfaction[7]. What will be this 'best' combination? This depends on the likes of the consumer and what the consumer can afford to buy. The 'likes' of the consumer are also called 'preferences'. And what the consumer can afford to buy, depends on prices of the goods and the income of the consumer. This chapter presents two different approaches that explain consumer behaviour (i) Cardinal Utility Analysis and (ii) Ordinal Utility Analysis.

The theory of consumer behaviour built on both the cardinal and ordinal approach is attributed to modern economists such as Alfred Marshal, J. R. Hicks and R. G. Allen[8]. The cardinal utility analysis believes that utility can be measured quantitatively in monetary units (utils) which attracted criticisms and led to the development of the ordinal utility analysis. The ordinals maintained that utility is not measurable. Our discussion in this chapter is centered on consumer behaviour using the ordinal approach. The assumptions of the ordinals approach are also discussed in order to understand the difference between the ordinal approach and the cardinal approach. Other topics discussed in order to fully understand the ordinal utility approach to consumer behaviour include the equilibrium maximization of the consumer and income and substitution effects of price change.

A consumer, in general, consumes many goods; but for simplicity, one shall consider the consumer's choice problem in a situation where there are only two goods[9]: bananas and mangoes. Any combination of the amount of the two goods will be called a consumption bundle or, in short, a bundle[10]. In general, one shall use the variable *x1* to denote the quantity of bananas and *x2* to denote the quantity of mangoes. *x1* and *x2* can be positive or zero. (*x1*, *x2*) would mean the bundle consisting of *x1* quantity of bananas and *x2* quantity of mangoes. For particular values of *x1* and *x2*, (*x1, x2*), would give us a particular bundle. For example, the bundle (5,10) consists of 5 bananas and 10 mangoes; the bundle (10, 5) consists of 10 bananas and 5 mangoes.

[6] One shall use the term goods to mean goods as onell as services.
[7] http://ncert.nic.in/textbook/pdf/leec202.pdf
[8] https://www.coursehero.com/file/49339659/Consumer-Behavior-Ordinal-Utilitydocx/
[9] The assumption that there are only two goods simplifies the analysis considerably and allows us to understand some important concepts by using simple diagrams.
[10] https://www.scribd.com/document/439849964/Class-12-Introductory-Microeconomics-pdf

6.2. Concept of Utility[11]

The concept of utility discussed in the previous section was introduced at about the same time, in the early 1870s, by William Stanley Jevons of Great Britain, Carl Menger of Austria, and Léon Walras of France. They believed that the utility an individual receives from consuming each quantity of a good or basket of goods could be measured cardinally just like on weight, height, or temperature. A consumer usually decides his demand for a commodity on the basis of utility (or satisfaction) that he derives from it. What is utility? Utility of a commodity is its want-satisfying capacity. The more the need of a commodity or the stronger the desire to have it, the greater is the utility derived from the commodity. Utility is subjective. Different individuals can get different levels of utility from the same commodity. For example, some one who likes chocolates will get much higher utility from a chocolate than some one who is not so fond of chocolates, Also, utility that one individual gets from the commodity can change with change in place and time[12]. For example, utility from the use of a room heater will depend upon whether the individual is in Ladakh or Chennai (place) or whether it is summer or winter (time).

6.2.1. Measures of Utility[13]

The distinction between cardinal and ordinal utility is important because a theory of consumer behaviour can be developed on the weaker assumption of ordinal utility without the need for a cardinal measure. And a theory that reaches the same conclusion as another on weaker assumptions is a superior theory.4 Utility theory provides a convenient introduction to the analysis of consumer tastes and to the more rigorous indifference curve approach. It is also useful for the analysis of consumer choices in the face of uncertainty. Example 3–1 examines the relationship between money income and happiness.

Cardinal utility theory[14]

Cardinal utility analysis assumes that level of utility can be expressed in numbers. For example, one can measure the utility derived from a shirt and say, this shirt gives me 50 units of utility. Before discussing further, it will be useful to have a look at two important measures of utility. **Cardinal utility** means that an individual can attach specific values or numbers of utils from consuming each quantity of a good or basket of goods. In Table 3.1 one saw that the individual received 10 utils from consuming one hamburger. He received 16 utils, or 6 additional utils, from

[11] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[12] http://ncert.nic.in/textbook/pdf/leec202.pdf
[13] http://docplayer.net/9790572-Chapter-consumer-preferences-and-choice.html
[14] http://ncert.nic.in/textbook/pdf/leec202.pdf

consuming two hamburgers. The consumption of the third hamburger gave this individual 4 extra utils, or two-thirds as many extra utils, as the second hamburger. Thus, Table 3.1 and Figure 3.1 reflect cardinal utility. They actually provide an index of satisfaction for the individual.

The Marginal utility theory was developed by classical economists. According to them, a consumer will continue to buy such products that will deliver him the most utility or maximum satisfaction at relative prices[15]. He continues buying and consuming a product so long the total satisfaction increases thus he avoids dissatisfaction. How a consumer calculates his total satisfaction? According to Kotler, he calculates it by taking into account the consequences or results of purchases. As a customer one will buy a good because one feel it gives one satisfaction or utility. A first unit of a good gives one certain amount of psychological utility or satisfaction. Now imagine consuming a second unit. Your total utility goes up because the second unit of the good gives one some additional utility. What about adding a third and fourth unit of the same good?

As one consume more of the same good, your total (psychological) utility increases. However, let us use the term marginal utility to refer to the extra utility added by one extra last unit of a good. Then, with successive new units of the good, your total utility will grow at a slower and slower rate because of a fundamental tendency for your psychological ability to appreciate more of the good to become less keen. This fact, that the increments in total utility fall off, economists describe as follows:

Table 6.1 Law of diminishing marginal utility[16]

(1)	(2)	(3)
Quantity of a good consumed	**Total Utility**	**Marginal Utility**
0	0	0
1	4	4
2	7	3
3	9	2
4	10	1
5	10	0

As the amount consumed of a good increases, the marginal utility of the good (or the extra utility added by its last unit) tends to decrease known as the law of diminishing marginal utility. "At some point, the addition of one more unit of that item will have no effect whatsoever upon total

[15] http://docplayer.net/42360928-Consumer-behavior-theories.html
[16] http://docplayer.net/42360928-Consumer-behavior-theories.html

utility".[1] The table above shows the law of diminishing marginal utility[17]. The above table shows that consuming the first unit of an item gives the consumer an utility of say 4 unit. In this instance both the total and marginal utility is 4. The second unit of the item will also give him some utility, but not same as the first one as his urge reduces. After consuming the second unit, his total utility is 7 and the marginal utility is 3 as he gets 3 units of satisfaction from the second unit. As he consumes more of the same item, marginal utility gradually drops. This pattern will continue through the third and fourth item until finally, by the fifth perhaps, fails to offer any satisfaction whatsoever.

This theory holds the view that man is rational in all his activities and purchasing decisions are the result of economic calculations. The lesson marketers may take from this theory is that, no matter how attractive the product is, it cannot be sold in unlimited quantities to an individual as he decides based on the diminishing marginal utility. Marketers' production and marketing planning should, therefore, be based on this concept. Marketers, however, do not accept this theory all the time, on the ground that it fails to explain how product and brand preferences are formed. Further, economic factors alone cannot explain variations in sales.

Goods are desired because of their ability to satisfy human wants[18]. The property of a good that enables it to satisfy human wants is called **utility.** As individuals consume more of a good per time period, their **total utility** (TU) or satisfaction increases, but their marginal utility diminishes. Marginal utility (MU) is the extra utility received from consuming one additional unit of the good per unit of time while holding constant the quantity consumed of all other commodities. For example, Table 3.1 indicates that one hamburger per day (or, more generally, one unit of good X per period of time) gives the consumer a total utility (*TU*) of 10 utils, where a **util** is an arbitrary unit of utility. Total utility increases with each additional hamburger consumed until the fifth one, which leaves total utility unchanged. This is the *saturation point.* Consuming the sixth hamburger then leads to a decline in total utility because of storage or disposal problems[19]. The third column of Table 6.1 gives the extra or marginal utility resulting from the consumption of each *additional* hamburger. Marginal utility is positive but declines until the fifth hamburger, for which it is zero, and becomes negative for the sixth hamburger.

Total Utility[20]: Total utility of a fixed quantity of a commodity (TU) is the total satisfaction derived from consuming the given amount of some commodity *x*. More of commodity *x* provides more satisfaction to the consumer. TU depends on the quantity of the commodity consumed.

[17] http://docplayer.net/42360928-Consumer-behavior-theories.html
[18] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[19] That is, some effort (disutility), no matter how small, is required to get rid of the sixth hamburger. Assuming that the individual cannot sell the sixth hamburger, he or she would not want it even for free.
[20] http://ncert.nic.in/textbook/pdf/leec202.pdf

Therefore, TU_n refers to total utility derived from consuming *n* units of a commodity *x*. Marginal Utility: Marginal utility (MU) is the change in total utility due to consumption of one additional unit of a commodity. For example, suppose 4 bananas give us 28 units of total utility and 5 bananas give us 30 units of total utility. Clearly, consumption of the 5_{th} banana has caused total utility to increase by 2 units (30 units minus 28 units). Therefore, marginal utility of the 5_{th} banana is 2 units.

$MU_5 = TU_5 - TU_4 = 30 - 28 = 2$

In general, $MU_n = TU_n - TU_{n-1}$, where subscript *n* refers to the n^{th} unit of the commodity Total utility and marginal utility can also be related in the following way.

$TU_n = MU_1 + MU_2 + \ldots + MU_{n-1} + MU_n$ …….. [1]

This simply means that TU derived from consuming *n* units of bananas is the sum total of marginal utility of first banana (MU_1), marginal utility of second banana (MU_2), and so on, till the marginal utility of the n_{th} uni[21]t. Table 6.2 and Figure 6.1 show an imaginary example of the values of marginal and total utility derived from consumption of various amounts of a commodity. Usually, it is seen that the marginal utility diminishes with increase in consumption of the commodity. This happens because having obtained some amount of the commodity, the desire of the consumer to have still more of it becomes weaker. The same is also shown in the table and graph. Table 6.2: Values of marginal and total utility derived from consumption of various amounts of a commodity

Table 6.2 The values of marginal and total utility derived from consumption of various amounts of a commodity.

Units	Total Utility	Marginal Utility
1	12	12
2	18	6
3	22	4
4	24	2
5	24	0
6	22	-2

[21] http://ncert.nic.in/textbook/pdf/leec202.pdf

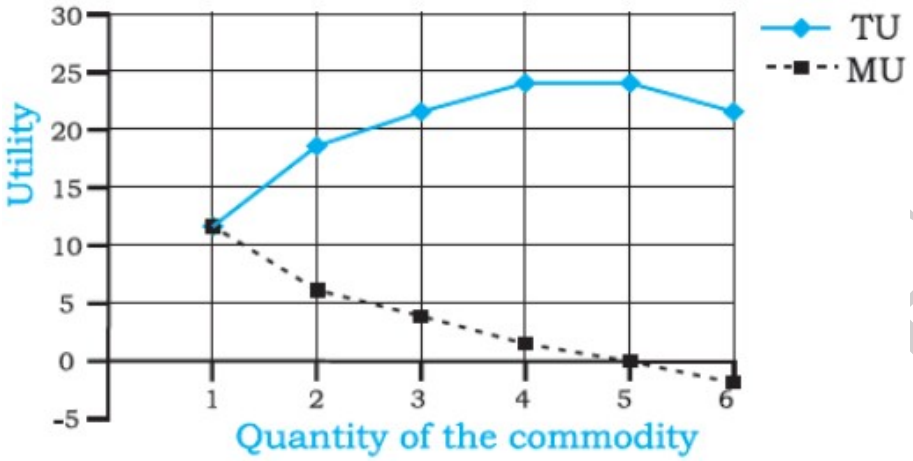


Figure 6.1 The marginal utility diminishes with increase in consumption of the commodity[22]

Notice that MU_3 is less than MU_2. One may also notice that total utility increases but at a diminishing rate: The rate of change in total utility due to change in quantity of commodity consumed is a measure of marginal utility. This marginal utility diminishes with increase in consumption of the commodity from 12 to 6, 6 to 4 and so on. This follows from the law of diminishing marginal utility. Law of Diminishing Marginal Utility states that marginal utility from consuming each additional unit of a commodity declines as its consumption increases, while keeping consumption of other commodities constant. MU becomes zero at a level when TU remains constant. In the example, TU does not change at 5th unit of consumption and therefore $MU_5 = 0$. Thereafter, TU starts falling and MU becomes negative.

Table 6.3 Total and marginal utility[23]

Q_X	TU_X	MU_X
0	0	. . .
1	10	10
2	16	6
3	20	4
4	22	2
5	22	0
6	20	−2

[22] http://ncert.nic.in/textbook/pdf/leec202.pdf
[23] https://www.coursehero.com/file/33587443/Consumer-Choice-Chapter4pdf/

Derivation of demand curve for single commodity

Cardinal utility analysis can be used to derive demand curve for a commodity. What is demand and what is demand curve? The quantity of a commodity that a consumer is willing to buy and is able to afford, given prices of goods and income of the consumer, is called demand for that commodity. Demand for a commodity *x*, apart from the price of *x* itself, depends on factors such as prices of other commodities (substitutes and complements), income of the consumer and tastes and preferences of the consumers.

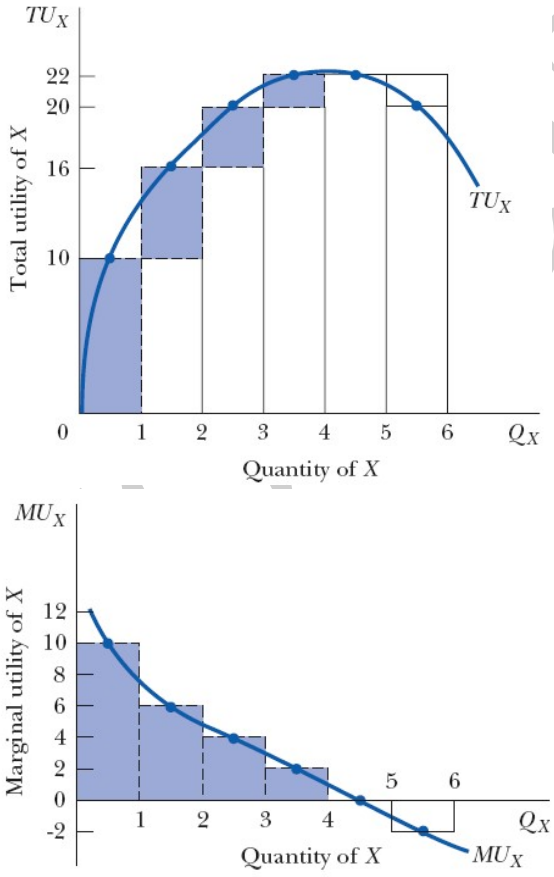


Figure 6.2 Total and Marginal Utility[24]

In the top panel, total utility (*TU*) increases by smaller and smaller amounts (the shaded areas) and so the marginal utility (*MU*) in the bottom panel declines. *TU* remains unchanged with the consumption of the fifth hamburger, and so *MU* is zero. After the fifth hamburger per day, *TU* declines and *MU* is negative.

Plotting the values given in Table 6.3, one obtain Figure 6.2, with the top panel showing total utility and the bottom panel showing marginal utility. The total and marginal utility curves are

[24] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

obtained by joining the midpoints of the bars measuring *TU* and *MU* at each level of consumption. Note that the *TU* rises by smaller and smaller amounts (the shaded areas) and so the *MU* declines. The consumer reaches saturation after consuming the fourth hamburger. Thus, *TU* remains unchanged with the consumption of the fifth hamburger and *MU* is zero. After the fifth hamburger, *TU* declines and so *MU* is negative. The negative slope or downward-to-the-right inclination of the *MU* curve reflects the **law of diminishing marginal utility.** Utility schedules reflect tastes of a particular individual; that is, they are unique to the individual and reflect his or her own particular subjective preferences and perceptions[25]. Different individuals may have different tastes and different utility schedules. Utility schedules remain unchanged so long as the individual's tastes remain the same.

Box 6.1 Does money buy happiness?[26]

Does money buy happiness? Philosophers have long pondered this question. Economists have now gotten involved in trying to answer this age-old question. They calculated the "mean happiness rating" (based on a score of "very happy" = 4, "pretty happy" = 2, and "not too happy" = 0) for individuals at different levels of personal income at a given point in time and for different nations over time. What they found was that up to an income per capita of about $20,000, higher incomes in the United States were positively correlated with happiness responses, but that after that, higher incomes had little, if any, effect on observed happiness. Furthermore, average individual happiness in the United States remained remarkably flat since the 1950s in the face of a considerable increase in average income. Similar results were found for other advanced nations, such as the United Kingdom, France, Germany, and Japan. These results seem to go counter to the basic economic assumption that higher personal income leads to higher utility.

Two explanations are given for these remarkable and puzzling results: (1) that happiness is based on relative rather than absolute income and (2) that happiness quickly adapts to changes in the level of income. Specifically, higher incomes make individuals happier for a while, but their effect fades very quickly as individuals adjust to the higher income and soon take it for granted. For example, a generation ago, central heating was regarded as a luxury, while today it is viewed as essential. Furthermore, as individuals become richer, they become happier, but when society as a whole grows richer, nobody seems happier. In other words, people are often more concerned about their income relative to others' than about their absolute income. Pleasure at your own pay rise can vanish when one learn that a colleague has been given a similar pay increase.

The implication of all of this is that people's effort to work more in order to earn and spend more in advanced (rich) societies does not make people any happier because others do the same. (In poor

[25] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[26] *Sources:*
(Clark, Frijters, & Shields, 2008);
(Layard, 2005);
(Di Tella & MacCulloch, 2006);
(Easterlin, 2000); and
(Frey & Stutzer, 2002).

Box 6.1 Does money buy happiness?[26]
countries, higher incomes do make people happier). Lower taxes in the United States encourage people to work more and the nation to grow faster than in Europe, but this does not necessarily make Americans happier than Europeans. The consensus among happiness researchers is that after earning enough to satisfy basic wants (a per capita income of about $20,000), family, friends, and community tend to be the most important things in life.

Demand curve is a graphic presentation of various quantities of a commodity that a consumer is willing to buy at different prices of the same commodity, while holding constant prices of other related commodities and income of the consumer. Figure 6.3 presents hypothetical demand curve of an individual for commodity *x* at its different prices. Quantity is measured along the horizontal axis and price is measured along the vertical axis. The downward sloping demand curve shows that at lower prices, the individual is willing to buy more of commodity *x*; at higher prices, she is willing to buy less of commodity *x*. Therefore, there is a negative relationship between price of a commodity and quantity demanded which is referred to as the Law of Demand.

An explanation for a downward sloping demand curve rests on the notion of diminishing marginal utility. The law of diminishing marginal utility states that each successive unit of a commodity provides lowers marginal utility. Therefore the individual will not be willing to pay as much for each additional unit and this result in a downward sloping demand curve. At a price of Rs. 40 per unit *x*, individual's demand for *x* was 5 units. The 6_{th} unit of commodity *x* will be worth less than the 5_{th} unit. The individual will be willing to buy the 6^{th} unit only when the price drops below Rs. 40 per unit. Hence, the law of diminishing marginal utility explains why demand curves have a negative slope.

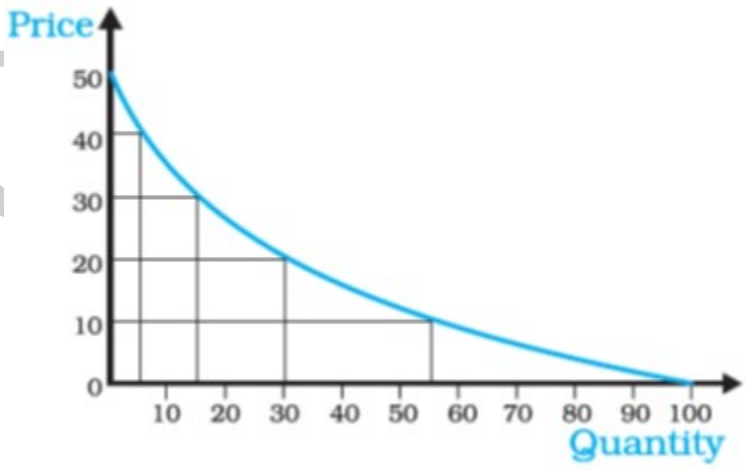


Figure 6.3 Demand curve of an individual for commodity x[27]

[27] http://ncert.nic.in/textbook/pdf/leec202.pdf

Ordinal utility analysis[28]

Indifference theory states that consumers form preferences for some combination of products over others. It also states that they (consumers) remain indifferent to some other combinations. The combinations of products that consumers view indifferently may be plotted on a graph which will give some points. If joined, these points will give us a curve termed as an indifference curve. All of the combinations of products that will fall right to or above the indifference curve will definitely be considered more satisfactory by the consumers, and as a result they will undertake activities to buy and consume those. The combinations of products that will fall left to or below the indifference curve will be viewed negatively as they are considered less satisfactory than the combinations falling on or above the indifference curve. Consumers as a result, will try to avoid buying and consuming products of these combinations (that fall below the indifference curve). The lesson that marketers may take from this theory is that, they should do their best to produce and offer products in such a way that are considered falling above the indifference curve. If viewed so, chances are that they will sell better than competing products.

Neoclassical economists maintain that indifference curves, utility and the utility functions from which they are derived, are ordinal, not cardinal, in nature[29]. They also maintain that utility cannot be measured cardinally. That is, an individual can only prefer A to B or be indifferent between them;1 he cannot measure how much he prefers A over B. They also maintain that interpersonal utility comparisons are logically invalid[30]. Indeed, the history of economic thought bears eloquent witness to the fact that the concept of ordinal utility triumphed over cardinal utility. Cardinal utility analysis is simple to understand, but suffers from a major drawback in the form of quantification of utility in numbers[31]. In real life, one never express utility in the form of numbers. At the most, one can rank various alternative combinations in terms of having more or less utility. In other words, the consumer does not measure utility in numbers, though she often ranks various consumption bundles. This forms the starting point of this topic – Ordinal Utility Analysis[32].

[28] http://docplayer.net/42360928-Consumer-behavior-theories.html
[29] http://mises.org/journals/qjae/pdf/qjae6_1_3.pdf
[30] A market basket of goods can be defined as containing specific quantities of various goods and services. For example, one basket may contain one hamburger, one soft drink, and a ticket to a ball game, while another basket may contain two soft drinks and two movie tickets. To be sure, numerical values could be attached to the utility received by the individual from consuming various hamburgers, even with ordinal utility. However, with ordinal utility, higher utility values only indicate higher rankings of utility, and no importance can be attached to actual numerical differences in utility. For example, 20 utils can only be interpreted as giving more utility than 10 utils, but not twice as much. Thus, to indicate rising utility rankings, numbers such as 5, 10, 20; 8, 15, 17; or I (lowest), II, and III are equivalent. See https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[31] http://ncert.nic.in/textbook/pdf/leec202.pdf
[32] http://ncert.nic.in/textbook/pdf/leec202.pdf

ordinal utility only *ranks* the utility received from consuming various amounts of a good or baskets of goods[33]. Ordinal utility specifies that consuming two hamburgers gives the individual more utility than when consuming one hamburger, but it does not specify exactly how much additional utility the second hamburger provides. Similarly, ordinal utility would say only that three hamburgers give this individual more utility than two hamburgers, but *not* how many more utils. Ordinal utility is a much weaker notion than cardinal utility because it only requires that the consumer be able to rank baskets of goods in the order of his or her preference. That is, when presented with a choice between any two baskets of goods, ordinal utility requires only that the individual indicate if he or she prefers the first basket, the second basket, or is indifferent between the two. It does not require that the individual specify how many more utils he or she receives from the preferred basket. In short, ordinal utility only ranks various consumption bundles, whereas cardinal utility provides an actual index or measure of satisfaction.

The ordinal utility approach is a school of thought that believes that utility cannot be measured quantitatively, that is, utility is not additive rather it could only be ranked according to preference[34]. The consumer must be able to determine the order of preference when faced with different bundles of goods by ranking the various 'baskets of goods' according to the satisfaction that each bundle gives[35]. For instance, if a consumer derives 3 utils from the consumption of one unit of commodity X and 12 utils from the consumption of commodity Y, this means that the consumer derives more satisfaction from consuming commodity Y than from commodity X. Though to the cardinals, the consumer derives four times more utility from one unit of Y than from X. The ordinal utility theory explains consumer behaviour by the use of indifference curve[36].

Consumers' tastes can be examined with ordinal utility[37]. An ordinal measure of utility is based on three assumptions. First, one assume that when faced with any two baskets of goods, the consumer can determine whether he or she prefers basket *A* to basket *B*, *B* to *A*, or whether he or she is indifferent between the two. Second, one assume that the tastes of the consumer are *consistent* or *transitive.* That is, if the consumer states that he or she prefers basket *A* to basket *B* and also that he or she prefers basket *B* to basket *C*, then that consumer will prefer *A* to *C*. Third, one assume that more of a commodity is preferred to less; that is, one assume that the commodity is a **good** rather than a **bad,** and the consumer is never satiated with the commodity[38]. The three

[33] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[34] https://www.coursehero.com/file/49339659/Consumer-Behavior-Ordinal-Utilitydocx/
[35] https://www.coursehero.com/file/49339659/Consumer-Behavior-Ordinal-Utilitydocx/
[36] http://ncert.nic.in/textbook/pdf/leec202.pdf
[37] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[38] Examples of bads are pollution, garbage, and disease, of which less is preferred to more.

assumptions can be used to represent an individual's tastes with indifference curves. In order to conduct the analysis by plane geometry, one will assume throughout that there are only two goods, *X* and *Y*.

Assumptions of ordinal utility approach[39]

It may be mentioned that the law of Diminishing Marginal Rate of Substitution causes an indifference curve to be convex to the origin. This is the most common shape of an indifference curve. But in case of goods being perfect substitutes[40], the marginal rate of substitution does not diminish. It remains the same. Let's take an example.

Here, the consumer is indifferent for all these combinations as long as the total of five rupee coins and five rupee notes remains the same. For the consumer, it hardly matters whether she gets a five rupee coin or a five rupee note. So, irrespective of how many five rupee notes she has, the consumer will sacrifice only one five rupee coin for a five rupee note. So these two commodities are perfect substitutes for the consumer and indifference curve depicting these will be a straight line. In the Table 6.4, it can be seen that consumer sacrifices the same number of five-rupee coins each time he has an additional five-rupee note.

i. Rationality: - The consumer is assumed to be rational meaning that he aims at maximizing total utility given his limited income and the prices of goods and services.

Table 6.4 Representation of Law of Diminishing Marginal Rate of Substitution

Combination	Quantity of five Rupees notes (Qx)	Quantity of five Rupees coins (Qy)	MRS
A	1	8	-
B	2	7	1:1
C	3	6	1:1
D	4	5	1:1

ii. Utility is Ordinal: - According to this assumption, utility is assumed not to be measurable but can only be ranked according to the order of preference for different kinds of goods.

[39] http://ncert.nic.in/textbook/pdf/leec202.pdf
[40] Perfect Substitutes are the goods which can be used in place of each other, and provide exactly the same level of utility to the consumer.

iii. Transitivity and Consistency of Choice: - By transitivity of choice, it means that if a consumer prefers bundle A to B and bundle B to C, then invariably, the consumer must prefer bundle A to C. Symbolically, it is written as:

If A > B and B > C; then A > C.

By consistency of choice, it is assumed that the consumer is consistent in his choice making. If two bundles A and B are available to the consumer, if the consumer prefers bundle A to B in one period, he cannot choose bundle B over A nor treat them as equal. Symbolically:

If A > B, then B > A and A ≠ B

iv. Diminishing Marginal Rate of Substitution (MRS):- MRS is the rate at which the consumer can exchange between two goods and still be at the same level of satisfaction. This assumption is based on the fact that the preferences are ranked in terms of indifference curves which are assumed to be convex to the origin. The Total Utility of the consumer depends on the quantities of the commodities consumed. That is, the total utility is the addition of the different utilities.

u = f(q1, q2 ----- qn) …….....…….. [2]

v. Non Satiation: - it is assumed that the consumer would always prefer a larger bundle of goods to a smaller bundle of the same good. He is never over supplied with goods within the normal range of consumption.

6.3. Indifference curves[41]

A consumer often consumes a large number of goods and may substitute one commodity for another and still be on the same level of satisfaction. As the consumer increases the consumption of one of the commodities, he must reduce the consumption of the second commodity and vice versa, to maintain the same level of satisfaction. A consumer's preferences over the set of available bundles can often be represented diagrammatically. One have already seen that the bundles available to the consumer can be plotted as points in a two-dimensional diagram. The points representing bundles which give the consumer equal utility can generally be joined to obtain a curve like the one in Figure 6.4. The consumer is said to be indifferent on the different

[41] http://ncert.nic.in/textbook/pdf/leec202.pdf

bundles because each point of the bundles give the consumer equal utility. It is clear that when a consumer gets one more banana, he has to forego some mangoes, so that her total utility level remains the same and she remains on the same indifference curve. Therefore, indifference curve slopes downward

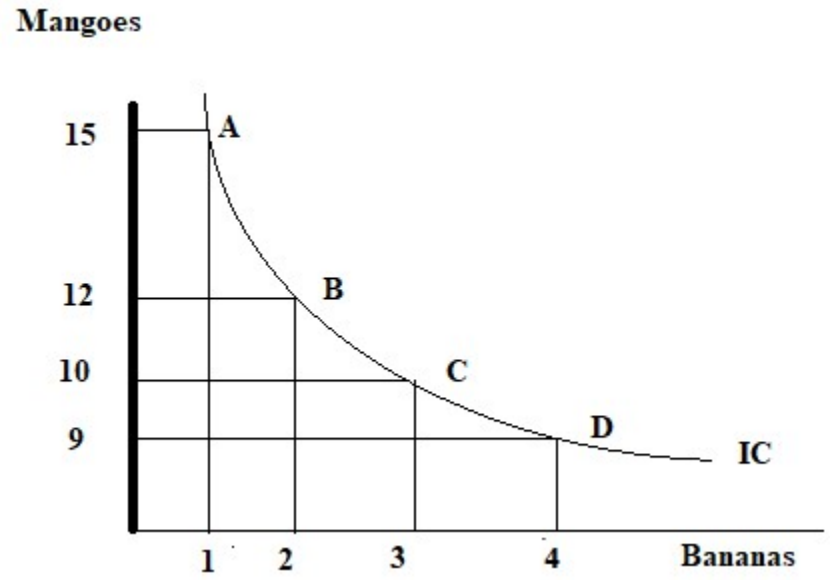


Figure 6.4 Indifference curve.

An indifference curve joins all points representing bundles which are considered indifferent by the consumer.

A curve joining all points representing bundles among which the consumer is indifferent is called an indifference curve. All the points such as A, B, C and D lying on an indifference curve provide the consumer with the same level of satisfaction. An indifference curve is defined as the locus of points representing different combination of two goods which yield equal utility to the consumer so that the consumer is indifferent to the combination consumed (Figure 6.5a). An indifference curve is also called iso-utility curve or equal utility curve. A higher indifference curve refers to a higher level of satisfaction, and a lower indifference curve refers to less satisfaction. However, one have no indication as to how much additional satisfaction or utility a higher indifference curve indicates. That is, different indifference curves simply provide an ordering or ranking of the individual's preference.

Indifference curves were first introduced by the English economist F.Y. Edgeworth in the 1880s. The concept was refined and used extensively by the Italian economist Vilfredo Pareto in the early 1900s. Indifference curves were popularized and greatly extended in application in the 1930s by two other English economists: R. G. D. Allen and John R. Hicks. Indifference curves are a crucial tool of analysis because they are used to represent an ordinal measure of the tastes

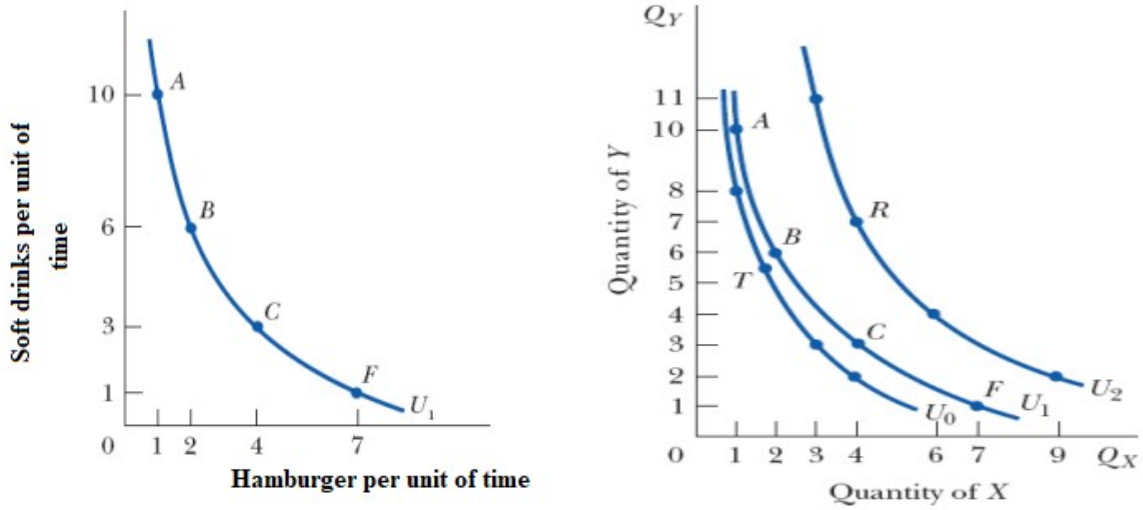
and preferences of the consumer and to show how the consumer maximizes utility in spending income. Let us illustrate the indifference curve using a consumer consuming two goods X and Y and makes six combinations which yield the same level of satisfaction. If one assume a hypothetical table with the different combinations of goods X and Y, the table could be regarded as an indifference schedule.

Table 6.5 Indifference schedule[42]

Hamburgers (*X*)	Soft Drinks (*Y*)	Combinations
1	10	*A*
2	6	*B*
4	3	*C*
7	1	*F*

For example, Table 6.5 gives an indifference schedule showing the various combinations of hamburgers (good *X*) and soft drinks (good *Y*) that give the consumer equal satisfaction. This information is plotted as indifference curve U_1 in the left panel of Figure 6.5. The right panel repeats indifference curve U_1 along with a higher indifference curve (U_2) and a lower one (U_0). Indifference curve U_1 shows that one hamburger and ten soft drinks per unit of time (combination *A*) give the consumer the same level of satisfaction as two hamburgers and six soft drinks (combination *B*), four hamburgers and three soft drinks (combination *C*), or seven hamburgers and one soft drink (combination *F*). On the other hand, combination *R* (four hamburgers and seven soft drinks) has both more hamburgers and more soft drinks than combination *B* (see the right panel of Figure 6.5), and so it refers to a higher level of satisfaction[43].

[42] https://www.coursehero.com/file/33587443/Consumer-Choice-Chapter4pdf/
[43] https://mafiadoc.com/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html



a) An indifference curve b) Indifference Map

Figure 6.5 Indifference Curves and Maps

The individual is indifferent among combinations *A*, *B*, *C*, and *F* since they all lie on indifference curve *U*1. *U*1 refers to a higher level of satisfaction than *U*0, but to a lower level than *U*2.[44]

Thus, combination *R* and all the other combinations that give the same level of satisfaction as combination *R* define higher indifference curve U_2[45]. Finally, all combinations on U_0 give the same satisfaction as combination *T*, and combination *T* refers to both fewer hamburgers and fewer soft drinks than (and therefore is inferior to) combination *B* on U_1. Although in Figure 6.5 one have drawn only three indifference curves, there is an indifference curve going through each point in the *XY* plane (i.e., referring to each possible combination of good *X* and good *Y*).

Table 6.6 A Hypothetical indifference schedule

Combination	Units of commodity X	Units of commodity Y	Utility
a	3	28	u
b	6	23	u
c	10	16	u
d	18	12	u
e	26	8	u
f	30	5	u

[44] https://www.coursehero.com/file/66684850/12-Consumer-Behavior-Indifference-Curvespdf/
[45] https://www.coursehero.com/file/33587443/Consumer-Choice-Chapter4pdf/

When the combinations a, b, c, d, e, f are plotted on a graph, the resulting curve is known as indifference curve. The indifference curve slopes downward from left to right showing that it is convex to the origin. Different sets of indifference curves give an indifference map. An indifference map (Figure 6.5b) contains different number of indifference curves to show that the consumer may also choose other combinations of goods X and Y. The combinations of goods on a higher indifference curve yield higher level of satisfaction and are preferred. From Figure 6.5b, combination of goods X and Y on IC_3 is higher than the combination on IC_2, while the combination on IC_2 is higher than the combination on IC_1.

6.3.1. Indifference map[46]

The consumer's preferences over all the bundles can be represented by a family of indifference curves as shown in Figure 6.6. That is, between any two indifference curves, an additional curve can always be drawn. The entire set of indifference curves is called an **indifference map** and reflects the entire set of tastes and preferences of the consumer. All points on an indifference curve represent bundles which are considered indifferent by the consumer[47].

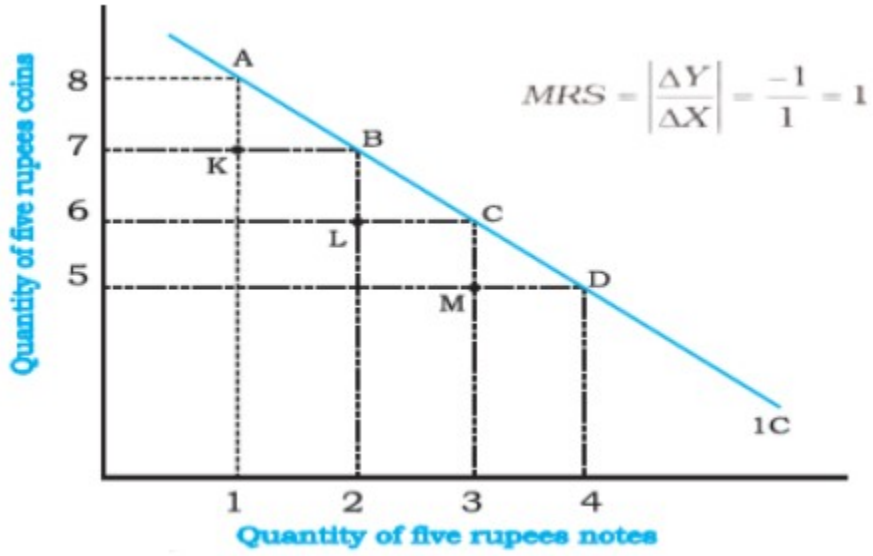


Figure 6.6 Indifference Curve for perfect substitutes[48]

Indifference curve depicting two commodities which are perfect substitutes is a straight line.

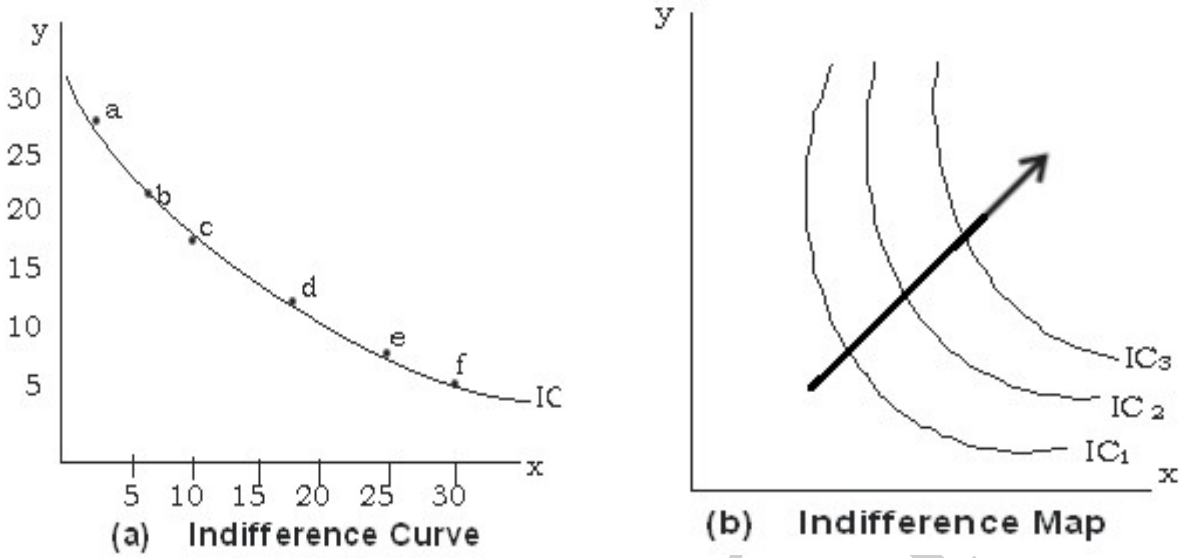
[46] http://ncert.nic.in/textbook/pdf/leec202.pdf
[47] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[48] http://ncert.nic.in/textbook/pdf/leec202.pdf

In Figure 6.7 Consumer's preferences are assumed to be such that between any two bundles (x_1, x_2) and (y_1, y_2), if (x_1, x_2) has more of at least one of the goods and no less of the other good compared to (y_1, y_2), then the consumer prefers (x_1, x_2) to (y_1, y_2). Preferences of this kind are called monotonic preferences[49]. Thus, a consumer's preferences are monotonic if and only if between any two bundles, the consumer prefers the bundle which has more of at least one of the goods and no less of the other good as compared to the other bundle.

6.3.2. Properties of an indifference curve[50]

Indifference curve slopes downwards from left to right: An indifference curve slopes downwards from left to right, which means that in order to have more of bananas, the consumer has to forego some mangoes. If the consumer does not forego some mangoes with an increase in number of bananas, it will mean consumer having more of bananas with same number of mangoes, taking her to a higher indifference curve. Thus, as long as the consumer is on the same indifference curve, an increase in bananas must be compensated by a fall in quantity of mangoes. This negative slope shows that for a consumer to stay on the same level of satisfaction, as the consumption of one commodity (X) increases, the quantity of the other commodity (Y) must decrease. This reflects the marginal rate of substitution. Marginal rate of substitution describes the rate of exchange between two commodities. For our two commodities X and Y, the marginal rate of substitution of commodity X for commodity Y denoted as MRSx,y is the rate at which commodity X can be substituted for commodity Y, leaving the consumer at the same level of satisfaction. It is also known as the negative slope of an indifference curve at any one point.

[49] https://www.scribd.com/document/439849964/Class-12-Introductory-Microeconomics-pdf
[50] http://ncert.nic.in/textbook/pdf/leec202.pdf



a) An indifference curve b) An indifference map

Figure 6.7A Graph showing an Indifference Curve and Map

The arrow indicates that bundles on higher indifference curves are preferred by the consumer to the bundles on lower indifference curves.

Slope of IC = $-\frac{dX}{dY}$ = $MRS_{Y,X}$ ……...…….. [3]

Indifference curves are negatively sloped because if one basket of goods *X* and *Y* contains more of *X*, it will have to contain less of *Y* than another basket in order for the two baskets to give the same level of satisfaction and be on the same indifference curve[51]. For example, since basket *B* on indifference curve *U*1 in Figure 6.8 contains more hamburgers (good *X*) than basket *A*, basket *B* must contain fewer soft drinks (good *Y*) for the consumer to be on indifference curve *U*1.

[51] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

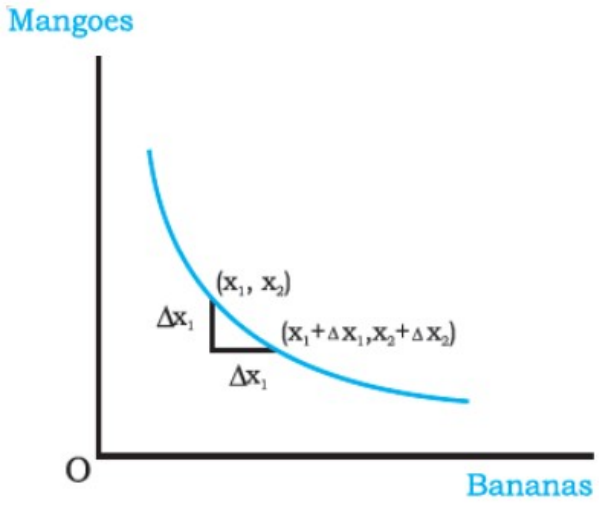
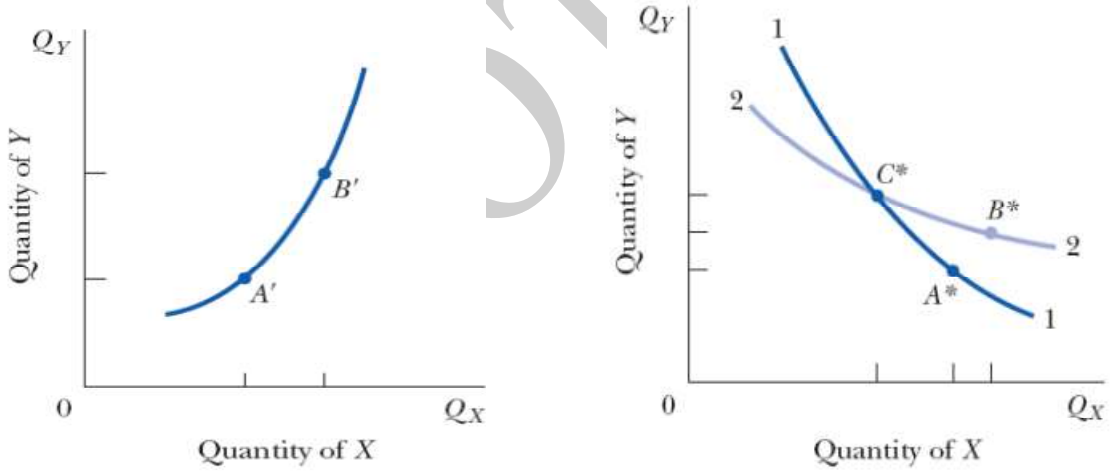


Figure 6.8 Slope of the Indifference Curve[52]

The indifference curve slopes downward. An increase in the amount of bananas along the indifference curve is associated with a decrease in the amount of mangoes. If D x1 > 0 then D x2 < 0.



a) Positively sloped curve cannot be an indifference curve

because it shows that combination *B*, which contains more of *X* and *Y* than combination *A*, gives equal satisfaction to the consumer as *A*_.

b) Indifference Curves Cannot be positively sloped or Intersect

Since *C** is on curves 1 and 2, it should give the same satisfaction as *A** and *B**, but this is impossible because *B** has more of *X* and *Y* than *A**. Thus, indifference curves cannot intersect.

Figure 6.9 Properties of indifference curves[53]

[52] http://ncert.nic.in/textbook/pdf/leec202.pdf
[53] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

A positively sloped curve would indicate that one basket containing more of both commodities gives the same utility or satisfaction to the consumer as another basket containing less of both commodities (and no other commodity). Because one are dealing with goods rather than bads, such a curve could not possibly be an indifference curve. For example, in the left panel of Figure 6.9, combination *B*_ contains more of *X* and more of *Y* than combination *A*_, and so the positively sloped curve on which *B*_ and *A*_ lie cannot be an indifference curve. That is, *B*_ must be on a higher indifference curve than *A*_ if *X* and *Y* are both goods[54].

Indifference curves must not Intersect[55]: - If two indifferent curves intersect, it means two different levels of satisfaction at the point of intersection. This situation is impossible because it implies inconsistency in consumer's choices. In other words, it nullifies the consistency and transitivity of choice assumption. Intersecting curves are inconsistent with the definition of indifference curves. For example, if curve 1 and curve 2 in the right panel of Figure 6.9 were indifference curves, they would indicate that basket *A** is equivalent to basket *C** since both *A** and *C** are on curve 1, and also that basket *B** is equivalent to basket *C** since both *B** and *C** are on curve 2. By transitivity, *B** should then be equivalent to *A**. However, this is impossible because basket *B** contains more of both good *X* and good *Y* than basket *A**. Thus, indifference curves cannot intersect.

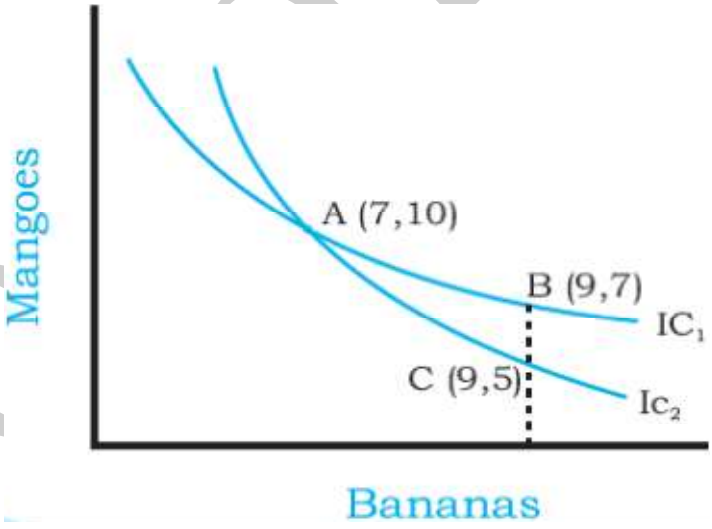


Figure 6.10 Two indifference curves never intersect each other[56]

Two indifference curves intersecting each other will lead to conflicting results[57]. To explain this, let us allow two indifference curves to intersect each other as shown in the Figure 6.9b and 6.10

[54] Only if either X or Y onere a bad would the indifference curve be positively sloped as in the left panel of Figure 3.3.
[55] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[56] http://ncert.nic.in/textbook/pdf/leec202.pdf

As points A and B lie on the same indifference curve IC_1, utilities derived from combination A and combination B will give the same level of satisfaction. Similarly, as points A and C lie on the same indifference curve IC_2, utility derived from combination A and from combination C will give the same level of satisfaction.

From this, it follows that utility from point B and from point C will also be the same. But this is clearly an absurd result, as on point B, the consumer gets a greater number of mangoes with the same quantity of bananas. So consumer is better off at point B than at point C. Thus, it is clear that intersecting indifference curves will lead to conflicting results. Thus, two indifference curves cannot intersect each other.

Upper indifference curve indicates a higher level of satisfaction[58]: - An upper indifference curve contains a larger combination of both commodities than a lower one and gives the consumer a higher level of satisfaction. As long as marginal utility of a commodity is positive, an individual will always prefer more of that commodity, as more of the commodity will increase the level of satisfaction.

Table 6.7 Representation of different level of utilities from different combination of goods

Combination	Quantity of bananas	Quantity of Mangoes
A	1	10
B	2	10
C	3	10

Consider the different combination of bananas and mangoes, A, B and C depicted in Table 6.7 and Figure 6.10. Combinations A, B and C consist of same quantity of mangoes but different quantities of bananas. Since combination B has more bananas than A, B will provide the individual a higher level of satisfaction than A. Therefore, B will lie on a higher indifference curve than A, depicting higher satisfaction. Likewise, C has more bananas than B (quantity of mangoes is the same in both B and C). Therefore, C will provide higher level of satisfaction than B, and also lie on a higher indifference curve than B. A higher indifference curve consisting of combinations with more of mangoes, or more of bananas, or more of both, will represent combinations that give higher level of satisfaction.

[57] http://ncert.nic.in/textbook/pdf/leec202.pdf
[58] http://ncert.nic.in/textbook/pdf/leec202.pdf

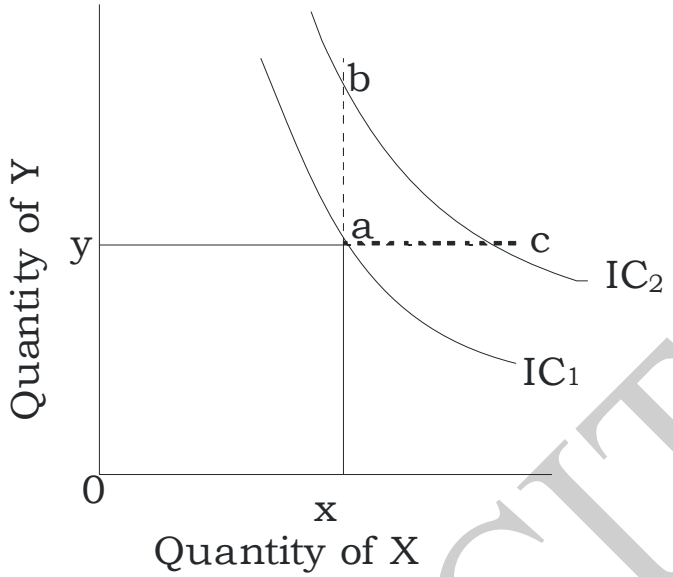


Figure 6.11 Higher and Lower Indifference Curve.

Higher indifference curves give greater level of utility.

Let us assume two commodities X and Y with different combinations. From Figure 6.11, there are two indifference curves IC_1, and IC_2. A movement from point 'a' on IC_1 to point 'b' on IC_2 indicates an increase in the quantity of commodity Y, while a horizontal movement from point 'a' to point 'c' on IC_2 indicates an increase in the quantity of commodity X with the quantity of commodity Y remaining constant. The combinations on point 'b' and 'c' on IC_2 yield higher utility and will be preferred by the consumer.

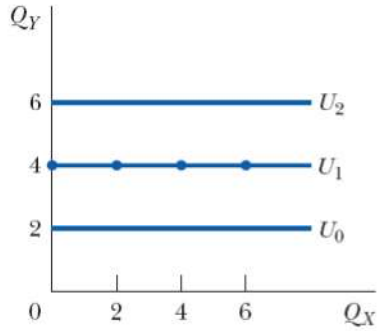
Indifference curve must be convex to the origin: - This shows that the slope of the indifference curve decreases as one move along the curve from left to the right. Convexity results from or is a reflection of a decreasing marginal rate of substitution, which is discussed next.

6.3.3. Some special types of indifference curves[59]

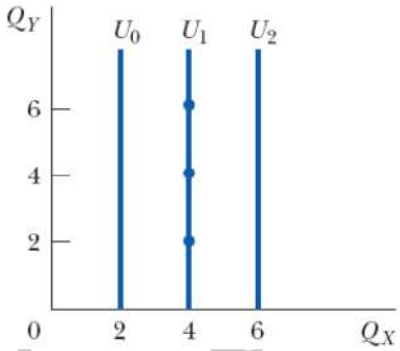
Although indifference curves are usually negatively sloped and convex to the origin, they may sometimes assume other shapes, as shown in Figure 6.12. Horizontal indifference curves, as in the top left panel of Figure 6.12, would indicate that commodity *X* is a **neuter;** that is, the consumer is indifferent between having more or less of the commodity. Vertical indifference curves, as in the top right panel of Figure 6.12, would indicate instead that commodity *Y* is a neuter. The bottom left panel of Figure 6.12 shows indifference curves that are negatively sloped

[59] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

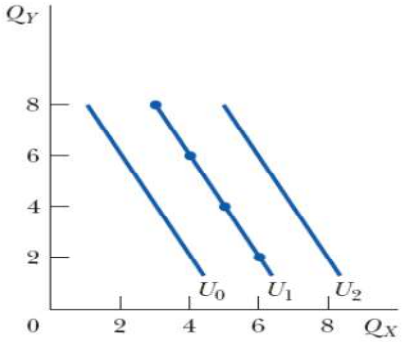
straight lines. Here, MRS_{XY} or the absolute slope of the indifference curves is constant. This means that an individual is always willing to give up the same amount of good *Y* (say, two cups of tea) for each additional unit of good *X* (one cup of coffee). Therefore, good *X* and two units of good *Y* are *perfect substitutes* for this individual.



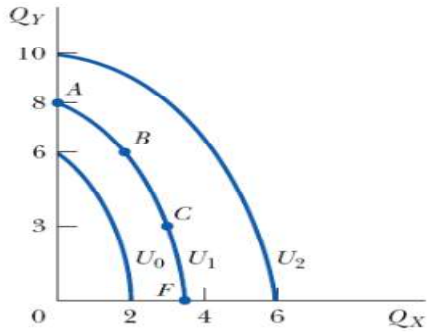
a) Horizontal indifference curves, as in the top left panel, indicate that *X* is a neuter; that is, the consumer is indifferent between having more or less of it



b) Vertical indifference curves, as in the top right panel, would indicate instead that commodity Y is a neuter



c) Indifference curves that are negatively sloped straight lines, as in the bottom left panel, indicate that MRSXY is constant, and so X and Y are perfect substitutes for the individual

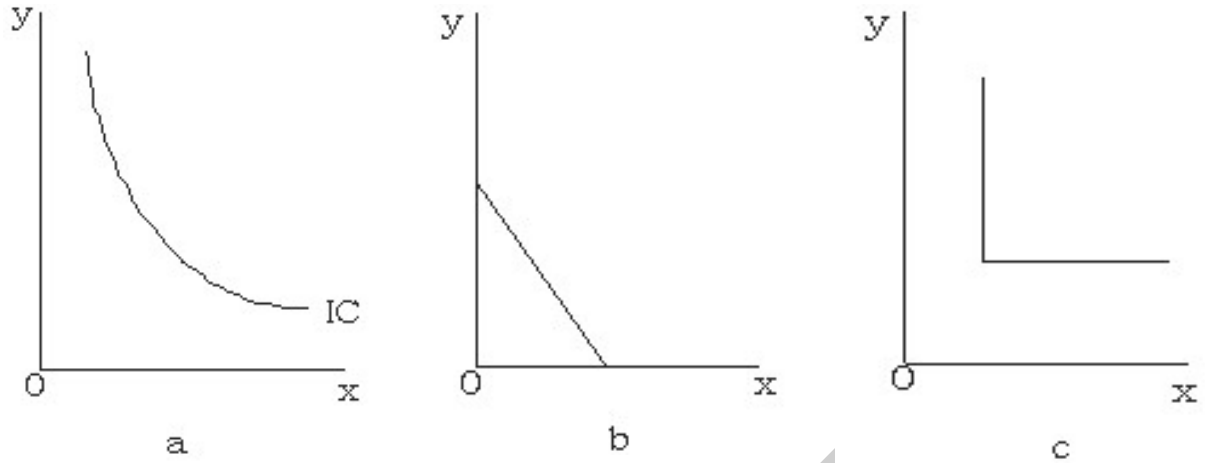


d) The bottom right panel shows indifference curves that are concave to the origin (i.e., MRSXY increases).

Figure 6.12 Some unusual Indifference Curves

It is assumed that the goods may not be perfect substitutes but if the commodities are perfect substitutes, the indifference curve becomes a straight line with a negative slope (Figure 6.13b). And if the commodities are complements the curve assumes the shape of a right angle (Figure 6.13c)[60].

[60] http://www.economicsdiscussion.net/theory-of-demand/theory-of-consumer-behaviour-indifference-curves/4848



a) Well behaved preferences b) Perfect substitutes c) Perfect complements

Figure 6.13 Different shapes of Indifference Curve[61]

Box 6.2 How Ford Decided on the Characteristics of Its Taurus[62][63]
Firms can learn about consumers' preferences by conducting or commissioning marketing studies to identify the most important characteristics of a product, say, styling and performance for automobiles, and to determine how much more consumers would be willing to pay to have more of each attribute, or how they would trade off more of one attribute for less of another. This approach to consumer demand theory, which focuses on the characteristics or attributes of goods and on their worth or *hedonic prices* rather than on the goods themselves,was pioneered byKelvin Lancaster. This is in fact how the Ford Motor Company decided on the characteristics of its 1986 Taurus. Specifically, Ford determined by marketing research that the two most important characteristics of an automobile for the majority of consumers were styling (i.e., design and interior features) and performance (i.e., acceleration and handling) and then produced its Taurus in 1986 that incorporated those characteristics. The rest is history (the Taurus regained in 1992 its status of the best-selling car in America—a position that it had lost to the Honda Accord in 1989). Ford also used this approach to decide on the characteristics of the all-new 1996 Taurus, the first major overhaul since its 1986 launch, at a cost of $2.8 billion, as well as in deciding the characteristics of its world cars, Focus, launched in 1998, the Mondeo introduced in 2000, and the new Fiesta in Europe in 2008 and in the United States in 2010. Other automakers, such as General Motors,

[61] http://www.economicsdiscussion.net/theory-of-demand/theory-of-consumer-behaviour-indifference-curves/4848
[62] Sources:
(Bajic, 1993);
(Berry, Levinsohn, & Pakes, 1998);
(Ford's Taurus Loses Favor to New-Age Sport Wagon, 2002);
(Ford Eyes More Cuts, as Recovery Advances, 2008); and
(Ford Puts Its Future on the Line, 1985);
(Ford Hopes Its New Focus Will Be a Global Best Seller, 1998)
(Once Frumpy, Green Cars Start Showing Some Flash, 2007); and
(One World, One Car, One Name, 2008).
[63] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

Box 6.2 How Ford Decided on the Characteristics of Its Taurus[6263]
followed similar procedures in determining the characteristics of their automobiles. Since then U.S. automakers have shifted somewhat toward producing "sports wagons," which are a cross between sedans and sport-utility vehicles (SUVs) to reflect recent changes in consumer tastes, and toward more fuel-efficient and "green" automobiles as a result of the sharp increase in gasoline prices and heightened environmental concerns. Market studies can also be used to determine how consumers' tastes have changed over time. In terms of indifference curves, a reduction in the consumer's taste for commodity *X* (hamburgers) in relation to commodity *Y* (soft drinks) would be reflected in a flattening of the indifference curve of Figure 3.4, indicating that the consumer would now be willing to give up less of *Y* for each additional unit of *X*. The different tastes of different consumers are also reflected in the shapes of their indifference curves. The consumer who prefers soft drinks to hamburgers will have a flatter indifferences curve than a consumer who does not.

Finally, the bottom right panel 0f Figure 6.13 shows indifference curves that are concave rather than convex to the origin[64]. This means that the individual is willing to give up more and more units of good *Y* for each additional unit of *X* (i.e., MRS_{XY} increases). For example, between points *A* and *B* on U_1, $MRS_{XY} = 2/2 = 1$; between *B* and *C*, $MRS_{XY} = 3/1 = 3$; and between *C* and *F*, $MRS_{XY} = 3/0.5 = 6$. In Section 3.5, one will see that in this unusual case, the individual would end up consuming only good *X* or only good *Y*. Even though indifference curves can assume any of the shapes shown in Figure 3.5, they are usually negatively sloped, nonintersecting, and convex to the origin. These characteristics have been confirmed experimentally[65]. Because it is difficult to derive indifference curves experimentally, however, firms try to determine consumers' preferences by marketing studies, as explained in Box 6.2.

6.3.4. The marginal rate of substitution[66]

The **marginal rate of substitution (*MRS*)** refers to the amount of one good that an individual is willing to give up for an additional unit of another good while maintaining the same level of satisfaction or remaining on the same indifference curve. For example, the marginal rate of substitution of good *X* for good *Y* (MRS_{XY}) refers to the amount of *Y* that the individual is willing to exchange per unit of *X* and maintain the same level of satisfaction. Note that MRS_{XY} 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,

$MRS_{XY} = -\Delta Y/\Delta X.$ |[67]. ……...…….. [4]

[64] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[65] See, for example, K. R. MacCrimmon and M. Toda, "The Experimental Determination of Indifference Curves," *Review of Economic Studies,* October 1969.
[66] http://docplayer.net/9790572-Chapter-consumer-preferences-and-choice.html
[67] $|DY/DX| = DY/DX$ *if* $(DY/DX)\ 0$

Because of the reduction in Y, MRS_{XY} is negative. However, one multiply by −1 and express MRS_{XY} as a positive value.

For example, starting at point A on U_1 in Figure 6.14, the individual is willing to give up four units of Y for one additional unit of X and reach point B on U_1. Thus, $MRS_{XY} = -(-4/1) = 4$. This is the absolute (or positive value of the) slope of the chord from point A to point B on U_1. Between point B and point C on U_1, $MRS_{XY} = 3/2 = 1.5$ (the absolute slope of chord BC). Between points C and F, $MRS_{XY} = 2/3 = 0.67$. At a particular point on the indifference curve, MRS_{XY} is given by the absolute slope of the tangent to the indifference curve at that point. Different individuals usually have different indifference curves and different MRS_{XY} (at points where their indifference curves have different slopes)[68].

One can relate indifference curves to the preceding utility analysis by pointing out that all combinations of goods X and Y on a given indifference curve refer to the same level of total utility for the individual. Thus, for a movement down a given indifference curve, the gain in utility in consuming more of good X must be equal to the loss in utility in consuming less of good Y. Specifically, the increase in consumption of good X (ΔX) times the marginal utility that the individual receives from consuming each additional unit of X (MU_X) must be equal to the reduction in Y ($-\Delta Y$) times the marginal utility of Y (MU_Y). That is,

$$(\Delta X)(MU_X) = -(\Delta Y)(MU_Y) \qquad \text{[5]}$$

so that

$$MU_X/MU_Y = -\Delta Y/\Delta X = MRS_{XY} \qquad \text{[6]}$$

Thus, MRS_{XY} is equal to the absolute slope of the indifference curve and to the ratio of the marginal utilities.

Note that MRS_{XY} (i.e., the absolute slope of the indifference curve) declines as one move down the indifference curve. This follows from, or is a reflection of, the convexity of the indifference curve. That is, as the individual moves down an indifference curve and is left with less and less Y (say, soft drinks) and more and more X (say, hamburgers), each remaining unit of Y becomes more valuable to the individual and each additional unit of X becomes less valuable. Thus, the

---

$= -\mathrm{D}Y / \mathrm{D}X$ *if* $(\mathrm{D}Y / \mathrm{D}X) < 0$ $MRS = |\mathrm{D}Y / \mathrm{D}X|$
means that MRS equals only the magnitude of the expression
$\mathrm{D}Y / \mathrm{D}X$. If $\mathrm{D}Y / \mathrm{D}X = -3/1$ it means MRS=3.
[68] https://es.scribd.com/document/109578637/Salvatore-Chapter-3

individual is willing to give up less and less of *Y* to obtain each additional unit of *X*. It is this property that makes MRS_{XY} diminish and indifference curves convex to the origin. One will see in Section 3.5 the crucial role that convexity plays in consumer utility maximization.[8]

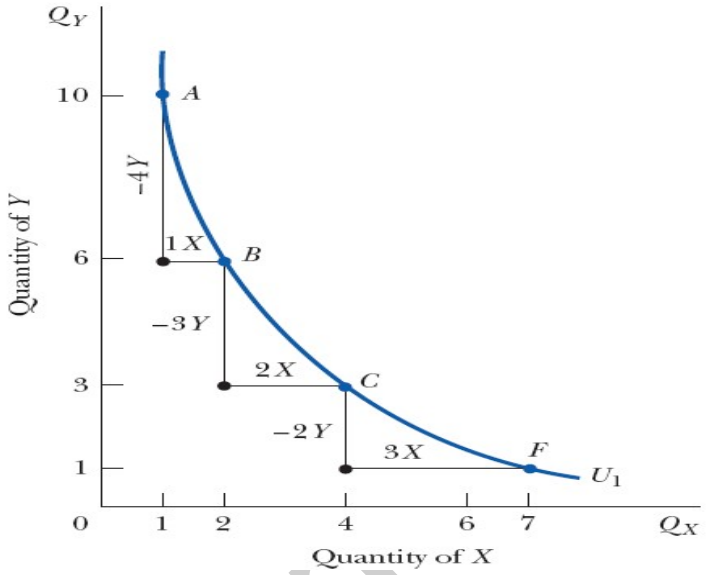


Figure 6.14 Marginal Rate of Substitution (*MRS*)[69]

Starting at point *A*, the individual is willing to give up 4 units of *Y* for one additional unit of *X* and reach point *B* on *U*1. Thus, *MRSXY* = 4 (the absolute slope of chord *AB*). Between points *B* and *C*, *MRSXY* = 3/2. Between *C* and *F*, *MRSXY* = 2/3. *MRSXY* declines as the individual moves down the indifference curve.

In terms of the Mangoes-Banana example[70], the amount of mangoes that the consumer has to forego, in order to get an additional banana, holding total utility level the same, is called marginal rate of substitution (MRS of mangoes for banana). In other words, MRS is simply the rate at which the consumer will substitute bananas for mangoes, so that her total utility remains constant. One can notice that, in the Table 6.8, as one increase the quantity of bananas, the quantity of mangoes sacrificed for each additional banana declines. In other words, MRS diminishes with increase in the number of bananas. As the number of bananas with the consumer increases, the MU derived from each additional banana falls. Similarly, with the fall in quantity of mangoes, the marginal utility derived from mangoes increases. So, with increase in the number of bananas, the consumer will feel the inclination to sacrifice small and smaller amounts of mangoes. This tendency for the MRS to fall with increase in quantity of bananas is known as Law of Diminishing Marginal Rate of Substitution[71].

[69] https://es.scribd.com/document/109578637/Salvatore-Chapter-3
[70] http://ncert.nic.in/textbook/pdf/leec202.pdf
[71] http://ncert.nic.in/textbook/pdf/leec202.pdf

This can be seen from Figure 6.16 also. Going from point A to point B, the consumer sacrifices 3 mangoes for 1 banana, going from point B to point C, the consumer sacrifices 2 mangoes for 1 banana, and going from point C to point D, the consumer sacrifices just 1 mango for 1 banana. Thus, it is clear that the consumer sacrifices smaller and smaller quantities of mangoes for each additional banana.

Table 6.8 Representation of Law of Diminishing Marginal Rate of Substitution[72]

Combination	Quantity of bananas (Qx)	Quantity of Mangoes (Qy)	MRS
A	1	15	-
B	2	12	3:1
C	3	10	2:1
D	4	9	1:1

6.3.5. International convergence of tastes[73]

A rapid convergence of tastes is taking place in the world today. Tastes in the United States affect tastes around the world and tastes abroad strongly influence tastes in the United States. Coca-Cola and jeans are only two of the most obvious U.S. products that have become household items around the world. One can see Adidas sneakers and Walkman personal stereos on joggers from Central Park in New York City to Tivoli Gardens in Copenhagen. One can eat Big Macs in Piazza di Spagna in Rome or Pushkin Square in Moscow. One find Japanese cars and VCRs in New York and in New Delhi, French perfumes in Paris and in Cairo, and Perrier in practically every major (and not so major) city around the world. Texas Instruments and Canon calculators, Dell and Hitachi portable PCs, and Xerox and Minolta copiers are found in offices and homes more or less everywhere. With more rapid communications and more frequent travel, the worldwide convergence of tastes has even accelerated. This has greatly expanded our range of consumer choices and forced producers to think in terms of global production and marketing to remain competitive in today's rapidly shrinking world.

In his 1983 article "The Globalization of Markets" in the *Harvard Business Review,* Theodore Levitt asserted that consumers from NewYork to Frankfurt to Tokyo want similar products and that success for producers in the future would require more and more standardized products and pricing around the world. In fact, in country after country, one are seeing the emergence of a middle-class consumer lifestyle based on a taste for comfort, convenience, and speed. In the food business, this means packaged, fast-to-prepare, and ready-to-eat products. Market researchers have discovered that similarities in living styles among middle-class people all over the world

[72] http://ncert.nic.in/textbook/pdf/leec202.pdf
[73] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

are much greater than one once thought and are growing with rising incomes and education levels. Of course, some differences in tastes will always remain among people of different nations, but with the tremendous improvement in telecommunications, transportation, and travel, the cross fertilization of cultures and convergence of tastes can only be expected to accelerate. This trend has important implications for consumers, producers, and sellers of an increasing number and types of products and services.

Box 6.3 Gillette Introduces the Sensor and Mach3 Razors—Two Truly Global Products[74][75]

As tastes become global, firms are responding more and more with truly global products. These are introduced more or less simultaneously in most countries of the world with little or no local variation. This is leading to what has been aptly called the "global supermarket." For example, in 1990, Gillette introduced its new Sensor Razor at the same time in most nations of the world and advertised it with virtually the same TV spots (ad campaign) in 19 countries in Europe and North America. In 1994, Gillette introduced an upgrade of the Sensor Razor called SensorExcell with a high-tech edge. By 1998, Gillette had sold over 400 million of Sensor and SensorExcell razors and more than 8 billion twin-blade cartridges, and it had captured an incredible 71% of the global blade market. Then in April 1998, Gillette unveiled the Mach3, the company's most important new product since the Sensor. It has three blades with a new revolutionary edge produced with chipmaking technology that took five years to develop. Gillette developed its new razor in stealth secrecy at the astounding cost of over $750 million, and spent another $300 million to advertise it. Since it went on sale in July 1998, the Mach3 has proven to be an even greater success than the Sensor Razor. Gillette introduced the Mach3 Turbo Razor worldwide in April 2002, in June 2004 its M3Power Razor, as an evolution of its Mach 3, and its five-blade Fusion in early 2006. With the merger of Gillette and Procter & Gamble, the global reach of the M3Power and Fusion are likely to be even greater than for its predecessors.

The trend toward the global supermarket is rapidly spreading in Europe as borders fade and as Europe's single currency (the euro) brings prices closer across the continent. A growing number of companies are creating "Euro-brands"—a single product for most countries of Europe—and advertising them with "Euro-ads," which are identical or nearly identical across countries, except for language. Many national differences in taste will, of course, remain; for example, Nestlé markets more than 200 blends of Nescafé to cater to differences in tastes in different markets. But the

[74] Sources:
(Building the Global Supermarket, 1988)
(Can Nestlé Be the Very Best?, 2001)
(Converging Prices Mean Trouble for European Retailers, 1999)
(For Cutting-Edge Dads, 2004)
(Gillette, Defying Economy, Introduces a $9 Razor Set, 2001)
(Gillette New Edge, 2006)
(Gillette Finally Reveals Its Vision of the Future, and it Has 3 Blades, 1998)
(Gillette's World View: One Blade Fits All, 1994)
(How Many Blades Is Enough?, 2005)
(P&G's $57 Billion Bargain, 2005)
(Selling in Europe: Borders Fade, 1990)

[75] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

Box 6.3 Gillette Introduces the Sensor and Mach3 Razors—Two Truly Global Products[74][75]
converging trend in tastes around the world is unmistakable and is likely to lead to more and more global products. This is true not only in foods and inexpensive consumer products but also in automobiles, tires, portable computers, phones, and many other durable products.

6.3.6. The budget constraint[76]

In order to conduct the analysis by plane geometry, one assume that the consumer spends all of his or her income on only two goods, *X* and *Y*. One will see that the constraints of the consumer can then be represented by a line called the budget line[77]. The position of the budget line and changes in it can best be understood by looking at its endpoints. Let us consider a consumer who has only a fixed amount of money (income) to spend on two goods. The prices of the goods are given in the market. The consumer cannot buy any and every combination of the two goods that she may want to consume. The consumption bundles that are available to the consumer depend on the prices of the two goods and the income of the consumer. Given her fixed income and the prices of the two goods, the consumer can afford to buy only those bundles which cost her less than or equal to her income.

The main objective of a rational consumer is to maximize his total utility by assigning his limited resources (income). The consumer's ability to allocate these commodity bundles depends on the prices of the commodities. The income and prices of the concerned commodities act as a constraint to the consumer's ability to consume the desired commodities. Jointly they form a budget constraint and when graphed, it gives the budget line. Assuming our two commodities X and Y with prices Px and Py respectively, if the consumer spends all the income on the two commodities alone, the budget equation may be written as follows:

$I = XPx + YPy$ ……...…….. [7]

Where,

I = the income constraint of the consumer. X and Y quantities of commodities X and Y respectively while Px and Py are the respective prices of commodities X and Y.

[76] http://ncert.nic.in/textbook/pdf/leec202.pdf
[77] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

Suppose the income of the consumer is M and the prices of bananas and mangoes are p_1 and p_2 respectively[78]. If the consumer wants to buy x_1 quantities of bananas, she will have to spend p_1x_1 amount of money. Similarly, if the consumer wants to buy x_2 quantities of mangoes, she will have to spend p_2x_2 amount of money. Therefore, if the consumer wants to buy the bundle consisting of x_1 quantities of bananas and x_2 quantities of mangoes, she will have to spend $p_1x_1 + p_2x_2$ amount of money. She can buy this bundle only if she has at least $p_1x_1 + p_2x_2$ amount of money. Given the prices of the goods and the income of a consumer, she can choose any bundle as long as it costs less than or equal to the income she has. In other words, the consumer can buy any bundle (x_1, x_2) such that

$$P_1x_1 + P_2x_2 \leq M \quad \text{.....} \quad [7]$$

The inequality (2.1) is called the consumer's budget constraint. The set of bundles available to the consumer is called the budget set. The budget set is thus the collection of all bundles that the consumer can buy with her income at the prevailing market prices.

Box 6.4 Example of a budget line[79]

Consider, for example, a consumer who has Rs 20, and suppose, both the goods are priced at Rs 5 and are available only in integral units. The bundles that this consumer can afford to buy are: (0, 0), (0, 1), (0, 2), (0, 3), (0, 4), (1, 0), (1, 1), (1, 2), (1, 3), (2, 0), (2, 1), (2, 2), (3, 0), (3, 1) and (4, 0). Among these bundles, (0, 4), (1,3), (2, 2), (3, 1) and (4, 0) cost exactly Rs 20 and all the other bundles cost less than Rs 20. The consumer cannot afford to buy bundles like (3, 3) and (4, 5) because they cost more than Rs 20 at the prevailing prices.

Suppose that PX = \$2, PY = \$1, and I = \$10 per unit of time. This could, for example, be the situation of a student who has \$10 per day to spend on snacks of hamburgers (good X) priced at \$2 each and on soft drinks (good Y) priced at \$1 each. By spending all income on Y, the consumer could purchase 10Y and 0X. This defines endpoint J on the vertical axis of Figure 3.6. Alternatively, by spending all income on X, the consumer could purchase 5X and 0Y. This defines endpoint K on the horizontal axis. By joining endpoints J and K with a straight line one get the consumer's **budget line.**

This line shows the various combinations of X and Y that the consumer can purchase by spending all income at the given prices of the two goods. For example, starting at endpoint J, the consumer could give up two units of Y and use the \$2 not spent on Y to purchase the first unit of X and reach point L. By giving up another 2Y, he or she could purchase the second unit of X. The slope of −2 of budget line JK shows that for each 2Y the consumer gives up, he or she can purchase 1X more.

[78] Price of a good is the amount of money that the consumer has to pay per unit of the good she wants to buy. If rupee is the unit of money and quantity of the good is measured in kilograms, the price of banana being p1 means the consumer has to pay p1 rupees per kilograms of banana that she wants to buy

[79] http://ncert.nic.in/textbook/pdf/leec202.pdf

The consumer can purchase any combination of X and Y on the budget line or in the shaded area below the budget line (called budget space). For example, at point B the individual would spend \$4 to purchase 2X and the remaining \$6 to purchase 6Y. At point M, he or she would spend \$8 to purchase 4X and the remaining \$2 to purchase 2Y. On the other hand, at a point such as H in the shaded area below the budget line (i.e., in the budget space), the individual would spend \$4 to purchase 2X and \$3 to purchase 3Y and be left with \$3 of unspent income. In what follows, one assume that the consumer does spend all of his or her income and is on the budget line. Because of the income and price constraints, the consumer cannot reach combinations of X and Y above the budget line. For example, the individual cannot purchase combination *G* (4*X*, 6*Y*) because it requires an expenditure of \$14 (\$8 to purchase 4*X* plus \$6 to purchase 6*Y*). If both the goods are perfectly divisible[80], the consumer's budget set would consist of all bundles (x1, x2) such that x1 and x2 are any numbers greater than or equal to 0 and $P_1x_1 + P_2x_2 \leq M$. The budget set can be represented in a diagram as in Figure 2.9. All bundles in the positive quadrant which are on or below the line are included in the budget set. The equation of the line is

$P_1x_1 + P_2x_2 = M$ …….……..…….. [8]

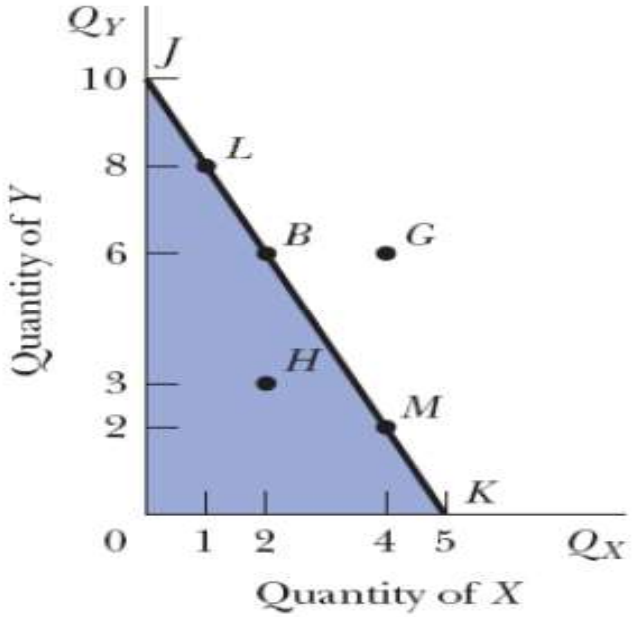


Figure 6.15 The Budget Line[81]

With an income of *I* = \$10, and *PY* = \$1 and *PX* = \$2, one get budget line *JK*. This shows that the consumer can purchase10*Y* and *0X* (endpoint *J*), 8*Y* and1*X* (point *L*), 6*Y* and 2*X* (point *B*), or . . . 0*Y* and 5*X* (endpoint *K*). *I*/*PY* = \$10/\$1 = 10 is the vertical or *Y*-intercept of the budget line and −*PX*/*PY*=−\$2/\$1=−2 is the slope.

[80] The goods considered in Example 2.1 are not divisible and are available only in integer units. There are many goods which are divisible in the sense that they are available in non-integer units also. It is not possible to buy half an orange or one-fourth of a banana, but it is certainly possible to buy half a kilogram of rice or one-fourth of a litre of milk. See http://ncert.nic.in/textbook/pdf/leec202.pdf.

[81] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

The line consists of all bundles which cost exactly equal to *M*. This line is called the budget line. Points below the budget line represent bundles which cost strictly less than *M*. The equation (6.8) can also be written as[82]

$$x_2 = \frac{M}{p_2} - \frac{p_1}{p_2} x_1. \quad \text{.....} \quad [9]$$

If the consumer decides not to buy commodity X and spend the whole income in consuming commodity Y, then the quantity of Y demanded by the consumer will be:

$$Qy = {}^{I}/_{p_y}. \quad \text{.....} \quad [10]$$

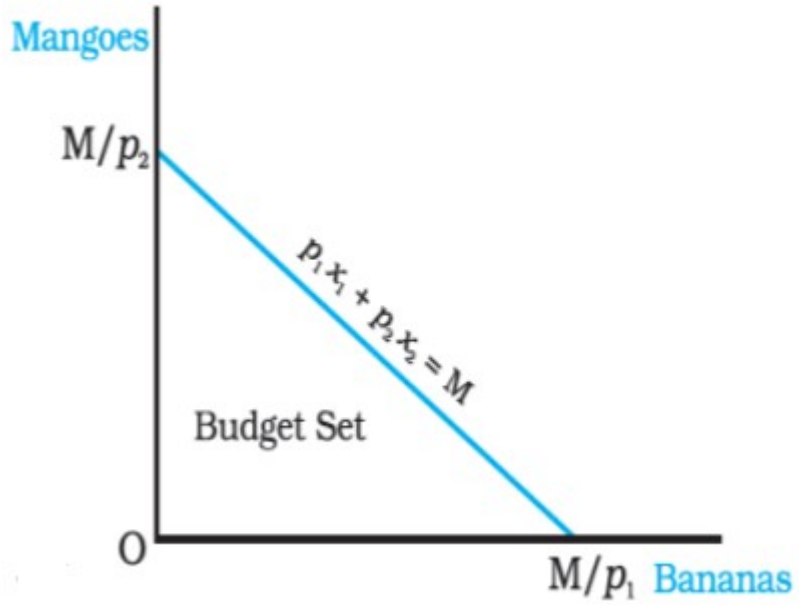


Figure 6.16 Budget Set[83]

Quantity of bananas is measured along the horizontal axis and quantity of mangoes is measured along the vertical axis. Any point in the diagram represents a bundle of the two goods.

The budget set consists of all points on or below the straight line having the equation

$P_1X_1 + P_2X_2 = I.$ ..... [11]

Similarly, if the consumer decides to spend the entire income in buying commodity X, then the quantity of X demanded will be:

[82] In school mathematics, onehave learnt the equation of a straight line as y = c + mx where c is the vertical intercept and m is the slope of the straight line. Note that equation (2.3) has the same form.

[83] http://ncert.nic.in/textbook/pdf/leec202.pdf

$Q_x = {}^{I}/_{p_1}$ ……..…….. [12]

Therefore, equation 6.12 and 6.13 explains the points of intersection of the budget line at the respective X and Y axis. The income constraint can be represented graphically with the budget line as shown in Figure 6.20.

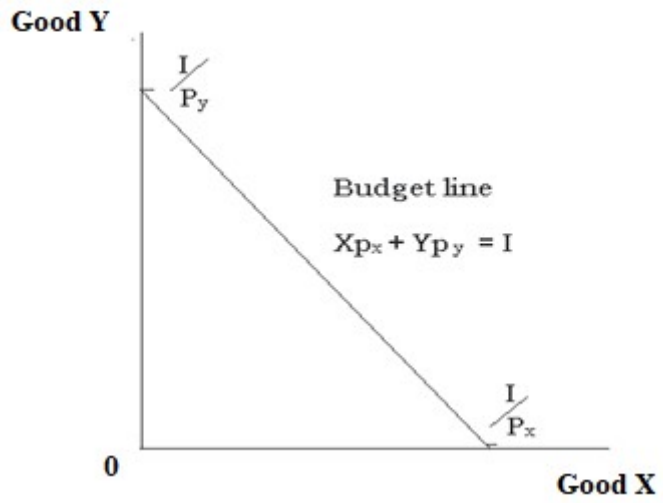


Figure 6.17 The consumer's budget line

Figure 6.17 show the budget line which places a constraint on the utility maximizing behaviour of the consumer. The budget line shows the various combinations of goods that the consumer can purchase with his limited income. The budget line is negatively slope showing that for the consumer to have more of a commodity, he needs to have less of the other commodity. The slope of the budget line is the ratio of the prices of the two commodities, that is: $\frac{Px}{Py}$. The budget line is a straight line with horizontal intercept ${}^{M}/_{p_1}$ and vertical intercept ${}^{M}/_{p_2}$. The horizontal intercept represents the bundle that the consumer can buy if she spends her entire income on bananas. Similarly, the vertical intercept represents the bundle that the consumer can buy if she spends her entire income on mangoes. The slope of the budget line is ${}^{p_1}/_{p_2}$.

Price ratio and the slope of the budget line[84]

Think of any point on the budget line. Such a point represents a bundle which costs the consumer her entire budget. Now suppose the consumer wants to have one more banana. She can do it only

[84] http://ncert.nic.in/textbook/pdf/leec202.pdf

if she gives up some amount of the other good. How many mangoes does she have to give up if she wants to have an extra quantity of bananas? It would depend on the prices of the two goods. A quantity of banana costs p_1. Therefore, she will have to reduce her expenditure on mangoes by p_1 amount, if she wants one more quantity of banana. With $^{p_1}/_{p_2}$. quantities of mangoes. Therefore, if the consumer wants to have an extra quantity of bananas when she is spending all her money, she will have to give up $^{p_1}/_{p_2}$. quantities of mangoes.

The slope of the budget line measures the amount of change in mangoes required per unit of change in bananas along the budget line. Consider any two points (x_1, x_2) and $(x_1 + \Delta x_1, x_2 + \Delta x_2)$, on the budget line[85]. It must be the case that

$$p_1 x_1 + p_2 x_2 = M \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad [13]$$

and,

$$p_1(x_1 + \Delta x_1) + p_2(x_2 + \Delta x_2) = M \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad [14]$$

Subtracting (2.4) from (2.5), one obtain

$$p_1 \Delta x_1 + p_2 \Delta x_2 = 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad [15]$$

By rearranging terms in (6.15), one obtain

$$\frac{p_1}{p_2} = \frac{\Delta x_2}{\Delta x_1} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad [16]$$

conditions, the consumer can substitute bananas for mangoes at the rate $\frac{p_1}{p_2}$. The absolute value[86] of the slope of the budget line measures the rate at which the consumer is able to substitute bananas for mangoes when she spends her entire budget.

[85] Δ (delta) is a Greek letter. In mathematics, Δ is sometimes used to denote 'a change'. Thus, Δx_1 stands for a change in x1 and Δx_2 stands for a change in x2.

[86] The absolute value of a number x is equal to x if x ³ 0 and is equal to – x if x < 0. The absolute value of x is usually denoted by |x|.

Changes in the budget set[87]

The set of available bundles depends on the prices of the two goods and the income of the consumer. When the price of either of the goods or the consumer's income changes, the set of available bundles is also likely to change. Suppose the consumer's income changes from *M* to *M¢* but the prices of the two goods remain unchanged. With the new income, the consumer can afford to buy all bundles (x_1, x_2) such that $p_1x_1 + p_2x_2 \leq M^1$. Now the equation of the budget line is

$$p_1x_1 + p_2x_2 = M^1 \quad \text{……..……..} \quad [17]$$

Equation (6.17) can also be written as

$$x_2 = \frac{M^1}{p_2} - \frac{p_1}{p_2}x_1. \quad \text{……..……..} \quad [18]$$

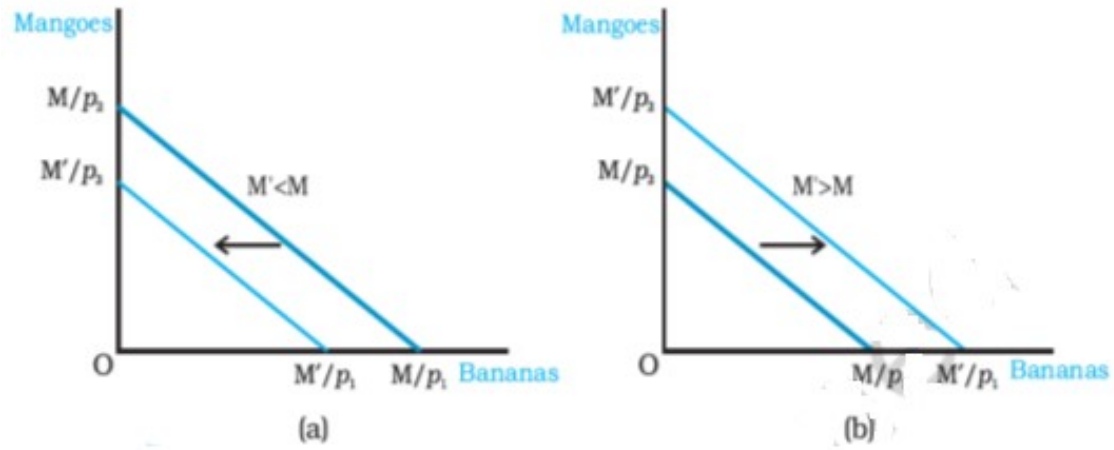


Figure 6.18 Changes in the Set of Available Bundles of Goods Resulting from Changes in the Consumer's Income[88]

A decrease in income causes a parallel inward shift of the budget line as in panel (a). An increase in income causes a parallel outward shift of the budget line as in panel (b).

Note that the slope of the new budget line is the same as the slope of the budget line prior to the change in the consumer's income[89]. However, the vertical intercept has changed after the change in income. If there is an increase in the income, i.e. if $M^1 > M$ the vertical as well as horizontal

[87] http://www.ncert.nic.in/book_publishing/NEW%20BOOK%202007/class12/microeconomics/Chapter%202.pdf
[88] http://ncert.nic.in/textbook/pdf/leec202.pdf
[89] http://ncert.nic.in/ncerts/l/leec202.pdf

intercepts increase, there is a parallel outward shift of the budget line. If the income increases, the consumer can buy more of the goods at the prevailing market prices. Similarly, if the income goes down, i.e. if $M^1 < M$, both intercepts decrease, and hence, there is a parallel inward shift of the budget line. If income goes down, the availability of goods goes down. Changes in the set of available bundles resulting from changes in consumer's income when the prices of the two goods remain unchanged are shown in Figure 2.10.

Changes in price[90]

Now suppose the price of bananas change from p_1 to p'_1 but the price of mangoes and the consumer's income remain unchanged. At the new price of bananas, the consumer can afford to buy all bundles (x_1,x_2) such that $p_1^1 x_1 + p_2 x_2 \leq M$. The equation of the budget line is

$$p_1^1 x_1 + p_2 x_2 = M \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad [19]$$

Equation (6.19) can also be written as

$$x_2 = \frac{M}{p_2} - \frac{p_1^1}{p_2} x_1. \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad [20]$$

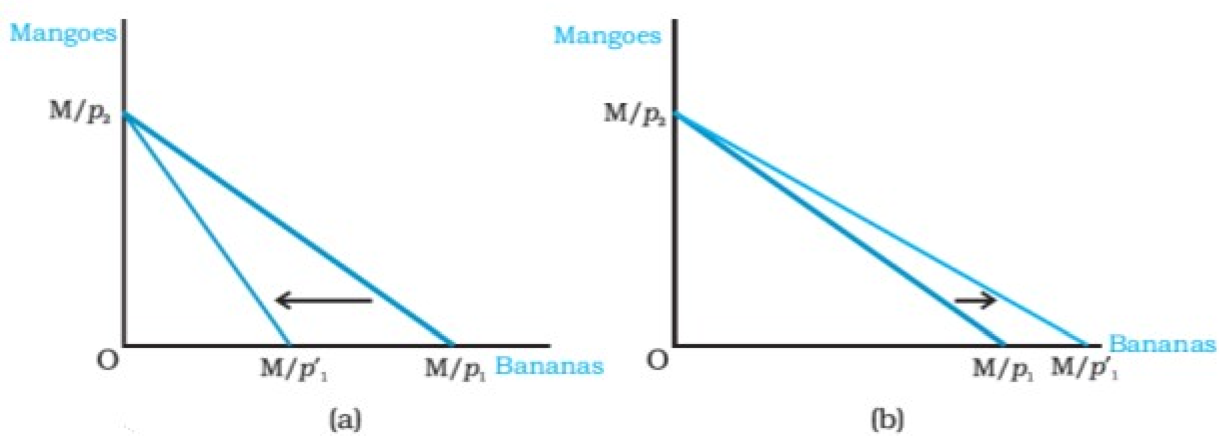


Figure 6.19 Changes in the Set of Available Bundles of Goods Resulting from Changes in the Price of bananas.

An increase in the price of bananas makes the budget line steeper as in panel (a). A decrease in the price of bananas makes the budget line flatter as in panel (b).

[90] http://www.ncert.nic.in/book_publishing/NEW%20BOOK%202007/class12/microeconomics/Chapter%202.pdf

Note that the vertical intercept of the new budget line is the same as the vertical intercept of the budget line prior to the change in the price of bananas. However, the slope of the budget line and horizontal intercept has changed after the price change. If the price of bananas increases, ie if $p_1^1 > p_1$, the absolute value of the slope of the budget line increases, and the budget line becomes steeper (it pivots inwards around the vertical intercept and horizontal intercept decreases). If the price of bananas decreases, i.e., $p_1^1 < p_1$, the absolute value of the slope of the budget line decreases and hence, the budget line becomes flatter (it pivots outwards around the vertical intercept and horizontal intercept increases). Figure 2.11 shows change in the budget set when the price of only one commodity changes while the price of the other commodity as well as income of the consumer are constant.

A change in price of mangoes, when price of bananas and the consumer's income remain unchanged, will bring about similar changes in the budget set of the consumer. If only the price of good *X* changes, the vertical or *Y*-intercept remains unchanged, and the budget line rotates upward or counter-clockwise if P_X falls and downward or clockwise if P_X rises. For example, the right panel of Figure 3.7 shows budget line *JK* (the same as in Figure 6.19 at P_X = \$2), budget line *JK*_ with P_X = \$1, and budget line *JN*_ with P_X = \$0.50. The vertical intercept (endpoint *J*) remains the same because *I* and P_Y do not change. The slope of budget line *JK*_ is $-P_X/P_Y = -\$1/\$1 = -1$. The slope of budget line *JN*_ is −1/2. With an increase in P_X, the budget line rotates clockwise and becomes steeper.

Box 6.5 Time as a Constraint[91][92]

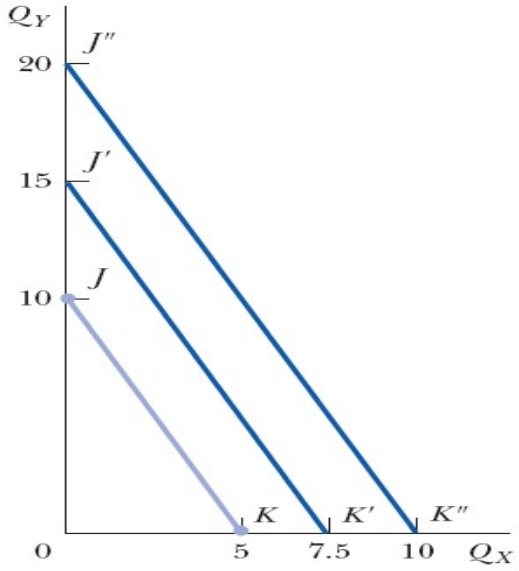
In the preceding discussion of the budget line, one assumed only two constraints: the consumers' income and the given prices of the two goods. In the real world, consumers are also likely to face a time constraint. That is, since the consumption of goods requires time, which is also limited, time often represents another constraint faced by consumers. This explains the increasing popularity of precooked or readyto-eat foods, restaurant meals delivered at home, and the use of many other time-saving goods and services. But the cost of saving time can be very expensive—thus proving the truth of the old saying that "time is money." For example, the food industry is introducing more and more foods that are easy and quick to prepare, but these foods carry with them a much higher price. A meal that could be prepared from scratch for a few dollars might cost instead more than \$10 in its ready-to-serve variety which requires only a few minutes to heat up. More and more people are also eating out and incurring much higher costs in order to save the time it takes to prepare home meals.

[91] *Sources:* "Suburban Life in the Hectic 1990s: Dinner Delivered," *New York Times,* November 20, 1992, p. B1;
"How Much Will People Pay to Save a Few Minutes of Cooking? Plenty," *Wall Street Journal,* July 25, 1985, p. B1;
"Riding the Rails at What Price," *New York Times*, June 18, 2001, p. 12; and
"Shining Future for Fiber Optics," *New York Times*, November 19, 1995, p. B10.

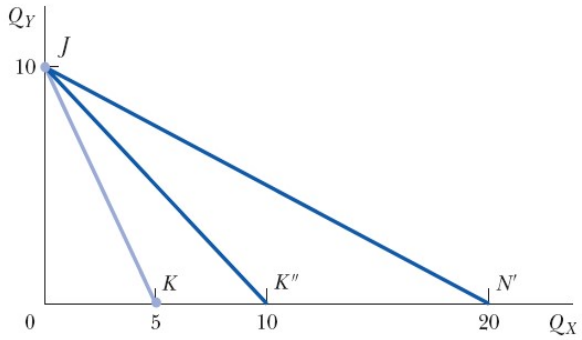
[92] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

Box 6.5 Time as a Constraint[9192]
McDonald's, Burger King, Taco Bell, and other fast-food companies are not just selling food, but fast food, and for that customers are willing to pay more than for the same kind of food at traditional food outlets, which require more waiting time. Better still, many suburbanites are increasingly reaching for the phone, not the frying pan, at dinner time to arrange for the home delivery of restaurant meals, adding even more to the price or cost of a meal. Time is also a factor in considering transportation costs and access to the Internet. One could travel from New York to Washington, D.C., by train or, in less time but at a higher cost, by plane. Similarly, one can access the Internet with a regular but slow telephone line or much faster, but at a higher cost, by DSL or fiber optics.

On the other hand, if only the price of Y changes, the horizontal or X-intercept will be the same, but the budget line will rotate upward if P_Y falls and downward if P_Y rises. For example, with I = \$10, P_X = \$2, and P_Y = \$0.50 (rather than P_Y = \$1), the new vertical or Y-intercept is Q_Y = 20 and the slope of the new budget line is $-P_X/P_Y = -4$. With P_Y = \$2, the new Y-intercept is Q_Y = 5 and $-P_X=P_Y = -1$ (one should be able to sketch these lines). Finally, with a proportionate reduction in P_X and P_Y and constant I, there will be a parallel upward shift in the budget line; with a proportionate increase in P_X and P_Y and constant I, there will be a parallel downward shift in the budget line. Box 6.5 shows that time, instead of the consumer's income, can be a constraint.



a) The budget line *JK* (the same as in Figure 3.6 with I = \$10), higher budget line *J_K_* with I = \$15, and still higher budget line *J__K__* with I = \$20 per day. *PX* and *PY* do not change, so the three budget lines are parallel and their slopes are equal.



b) The budget line JK with PX = \$2, budget line JK__ with PX = \$1, and budget line JN__ with PX = \$0.50. The vertical or Y-intercept (endpoint J) remains the same because income and PY do not change. The slope of budget line JK__ is −PX /PY=−\$1/\$1=−1, while the slope of budget line JN_ is −1/2.

Figure 6.20Changes in the Budget Line

6.3.7. Consumer equilibrium[93]

The budget set consists of all bundles that are available to the consumer. The consumer can choose her consumption bundle from the budget set. But on what basis does she choose her consumption bundle from the ones that are available to her? In economics, it is assumed that the consumer chooses her consumption bundle on the basis of her taste and preferences over the bundles in the budget set. It is generally assumed that the consumer has well defined preferences over the set of all possible bundles. She can compare any two bundles. In other words, between any two bundles, she either prefers one to the other or she is indifferent between the two. A rational consumer tries to attain equilibrium when he maximizes total utility given the price of the goods and his income (budget constraint)[94].

A rational consumer maximizes utility by trying to attain the highest indifference curve possible, given his or her budget line. This occurs where an indifference curve is tangent to the budget line so that the slope of the indifference curve (the MRS_{XY}) is equal to the slope of the budget line (P_X/P_Y). Thus, the condition for **constrained utility maximization, consumer optimization,** or **consumer equilibrium** occurs where the consumer spends all income (i.e., he or she is on the budget line) and

$$MRS_{XY} = P_X/P_Y \quad \text{[21]}$$

Figure 6.21 brings together on the same set of axes the consumer indifference curves of Figure 6.21 and the budget line of Figure 6.21 to determine the point of utility maximization. Figure 6.21 shows that the consumer maximizes utility at point B where indifference curve U_1 is tangent to budget line JK. At point B, the consumer is on the budget line and $MRS_{XY} = P_X/P_Y = 2$. Indifference curve U_1 is the highest that the consumer can reach with his or her budget line. Thus, to maximize utility the consumer should spend \$4 to purchase $2X$ and the remaining \$6 to purchase $6Y$.Any other combination of goods X and Y that the consumer could purchase (those on or below the budget line) provides less utility. For example, the consumer could spend all income to purchase combination L, but this would be on lower indifference curve U_0[95].

At point L the consumer is willing to give up more of Y than he or she has to in the market to obtain one additional unit of X. That is, MRS_{XY} (the absolute slope of indifference curve U_0 at

[93] http://ncert.nic.in/textbook/pdf/leec202.pdf
[94] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[95] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

point L) exceeds the value of P_X/P_Y (the absolute slope of budget line JK). Thus, starting from point L, the consumer can increase his or her satisfaction by purchasing less of Y and more of X until he or she reaches point B on U_1, where the slopes of U_1 and the budget line are equal (i.e., $MRS_{XY} = P_X/P_Y = 2$). On the other hand, starting from point M, where $MRS_{XY} < P_X/P_Y$, the consumer can increase his or her satisfaction by purchasing less of X and more of Y until he or she reaches point B on U_1, where $MRS_{XY} = P_X/P_Y$. One tangency point such as B is assured by the fact that there is an indifference curve going through each point in the XY commodity space. The consumer cannot reach indifference curve U_2 with the present income and the given prices of goods X and Y[96].

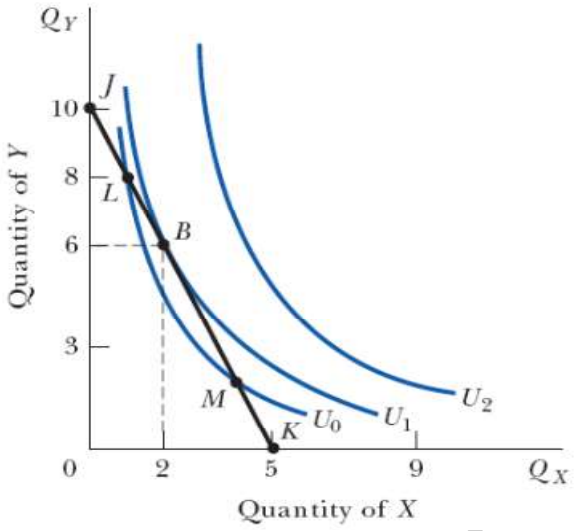


Figure 6.21 Constrained Utility Maximization[97]

The consumer maximizes utility at point B, where indifference curve $U1$ is tangent to budget line JK. At point B, $MRSXY = PX/PY = 2$. Indifference curve $U1$ is the highest that the consumer can reach with his or her budget line. Thus, the consumer should purchase 2X and 6Y.

Utility maximization is more prevalent (as a general aim of individuals) than it may at first seem. It is observed not only in consumers as they attempt to maximize utility in spending income but also in many other individuals—including criminals. For example, a study found that the rate of robberies and burglaries was positively related to the gains and inversely related to the costs of (i.e., punishment for) criminal activity[98]. Utility maximization can also be used to analyze the effect of government warnings on consumption, as Box 6.6. shows.

[96] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[97] https://es.scribd.com/document/109578637/Salvatore-Chapter-3
[98] See I. Ehrlich, "Participation in Illegitimate Activities: A Theoretical and Empirical Investigation," *Journal of Political Economy,* May/June 1973; W. T. Dickens, "Crime and Punishment Again: The Economic Approach with a Psychological Twist," National Bureau of Economic Research, *Working Paper No. 1884,* April 1986; and A. Gaviria, "Increasing Returns and the Evolution of Violent Crimes: The Case of Colombia," *Journal of Development Economics,* February 2000.

Box 6.6 Utility maximization and government warnings on Junk food[99]

Suppose that in Figure 3.9, good *X* refers to milk and good *Y* refers to soda, P_X = \$1, P_Y = \$1, and the consumer spends his or her entire weekly allowance of \$10 on milk and sodas. Suppose also that the consumer maximizes utility by spending \$3 to purchase three containers of milk and \$7 to purchase seven sodas (point *B* on indifference curve U_1) before any government warning on the danger of dental cavities and obesity from sodas. After the warning, the consumer's tastes may change away from sodas and toward milk. It may be argued that government warnings change the information available to consumers rather than tastes; that is, the warning affects consumers' perception

as to the ability of various goods to satisfy their wants—see M. Shodell, "Risky Business," *Science,* October 1985. The effect of the government warning can be shown with dashed indifference curves U_0 and U_1. Note that U_0 is steeper than U_1 at than original optimization point *B*, indicating that after the warning the individual is willing to give up more sodas for an additional container of milk (i.e., MRS_{XY} is higher for U_0 than for U_1 at point *B*). Now U_0 can intersect U_1 because of the change in tastes. Note also that U_0 involves less utility than U_1 at point *B* because the seven sodas (and the three containers of milk) provide less utility after the warning. After the warning, the consumer maximizes utility by consuming six containers of milk and only four sodas (point *B*_, where U_1 is tangent to the budget line).

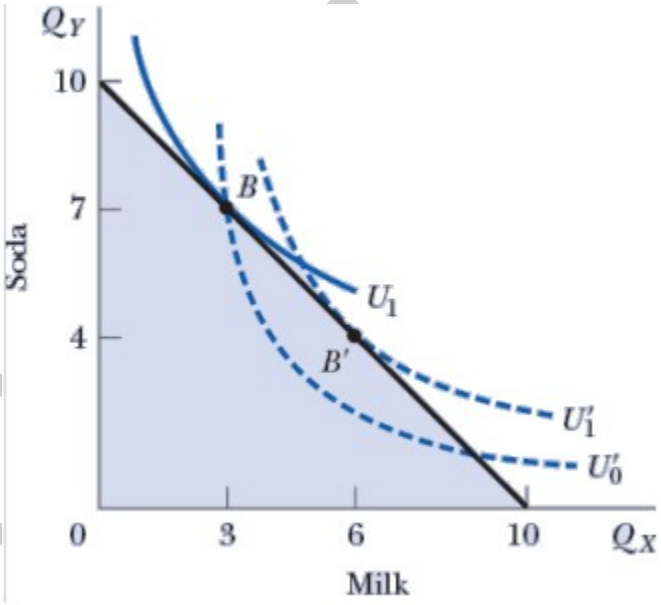


FIGURE 3.9 Effect of Government Warnings The consumer maximizes utility by purchasing 3 containers of milk and 7 sodas (point *B* on indifference curve U_1) before the government warning on the consumption of sodas. After the warning, the consumer's tastes change and are shown by dashed indifference curves U_0 and U_1. The consumer now maximizes utility by purchasing 6 containers of milk and only 4 sodas (point *B*_, where U_1 is tangent to the budget line).

[99] *Sources* "Some States Fight Junk Food Sales in School," *New York Times,* September 9, 2001, p. 1; and "Companies Agree to Ban on Sale of Fizzy Drinks in Schools," *Financial Times*, May 4, 2006, p. 6.

Box 6.6 Utility maximization and government warnings on Junk food[99]

The above analysis clearly shows how indifference curve analysis can be used to examine the effect of any government warning on consumption patterns, such as the 1965 law requiring manufacturers to print on each pack of cigarettes sold in the United States the warning that cigarette smoking is dangerous to health. Indeed, the World Health Organization is now stepping up efforts to promote a global treaty to curb cigarette smoking. One can analyze the effect on consumption of any new information by examining the effect it has on the consumer's indifference map. Similarly, indifference curve analysis can be used to analyze the effect on consumer purchases of any regulation such as the one requiring drivers to wear seat belts.

If utility were cardinally measurable, the condition for constrained utility maximization would be for the consumer to spend all income on X and Y in such a way that two conditions are fulfilled[100]: The necessary (first order) condition and the sufficient (second order) condition. The first order condition is that the marginal rate of substitution must be equal to the ratio of commodity prices. That is,

$$\frac{Mux}{Muy} = \frac{Px}{Py} \quad \text{……..} \qquad [22]$$

Which can also be written as

$$\frac{Mux}{Px} = \frac{MUy}{Py} \text{ …. ……..} \qquad [23]$$

Box 6.7 Example of declining marginal utility schedule[101]

For example, the table below shows a portion of the declining marginal utility schedule for good X and good Y, on the assumption that MUX is independent of MUY (i.e., that MUX is not affected by how much Y the individual consumes, and MUY is not affected by the amount of X consumed). If the consumer's income is I = \$10, PX = \$2, and PY = \$1, the consumer should spend \$4 to purchase 2X and the remaining \$6 to purchase 6Y so that equation [3.6] is satisfied. That is,

$$\frac{6 \text{ utils}}{\$2} = \frac{3 \text{ utils}}{\$1}$$

Marginal utility of X and Y

[100] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[101] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

Box 6.7 Example of declining marginal utility schedule[101]

Q_X	MU_X	Q_Y	MU_Y
1	10	4	5
2	6	5	4
3	4	6	3
4	2	7	2
5	0	8	1

If the consumer spent only \$2 to purchase 1*X* and the remaining \$8 to purchase 8*Y*, *MUX*/*PX* = 10/2 = 5 and *MUY*/*PY* = 1/1 = 1. The last (second) dollar spent on *X* thus gives the consumer five times as much utility as the last (eighth) dollar spent on *Y* and the consumer would not be maximizing utility. To be at an optimum, the consumer should purchase more of *X* (*MUX* falls) and less of *Y* (*MUY* rises) until he or she purchases 2*X* and 6*Y*, where equation [3.6] is satisfied[102]. This is the same result obtained with the indifference curve approach in Section 3.5. Note that even when the consumer purchases 1*X* and 4*Y* equation [3.6] is satisfied (*MUX*/*PX* = 10/2 = *MUY*/*PY* = 5/1), but the consumer would not be at an optimum because he or she would be spending only \$6 of the \$10 income.

Equation 6.23 reads, the marginal utility of good *X* divided by the price of good *X* equals the marginal utility of good *Y* divided by the price of good *Y*. MU_X/P_X is the extra or marginal utility per dollar spent on *X*. Likewise, MU_Y/P_Y is the marginal utility per dollar spent on *Y*. Thus, for constrained utility maximization or optimization, the marginal utility of the last dollar spent on *X* and *Y* should be the same[103].

The second order condition is that the indifference curve be convex to the origin. That is the slope of the indifference curve decreases from left to right as one move along the curve which is consistent with the axiom of diminishing marginal rate of substitution.

[102] By giving up the eighth and the seventh units of *Y*, the individual loses 3 utils. By using the \$2 not spent on *Y* to purchase the second unit of *X*, the individual receives 6 utils, for a net gain of 3 utils. Once the individual consumes 6*Y* and 2*X*, equation [3.6] holds and he or she maximizes utility.
[103] One will see in footnote 14 that equation [3.6] also holds for the indifference curve approach.

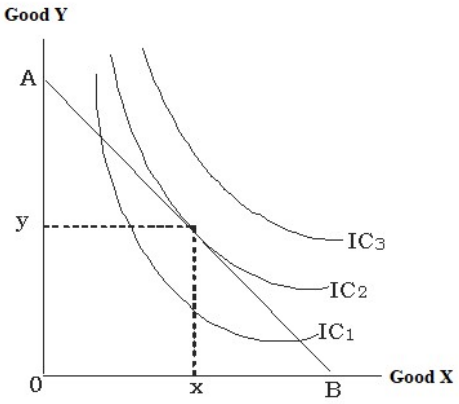


Figure 6.22 Equilibrium of the Consumer

Figure 6.22 represents the indifference map of a consumer for various combinations of commodities X and Y with the budget line AB. The consumer can afford to buy any of the combinations within the budget line, but, cannot afford the combination outside the budget line. The consumer will be in equilibrium by fulfilling both the first and second order conditions. The first condition is that point of tangency of the curves and the budget line while the second order condition is convex shape of the indifference curve. That is at the point where $MRS_{x,y} = \frac{Mux}{Muy} = \frac{Px}{Py}$. The consumer is in equilibrium at point D where the budget line intersects the highest indifference curve IC2.

In economics, it is generally assumed that the consumer is a rational individual[104]. A rational individual clearly knows what is good or what is bad for her, and in any given situation, she always tries to achieve the best for herself. Thus, not only does a consumer have well-defined preferences over the set of available bundles, she also acts according to her preferences. From the bundles which are available to her, a rational consumer always chooses the one which gives her maximum satisfaction. In the earlier sections, it was observed that the budget set describes the bundles that are available to the consumer and her preferences over the available bundles can usually be represented by an indifference map. Therefore, the consumer's problem can also be stated as follows: The rational consumer's problem is to move to a point on the highest possible indifference curve given her budget set.

If such a point exists, where would it be located? *The optimum point would be located on the budget line.* A point below the budget line cannot be the optimum. Compared to a point below the budget line, there is always some point on the budget line which contains more of at least one of the goods and no less of the other, and is, therefore, preferred by a consumer whose preferences are monotonic. Therefore, if the consumer's preferences are monotonic, for any

[104] http://ncert.nic.in/textbook/pdf/leec202.pdf

point below the budget line, there is some point on the budget line which is preferred by the consumer. Points above the budget line are not available to the consumer. Therefore, the optimum (most preferred) bundle of the consumer would be on the budget line.

Where on the budget line will the optimum bundle be located? *The point at which the budget line just touches (is tangent to), one of the indifference curves would be the optimum*[105]. To see why this is so, note that any point on the budget line other than the point at which it touches the indifference curve lies on a lower indifference curve and hence is inferior. Therefore, such a point cannot be the consumer's optimum. The optimum bundle is located on the budget line at the point where the budget line is tangent to an indifference curve.

Figure 6.23 illustrates the consumer's optimum. At (x_1^*, x_2^*), the budget line is tangent to the black coloured indifference curve. The first thing to note is that the indifference curve just touching the budget line is the highest possible indifference curve given the consumer's budget set. Bundles on the indifference curves above this, like the grey one, are not affordable[106]. Points on the indifference curves below this, like the blue one, are certainly inferior to the points on the indifference curve, just touching the budget line. Any other point on the budget line lies on a lower indifference curve and hence, is inferior to (x_1^*, x_2^*) ,. Therefore, (x_1^*, x_2^*) , is the consumer's optimum bundle.

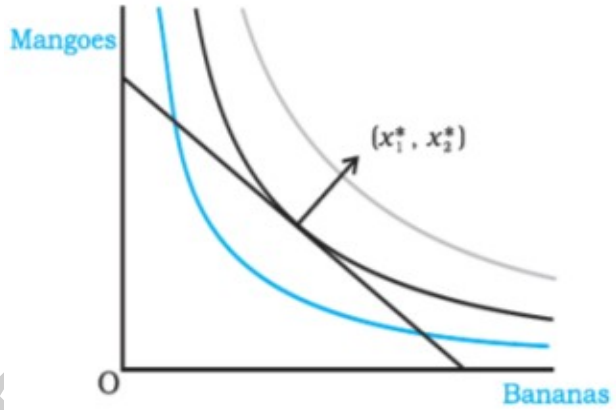


Figure 6.23 Consumer's Optimum[107]

The point (x*1, x *2), at which the budget line is tangent to an indifference curve represents the consumers.

[105] To be more precise, if the situation is as depicted in Figure 6.23 then the optimum would be located at the point where the budget line is tangent to one of the indifference curves. However, there are other situations in which the optimum is at a point where the consumer spends her entire income on one of the goods only. See http://ncert.nic.in/textbook/pdf/leec202.pdf
[106] http://www.tutorjar.com/files/Economics-12.pdf
[107] http://www.ncert.nic.in/book_publishing/NEW%20BOOK%202007/class12/microeconomics/Chapter%202.pdf

The fact that the marginal utility approach gives the same result as the indifference curve approach (i.e., 2*X* and 6*Y*) should not be surprising. In fact, one can easily show why this is so. By cross multiplication in equation 6.23, one get

$$\frac{Mux}{Px} = \frac{MUy}{Py} \qquad \text{……..……..} \qquad [24]$$

But one have shown that $MRS_{XY} = MU_X/MU_Y$ (see equation [6.23]) and $MRS_{XY} = P_X/P_Y$ when the consumer maximizes utility (see equation 6.24). Therefore, combining equations [6.22], [6.23], and [6.24], one can express the condition for consumer utility maximization as;

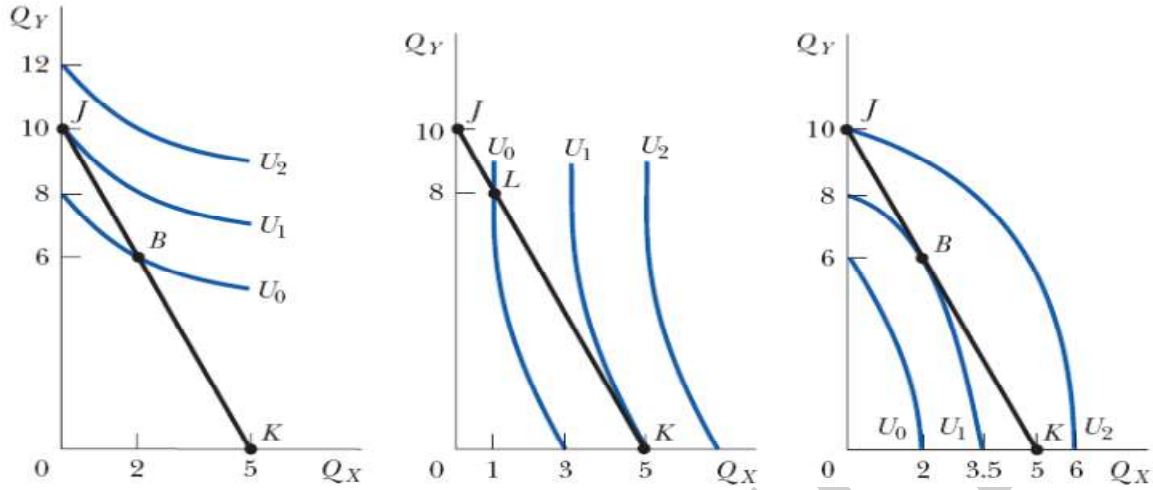
$$\text{MRSx,y} = \frac{Mux}{Muy} = \frac{Px}{Py} \qquad \text{……..} \qquad [25]$$

Thus, the condition for consumer utility maximization with the marginal utility approach (i.e., equation [6.25]) is equivalent to that with the indifference curve approach (equation [6.25]), except for corner solutions.

Corner solutions[108]

If indifference curves are everywhere either flatter or steeper than the budget line, or if they are concave rather than convex to the origin, then the consumer maximizes utility by spending all income on either good *Y* or good *X*. These are called **corner solutions.** In the left panel of Figure 6.24, indifference curves U_0, U_1, and U_2 are everywhere flatter than budget line *JK*, and U_1 is the highest indifference curve that the consumer can reach by purchasing 10*Y* and 0*X* (endpoint *J*). Point *J* is closest to the tangency point, which cannot be achieved. The individual could purchase 2*X* and 6*Y* and reach point *B*, but point *B* is on lower indifference curve U_0. Since point *J* is on the *Y*-axis (and involves the consumer spending all his or her income on good *Y*), it is called a corner solution. The middle panel shows indifference curves that are everywhere steeper than the budget line, and U_1 is the highest indifference curve that the consumer can reach by spending all income to purchase 5*X* and 0*Y* (endpoint *K*). The individual could purchase 1*X* and 8*Y* at point *L*, but this is on lower indifference curve U_0. Point *K* is on the horizontal axis and involves the consumer spending all his or her income on good *X*, so point *K* is also a corner solution.

[108] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html



a) Flattr indifference curve b) Steeper indifference curve c) Concave indifference curve

Figure 6.24 Corner Solutions[109]

In panel (a), indifference curves are everywhere flatter than the budget line, and U_1 is the highest indifference curve that the consumer can reach by purchasing 10Y only (point J). The middle panel shows indifference curves everywhere steeper than the budget line, and U_1 is the highest indifference curve that the consumer can reach by spending all income to purchase 5X (point K). In the right panel, concave indifference curve U_1 is tangent to the budget line at point B, but this is not the optimum point because the consumer can reach higher indifference curve U_2 by consuming only good Y (point J).

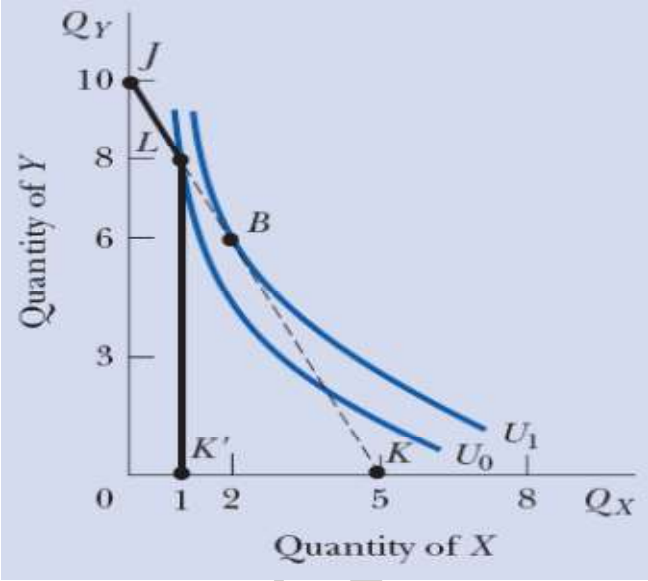
In the right panel, *concave* indifference curve U_1 is tangent to the budget line at point B, but this is not optimum because the consumer can reach higher indifference curve U_2 by spending all income to purchase 10Y and 0X (endpoint J). This is also a corner solution. Thus, the condition that an indifference curve must be tangent to the budget line for

Box 6.8 Water rationing in the west[110][111]
Because goods are scarce, some method of allocating them among individuals is required. In a free-enterprise economy such as our own, the price system accomplishes this for the most part. Sometimes, however, the government rations goods, such as water in the west of the United States (as a result of

[109] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[110] *Sources:*
"Trickle-Down Economics," *Wall Street Journal,* August 23, 1999, p. A14;
"Water Rights May Become More Liquid," *Wall Street Journal,* February 15, 1996, p. A2;
W. C. Lee, "The Onelfare Cost of Rationing-by-Queuing Across Markets," *Quarterly Journal of Economics,* July 1987;
J. Breoner, et al., "Water Markets in the Onest: Prices, Trading, and Contractual Forms," *NBER Working Paper No. 13002*, March 2007, and
M. Greenstone, "Tradable Water Rights," *Democracy Journal*, No. 8, Spring 2008, pp. 1–2.
[111] https://es.scribd.com/document/109578637/Salvatore-Chapter-3

Box 6.8 Water rationing in the west[110111]

recurrent droughts) and gasoline in 1974 and 1979 (at the height of the petroleum crisis). If the maximum amount of the good that the government allows is less than the individual would have purchased or used, the **rationing** will reduce the individual's level of satisfaction.



Rationing

In the absence of rationing, the individual maximizes satisfaction at point *B*, where indifference curve U_1 is tangent to budget line *JK*, and consumes 2*X* and 6*Y* (as in Figure 3.8). If the government did not allow the individual to purchase more than 1*X* per week, the budget line becomes *JLK*_, with a kink at point *L*. The highest indifference curve that the individual can reach with budget line *JLK*_, is now U_0 at point *L*, by consuming 1*X* and 8*Y*.

The effect of rationing on utility maximization and consumption can be examined with Figure 3.11. In the absence of rationing, the individual maximizes satisfaction at point *B*, where indifference curve U_1 is tangent to budget line *JK*, by consuming 2*X* and 6*Y* (as in Figure 3.8). Good *X* could refer to hours per week of lawn watering (in absence of an automatic water sprinkler system), while good *Y* could refer to hours per week of TV viewing. If the government did not allow the individual to use more than 1*X* per week, the budget line becomes *JLK*_, with a kink at point *L*. Thus, rationing changes the constraints under which utility maximization occurs. The highest indifference curve that the individual can reach with budget line *JLK*_ is now U_0 at point *L*, by consuming 1*X* and 8*Y*. In our water rationing case, this refers to one hour of lawn watering and eight hours of TV viewing per week. With water rationing, the incentive arises to illegally water lawns at night under the cover of darkness. On the other hand, gasoline rationing during 1974 and 1979 led to long lines at the gas pump and to black markets where gasoline could be purchased illegally at a higher price without waiting. Thus, rationing leads to price distortions and inefficiencies. If rations were 2*X* or more per week, the rationing system would not affect this consumer since he or she maximizes utility by purchasing 2*X* and 6*Y* (point *B* in the figure). Rationing is more likely to be binding or restrictive on high-income people than on low-income people (who may not have sufficient income to purchase even the allowed quantity of the rationed commodity). Thus, our model predicts that high income people are more likely to make black-market purchases than low-income people. Effective rationing leads not only to black markets but also to "spillover" of consumer purchases on other goods not subject to rationing (or into savings). Both occurred in the United States during the 1974 and 1979 gasoline rationing

Box 6.8 Water rationing in the west[110111]
periods. As pointed out in Section 2.7, allowing the market to operate (i.e., letting the price of the commodity reach its equilibrium level) eliminates the inefficiency of price controls and leads to much better results.

Optimization is true only when indifference curves assume their usual convex shape and are neither everywhere flatter nor steeper than the budget line[112]. Finally, although a consumer in the real world does not spend all of his or her income on one or a few goods, there are many more goods that he or she does not purchase because they are too expensive for the utility they provide. For example, few people purchase a $2,000 watch because the utility that most people get from the watch does not justify its $2,000 price. The non consumption of many goods in the real world can be explained by indifference curves which, though convex to the origin, are everywhere either flatter or steeper than the budget line, yielding corner rather than interior solutions. Corner solutions can also arise with rationing, as Example 3–6 shows.

The effect of changes in income on optimal choice[113]

When the consumer's income changes (holding other determinants of demand constant) the capacity to buy goods and services changes too leading to a shift in the budget line.

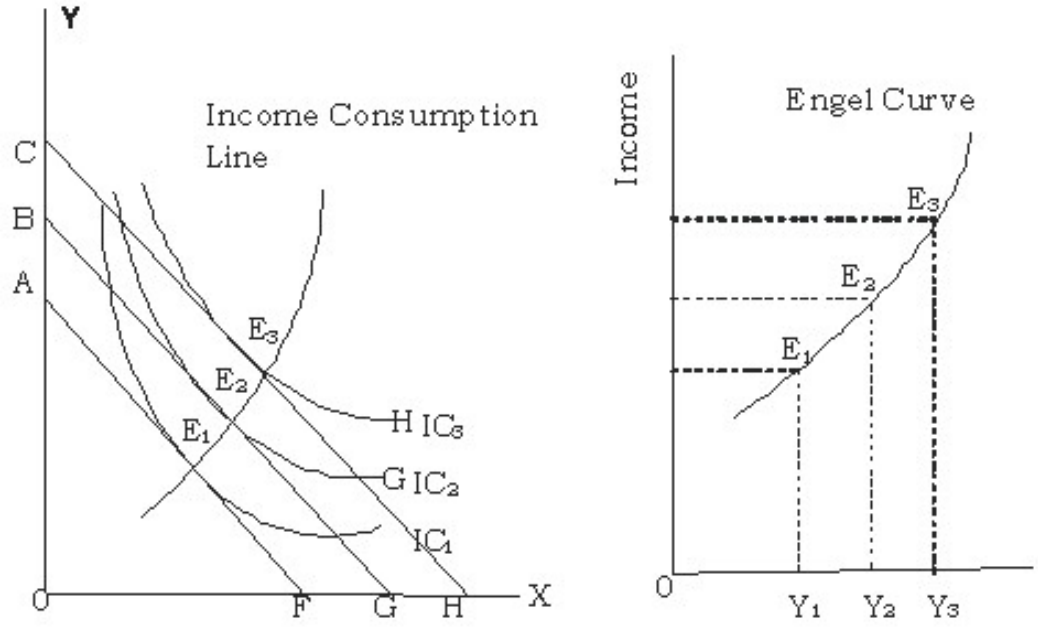


Figure 6.25 Income consumption line

[112] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[113] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

Let us assume the consumer has a given income and the prices of commodities X and Y are given while the initial budget line is depicted as AF in Figure 6.25. Let us also assume that the consumer's initial equilibrium is at point E_1, on the first indifference curve IC_1. Suppose the income rises as shown by a shift in the budget line from AF to BG. The rise in income leads to increase in quantities consumed thereby pushing the consumer to a higher indifference curve IC_2 and a new equilibrium position E_2. Further rise in income causes an outward shift in the budget line from BG to CH. The new budget line CH is tangent to the highest indifference curve IC_3. The consumer moves from equilibrium point E_2 to E_3 indicating increase in consumption as a result of increase in income. This is known as the **income effect**. A line joining the respective equilibrium points is known as **income consumption line or curve**. Income consumption line shows how the demand for two goods changes in response to changes in the consumer's income. Income effect of normal goods is always positive because consumption increases as income increases and decreases as income decreases; this is shown by the Engel curve. The income effect is negative for inferior goods because consumption decreases as income increases and vice versa and so the Engel curve slopes downward.

The effect of changes in price on optimal choice

The change in consumption pattern due to change in the price of consumer goods is called **total price effect**. Total price effect is divided into two: **Substitution effect and income effect**. Substitutions effect arises due to consumer's ability to substitute cheaper goods for the expensive ones. Let us assume the consumer's real income is unchanged despite the reduction in money income. Now assume that the price of commodity X falls with the price of Y and other factors remaining constant. The consumer will consume more of X than Y due to reduction in the price of X. To derive the substitution effect, the budget line will shift inward parallel to itself but tangent to the original indifference curve at point E_3 with the quantity demanded as X_3. The new budget line is known as **compensated budget line**. The product combination at point E_3 yields equal utility as those on point E_1 on the same indifference curve IC_1. The consumer would prefer combination at point E_3 which gives more combination at a lower price. This is known as the substitution effect. The substitution effect gives a higher quantity X_1X_3 with reduction in money income as shown in Figure 6.26. This is consistent with Slutsky's theorem which says that the substitution effect of a price change is always negative.

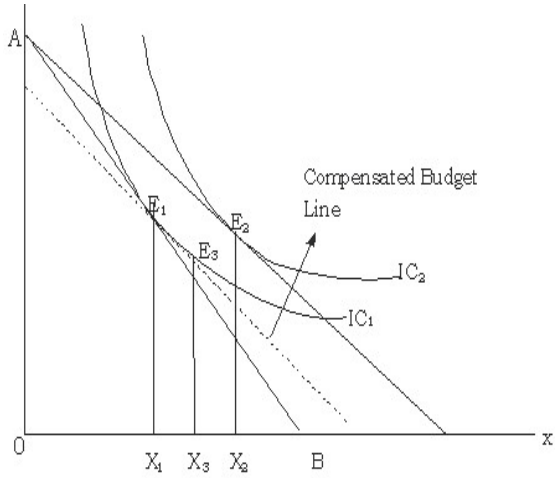


Figure 6.26 Substitution and Income Effect

Similarly, let us assume that the real income of the consumer increases one draw a new budget line (AF) from the vertical intercept of the original budget line (AB) thereby placing the consumer on a higher IC_2. This leads to an increase in the quantity of X and Y. The increase in quantities of commodities from X_1 to X_2 and Y_1 to Y_2 is known as the total effect. The income effect can be calculated by subtracting the income effect from the total price effect. If;

Total Price Effect = $X_1 - X_2$
Substitution Effect = $X_1 - X_3$

Income Effect = Total Effect - Substitution Effect

$= X_1 - X_2 - X_1 - X_3$
$= X_2 - X_3$

Table 4.2 A Summary of Geometric Representation of Substitution and Income Effect of Price Change[114]

Type of Good	Substitution effect, expressed quantitatively (or in terms of relationship between demand and price)	Income effect, expressed quantitatively (or in terms of relationship between demand and price)	Net effect, expressed quantitatively (or in terms of relationship between demand and price)
Normal	Negative: price and quantity moves in opposite direction (↓Px →Qx ↑)	Negative: price and quantity moves in opposite direction (↓Px →Qx ↑)	Negative: price and quantity moves in opposite direction (↓Px →Qx ↑)

[114] Source: Adapted from Iyoha, Oyefusi and Oriakhi, 2003

Inferior	Negative: price and quantity moves in opposite direction (Px Qx)	Positive: Price and quantity moves in same direction (Px Qx)	Negative: price and quantity moves in opposite direction (Px Qx)
Giffen	Negative: price and quantity moves in opposite direction (Px Qx)	Positive: Price and quantity moves in same direction (Px Qx)	Negative: price and quantity moves in opposite direction (Px Qx)

The substitution effect is caused by change in the relative price of the commodity and is associated with the movements of the consumer along the same indifference curve (from E_1 to E_3). The income effect is caused by the change in the real income of the consumer and associated with a shift to a new indifference curve (from E_1 to E_2). The substitution and income effects of a normal good are positive while the substitution effect for inferior good is positive and the income effect is negative.

6.4. The Theory of Revealed Preference[115]

Until now one have assumed that indifference curves are derived by asking the consumer to choose between various market baskets or combinations of commodities. Not only is this difficult and time consuming to do, but one also cannot be sure that consumers can or will provide trustworthy answers to direct questions about their preferences. According to the **theory of revealed preference** (developed by Paul Samuelson and John Hicks), a consumer's indifference curves can be derived from observing the actual market behaviour of the consumer and without any need to inquire directly about preferences. For example, if a consumer purchases basket A rather than basket B, even though A is not cheaper than B, one can infer that the consumer prefers A to B. The theory of revealed preference rests on the following assumptions:

1. The tastes of the consumer do not change over the period of the analysis.
2. The consumer's tastes are *consistent,* so that if the consumer purchases basket A rather than basket B, the consumer will never prefer B to A.
3. The consumer's tastes are *transitive,* so that if the consumer prefers A to B and B to C, the consumer will prefer A to C.
4. The consumer can be induced to purchase any basket of commodities if its price is lowered sufficiently.

[115] http://global.oup.com/us/companion.websites/9780195336108/pdf/Salvatore_Chapter_3.pdf

Figure 6.27 shows how a consumer's indifference curve can be derived by revealed preference. Suppose that the consumer is observed to be at point *A* on budget line *NN* in the left panel. In this case, the consumer prefers *A* to any point on or below *NN.* On the other hand, points above and to the right of *A* are superior to *A* since they involve more of commodity *X* and commodity *Y*. Thus, the consumer's indifference curve must be tangent to budget line *NN* at point *A* and be above *NN* everywhere else[116].

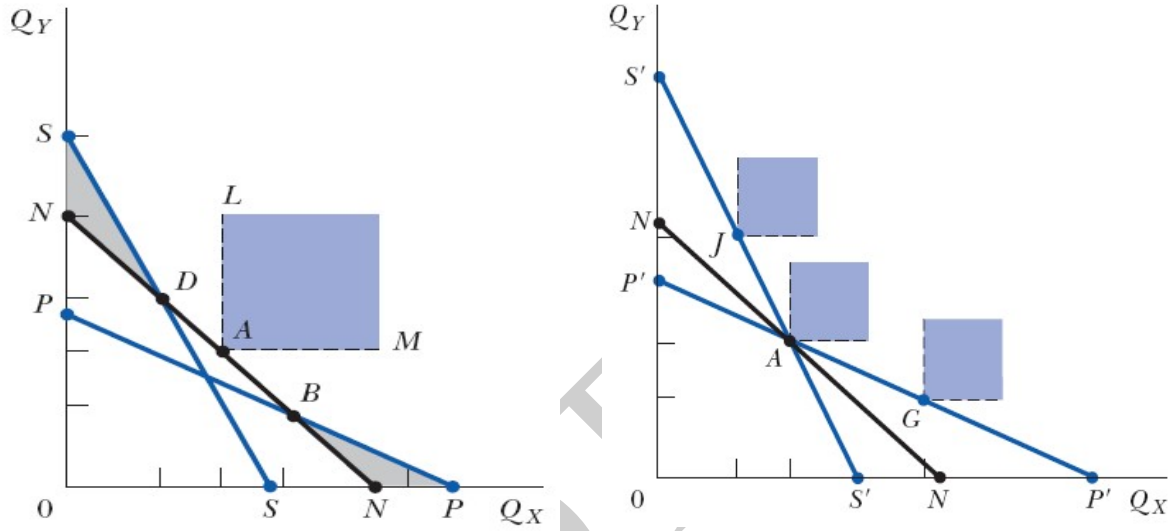


Figure 6.27 Derivation of an Indifference Curve by Revealed Preference[117]

In the left panel, the consumer is originally at optimum at point *A* on *NN.* Thus, the indifference curve must be tangent to *NN* at point *A* and above *NN* everywhere else. It must also be to the left and below shaded area *LAM.* If the consumer is induced to purchase combination *B* (which is inferior to *A*) with budget line *PP*, one can eliminate shaded area *BPN.* Similarly, with combination *D* on budget line *SS*, shaded area *DSN* can be eliminated. Thus, the indifference curve must be above *SDBP.* In the right panel, the consumer prefers *G* to *A* with budget line *P_P_* and prefers *J* to *A* with budget line *S_S_*. Thus, the indifference curve must be below points *G* and *J*[118].

The indifference curve must also be to the left and below shaded area *LAM*. Such an indifference curve would be of the usual shape (i.e., negatively sloped and convex to the origin). To locate more precisely the indifference curve in the *zone of ignorance* (i.e., in the area between *LAM* and *NN*), consider point *B* on *NN*. Point *B* is inferior to *A* since the consumer preferred *A* to *B*. However, the consumer could be induced to purchase *B* with budget line *PP* (i.e., with P_X/P_Y sufficiently lower than with *NN*). Since *A* is preferred to *B* and *B* is preferred to any point on *BP*, the indifference curve must be above *BP*. One have thus eliminated shaded area *BPN* from the zone of ignorance. Similarly, by choosing another point, such as *D*, one can, by following the

[116] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[117] https://moam.info/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html
[118] https://mafiadoc.com/chapter-3-consumer-preferences-and-choice_59ab80281723ddbec5e2b754.html

same reasoning as for *B*, eliminate shaded area *DSN*. Thus, the indifference curve must lie above *SDBP* and be tangent to *NN* at point *A*.

The right panel of Figure 6.27 shows that one can chip away from the zone of ignorance immediately to the left of *LA* and below *AM*. Suppose that with budget line *P_P_* (which goes through point *A* and thus refers to the same real income as at *A*), the consumer chooses combination *G* (with more of *X* and less of *Y* than at *A*) because P_X/P_Y is lower than on *NN*. Points in the shaded area above and to the right of *G* are preferred to *G*, which is preferred to *A*. Thus, one have eliminated some of the upper zone of ignorance. Similarly, choosing another budget line, such as *S_S_*, one can eliminate the area above and to the right of a point such as *J*, which the consumer prefers to *A* at the higher P_X/P_Y given by *S_S_*. It follows that the indifference curve on which *A* falls must lie below points *G* and *J*. The process can be repeated any number of times to further reduce the upper and lower zones of ignorance, thereby locating the indifference curve more precisely. Note that the indifference curve derived is the one need to show consumer equilibrium because it is the indifference curve that is tangent to the consumer's budget line. Although somewhat impractical as a method for actually deriving indifference curves, the theory of revealed preference (particularly the idea that a consumer's tastes can be inferred or revealed by observing actual choices in the market place) has been very useful in many applied fields of economics such as public finance and international economics.

6.5. Prelude to Demand

In the previous section, one studied the choice problem of the consumer and derived the consumer's optimum bundle given the prices of the goods, the consumer's income and her preferences. It was observed that the amount of a good that the consumer chooses optimally, depends on the price of the good itself, the prices of other goods, the consumer's income and her tastes and preferences. The quantity of a commodity that a consumer is willing to buy and is able to afford, given prices of goods and consumer's tastes and preferences is called demand for the commodity. Whenever one or more of these variables change, the quantity of the good chosen by the consumer is likely to change as well. Here one shall change one of these variables at a time and study how the amount of the good chosen by the consumer is related to that variable.

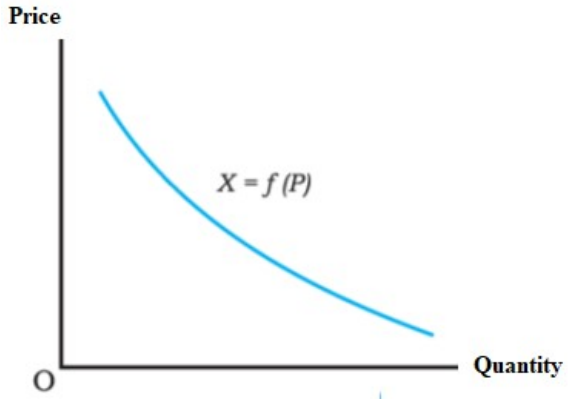


Figure 6.28 Demand Curve[119]

The demand curve is a relation between the quantity of the good chosen by a consumer and the price of the good. The independent variable (price) is measured along the vertical axis and dependent variable (quantity) is measured along the horizontal axis. The demand curve gives the quantity demanded by the consumer at each price.

6.5.1. Demand curve and the law of demand[120]

If the prices of other goods, the consumer's income and her tastes and preferences remain unchanged, the amount of a good that the consumer optimally chooses becomes entirely dependent on its price. The relation between the consumer's optimal choice of the quantity of a good and its price is very important and this relation is called the demand function. Thus, the consumer's demand function for a good gives the amount of the good that the consumer chooses at different levels of its price when the other things remain unchanged. The consumer's demand for a good as a function of its price can be written as

$X = f(P)$ ……..……..…….. [26]

Box 6.9 Functions[121]

Consider any two variables x and y. A function

$y = f(x)$

is a relation between the two variables x and y such that for each value of x, there is an unique value of the variable y. In other words, $f(x)$ is a rule which assigns an unique value y for each value of x. As the value of y depends on the value of x, y is called the dependent variable and x is called the independent variable.

Example 1

Consider, for example, a situation where x can take the values 0, 1, 2, 3 and suppose corresponding values of y are 10, 15, 18 and 20, respectively. Here y and x are related by the function $y = f(x)$ which

[119] http://ncert.nic.in/textbook/pdf/leec202.pdf
[120] http://www.ncert.nic.in/book_publishing/NEW%20BOOK%202007/class12/microeconomics/Chapter%202.pdf
[121] http://ncert.nic.in/textbook/pdf/leec202.pdf

Box 6.9 Functions[121]

is defined as follows:

$f(0) = 10$; $f(1) = 15$; $f(2) = 18$ and $f(3) = 20$.

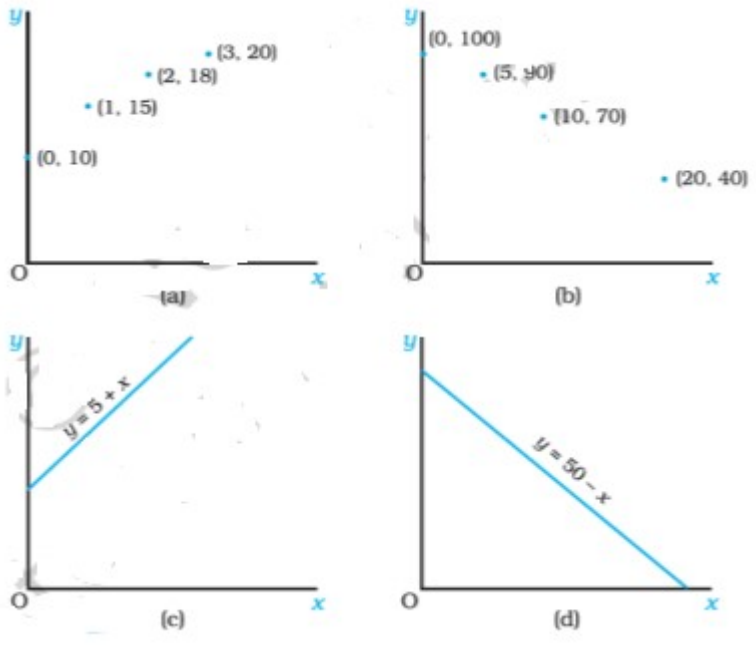
Example 2
Consider another situation where x can take the values 0, 5, 10 and 20. And suppose corresponding values of y are 100, 90, 70 and 40, respectively. Here, y and x are related by the function $y = f(x)$ which is defined as follows:

$f(0) = 100$; $f(10) = 90$; $f(15) = 70$ and $f(20) = 40$.

Very often a functional relation between the two variables can be expressed in algebraic form like $y = 5 + x$ and $y = 50 - x$ A function $y = f(x)$ is an increasing function if the value of y does not decrease with increase in the value of x. It is a decreasing function if the value of y does not increase with increase in the value of x. The function in Example 1 is an increasing function. So is the function $y = x + 5$. The function in Example 2 is a decreasing function. The function $y = 50 - x$ is also decreasing.

Graphical Representation of a Function

A graph of a function $y = f(x)$ is a diagrammatic representation of the function. Following are the graphs of the functions in the examples given above.



Usually, in a graph, the independent variable is measured along the horizontal axis and the dependent variable is measured along the vertical axis. However, in economics, often the opposite is done. The

Box 6.9 Functions[121]
demand curve, for example, is drawn by taking the independent variable (price) along the vertical axis and the dependent variable (quantity) along the horizontal axis. The graph of an increasing function is upward sloping or and the graph of a decreasing function is downward sloping. As one can see from the diagrams above, the graph of $y = 5 + x$ is upward sloping and that of $y = 50 - x$, is downward sloping.

where X denotes the quantity and P denotes the price of the good. The demand function can also be represented graphically as in Box 6.9. The graphical representation of the demand function is called the demand curve. The relation between the consumer's demand for a good and the price of the good is likely to be negative in general. In other words, the amount of a good that a consumer would optimally choose is likely to increase when the price of the good falls and it is likely to decrease with a rise in the price of the good.

6.5.2. Deriving a demand curve from indifference curves and budget lines

Linear Demand[122]

A linear demand curve can be written as

$d(p) = a - bp; 0 \leq p \leq \frac{a}{b}$. …….……..…….. [27]

$= 0; p > \frac{a}{b}$

where a is the vertical intercept, –b is the slope of the demand curve. At price 0, the demand is a, and at price equal to $\frac{a}{b}$, the demand is 0. The slope of the demand curve measures the rate at which demand changes with respect to its price. For a unit increase in the price of the good, the demand falls by b units.

Consider an individual consuming bananas (X_1)and mangoes (X_2), whose income is M and market prices of X_1 and X_2 are P_1^1 and P_2^1 respectively. Figure 6.29 (a) depicts her consumption equilibrium at point C, where she buys X_1^1 and X_2^1 quantities of bananas and mangoes respectively. In panel (b) of Figure 6.29, one plot P_1^1 against X_1^1 which is the first point on the demand curve for X_1.

[122] http://ncert.nic.in/textbook/pdf/leec202.pdf

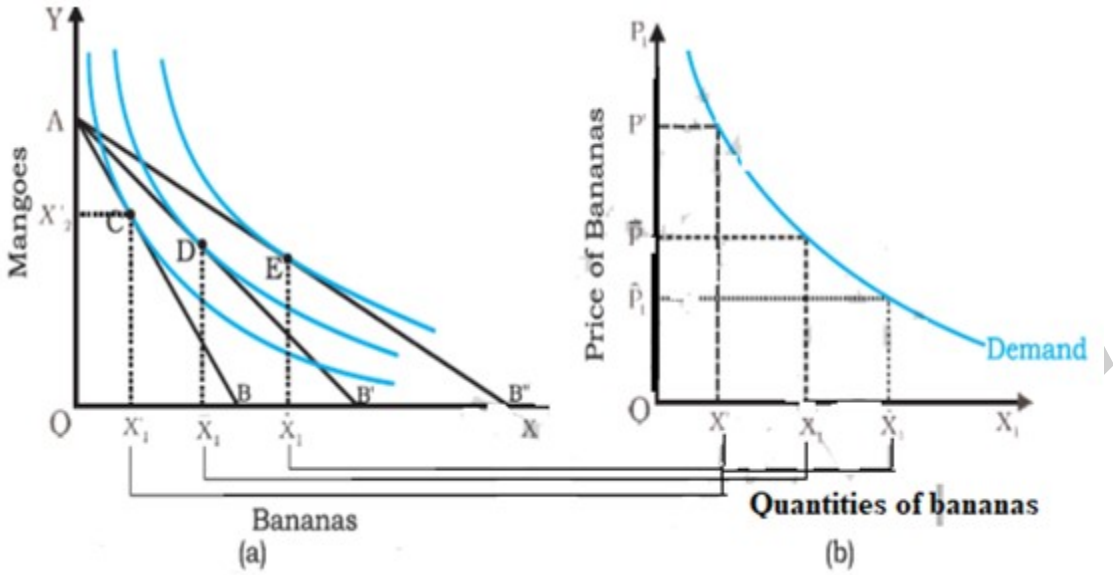


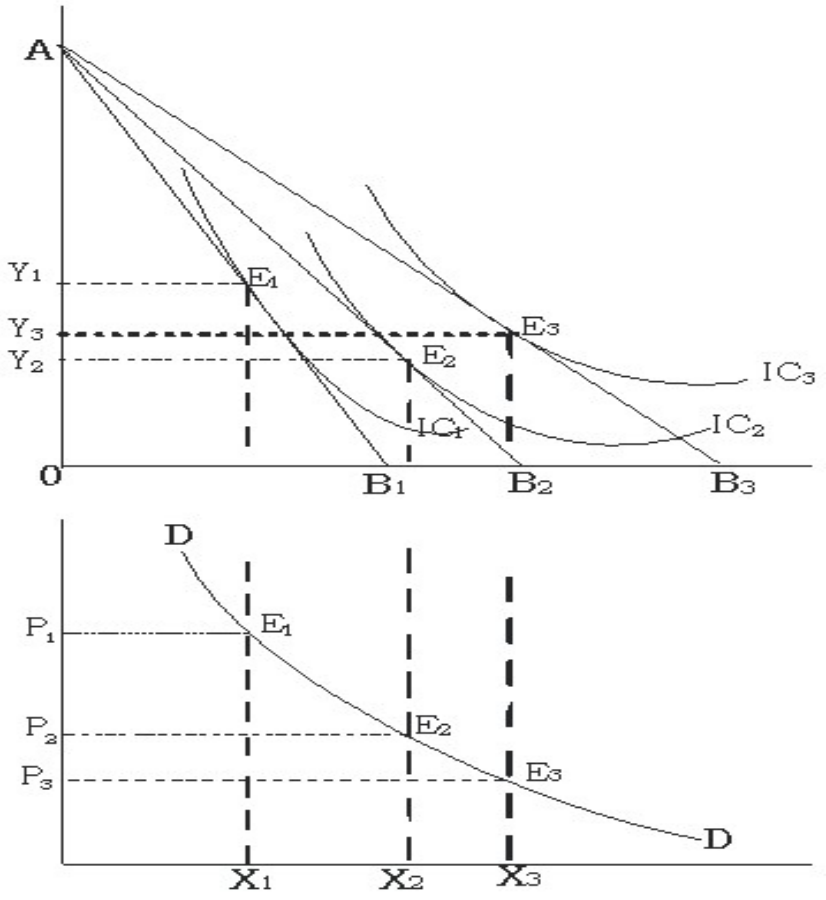
Figure 6.29 Deriving a demand curve from indifference curves and budget constraints

Suppose the price of X_1 drops to P_1 with P_2^1 and M remaining constant. The budget set in panel (a), expands and new consumption equilibrium is on a higher indifference curve at point D, where she buys more of bananas $X_1 > X_1^1$. Thus, demand for bananas increases as its price drops. One plot P_1 against X_1 in panel (b) of Figure 6.29 to get the second point on the demand curve for X_1. Likewise the price of bananas can be dropped further to $\widehat{P_1}$, resulting in further increase in consumption of bananas to $\widehat{X_1}$. X_1. gives us the third point on the demand curve. Therefore, one observe that a drop in price of bananas results in an increase in quality of bananas purchased by an individual who maximises his utility. The demand curve for bananas is thus negatively sloped.

The negative slope of the demand curve can also be explained in terms of the two effects namely, substitution effect and income effect that come into play when price of a commodity changes. when bananas become cheaper, the consumer maximises his utility by substituting bananas for mangoes in order to derive the same level of satisfaction of a price change, resulting in an increase in demand for bananas. Moreover, as price of bananas drops, consumer's purchasing power increases, which further increases demand for bananas (and mangoes). This is the income effect of a price change, resulting in further increase in demand for bananas. *Law of Demand states that*

> *"other things being equal, there is a negative relation between demand for a commodity and its price. In other words, when price of the commodity increases, demand for it falls and when price of the commodity decreases, demand for it rises, other factors remaining the same"*

The derivation of the demand curve using the ordinal utility approach can be achieved by considering the effect of price and income changes on consumption. When the price of a commodity changes the slope of the budget line equally change because the consumer adjusts his consumption pattern to maximize utility. From Figure 6.11, let us assume a consumer consuming two commodities X and Y, assuming that the price of commodity X falls holding other variables (consumer's income, price of the commodity, taste and preference) constant. The budget line will shift from its initial position AB_1 to a new position AB_2 and be tangent to a higher indifference curve IC_2, forming a new consumption point E_2. At this point, the consumption of Y has increase due to a fall in the price. This is known as the **price effect**. Similarly, if the price of commodity Y reduces further to P_3, the consumer's equilibrium position will shift from E_2 to E_3, giving us the **price consumption curve.**



Box 6.10 Derivation of the Demand Curve using the Indifference Curve

As the quantity of X purchased continues to increase as the price decreases, the law of demand is confirmed as shown by the downward demand curve in panel b.

Demand for normal and inferior goods[123]

The demand function is a relation between the consumer's demand for a good and its price when other things are given. Instead of studying the relation between the demand for a good and its price, one can also study the relation between the consumer's demand for the good and the income of the consumer. The quantity of a good that the consumer demands can increase or decrease with the rise in income depending on the nature of the good. For most goods, the quantity that a consumer chooses, increases as the consumer's income increases and decreases as the consumer's income decreases. Such goods are called normal goods. Thus, a consumer's demand for a normal good moves in the same direction as the income of the consumer. However, there are some goods the demands for which move in the opposite direction of the income of the consumer. Such goods are called inferior goods. As the income of the consumer increases, the demand for an inferior good falls, and as the income decreases, the demand for an inferior good rises. Examples of inferior goods include low quality food items like coarse cereals.

Box 6.11 Giffen good[124]
A rise in the purchasing power (income) of the consumer can sometimes induce the consumer to reduce the consumption of a good. In such a case, the substitution effect and the income effect will work in opposite directions. The demand for such a good can be inversely or positively related to its price depending on the relative strengths of these two opposing effects. If the substitution effect is stronger than the income effect, the demand for the good and the price of the good would still be inversely related. However, if the income effect is stronger than the substitution effect, the demand for the good would be positively related to its price. Such a good is called a Giffen good.

A good can be a normal good for the consumer at some levels of income and an inferior good for her at other levels of income. At very low levels of income, a consumer's demand for low quality cereals can increase with income. But, beyond a level, any increase in income of the consumer is likely to reduce her consumption of such food items as she switches to better quality cereals.

6.6. Chapter Summary

The theory of consumer behaviour can be explained using the cardinal and the ordinal utility theory. The cardinal utility theory assumes that utility can be quantitatively measured using utils, while the ordinal utility theory assumes that utility cannot be measured but ranked according to preference. The ordinal utility theory used the indifference curve approach to explain consumer behaviour. They assume that choices are made subject to income represented by the budget line. The consumer maximizes utility at the point where the budget line is tangent to the highest

[123] http://ncert.nic.in/textbook/pdf/leec202.pdf
[124] http://www.ncert.nic.in/book_publishing/NEW%20BOOK%202007/class12/microeconomics/Chapter%202.pdf

indifference curve. The Austrian economists maintain that utility is ordinal[125]. However, they challenge the use of mathematical utility functions by neoclassical economists on the grounds that such functions yield cardinal utilities, "measured," usually, in utils[126]. Neoclassicals respond by asserting that, in dealing with bundles of goods:

(1) a function that ranks bundles in accordance with an individual's necessarily ordinal preference ranking is an ordinal function, and the ranking it generates is ordinal;
(2) because the ranking of bundles generated by a specific utility function (F) remains the same after any positive monotonic transformation into another function (G), G, also, is a utility function; and,
(3) in that case, it does not make any difference whether an individual's preferences are represented by F, by G, or by any other function that is a positive monotonic transformation of F (or of G for that matter).

What should be clear from this chapter is that utility functions are not strictly used to represent mathematically differentiable functions rather to approximate it. The utils are basically represented as numbers and functions as an approximation of reality. One should therefore assess these models based on their ability to predict human behaviour and actions rather than attempting to raise unfounded criticisms.

[125] http://mises.org/journals/qjae/pdf/qjae6_1_3.pdf
[126] See for example Barnett, (2003).

6.7. Test and Examination Questions

Self-Check Questions

1. What do one mean by the budget set of a consumer?
2. What is budget line?
3. Explain why the budget line is downward sloping.
4. A consumer wants to consume two goods. The prices of the two goods are Rs 4 and Rs 5 respectively. The consumer's income is Rs 20.
   i. Write down the equation of the budget line.
   ii. How much of good 1 can the consumer consume if she spends her entire income on that good?
   iii. How much of good 2 can she consume if she spends her entire income on that good?
   iv. What is the slope of the budget line?

Questions 5, 6 and 7 are related to question 4.

5. How does the budget line change if the consumer's income increases to Rs 40 but the prices remain unchanged?
6. How does the budget line change if the price of good 2 decreases by a rupee but the price of good 1 and the consumer's income remain unchanged?
7. What happens to the budget set if both the prices as well as the income double?
8. Suppose a consumer can afford to buy 6 units of good 1 and 8 units of good 2 if she spends her entire income. The prices of the two goods are Rs 6 and Rs 8 respectively. How much is the consumer's income?
9. Suppose a consumer wants to consume two goods which are available only in integer units. The two goods are equally priced at Rs 10 and the consumer's income is Rs 40.
   i. Write down all the bundles that are available to the consumer.
   ii. Among the bundles that are available to the consumer, identify those which cost her exactly Rs 40.
10. What do one mean by 'monotonic preferences'?
11. If a consumer has monotonic preferences, can she be indifferent between the bundles (10, 8) and (8, 6)?
12. Suppose a consumer's preferences are monotonic. What can one say about her preference ranking over the bundles (10, 10), (10, 9) and (9, 9)?

13. Suppose your friend is indifferent to the bundles (5, 6) and (6, 6). Are the preferences of your friend monotonic?
14. Suppose there are two consumers in the market for a good and their demand functions are as follows:

    $d_1(p) = 20 - p$ for any price less than or equal to 20, and
    $d_1(p) = 0$ at any price greater than 20.

    $d_2(p) = 30 - 2p$ for any price less than or equal to 15 and
    $d_1(p) = 0$ at any price greater than 15.

    Find out the market demand function.

15. Suppose there are 20 consumers for a good and they have identical demand functions:

    $d(p) = 10 - 3p$ for any price less than or equal to 10/3 and
    $d_1(p) = 0$ at any price greater than 10/3

    What is the market demand function?

16. Consider a market where there are just two consumers and suppose their demands for the good are given as follows:

p	d_1	d_2
1	9	24
2	8	20
3	7	18
4	6	16
5	5	14
6	4	12

    Calculate the market demand for the good.

17. What do one mean by a normal good?
18. What do one mean by an 'inferior good'? Give some examples.

19. What do one mean by substitutes? Give examples of two goods which are substitutes of each other.
20. What do one mean by complements? Give examples of two goods which are complements of each other.
21. Explain price elasticity of demand.
22. Consider the demand for a good. At price Rs 4, the demand for the good is 25 units. Suppose price of the good increases to Rs 5, and as a result, the demand for the good falls to 20 units. Calculate the price elasticity .
23. Consider the demand curve D (p) = 10 – 3p. What is the elasticity at price 5/3?
24. Suppose the price elasticity of demand for a good is – 0.2. If there is a 5 % increase in the price of the good, by what percentage will the demand for the good go down?
25. Suppose the price elasticity of demand for a good is – 0.2. How will the expenditure on the good be affected if there is a 10 % increase in the price of the good?
26. Suppose there was a 4 % decrease in the price of a good, and as a result, the expenditure on the good increased by 2 %. What can one say about the elasticity of demand?

Review Questions

1. Explain the assumptions of the ordinal school of thought
2. What do one understand by an indifference curve? Enumerate its properties.
3. Explain how an individual maximizes utility using the indifference curve approach.
4. Derive a hypothetical demand curve for a normal good using the indifference curve.
5. Differentiate between the substitution and the income effect of price change on quantity demanded. {Hint: Use the ordinal approach}
6. The utility approach to consumer demand theory is based on the assumption of cardinal utility, while the indifference curve approach is based on ordinal utility. Which approach is better? Why?
7. If Alan is indifferent between Coke and Pepsi, what would Alan's indifference curves look like?
8. The indifference curve between a good and garbage is positively sloped. True or false? Explain.
9. What is the relationship between two goods if the marginal rate of substitution between them is zero or infinite? Explain.
10. What is the marginal rate of substitution between two complementary goods?
11. Are indifference curves useless because it is difficult to derive them experimentally?
12. Why is there a convergence of tastes internationally?
13. If Jennifer's budget line has intercepts 20X and 30Y and PY = \$10, what is Jennifer's income? What is PX? What is the slope of the budget line?
14. Must a consumer purchase some quantity of each commodity to be in equilibrium?

15. Janice spends her entire weekly food allowance of $42 on hamburgers and soft drinks. The price of a hamburger is $2, and the price of a soft drink is $1. Janice purchases 12 hamburgers and 18 soft drinks, and her marginal rate of substitution between hamburgers and soft drinks is 1. Is Janice in equilibrium? Explain.
16. Why is a consumer likely to be worse off when a product that he or she consumes is rationed?
17. In what way is the theory of revealed preference related to traditional consumer theory? What is its usefulness?
18. For each question, choose the correct response:
    i. The price of car transport is 30 cents per mile. The price of bus transport is 60 cents per mile. The marginal utility of Mario's last mile of car transportation is 80 utils, and the marginal utility of his last mile of bus transportation is 150 utils. Hence:
        a. Mario is currently maximising his utility.
        b. Mario could increase his utility by decreasing his consumption of car transportation.
        c. Mario could increase his utility by increasing his consumption of car transportation.
    ii. If an agent has a utility function of the form u(x,y)=xy then:
        a. They will be indifferent between (6,4) and (3,8).
        b. They will prefer (6,4) over (5,5).
        c. They will be indifferent between (6,4) and (5,5).
        d. None of the above.
    iii. The slope of the demand for an inferior good is steeper than that of a normal good because:
        a. Income and substitution effects enhance each other.
        b. Substitution effect for a normal good is greater than that of an inferior good.
        c. Income effect of a normal good is smaller in magnitude (absolute value) than the income effect of an inferior good.
        d. Income and substitution effects offset each other.
    iv. Judith spends all her money buying wine and cheese and wants to maximise her utility from consuming these two goods. The marginal utility of the last bottle of wine is 60, and the marginal utility of the last block of cheese is 30. The price of wine is £3, and the price of cheese is £2. Judith:
        a. is buying wine and cheese in the utility-maximising amounts
        b. should buy more wine and less cheese
        c. should buy more cheese and less wine

d. is spending too much money on wine and cheese.

Critical Thinking Questions

1. (a) Susan buys bread rolls and cheese. One bread roll costs £1 and cheese costs £3 per 500g block. Susan has £12 income to spend on bread and cheese.
   i. Draw Susan's budget constraint and a possible indifference curve. Explain the assumptions behind the shape of the indifference curve one have drawn.
   ii. If the price of bread falls to £0.80 per loaf, how will this affect her purchases? Answer in words and graphically, clearly indicating income and substitution effects of the price change.
   iii. If Susan only enjoys bread and cheese when she has 500g of cheese for every bread roll that she eats, draw her indifference curves. How much bread and cheese should she buy to maximise her utility? Assume Susan has £12, one bread roll costs £0.80 and cheese costs £3 per 500g block.

   (b) Now let's assume that Susan grows 100 potatoes each year and all of her income comes from selling them. She spends all of her income each year consuming potatoes and other goods. For Susan, potatoes are a Giffen good, in that if her income is fixed in some way (i.e. ignoring the fact that she sells potatoes and just fixing her income at some value) her consumption of potatoes will rise when their price rises. The price of potatoes falls and she consumes more potatoes. Taking into account the fact that her income actually comes from selling potatoes, explain how the last statement can be consistent with those that precede it.
2. I consume two goods, ice cream and biscuits. I shop once a week, spending £100, at either Sainsbury or Tesco (two well-known UK supermarkets). Interestingly, I've noticed that the bundle I purchase when I visit Tesco costs more at Sainsbury. Similarly, the bundle I purchase when I visit Sainsbury costs more at Tesco. And yet, I find that I get the same utility from shopping at either store (i.e. the Sainsbury shopping bundle gives me the same utility as the Tesco shopping bundle). Explain how it is possible for all of these statements to be true. (Hint: draw a single indifference curve and have me maximise utility given a £100 budget and different prices in the two stores).

Problems

1 From the following total utility schedule

Q_X	0	1	2	3	4	5	6	7
TU_X	0	4	14	20	24	26	26	24

a. derive the marginal utility schedule.
b. plot the total and the marginal utility schedules.
c. determine where the law of diminishing marginal utility begins to operate.
d. find the saturation point.

2 The following table gives four indifference schedules of an individual.

	U_1		U_2		U_3		U_4	
Combination	Q_X	Q_Y	Q_X	Q_Y	Q_X	Q_Y	Q_X	Q_Y
A	3	12	6	12	8	15	10	13
B	4	7	7	9	9	12	12	10
C	6	4	9	6	11	9	14	8
F	9	2	12	4	15	6	18	6.4
G	14	1	15	3	19	5	20	6

a. Using graph paper, plot the four indifference curves on the same set of axes.
b. Calculate the marginal rate of substitution of X for Y between the various points on U1.
c. What is MRSXY at point C on U1?
d. Can one tell how much better off the individual is on U2 than on U1?

3 Answer the following:

a) Starting with a given equal endowment of good X and good Y by individual A and individual B, draw A's and B's indifference curves on the same set of axes, showing that individual A has a preference for good X over good Y with respect to individual B.
b) Explain why one drew individual A's and individual B's indifference curves as one did in Problem 3(a).

4 Draw an indifference curve for an individual showing that

a. good X and good Y are perfect complements.
b. item X becomes a bad after 4 units.
c. item Y becomes a bad after 3 units.
d. MRS is increasing for both X and Y.

5 Suppose an individual has an income of \$15 per time period, the price of good X is \$1 and the price of good Y is also \$1. That is, I = \$15, PX = \$1, and PY = \$1.

a. Write the equation of the budget line of this individual in the form that indicates that the amount spent on good X plus the amount spent on good Y equals the individual's income.
b. Write the equation of the budget line in the form that one can read off directly the vertical intercept and the slope of the line.
c. Plot the budget line.

6 This problem involves drawing three graphs, one for each part of the problem. On the same set of axes, draw the budget line of Problem 5 (label it 2) and two other budget lines:

a. One with I = \$10 (call it 1), and another with I = \$20 (label it 3), and with prices unchanged at PX = PY = \$1.

b. One with PX = \$0.50, PY = \$1, and I = \$15 (label it 2A), and another with PX = \$2 and the same PY and I (label it 2B).

c. One with PY = \$2, PX = \$1, and I = \$15 (label it 2C), and another with PX = PY = \$2 and I = \$15 (label it 2F).

7 Answer the following

a) On the same set of axes, draw the indifference curves of Problem 2 and the budget line of Problem 5(c).

b) Where is the individual maximizing utility? How much of X and Y should he or she purchase to be at optimum? What is the general condition for constrained utility maximization?

c) Why is the individual not maximizing utility at point A? At point G?

d) Why can't the individual reach U3 or U4?

8 On the same set of axes (on graph paper),

a. draw the indifference curves of problem 2 and budget lines 1, 2, and 3 from Problem 6(a); label the points at which the individual maximizes utility with the various alternative budget lines.

b. 2 and 2A from Problem 6(b); label the points at which the individual maximizes utility on the various alternative budget lines: E and L.

9 Given the following marginal utility schedule for good *X* and good *Y* for the individual, and given that the price of *X* and the price of *Y* are both \$1, and that the individual spends all income of \$7 on *X* and *Y*,

Q	1	2	3	4	5	6	7
MU_X	15	11	9	6	4	3	1
MU_Y	12	9	6	5	3	2	1

a. indicate how much of X and Y the individual should purchase to maximize utility.

b. show that the condition for constrained utility maximization is satisfied when the individual is at his or her optimum.

c. determine how much total utility the individual receives when he or she maximizes utility? How much utility would the individual get if he or she spent all income on X or Y?

10 Show on the same figure the effect of (1) an increase in cigarette prices, (2) an increase in consumers' incomes, and (3) a government warning that cigarette smoking is dangerous to health, all in such a way that the net effect of all three forces together leads to a net decline in cigarette smoking.

11 Answer the following;

a. Draw a figure showing indifference curve U2 tangent to the budget line at point B (8X), and a lower indifference curve (U1) intersecting the budget line at point A (4X) and at point G (12X).

b. What happens if the government rations good X and allows the individual to purchase no more than 4X? No more than 8X? No more than 12X?

c. What would happen if the government instead mandated (as in the case of requiring auto insurance, seat belts, and so on) that the individual purchase at least 4X? 8X? 12X?

12 Show by indifference curve analysis the choice of one couple not to have children and of another couple, with the same income and facing the same costs of having and raising children, to have one child.

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