MICROECONOMICS

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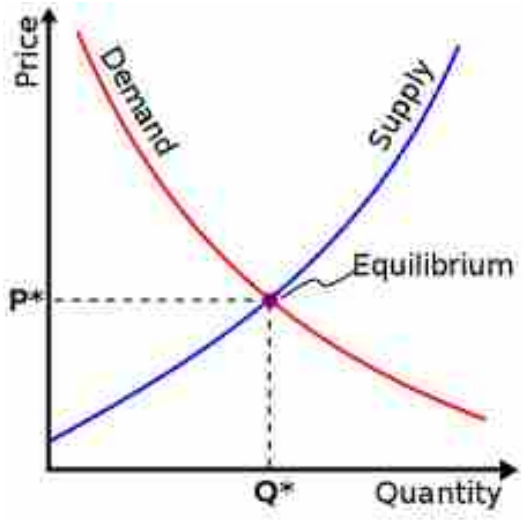

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- ❑ The Government and the Economy

Technologies Used for Content Delivery

- BOUTUBE
- BOULMS
- WebTV
- Web Radio
- Mobile Technology with Micro SD Card
- LP+Office365
- BTV Program
- Bangladesh Betar Program

Lesson 1: Nature and Methodology of Economics

Lesson Objectives

After studying this lesson, you should be able to:

- state the nature of economics;
- state the format of an economic theory;
- distinguish between positive and normative analysis; and
- distinguish between microeconomics and macroeconomics.

Nature of Economics

Economics is a social science which deals with economic activities of people. People have unlimited wants, but the resources required to satisfy these wants are limited. Scarcity of resources in the presence of unlimited wants gives rise to all economic activities. If the resources were not scarce, there would not be any economic activity at all. With unlimited resources, a person could get as much as he would like to have without any work. Economics is rightly called the study of the allocation of resources for satisfying human wants.

Since people cannot satisfy all wants with limited resources, they have to choose the most and urgent ones from unlimited wants. A person may feel the wants for food, color television, and a host of other items, but he must meet his want for food before anything. The choice problem arises also because a resource has alternative uses. For example, a piece of land can be used for growing paddy or it can be used for building a market on it or it can be put to any other use its owner thinks most profitable. Once its owner has put it to one use, it cannot be used for other purposes. The best use of a resource can be assured by utilizing it to meet the most urgent and important wants. The definition of Economics is based on the fundamental concepts of unlimited wants, limited resources, the choice problem, and alternative uses of resources. Professor L. Robbins defines economics as, "Economics is the science which studies human behavior as a relationship between ends and scarce means which have alternative uses."

Methodology of Economics

Economics is a science in the sense that it employs scientific methods of acquiring and disseminating knowledge. There is, however, a sharp distinction between the methods of acquiring knowledge used in economics and those used in natural sciences like physics, chemistry, etc. The natural sciences conduct controlled experiments with inanimate matters and

animals in laboratories whereas, Economics experiments with human being who cannot be subjected to such controlled experiments. Moreover, randomness is a latent feature of human behavior. The science of Economics formalized the systematic pattern of economic behavior of a person, if any, despite the wide fluctuations in his behavior. Nevertheless, Economics uses scientific methods of acquiring knowledge. Broadly speaking, there are two methods of gathering knowledge, viz., deductive and inductive methods. Let us now determine which of the two methods is used in Economics.

Difference between Positive and Normative Economics

Positive analysis is concerned with the description of economic phenomena and analyzes organizations, functions and interactions of economic agents in the economy. It also deals with the nature and the consequences of different economic policies. On the other hand, normative analysis is concerned with value judgments about economic agents. It discusses how an economic agent should behave, but positive analysis discusses how it behaves. Normative analysis suggests about policies a government should undertake, whereas positive analysis discusses the consequences of the policies undertaken. For example, the government proposes enacting a law that determines the minimum wage for workers in ready-made garments industry in Bangladesh. Positive analysis deals with the following aspects of the minimum wage regulation:

- What will be the implications of minimum wage for employment level and price of garments?
- Who will be the beneficiaries and who will be the losers?
- What will be the net effect of minimum wage regulation for the economy as a whole?
- How will the efficiency and equity of the national economy be affected?

Normative analysis is concerned with the question of whether the government should implement the minimum wage act at all. It will take a host of economic and non-economic factors into consideration for making value judgments on this issue.

It should be noted that much of economic analysis are positive. A few topics in economics, however, are normative in nature. Finally, we can think of another type of economic analysis known as the Art of economics. It discusses the methods of applying the knowledge obtained in Positive Economics to achieve the goals determined in Normative Economics. Suppose, we have decided to achieve a particular type of distribution of income in the economy given the way the economy works, how can we obtain the specified pattern of distribution of income? The art of Economics provides answers to this type of questions.

Distinction between Microeconomics and Macroeconomics

Microeconomics deals with behavioral patterns of the smallest economic agents who make their decisions independently. It shows how allocation of resources, production of commodities, determination of price, etc., are affected by the independent decisions of the consumers, producers and other economic agents. Microeconomics analyzes the decision-making process of different economic agents under different behavioral assumptions. For example, it deals with utility-maximizing behavior of a consumer, profit maximizing behavior of a competitive firm, revenue-maximizing behavior of an oligopolist, etc. Consumer, households, production firms,

markets for products, markets for inputs are a few examples of microeconomic topics. Not only microeconomics discusses the behavior of the smallest independent decision units, but also discusses the interactions emerging among different economic agents.

Macroeconomics deals with aggregate variables facing an economy. Gross national product (GNP), aggregate employment level, the general price level, the growth rate of the economy, etc., are few examples of macroeconomic topics. The macroeconomic topics are quite distinct from the microeconomic topics. For example, Macroeconomics shows how the equilibrium levels of income and consumption of the economy are determined, whereas Microeconomics determines the utility maximizing levels of commodities of a consumer. Microeconomics discusses the determination of relative prices of the commodities and services and Macroeconomics discusses the determination of general price level in the economy.

The assumptions of the two branches of economics are, of course, different. Microeconomics assumes prices of other commodities and services to remain fixed when it explains the determination of price of one commodity. Macroeconomics, on the other hand, assumes that the relative prices have already been determined when it explains the determination of the general price level. In some cases, the boundaries of Microeconomics and Macroeconomics are overlapping. For example, one topic of Microeconomics is general equilibrium analysis which shows the simultaneous equilibrium of all consumers and production firms in the economy. On the other hand, Macroeconomics analyzes separately the determinants and functioning of bond market, labor market, etc.

Finally, it is observed that the values of Macroeconomic variables are not equal to sums of values of microeconomic variables. The study of Macroeconomics will not be necessary and interesting if macroeconomic variables can be created by adding microeconomic variables. It can, however, be asserted that the two types of variables are quite distinct. Consider, for example, the case of transfer payments to a person, who wins a lottery award of forty lakh taka. There is no doubt that the income of the person has increased, but national income has not increased due to the increment in personal income. In other words, national income does not reflect the increment in personal income in this case.

Review Questions

1. What is Economics? Is Economics a normative or positive science? Illustrate your answer.
2. Distinguish Microeconomics from Macroeconomics. What are the uses and limitations of Microeconomic theories?

Lesson 2: The Basic Problems of an Economy

Lesson Objectives
After studying this lesson, you should be able to:

- state the basic problems of an economy;
- define opportunity cost and derive the production possibility curve;
- state the solutions of fundamental problems under alternative economic systems; and
- state the role of government in economics.

Basic Problems of an Economy

The central problems of an economic society are similar to the individual problems except that the problems here in an economic society relate to the economy as a whole. The main problem is the scarcity of resources in the face of unlimited wants. The scarce resources have, however, alternative uses. The problems of an economic society are, symbolically expressed by three question words, such as what? how? and for whom? The problem of deciding the level of investment can be added to the above list. We shall discuss each of these problems systematically by turns.

The problem of Allocation of Resources: What?

The term 'what?' refers to the problem of allocating resources to the production of commodities and services. It is the problem of determining the commodities and services which will be produced. Related to this problem is the necessity of determining the quantities of selected commodities and services. Had the resource been not scarce, the necessity of selecting and determining the quantities of the commodities and services wouldn't have arisen? The concepts of opportunity cost and production possibility curve can be employed to explain the problem expressed by the word, 'what?'

Opportunity Cost and Production Possibility Curve

Since the concept of opportunity cost is crucial in Economics. We intend to present a detailed analysis of the concept. Opportunity cost of undertaking an activity is the forgone benefit from the next-best activity. Though a resource has alternative uses, it cannot be put into more than one use at the same time. If the owner of a price of land decides to build a house on it, the opportunity cost of the house will be the forgone benefit from its next-best use which is, say, growing paddy in it. The opportunity cost of reading this Economics text-book is the lost time that could be spent reading the Accounting text book.

The idea of opportunity cost can be explained with the help of an opportunity cost curve, alternatively known as *production possibility curve*. Suppose, a hypothetical economy can produce only two commodities: guns and paddy, by using all its resources. The production possibilities of the economy are shown in Figure-1.1. We measure the quantity of food in million metric tons along the vertical axis and the number of guns in millions along the horizontal axis.

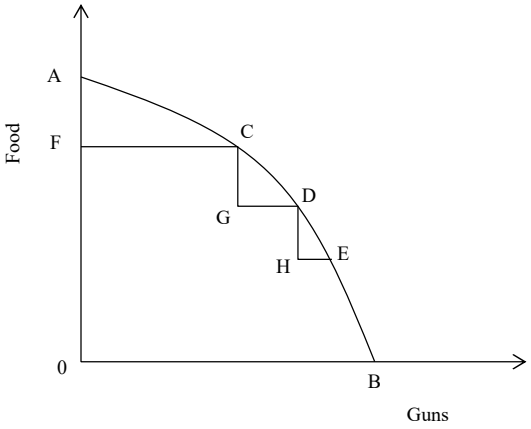

Figure 1.1: Production Possibility Curve

Initially, the economy is at point A producing OA quantity of food and no guns. Perhaps both the people and the government of the economy express their dissatisfaction in having no guns and would like to produce FC guns by sacrificing AF quantity of food. In other words, the opportunity cost of FC guns is AF quantity of food. Some resources previously used in producing food were released and shifted to the production of guns. Consequently, the production of food fell when the economy stands to produce a small number of guns.

Suppose the new military ruler of the country wants more guns. The economy moves to D from C gaining GD guns at the cost of GC tons of food. Similarly, to obtain HE additional units of guns, the economy has to sacrifice DH units of food. It can be easily seen that the amount of sacrifice of food for each extra unit of gun is rising gradually. In economic terminology, this phenomenon is known as increasing marginal opportunity cost or increasing marginal cost in brief. There is, of course, an economic explanation for increasing marginal cost. When the economy was producing a large amount of food and a small number of guns initially, some of the resources used in food production were indeed more suitable to gun production. The resources having comparative advantage in gun production were released for gun production when the economy started to produce more guns. As a result, the opportunity cost of producing guns was low initially. As the economy increased the production level of guns further, some of the resources having comparative advantage in food production had then to be shifted to gun production. Consequently, the opportunity cost of producing guns increased with increase level of gun production. Needless to say, the phenomenon of increasing marginal cost makes the production possibility curve concave to the origin.

It should be noted that the production possibility curve shows efficient production levels. At each point on the production possibility curve, the economy produces the two commodities as much as possible with given resources. Take, for example, the production level shown by H in Figure 1.1, which is clearly inefficient. Using the given resources, production level can be pushed to D which shows increased quantity of food with no change in the production level of guns. Or, it can be shifted to E where production of guns increases, whereas production of food remains fixed. Production of both commodities will increase if the production shifts to any point between D and E.

Now that we have explained the concept of opportunity cost and illustrated the derivation of production possibility curve which entails opportunity cost. We can use the production possibility curve for explaining the problem denoted by the word 'what?'. The production possibility curve shows the different bundles of two commodities, food and gun, that can be produced utilizing all the available resources in the economy. For example, the country can produce the combination shown by C or the combination shown by D in Figure 1.2. Combination C signifies F_1 tons of food and G_1 units of guns. Similarly, combination D shows F_2 tons of food and G_2 units of guns.

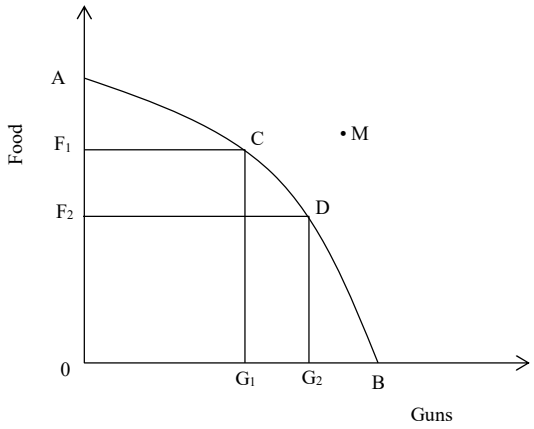

Figure 1.2: Production Possibility Curve

Each point on the curve AB shows a specific combination of two commodities. The country chooses one and only one combination from the set of many combinations on the curve AB. It cannot choose more than one combination on the curve. Similarly, it cannot choose the point M, which it cannot produce with the given resources. It would not choose any point below the production possibility curve because production at such a point would entail inefficiency in production. The word 'what?' refers to the problem of choosing one specific combination of the two commodities from a large number of combinations lying on the efficient production frontier AB.

The Problem of Selecting Method of Production: 'How?'

The abbreviated question 'how?' refers to the problem of the choice of the method of producing the selected commodities. There are different methods of producing the predetermined quantities of a number of commodities and services. For example, there are labor intensive and capital intensive methods of production. Normally, production of a commodity or service requires all inputs of production. The quantities put in the production of a commodity may be changed, because, one input may be substituted another depending on the relative prices of two inputs.

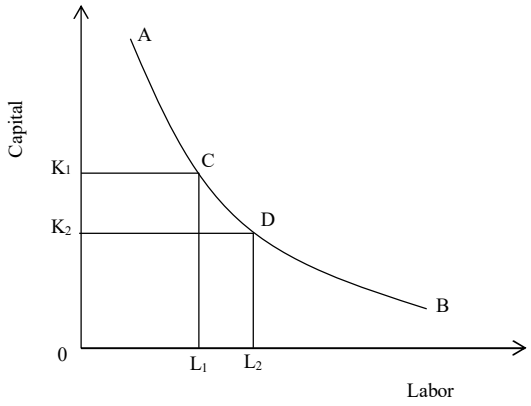

Figure 1.3: Equal Prduct Curve

Method of producing commodity is called labor intensive when more labor and less capital is used in the production process of that commodity. Input intensity of a commodity can also be defined in relative terms. Gun is said to be more capital intensive than food when the ratio of capital to labor in gun production is larger than the corresponding capital labor-ratio of food production. It should be noted that the method of production depends on technology of production and prevailing input price.

Figure 1.3 explains the nature of the second problem denoted by the term 'how?'. Here, we introduce the concept of equal product curve, alternatively known as iso-quant. An equal product curve shows the different combinations of two inputs, which produce a given quantity of output. The curve AB in Figure 1.3 is an equal product curve. The vertical axis of Figure 1.3 measures capital and the horizontal axis measures labor. Combination C with OK_1 units of capital and OL_1 units of labor can produce as much of the commodity as the combination D with OK_2 amount of capital and OL_2 amount of labor can produce. Input allocation at C, however, implies a capital intensive method of production, because, at C production of the commodity requires more capital than labor. Similarly, combination D implies a labor intensive method of production. Each point on the curve AB implies a distinct capital labor ratio, and hence, a distinct production process of the commodity in question. The choice problem indicated by the word 'how?' refers to the problem of choosing one of several methods of production shown along different points of an equal product curve.

The Problem of Distribution: 'For Whom?'

The third problem of an economic society as abbreviated by the phrase 'for whom?' refers to the problem of distribution of the produced commodities and services among the consumers. An economy may be endowed with many natural and non-natural resources so that it can produce a large volume of goods and services. The people of the economy might still face problems in meeting their wants for daily necessities if most of the produced commodities and services go to the consumption of a small section of the people. Most least developed countries (LDCs) face the problems of both inadequate resources and distribution of income. In Bangladesh, small portion of population are rich, and one of the reasons is that their forefathers were rich and these people have much more than they would like to have. Majority of the people live below the poverty line. The big question is: should we ignore it and endure with the existing distribution of income as happily as ever? We also face the problem of physically crippled and mentally retarded persons who are unable to work. Should these persons be left uncared and allowed to starve to death? The central authority of an economy often faces these types of questions. The problem expressed by the phrase 'for whom?' refers to the problem of selecting a widely accepted criterion of distributing income among hundreds of millions of people living in the country.

Solutions of the Fundamental Problems under Alternative Economic Systems

Socialist and other Centrally Planned Economics

In socialist and other centrally planned economies, the answers to the fundamental questions are dictated by central authority under the government. Usually, a planning commission under close supervision of the government takes decisions about the nature and production targets of different commodities and services. In doing so, the planning commission usually makes use of the vast wealth of data on consumers' tastes, preferences, and demand and supply conditions prevailing in the country. In allocating resources, the central planners give more emphasis to those commodities and services which, they believe, are socially beneficial. The central planners choose the method of production, which is, according to them, ideally good for the country. In distributing the produced commodities, the central planners use the criterion of "to each according to her/his need" as determined by them. The central planners again determine the rate of investment for the economy.

Capitalist Economy

In a capitalist economic system, answers to the four fundamental questions are provided through the operation of the market mechanism in the economy. A market for a commodity is the collection of consumers and suppliers for that commodity, who interact among themselves for exchanges. The participants of the market need not be concentrated in one place. They may be widely scattered all over the whole country or beyond the national geographic boundaries. Operation of the market economy presupposes fulfillment of three conditions. **Firstly,** people are assumed to enjoy unfettered freedom in making decisions about economic activities like consumption, production, etc. This psychological view is often referred to as individualism, which ensures that only individuals make decisions without being influenced by any authority and by any other pressure group. **Secondly,** in a market economy every economic agent is supposed to be a maximizer. For example, a consumer tries to maximize her/his satisfaction by consuming commodities and services. The producer tries to maximize her/his net profit which is equal to total revenue minus total cost. In a capitalist economy, everybody is motivated by her/his self-interest. The attempt to augment self-interest by everybody in the economy leads to discipline and integration among the diversified economic activities of different economic agents

in society. **Thirdly,** market economy can work properly only when private property rights are well defined and defended by the government. Private property rights include unfettered control over an asset or the right to do something without encroaching on others' rights.

Let's now explain how a market economy provides answers to the four fundamental questions. In a market economy, price is determined at the point where aggregate demand equals aggregate supply. Price acts as a signal in the market economy. It is said that consumers are sovereign in a market economy. It is the consumer who determines the allocation of resources to different commodities and services. They decide which commodities and services will be produced in the economy. Their preferences are expressed through prices. If consumers' demand for a commodity increases, the market price of that commodity goes up. Since producers are profit maximizers, increased price of a commodity acts as a signal to the producers for increasing production of that commodity. Thus, the message of consumers' preferences is conveyed to the producers through the price system. Quantity of the selected commodity is also determined through the price system. Producers must produce that level of output at which demand is equal to supply. If the producers produce more than the equilibrium quantity, they will not be able to sell all output. If they produce less than the equilibrium quantity, they will not be able to meet all the demand from the consumers.

We now illustrate how market mechanism determines the method of production. Since a producer's ultimate objective is to maximize her/his profit, she/he will always use the cheapest method of production. A method of production will be the least expensive method if it uses the cheap inputs more than the dear inputs. An input is cheaper when its relative abundance in a country makes its price lower. Thus, market determines how commodities and services should be produced.

Distribution of the produced goods and services also takes place through the market mechanism. Every economic agent has a dual role in a market economy: she/he is a consumer and a supplier of productive input at the same time. By supplying the inputs, she/he earns income which she/he spends on consumption. A person's purchasing power will be higher if the price of the input supplied by her/him increases due to increased demand for that input. A person's income will be lower if there is less demand for her/his input. A person's income is, therefore, dependent on the price and quantity of input sold by her/him. The price and quantity of input sold are determined by market forces. A person's income will also be higher if she/he acquires or inherits a large volume of wealth and income from her/his forefathers. A person with higher income will consume more commodities and services than another person with lower income. Thus, the question who consumes the produced commodities is also determined by the market mechanism, because, the price of input is also determined by market forces.

Finally, the rate of investment in a capitalist economic system is also determined by the market. People's attitude toward investment depends on the rate of interest and a host of other factors. The rate of interest and other determinants of investment are determined by forces of demand and supply prevailing in a capital market. The capital market integrates the demand for and supply of funds for loan in an economy through different financial institutions like banks, stock markets, etc. Thus, the market mechanism also determines the investment rate in the economy.

Mixed Economy

It should be noted that pure capitalism is rare in real world. In most of the capitalist countries of the world, governments have means of controlling the markets though answers to the

fundamental question are sought through market mechanism. Private ownership of some key sectors of the economy is replaced by state ownership. In the USA, anti-trust laws are in vogue to check and curb the emergence of monopoly powers. Market economies having both private and public ownerships may be called mixed economic systems. We have a mixed economic system in Bangladesh where some enterprises are owned and managed by the state.

The Role of Government

The role of government in economic affairs of the state is pervasive in socialist and other centrally planned economies. As mentioned earlier, a planning commission under close supervision of the government determines the answers to four fundamental problems of an economy. The proponents of market economy discourage any intervention in free functioning of market mechanism. They would like to restrict the role of the state to maintenance of law and order in society so that economic forces and agents can work undisturbed. The non-interventionist view of the role of the state is now held in abeyance. Especially, the theory of demand management put forward by the great economist John Maynard Keynes brought the government to the forefront as the most important economic institution for devising and implementing different economic policies. The intervention of government in economic affairs of the state is sought from another perspective also. It has been theoretically and empirically proved that market economy performs better than any other economic system in providing answers to three fundamental questions with the exception of the answer to the problem of distribution. The superior performance of the market economy is contingent on fulfillment of some conditions. Moreover, the market economy can achieve the desired goal of efficiency if the market structure is competitive. There are a few cases where market economy cannot work. The major problem is that market structure is not competitive for most of the commodities and services. In such a dismal situation about the efficiency of market economy, the government has a significant role in facilitating and encouraging unhindered functioning of market economy. The government can use different kinds of policy tools to correct market failures. Only then the market economy can function properly. Despite the importance of government interventions, theoretical controversies about the role of the government in economic affairs are still on. In reality, however, most governments of capitalist economic systems frame and implement economic policies to achieve economic goals.

Review Questions

1. What is economy? What are the basic problems of an economic system?
2. What is price mechanism? How does it solve the central problems of an economy?
3. What are the basic economic problems? Explain as to how they arise due to the scarcity of resources.
4. What are the features of a mixed capitalist economic system? Does price mechanism help in solving the problems of allocation of resources in such an economy in the most efficient way?
5. How are the central problems of an economy solved in a capitalist economy?
6. What are the three economic questions that must be answered by every society?

7.(a) What role do market prices play in answering the first two of the three economic questions?
(b) What determines how much of the output of the private sector a person can claim?

8. Suppose there is a sudden cutoff of oil from the Middle East, as occurred in the early 1970s. Trace the effects of this disruption in a market economy.
9. (a) What is the main argument used to justify a centrally planned economy?
   (b) What are the main problems of this economy?

Unit 2: DEMAND AND SUPPLY

Highlights

- Law of Demand
- Individual Demand Curve
- Market Demand Curve
- Law of Supply
- Individual Supply Curve
- Market Supply
- Market Equilibrium and Disequilibrium

Technologies Used for Content Delivery

- BOUTUBE
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Lesson 1: Theory of Demand

Lesson Objectives

After studying this lesson, you should be able to:

- define the concept of demand;
- explain the main influences on demand;
- explain law of demand;
- draw demand curve from demand schedule; and
- describe the relation between individual and market demand.

Wants

Wants are the unlimited desires or wishes that people have for goods and services. Every person wants to get more and more of goods and services. A person who has a bicycle likes to get a motorcycle. When he/she gets a motorcycle, she/he wants to have a private car, and so on. Wants are always unlimited. In these circumstances, a question arises: can people meet all of their wants? The answer is NO. Why? Because, resources are limited.

Need

Need for a commodity refers to the necessity of the commodity to sustain life. For example, if you tell your friend that you need three tickets for watching a movie if the price is Tk. 30.00 per ticket, it would be easy for your friend to disagree with your statement. She/he could argue that you did not need any movie tickets because watching movie was not necessary to sustain life. But if you say that you want three movie tickets, then it's all right - it cannot be disputed. You can rightly say that you need a glass of water to quench your thirst. In this lesson, we are concerned with *wants,* not *needs* because, demand reflects only *wants*.

Demand

You have seen earlier that all of our wants cannot be satisfied due to the limited availability of resources. Only a few numbers of wants are affordable. Demand reflects the decision about which wants are to satisfy. That is, the affordable wants are considered as demand. So we will say the consumer has demand for commodity X if (if and only if) the following things are true:

- The consumer has want for commodity X, i.e., commodity X has the ability to meet the desire of the consumer.
- The consumer is willing to have it.
- The consumer has sufficient purchasing power to buy the commodity.

Quantity Demanded

The quantity demanded of a good or service is the amount that people are willing and able to purchase at each price in a series of possible prices during a specified period of time. Three important things are to be noticed when someone thinks about *quantity demanded*:

- Quantity demanded is a desired quantity- not necessarily the same amount as the people actually bought. Quantity demanded may be a different amount than people actually succeed in purchasing. If sufficient quantities are not available, the amount people wish to purchase may exceed the amount they actually do purchase. To avoid confusion, we could use quantity demanded to refer to desired purchase and quantity exchanged to refer to actual purchase.
- The word "Desired" does not refer to idle dreams or future possibilities but to effective demands, that is, to the amounts people are willing to buy given the price they must pay for the commodity. For persons willing to spend Tk. 500 this year on a commodity whose price is Tk. 100 per unit, the quantity demanded is 5 units even though they would prefer to consume much more if only they did not have to pay for it.
- Quantity demanded refers to a continuous flow of purchase. It must, therefore, be expressed as so much per period of time: 1 thousand bananas per day, 7 thousand per week, or 100 thousand per year. If you were told, for example, that the quantity of computers demanded (at current prices) in Bangladesh was 50,000, this would mean nothing. Because you were not told the period of time involved.

Demand versus Quantity Demanded

Demand refers to the relationship between price and quantity. When we think about the whole demand curve (shown in figure 2.1), we think of demand- the relationship between price and quantity- for the commodity. However, quantity demanded refers to a particular quantity or point on the demand curve. Thus, when we think of a particular quantity, we can avoid confusion by calling it *quantity demanded* rather than *demand*.

Determinants of Quantity Demanded

The amount of any particular commodity or service that consumers plan to buy depends on many factors. The main ones are as follows:

The commodity's own price: The amount of a commodity the people will be willing to buy depends mainly on the commodity's own price. If price of the commodity is low, people desire to buy more; if price is high, then people wish to buy less.

The prices of related goods: The quantity of a commodity that a consumer plans to buy depends in part on the prices of related goods and services that fall into two categories: substitutes and complements.

A ***substitute*** is a good that can be used in place of another good. For example, rice substitutes for wheat, sugar substitutes for saccharin, beef substitutes for chicken, mustard oil substitutes for soyabin oil, etc. More similarly, burger has many substitutes- hotdog, pizza, sandwich, etc. If the price of one of the substitutes increases, people economize its use and buy more burger. For example, if the price of hotdog rises, more burgers are bought- the demand for burger increases.

A ***complement*** is a good that is used in conjunction with another good. Some examples of complements are burger and French fries, snacks and drinks, noodles and sauce, running shoes and jogging pants, cements and sand, etc. If the price of French fries increases, people will buy fewer burgers. If the price of cement increases, people will buy less sand. Thus, if the price of the complement increases, the demand for a commodity decreases.

Income: Other things remaining the same, when income increases, consumers buy more of most of the goods, and when income decreases, they buy less of most of the goods.

Tastes: Tastes are an individual's attitudes toward goods and services. For example, a pop music fanatic has a much greater taste for tapes than does a tune-deaf workaholic. As a consequence, even if they have the same incomes, their demand for tapes will be very different.

Population: If the population of the country increases, the quantity demand of a good increases even though the price of the commodity remains unchanged.

Other unrelated goods: If price of a good decreases, you will get more money to spend on books or any other goods or services. On the other hand, if other unrelated goods are not available, then you will have more money to spend on the commodity.

Expectations : Expectations have influence on consumer decisions. If someone expects that the price of Sony TV will be decreased within the next few days, she/he will be reluctant to buy a TV set at the moment. If you think that you are going to get a personal computer with more facilities and same price after a few days, would you decide to buy a computer at this moment? Certainly not.

Therefore, due to the expectations about future price, quality, etc. of a product, the demand for the product varies.

Now, think yourself. What is the most important determinant of quantity demanded? Certainly, *price* of the commodity. Let's know about the relationship between price and demand.

Relationship between Price and Quantity Demanded: The Law of Demand

You have learnt about the determinants of quantity demanded in the above section. Now, if we see the influences on the quantity demanded of the commodity's own price, how do we do that? The basic hypothesis is that we have to assume all the determining variables other than commodity's own price are constant.

A basic economic hypothesis about the relationship between price and quantity demanded is as:

"Other things remaining the same, the higher the price of a commodity, the smaller the quantity demanded and the lower the price of a commodity, the higher the quantity demanded." Economists call this relationship the ***Law of demand***. Here, *other things* indicate the determining factors of quantity demanded other than commodity's own price (see in the table below).

Determining factors of quantity demanded	
Commodity's own price	
Prices of related goods Average income of the consumers Tastes Prices of unrelated goods Expectations about future price Population	} Other things

On What Basis Does the Price-Demand Relationship (or the Law of Demand) Rest?

There are several levels of analysis on which to argue the case:

Firstly, our common sense says that people ordinarily do buy more of a product at a low price than they do at a high price. A high price discourages consumers from buying, and a low price encourages them to buy. Businesses, for example, Bata, Arong, etc. declare "Sale" sometimes in the year. At that time the products are sold at low prices. Lots of people gather in the sales centers. Within a short period their inventories are exhausted. This evidence makes our belief in the law of demand consistent.

Secondly, after a given period of time, each buyer of a product will get less satisfaction or utility from each successive unit of a product. The second piece of "biscuit" will yield less satisfaction to the consumer than the first one and the third will still add less satisfaction or utility than the second. As consumption is subject to diminishing marginal utility (see Lesson 2 of Unit 4) - consuming successive units of a particular product yields less and less additional satisfaction, consumers will agree to buy additional units of the product if its price is reduced.

Thirdly, the law of demand also can be explained in terms of income and substitution effects. The *substitution effect* indicates that the lower price of a good, other things remaining the same, the consumers get the incentive to substitute the cheaper good for goods relatively expensive. Consumers tend to substitute cheap products for dear products.

The *income effect* suggests, at a lower price, other things remaining the same, a consumer can afford more of the good without giving up other goods. In other words, a decline in the price of a product will increase the purchasing power of the consumer enabling her/him to buy more of the product than before. A higher price will have the higher opposite effect. For example, a decline in the price of beef will increase the purchasing power of consumer enabling her/him to buy more beef (the income effect). At a lower price, beef is more attractive and is substituted for mutton, chicken, and fish (the substitution effect). The income and substitution effects combine to make consumers able and willing to buy more of a product at a lower price than at a higher price.

How Can the Relationship between Quantity Demand and Price be Portrayed?

Two methods are usually used to do that:

First Method: Demand schedule

This is a numerical tabulation showing the quantity that is demanded at selected prices. Table 2.1 shows a hypothetical demand schedule for biscuits. It lists the quantity of biscuits that would be demanded at various prices on the assumption that average households income is fixed at Tk. 1000.00, and other factors like tastes, expectations, prices of other related goods, etc. do not change. The table gives the quantities demanded for five selected prices, but actually there is a separate quantity that would be demanded at each possible price.

Table 2.1: Demand schedule for biscuits (hypothetical data)

	Price per kg (Tk.) P_t	Quantity demanded (kg per week) Q_t
A	10	100
B	15	80
C	20	60
D	30	40
E	60	20

In Table 2.1, we see that as the price of biscuit increases, the quantity demanded for biscuits decreases. That is, there is an inverse relationship between the quantity demanded for biscuit and its own price.

Second method: Demand curve or ***willingness and ability to pay curve***

The relationship between quantity demanded and price can be shown by drawing a graph. If we plot the information given in Table 2.1 in a graph, we get demand curve. Figure 2.1 shows a demand curve which represents the points corresponding to price-quantity pairs of Table 2.1.

In Figure 2.1, DD is the demand curve for biscuit. Each point on the DD curve refers to the quantity demanded for biscuit at a particular price. We see that with the uise of price of biscuit, quantity demand for biscuit decreases along the DD curve.

Properties of a Demand Curve

- Demand Curve shows the relationship between quantity demanded of a good and its own price assuming that other things remain the same.

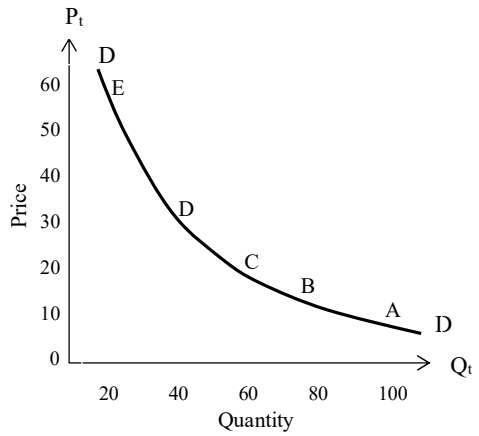


Figure 2.1: Demand Curve for Biscuit

- Normally, demand curves are downward sloping i.e., the relationship between quantity demand and price is inverse. According to the law of demand, people buy more at a low price than at a high price, which is reflected in the downward slope of the demand curve.
- The term *demand* refers to the entire relationship between price and quantity. However, a single point on a demand curve refers to the quantity demanded at a particular price. For example, at point C in Figure 2.1, we see that 60 kg of biscuits is demanded at a price of Tk. 20.00 per kg
- The *slope* of the demand curve changes if the pattern of the relationship between price and quantity demanded changes.
- The *position* of a demand curve changes if the ceteris paribus assumption is violated, i.e., if *other things,* such as tastes, income, price of related goods, expectation, etc. change.

What is the Advantage of Graphing the Demand Schedule?

We see that in both Table 2.1 and Figure 2.1 contain exactly the same data and reflect the same relationship between price and quantity demanded. However, an added advantage lies with graphing that we can represent clearly a given relationship in which case the law of demand is shown more simply than that of tabular or verbal presentation. A single curve on a graph, if understood, is simpler to state and manipulate than tables and lengthy verbal descriptions. Especially, in economic analysis, graphs are invaluable tools. They permit clear expression and handling of complex relationships.

Change in the Quantity Demanded Vs. Change in Demand

From the above discussion, you have learnt that *quantity demanded* refers to a particular point on a demand curve, whereas *demand* refers to the entire relationship between price and quantity as shown by the whole demand curve. Therefore, if the own price of a commodity changes (i.e., rises/falls), the quantity demanded of that commodity changes along the demand curve; the position of the demand curve does not change. This is called the *movement along the demand curve* (see Figure 2.3). On the other hand, if factors other than price (i.e., tastes, income,

population, expectation, etc.) change, the demand changes, which is reflected by the change in the location of the demand curve, i.e., the demand curve *shifts* (see Figure 2.2 below). Hence, the determinants other than the commodity's own price are called *demand shifters*. The chart below shows the reasons and consequence of the change in the quantity demanded and the change in demand for a commodity:

Chart 2.1: Consequences of the changes in the determinants of quantity demanded

Possible causes		***Consequences***		
		Change in quantity demanded	Change in demand	What happens with the demand curve?
Own price	Rise	Decreases		Downward movement along the demand curve
	fall	increases		Upward movement along the demand curve
Price of substitute	Rise		Increase	Outward shift of the demand curve
	fall		decrease	Inward shift of the demand curve
Price of complement	Rise		Decrease	Inward shift of the demand curve
	fall		Increase	Outward shift of the demand curve
Income	Increase		Increase	Outward shift of the demand curve
	decrease		decrease	Inward shift of the demand curve
Population	Increase		Increase	Outward shift of the demand curve
	decrease		decrease	Inward shift of the demand curve
Expectation about future price	Rise		Decrease	Inward shift of the demand curve
	fall		Increase	Outward shift of the demand curve
Taste	Increase		Increase	Outward shift of the demand curve
	decrease		decrease	Inward shift of the demand curve

Therefore, if the own price of a commodity changes, the quantity demanded changes but demand doesn't change i.e., the demand curves doesn't shift. However, if the factors other than commodity's own price change, the demand does change and the demand curve shifts. Since the demand curve shifts, at any price the quantity demanded will also be different from the previous amount. For example, if the average income of the people increases by 10%, price remaining same, the demand for biscuits will be more than before. Table 2.2 shows the change in demand.

Table 2.2: Changes in Demand (hypothetical data)

Price (Tk. per kg)	Quantity demanded (kg per week) Average household income = Tk. 1,000	Quantity demanded (kg Per week) Average household income = Tk. 1,500
10	100	110
15	80	90
20	60	70
30	40	60
60	20	30

In Column 2 of Table 2.2, the quantities of biscuits demanded at different prices are shown (same as Table 2.1). But in Column 3, the quantity demanded for biscuits is higher than before at each price, though the prices are the same. The reason is the increase of average income level. People are now willing to buy more of the commodity (since biscuit is a normal good; for detail see Lesson 3 of Unit 3) because their purchasing power is now higher than before. Graphically, the change in demand is shown by the outward shift of the demand curve, from DD_1 to DD_2 in

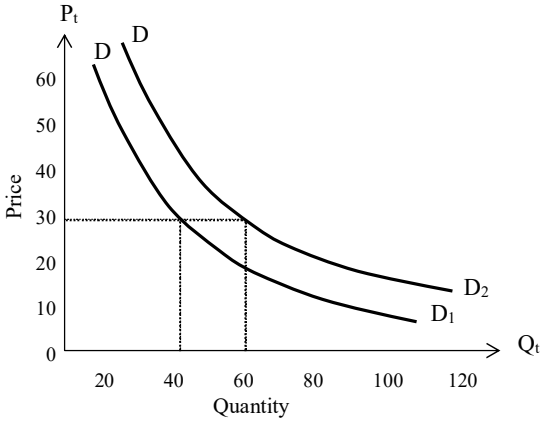


Figure 2.2: Shift of the demand curve

Figure 2.2.

In Figure 2.2, the initial location of the demand curve was DD_1. Due to the increase in income, the demand curve has been shifted to the right, from DD_1 to DD_2. Conversely, due to a decrease in average household income, the demand curve shifts to the left from the initial position. Notice that due to change in income, people now buy more amount of biscuit at the same price. At price of Tk. 30.00, people now buy 60 kg biscuits which is 20 kg higher than the initial purchase (40 kg).

Similarly, if any other determinant (except the commodity's own price) of demand is changed, the demand will be changed causing the demand curve to shift. For detail please see Chart 2.1.

When the own price of the commodity changes, the quantity demanded of the commodity is

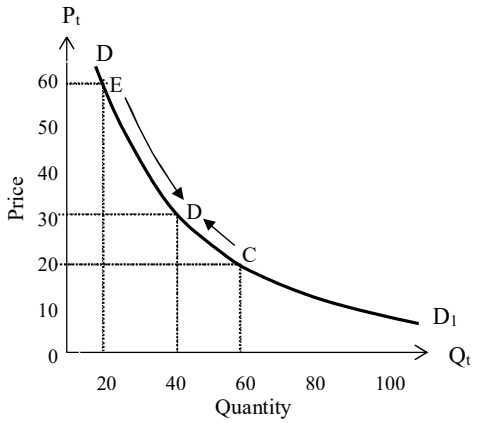


Figure 2.3: Movement along the demand curve

changed and thus a *movement along the demand curve* occurs. For example, along the demand curve DD_1 in Figure 2.3, a rise in the price of biscuit produces a decrease in the quantity demanded of biscuit and fall in the price produces an increase in the quantity demanded of biscuit. The arrows on the demand curve represent the movements along the demand curve. Due to the fall in the price of biscuit from Tk. 60.00 to Tk. 30.00, the quantity demanded has been increased by 20 kg, from 20 kg to 40 kg This situation is shown by the movement from point E to point D along the DD_1 curve. Conversely, in the case of a rise in price, the consumer moves from point C to point D. In this case, point C is assumed to be the initial point.

Therefore, when any determinant of demand other than commodity's own price changes which increases the quantity people plan to buy, then demand curve shifts rightward (from DD_1 to DD_2 in Figure 2.2) and demand increases. Conversely, if any determinant of demand other than its own price changes that reduces the quantity people plan to buy, the demand curve shifts leftward and demand decreases. On the other hand, if the commodity's own price changes, the quantity demanded changes and the consumer moves from one point to another point along the same demand curve.

Exceptions to the Law of Demand

The law of demand does not apply to the following cases:

- **Expectations regarding future prices.** When consumers expect a continuous increase in the price of a durable commodity, they buy more of it despite the increase in its price. They do so with a view to avoiding the pinch of a still higher price in future. Similarly, when consumers anticipate a considerable decrease in the price in future, they postpone their purchases and wait for the price to fall to the expected level rather than buy the commodity when its price initially falls. Such decisions of the consumers are contrary to the law of demand.

- **Prestigious Goods.** The law does not apply to the commodities which serve as a status symbol, enhance social prestige or display wealth and richness, e.g., gold, precious stones, rare paintings and antiques, etc. Rich people buy such goods mainly because their prices are high.
- **Giffen Goods.** An exception to this law is also the classic case of Giffen Goods named after Robert Giffen (1837-1910). A Giffen Good does not mean any specific commodity. It may be any commodity much cheaper than its substitutes, consumed mostly by the poor households claiming a large part of their incomes. If price of such a good increases (price of its substitute remaining constant), its demand increases instead of decreasing. For instance, let us suppose that the monthly minimum consumption of food grains by a poor household includes 20 kg of wheat (an inferior good) at the rate of Tk. 10 per kg and 5 kg of flour (a superior good) at Tk. 20.00 per kg It spends a fixed amount of Tk. 300.00 on these items. Now, if price of wheat increases to Tk 13 per kg, the household will be forced to reduce the consumption of flour by 3 kg and increase that of wheat by the same quantity in order to meet its minimum monthly consumption requirement within Tk. 300.00. Obviously, the household's demand for wheat increases from 20 to 23 kg per month despite increase in its price.

Individual and Market Demand

In the previous sections, we have discussed the things related to the individual demand curve and that time we have assumed just one consumer. Certainly, the choices by individuals are the basis of the theory of demand. But the market demand is of primary interest to managers.

Fortunately, the transition from the individual to the market demand schedule is possible. Market demand curve can easily be derived by summing the quantity demanded by each consumer at various prices. The aggregation process is not more difficult than simple arithmetic. If there are just three consumers in the market, it would be easy to determine the total quantities demanded (or market demand) at each price. This is shown in Table 2.4.

Table 2.4 : Market demand for biscuit, three buyers (hypothetical data)

Price (Tk.. per kg)	Quantity demanded			Total quantity Demanded/ Market demand (kg per week)
	First buyer (kg per week)	Second buyer (kg per week)	Third buyer (kg per week)	
10	30	35	35	110
15	25	25	25	75
20	15	20	20	55
30	10	15	15	40
40	5	10	10	25

If we plot the data of Table 2.4 in graph, we get the market demand curve as a horizontal summation of the individual demand curves. Figure 2.4 shows this.

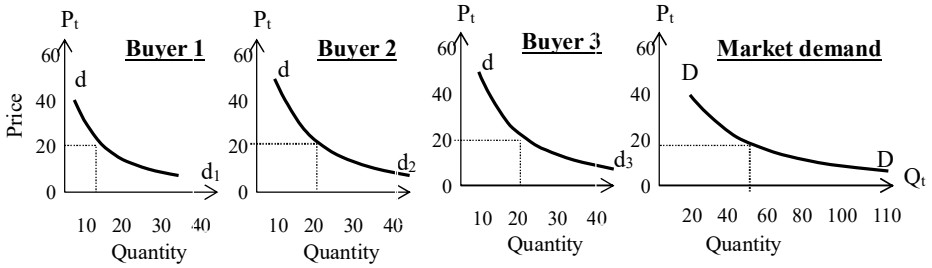


Figure 2.4: Market demand curve derived from the individual demand curves

In Figure 2.4, market demand curve is drawn from the individual demand curves. In the figure, we see that at price Tk. 20.00, the demand for biscuit from buyer 1, buyer 2, and buyer 3 are 15 kg, 20 kg, and 20 kg per week, respectively. The market demand at this price is 55 kg (=15 + 20 + 20). Similarly, we can see that at each price, the market demand for biscuit is the summation of the quantity demanded by individual buyers at that price.

What Does Happen With the Derivation of the Market Demand Curve if More Than Three Buyers are in the Market?

Competition, of course, entails many more than three buyers in the market. So to avoid a lengthy aggregation process, suppose there are 100 buyers of biscuit in the market, each of whom chooses to buy the same amount at each of the various prices as our original consumer does. Thus we can determine total or market demand by multiplying the quantity-demanded data of Table 2.1 by 100, as in Table 2.5. Curve DD_1 in Figure 2.5 indicates this market demand curve for the 100 buyers.

Table 2.5: Market demand for biscuits, 100 buyers (hypothetical data)

Price per kg (Tk.) P_t	Quantity demanded (kg per week) Q_t	No. of buyers in the market	Total quantity demanded/market demand ('000 kg per week)
10	100	× 100	= 10
15	80	× 100	= 8
20	60	× 100	= 6
30	40	× 100	= 4
60	20	× 100	= 2

Points on the DD_1 curve represent the price-quantity data of Table 2.5. In the figure, we see that as the price of biscuit falls the market demand for biscuit increases because, all the individuals are now

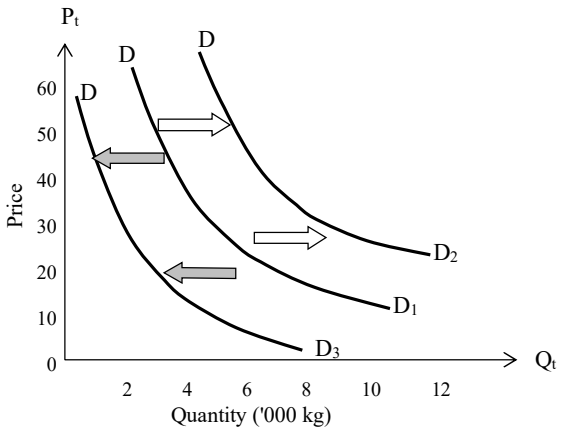


Figure 2.5: Market demand for biscuit, 100 buyers.

buying more biscuits than before. Lower price induced the buyers to buy more.

Let's now know the determinants of market demand.

Determinants of Market Demand

The basic determinants of market demand are as follows:

- The tastes or preferences of consumers;
- The number of consumers in the market;
- The money incomes of the consumers;
- Prices of related goods, and
- Consumer expectations about future prices and incomes.

Changes in Market Demand

If any of the determinants mentioned above is changed, the market demand for biscuit changes. As a result, the market demand curve shifts. For example, if the money income of the consumers increases, the market demand for biscuit increases and thus the market demand curve shifts rightward, from DD_1 to DD_2 in Figure 2.5. In the case of a decrease in consumers' money income, the market demand curve shifts leftward from DD_1 to DD_3 in Figure 2.5.

Review Questions

1. (a) What is demand? How does it differ from need, want and desire?

   (b) Distinguish between demand and quantity demanded.

2. State the law of demand and show it through a demand schedule and a demand curve. what are the exceptions to the law of demand?

3. Explain demand schedule, demand curve and demand function. Derive curve from the demand function Q=50-10 *P*.

4. (a) What is implied by the downward sloping characteristic of a demand curve?

   (b) Is a downward demand curve consistent with the utility-maximizing rule? Explain.

5. (a) Define an increase in demand- A decrease in demand.

   (b) Illustrate each on a diagram.

6. (a) What factors are held constant when drawing a given demand curve?

   (b) What happens when one or more of these factors change?

   (c) How does increase in income, other factors remaining the same, affect the demand for necessities, comforts and luxuries?

7. (a) What is market demand?

   (b) What are the determinants of market demand?

8. State whether the following changes increase or decrease the current demand for new American-made cars, and explain why. Also illustrate each on a diagram.

   (a) An increase in the price of Japanese cars.

   (b) A decrease in money incomes.

   (c) Consumers expect lower U.S car prices in the future.

Lesson 2: Theory of Supply

Lesson Objectives

After studying this lesson, you should be able to:

- define the concept of supply;
- explain the law of supply;
- describe supply schedule;
- draw supply curve from supply schedule;
- describe the relationship between individual and market supply curve;
- tell the determinants of supply; and
- explain the difference between quantity supplied and supply.

What is Supply?

Supply is a schedule which shows the amounts of a product a producer is willing and able to produce and make available for sale at each price in a series of possible prices during a specified period. The amount the firms are willing to sell (desired sales) may not be the same as the amount they succeed in selling. Desired sales many not be equal to the actual sales.

Since desired purchases do not have to equal desired sales, different terms (quantity demanded and quantity supplied) are needed to describe the two separate amounts. But, as the quantity actually purchased must be the same amount as the quantity actually sold, both can be described by a single term *quantity exchanged*.

Determinants of Quantity Supplied

How much of a commodity will firms be willing to produce and offer for sale?
It depends on a number of factors. The main ones are as follows:
The price of the commodity: If the price of the commodity is higher, firms will produce and sell more amount of the commodity and vice versa.

The price of other goods produced: The supply of a commodity is influenced by the prices of the other goods produced. For example, a piece of high land can produce either potato or wheat in the winter season. So, these two commodities are substituted in production. If the price of potato increases, the supply of wheat will be lower. People will use their land more in producing potatoes. Therefore, an increase in the price of the ***substitute in production*** lowers the supply of the commodity. Commodities can also be complements in production. ***Complements in production*** arise when two things are, of necessity, produced together. For example, cattle produce beef and cowhide. An increase in the price of anyone of these byproducts of cattle increases the supply of the other.

Prices of factors of production: The prices of factors of production used to produce a commodity do influence its supply. For example, an increase in the prices of the labor and the capital equipment used to produce audio-cassettes increase the cost of producing audio-cassettes; so the supply of audio-cassettes decrease.

The goals of the firm: Normally, the firm is assumed to have the single goal of profit maximization. Firms might, however, have other goals either in addition to or as substitutes for profit maximization. If the firm worries about risk, it will pursue safer lines of activity even though they promise lower probable profits. If the firm values seize, it may produce and sell more than the profit-maximizing quantities. If it worries about its image in society, it may avoid highly profitable activities (such as the production of opium) when there is major public disapproval. However, as long as the firm prefers more profits to less, it will respond to changes in the possibilities of alternative lines of actions. A change in the emphasis that firms give to other goals will change the willingness to supply the quantity at given price and hence, the level of profitability will be changed.

Expected Future Price: Assume, the price of paddy will rise just after four months. What will happen with the supply of paddy presently? Since paddy can be stored for couple of months and the return from selling paddy will be higher than it is in the present, producers will offer a smaller quantity of paddy for sale now and so the current supply of paddy decreases. Here, producers substitute over time. Similarly, if the price of paddy is expected to fall in the future, the return from selling it at present is high as against what is expected. So, again producers substitute over time. They offer more paddy for sale before its price is expected to fall, so the current supply of paddy increases.

The state of technology: Invention of new technologies that enable the producers to produce their commodity at lower cost (use of less factors of production or cheaper factors of production), which increases their profits at any given price of the commodity, and they increase supply. For example, the invention of transistors and silicon chips has revolutionized production in television, high-fidelity equipment, computers, and guidance-control systems.

Number of suppliers: Other things remaining the same, the larger the number of firms supplying a commodity, the larger is the supply of the commodity.

Taxes and subsidies: Producers treat most taxes as costs. Therefore, an increase in sales or property taxes will increase costs and reduce supply. On the other hand, subsidies are reverse of taxes. If the government subsidizes the production of a good, it in effect lowers cost and increases supply.

Let's now look at the relationship between commodity's own price and the quantity supplied.

The Relationship between Price and Quantity Supplied: Law of Supply

In the previous section, you have learnt the determinants of quantity supplied. If all other factors remain constant, there exists a relationship between commodity's own price and quantity supplied. This relationship is called the *law of supply*.

The law of supply simply states:

Others things remaining the same, the higher the price of a commodity, the higher the quantity supplied and vice versa.

Why does the higher price lead to greater quantity supplied?

It is because of increasing opportunity cost. The opportunity cost of the commodity increases as the quantity produced increases. So, if the price of commodity is high, only then producers are willing to incur the higher opportunity cost and increase production.

Does supply always increase with the rise in price?

NO.

How can the relationship between quantity supplied and price be portrayed?

Two methods are usually used to do that:

First Method: Supply schedule

This is a numerical tabulation showing the quantity that is supplied at selected prices. Table 2.1 is a hypothetical supply schedule of biscuits. It lists the quantity of biscuits that would be supplied at various prices on the assumption that all the factors influencing supply other than price do not change. The table gives the quantities supplied for five selected prices, but actually there is a separate quantity that would be supplied at each possible price.

Table 2.6: Supply schedule of biscuits (hypothetical data)

	Price per kg (Tk.) P_t	Quantity supplied (kg per week) Q_t^S
A	10	20
B	15	40
C	20	60
D	30	80
E	60	100

In Table 2.6, we see that as the price of biscuit increases, the quantity supplied of biscuits increases. That is, there is a positive relationship between the quantity supplied of biscuits and its own price.

Second method: Supply curve

The relationship between quantity supplied and price can be shown by drawing a graph. If we plot the information given in Table 2.6 in a graph, we get the supply curve. Figure 2.6 shows a supply curve which represents the points corresponding to price-quantity pairs of Table 2.6.

In Figure 2.6, SS is the supply curve of biscuit. Each point on the SS curve refers to the quantity supplied of biscuit at a particular price. We see that as price of biscuit rises, the quantity supplied of biscuit increases along the SS curve.

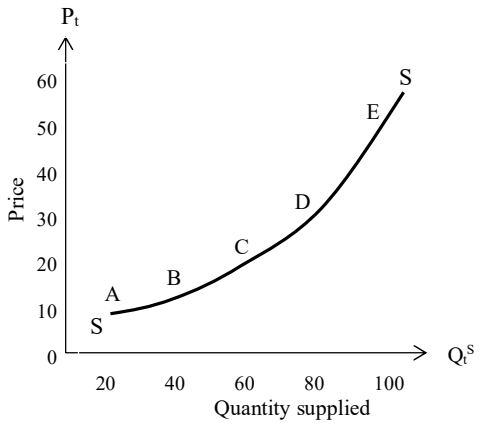


Figure 2.6: Supply curve of biscuit

Properties of a Supply Curve

- Supply curve shows the relationship between quantity supplied of a good and its own price assuming that other things remain the same.
- Normally, supply curves are upward sloping i.e., the relationship between quantity supplied and price is direct. The law of supply shows producers' supply more at a high price than at a low price as is reflected in the upward slope of the supply curve.
- The term *supply* refers to the entire relationship between price and quantity. However, a single point on a supply curve refers to the quantity supplied at a particular price. For example, at point C in Figure 2.6, we see that 60 kg of biscuits are supplied at a price of Tk. 20.00 per kg
- The *slope* of the supply curve changes if the pattern of the relationship between price and quantity supplied changes.
- The *position* of a supply curve changes if the ceteris paribus assumption is violated, i.e., if *other things,* such as price of other goods produced, prices of factors of production, the goals of the firm, expected future price, the state of technology, number of suppliers, taxes and subsidies, etc. change.

Distinguish between Supply and Quantity Supplied

We have seen in the previous lesson that there is a difference between the concepts *demand* and *quantity demanded*. Similarly, to avoid confusion, we should know the difference between *supply* and *quantity supplied*.

Supply refers to the entire relationship between quantity supplied and price while a single point on the supply curve refers to the quantity supplied at that price.

Distinction between Change in the Quantity Supplied and Change in Supply

From the above discussion, you have learnt that *quantity supplied* refers to a particular point on a supply curve, whereas *supply* refers to the entire relationship between price and quantity as

shown by the whole supply curve. Therefore, if the own price of a commodity changes (i.e., rises/falls), the quantity supplied of that commodity changes along the supply curve; the position of the supply curve does not change. This is called the *movement along the supply curve* (see Figure 2.8). On the other hand, if factors other than price (i.e., price of other goods produced, prices of factors of production, the goals of the firm, expected future price, the state of technology, number of suppliers, taxes and subsidies, etc.) change, supply changes, which is reflected by the change in the location of the supply curve, i.e., the supply curve *shifts* (see Figure 2.7 below). Hence, the determinants other than the commodity's own price are called *supply shifters*. The chart below shows the reasons and consequence of the change in the quantity supplied and the change in supply of a commodity:

Chart 2.2: Consequences of the changes in the determinants of quantity supplied

Possible causes		**Consequences**		
		Change in quantity supplied	**Change in supply**	**What happens with the supply curve?**
Own price	Rise	Increases		Upward movement along the supply curve
	Fall	Decreases		Downward movement along the supply curve
Price of substitute in production	Rise		Decrease	Leftward shift of the supply curve
	Fall		Increase	Rightward shift of the supply curve
Price of complement in production	Rise		Increase	Rightward shift of the supply curve
	Fall		Decrease	Leftward shift of the supply curve
Price of factors of production	Rise		Decrease	Leftward shift of the supply curve
	Fall		Increase	Rightward shift of the supply curve
Expected future price	Increase		Decrease	Leftward shift of the supply curve
	Decrease		Increase	Rightward shift of the supply curve
State of technology	New invention		Increase	Rightward shift of the demand curve
	Backward trend		Decrease	Leftward shift of the demand curve
Taxes	Rise		Decrease	Leftward shift of the supply curve
	Fall		Increase	Rightward shift of the supply curve
Subsidies	Increase		Increase	Rightward shift of the supply curve
	Decrease		Decrease	Leftward shift of the supply curve
Number of suppliers	Increase		Increase	Rightward shift of the demand curve
	Decrease		decrease	Leftward shift of the demand curve

Therefore, if the own price of a commodity changes, the quantity supplied changes but supply doesn't changes, i.e., the supply curve doesn't shift. However, if the factors other than the commodity's own price changes, then supply does change and the supply curve shifts. Since the supply curve shifts, at any price, the quantity supplied will also be different from the previous amount. For example, if the government initiates subsidy to biscuit production, price remaining the same, the quantity supplied will be more than before. Table 2.7 shows the change in supply.

Table 2.7: Changes in supply (hypothetical data)

Price (Tk. per kg)	Quantity supplied (kg per week) Without subsidy	Quantity supplied (kg per week) With subsidy of Tk.2 per kg
10	20	40
15	40	50
20	60	70
30	80	90
60	100	110

In Column 2 of Table 2.7, the quantity of biscuits supplied at different prices is shown (same as Table 2.6). But in Column 3, the quantity supplied of biscuits is higher than before at each price, through the prices are the same. What's the reason? As subsidy is provided with biscuit production, it lowers the cost of producing biscuit. As a result, bakers are now willing to produce more biscuits because, producing biscuit is now more profitable than before. Graphically, the change in supply is shown by the rightward shift of the supply curve, from SS_1 to SS_2 in Figure

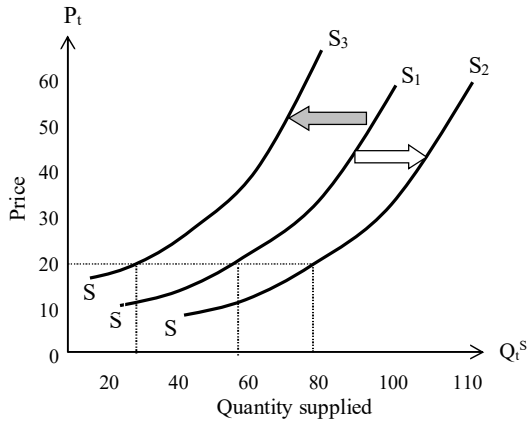


Figure 2.7: Shift of the supply curve

2.7. ??

In Figure 2.7, the initial location of the supply curve was SS_1. Due to the initiation of subsidy to biscuit production, the supply curve has been shifted to the right, from SS_1 to SS_2. Conversely, due to the imposition of taxes, the supply curve shifts to the left from the initial position, from SS_1 to SS_3. Notice that due to the initiation of subsidy, more biscuits come out in the market at the same price. At price of Tk. 20.00, bakers now supply 70 kg biscuit which is 10 kg higher than the initial supply (60 kg).

Similarly, if any other determinant (except the commodity's own price) of supply is changed, then supply will be changed causing the supply curve to shift. For detail please see Chart 2.2.

When the own price of the commodity changes, the quantity supplied of the commodity is changed and thus a *movement along the supply curve* occurs. For example, along the supply curve SS in Figure 2.8, a rise in the price of biscuit produces an increase in the quantity supplied of biscuit and fall in the price produces a decrease in the quantity supplied of biscuit. The arrows

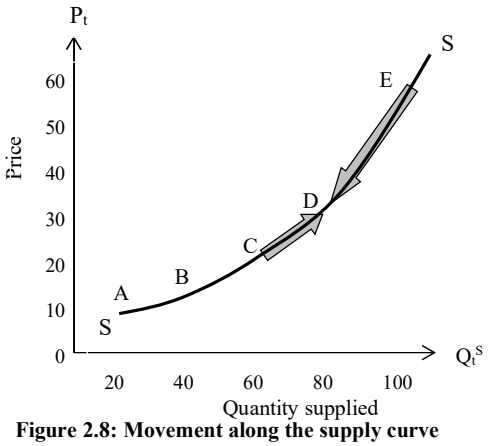


Figure 2.8: Movement along the supply curve

on the supply curve represent the movements along the supply curve. Due to the fall in the price of biscuit from Tk. 60.00 to Tk. 30.00, the quantity supplied has been decreased by 20 kg, from 100 kg to 80 kg This has been shown by the movement from Point E to Point D along the SS curve. Conversely, in the case of rise in price, the producer moves from Point C to Point D. In this case, Point C is assumed to be the initial point. Therefore, when any determinant of supply other than commodity's own price changes which increases the quantity supplied, then supply curve shifts rightward (from SS_1 to SS_2 in Figure 2.7) and supply increases. Conversely, if any determinant of supply other than its own price changes that reduces the quantity people plan to buy, the supply curve shifts leftward and supply decreases. On the other hand, if the commodity's own price changes, the quantity supplied changes and the consumer moves from one point to another point along the same supply curve.

Market Supply

By adding up the quantity each supplier is willing and able to offer at every price, we can get the market supply. In brief, the market supply is just the summary of the supply intention of all producers. Assume that there are 100 sellers in the market having the same supply schedules. So, the market supply schedule can be found as in Table 2.8.

Table 2.8: Market supply of biscuit, 100 sellers (hypothetical data)

Price per kg (Tk.) P_t	Quantity supplied (kg per week) Q_t^S	Number of sellers In the market	Total quantity supplied/market supply ('000 kg per week)
10	20	× 100	= 2
15	40	× 100	= 4
20	60	× 100	= 6
30	80	× 100	= 8
60	100	× 100	= 10

In Figure 2.9, SS_1 is the market supply of biscuit. As the price of biscuit increases, the supply of biscuit

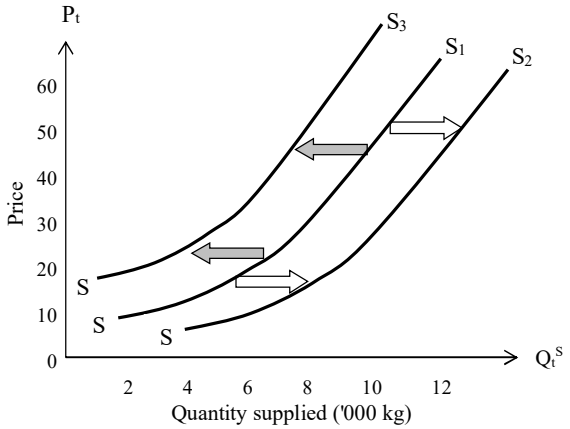


Figure 2.9: Market supply of biscuit, 100 sellers.

in the market increases because all the bakers are now producing more biscuits than before. Lower price induces the buyers to buy more.

Let's now know the determinants of market supply.

Determinants of Market Supply

The basic determinants of market supply are as:

- Price of other goods produced;
- Prices of factors of production;
- The goals of the firm;
- Expected future price;
- The state of technology;
- Number of suppliers;
- Taxes and subsidies, etc.

Changes in Market Supply

If any of the determinants mentioned above is changed, the market supply of biscuit changes. As a result, the market supply curve shifts. For example, if the subsidy to biscuit production is initiated, the market supply of biscuit increases and thus the market supply curve shifts rightward, from SS_1 to SS_2 in Figure 2.9. In the case of an imposition of tax on biscuit production, the market supply curve shifts leftward, from SS_1 to SS_3 in Figure 2.9.

Review Questions

1. (a) What is supply?
   (b) Distinguish between supply and quantity supplied.
   (c) What are the determinants of supply?

2. (a) What is the law of supply?
   (b) Explain the law of supply through a supply schedule and a supply curve.
   (c) Why does a supply curve slope upward to the right?
   (d) What factors cause a rightward shift of the supply curve?

3. Explain supply schedule, supply curve and supply function. Derive the supply curve from the supply function $Q=30 + 5P$.

4. (a) What factors are held constant when drawing a given supply curve?
   (b) What happens when one or more of these factors change?

5. (a) What is market supply?
   (b) What are the determinants of market supply?

Lesson 3: Price Determination: Equilibrium of Demand and Supply

Lesson Objectives

After studying this lesson, you should be able to:

- explain the process of price determination in a market;
- explain the concepts of equilibrium and disequilibrium in market; and
- describe the difference among equilibrium price, demand price and supply price.

Introduction

In last two lessons, demand and supply have been considered separately. You learnt from the previous lessons how demand and supply respond to the change in price and other determinants.

Moreover, you learnt that demand schedule/curve shows the quantities people desire and are able to buy at different prices. But one question was not solved. Can the consumers always buy the quantity exactly they desire at any price? The answer is 'No'. Then why do they fail to meet their desire, i.e., what makes the difference between desired and actual purchase?

Similarly, the supply schedule/curve shows the quantity of goods producers desire and able to supply at different prices. But the question arises: can the producers always sell the amount exactly they desire to sell? The answer is again 'No'. So, why do they fail to meet their desire, e.g., what makes the difference between desired and actual sale?

So, in the case of demand as well as supply, the desired quantity is not always identical to the actual quantity. The reason is: the amount of goods people want to buy at a given price, the suppliers do not want to supply exactly that amount at the same price; in other words, the amount of goods the suppliers desire to supply at a given price is not the same as the amount the consumers are interested to buy at that price.

But what is the price at which the desired and actual quantities become identical, i.e., at what price the suppliers will supply exactly the same amount of goods that the consumers desire to buy - no goods will remain unsold? There will be no excess demand or excess supply in the market. In this lesson, we will discuss how and when this golden situation comes.

Price Determination

In a free market, where no outside forces other than commodity's own price are considered to influence supply decisions and buying decisions, adjustments in price coordinate the devices of buyers and sellers. Here price is treated as a regulator. The price of a good regulates the quantities demanded and supplied. If the price is too high, the quantity supplied exceeds the quantity demanded. If the price is too low, the quantity demanded exceeds the quantity supplied. There is one price, and only one price, at which the quantity demanded equals the quantity supplied - that price is called equilibrium price (or market price).

What is "Equilibrium"?

Equilibrium is a situation in which the opposing forces are in balance. So, equilibrium in market occurs when the price is such that the opposing forces of the plans of buyers and sellers balance each other, e.g., in equilibrium situation, the price is such that the quantity demanded equals quantity supplied where there is no surplus or shortage. So, the equilibrium price is called the *market-clearing price*.

Now, let's see graphically, how the market-clearing price or equilibrium price is established. Figure 2.10 shows the equilibrium that occurs at the intersection of market demand and market supply curves. In the figure, Point E is the equilibrium point. The equilibrium price is Tk. 20.00 and the equilibrium quantity is 6,000 kg of biscuits.

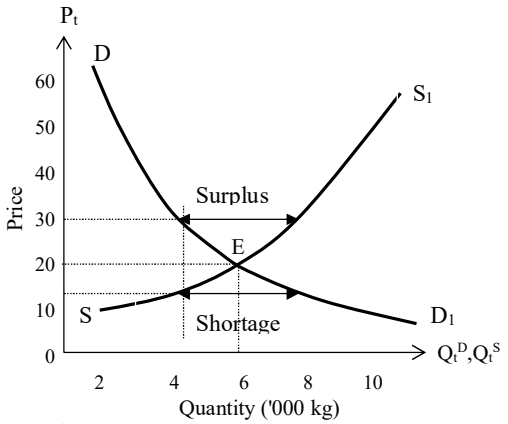


Figure 2.10: Equilibrium in market

At point E, the market demand curve intersects market supply curve. Hence, there is no surplus or shortage at this point. At any price level other than Tk. 20.00, the market is in disequilibrium. We see that at the price of Tk. 30.00, market supply of biscuit exceeds market demand by 4,000 kg - there is an excess supply or surplus in the market. Similarly, at price of Tk. 10.00, market demand for biscuit exceeds market supply by 4,000 kg- there is an excess demand or shortage in the market. But the disequilibrium situations are not long-lived. They disappear through market mechanism. In the case of excess demand, the producers want to supply less than the buyers' desire. The tendency for buyers to offer, and sellers to ask for, higher prices crates upward pressure on price. Price rises till the equilibrium occurs again.

Similarly, in the case of excess supply in market, e.g., the producers wants to supply more than the consumers' or buyers' desire, the tendency for buyers to offer, and sellers to ask for, lower prices creates a downward pressure on price. Price falls till the equilibrium occurs again. Table 2.9 below summarizes these events:

Table 2.9: Equilibrium in the market

Price (Tk. per kg)	Quantity supplied ('000 kg Per week) Q_t^S		Quantity demanded ('000 kg Per week) Q_t^D
10	2	Excess demand/market shortage ($Q_t^S < Q_t^D$)	10
15	4		8
20	**6**	**Equilibrium**($Q_t^S = Q_t^D$)	**6**
30	8	Excess supply/market surplus ($Q_t^S > Q_t^D$)	4
60	10		2

Market Price, Demand Price and Supply Price

The price at which demand equals supply is called *market price*. On the other hand, the price consumers are willing to pay for a specific amount of commodity is called *demand price*. Similarly, the price suppliers are willing to charge for supplying a specific amount of commodity is called *supply price*. In Figure 2.10, at the 4000th kg of the commodity, the demand price is Tk. 30 per kg and the supply price is Tk. 15 per kg Only at the equilibrium point, demand price equals supply price (Tk. 20 per kg).

What Happens With the Equilibrium Situation When Supply or Demand Changes?

We learnt from the previous lessons that when the determinants of quantity supplied other than commodity's own price change, then supply curve shifts, and when the determinants of quantity demanded other than commodity's own price change, the demand curve shifts. Let's first consider the effect of a change in demand on the equilibrium position. Figure 2.11 shows the effects of a

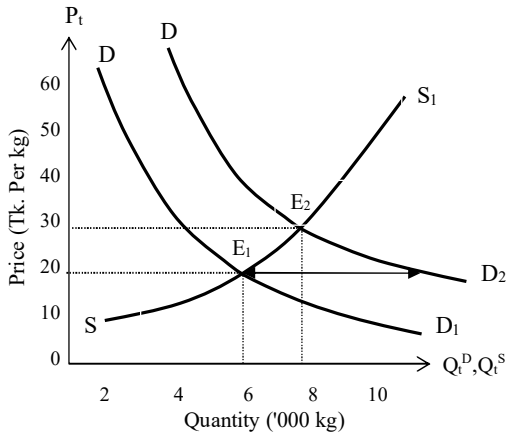


Figure 2.11: The effects of a change in Demand

change in demand on the equilibrium price and quantity. The figure shows that the original equilibrium price is Tk. 20.00 per kg of biscuit, and the quantity is 6,000 kg biscuit a week. When demand increases, the demand curve shifts rightwards, from DD_1 to DD_2 in Figure 2.11. The equilibrium price rises to Tk.30.00 a kg of biscuit and the equilibrium quantity increases to 8,000 kg of biscuit, which corresponds to the new equilibrium Point E_2. The effects will be reverse if demand decreases, i.e., the demand curve shifts leftward.

On the other hand, if the supply curve shifts rightward, then equilibrium price of the commodity decreases and the equilibrium quantity increases as in Figure 2.12. The effect will be reverse if the supply curve shifts leftward.

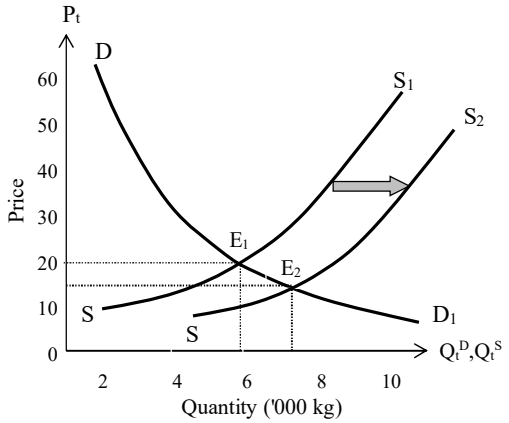


Figure 2.12: Effect of a change in supply on equilibrium position

In Figure 2.12, we see that due to the rightward shift of the supply curve, new equilibrium position has been established at Point E_2. At E_2, the price of the commodity is lower and the quantity exchanged is higher than those at the initial equilibrium point E_1.

In the cases described by Figure 2.11 and Figure 2.12, only demand curve or supply curve was assumed to be shifted. There we haven't explained the case where both supply and demand curves shift simultaneously.

What Will Happen If Both Demand Curve and Supply Curve Shift?

If they shift in the same direction and same extent, the equilibrium price will not be changed, but the equilibrium quantity will be changed as in Panel A of Figure 2.13.

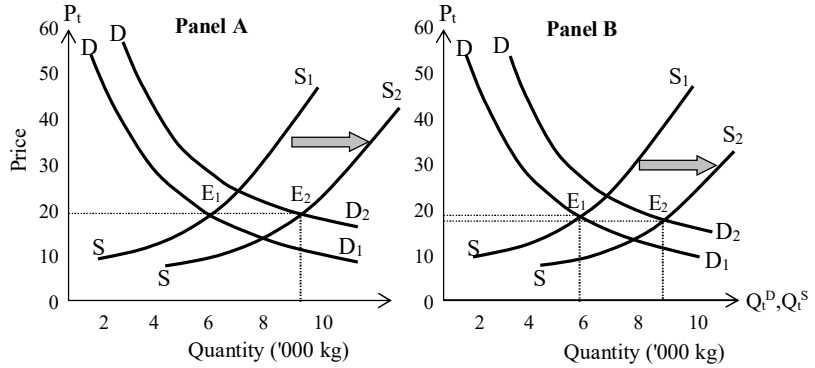


Figure 2.13: Effect of a change in both supply and demand

In Figure 2.13, we see that the supply curve has been shifted rightward from SS_1 to SS_2 and at the same time, the demand curve has been shifted outward from DD_1 to DD_2. The extent of change in both demand and supply is the same. We see that at the new equilibrium point E_2, the equilibrium price is the same as that at the initial equilibrium Point E_1, but the quantity exchanged has been increased. If the extent of change in both demand and supply is not the same, both equilibrium price and quantity exchanged are changed. Panel B of Figure 2.13 shows that.

Similarly, we can see what happens to the equilibrium price and quantity when supply and demand change in opposite directions.

Review Questions

1. (a) Define equilibrium price.
   (b) If actual price is above the equilibrium, what will force it down?
   (c) If actual price is below the equilibrium, what will force it up?

2. (a) Plot the corresponding demand and supply curves from the figures below, showing equilibrium price and quantity.

Price	Quantity Demanded	Quantity Supplied
$100	10	50
80	20	40
60	30	30
40	40	20
20	50	10

   (b) If price was $100, would there be a surplus or a shortage? How much?
   (c) If price was $20, would there be a surplus or a shortage? How much?

3. State how the stipulated changes in each of the following demand shifters would change the equilibrium price and quantity of new US cars? Assume all other shifters remain constant except the one under consideration:
   (a) An increase in money income of the car-buying public. Assume new cars are a superior good.
   (b) A decrease in the price of foreign cars, a substitute for US cars.
   (c) Consumers expect less unemployment in the near future.
   (d) Consumers tastes shift in the direction of European styling.
   (e) Population increases.

4. State how the stipulated changes in the following supply shifters change the equilibrium price and quantities of personal computers. Assume all other shifters remain constant except the one under consideration:
   (a) A decrease in the price of typewriters - an alternative product that can be produced.
   (b) A decrease in the price of silicon chips.
   (c) Producers expect prices to be lower next year.
   (d) Advances are made in electronics technology.
   (e) There is a decrease in the number of manufacturers of this product.

5. (a) Is it possible for the equilibrium price of a good or service to change Without a change in the equilibrium quantity exchanged in the market? Explain.
   (b) Is it possible for the equilibrium quantity of a good or service to changes without a change in the equilibrium market price? Explain.

Unit 3: ELASTICITIES OF DEMAND

Highlights

- Price Elasticity of Demand;
- Point and Arc Elasticity;
- Determinants of Price Elasticity of Demand;
- Income Elasticity of Demand;
- Determinants of Income Elasticity of Demand;
- Cross Elasticity of Demand and Its Determinants;

Technologies Used for Content Delivery

- BOUTUBE
- BOULMS
- WebTV
- Web Radio
- Mobile Technology with Micro SD Card
- LP+Office365
- BTV Program
- Bangladesh Betar Program

Lesson -1: Elasticity of Demand

Lesson Objectives

After studying this lesson, you should be able to:

- define the concept of elasticity;
- describe the techniques of measuring elasticity; and
- explain the elasticity of demand.

What Is Elasticity?

Elasticity is the ratio which measures the responsiveness or sensitiveness of a dependent variable to the changes in any of the independent variables. Specifically, the term *elasticity* refers to the percentage change in dependent variable divided by the percentage change in independent variable. That is,

$$\text{Elasticity} = \frac{\text{Percentage change in dependent variable}}{\text{Percentage change in the independent variable}}$$

If Y = f (X), i.e., Y depends on X, then the elasticity of Y with respect to X is as follows:

$$\text{Elasticity of Y} = \frac{\text{Percentage change in Y}}{\text{Percentage change in X}} = \frac{\%\Delta Y}{\%\Delta X}$$

Percentage change in X $\%\Delta X$

If $Y = f(X_1, X_2, ..., X_n)$, then we can calculate elasticity of Y with respect all X's, which is called *total elasticity*, as follows:

$$\text{Elasticity of Y} = \frac{\text{Percentage change in Y}}{\text{Percentage change in X}} = \frac{\%\Delta Y}{\%\Delta X_1} + \frac{\%\Delta Y}{\%\Delta X_2} + ... + \frac{\%\Delta Y}{\%\Delta X_n}$$

or we can calculate the elasticity of Y with respect to each of the X's, which is called *partial*

$$\text{Elasticity of Y with respect to } X_1 = \frac{\text{Percentage change in Y}}{\text{Percentage change in } X_1} = \frac{\%\Delta Y}{\%\Delta X_1}$$

elasticity, as follows:

Now let's think about the elasticity of demand.

Elasticity of Demand

$$\text{Elasticity of Y with respect to } X_2 = \frac{\text{Percentage change in Y}}{\text{Percentage change in } X_2} = \frac{\%\Delta Y}{\%\Delta X_2}$$

$$\text{Elasticity of Y with respect to } X_n = \frac{\text{Percentage change in Y}}{\text{Percentage change in } X_n} = \frac{\%\Delta Y}{\%\Delta X_n}$$

The elasticity of demand is the measure of responsiveness of demand for a commodity to the changes in any of its determinants. We studied in the previous lessons that the determinants of

$$Q_X^D = f(P_X, M, P_y, P_z, etc.)$$

demand are the commodity's own price, income, price of related goods (substitutes and complements), and consumers expectations regarding future price, i.e.,

Here, Q_X^D = Quantity demanded of commodity X

P_X = Price of commodity X

M = Money income of the consumer

P_Y = Price of the substitute, X and Y are substitutes to each other

P_Z = Price of the complement, X and Z are complements to each other

Therefore, we can calculate the elasticity of demand with respect to each of the determinants. When we calculate the responsiveness of demand to the change in commodity's own price, then we call it *price elasticity of demand*. If we calculate the elasticity of demand with respect to the change in consumer's money income, we call it *income elasticity of demand*. If we calculate the elasticity of demand with respect to the change in the price of any related goods (substitutes or complements), we call it *cross elasticity of demand*.

Now let's start with *price elasticity of demand*.

Price Elasticity of Demand

If the price of a commodity changes, then do consumers change their attitude in buying that commodity?

The answer may be one of the following three:

- They do not change their attitude;
- They slightly change their attitude;
- They change their attitude drastically.

How much consumers respond to the price changes are measured by price elasticity of demand. In other words, the response of consumers to a change in price is measured by the price elasticity of demand. Specifically, the price elasticity of demand refers to the percentage change in quantity demanded divided by the percentage change in price. That is, the price elasticity of demand,

$$E_P^D = \frac{\text{percentage change in quantity demanded of X}}{\text{percentage change in price of X}} = \frac{\%\Delta Q_X^D}{\%\Delta P_X}$$

Here, Q_X = Quantity demanded for commodity X

P_X = Price of commodity X

$\%\Delta P_X$ denotes percentage change in price which is calculated by dividing the change in price by the original price and $\%\Delta Q_X^D$ denotes percentage change in quantity demanded which is calculated by dividing the change in quantity by the original quantity. That is:

$$\%\,\Delta P_X = \frac{\Delta P_X}{P_X^O} \times 100, \quad \text{where } P_X^O = \text{Original Price}$$

and $\%\,\Delta Q_X^D = \frac{\Delta Q_X}{Q_X^O} \times 100$, where Q_X^O = Original Quantity

Thus, our formula restated :

$$E_P^D = \frac{\Delta Q_X / Q_X^O}{\Delta P_X / P_X^O} = \frac{\Delta Q_X}{\Delta P_X} \cdot \frac{P_X^O}{Q_X^O}$$

As we know from the demand law that one of the changes (ΔQ_X or ΔP_x) in the elasticity formula will be negative. As a result, the sign of the elasticity coefficient will be negative. For convenience, we ignore the sign of the elasticity formula.

At the moment, some questions may arise in your mind:

(a) Why are percentages used rather than absolute amounts in measuring consumer responsiveness?

The answer is two- fold:

- If we use absolute changes, our impression of buyer responsiveness will be arbitrarily affected by the choice of units. For example, the price of product X falls from Tk. 5 to Tk. 3, and consumers increase their purchases from 70 to 100 kg, it appears that consumers are quite sensitive to price changes, and, therefore, that demand is elastic. After all, a price change of 'two' has caused a change in the amount demanded of 'thirty'. But by charging the monetary unit from taka to paisa, we find a price change of 'two hundred' causes a quantity

change of 'forty', giving the impression of inelasticity. Using percentage changes avoids this problem. The given price decline is 33 per cent whether measured in term of taka (Tk. 2 / Tk. 5) or paisa (200 p / 500 p). Therefore, elasticity is a *unit-free* measure.

- The other reason for using percentage is that we can more meaningfully compare consumer responsiveness to changes in the prices of different products. It makes little sense to compare the effects on quantity demanded of a Tk. 1 increase in the price of a Tk. 10,000 washing machine with a Tk. 1 increase in the price of a Tk. 1 shaving blade. Here the price of washing machine is rising by .0001 per cent while the blade price is up by 100 per cent! If the price of both products were increased by 1 percent - Tk. 100 for the washing machine and 1 p for the blade - we would obtain a sensible comparison of consumer sensitivity to the price changes.

(b) Why should we ignore the 'minus sign' in the price elasticity of demand formula?

We know from the downward sloping demand curve that price and quantity demanded are inversely related (demand law). This means that the price elasticity coefficient of demand will always yield a negative number. For example, if price declines, then quantity demanded will increase. This means that the numerator in our formula positive and denominator negative, yielding a negative coefficient. Conversely, for an increase in price, the coefficient will also be negative.

This negative sign is usually ignored and it is simply presented the *absolute value* of the elasticity coefficient to avoid an ambiguity which might otherwise arise. It can be confusing to say that an elasticity coefficient of '- 4' is greater than one of '- 2', this possible confusion is avoided when we say a coefficient of 4 indicates greater elasticity than one of 2. Hence, we ignore the minus sign in the coefficient of price elasticity of demand and merely show the absolute value. However, the noted ambiguity does not arise with supply because price and quantity are positively related.

(b) **Does elasticity coefficient give the same message as the slope of demand curve gives?**

Elasticity coefficient certainly does not give the same message as that of the slope of demand curve. Slope depends on the units in which we measure the price and quantities. This is why, if we want to compare two demand curves, we can't do that simply by their slopes. Also, we often need to compare the demand curves for different goods and services. For example, when deciding by how much to change the tax rates, the government needs to compare the demand for oil and the demand for tobacco. Which is more responsive to price? Which can be taxed at an even higher rate without decreasing the tax revenue? Comparing the slope of the demand curve for oil with the slope of the demand curve for tobacco has no meaning because oil is measured in gallons and tobacco in pounds- completely unrelated units.

In this case, for meaningful comparison, we should have a measure of responsiveness that is independent of the units of measurement of prices and quantities. Elasticity is such a measure.

On the other hand, at every point on a straight line demand curve, the slope is the same. But the elasticity coefficient varies from one point to another point on the straight line demand curve.

(d) **Is elasticity of demand the ratio of percentage changes or proportionate changes?**

Elasticity is the ratio of the percentage change in the quantity demanded to the percentage change in the price. It is also, equivalently, the proportionate change in the quantity demanded by the proportionate change in the price. This can be shown as follows:

Percentage change in quantity demanded = $\%\Delta Q = \frac{\Delta Q}{Q} \times 100$

Percentage change in price = $\%\Delta P = \frac{\Delta P}{P} \times 100$

Proportionate change in quantity demanded = $\frac{\Delta Q}{Q}$

Proportionate change in price = $\frac{\Delta P}{P}$

Now, the formula of elasticity of demand is:

$$E_P^D = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

$$= \frac{\%\Delta Q}{\%\Delta P}$$

$$= \frac{\frac{\Delta Q}{Q} \times 100}{\frac{\Delta P}{P} \times 100}$$

$$= \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\text{Proportionate change in quantity demanded}}{\text{Proportionate change in price}}$$

Therefore, elasticity is the ratio of percentage changes, which ultimately stands as a ratio of proportionate changes after the cancellation of the 100s.

Approaches to Computing Price Elasticity: Point versus Arc Elasticity

There are two approaches to computing price elasticity: *point* and *arc* elasticity. What approach we will choose depends on the available data and the intended use. For analyzing the effect of discrete (i.e., measurable) change in price, arc elasticity is appropriate. For example, a price increase from Tk. 5.00 to Tk. 6.00 could be evaluated by computing the arc elasticity. In practice, most elasticity computations involve the *arc method*.

On the other hand, *point elasticity* can be used to evaluate the effect of infinitesimally small change in price or to compute the price elasticity at a particular price. Point elasticities are important in theoretical Economics.

Now let's know about arc and point elasticity in detail.

Arc Elasticity

The formula used to computing arc elasticity is,

$$E_P = \frac{\Delta Q_X / Q_X^O}{\Delta P_X / P_X^O} = \frac{\Delta Q_X}{\Delta P_X} \cdot \frac{P_X^O}{Q_X^O}$$

Graphically, arc elasticity is the measure of elasticity of demand between two finite points on a demand curve. For example, in Figure 3.1, the measure of elasticity between points A and B is arc elasticity.

Let's assume that the original price and quantity (at Point A) are Tk. 30 and 20 units,

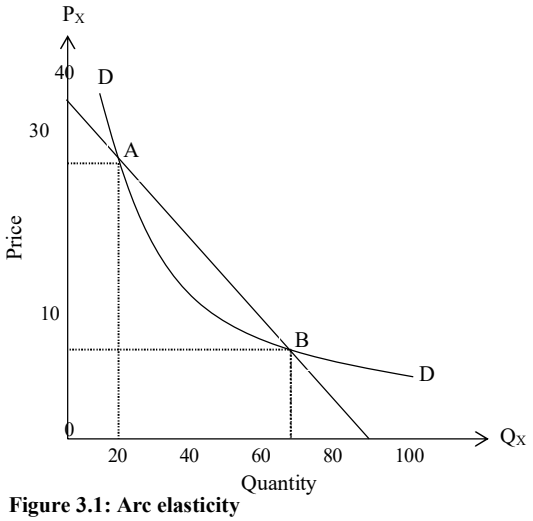


Figure 3.1: Arc elasticity

respectively. If we move from Point A to B along the demand curve DD, price will fall and consequently, the quantity demanded will be increased. That is:

$\Delta P_x = 30 - 10 = 20$

$\Delta Q_x = 20 - 70 = -50$

Therefore, the elasticity between Point A and B (moving from A to B) will be as follows:

$$E_P{}^D = \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{P_x^o}{Q_x^o}$$

$$= \frac{-50}{20} \cdot \frac{30}{20} = 3.75$$

The elastically coefficient 3.75 indicates that as a result of a 1 percent decrease in the price of X the demand for the commodity X is increased by 3.75 per cent.

We have seen that the elasticity coefficient 3.75 indicates the elasticity of the portion of the demand curve between Points A and B. Is this result true for either direction or change in price? That means, will we get the same elasticity coefficient (3.75) if we start from Point B to A on the demand curve? Let's check it.

Original price and quantity at Point B are $P_x^o = 10$ and $Q_x^o = 80$, respectively.

$\Delta P_x = 30 - 10 = 20$, $\Delta Q_x = 20 - 70 = -50$

Now, putting the values into the elasticity formula, we get elasticity between Point B and A as:

$$E_P{}^D = \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{P_x^o}{Q_x^o}$$

$$= \frac{-50}{20} \cdot \frac{10}{70}$$

$$= \frac{5}{-14} = -.35$$

Therefore, the elasticity coefficient computed for the same portion of the demanded curve varies in respect to the direction of the change in price, which indicates a serious problem with computation of the elasticity coefficient using the above formula.

To resolve this problem, economists suggested some modifications in the elasticity formula:

Using lower values of price and quantity demanded: By using lower values of price and quantity demanded instead of their original values (P_x^o, Q_x^o) the problem arising due to the change in the direction of price change may be avoided. The formula will be:

$$E_P^D = \frac{\Delta P_X}{\Delta Q_X} \cdot \frac{P_X^l}{Q_X^l} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where *l* denotes lower value.

From our example, for measuring elasticity between Points A and B in Figure 3.1, we find P_x^l =10 (lower one of the two prices), Q_x^l= 20 (the lower one of the two quantities), $\Delta P_x = 20$, ΔQ_x = 50.

By substituting these values in Equation (1), we get:

$$E_P^D = \frac{-50}{20} \times \frac{10}{20} = -1.25$$

This method, however, violates the rule of computing percentage change, because, the choice of the lower values of P and Q is arbitrary. Thus this method is devoid of any logic.

Using average value of price and quantity: In this method, the average of the upper and lower values of P and Q are used. The formula then stands as:

$$E_P = \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{(P_x^u + P_x^l)/2}{(Q_x^l + Q_x^u)/2}$$

$$= \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{P_x^{ave}}{Q_x^{ave}}$$

$$= \frac{\Delta Q_x}{\Delta P_x} \cdot \frac{P_x^u + P_x^l}{Q_x^l + Q_x^u} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where u, l are upper and lower values, respectively. 2's are cancelled by each other. 'Ave' means 'average'.

Putting the values from our example of Figure 3.1 into Equation 2 we get:

$$E_P^D = \frac{50}{-20} \cdot \frac{30+10}{20+70} = -\frac{50.40}{20.90} = \frac{10}{9} = 1.11$$

This method measures the elasticity at the mid-point of the chord that connects the Points A and B on the demand curve defined by the initial and new price levels (Figure 3.1).

The elasticity coefficient just computed (1.11) is not true for the whole range of price-quantity combinations between Points A and B (see Figure 3.1). It does not resolve the problem that arises due to the change in the direction of the price. It gives only the mean of the elasticities between the two points.

However, this method is widely used, conventionally, to calculate arc elasticity.

It should be clear that this measure of the arc elasticity is an approximation of the true elasticity of the section AB of the demand curve, which is used when we know only the two Points A and B from the demand curve, but not the intermediate ones. Clearly the more convex to the origin the demand curve, the poorer the linear approximation attained by the arc elasticity formula.

Point Elasticity

If the changes in price are infinitesimally small, we use the point elasticity of demand as a measure of the responsiveness of demand. The point elasticity of demand is defined as the percentage change in the quantity demanded resulting from an infinitesimally small change in prices. Symbolically, we may write the formula of point elasticity as follows:

$$E_p = \frac{dQ_x}{Q_x} \Big/ \frac{dP_x}{P_x}$$

$$= \frac{dQ_x}{dP_x} \cdot \frac{P_x}{Q_x} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

In this formula, the first part, $\frac{dQ_x}{dP_x}$ is reciprocal of the slope of the demand curve. So, the slope is the part of the elasticity formula. But it is not the only part : The ratio P_x/Q_x is invalid as well.

Example: Suppose, a linear demand curve is:

$Q_x = b_0 - b_1 P_x$

By differentiating we get,

$\frac{dQ_x}{dP_x} = -b_1$. Substituting this value into the elasticity formula (Equation-3), we obtain:

$$E_p = b_1 . \frac{P_x}{Q_x}$$

This implies that the elasticity changes at the various points of the linear demand curve (why?). In this case, since the changes are very small, the directions of price changes do not affect the elasticity coefficient. If we calculate elasticity considering either direction of price changes, the result will be almost the same.

Graphically, the point elasticity of a linear demand curve is shown by the ratio of the segments of the line to the right and to the left of the particular point. That means:

$$Ep = \frac{\text{Right or lower part of the particular point}}{\text{Left or upper part of the particular point}}$$

For example, in Figure 3.2, the elasticity of the linear demand curve DD' at Point F is the ratio $\frac{FD'}{FD}$

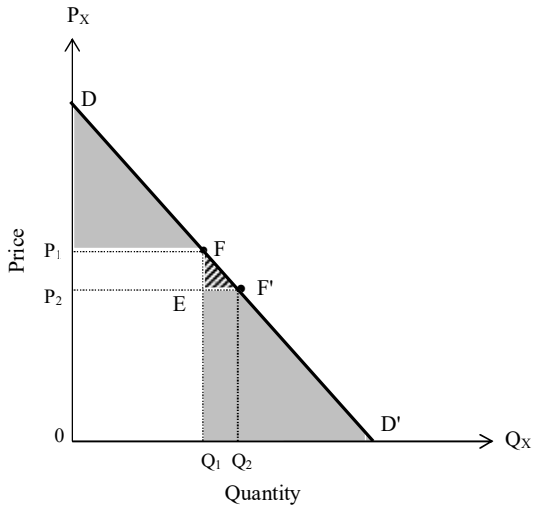


Figure 3.2: Point elasticity

Proof :

From Figure 3.2 we see that

$\Delta P = P_1P_2 = EF$

$\Delta Q = Q_1Q_2 = EF'$

If changes in P and Q are considered as infinitesimally small, then $\Delta P \Rightarrow dP$ and $\Delta Q \Rightarrow dQ$. Thus, substituting in the formula for the point elasticity, we obtain:

$$E_P = \frac{dQ}{dP} \cdot \frac{P}{Q} = \frac{Q_1Q_2}{P_1P_2} \cdot \frac{OP_1}{OQ_1} = \frac{EF'}{EF} \cdot \frac{OP_1}{OQ_1}$$

$$\frac{EF'}{EF} = \frac{Q_1D'}{FQ_1} = \frac{Q_1D'}{OP_1}$$

$$E_P = \frac{Q_1D'}{OP_1} \cdot \frac{OP_1}{OQ_1} = \frac{Q_1D'}{OQ_1}$$

From the figure, we can also see that the triangles FEF' and FQ_1D' are similar (because each corresponding angle is equal). Hence, ??

Thus??

Furthermore, the triangle DP_1F and FQ_1D' are similar, so that

Rearranging we obtain

Thus the price elasticity at Point F is:

$$\frac{Q_1D'}{OP_1} = \frac{P_1F}{FD} = \frac{OQ_1}{FD}$$

$$\frac{Q_1D'}{OQ_1} = \frac{FD'}{FD}$$

$$E_P = \frac{Q_1D'}{OQ_1} = \frac{FD'}{FD}$$

Elasticities at different points on a demand curve

According to the graphical measurement of point elasticity, we can easily identify the elasticity coefficients at different points on a demand curve. Let's first deal with the linear demand curve.

Point elasticities of a linear demand curve: See the Figure 3.3. DD' is a straight-line or linear demand curve.

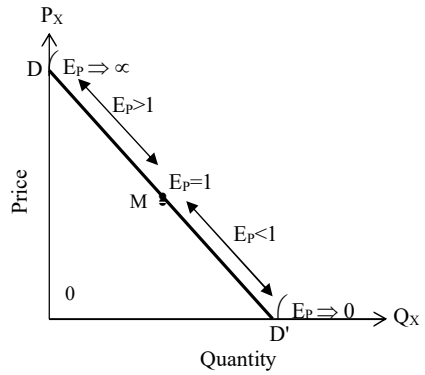


Figure 3.3: Point elasticities at point on a straight line

At mid-point, M, of the demand curve the $E_P = 1$. At any point right of M the $E_P < 1$ and at any point left of M the $E_P > 1$. At Point D the $E_P \Rightarrow \alpha$, while at Point D' the $E_P \Rightarrow 0$. So, the range of values of the elasticity are: $0 \leq E_P \leq \alpha$. Let's now know the explanation of different elasticity coefficients and about the shape of the corresponding demand curves presented as below:

Elasticity coefficients	**Explanation**	**Shape of the demand curve**
$E_P = 0$	Demand is perfectly inelastic	Vertical (Figure 3.4)
$E_P = 1$	Demand is unitary elastic	Rectangular hyperbolic (Figure 3.5)
$E_P \Rightarrow \alpha$	Demand is perfectly elastic	Horizontal (Figure 3.6)
$0 < E_P < 1$	Demand is inelastic	
$1 < E_P < \alpha$	Demand is elastic	

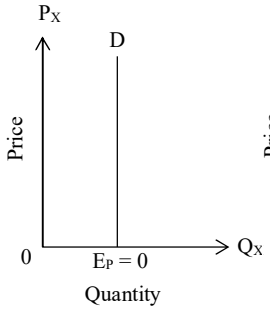


Figure 3.4

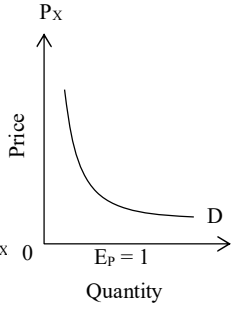


Figure 3.5

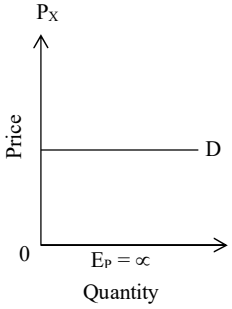


Figure 3.6

Point elasticities of a non-linear demand curve: The elasticity at a point (say A) on a non-linear demand curve can be computed in the following way:

Firstly, draw a tangent to the demand curve at Point A.

Secondly, divide the segment of the tangent to the right of A by the segment to the left of A. Then you will get the elasticity coefficient of the demand curve at Point A.

This is shown in Figure 3.7.

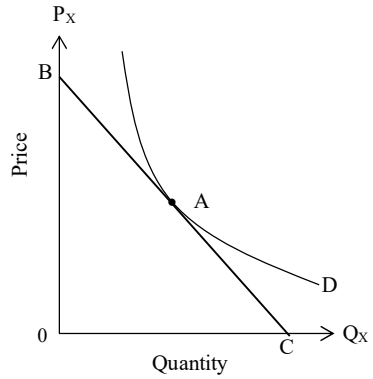


Figure 3.7: Point elasticity of a non-linear demand curve

At Point A the E_P = AC/ AB. Similarly, we can find the elasticity at any other point on the demand curve.

Determinants of Price Elasticity of Demand

What factors make demand for a commodity more elastic or less elastic? Why are people price-sensitive ($e > 1$) with some goods and not ($e < 1$) with others? To find answers to these questions, we have to go back to the demand curve itself. The elasticity of demand is computed between points on a given demand curve. Hence, the price elasticity of demanded is influenced by all the determinants of demand. Anyway, there are no iron-clad generalizations concerning determinants of the elasticity of demand. The following factors, however, are worth noting:

*Nature of the Goods (Luxuries versus Necessities)***:** Necessities, such as food stuffs are price inelastic, meaning they are not very responsive to change in prices. For example, the quantity of rice demanded does not decline much when the price of rice rises. This happens because people do not reduce their consumption of rice even if the price is very high. People cannot live without rice. Therefore, rise in price cannot influence the demand for necessities very much.

In contrast, any luxury goods, such as air conditioner, decoration item, etc. are price elastic, meaning they are very responsive to changes in prices. People can postpone the consumption of luxury goods when their prices rise.

Availability of Close Substitutes: This is a critical determinant of price elasticity of demand. If consumers can easily get a good substitute Y for a product X, they will switch readily to Y if the price of X rises. Thus the closer the substitutes for X that are available, the more elastic its demand will be. For example, the demand for a particular brand of toothpaste is quite elastic; because another brand will work just as well. If the price of Close-Up toothpaste rises, people will switch readily to any other brands such as Pepsodent, Colgate, etc. Here an important thing should be remembered that availability of close substitutes depend on how narrowly or broadly the commodity is defined. If we define a commodity narrowly (such as Close-Up toothpaste), many substitutes are available for that commodity. So, the elasticity of demand for that commodity is high. On the other hand, if the commodity is broadly defined (such as toothpaste), as not many substitutes for that commodity are available and thus the elasticity of the demand for that commodity is low. Similarly, the elasticity of demand for meat in general is low, but the elasticity of demand for beef, lamb, or chicken is high. The elasticity of demand for personal computers is low, but the elasticity of demand for a Compaq, Dell, Intel or IBM is high.

Therefore, the demand for narrowly defined commodity is more elastic than the demand for more broadly defined commodities.

*Fraction of the Income Absorbed***:** Other things remaining the same, the higher the proportion of income spent on a good, the more elastic the demand for it. If only a small fraction of income is spent on a good, then a change in its price has little impact on the consumer's overall budget. In contrast, even a small rise in the price of a good that commands a large part of a consumer's budget induces the consumer to make a radical reappraisal of expenditures.

For example, think about the elasticity of demand for textbooks and chewing gum. If price of textbooks doubles (rises by 100%), there will be a big decrease in the quantity of textbooks bought. Thus, students will share and photocopy the textbook instead of buying new ones. If the price of chewing gum doubles, also a 100% increase, there will be no change in the quantity of gum demanded. Why is the difference? It is because, textbooks take a large portion of the budget while gum takes only a tiny portion.

Evidence (1989) shows that in Tanzania, a poor African nation where average income is 3.3% of that in the United States and where 62% of income is spent on food, the price elasticity of demand for food is 0.77. In contrast, in the United States, where 12 percent of income is spent on food, the elasticity of demand for food is 0.12.

Time: The demand for many products is more elastic in the long-run than in the short-run. When the price of a product rises, it takes time to find and experiment with other products to see if they are acceptable. Consumers may not immediately reduce their purchases very much when the price of chicken rises by 10 percent, but in time they may shift to beef or fish. Therefore, since consumers do not reduce the demand for a commodity (for example, chicken) immediately after the rise in its price, the demand for that commodity is inelastic in the short-run. But if the price of chicken remains high for a long time, then consumers switch to any convenient (or less costly) substitutes for chicken (for example, beef, fish, etc.), which makes the demand for chicken elastic in the long-run.

*Alternative uses of a commodity***:** The more the alternative uses of a commodity the highly elastic is the demand for it. For example, if the price of milk falls, the demand for milk will increase more than the proportionate fall in its price, because milk can be used in different purposes such as in making curds, ghees, butter, sweets, etc. Therefore, the demand for milk is highly elastic.

Price Elasticity and Total Revenue

We have learnt from the previous sections that price elasticity is a measure of the responsiveness of demand or consumer's buying plan to a change in price. But why should one need to know the elasticity of demand? What things depend upon the elasticity of demand? There are a number of purposes in which elasticity is used as a guide. For example, if a firm wants to know the impact of the price of its product on its revenue, then price elasticity of demanded provides a simple guide to the answer.

If demand for the firm's product is elastic, a rise in price will decrease total revenue. If the demand is exactly unit elastic, a rise in price will have total revenue unaffected. If demand is inelastic ($e_p<1$), a rise in price will raise total revenue. The opposite will be true when price falls.

Therefore, only rise or fall in price cannot tell us anything about the change in revenue. This happens, because, total revenue (or expenditure, since the expenditure of the buyers are exactly the same thing as the revenue of the seller) equals price times quantity demanded, $P \times Q$, and a fall in price has two opposing effects on $P \times Q$. **First effect:** Since the price has fallen, people now have to spend less money on each unit of good, which decreases the revenue. **Second effect:** Since price has fallen, people now buy more units of the goods than before, which increases revenue.

The net consequence for total revenue depends on the elasticity. If price goes down by 10% and quantity demanded increases by 10% (a case of unit elasticity), the two effects just cancel out : $P \times Q$ (= total revenue) remains constant. On the other hand, if price goes down 10% and quantity demanded rises 15% (a case of elastic demand), $P \times Q$ increases. Finally, if a 10% price fall leads to a 5% rise in quantity demanded (an inelastic case), $P \times Q$ decreases.

In the previous paragraphs, we have learnt that if the demand is unit elastic, a decrease in price will result in an increase in total revenue. We can say the same thing in a different way. If a

decrease in price results in an increase in total revenue, the demand is elastic- this can be named as ***total revenue test***.

By employing this test, we can most easily infer whether demand is elastic or inelastic. In this test, we have to observe what happens to total revenue, total expenditures from the buyer's view point when the product price changes.

Income Elasticity of Demand

We know from *Lesson 1* of *Unit 2* about the impact of income changes on demand for a good. Now we will know how the demand for a particular good change as income grows? The answer depends on the income elasticity of demand for the good. The income elasticity of demand is a measure of the responsiveness of demand to a change in income, other things remaining the same. It is calculated by using the following formula:

$$\text{Income elasticity of demand} = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

As price elasticity, income elasticity can be expressed in either arc or point terms. ***Arc income elasticity*** is used when relatively long changes in income are considered and is defined as:

$$E_Y = \frac{\Delta Q_X}{\Delta Y} \cdot \frac{Y^{ave}}{Q_X^{ave}}$$

Where $\Delta Y = Y^0 - Y^1$

$\Delta Q_X = Y_X{}^0 - Y_X$

$$E_Y = \frac{\Delta Q_X}{\Delta Y} \cdot \frac{Y' + Y''}{Q_X' + Q_X''}$$

$$Q_X^{ave} = \frac{Q_X' + Q_X''}{2}$$

$$Y^{ave} = \frac{Y' + Y''}{2}$$

Q' = Initial quantity

Q" = Changed quantity

Y' = Initial income

Y" = Changed income

On the other hand, if the change in income is small or if income elasticity at a particular income level is to be determined, a ***point elasticity*** is appropriate.

In this case,

$$Lim_{\Delta Y \to 0} \frac{\Delta Q_X}{\Delta Y} \approx \frac{dQ_X}{dY}$$

So, the income elasticity formula stands as follows:

$$E_Y = \frac{dQ_X}{dY} \cdot \frac{Y}{Q_X}$$

Nature of the Commodity and Income Elasticity

Income elasticity of demand can be positive or negative and falls into the following interesting ranges:

Absolute value of elasticity coefficient	**Terminology**	**Description**	**Nature of the commodity**	**Example**
Greater than 1 ($E_Y>1$)	Elastic demand	Quantity demanded changes by a larger percentage than does income	Normal	International travel, jewelry, works of arts, etc.
Between zero and 1 ($0<E_Y<1$)	Inelastic demand	Quantity demanded changes by a smaller percentage than does income	Normal	Food, clothing, furniture, newspaper, and magazines
Less than 0 ($E_Y<0$)	Inelastic demand	Quantity demanded changes in opposite direction of the income change	Inferior	Potatoes, rice, etc.

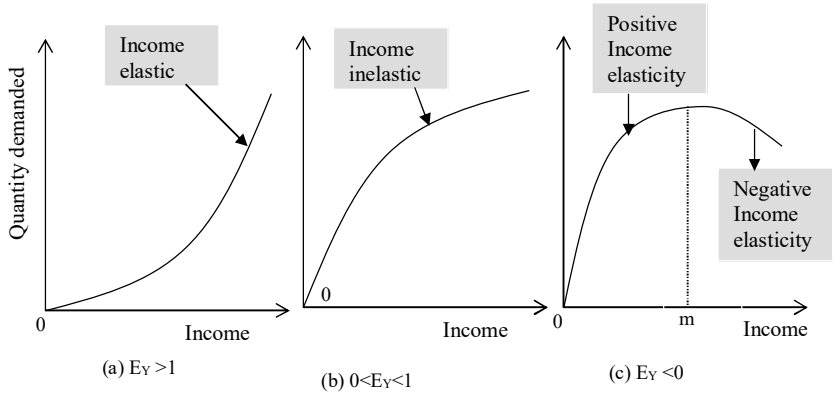


Figure 3.11: Income elasticity of demand

The three cases cited above can be illustrated by diagrams. Figure 3.11 does it.

Part (a) shows an income elasticity that is greater than 1, i.e., as income increases, quantity demanded increases, but the quantity demanded increases faster than income.

Part (b) shows an income elasticity of demand that is between zero and 1. In this case, the quantity demanded increases as income increases, but income increases faster than the quantity demanded.

Part (c) shows an income elasticity of demand that eventually becomes negative. In this case, the quantity demanded increases as income increases until it reaches a maximum at income **m**. After that point, as income continues to increase, the quantity demanded declines. Up to the income **m**, the income elasticity of demand is positive but less than 1. After income **m**, the income elasticity of demand is negative.

The low-income people normally buys bicycles, potatoes, and rice. Up to a level of income, they increase buying of these commodities as income increases. But as income goes above the Point **m**, consumers replace these goods with superior alternatives. For example, a motorcycle replaces bicycle; fruit, vegetables, and meat begin to appear in a diet that was heavy in rice or potato.

Determinants of Income Elasticity

The income elasticity of demand for different categories of goods may, however, vary from household to household and from time to time. The main factors that determine the income elasticity of demand are as below:

The nature of the need that the commodity covers: The percentage of income spent on necessities (for example, food, clothing, etc.) declines as income increase (see Engel's law).

The initial level of income of a country: A TV set is a luxury in an underdeveloped, poor country while it is a necessity in a country with high per capita income.

The time period: Time period is one of the determining factors of elasticity, because, consumption patterns adjust with time-lag to changes in income.

Uses of Income Elasticity

Some important uses of income elasticity of demand are as follows:

Estimating Future demand: If the rate of increase in income and income elasticity of demand the concept of are known, then income elasticity can be used to estimate the future demand.

Defining the nature of goods: The goods income elasticity is positive for all levels of income are termed as *normal goods*. On the other hand, the goods for which income-elasticity is negative, beyond a certain level of income, are termed as *inferior goods*.

Engel's Law

Ernst Engel, a German statistician, proposed this law in the nineteenth century.

Main theme of the Law: The percentage of income spent on food decreases as incomes increases, i.e., the income elasticity of demand for food is less than unity and greater than zero ($0<E_Y<1$).

To conclude this expenditure pattern, Engel studied the consumption patterns of a large number of households. Later, many other researchers have been confirmed his findings repeatedly.

Implication of Engel's Law: During the period of economic prosperity, farmers may not prosper as much as people in other occupations. The reason is that if expenditures on food do not keep pace with increase in gross domestic product, farm incomes may not increase as rapidly as incomes in general. However, this tendency has partially offset by the rapid increase in farm productivity in the recent years.

Cross Elasticity of Demand

We already talked about the response of demand for a commodity to its own price and also to consumer's income. Now, we will discuss the responsiveness of quantity demanded for a commodity to the prices of related commodities (substitutes and complement).

When we measure the responsiveness of demand of a commodity to the price of its substitutes or complements, then we call it *cross elasticity of demand*. Symbolically, we have

$$E_{xy} = \frac{dQ_x}{Q_x} \Big/ \frac{dP_y}{P_y} = \frac{dQ_x}{dP_y} \cdot \frac{P_y}{Q_x}$$

Here X and Y are related goods.

If X and Y are complementary goods, the sign of the cross-elasticity is negative. If X and Y are substitutes, the sign is positive.

The higher the value of the cross-elasticity the stronger will be the degree of substitutability or complimentary nature of X and Y.

Determinants of Cross Elasticity

Nature of the commodities relative to their uses: The main determinant of cross elasticity is the nature of the commodities relative to their uses. If two commodities can satisfy equally well the same need, the cross elasticity is high, and vice versa.

Use of Cross Elasticity

- The cross elasticity is used for the definition of the firms which form an industry.
- It is used in defining whether producers in similar products are in competition with each other. *Econo ball pen* and *Writer ball pen* have a high cross elasticity of demand. The producer of Econo ball pen is thus in competition with the producer of Writer ball pen. If the Econo ball pen company raises its price, it will lose substantial sales to the Writer ball pen producer. Men's shoes and women's shoes have low cross elasticity. Thus a producer of men's shoes is not in close competition with a producer of women's shoes. If the former raises its price, it will not lose many sales to the latter.

Review Questions

1. (a) Explain the following concepts separately
   (i) Price-elasticity of demand
   (ii) Income-elasticity of demand
   (iii) Price-elasticity of supply
   (iv) Cross elasticity of demand
   (b) What are the uses of these concepts of elasticity in the analysis of the market.
2. (a) Explain the concepts of arc and point elasticity of a demand curve for a commodity.
   (b) What is the problem in using the arc elasticity? How can this problem be resolved?
   (c) How is the point elasticity on curvilinear demand curve measured?
3. Explain the concept of price elasticity of demand and the relationship between price elasticity, average revenue and marginal revenue.
4. (i) What are the determinants of price elasticity of demand?
   (ii) Prove that in the case of two straight line demand curves, with the same point of origin on the price axis, at any given point, elasticity is the same in spite of their different slopes.
5. (a) What does price elasticity of demand measure?
   (b) If two straight line demand curves intersect each other, which of them will have higher elasticity of demand at point of intersection?
   (c) Explain cross elasticity of demand and income elasticity of demand.
6. Suppose a demand schedule is given as follows:

Price (Tk.)	**100**	**80**	**60**	**40**	**20**	**0**
Quantity	100	200	300	400	500	600

   (a) Work out the elasticity for the fall in price from Tk. 80 to Tk. 60
   (b) Calcualte the elasticity for the increase in the price from Tk. 60 to Tk. 80.
   (c) Why is the elasticity coefficient in (a) different form that in (b)?

Unit 4: CONSUMER BEHAVIOR

Highlights

- Definition of Utility
- Different Approaches to the Measurement of Utility
- Total and Marginal Utility
- Law of Diminishing Marginal Utility
- Indifference Curves and Budget Line
- Theory of Revealed Preference

Technologies Used for Content Delivery

- BOUTUBE
- BOULMS
- WebTV
- Web Radio
- Mobile Technology with Micro SD Card
- LP+Office365
- BTV Program
- Bangladesh Betar Program

Lesson 1: Introduction

Lesson Objectives

After studying this lesson, you should be able to:

- understand consumer behavior ;
- define the concept of utility; and
- say about the measurability of utility.

Introduction

We discussed the concept of demand and the law of demand in the previous unit. There we saw that demand has an important effect on the price of a good. But we didn't analyze what exactly shapes a person's demand? In this unit, we will examine the household or consumer behavior and its influence on demand. In this regard, we will try to find the answers to the following questions: How does a consumer decide how much of the commodity she/he should buy at a given price? Why she/he buys more of some commodities when their prices fall? Why she/he doesn't change his consumption of some items even if their prices go up? Why the prices of some items are so out of proportion to their total benefits? Lesson 1 of this unit will discuss some important concepts used in the analysis of consumer behavior, Lesson 2, and Lesson 3 will discuss Cardinalist approach and Ordinalist approaches to consumer behavior, respectively. Let's take the lessons sequentially.

The Consumer

Commonly, we think that a *consumer* is one who consumes or uses a commodity. Here, it doesn't matter whether the consumer is a qualified or an unqualified person. However, in Economics, the term *consumer* refers to a person or entity with the following qualifications:

Rational behavior: The consumer is a rational being. She/he tries to spend her/his money income so as to derive the greatest amount of satisfaction, or utility, from it. Consumers want to maximize the total utility.

Clear-cut preferences: The consumer has rather clear-cut preferences for different goods and services that are available in the market. She/he can guess about the utility she/he will get from the consumption of the additional units of various products what might purchase.

Budget constraint: The consumer has limited money income. Because, a consumer supplies limited amounts of human and property resources to businesses, the money income received will be limited.

Perfect competition: Perfect competition exists on the demand and supply side of the market, i.e., the product prices are not affected by the amount of specific goods which the individual consumer buys.

What is Meant by Consumer Behavior?

As a consumer, we have to take several decisions on the goods and services we consume in our daily life. For example, we have to decide: whether we should take tea or coffee in the morning, whether we should carry lunch packet or eat in the office canteen, whether we should buy or rent a house, etc. The way a consumer takes decisions on such problems is called ***consumer's decision-making behavior*** or, in brief, ***consumer behavior***.

Economists constructed a theory of consumer behavior based on the hypothesis that how each consumer spends income between the goods depends on her/his likes or dislikes- her/his preferences. Consumers are willing to pay more for the good that is expected to give them additional satisfaction or pleasure. If the oral sensation of mango juice at the cricket matches really turns you on, you are likely to be willing to pay more prices for it. If you don't have great taste or desire for mango juice, you are not likely to pay more money for it. Consumers always want to allocate their spending among the goods and services in the way that yields the greatest amount of satisfaction, or pleasure. Economists use the term ***utility*** to refer the expected pleasure, or satisfaction, obtained from the goods and services.

Meaning of Utility?

The notion of *utility* was first introduced to social thought by the British philosopher Jeremy Bentham in the 18th century. Later William Stanly Jevons introduced it to Economics in the 19th century.

In its economic meaning, the term *utility* refers to the benefit or satisfaction or pleasure a person gets from the consumption of a commodity or service. In abstract sense, *utility* is the power of a commodity to satisfy human want, i.e., *utility* is want-satisfying power. A commodity is likely to have utility if it can satisfy a want. For example, rice has the power to satisfy hunger; water quenches our thirst; books fulfill our desire for having knowledge, and so on.

Characteristics of Utility

The following characteristics of the concept of utility must be emphasized:

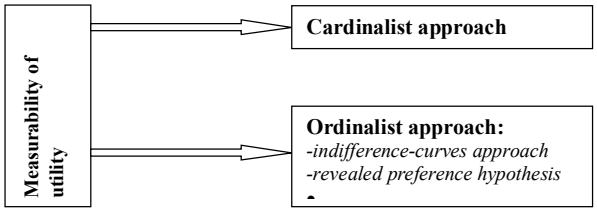
Utility and usefulness are not synonymous: Usefulness is not necessary for a commodity to satisfy one's want. A useless commodity may yield substantial utility. For example, Paintings by Picasso may be useless in a functional sense and yet be of tremendous utility to art connoisseurs.

Utility is a subjective notion: The utility of a specific product varies widely from person to person. All persons need not derive utility from all commodities. For example, non-drinkers do not derive any utility from wine, but alcoholic people derive great utility from wine; non-smokers do not get utility from cigarettes, but smokers derive utility from smoking; strict vegetarians do not derive any utility from beef and chicken, but non-vegetarians get utility from beef and chicken; eyeglasses have no utility to a person having 20-20 vision, but great utility to someone who is extremely far- or near-sighted; and so on.

Utility is ethically neutral: Utility is neutral between good and bad and between useful and harmful. For example, opium is bad and harmful, but it yields utility to the people who take it. Utility is free from moral values. It is not subject to social desirability of consuming a good.

Measurability of Utility

As you have learnt at the beginning of this lesson, the consumer is a rational being. Given her/his income and the market prices of the various commodities, he plans her/his income so as to attain the highest possible satisfaction or utility - this is the *axiom of utility maximization*. In order to



attain this objective the consumer must be able to compare the utility of the various baskets of goods which he/she can buy with her/his income. To compare utilities we need to know whether utility can be measured or not. Economists have different views on this point. There are two basic approaches to the problem: the *Cardinalist approach* and the *Ordinalist approach:*

The Cadinalist School held the views that utility can be measured. But how can it be measured? What units can it be measured in? Various suggestions have been made for the measurement of the utility. Some economists have suggested that utility can be measured in *monetary units* while others suggested the measurement of utility in subjective units, called *utils.*

On the contrary, the Ordinalist School postulated that utility is not measurable, but is an ordinal magnitude. The consumer need not know the units of utility she/he gets from the commodities to make her/his choice. It is sufficient for him if he is able to rank the various baskets of goods according to the satisfaction that each bundle gives him.

In this lesson, we are not going to discuss the approaches to the analysis of consumer behavior, i.e., the Cardinalist approach and the Ordinalist approach, in detail. We will thoroughly examine them in the following lessons.

Review Questions

1. What is meant by the term 'consumer'? Write down the characteristics of a consumer.
2. What is utility? Is it measurable? Describe different approaches to the measurement of utility.

Lesson 2: The Cardinal Utility Approach

Lesson Objectives

After studying this lesson, you should be able to:

- explain how utility is measured cardinally or quantitatively;
- define the concepts of marginal and total utility;
- describe the law of diminishing marginal utility;
- explain the law of equimarginal utility;
- derive the demand curve using the concept of marginal utility; and
- explain the concept of consumer surplus.

Introduction

Classical and neo-classical economists including Gossen (1854) of Germany, William Stanly Jevons (1871) of England, Leon Walras (1874) of France and Karl Menger of Austria held views that utility is quantitatively or cardinally measurable entity. It can be measured like any other entities, such as temperature, height, weight, and length. But what exactly is utility and in what units can we measure it? Starting with the answer to this question, this lesson will discuss the different concepts of utility, such as marginal utility, total utility, and the concept of consumer surplus.

How Can We Measure Utility?

Utility is an abstract concept. It cannot be observed or touched anyway. That's why, the measuring units of this entity are arbitrary. Just like temperature, utility can be measured in arbitrary units. Let's know how temperature is measured, that will help us understand how the measurability of utility in arbitrary units is justifiable:

Temperature is an abstract concept. We cannot observe it - only we can feel it. However, we can observe water turning to steam if it is hot enough or turning to ice if it is cold enough. And we can construct an instrument, called thermometer, that can help us predict when such changes will occur. The scale on the thermometer is what we call temperature. But the units in which we measure temperature are arbitrary. For example, we can accurately predict that when a Celsius thermometer shows a temperature of 0, water will turn to ice. But the units of measurement do not matter because this same event also occurs when a Fahrenheit thermometer shows a temperature of 32^0.

In the above example, we have seen that temperature helps us to make predictions about physical phenomena. In the same way utility helps us make predictions about consumption choices. However, utility theory is not as precise as the theory that helps us to predict when water will turn to ice or steam.

From the above discussion, one thing is now clear to us that utility is measurable, though it is not so precise as other measurements. But it is still unclear how to measure utility, i.e., in what units we can measure the utility we get from the consumption of a commodity?

About a hundred years ago, economists thought utility as an indicator of the pleasure a person gets from the consumption of some set of goods, and they thought that utility could be measured directly in some psychological units called ***utils,*** after somehow reading the consumer's mind. But it was an impossible task to guess the satisfaction one gets from consuming a commodity. Can you say how many utils did you get from the last cricket match you saw at the Bangabandhu National Stadium? Probably your answer is NO, because you have no idea what util is. The same thing would happen to anyone else.

But if you are asked: how many Shingara would you give up to get the ticket to watch that cricket match? Now you can answer this question confidently, for example, five Shingaras. Remember that still you don't know how many utils you got from watching the cricket match. But you do know that your satisfaction from the cricket match is more than the satisfaction from a piece of Shingara. In this case, Shingaras, rather than utils, become the unit of measurement. We can say that the utility you derived from the cricket match is five Singagas. Actually, this indirect way of measuring utility is the basis of the Cardinalist theory of consumer behavior. In the early twentieth century, economists used this indirect way of measuring utility to analyze the consumer behavior.

We can measure utility derived from a commodity (like a ticket for watching cricket match) in terms of any other commodity (such as Shingara, Samucha, money, etc.) we are willing to give up for it. In our discussion, we will use the commodity which is the simplest and commonly used as a medium of exchange- that is, MONEY- to measure utility.

Thus we can define the utility of a commodity to a consumer as the amount of money she/he is willing to give up for it. For example, suppose Modhu decides to buy one Chicken Patty by Tk. 10.00, she will not buy any Chicken Patty if the price is higher than 10.00 taka. Then the utility of one piece of Chicken Patty is Tk. 10.00 - the maximum amount of money she is willing to pay to have it. If she wants to buy five pieces of Chicken Patty and is willing to pay Tk.30.00 at a maximum, then the *total utility* of five pieces of Chicken Patty to her is Tk. 30.00. Here one thing is noticeable that though Modhu is willing to pay Tk. 10.00 for one piece of Chicken Patty, she is willing to spend Tk. 30.00 only - not Tk. 50.00 = 5 @Tk. 10.00 - for five pieces of Chicken Patty. This happens because she is willing to pay less for each additional piece of Chicken Patty, which indicates that she gets lower utility from additional unit. The utility derived from an additional piece of Chicken Patty is called *marginal utility*. Marginal utility and Total utility are two related concepts. Let's now see how these concepts are related.

Total and Marginal Utility

Total utility refers to the amount of satisfaction from consumer's entire consumption of a commodity. In the example cited earlier, the utilities Modhu derives from the 1st, 2nd, 3rd, 4th, and 5th pieces of Chicken Patty are Tk. 10.00, Tk. 9.00, Tk. 7.00, Tk. 4.00 and Tk. 0.00, respectively. Therefore, the total utility derived from five pieces of Chicken Patty is Tk.30.00 = Tk. 10.00 + Tk. 9.00 + Tk. 7.00 + Tk. 4.00 + Tk. 0.00.

On the contrary, marginal utility is the amount of utility a consumer derives from consuming the last, i.e., marginal, unit of a commodity. In other words, marginal utility can be defined as the amount of utility a consumer derives from the consumption of an additional unit of the commodity. Marginal utility can also be defined as the change in the total utility resulting from the change in the consumption- that is,

$$MR = \Delta TU/\Delta C$$

Here, MR = marginal utility, ΔTU = change in total utility and ΔC = change in consumption.
Recall our example of Chicken Patty consumption. Modhu gets the utility of Tk.10.00 from the first piece of Chicken Patty. When she takes the second one, she gets the utility of Tk. 9.00. This additional utility is called marginal utility. When she takes the third one, her marginal utility becomes Tk. 7.00. For the fifth one, she is not willing to pay any money, i.e., the marginal utility is zero.

Table 4.1 helps clarify the distinction between marginal and total utility and shows how the two are related. First two columns show how much total utility Modhu derives from various quantities of Chicken Patty. For example, one Chicken Patty is worth Tk.10.00 to her, two Chicken Patties are worth Tk.19.00, in total, to her and so on.

Table 4.1: Total and Marginal Utility

Quantity of Chicken Patties	Total Utility (TU) (in taka)	Marginal Utility (MU) (in taka)
0	00	
1	10	10 (=10-00)
2	19	09 (=19-10)
3	**26**	07 (=26-19)
4	30	04 (=30-26)
5	30	00 (=30-30)

The marginal utility is the difference between any two successive total utility figures, which is shown in the third column of the Table 4.1. For example, if Modhu already consumed three pieces of Chicken Patty which are worth Tk.26.00 to her, consumption of an extra piece of Chicken Patty makes her total utility Tk.30.00. Thus her marginal utility is the difference between the two, i.e., Tk.4.00 (= Tk. 30.00 - Tk. 26.00). If we plot the data of Table 4.1 into the graph, we get total and marginal utility curves. Figure 4.1 portrayed the total utility and the marginal utility curves in the same plot area.

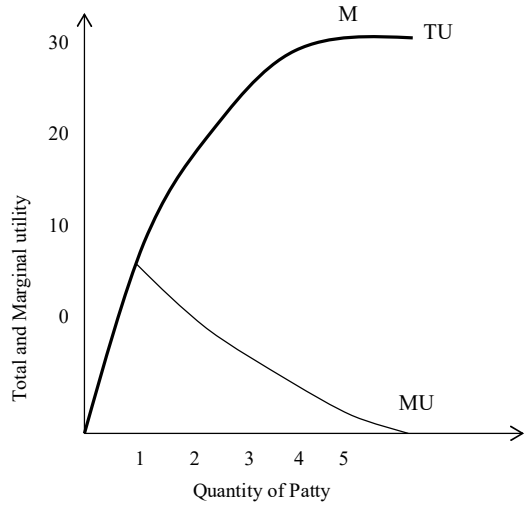


Figure 4.1: Total and marginal utility curves

In Figure 4.1, the TU curve indicates the total utility Modhu derives from Chicken Patties at different consumption levels. We see that the total utility curve is upward up to a level of consumption (Point M), which means that the more patties Modhu consumes, the more total utility she gets up to a certain level of consumption. Notice that the total utility curve is rising but at a diminishing rate (Why?- see the *law of diminishing marginal utility*). We see the MU (Marginal Utility) curve lying just under the TU curve in the same plot area. The downward sloping MU curve tells us that as she incases her consumption, the amount of utility Modhu gets from each extra piece of Patty decreases.

Therefore, if we summarize the message given in Figure 4.1, we get the following characteristics of total and marginal utility, which tells us how total and marginal utility are related:

- Up to a certain level of consumption, total utility increases as the consumption increases.
- Marginal utility is decreasing with the increase in consumption.
- Total utility increases till marginal utility is positive, but at a diminishing rate.
- When marginal utility becomes *zero*, then total utility is the maximum.
- Total utility decreases if marginal utility becomes negative.

- The area under the marginal utility curve indicates the total utility derived from various pieces of Patty.

In the previous discussion, we have learnt that marginal utility diminishes as the consumer increases her consumption of Chicken Patty. This very nature of marginal utility is described by the *law of diminishing marginal utility.* Let's know the law in detail.

The Law of Diminishing Marginal Utility

This law is the main instrument used in the cardinal utility analysis of the consumer behavior. It explains why the demand curve of a specific commodity is downward sloping? It also explains the elasticity of demand for a product. Except these, there are many other applications of this law in our everyday life.

Main theme of the law

The additional units of a specific commodity are worth less and less to a consumer as more of the commodity she/he consumes. In other words, marginal utility of a specific commodity declines as more of it is consumed.

Assumptions

The assumptions upon which this law is based are as follows:

*Given time period***:** Units of the commodity are consumed in a given time period. The time period must be appropriate. If you drink ten cans of cold drinks during the whole day, the idea of diminishing marginal utility will not hold. However, if you are asked to drink all of the cans in two hours of time, then the idea of diminishing marginal utility makes sense.

Continual consumption: The units of the commodity are consumed continually, but the time interval between the consumption of two units of the commodity must be appropriately short.

*Normal behavior of the consumer***:** The mental condition of the consumer remains normal during the period of consumption of the commodity. She/he has a hierarchy of uses to which she/he will put a particular commodity. All of these uses are valuable, but some are more valuable than others.

*Standard units of the commodity***:** The units of the commodity must be standard, i.e., a can of cold drinks, a glass of juice, a cone of ice-cream, a cup of tea, a pair of shoes, etc. If the units are excessively small or large, the law may not hold.

*Consumption of other commodities is given***:** During the consumption of the commodity, the consumption of all other commodities remains constant.

Logic behind the law

Our wants are unlimited. However, the want for a specific commodity is not unlimited - we can meet it. How? Simply think of your personal desire to have a specific commodity. Do you want more and more of a specific commodity? Are you willing to spend the same amount of money for each unit of it? Will you Consume endless quantities of the commodity if you can afford it? The answer to all of the questions is NO, because, the thrill diminishes with the consumption of

each unit of the commodity. Even people who love sea-fish (for example, Rupchanda or pomfret), i.e., get great utility from it, and can afford it, don't eat endless quantities of it, presumably, because, satisfaction from each piece of fish diminishes as the consumption increases. The first piece of fish may bring sensual gratification, but the second or third piece is likely to bring a stomach ache. If we express this change in perceptions in terms of utility, we find that the marginal utility derived from the first piece of Rupchanda (pomfret) fish is higher than the marginal utility derived from the second piece, i.e., the marginal utility from each extra piece of Rupchanda fish diminishes as the consumption of it increases.

The behavior of the sea-fish connoisseurs is not abnormal. Generally speaking, as we consume more and more of a commodity, even the most favorite one, we become bored with it and our satisfaction from additional units of it diminishes. Indeed, this phenomenon of diminishing is so nearly universal that economists have fashioned a law around it which is called the *law of diminishing utility.*

Note that this law does not say that we won't like the third or fourth piece of a commodity; it just says we won't like them as much as the ones we have already consumed.

Numerical and graphical illustration of the law

Recall the hypothetical data in Table 4.1. In the table, we see that as the consumption of Chicken Patty increases, the total utility increases, but at a decreasing rate, which indicates that the additional or marginal utility derived from each extra piece of Chicken Patty diminishes with the increase in consumption. This is shown in the third column of the table.

Graphically, the law of diminishing marginal utility has been illustrated in Figure 4.1. The downward sloping MU curve in the figure indicates that the marginal utility derived from each extra piece of Chicken Patty diminishes as the consumption of it increases.

Exceptions of the law

The law of diminishing marginal utility is plausible for most consumers and for most commodities. However, like most laws, it has some exceptions. There are some commodities particularly significant to some people. The more of those commodities they get, the more they want. For example, the need for second glass of alcohol is higher than the need for the first glass to an alcoholic, the need for additional stamps do not diminish to a stamp collector, the desire to have more rare paintings doesn't diminish to a painting connoisseur, the need for more gold doesn't dwindle to women, and the want for money doesn't diminish to anybody. In these cases, the marginal utility increases rather than decreases. Economists, however, generally treat such cases of *increasing marginal utility* as anomalies. For most goods and most people, marginal utility probably diminishes as consumption increases.

Review Questions

1. (a) What is marginal utility?

   (b) What is the law of diminishing marginal utility?

   (c) What evidence is there to suggest that diminishing marginal utility exists?

   (d) Calculate the marginal utilities of additional glasses of orange juice from the following figures:

Number of Glasses	Total Utility
0	0
1	100
2	190
3	200
4	150

2. Suppose you are in the market for a new bicycle. A salesperson shows you a new 10-speed model for $249. You say the bicycle is nice but you cannot afford such an expensive model. What do you really mean when you say you cannot afford this item? Surely you could fine $249 in either your savings or a small loan?

3. "The more the marrier" contradicts the law of diminishing marginal utility. True or false? Explain.

4. The marginal utiltity of a steak and a fish dinner for an individual is given below. Under the following prices, is the individual maximizing utility for a given expenditure? Why or why not?

	MU	Price
Steak dinner	100	$10
Fish dinner	75	5

5. Let's say that the combination of food that maximizes your satisfaction for lunch consists of one cheeseburger, one slice of apple pie, and one cup of coffee. According to the marginal-utility-over-price approach to making consumer decisions, you should continue to consume this mix of foods for lunch the rest of your life. True or false? Explain.

6. It is a common practice in restaurants for customers to be given as much coffee as they desire free of charge when they purchase a meal. Under these circumstances, what is the marginal utility of the last cup of coffee; that is, what should be the marginal utility of the last unit consumed of goods received 'free'.

Lesson 3: Ordinal Utility Theory - Indifference Curve

Lesson Objectives

After studying this lesson, you should be able to:

- describe the basic difference between the ordinalist theory and cardinalist theory;
- explain the indifference curve;
- explain the budget line;

Introduction

At the end of the previous lesson, we learnt that there are some basic weaknesses in the Cardinalist approach. The main weakness in the Cardinalist approach is the assumption of cardinal utility. In the Cardinalist approach, the taste or satisfaction or utility derived from the consumption of a commodity can be measured objectively. In Table 4.1, we saw that the marginal utility Modhu got from the first piece of Patty was Tk. 10.00, while the second piece of Patty had the marginal utility of Tk.9.00. Now, the question is: can we really be so specific about our tastes? Is it reasonable to say that you got the marginal utility of Tk.10.00 from the consumption of the first can of Virgin? Should we calculate a psychological entity, like *utility*, arithmetically?

Till early twentieth century, the above questions were left unanswered. In 1906, Vilfredo Pareto first opposed the idea of cardinal utility and initiated the idea of ordinal utility to consumer behavior analysis. Later Eugene E. Slutsky, W.E. Johnson, A.L. Bowley, John R. Hicks, and R.G.D. Allen systematically developed the ordinal utility theory as a powerful tool of consumer behavior analysis. There are several theories which are based on the concept of ordinal utility. For example, the indifference curves analysis, theory of revealed preference, etc.

This lesson presents the indifference curve analysis of consumer behavior. Let's first know something about the concept of *ordinal utility*.

The Concept of Ordinal Utility

The word ***ordinal*** is synonymous to the word ***rank.*** We know that rank is not a quantity; rather it indicates the position of something in a group in terms of magnitude or satisfaction or any other attributes. For example, if you are asked to express your preference among three commodities such as Patty, Shingara and Orange, you may express your best favour to Orange , less favour to Shingara and very low favour to Patty, i.e., the ranking of your preference according to the satisfaction of each commodity is:

Commodities	***Ranks***
Patty	3
Shingara	2
Orange	1

Therefore, the ***ordinal utility*** is the expression of the consumer's preference for one commodity over another or one basket of goods over another, but not a numerical figure of utility derived

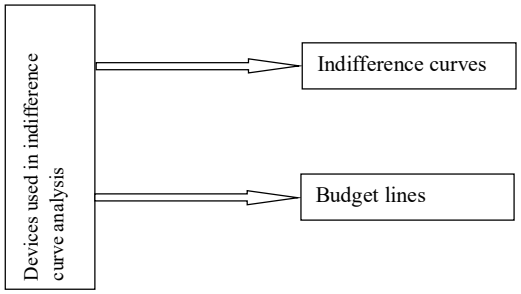
from different commodities or baskets. In this case, it is assumed that the utility derived from the consumption of various commodities cannot be measured in quantities, but the consumer can rank her/his preferences according to the satisfaction of each commodity or basket. For example, you can say that you prefer Orange to Shingara, but it is extremely doubtful if you say that the utility you will receive from Orange and Shingara is Tk.10.00 and Tk.5.00, respectively.

So, *ordinal utility analysis* is a more advanced explanation of consumer behavior than *cardinal utility analysis.*

Let's now discuss *indifference curve analysis* which is based on the ordinal utility concept.

Indifference Curve Analysis

Two geometric devices are used in this analysis: ***indifference curves*** and ***budget lines.*** Both of them are the locus of various combinations of two commodities. However, the first one is concerned with those combinations from which the consumer gets same satisfaction or she/he is indifferent among them, while the second one is concerned with such combinations or bundles which she/he can afford by spending the same amount of money.



Let's first discuss the assumptions underlying the indifference curve analysis. Later, we will discuss *indifference curves* and *budget lines* in detail.

Assumptions

The indifference curve analysis of consumer's behavior is based on the following assumptions:

Rationality: The consumer is rational - she/he aims at the maximization of her/his utility, given her/his income and market prices. She/he has full knowledge of all relevant information.

Ordinal utility: The consumer can rank her/his preferences according to the satisfaction of each basket. She/he doesn't need to care the arithmetic calculation of utility or satisfaction. Only ordinal measurement of utility is required.

Diminishing marginal rate of substitution: The slope of the indifference curve is called the marginal rate of substitution of the commodities. The indifference curve analysis is based on the axiom of diminishing marginal rate of substitution.

Total utility depends on the quantities consumed: The total utility depends on the quantities of the commodities consumed. That is,

$$U = f(q_1, q_1, ..., q_x, q_y, ..., q_n)$$

Consistency of choice: The consumer is consistent in her/his choice, which means if the consumer once chooses Bundle A over Bundle B, she/he will not choose B over A in another period if both bundles are available to her/him. Symbolically, the assumption of consistency may be written as follows:

$$\text{If } A > B, \text{ then } B \not> A$$

Transitivity of choice: Consumer's choices are characterized by transitivity, i.e., if Bundle A is preferred to B, and B is preferred to C, then Bundle A is preferred to C. Symbolically,

$$\text{If } A > B, \text{ and } B > C, \text{ then } A > C$$

Non-satiation: The consumer is assumed never to be satiated with goods. That's why, the more of each goods the bundle contains the more it is preferred to the consumer. She/he always prefers the bundle which contains the larger quantity of the commodities.

Indifference Curve: What the Consumer Prefers

An indifference curve is the locus of points which indicates various combinations of two commodities that yield the same level of satisfaction or utility to the consumer. So, the indifference curves embody subjective information about consumer preferences for two commodities.

Table 4.4 shows an indifference schedule and Figure 4.6 shows the indifference curve which is derived by plotting the hypothetical data in Table 4.4.

Indifference schedule: Let us assume that a consumer named Modhu is indifferent between the various combinations of orange and Patty. In Table 4.4, some combinations of Orange and Patty are presented. These combinations yield her equal satisfaction. Table 4.4 is, thus, called an indifference schedule.

Table 4.2: Indifference schedule (hypothetical data)

Combinations	Units of Orange	Units of Patty
a	12	2
b	7	4
c	4	6
d	2	8
e	1	10

In Table 4.2, five combinations of Orange and Patty have been shown. Combination-a contains 12 pieces of Orange and 2 pieces of Patty, combination-b contains 7 pieces of Orange and 4 pieces of Patty, combinaton-c contains 4 pieces of Orange and 6 pieces of Patty, and so on. We see that the quantity figures are not the same in all the combinations. If a combination contains

more Oranges, it has to contain less Patty. This is necessary, because all the combinations should yield the consumer the same satisfaction. Note that as the combinations include more of Patties, the quantity of Oranges in the combinations becomes lower. That means, the consumer has to give up Oranges for getting more Patties to keep her satisfaction same. So, there is a substitution between the two commodities. But what is about the rate of substitution? Does she always give up or substitute the same amount of Oranges for every extra piece of Patty? Look at Table 4.4. When Modhu moves from combination-a to combination-b, she substitutes 2 pieces of Patty for 5 pieces of Orange; if she moves further, i.e., from combination-b to combination-c, she substitutes same amount of Patty (2 pieces of Patty) for 3 pieces of Orange; and so on. Therefore, the rate of substitution of each extra piece of Patty (marginal rate of substitution) diminishes. This is shown in Table 4.5.

Table 4.3: Marginal rate of substitution (hypothetical data)

Combinations	Units of Orange	Change in the quantity of Orange (ΔQ_{orange})	Units of Patty	Change in the quantity of Patty (ΔQ_{Patty})	Marginal rate of substitution $\Delta Q_{orange} \div \Delta Q_{Patty}$
a	12		2		
b	7	**5** (=12-7)	4	**2** (= 4-2)	2.5
c	4	**3** (= 7-4)	6	**2** (= 6-4)	1.5
d	2	**2** (= 4-2)	8	**2** (= 8-6)	1.0
e	1	**1** (= 2-1)	10	**2** (= 10-8)	0.5

In Table 4.3, it is shown that for every extra 2 pieces of Patty the consumer is not willing to give up the same quantity of Oranges - her willingness to giving up Oranges becomes lower as she gets more of Patties. This means, her attraction toward Patty reduces as she gets more of it. Column-6 of the table shows the diminishing marginal rate of substitution of Patty for Orange.

Indifference curve: Plotting the data given in Table 4.4 we get the indifferent curve of the consumer. Figure 4.4 shows it.

In the above figure, IC indicates the indifference curve. Any point on the indifference curve indicates a combination of two commodities - Orange and Patty. At all the points, the consumer is indifferent, i.e., throughout this curve the consumer's utility or satisfaction is the same. That's why, indifference curve is also called ***Iso-utility*** or ***Equal-utility*** curve.

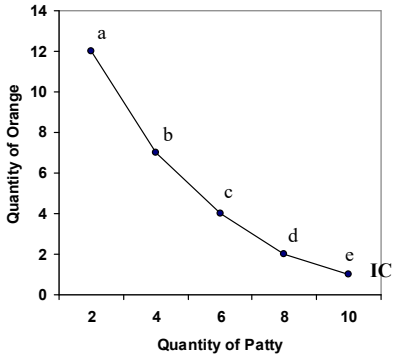


Figure 4.4: Indifference curve of Modhu

Indifference map
An indifference map is the collection of all indifference curves which rank the preferences of the consumer. As we move out from the origin, each successive indifference curve entails a higher level of utility. That means, combinations of goods lying on a higher indifference curve yield higher level of satisfaction and are preferred. Figure 4.5 shows an *indifference map*.

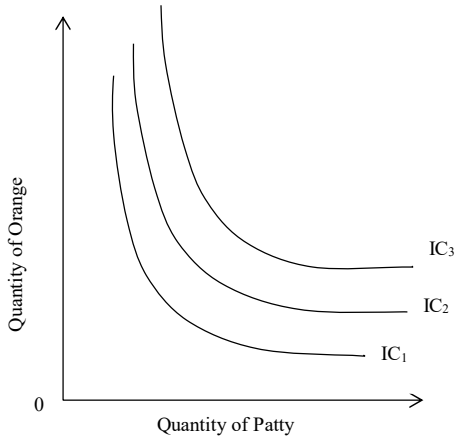


Figure 4.5: Indifference map

Figure 4.5 depicts a partial indifference map, because only three indifference curves are shown here. Like IC_1, IC_2 and IC_3 there may be many other indifference curves in the indifference plane. The area between the two axes is called ***indifference plane***.

Properties of the indifference curve
The indifference curve has the following basic properties:

Downward sloping: The indifference curve is downward sloping, which implies that: the two commodities can be substituted for each other; and if quantity of one commodity decreases, quantity of the other commodity must increase if the consumer has to stay at the same level of satisfaction. Technically, the slope of the indifference curve is called the ***Marginal Rate of Substitution (MRS),*** because it shows the rate, at the margin, at which the consumer will substitute one good for the other to remain equally satisfied.

Convex to the origin: Downward slope is the necessary, not sufficient, property of the indifference curve. As viewed from the origin, a downward sloping curve can be concave (bowed outward) or convex (bowed inward). The indifference curve is convex to the origin, which means that slope of the indifference curve, the marginal rate of substitution, diminishes as we move down the curve. The diminishing slope of the indifference curve means the willingness to substitute one commodity (orange) for the other (Patty) diminishes as one moves down the curve.

Indifference curves do not intersect nor be tangent to one another: By definition, we know that along an indifference curve the consumer's satisfaction remains the same. If indifference curves intersect, the point of their intersection would imply two different levels of satisfaction, which is impossible.

Upper indifference curves represent higher level of satisfaction than the lower ones: The further away from the origin an indifference curve lies, the higher the level of utility it denotes. Bundles of commodities on an upper indifference contain a larger quantity of one or both of the commodities than the lower indifference curve. Thus bundles of commodities on a higher indifference curve are more preferred by the rational consumer.

Budget Line: What the Consumer Can Afford

In the previous section, we learnt that an indifference curve shows such combinations of commodities from which the consumer gets the same level of satisfaction. In that case, we haven't considered any constraint. Is the consumer able to consume any combination she/he prefers? Certainly the answer is NO. Why? Because her/his income is limited. Thus which bundle or combination of the commodities the consumer can afford depends on her/his income and the prices of the commodities.

A ***budget line*** shows such combinations of two commodities which the consumer can afford, given her/his money income and prices of the commodities. Table 4.6 shows the combinations of Orange and Patty which the consumer can purchase when her/his money income is Tk.36.00, price of Orange is Tk.3.00 and price of Patty is Tk.4.00.

Table 4.6: Combinations of Orange and Patty attainable with an income of Tk.36.00 (hypothetical data)

Combinations	Quantity of Orange (price = Tk.3.00)	Quantity of Patty (price = Tk.4.00)	Expenditure on Orange (in taka)	Expenditure on Patty (in taka)	Total Expenditure (in taka)
a	12	0	$3 \times 12 = 36$	$4 \times 0 = 0$	$36 + 0 = 36$
b	8	3	$3 \times 8 = 24$	$4 \times 3 = 12$	$24 + 12 = 36$
c	4	6	$3 \times 4 = 12$	$4 \times 6 = 24$	$12 + 48 = 36$
d	0	9	$3 \times 0 = 0$	$4 \times 9 = 36$	$0 + 36 = 36$

In the table above, four combinations are shown such as *combination-a*{12 pieces of Orange and 0 piece of Patty}, *combination-b*{ 8 pieces of Orange and 3 pieces of Patty}, *combination-c*{ 4 pieces of Orange and 6 pieces of Patty} and *combination-d*{0 piece of Orange and 9 pieces of Patty}. Each of the combinations can be purchased with Tk.36.00 of money income.

Algebraically, we can write the ***income constraint***, in the case of two commodities, as follows:

$$P_{or} \times Q_{or} + P_{pa} \times Q_{pa} = M \text{.....(4.1)}$$

Here, P_{or} = Price of Orange; Q_{or} = Quantity of Orange; P_{pa} = price of Patty; Q_{pa} = Quantity of Orange; and M = Money income.

Solving the above equation (4.1) for Q_{pa}, we derive:

$$Q_{pa} = \frac{1}{P_{pa}} M - \frac{P_{or}}{P_{pa}} Q_{or} \text{.....(4.2)}$$

Equation (4.2) is called ***budget equation***.

Assigning successive values to Q_{or} (M, P_{or} and P_{pa} remain the same), we may find the corresponding values of Q_{pa} . Thus, if Q_{or} = 0 (that is, if the consumer spends all her/his income on Patty), then the consumer can buy M/P_{pa} units of Patty. Similarly, if Q_{pa} = 0 (that is, if the consumer spends all her/his income on Orange), then the consumer can buy M/P_{or} units of Orange. These results are shown in Figure 4.8 by Points A and B. If we join these points with a line, we obtain the ***budget line***. Budget line is also called as ***price line.*** In the above figure, AB is the budget line. Any point on or under the budget line indicates the combination of Orange and Patty which is affordable to the consumer, but the points on the north-east area of the budget line indicate such combinations which are out of the purchasing capacity of the consumer. Thus the south-west area of the budget line is ***feasibility area*** and the north-east area of the budget line is ***non-feasibility area***. We can geometrically calculate the slope of the budget line as follows:

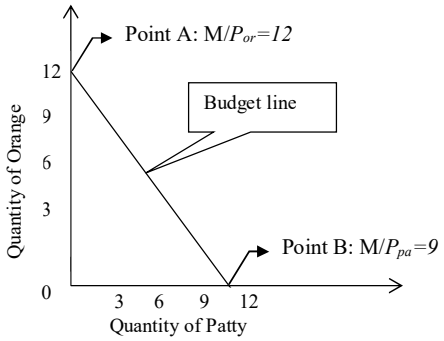


Figure 4.6: Budget line (representing the data in table 4.1)

$$\frac{OA}{OB} = \frac{M / P_{or}}{M / P_{pa}} = \frac{P_{pa}}{P_{or}}$$

So, we can draw the budget line easily if we know the prices of the commodities and the money income of the consumer. Let's consider the prices and money income assumed in Table 4.6. We find:

P_{or} = price of Orange = Tk.3.00

P_{pa} = price of Patty = Tk.4.00

M = Money income of the consumer = Tk.36.00

Therefore, M/P_{or} = 36/3 = 12 units of Orange
M/P_{pa} = 36/4 = 9 units of Patty

These two results are shown in Figure 4.8 by Points A and B. If we join these points with a line, we obtain the budget line, AB. Points on the budget line represents the combinations of Orange and Patty which can be purchased with Tk.36.00. All the combinations in Table 4.6 fall on the budget line. Thus, without plotting the data in Table 4.6 budget line can be derived if we have the information about the prices of the commodities and the money income of the consumer.

Properties of budget line
Budget line has the following basic properties:

Downward sloping: Budget line is downward sloping, which implies that: the two commodities can be substituted for each other; and if quantity of one commodity decreases, quantity of other commodity must increase if the consumer has to spend all of her/his money income. Technically, the slope of the budget line is the ratio of the prices of the commodities: P_{pa}/P_{or}.

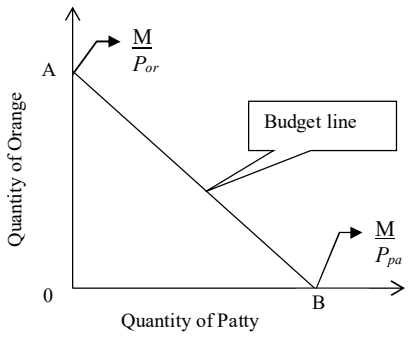


Figure 4.7: Slope of the budget line: $P_{pa}/P_{or} < 0$

Position of the budget line: Position of the budget line is determined by two types of data: the prices of the commodities and consumer's disposable income.

Income change: If the income of the consumer increases, the budget line shifts outward parallely. The reason is simply that say, 33 per cent increase in available income, if entirely spent on two goods in question, would permit the consumer to purchase exactly 33 per cent more of either commodity. Conversely, if the income decreases by 33 per cent, then the consumer's purchase of either goods is decreased by 33 per cent. In this case, the budget line shifts inward in parallel way. Figure 4.10 shows both the cases.

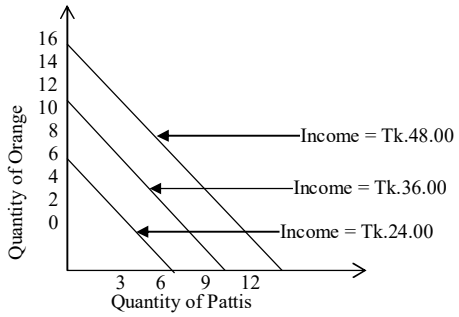


Figure 4.8: The effect of income changes on the budget line

Price change: If the price of one or both of the commodities is changed, the budget line will swing. To explain the nature of the swing we can consider the following cases:

Case-1: Price of only one commodity changes. If the price of only one commodity changes, one end of the budget line swings away from the initial position. For example, in Figure 4.11(A), the initial position of the budget line is indicated by the bold line. The initial prices of Orange and Patty are Tk.3.00 and Tk.4.00, respectively. Now, if the price of Patty rises to Tk.4.00 while the price of Orange remains fixed, the end of the budget line on the Patty axis (i.e., horizontal axis)

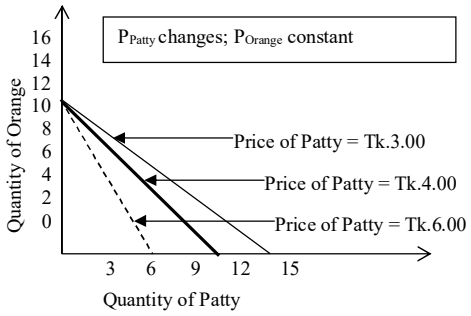


Figure 4.9(A): The effect of price changes on the budget line.

will swing toward the origin. This is shown by the *dotted line* in Figure 4.11(A). But in the case of fall in the price of Patty (from Tk.4.00 to Tk.3.00), the effect will be reverse. The *right most budget line* in Figure 4.11(A) shows that. Similarly, we can see the effect of the changes in the price of Orange assuming that the price of Patty is fixed. Figure 4.11(B) shows that.

In Figure 4.11(B), The bold line indicates the initial position of the budget line, when the prices of Orange and Patty are Tk.3.00 and Tk.4.00 respectively. If the price of Orange rises, the price

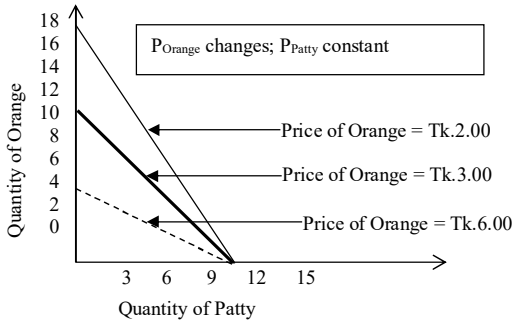


Figure 4.10(B): The effect of price changes on the budget line

of Patty remaining the same, the end of the budget line on the Orange axis (vertical axis) swings inward, which is shown by the *dotted line* in Figure 4.11(B). But in the case of a fall in the price of Orange, the effect will be reverse, i.e., the upper end of the budget line swings outward, which is shown by the right most line in Figure 4.11(B).

In conclusion, we can say that if the price of a particular commodity changes, the respective end of the budget line swings. If price falls, it swings outward and if price rises, it swings inward.

Case-2: Price of both commodities change. If the prices of both commodities are changed simultaneously, then it becomes more complex to discuss their effect on budget line. However, keeping the effect of individual price changes on the budget line in mind, we can see how the budget line shifts or rotates. If the prices change in opposite direction, the budget line rotates as in Figure 4.11(C). For example, if the price of Orange falls and the price of Patty rises

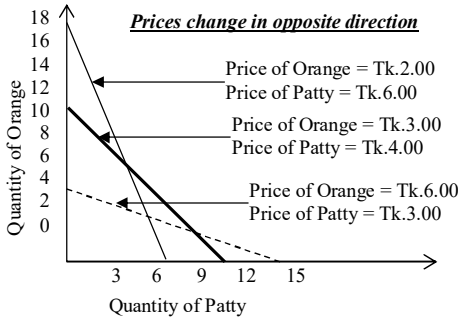


Figure 4.11(C): The effect of price changes on the budget line

simultaneously, the budget line will rotate clockwise, which is shown by the steepest line in Figure 4.11(C). On the other hand, if the price of Orange rises and the price of Patty falls, then the budget line rotates anti-clockwise, which is shown by the dotted line in Figure 4.11(C). The bold line in the figure indicates the initial position of the budget line.

If the prices change in the same direction, the budget line shifts. Figure 4.11(D) shows it. For

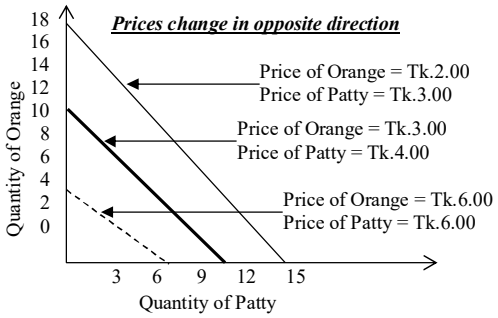


Figure 4.11(D): The effect of price changes on the budget line

example, if both prices fall, the budget line shifts outward (steepest line in the figure), while the rise in both prices causes the budget line shift inward entirely (dotted line in the figure).

Review Questions

1. Explain the concept of ordinal utility. What are the assumptions in ordering consumer preference?
2. What is an indifference curve? What are the main properties of indifference curve? What will be the shape of indifference curve if one of the two goods is a free commodity?
3. Why are the indifference curves convex to the point of origin?
4. What is marginal rate of substitution? Why does the MRS diminish along the indifference curve?
5. Draw indifference curves for the following pairs of products and explain why you have drawn them in a certain shape:
   (a) paper and pencils.
   (b) pens and pencils.
6. How do you depict the indifference preference map for (a) good and a bad, (b) a bad and a bad?
7. What is the shape of an indifference curve between a good and another good over same range of consumption and a bad thereafter.
8. Suppose there are two commodities each of which cause a reduction in total utility beyond a certain rate of consumption. What would be the shape of a typical indifference curve?
9. What is the shape of indifference curve when one of the two good is a normal good and the other a neutral?
10. Show with the help of indifference curves that price effect is a combination of income and substitution effects.
11. Derive a demand curve with the help of indifference curves.
12. What is the difference between the price consumption curve and the conventional demand curve? Derive a demand curve with the help of price consumption curve.

Unit 5: PRODUCTION, COST AND SUPPLY

Highlights

- Defining the Concept of Production
- Total, Marginal and Average Product Curves
- Short-run and Long-run Product Curves
- Total, Marginal Cost and Average Cost Curves
- Short-run and Long-run Cost Curves
- Laws of Returns

Technologies Used for Content Delivery

- BOUTUBE
- BOULMS
- WebTV
- Web Radio
- Mobile Technology with Micro SD Card
- LP+Office365
- BTV Program
- Bangladesh Betar Program

Lesson 1: Concepts Related to Production

Lesson Objectives

After studying this lesson, you should be able to:

- state the meaning of production in Economics;
- state the nature of short-run and long-run production functions;
- define equal product curve and state its characteristics;
- state how the least cost combination of factors is obtained; and
- show returns to scale with the help of equal product curves.

Meaning of Production

In popular language, the term *production* is used to mean creation of a new commodity or a service. In Economics, production means creation of new utility. The law of indestructibility of matters in physics states that human beings cannot create or destroy matters. She/he can only change the shape of matters so that these transformed matters satisfy human wants. In other words, a human being creates new utility by rendering her/his services. Suppose a person gets a piece of wood, free of cost, from her/his friend. As long as the piece of wood lies unused in his courtyard, it will not be a production activity. The person hires a carpenter who puts her/his services on the piece of wood to change it to an item of furniture.

The carpenter creates new utility by changing the piece of the wood to the shape of a furniture item. Thus, the carpenter produces a commodity which satisfies human wants. There are four factors of production - land, labor, capital, and entrepreneur. The owners of land, labor, and capital and the entrepreneur get rent, wages, interest income and profit respectively as their remunerations. The entrepreneur organizes the production activities. She/he buys a piece of land, hires the workers and borrow the necessary capital from the financial institutions for investing in her/his production firm. Her/his ultimate objective is to maximize her/his profit which can be defined as the difference between total revenue and total cost. A production firm generally consists of a few production plants; each production plant in turn consists of one production unit with one big furnace, machinery and equipments. The collection of all firms producing one commodity is called an industry. For example, the sugar industry in Bangladesh consists of all production firms engaged in producing sugar.

Production Function

A production function is a technical relationship between the inputs of production and output of the firm; the relationship is such that the level of output depends on the levels of inputs used, not vice versa. A production function is traditionally expressed by the following equation:

$Q = f(K,L)$

where,

Q = the level of output
f = the symbol of relationship, which is determined by the production engineers.
K = the amount of capital
L = the amount of labor

A production function may be a short-run or a long-run production function depending on the period of time. In a short-run production function, at least one input of production cannot be changed. In a long-run production function, all inputs of production can be changed. Short-run does not specify a specific period of time; it depends on the nature of the commodity in question. It may be six months for one commodity and one year for another commodity, etc. The inputs of production consist of raw materials that a particular firm buys to use in the production process and the inputs may be the commodities produced by other firms.

The Short-run Production Function

In the case of short-run production function, at least one input cannot be changed. For example, the firm owner increases her/his production level by hiring more labor and by buying more raw materials if the demand for her/his commodity increases in the short-run. She/he cannot add a new production plant in the short-run, because it takes some time to erect a new building, to buy machinery and other fixed inputs in the short-run. Even if she/he can add another production unit, she/he would not do so, because the increase in the demand for his commodity may be very much transitory. Whatever be the cause, some factors of production would remain fixed in the short-run.

Symbolically, a short-run production function can be expressed as follows:
$Y = f(K^0, L)$
Where,
K^0 means fixed level of capital.
Suppose there are two factors of production, capital (K) and labor (L). Also suppose capital is fixed in the short-run. We are interested to examine how total, average, and marginal product curves would be affected if we keep increasing the level of labor input. The following diagram shows the behavior of total, average, and marginal product curves in the short-run.

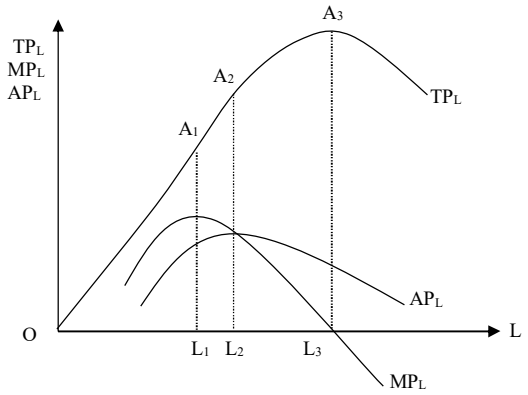


Figure 5.1: Total, average and marginal product curve in the short-run

In Figure 5.1, we measure productivity along the vertical axis, and quantity of labor along the horizontal axis. The TP curve in the diagram shows how total product behaves if we increase the quantity of labor keeping the quantity of other factors fixed in the short-run. It is evident that total product increases at an increasing rate initially. It starts increasing at a decreasing rate after point L_1 along the horizontal axis and after A_1 along the TP curve. Total product becomes the maximum when OL_3 amount of labor is used. Then it starts diminishing. Marginal product increases as long as total product increases at an increasing rate. Marginal product becomes the maximum at the inflection point where total product starts increasing at a decreasing rate. Marginal product becomes zero when total product is the maximum. Marginal product remains negative as long as total product diminishes. Average product increases initially up to point L_2 along the horizontal axis and up to point A_2 along the TP curve. It begins to fall after OL_2 amount of labor. It should be noted that average product can never be zero or negative.

Law of Variable Proportions
Depending on the nature of various product curves, the economists have divided the diagram in Figure 5.1 into three parts on the basis of quantity of labor used in the production process. These three regions are O- L_2, L_2- L_3, L_3 - infinite. The first region is called the region of increasing returns, because marginal productivity of the variable input increases here. The producer will not

stop here. The second region, L_2- L_3, is known as the region of diminishing returns, because marginal productivity diminishes in this region. The entrepreneurs find that increased doses of labor applied to a fixed quantity of other inputs result in decreasing amount of marginal products. Diminishing returns are frequently found in agricultural production functions. The second stage is also called the economic stage, because the entrepreneur produces at some point in this stage. The point of production, of course, depends on the prices of the two inputs, the variable input and the fixed input. For example, the producer will produce at OL_2 if the fixed input is free but the variable input is not free. Similarly, the producer will produce at OL_3 if the variable input is free but the fixed input is not free. She/he will produce at some point in the second stage if both the inputs are not free. The third stage is called the stage of negative returns. The producer will not produce in this stage, because the marginal product of the variable input is negative here. In this case, the producer can increase her/his total product by withdrawing labor from production process. Some economists call this the stage of disguised unemployment. Labor used at this stage seems to be employed but their employment decreases total output rather than increasing it. Total product in the short-run is also called returns to variable proportions. The ratio of variable input to fixed inputs changes when quantity of variable input increases with the quantity of other factors remaining the same.

The Long-run Production Function

In a long-run production function, all factors are variable. The factors, however, can be varied in two ways. We can vary all factors of production proportionately so that the initial ratio of the two inputs remains constant. Alternatively, the two inputs can be varied by changing the initial ratio between them. Let us examine how total product changes when we increase all factors of production at the same rate. Total product and the inputs may increase at the same rate. This is the case of constant returns to scale. Total product may increase at a rate higher than the rate at which the inputs increase. This is the case of increasing returns to scale. Finally, the rate of increment of total output may be less than the rate of increment of inputs. That is the case of decreasing returns to scale. The following table illustrates the three cases of returns to scale clearly.

Step	Capital K	Labor L	Capital-Labor ratio K/L	Total output
1	10	20	10/20 = ½	100
2	20	40	20/40 = ½	300
3	40	80	40/80 = ½	600
4	80	160	80/160 = ½	1000

It is evident from the table that we change all factors of production keeping the ratio of capital (K) to labor (L) always equal to half. From step 1 to step 2, we double both the factors, capital and labor. Total product however, becomes more than double. It is a case of increasing returns to scale. From step 2 to step 3, total output and the two inputs increase at the same rate - all double in step 3. We have constant returns to scale here. From step 3 to step 4, total product becomes less than double though the inputs double in step 4. The final case shows decreasing returns to scale. It should be noted that production functions showing any kind of returns to scale are known as homogeneous production functions. We must use equal product curves in order to show returns to scale diagrammatically. At the end of this lesson returns to scale will be shown by equal product curves.

Equal Product Curves and Budget Lines

Equal Product Curve

An equal product curve is the locus of different combinations of two inputs that can produce a give level of output. It should be noted that an equal product curve is very much similar to an indifference curve. An indifference curve consists of different combinations of two commodities. An indifference curve represents the same level of satisfaction at all points on it; an equal product curve shows the same level of output at all points on it. There is one difference between two: the given level of satisfaction cannot be quantified in the case of indifference curve whereas the given level of output can be quantified in the case of an equal product curve. The following figure shows an equal product curve.

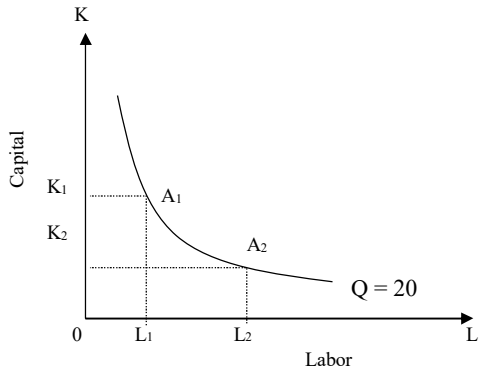


Figure 5.2: Equal product curve

In Figure 5.2, we measure quantity of capital (K) along the vertical axis and the quantity of labor (L) along the horizontal axis. Q = 20 is an equal product curve showing the different combinations of two inputs capable of producing 20 units of output. For example, both combination A_1 with OK_1 units of capital and OL_1 units of labor and combination A_2 with OK_2 units of capital and OL_2 units of labor can produce 20 units of output. The other points on Q = 20 are also capable of producing 20 units of output.

Characteristics of Equal Product Curve

Equal product curves possess characteristics similar to those of indifference curves. These are cited below:

- Equal product curves are downward sloping;
- Equal product curves are convex to the origin;
- Two equal product curves cannot intersect each other; and
- A higher level of equal product curve indicates higher level of output.

Let's now discuss the concept of budget line in production analysis.

Budget Line or Iso-Cost Line

A budget line in production analysis shows the different combinations of two inputs that a firm owner can buy with a given amount of money and given prices of two inputs. Figure 5.3 shows a budget line with capital measured along the vertical axis and labor along the horizontal axis.

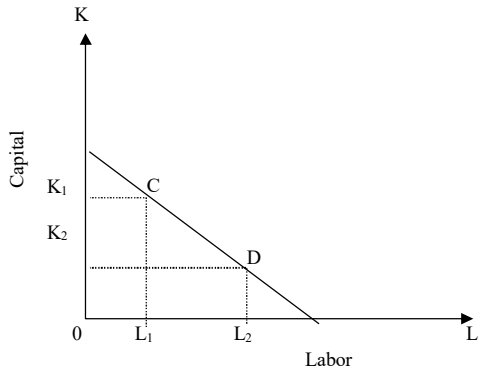


Figure 5.3: Budget line or Iso-Cost Line

The combination C with OK_1 of capital of OL_1 of labor costs as much as the combination D with OK_2 of capital and OL_2 of labor. All other points on the budget line cause the firm owner to spend the same amount of money.

Least Cost Combination of Factors

The ultimate objective of a firm owner is to maximize her/his profit. This can be done in two steps. First, the entrepreneur minimizes the cost of producing a given level of output. Second, she/he maximizes the total revenue by selling her/his product. The following analysis explains how a producer minimizes the cost of producing a given level of output when the prices of two inputs are given. Figure 5.4 illustrates the minimization problem.

The producer wants to minimize the costs of producing 20 units of output shown by the equal product curve Q = 20. The producer can obtain 20 units of output by producing at points M,N, P, and Q, because these points are located on her/his equal product curve Q = 20. The producer, however, will not produce at M, N, P and Q, because these points lie on higher budget lines. A higher budget line means higher level of cost. Her/his cost of producing 20 units of output will be minimum at point E at which the budget line is tangent with the equal product curve. At point E the entrepreneur uses the least cost combination of K* units of capital and L* units of labor.

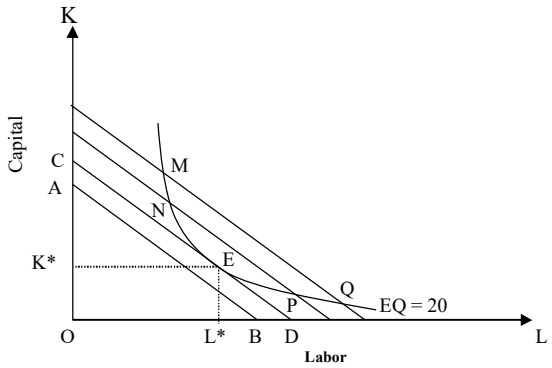


Figure 5.4: Least-cost combination of factors

Her/his minimum cost is given by the budget line CD. She/he would like to go to budget line AB, but she/he cannot produce 20 units of output by going to budget line AB. Thus, geometric condition for minimum cost is that at the least cost combination, the equal product curve must be tangent with the budget line. We can formalize the necessary and sufficient conditions for cost minimization as follows:

Necessary Condition

$P_L/P_K = MP_L/MP_K$

Where,

P_L = Price of labor input
P_K = Price of capital input
MP_L = Marginal productivity of labor
MP_K = Marginal productivity of capital

Sufficient Condition

At the least cost combination, the equal product curve must be convex to the origin.

Equal Product Curves and Returns to Scale

We can illustrate the concepts of returns to scale with the help of least cost combinations of factors. Figure 5.5 explains three kinds of returns to scale.

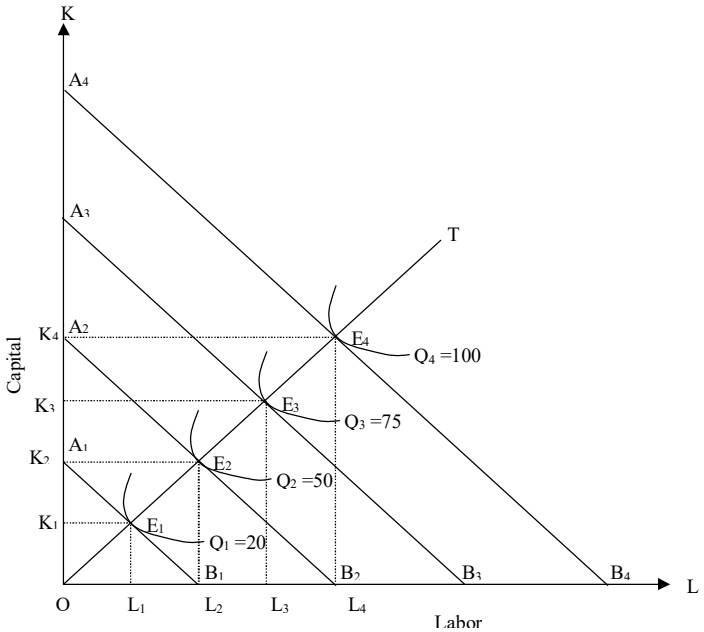


Figure 5.5: Returns to scale

We measure capital along the vertical axis and labor, along the horizontal axis. In Figure 5.5, we have four budget lines A_1B_1, A_2B_2, A_3B_3 and A_4B_4 which result from increased budgets of the entrepreneur with prices of two inputs remaining the same. We also notice four least cost combinations of factors in the diagram. These are E_1, E_2, E_3 and E_4. By joining the least cost combinations, we get a curve like OT in Figure 5.5. This curve is called the ***expansion path***, because it shows the inputs utilization levels when an entrepreneur wants to expand its production levels keeping the inputs ratio the same. It should be noted that the expansion path is a straight line in the case of a homogeneous production function. It is evident from Figure 5.5 that the following distances have the same length in the diagram.

$OE_1 = E_1E_2 = E_2E_3 = E_3E_4$

This implies that if the producer doubles both the inputs, she/he comes to the least cost combination E_2 from the earlier least cost combination E_1. The level of output, however, more than doubles at E_2 because E_2 is on the equal product curve Q_2 showing 50 units of output. At E_1, the producer used to produce 20 units of output. In other words, the movement from E_1 to E_2 shows *increasing returns to scale* if the two inputs are doubled and as a result the increase in output is the same as the initial output, the situation is called constant returns to scale. In Figure 5.5, movement from E_2 to E_3 indicates constant returns to scale to the producer. Similarly, if the inputs are doubled and as a result the increase in total output is 1.5 times of the initial output, the situation is called decreasing returns to scale, the movement from E_3 to E_4 in Figure 5.5 indicates decreasing returns to scale.

Review Questions

1. Explain the relationship between the average cost and marginal cost curves.
2. Explain the behavior of cost curves in short-run. Show the relationship between marginal cost, average variable cost, average total cost.
3. Suppose a cost function is given as $C = 135 + 75Q - 15Q^2 + Q^3$. There are a cost schedule showing total cost, marginal cost, marginal cost, average cost and average variable cost. Draw the cost curves on the basis of cost data obtained from the cost function.
4. (a) What is production?
   (b) In each of the following activities, identify what is being produced and the major inputs:
   (1) Baking a cake
   (2) Attending college
   (3) Eating
   (4) Sleeping
5. (a) What is production function? Distinguish between short-run and long run production functions.
   (b) Write down the characteristics of equal product curves.
   (c) What is budget line or iso-cost curve?
   (d) Explain the least cost combination of factors.
6. What is expansion path? Explain it graphically.
7. What is marginal physical product of labor? In what units MP_L is measured in production of:
   (a) Wheat
   (b) Haircuts
   (c) Houses
   (d) Dental services

Lesson 2: Short-run and Long-run Cost Curves

Lesson Objectives

After studying this lesson, you should be able to:

- derive the different short-run cost curves;
- state the nature of different short-run average cost curves;
- derive the different long-run cost curves; and
- state the nature of different long-run cost curves.

Derivation of Short-Run Cost Curves

A firm owner has to incur costs when she/he undertakes production activities. She/he has to pay rent to the landowner, wages to the labor, and interest to the owner of capital. In other words, she/he has to buy her/his raw materials to be used in the production process. The nature of cost of production depends on two things, viz., (a) the physical conditions of production and the input prices and (b) the period of time.

In the production analysis, we defined short-run as a period of time in which certain types of inputs cannot be changed regardless of the level of output. At least one input must be fixed in the short-run. The usage of the variable inputs, however, can be changed in the short-run. In the long-run, on the other hand, all inputs can be varied to obtain the minimum cost of production. The amount of money spent for fixed inputs are short-run fixed cost. The various fixed inputs have unit prices. The fixed explicit cost is simply the sum of unit prices multiplied by the fixed number of units used. In the short-run, implicit costs are also fixed. Thus, it is an element of fixed cost. Total fixed cost (TFC) is the sum of the short-run explicit fixed cost and the implicit cost incurred by an entrepreneur. Variable inputs in the short-run give rise to variable cost. The entrepreneur has to increase the usage of the variable inputs if she/he wants to increase her/his output level in the short-run. As a result, total variable cost (TVC) increases when output level increases. If there is zero output, no units of the variable input need to be employed. Variable cost is zero and total cost is equal to fixed cost at the zero level of output. Total variable cost is the sum of the amounts spent for each of the variable inputs used. The short-run total cost (STC) is the sum of total variable cost and total fixed cost. It is shown by the following equation:

STC = TFC + TVC

An explanation of different types of the short-run cost curves is given in Figure 5.6.

In Figure 5.6, we measure output level along the horizontal axis and different types of cost along

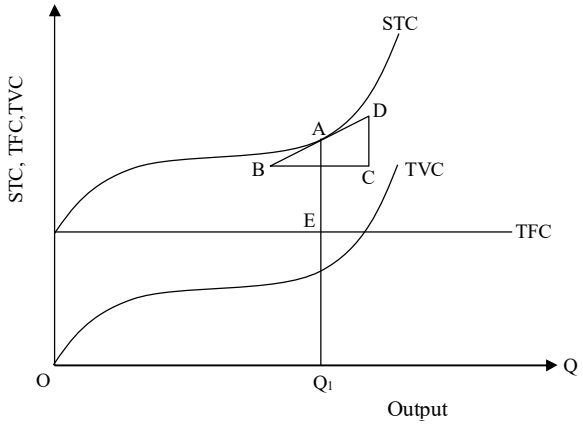


Figure 5.6: Different types of short-run cost curves

the vertical axis. The horizontal line marked TFC shows that total fixed cost does not depend on the level of output; it is fixed at all levels of output. The curve STC shows how short-run total costs increase with the level of output. The gap between short-run total cost (STC) and total fixed cost (TFC) measures the total variable cost (TVC) of production. It can easily be seen from the figure that both STC and TVC increase at a decreasing rate initially when output level increases, and then both increase at an ??? here that the shape of STC derives from the shape of the short-run total product curve; the shape of STC is just the opposite of the shape of the short-run total product curve. We know that the short-run total product curve increases at an increasing rate and then it increases at a decreasing rate.

Commented [H1]: See

If we divide short-run total cost (STC), total variable cost (TVC), and total fixed cost (TFC) by the level of output, we obtain short-run average total cost SATC, short-run avarage variable cost (SAVC) and short-run average fixed cost (SAFC) respectively. The relations are shown below:

SATC = STC/Q

SAVC = TVC/Q

SAFC = TFC/Q

$\therefore$ SATC = STC/Q = (TVC+TFC)/Q = TVC/Q + TFC/Q = SAVC + SAFC

Short-run marginal cost is defined as the change in short-run total cost due to one unit change in output.

SMC = ΔSTC/Δ Q = ΔTVC/ΔQ

Alternatively, the average cost curves can be derived geometrically from the STC and TFC curves. First, we find the values of SAC, SAVC, SAFC, and SMC at a particular level of output like Q_1 along the horizontal axis. Then we find these values at all levels of output. Finally, by plotting these values, we get the different types of average cost curves. For example, we are interested in finding the values of SAC, SAVC, SAFC, and SMC at output level Q_1 in Figure 5.6. SATC at Q_1 is found by dividing total cost, Q_1A, by the level of output, Q_1. SAFC is equal to total fixed cost, Q_1 E, divided by the level of output, Q_1. Finally, SMC is calculated as the value of the slope of the tangent at point A, which is equal to DC divided by BC.

Nature of Short-run Average Cost Curves
Short-run average total cost SATC is the sum of short-run average fixed cost (SAFC) and short-run average variable cost (SAVC).
SATC = SAFC + SAVC
SAFC declines continuously when the level of output increases, because the quotient TFC/Q falls continuously with increasing units of output. SAFC is a rectangular hyperbola approaching both axes asymptotically. SAVC is normally U-shaped, falling initially as output level increases. It reaches a minimum value at a certain level of output and starts rising after that.

Why is Short-run Average Variable Cost Curve (SAVC) U-shaped?
There are two explanations for the U-shape of SAVC:
First, SAVC is related to average productivity of the variable input in the short-run. We know that SAVC is equal to TVC divided by Q:
SAVC = TVC/Q
But TVC is nothing but the of product price of the variable input and quantity of the variable input. Assuming labor to be our variable input, we can write SAVC as follows:
$SAVC = TVC/Q = P_L L/Q = P_L/(Q/L) = P_L/AP_L$
Where,
P_L = Price of labor
L = Quantity of labor
Q = Output level
$AP_L = Q/L$ = Average productivity of labor

SAVC is found to be the reciprocal of average productivity of labor if we assume that price of labor does not depend on the level of employment. We know that the average productivity curve is inverted U-shaped in the short-run. Hence the SAVC curve is U-shaped in the short-run.
Second, in the short-run certain inputs are fixed. Each fixed input needs a certain number of labor force for its optimum utilization. We assume that the number of labor force applied to each fixed input in the short-run increases gradually starting from zero. Initially, a small number of labor input is applied to the fixed input. Average productivity is, therefore, low and short-run average variable cost is high at the initial stage. Average productivity of labor starts rising as the number of labor input increases. As a result, SAVC starts falling. As the number of variable input, labor, keeps increasing, average productivity of labor becomes maximum when the fixed inputs are put to optimum their utilization. Corresponding to this point of labor employment, SAVC becomes the minimum. If we increase the number of labor force beyond the optimum utilization point, average and marginal productivity of labor start falling due to mismanagement and chaotic conditions prevailing in the firm. Consequently, SAVC starts rising after the optimum utilization points of the fixed inputs. This ends the explanation of the U-shape of SAVC.

Why Is Short-run Average Total Cost Curve (SATC) U-shaped?
The shape of short-run average total cost SATC curve depends on the shapes of SAFC and SAVC. Initially SATC falls because both SAFC and SAVC fall initially. SATC continues to fall even when SAVC starts rising after its minimum point. This happens, because the rate of fall of

SAFC is greater than the rate of rise of SAVC. After some units of output, the rate of rise of SAVC becomes greater than the rate of fall of SAFC.
From that point, rise in SAVC offsets the fall in SAFC. As a result, SATC starts rising with the increase in the level of output.
The preceding discussion explains why SATC is also U-shaped. Like SATC, short-run marginal cost (SMC) curve is also U-shaped. SMC derives its shape from the shape of short-run marginal productivity curve. The following equation shows how SMC and marginal productivity (MP_L) are related to each other.
$SMC = \Delta STC/\Delta Q = \Delta(L.P_L)/\Delta Q = P_L/(\Delta Q/\Delta L) = P_L/MP_L$
If we assume P_L to be fixed regardless of the level of employment, we find SMC to be the reciprocal of MP_L. Since MP_L curve is inverted U-shaped, SMC curve will be U-shaped.
Now let's explain how short-run marginal cost (SMC) curve is related to SAFC, SAVC and SATC curves.

Relationship among Short-run Average Cost Curves
It should be noted that SMC has no relationship with TFC and hence with SAFC. SMC is less than SAVC as long as SAVC continues to fall in the initial stage. SMC equals SAVC at the minimum point of SAVC. SMC is greater than SAVC as long as SAVC continues to rise. Similar relationship holds between SMC and SATC. SMC is less than SATC as long as SATC decreases, the two become equal at the minimum point of SATC and SMC remains greater than SATC as

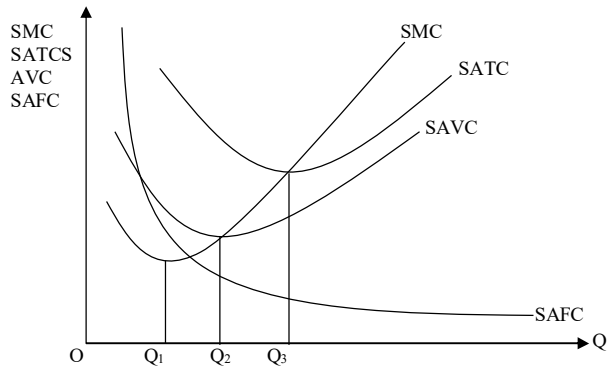


Figure 5.7: Short-run average cost curves

long as SATC increases. Figure 5.7 shows the different types of short-run average cost curves.
In the Figure 5.7, we measure different types of costs along the vertical axis and the level of output along the horizontal axis. It is evident from the Figure 5.7 that SAFC declines continuously and becomes asymptotic to the horizontal axis as the level of output increases. SAFC is also measured by the gap between SATC and SAVC. The gap is very large initially and narrows down as SAVC becomes asymptotic to SATC as Q increases. SAVC declines initially and becomes minimum at Q_2 level of output. It begins to rise after Q_2. The SATC curve falls initially to its minimum at output level Q_3, and it starts rising after that. Both the SATC and SAVC curves are U-shaped for reasons discussed earlier, The SMC curve is also U-shaped,

falling initially to Q_1 level of output and then starts rising. The SMC curve cuts the SAVC and SAC curves at their minimum points corresponding to Q_2 and Q_3 levels of output, respectively.

Derivation of Long-run Cost Curves

In the long-run, all inputs are variable. The firm can increase its output level by changing production plants in the long-run. There is no fixed input and hence no fixed cost in the long-run. Hence the long-run total cost curve starts from the origin indicating that total cost is zero when output is zero. Moreover, it can be shown that the long-run total cost curve is an envelope of the short-run total cost curves, the firm owner faces a new Short-run Total cost (STC) curve when she/he changes production plant, she/he can reduce total cost of production by changing production plants and STCs.

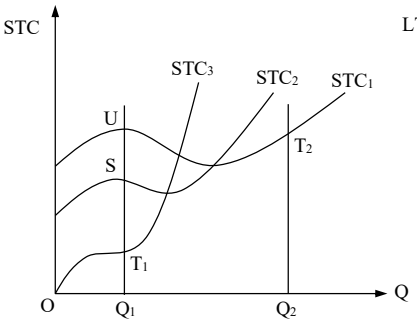


Figure 5.8

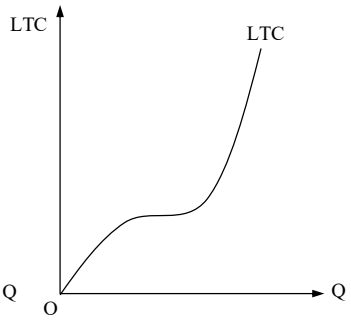


Figure 5.9

In Figure 5.8, we showed three STC curves for three plants. If the entrepreneur wants to produce Q_1 level of output, she/he can use one of the three production plants. Her/his total cost of production is Q_1U with plant-1, Q_1 S with plant-2 and Q_1 T with plant-3. Her/his minimum total cost is Q_1T_1 with plant-3. By joining minimum cost points like T_1 and T_2, we obtain the long-run total cost curve (LTC) which starts from the origin as shown in Figure 5.9. Like STC, LTC also increases at a decreasing rate initially and then it increases at an increasing rate.

Derivation of Long-Run Average and Marginal Cost Curves

It can be shown that long-run average cost (LAC) curve is also an envelope of short-run average cost (SAC) curves. It is true, because, the producer can lower the average cost of production by changing production plants in the long- run. Figure-5.10 shows the derivation of LAC from a number of SATC curves.

In Figure 5.10, we measure short-run costs along the vertical axis and level of output along the

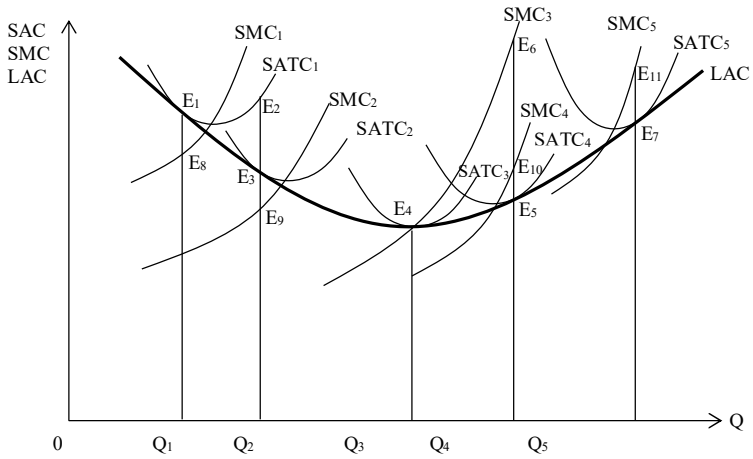


Figure 5.10: Derivation of long-run average cost curve (LAC)

horizontal axis. In this diagram, we show five short-run average total cost (SATC) curves, each representing one production plant. The SATC curves have been numbered according to the number of production plants. Suppose the producer produces Q_1 level of output with production plant-1. The producer wants to increase his production level to Q_2, which he can produce using his old plant-1 or using the new plant-2. Her/his average cost of production is Q_2E_2 in plant-1 and Q_2E_3 in plant-2. He/she will use plant-2 since his average cost of producing Q_2 level of output is lower in plant-2 ($Q_2E_3 < Q_2E_2$). Similarly, she/he will produce Q_3 level of output using plant-3. Her/his average cost of production of Q_4 level of output will be lower if she/he uses plant-4 instead using plant-3 ($Q_4E_5 < Q_4E_6$). She/he will use plant-5 for producing Q_5 level of output. By joining the points of minimum average cost like E_1, E_3, E_4, E_5, and E_7, we get the long-run average cost (LAC) curve. It is easily seen that the long-run average cost of production will be minimum if the producer produces Q_3 level of output using plant-3. The plant giving rise to long-run minimum average cost is known as the optimum plant, which is plant-3 in Figure 5.10. We also notice that LAC is tangent to the SATC curves in their falling portions to the left of the optimum plant. LAC is tangent to the SATC curves in their rising portions to the right of the optimum plant. In the long-run minimum cost level of output Q_3, the LAC curve is tangent to the SATC curve at its minimum point. It should be noted here that like SATC, LAC curve is also U-shaped, though it is flatter than the SATC curve. Unlike the LAC curve, the long-run marginal cost curve is not the envelope of the short-run marginal cost (SMC) curves. We know that there is a short-run marginal cost curve corresponding to each short-run average cost curve. We find the short-run marginal cost of each level of output produced in the long- run. We obtain the long-run marginal cost (LMC) curve by joining the points showing short-run marginal cost of producing the different levels of output in the long- run. For example, the short-run marginal cost is Q_1E_8 for Q_1, Q_2E_9 for Q_2, Q_3E_4 for Q_3, Q_4E_{10} for Q_4 and Q_5E_{11} for Q_5 level of output. We

obtain the LMC curve by joining the points like E_8, E_9,E_4, E_{10} and E_{11}. In Figure 5.11, we show both the LAC and LMC curves derived in Figure 5.10.

We observe that LMC is less than LAC as long as LAC continues to fall. LMC is equal to LAC at the minimum point of LAC curve LMC is greater than LAC as long as LAC continues to rise.

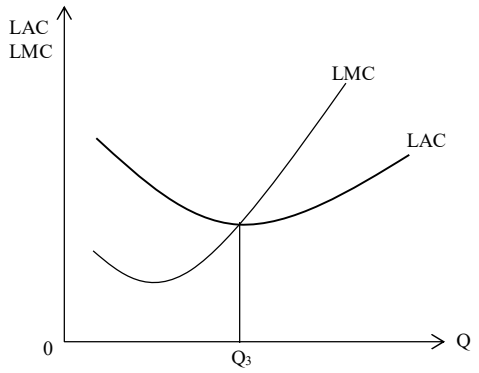


Figure 5.11: Long-run average and marginal cost curves

Review Questions

1. Derive different short-run cost curves? Is there any relation among them?
2. Explain the different nature of short-run cost curves.
3. Derive the long-run cost curves and explain their natures.
4. How is the long-run average cost curve derived from the short-run average cost curves? The long-run average cost curve joins the minimum points on the short-run average cost curves. Do you agree?
5. How are internal and external economies related to long-run average cost curves?

Lesson 3: Laws of Returns

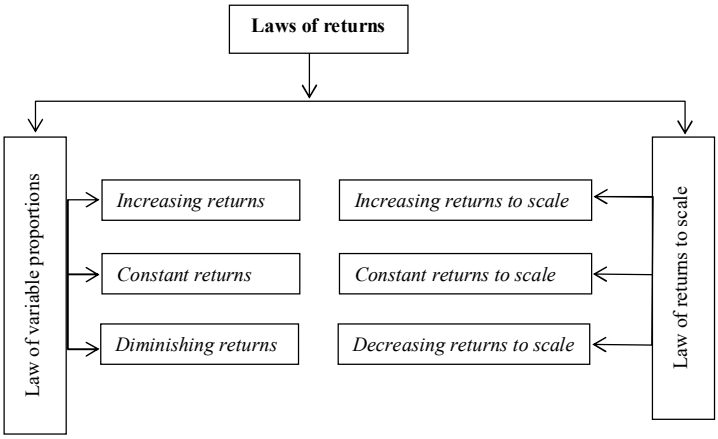
Lesson Objectives

After studying this lesson, you should be able to:

- explain returns to variable proportions;
- explain returns to scale; and
- compare laws of variable proportions with returns to scale.

Introduction

In Lesson 1 of this unit, we have discussed the basic concepts and tools of analysis used in the exposition of production theory. There we briefly explained the returns to variable proportions and the returns to scale. The laws related to the returns to variable proportions and the returns to scale are called the *laws of returns*. In this lesson, we will discuss the laws in detail. There are two kinds of laws of returns:



Let's discuss the laws of variable proportions first.

Law of Variable Proportions: Production with One Variable Factor

The laws of returns associated with 'one variable input' are called the Laws of Variable Proportions. It is a short-run phenomenon.

In Lesson 1 of this unit, you learnt that Production is a function of both capital and labor. It is, however, possible for a firm to increase production by holding capital constant and employing more and more of labor. This is actually true in the short-run, because the supply of capital is inelastic in the short-run.

When production is carried out with capital as a fixed factor and labor as a variable factor, or when more and more of labor is used with a fixed amount of capital, capital-labor proportions change. The change in factor proportions causes a change in output at a certain rate. The relationship between the changing factor proportions and the output is generalized in the forms of certain laws of production which are called the *laws of variable proportions.*

Main theme of the law

The ***law of variable proportions*** can be stated as follows:

If more and more of a variable input is applied to a fixed input, the total output initially increases at an increasing rate, but beyond a certain level of output, it increases at a diminishing rate. More precisely, if some factors are held constant and more and more units of a variable factor are employed, the marginal product of the variable factor initially increases, then decreases and eventually turns negative.

Therefore, the law of variable proportions refers to three regions of production: increasing returns, diminishing returns and negative returns. These are discussed below with a table and also with figure.

Three regions of production

Table 5.1 presents the three regions of production. The regions of production are also shown by three regions indicated in Figure 5.12. In Region 1, marginal productivity of labor (MP_L) continues to increase making total product (TP_L) increase at an increasing rate. In Region 2, MP_L starts falling so that TP increases at a decreasing rate. In Region 3, MP_L becomes negative and TP_L starts falling. The reasons for increasing, diminishing and negative returns are given below.

Table 5.1: Increasing, diminishing and negative returns

No. of workers (N)	Total product (TP) (tonnes)	Marginal product (MP_L) (tonnes) TP_n-TP_{n-1}	Average product (AP_L) (tonnes) TP/N	Region
1	25	25	25	
2	68	43	34	1
3	117	49	39	
4	172	55	43	
5	220	48	44	
6	258	38	43	
7	287	29	41	2
8	288	1	36	
9	252	(-) 36	28	
10	190	(-) 62	19	3

Region 1: Increasing returns

The increasing return to one variable factor is depicted by the Region 1 of Figure 5.12. We see that the portion of the TP curve in Region 1 is growing at an increasing rate, i.e., the slope of the TP curve, marginal product, in Region-1 is increasing. The reason is as follows:

Given the production technology, the size of the capital, the fixed factor, is given.

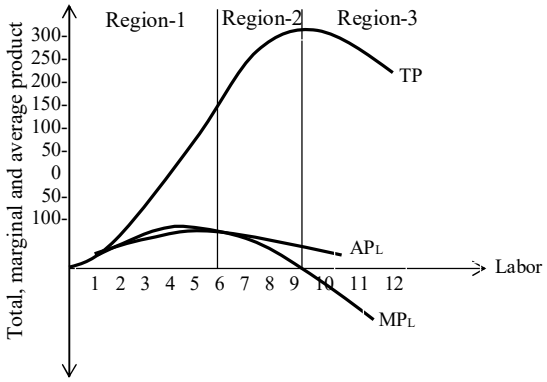


Figure 5.12: Total, marginal and average product curve

It is indivisible. Therefore, a certain minimum labor is required to make the optimum use of the capital. If a smaller number of workers are used, capital remains underutilised. This under-utilisation of the fixed factor, capital, causes the firm come out with returns at an increasing rate as it increases the employment of the variable factor, labor. Let us suppose that optimum capital-labor combination is 1:5. That is, one unit of capital is optimally used with 5 workers. Under this condition, if less than 5 workers are employed, the plant or machine would remain under-utilised. When more and more workers are added, utilisation of machine increases and also the productivity of additional workers. Another reason for increase in labor productivity is that, employment of additional workers leads to advantages of division of labor, until optimum capital-labor combination is reached.

Region -2: Diminishing Returns

Once the optimum capital-labor ratio is reached employment of additional workers will amount to substitution of capital with labor. But technically, one factor can substitute another only to a limited extent. In other words, there is a limit to which one input can be substituted for another. That is, the elasticity of substitution between inputs is not infinite. Hence, to replace the same amount of capital and to achieve the labor productivity at the optimum level of capital-labor combination, more and more workers will have to be employed. As a result, capital/labor ratio decreases. It means worker gets less and less capital to work with. As a result, marginal productivity of labor decreases.

Region 3: Negative Returns

The negative marginal return is only a theoretical possibility. As shown in Figure 5.12, in Region 3 production begins when marginal productivity of labor turns negative. At this region, total production begins to fall. The reasons for MP_L becoming negative are both technical and managerial.

- *Technical reasons:* As mentioned earlier, employing more labor beyond the optimum capital-labor combination means substituting another. In our case here, this limit is given by $MP_L = 0$. Any addition of labor beyond this limit leads to overcrowding, lower availability of tools and equipments which causes fall in total production. Besides, use of more and more labor results in excessive exploitation of capital. This reduces its contribution to production. For example, use of excessive labor on a piece of land reduces its fertility. That is why, the law of diminishing returns is more applicable to agriculture.
- *Managerial reasons:* Overcrowding gives labor an opportunity to shift work responsibility to others. Instead of cooperating with each other, they come in each other' way. With excess labor, it becomes increasingly difficult to fix accountability. Labor can therefore avoid the work.

The Laws of Returns to Scale

In the previous paragraphs, we have discussed production with one variable input (labor), holding the other input (capital) constant. Here we will discuss input-output relationships under the condition that all the inputs (labor and capital) are proportionately and simultaneously changed. When all the inputs are proportionately increased, the scale of production, the size of the firm increases. The laws that pertain to the input-output relationships under the condtion of changing scale of production are called the Laws of Returns of Scale. The laws of returns to scale are a long-term phenomenon.

In the long-run, supplies of both labor and capital are elastic. Therefore, the firms can employ more of both labor and capital to increase their production. In this section, the question that we will answer is: how does total output behave when all the inputs are proportionately changed?

When all the inputs are proportionately increased, there are technically three possible ways in which total output may increase. For example, if all the inputs are doubled, the resulting output may more than double, double and grow less than double. This kind of output behavior gives three kinds of returns to scale as given below:

Initial input combination	Initial output level	Changed input combination	Changed output	Returns to scale
K + L	20	2K + 2L	50	Increasing returns to scale
K + L	20	2K + 2L	40	Constant returns to scale
K + L	20	2K + 2L	30	Decreasing returns to scale

- If increase in output is more than proportional to the increase in inputs, it means increasing return to scale.
- If increase in output is proportional to increase in inputs, it gives constant returns to scale.
- If increase in output is less than proportional to the increase in inputs, it gives decreasing returns to scale.

Increasing Returns to Scale

As stated above, the law of increasing returns to scale implies that output increases more than proportionately to the increase in inputs. For example, when inputs increase by 50% output increases by more than 50%; when inputs are increased by 100%; output increases by more than 100% and so on. This kind of returns to change in scale is illustrated in Figure 5.13. Isoquants EQ_1 and EQ_2 represent two different levels of production, 20 units, 50 units, respectively. Product line OA shows the relationship between inputs and output. For instance, movement from point *a* to *b* denotes doubling the inputs, labor, and capital. As Figure 5.13 shows, input combination increases from K + L to 2K + 2L. The movement from *a* to *b* also indicates increase in output from 20 units to 50 units. This means that when inputs are doubled output has more than doubled. This reveals increasing returns to scale.

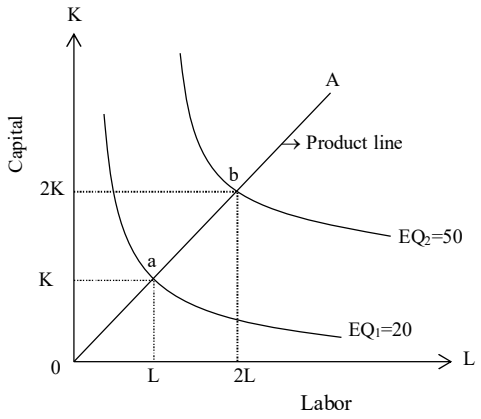


Figure 5.13: Increasing returns to scale

The Causes of Increasing Returns to Scale

Returns to scale increase because of Economics of Scale. There are at least three kinds of economies of scale that make plausible reasons for increasing returns to scale.

- *Technical and Managerial Indivisibilities:* Certain inputs, particularly mechanical equipments and managerial skills, used in the process of production are available in a given size. Such inputs cannot be divided into small sizes to suit the small scale of production. For example, half a tractor cannot be used; one third of a water pump cannot be used. Similarly, half of a manager cannot be employed, if part-time employment is not acceptable. Because of their indivisibility, such factors have to be employed in a minimum quantity even if scale of production is much less than their capacity output. Therefore, when scale of production is increased by increasing all inputs, the productivity of indivisible factors increases exponentially. This results in increasing returns to scale.
- *Higher Degree of Specialization:* Another factor causing increasing returns to scale is higher degree of specialization of both labor and machinery, which becomes possible with increase

in scale of production. The use of specialized labor and machinery increases productivity per unit of inputs. Their cumulative effects contribute to the increasing returns to scale. Besides, managerial specialization contributes a great deal in increasing production.

- *Dimensional Relations:* Increasing returns to scale is also a matter of dimensional relations. For example, when the size of a room (12' × 10' = 120 sq. ft.) is doubled to 24' × 20', the area of the room is more than doubled, i.e., 24' × 20' = 480 sq. ft. When diameter of a pipe is doubled, the flow of water is more than doubled. Following this dimensional relationship, when the labor and capital are doubled, the output is more than doubled over some level of output.

Constant Returns to Scale

When change in output is proportional to the change in inputs, it shows constant returns to scale. Constant returns to scale have been illustrated in Figure 5.14. The lines OA is product line indicating two hypothetical techniques of production. The isoquants, EQ_1= 20 and EQ_2=40 indicate the two different levels of output. In the figure, the movement from point *a* to *b* indicates doubling both the inputs. That is, K increases to 2K and L increases to 2L. When inputs are doubled, output is also doubled, i.e., output increases from 20 to 40.

This kind of relationship between inputs and output exhibits the constant returns to scale.

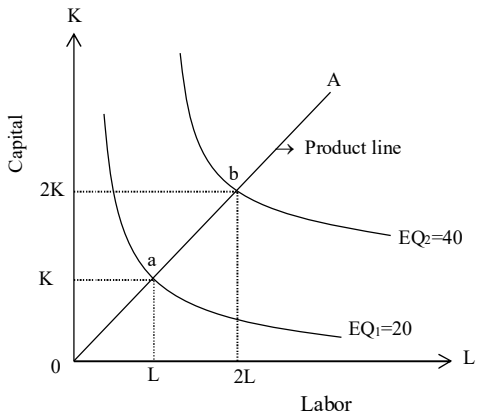


Figure 5.14: Constant returns to scale

The constant returns to scale are also attributable to the limits of the economies of scale. With the expansion in the scale of production, economies arise from such factors as indivisibility of certain factors, greater possibility of specialization of capital and labor, use of labor-saving techniques of production, etc. But there is a limit to the economies of scale. When economies of scale disappear and diseconomies are yet to begin, the returns to scale becomes constant. The diseconomies arise mainly because of decreasing efficiency of management and scarcity of certain inputs.

The constant returns to scale are said to occur also in productive activities in which factors of production are perfectly divisible.

Decreasing Returns of Scale

The firms are faced with decreasing returns to scale when a proportionate increase in inputs, *K* and *L,* leads to a less than the proportional rise in the output. That is, when inputs are doubled, output is less than doubled and so on. The decreasing returns to scale have been illustrated in Figure 5.15. As the Figure shows, when inputs, *K* and *L,* are doubled, i.e., increased from *K*+*L* to 2*K*+2*L*, the output increases from 20 to 30 units, which is less than the proportionate increase. The movement from point *a* to *b* indicates doubling both the inputs. But output is less than doubled.

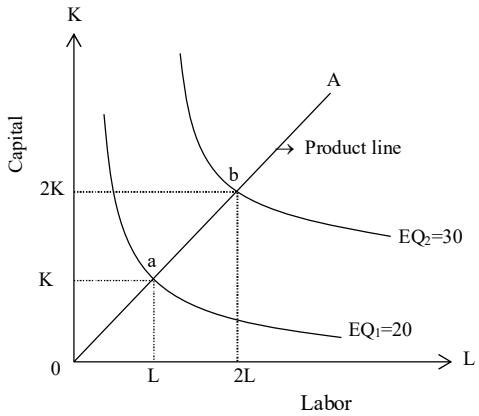


Figure 5.15: Decreasing returns to scale

Causes of Decreasing Returns to Scale

The decreasing returns to scale are attributed to the following two things:

- *Managerial diseconomies:* The most important factor causing diminishing returns to scale is 'the diminishing return to management', i.e., managerial diseconomies. As the size of the firm expands, managerial efficiency decreases.
- *Limitedness of the natural resources*: Another factor responsible for decreasing returns to scale is the limitedness or exhaustibility of the natural resources. For example, doubling of coal-mining plants may not double the coal output because of limited of coal deposits or difficult accessibility to coal deposits. Similarly, doubling the fishing fleet may not double the fish output because the availability of fish may decrease when fishing is carried out on an increasing scale.

Comparison between the Law of Variable Proportions and Returns to Scale

The basic difference between the law of returns to a variable factor and the law of returns to scale lies in the assumptions and conditions on which these laws are based.

- The law of returns to a variable factor allows only one input to vary, holding all other inputs constant, whereas in the case of the law of returns to scale all the inputs are variable.
- The law of returns to a variable factor is a short-run phenomenon, because, supply of capital in the short-run is inelastic. On the contrary, the law of returns to scale is a long-run phenomenon, because, supply of all the inputs in the long-run is elastic and more and more of their quantities can be employed.

Review Questions

1. What is meant by the laws of returns? Why is this law associated with one variable input?
2. What is the law of diminishing returns? Why it is called the law of variable proportions?
3. Discuss the law of variable proportions. What are the causes of diminishing returns?
4. Draw diagrams to show firms' average product, marginal product and total product curves in the short period. How do these curves depict the law of variable proportions?
5. State and explain returns to scale using suitable iso-product diagrams.
6. Show returns to scale with the help of iso-product map.
7. Show increasing, constant and diminishing returns to scale with the help of iso-product diagrams.
8. Distinguish between the law of variable proportions and returns to scale. Enumerate the factors that cause decreasing returns to scale.

Unit 6: PERFECT COMPETITION

Highlights

- ❑ Characteristics of Perfect Competition;
- ❑ AR & MR Curves in Perfect Competition;
- ❑ Equilibrium of a Competitive Firm.

Technologies Used for Content Delivery

- BOUTUBE
- BOULMS
- WebTV
- Web Radio
- Mobile Technology with Micro SD Card
- LP+Office365
- BTV Program
- Bangladesh Betar Program

Lesson 1: Characteristics of Perfect Competition, AR & MR Curves in Perfect Competition

Lesson Objectives

After studying this lesson, you should be able to:

- state the characteristics of perfect competition;
- describe the shapes of average revenue and marginal revenue curves of a firm; and
- describe the shapes of average revenue and marginal revenue curves of an industry.

Introduction

A firm owner, popularly known as factory owner, may have different motives when she/he organizes production activities. For example, she/he may be interested in increasing her/his social status as an industrialist. In Economics, however, profit maximization is identified as the sole motive for undertaking production activities. Profit is the difference between total revenue and total cost of production, both depending on the nature of market. Total revenue is equal to the product of price of the commodity and quantity of the commodity sold. The price which a seller can charge its buyers for his commodity depends on the nature of market. Total cost of production depends, among others, on the prices of inputs of production which in turn are determined by the forces of input market. Total cost of production also depends on the productivity of inputs. The important point is that profit of an entrepreneur depends on the nature of both product market and input market. A study of market structure is, therefore, important to realize the price and output determination process. Economists conceptualize two broad categories of market structures: perfect competition and imperfect competition. In this unit, we undertake the study of the ideal form of market structure which is called perfect competition.

Characteristics of Perfect Competition

The economists' concept of perfect competition is quite opposite of the businessmen's concept of competition. Businessmen would describe the market for tooth paste as highly competitive indicating the rigorous competition among the few brands of tooth paste in the market. This type of market is quite distinct from what the economist calls perfect competition. The concept of perfect competition in Economics is entirely impersonal. The economists always refer to large number of buyers and sellers in perfect competition so that no one seller or no one buyer can exert a perceptible influence on the market price. The market price is determined at the level where aggregate demand from all consumers of the product just equals the aggregate supply of the product from all sellers. Perfect competition is better known as the market of price takers as opposed to the market of price makers. Both the buyers and sellers in perfect competition are price takers. A price taker is a firm or consumer who sells or buys at the given price. If the price of Aman rice is Tk. 16 per kg the next door grocer charges the same price of Tk. 16 for each Kilogram of Aman rice sold when the consumer buys 100 kg or 1000 kg The seller does not give any kind of price rebate whatever be the volume of the sale.

We now turn to a systematic description of the characteristics of perfect competition. It should be noted at this point that all the characteristics of perfect competition ensure price-taking behavior of firms and buyers.

Large number of buyers and sellers: Presence of many buyers and sellers in the market is the most important feature of perfect competition. Because of a large number of buyers and sellers, each buyer buys and each seller sells a very small fraction of total output sold in the market. Consequently, no single seller or no single buyer can exert a perceptible effect on price. Not only the buyers and the sellers are many in number, but also they are widely scattered all over the country so that they find it difficult to organize themselves into groups. By forming groups or associations, the buyers as a group can claim price rebate. Similarly, the sellers can raise the price of the product by forming guilds of sellers. Because of multiplicity of numbers and lack of concerted pressure, no single seller or no single buyer can exert a perceptible effect on the price of the product. If a seller charges a higher price than her/his rivals, she/he looses customers. Though a seller cannot sell at a price higher than the market price, why cannot he sell at a lower price? He cannot sell at lower price because by doing so he incurs unnecessary loss - he can sell all of his product at the market price.

Homogeneous product: All the firms in perfect competition produce and sell identical product. Product of one firm cannot be distinguished from the product of another firm. If the product of one firm can be differentiated from the product of other firms by any means, the said firm may have some fixed customers who will be willing to pay even a higher price for their preferred product. Since the product in perfect competition is homogeneous the question of paying a different price for the product of any firm does not arise.

No barriers to entry or exit: Perfectly competitive firms face no barriers in moving into and leaving the industry in three senses. Industry is a collection of all firms producing a homogeneous product. A firm is production unit comprising one or more production plants which is independent in decision making.

Firstly, firms from other industries or new firms can enter into the industry if existing firms make supernormal profit. Similarly, some of the losing firms may leave the industry in the long-run. Secondly, barriers to entry might arise due to economic reasons. New firms may be prevented

from entering into an industry due to the existence of patent laws and other legal barriers. Economies of scale enjoyed by large firms prevent other firms from entering into the industry because entry of new firms would cause average cost of production to rise and to drive away the small firms. Cost of providing funds may be high for new firms due to imperfections in the capital markets. These kinds of economic barriers may restrict entry or exit of firms. Thirdly, barriers to entry or exit might arise from immobility of some specific factors of production or when the resources are owned by one firm. It is assumed that such immobility of factors of production or sole ownership of resources does not exist in perfect competition.

Complete information: The consumers, producers, and resource-owners are assumed to possess prefect knowledge about prices and quality of the commodities and inputs. An ignorant consumer may buy the product at a price higher than the market price. Similarly, the unaware input-supplier may be offered a lower price than the market price of input. The profit maximizing entrepreneur must be fully knowledgeable about both the prices of output and input.

The Average Revenue (AR) and Marginal Revenue (MR) Curves of a Competitive Firm

The total income or total revenue (TR) of a firm is equal to the product of the price of the commodity and the number of units sold: $TR = P \times q$. Conversely, the average income or average revenue (AR) is calculated by dividing total revenue by the quantity of output sold: $AR=TR/q$. Another related concept is marginal revenue which is defined as the change in total revenue resulting from one unit change in output. For a better understanding of profit maximizing behavior of a competitive firm, we need to examine what happens to total revenue (TR) when quantity of output sold increases. The curve showing the relationship between total revenue and the quantity of output sold is known as total revenue curve. Similarly, the average revenue curve shows the relationship between AR and Q. Marginal revenue curve shows how marginal revenue changes when quantity of output increases. Our next discussion focuses on the shapes of the TR, AR and MR curves of a competitive firm.

It was mentioned earlier that a competitive firm is a price-taker. Its perception is that it can sell any quantity of output at the given market price. This perception arises, because, the maximum amount of output that an individual firm can produce and sell in the market using all of its production capacity constitutes a very small fraction of aggregate output produced and sold in the market. Consequently, the firm cannot exert any influence on the market price. The following example clarifies this point:

Suppose, the amount of total annual sale of Pajam rice in Bangladesh at a price of Tk. 15 per kg is ten thousand million kg A grocer or a farmer cannot charge a price higher than Tk. 15 per kg for this brand of rice when a buyer buys 100 kg or 1000 kg or any other quantity the farmer can sell. The individual firm charges the same price of Tk. 15 for any quantity of the product it can sell. In other words, price or AR of the firm remains fixed at Tk. 15 when quantity of output of sold increases. As a result, the AR curve of a competitive firm becomes a horizontal line at the given market price. Panel A of Figure-6.1 shows the AR curve of a hypothetical competitive firm. In this diagram, price or AR is measured along the vertical axis and quantity sold along the horizontal axis. It can be seen from panel A of the Figure-6.1 that the price of the commodity is Tk. 15 if the firm sells 100 kg or 1000 kg or any other quantity the firm can produce using 100% of production capacity. One question still remains to be answered: How is the market price of Tk. 15 determined? The answer is given in paned B of Figure 6.1. The units of measurements in

both the panels of Figure 6.1 are the same along the vertical axes but the units are not, however, the same along the horizontal axes.

The units are 100 kg of rice along the horizontal axis of panel A and one billion kg of rice along the horizontal axis of panel B. The DD and SS curves are aggregate demand curve for and aggregate supply curve of the product respectively. It is shown in Panel B that the market price of Tk. 15 is determined at the intersection point of the aggregate demand and supply curves. We can conclude that the price determined in the market gives the horizontal price or AR curves of the firm.

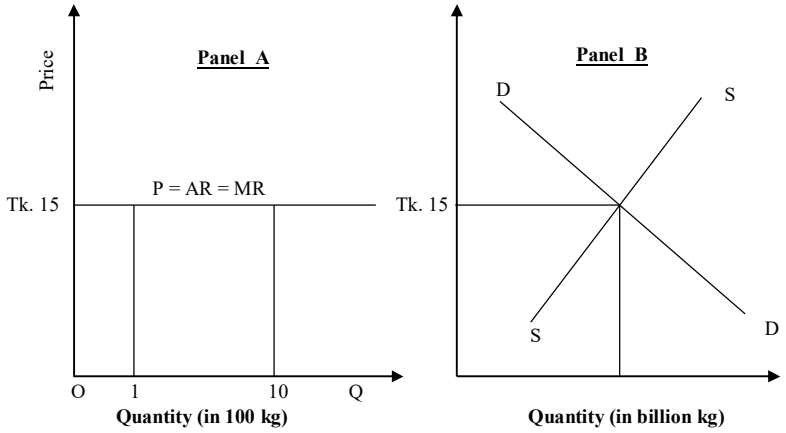


Figure 6.1: AR and MR Curves of a Competitive Firm

Having determined the shape of the AR curve, we now turn to the discussion of the shape of the MR curve of a competitive firm. Marginal revenue is the change in total revenue brought about by sale of one additional unit of output. Since a competitive firm sells all units of output at the same price, the additional total revenue from the sale of one extra unit becomes equal to price. If the firm sells 100 units of output at a price of Tk. 15, the 101th unit is also sold at the same price of Tk. 15. So that the additional revenue from the sale of that last unit of output also becomes Tk. 15. In other words, the MR curve of the firm coincides with the price curve or the AR curve of the firm. This is why the horizontal AR curve in panel A of Figure 6.1 has been labeled as the P = AR = MR curve.

Finally, we discuss the nature of the total revenue (TR) curve of a competitive firm. Since the competitive firm can sell any quantity of its output at a constant price, its total revenue will increase at a constant rate with the increase in the level of output. The result is that the total revenue curve will be a straight line starting from the origin as shown in Figure 6.2.

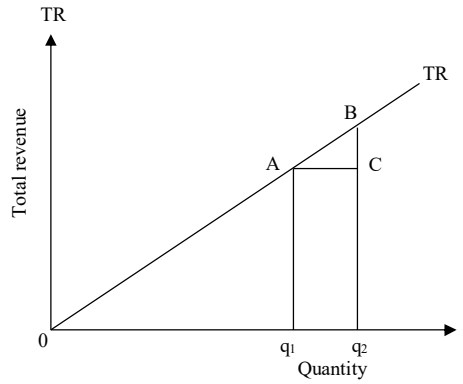


Figure 6.2: TR curve of a competitive firm

In the figure we measure TR along the vertical axis and quantity of output along the horizontal axis. The shape of the total revenue curve is important because it gives values of AR and MR at a particular level of output of the firm. Average revenue at a particular level of output is given by the slope value of a straight line joining the origin and the point at which a vertical line drawn upward from that particular level of output intersects the TR curve. For example, AR at q_2 is given by the slope of the line segment OB: $AR=Bq_2/Oq_2$. To find MR between two levels of output, we draw two vertical lines from the two levels of output to determine the points at which these vertical lines intersect the TR curve. The slope value of the line segment between these two intersection points gives the MR value. For example, MR between q_1 and q_2 in Figure 6.2 is given by the slope value of line segment AB : BC/AC.

Since line segment AB is a portion of line segment OB in Figure 6.2, both the line segments will have the same slope value. We come back to the previous conclusion: for a competitive firm both the AR and MR curves coincide with each other.

Review Questions

1. (a) What is a perfectly competitive firm?
   (b) What are the two characteristics that give rise to such a firm?
2. (a) What is the shape of the demand curve facing a perfectly competitive firm?
   (b) What is implied by such a demand curve?
3. What are the characteristics of perfect competition? Under what market conditions a firm is a price taker?
4. Write a short note on AR and MR curves of a competitive firm.

Lesson 2: Equilibrium of a Competitive Firm

Lesson Objectives

After studying this lesson, you should be able to:

- state when a competitive firm operates and when it shuts down in the short-run ;
- explain the profit maximizing conditions of a firm;
- state how a competitive firm determines its equilibrium level of output in the short-run; and
- state how a competitive firm determines its profit and shut-down point in the short-run.

Short-run Equilibrium of a Competitive Firm

We need to make one additional assumption about the competitive firms and explain one definition before we illustrate the profit-maximizing behavior of a firm. We assume that all firms in the industry face identical cost conditions so that the short-run and long-run cost curves are the same for all firms. As mentioned earlier, the goal of a competitive firm is to maximize its profit. A firm is said to reach its equilibrium when it maximizes its profit. The term 'equilibrium', often used in physical sciences, refers to a static position of a matter when opposite forces balance each other. A production firm also has no tendency to change its profit maximizing level of output.

A competitive firm makes changes in the level of output until it obtains maximum profit. Since at least one input of production is fixed in the short-run, changes in the level of output can be brought about by varying the level of its variable inputs. The firm has to make two decisions in the short-run:

- ***Under what conditions, is it profitable for the firm to continue its production activities?***
- ***If the firm decides to operate, how much output will it produce to maximize its profit?***

The first question is pertinent because in the short-run the firm may face market price which is less then short-run average variable cost (SAVC) at all levels of output. It implied that the market price is less than minimum average variable cost: P < minimum SAVC. Obviously, the firm incurs a loss which is equal to average fixed cost plus a fraction of SAVC. Total loss of the firm equals total fixed cost plus a portion of total variable cost if the firm continues to produce where as total loss equals total fixed cost (TFC) if the firm shuts down. Since the firm's total loss is less if it shuts down than it operates, it is reasonable to shut down when the market price goes below minimum AVC. Conversely, if the market price is greater than the minimum SAVC but less than short-run average total cost (SATC), at some levels of output price will be greater than SAVC. Then total loss of the firm will be less than TFC if the firm operates and greater than TFC if it stops producing. Therefore, a price lying between SATC and the minimum AVC pays the firm to stay in the production process, though it incurs a loss in the short-run.

Once a firm has decided to keep its production line busy in the short-run, its next task is to decide the profit maximizing level of output when P > SATC at all levels of output and to decide the loss minimizing level of output when the minimum SAVC < P < SATC. The profit

maximizing or loss minimizing level of output is known as equilibrium level of output since the firm cannot do better by producing any other quantity of output.

Deciding the Short-run Equilibrium Level of Output

The competitive firm is a price-taker. Moreover, it cannot change the quantity of at least one input in the short-run. It can only make changes in the level of output by changing the quantities of the variable inputs until the equilibrium level of output is determined. Suppose, at the initial output level of the firm, market price is greater than SATC so that it can make super normal profit. But the firm is not satisfied with the present level of profit - it wants more profit by increasing its output level. The firm makes a decision rule for itself to follow. It will increase its output by one unit each time if it can earn profit by doing so. It will stop increasing its output level when profit is zero or negative. The firm starts increasing its output level by one unit and finds that the addition to total revenue, known as marginal revenue (MR), is greater than the change is total cost, known as marginal cost (MC). The firm makes super normal profit from such a move and is tempted to increase the level of output further. With the increase in the level of output, MC decreases initially and then it increases whereas MR always remains the same. In the process of increasing its output level by one unit each time, the firm-owner notices that her/his MC is gradually increasing to the level MR. The firm, however, earns supernormal profit as long as MR remains greater than MC and the firm's total profit keeps increasing at that time. In the process, the firm reaches a level of output where MC equals MR, profit disappears, and total profit becomes the maximum. Further increase in the level of output will cause MC to be greater than MR yielding negative profit and reducing total profit of the firm. Total profit of the firm thus becomes the maximum when the following two conditions are satisfied:

Necessary Condition: MR = SMC

Sufficient Condition: MC increases at the level of output where MR = SMC.

The above conditions of profit maximization are universal and applicable in all market structures. Since in perfect competition P = AR = MR, the necessary condition can be rewritten as

P = AR = MR = SMC

In the preceding paragraphs, we have analyzed the economic reasoning underlying the profit maximizing conditions of a competitive firm. Application of these conditions to determine the profit maximizing or loss minimizing quantity of output of a competitive firm can be illustrated with the help of three devices: (i) the graphical method with MR and MC curves; (ii) the tabular method; and (iii) the graphical method with TR and TC curves.

The Graphical Method with MR and MC curves

The graphical method of determining the profit maximizing level of output with the help of MR and MC curves has been shown in Figure 6.3 with MR and MC measured along the vertical axis and quantity of output along the horizontal axis.

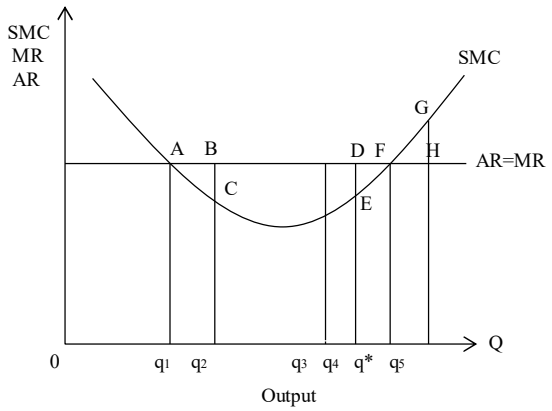


Figure 6.3: Profit maximization with MR and MC curves

Suppose, the market price of the commodity is P_0 which the firm accepts as fixed. The horizontal line at price P_0 is virtually the AR = MR curve of the firm. The SMC curve shows the nature of short-run marginal cost of the firm. Suppose, the firm's initial production level is q_3. If the firm decides to increase its output level to q_4, its MR becomes q_4D but its MC equals q_4E so that MR exceeds MC. The firm makes supernormal profit of Tk. DE from the last unit of output and its total profit increases. The firm increases its sale by one unit again to increase its total profit further. The process of increasing output level continues until the firm produces output level q^* where MR = MC. The firm earns no profit from the last unit and total profit turns out to be maximum at q^*. If the firm increases output to q_5, its MR falls short of MC. $q_5H < q_5G$. Profit becomes negative for the last unit of output sold and the firm's total profit decreases from the maximum level. If the initial output level were q_5, the firm would reduce it q*, which is the profit maximizing level of output in the figure. It is easily seen that at to q*, MR equals MC and MC is increasing in the neighborhood. At q_1, MR = MC but q_1 is not the profit maximizing level of output. An increase in the quantity of output from q_1 to q_2 leads to a fall in marginal cost from q_1 A to q_2B when MR remains fixed at the previous level of q_1A, i.e., $q_1A=q_2B$. Since the firm can make a profit of Tk. BC by increasing its sale level from q_1 to q_2, q_1 cannot qualify as the profit maximizing level of output. It is thus shown that MR = MC is only the necessary condition, not the sufficient condition, of profit maximization. The sufficient condition requires that the MC curve be increasing in the neighborhood of output level where MR = MC.

The Tabular Method

The process of determining the profit maximizing level of output can also be explained with the help of a table similar to that given below. The first column of the table shows the units of output. It is evident from the first column that the sale of the product is increasing by one unit each time. The price of the product, which is also MR of the firm, is assumed to be Tk. 25 for all units of output as shown in the second column. In the third column, we show MC which falls from an initial high level and then starts rising from a minimum level. The fourth column gives the amount of marginal profit obtained from successive marginal units of output. Satisfaction of necessary condition of profit maximization, MR = MC, yields zero profit for the marginal unit at the equilibrium point. Only the units before the marginal unit yield positive profits. Though we notice zero profit for the second and 6th units, the second unit cannot be the equilibrium output level. If output level is increased by one additional unit to 3 units, marginal cost decreases to Tk. 20 when MR remains at Tk. 25 so that the third unit brings profit of Tk. 5.

Table 6.1: Profit maximizing level of output of a competitive firm

Unit of output	P=AR=MR (Tk.)	MC(Tk.)	Marginal Profit (Tk.)	Total profit (Tk.)
1st	25	31	-6	-6
2nd	25	25	0	-6
3rd	25	20	5	-1
4th	25	18	7	6
5th	25	23	2	8
6th	25	25	0	8
7th	25	34	-9	-1
8th	25	40	-15	-16

Similarly, a profit of Tk. 7 can be earned from the 4th unit. The firm will increase its output level as long as it can earn a positive profit from sale of the last unit of output. At the sixth unit of output, MR equals MC yielding zero profit. It can be easily seen from Table 6.1 that profit becomes negative for output level beyond the sixth unit. Sixth unit of output becomes the profit maximizing level of output where MR = MC. Moreover, MC is found to increase in the neighborhood of the sixth unit of output. The fifth column of the table gives the amount of total profit which is calculated by adding the marginal profits of previous units to the marginal profit of the current unit. The maximum profit in this table is found to be Tk.8 at the sixth unit of output.

The Graphical Method with TR and TC Curves

Another method of determining the equilibrium level of output uses the total revenue and total cost curves. Figure-6.4 illustrates the use of these curves for finding the profit maximizing level of output. The vertical axis measures TC and TR in taka and the horizontal axis measures the level of output Q. The TR curve shows the changing pattern of total revenue of a competitive

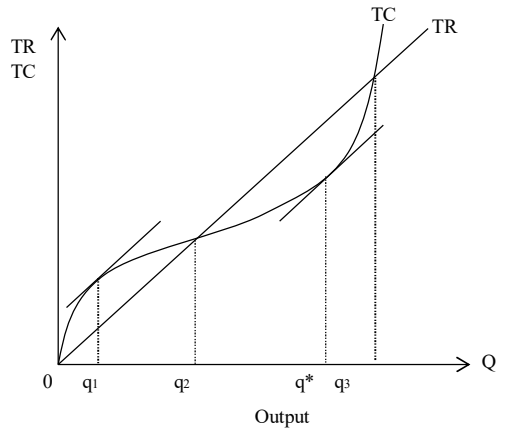


Figure 6.4: Profit maximization with TR and TC curves

firm and the TC curve shows the changing pattern of short-run total cost of a firm when output level increases. Profit is the difference between TR and TC so that the gap between these two curves measures total profit at different output levels. We observe that profit is negative up to q_2, positive between q_2 and q_3 and again negative after q_3 level of output. The maximum profit is obtained at output level q^*.

At q*, a tangent drawn on the TC curve becomes parallel to the TR curve indicating that the slope of the TC curve, which is MC, equals the slope of the TR curve, which is MR. Once again, we find that MR equals MC at the profit maximizing level of output. Moreover, the TC curve is found to be upward sloping and convex to the origin. The mathematical implication of upward sloping and convex to the origin TC curve is that MC is positive and rising in the neighborhood of equilibrium level of output. The slopes of the TC and TR curves, which are MC and MR values respectively, are also found to be equal at q_1, but this level of output maximizes loss, not profit. At q_1, the necessary condition of profit maximization is satisfied, but the sufficient condition is not satisfied.

Determining Profit and the Shut-down Point

In the preceding analysis, our primary concern was related to determination of the profit maximizing level of output. We discussed three equivalent methods of doing that and showed how to find the maximum profit in each of three cases. Here, we demonstrate another method of determining total profit with the help of short-run average total cost (SATC) and short-run average variable cost (SAVC) curves. Before doing that we must distinguish between the economists' definition of profit and the accountants' definition of profit. As we know, total profit is the difference between total revenue and total cost. The economists incorporate the opportunity cost of the entrepreneur as an item of total cost. The entrepreneur's opportunity cost is the nominal value of all financial and fringe benefits she/he could earn in her/his next best occupation. Instead of engaging himself full-time in organizing and managing the current firm,

the entrepreneur could work elsewhere in different capacities and earn some income as remuneration for her/his work in his next best occupation. She/he forgoes this income when she/he takes over as the entrepreneur of the current firm and the forgone income thus becomes the opportunity cost of her/his current occupation. The accountants do not include this opportunity cost in total cost of the firm, whereas the economists take this items of cost into consideration. According to the economists, the firm is said to earn normal profit when total revenue equals total cost inclusive of entrepreneur's opportunity cost. The firm earns supernormal profit if total revenue exceeds total cost and incurs loss if total revenue becomes less than total cost. A firm finds its short-run equilibrium level of output where the two conditions of profit maximization are satisfied. At the equilibrium output level, the firm may find itself in one of the five situations of profit. It may earn supernormal profit. or normal profit. It may also incur loss which may be less than, equal to, or greater than total fixed cost. The five situations of profit are demonstrated in five panels of Figure 6.5.

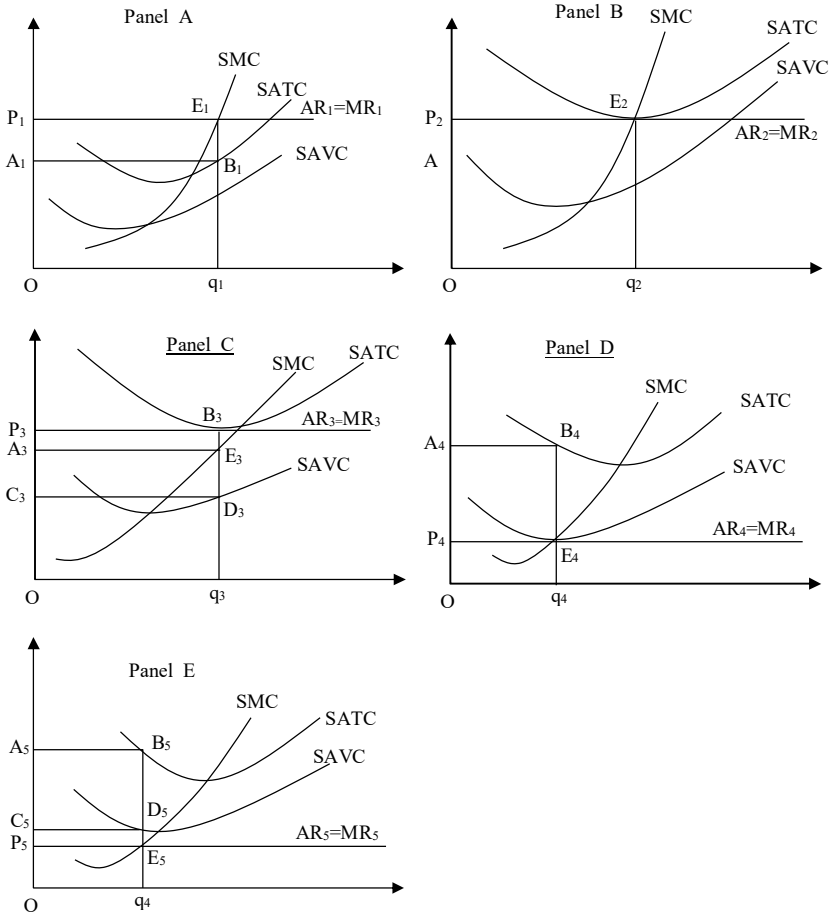


Figure 6.5: Five situations of profit

In each panel, we determine the equilibrium level of output of the competitive firm using the two conditions of profit maximization, viz, (i) MR = MC; (ii) MC is increasing.

In Panel A, equilibrium output is q_1 at which per unit profit is E_1B_1. Total profit at equilibrium output level is $E_1B_1A_1P_1$. Suppose, the market price falls to p_2 in panel B. The two conditions of profit maximization are satisfied at E_2 where price equals SATC yielding normal profit to the firm. If market price goes down further to p_3 in panel C, equilibrium output becomes q_3 corresponding to equilibrium point E_3. The firm, however, incurs loss at E_3, because, price q_3E_3 falls short of short-run average total cost q_3 B_3. Per unit loss is B_3 E_3 and total loss is $B_3E_3A_3P_3$. We know that the gap between the SATC and SAVC curves gives a measure of SAFC, which is B_3D_3 at equilibrium level of output. Multiplying B_3D_3 by quantity of equilibrium output q_3, we get total fixed cost equal to area $C_3D_3B_3P_3$ which is greater than total loss $B_3E_3P_3A_3$. Since the firm's operating loss $B_3E_3P_3A_3$ is less than the shut-down loss, which is equal to total fixed cost $C_3D_3B_3P_3$, the firm keeps its production activities running. In Panel D, the market price falls to the level of the minimum SAVC the firm incurs loss equal to total fixed cost $P_4E_4B_4A_4$ at equilibrium output q_4. The firm's total loss remains the same when it keeps operating it or it shuts down. In panel E, the market price of the commodity dips down further and goes below the minimum SAVC to P_5. Equilibrium output now becomes q_5 corresponding to equilibrium point E_5. The firm's total loss $P_5E_5B_5A_5$ will be greater than total fixed cost $C_5D_5B_5A_5$ if the firm continues its production activities but this loss will be equal to total fixed cost if it shuts down. The firm will, of course, shut down in such a situation.

The Long-Run Equilibrium of a Competitive Firm

In the long-run, a competitive firm can change all inputs of production. Moreover, new firms can enter and old firms can exit the industry. A firm keeps changing the plant of production in the long-run until the average cost of production becomes the minimum. In other words, the firm makes movements along the long-run average cost LAC and the long-run marginal cost LMC curves. We have already discussed the nature of long-run average cost curve and long-run marginal cost curve in Lesson-2 of Unit-4. These curves are used in determining the long-run equilibrium of the firm. We explain the long-run equilibrium of a competitive firm in Figure 6.6 which has two panels. As in previous figures, the vertical axes of the two panels measure production costs and price using the same unit of measurement. The horizontal axis measures the level of output in both panels, but unit of output level is much higher in panel B. We use small-letter q for the firm's output level in panel A and capital-letter Q for the industry output level in panel B. We have drawn the cost curves of a typical firm in panel A and the demand and short-run supply curves of the industry in panel B. Suppose, the initial market price is P_o, which is determined at the intersection point of the market demand curve D_oD_o and the initial short-run supply curve of the industry S_oS_o. The typical firm accepts the market price P_o as given and accordingly determines its equilibrium output level q_o corresponding to equilibrium point E_o. The firm makes supernormal profit equal to the area $A_oB_oE_oP_o$ in the short-run. Since we are considering the long-run equilibrium of the firm, we must take into account two types of market forces that work here. First, the typical firm will be tempted to increase its output level by increasing its plant size and start producing at q_1 corresponding to equilibrium point E_1, where the LMC curve intersects the MR= Price line. The supernormal profit of the firm increases from area $A_oB_oE_oP_o$ to $A_1B_1E_1P_o$. Remember that the adjustment of output is made along the LAC curve. Figure 6.6 demonstrates the behavior of a typical firm. If all firms behave in the same way under identical cost conditions, all firms of the industry increase their output levels causing the

short-run supply curve to shift upward. Observing the supernormal profit earned by each of the existing firms in the industry new firms will enter into the industry with a view to making supernormal profit. Increased production by each of the old firms and new firms will shift the short-run supply curve to the right until it shifts to S_1S_1. The new equilibrium for the industry as a whole is attained at the new

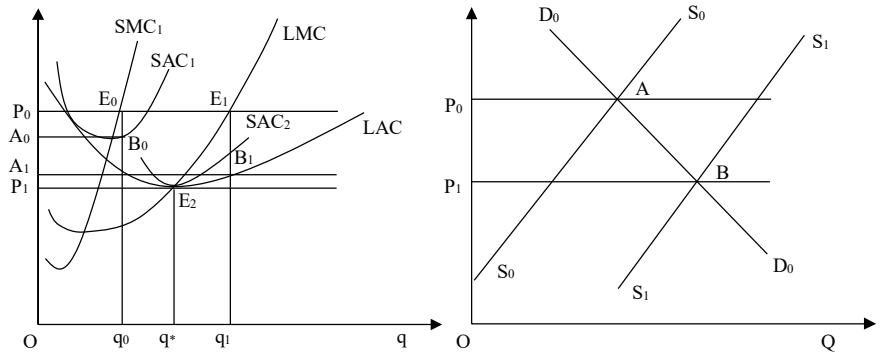


Figure 6.6: Long-run equilibrium of a firm

intersection Point B yielding a new market price P_1. An important feature of this new price is that a horizontal line at price level P_1 must be tangent with the LAC curve at its minimum point. The typical firm accepts the new price level P_1 as given and determines its new profit maximizing level of output q_* which yields normal profit for the firm. It is not a mere coincidence that the equilibrium point occurs at the minimum point of LAC. The market sets and monitors a few forces in the long-run to ensure the following features of long-run equilibrium of the firm:

(i) Each firm of the industry determines its equilibrium level of output according to the two conditions of equilibrium.

(a) MR = SMC = LMC.

(b) Both SMC and LMC will be increasing.

(ii) The Price line in the long-run equilibrium of the firm will be tangent to the LAC curve at its minimum point so that each firm earns only normal profit. This condition ensures that there will be no tendency for the new firms to enter into and for the old firms to leave the industry.

(iii) At the long-run equilibrium of the firm, market price will be determined such that the total demand from all consumers for the commodity will just be equal to the total supply of the commodity.

In Figure 6.6, these three conditions are met if the typical firm and hence each firm produces the output level q* at the minimum point of the LAC curve and uses the optimum plant with the short-run average cost curve SAC_2. Here, the long-run price level P_1 is equal to the minimum LAC.

Review Questions

1. Explain the short-run equilibrium of a competitive firm. When would a competitive firm close down its business in the short-run?
2. Show how under the condition of perfect competition in the long-run, the price of a commodity equal to its average and marginal cost.
3. Write a short note on the relationship between firm's short-run cost curves and supply curve.
4. Explain the long-run equilibrium of a competitive firm. Does a competitive firm incur loss in the long-run?

Unit 7: MONOPOLY

Highlights

- ❑ Nature of Monopoly
- ❑ AR & MR curve in Monopoly Market
- ❑ Equilibrium of a Monopolist
- ❑ Comparison between Monopoly and Perfect Competition
- ❑ Measures of Monopoly Power
- ❑ Regulating the Monopoly.

Technologies Used for Content Delivery

- BOUTUBE
- BOULMS
- WebTV
- Web Radio
- Mobile Technology with Micro SD Card
- LP+Office365
- BTV Program
- Bangladesh Betar Program

Lesson 1: Nature of Monopoly Market and AR and MR Curves in Monopoly Market

Lesson Objectives

After studying this lesson, you should be able to know:

- the characteristics of a monopoly market;
- why a monopoly market endures;
- the shapes of the AR and MR curves under monopoly market; and
- relationship between AR, MR and price elasticity in a monopoly market.

Nature of Monopoly Market

In a monopoly market, only one producer sells a homogeneous commodity to all buyers in the market. Moreover, no substitute goods for the commodity of the monopolist are available in the market. The above definition of monopoly market brings out two basic ingredients: sole ownership of industry of the commodity in absence of substitute goods. Both these criteria need further qualification. There are examples of commodity markets each of which has a single seller but substitutes for each commodity are readily available in the market. For example, one can

consider Bangladesh Telegraph and Telephone (T&T) Board as a monopoly for telephone services in the country. But in Bangladesh people use other devices of communication like FAX, e-mail, courier service, etc., for fast and ensured passage of information. These devices of communication serve as substitutes for telephone services, though these are not perfect substitutes. Since it is very difficult to find a commodity without substitutes, pure monopoly market as defined above is rare in the real world. Though each commodity must face competition from its substitutes, the degree of substitutability varies among different pairs of commodities. Two commodities may be close substitutes as in case of two tooth-paste brands or these commodities may be distant substitutes like electric bulb and candle when used for lighting rooms. Alternatively, the same two commodities, electric bulb, and candle may be close substitutes when used for lighting. The degree of substitutability is also dependent on time. A commodity might not have close substitutes at present, but such substitutes may eventually be developed in future in response to higher price of the commodity charged by the monopolist. It is, therefore, the degree of substitutability rather than availability of substitutes which should be used as a criterion in the definition of monopoly market. Lack of precise measurement of degree of substitutability between two commodities may give rise to subjectivity and value judgments in the process of defining monopoly market in reality. The second element about ownership of production enterprise can also be changed. Two or more producers can form a monopoly market if they merge together to form a joint firm and act in concert to take price and output decisions like a monopolist.

Now that we have defined a monopoly market, the next question that arises is why does a monopoly market endure once it has been created? The answer is simple: A monopoly market exists because barriers to entry into market prevent other firms from entering and competing with the monopolist. These barriers to entry can take different forms.

Sometimes a firm might have sole ownership of an important input to a product, which makes the firm the only producer and seller of the product. The barriers may be created by legal authorities. In some cases, the government permits only one firm the right to produce and sell a commodity or service. The license to run a restaurant in a railway station is an example of a local monopoly created by legal authority. Another legal monopoly is patent, which is legal protection of an innovation given out to a firm or a person for the time, energy, and merit expended on the innovation. A patent allows the patent holder to be a monopoly in using the innovation. Patent is given to encourage research and development activities. New firms cannot attain the level of technological progress profitably utilized by the monopolist. Lack of advance technology acts as a barrier to entry. Barriers to entry are also created by natural monopolist. A natural monopolist enjoys economies of scale in the form of falling average and marginal costs with increase in the level of output. These economies of scale disappear if monopoly is abolished and two more firms share the market. As a result, the monopolist can drive away the potential competitors. Natural monopolies occur in the case of production enterprises with very large amount of overhead costs compared to minimal variable cost.

Nature of AR and MR Curves

Since there is one producer in monopoly market, the monopolist has enough power to exert control over price or output. She/he is not a price taker like the competitive firm; rather she/he is a price-maker. She/he can set the price of the commodity at any level she/he likes. She/he can charge a higher price or she/he can be satisfied with a low price. Though the monopolist can set the price, she/he cannot set simultaneously the quantity she/he will sell at the predetermined price. The consumers are sovereign and it is to the consumers to decide how much output to demand and consume at the given price. Normally the consumers are supposed to be guided by the principle of equi-marginal utility which requires that marginal utility per taka spent on each commodity be equal. Other things remaining the same, consumers demand and consume more at a low price and less at a higher price. The monopolist cannot force the consumers to buy more at a high price. Ultimately the monopolist finds that she/he can sell more if she/he sets a low price and can sell less if she/he sets a high price. Alternatively, the monopolist can set the amount of

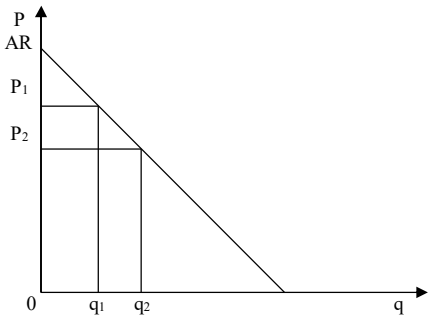


Figure 7.1: AR curve of the monopolist

her/his sale and leave the price to be determined by the consumers' preferences. This time, the monopolist observes that the consumers are willing to pay a lower price at a higher level of sale and a higher price at a lower level of sale. This means that the average revenue curve of the monopolist, which is demand curve of the consumers, is a downward sloping curve. A typical AR curve of the monopolist is shown in Figure 7.1 with AR or price measured along the vertical axis and quantity sold or quantity demanded along the horizontal axis.

As it can be seen from the Figure, the monopolist can sell q_1 if she/he sets the price at P_1 and q_2 if she/he sets the price at P_2. The final result is that the AR or price always falls with increase in the level of output sold.

Let's now discuss the shape of the MR curve in a monopoly market. In the case of perfect competition, the firm can sell any amount of the commodity within its capacity at a constant

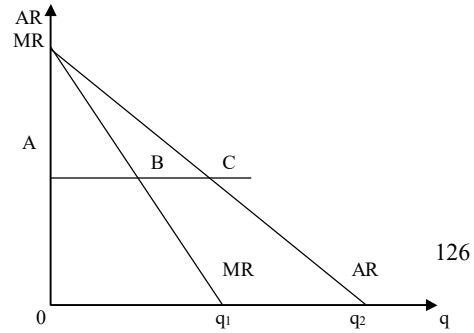


Figure 7.2: AR and MR curve of the monopolist

price. As a result, price equals marginal revenue for a competitive firm. The monopolist has to reduce the price level if she/he wants to sell one extra unit. If she/he didn't want to sell the extra unit, she/he could get the higher price for all previous units. Now that she/he sells one more unit, she/he gets a lower price for all previous units as well as for the extra unit. The change in total revenue from the sale of last unit or MR of the monopolist will be less than the price of the last unit because she/he is getting a lower price on each of the previous units. In fact, MR will be equal to price of the last unit minus the total loss due to a low price on all previous units. It means that when AR falls with the increase in output sold, MR becomes less than AR at all levels of output except at the starting point. We state an additional result without proving that the MR curve always lies at mid- point between the price axis and the straight line AR curve.

Figure 7.2 shows the positions of the AR and MR curves of a monopolist. It shows that the MR curve lies below the AR curve at all levels of output between O and q_1. After output q_1, MR, however, becomes negative whereas AR becomes negative after output q_2. Draw a horizontal line that interscts the MR and AR curves from point A on the vertical axis. It can be seen that AB = BC, which shows that the MR curve lies halfway between the price axis and the AR curve. The nature of the AR and MR curves and the relationship between them can also be explained with the help of a table. Table 7.1 shows the values of AR = Price, TR and MR for a hypothetical commodity of a monopolist.

Table 7.1: Relationship among AR, MR and TR

AR = Price	Output = q	TR = AR.q	MR= ΔTR/Δq
40	10	400	
38	11	418	18
36	12	432	14
34	13	442	10
32	14	448	6

As we can see from Table 7.1, the monopolist's initial sale is 10 units of output at price of Tk. 40 yielding a total revenue of Tk. 400. To sell one more unit of the commodity, the monopolist has to lower the price from Tk. 40 to Tk. 38. Total revenue now stands at Tk. 418 giving the marginal revenue of Tk. 18. We find that marginal revenue is less than price Tk. 38 at which 11 units were sold. The monopolist lost Tk. 2 (Tk. 40 - Tk. 38) on each of the previous 10 units so that her/his total loss on previous units amounts to Tk. 20 (10 × Tk. 2). Deducting the loss of Tk. 20 from the price of Tk. 38 for the last unit, we get the marginal revenue of Tk. 18 (Tk. 38 - Tk. 20). We notice from the table that MR is less than AR = Price at all levels of output starting from the 11th unit. For example, at 13 units of output, AR is Tk. 34, whereas MR is Tk. 10. Here, both the AR and MR values are found to decrease with the increase in the quantity of output. Moreover, the rate of decrease of MR is Tk. 4 which is two times Tk. 2, the rate of decrease of AR. This is not a mere coincidence. The values of AR and q in Table-7.1 have been chosen such that these values correspond to a straight line downward sloping AR curve. In the case of linear AR curve, the rate of fall of MR is always double the rate of fall of AR. We can summarize the results on the shapes of the AR and MR curves in a monopoly market as follows:

(i) Both the AR and MR curves are downward sloping;

(ii) The MR curve falls at a faster rate than the AR curve; and

(iii) In the case of a straight line AR curve, the rate of decrease of the MR curve is always double the rate of decrease of the AR curve.

Relationship Among AR, MR, and Price Elasticity

We derive an equation that shows how AR, MR and price elasticity of demand are related with each other. Figure 7.3 is used for this purpose.

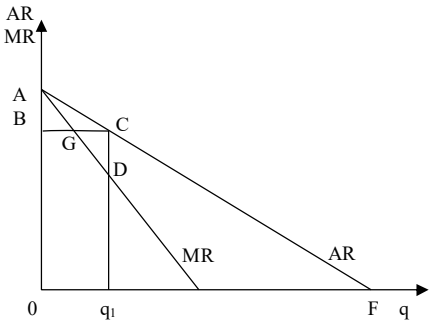


Figure 7.3: Relationship among AR, MR and price elasticity

We have drawn linear AR and MR curves in the diagram. As mentioned earlier, the MR curve corresponding to a linear AR curve always lies halfway between the vertical axis and the AR curve. Hence BG = CG. Consider triangles ΔABG and ΔCDG. We find the following equalities:

< ABG = < DCG (Right Angles).

< AGB = < CGD (Opposite Angles)

BG = CG

Thus ΔABG = ΔCDG

∴ AB = CD

Now Δ ABC and Δ Cq_1F are similar triangles.

$$\therefore \quad \frac{FC}{AC} = \frac{q_1C}{AB} = \frac{q_1C}{CD}$$

But $\frac{FC}{AC} = E_P$

where E_P is the absolute value of price elasticity of demand.

We get,

$$E_P = \frac{q_1C}{CD} = \frac{q_1C}{q_1C - q_1D} [\because CD = q_1C - q_1D]$$

But

q_1C = AR or price (p) at q_1

q_1D = MR at q_1

Therefore, $E_P = \frac{AR}{AR - MR}$

Rearranging we get,

$MR = AR\left(1 - \frac{1}{E_P}\right)$

From the above equation, we get the following results:

$MR = 0$ when $E_P = 1$

$MR > 0$ when $E_P > 1$

$MR < 0$ when $E_P < 1$

Review Questions

1. (a) How does an imperfectly competitive firm differ from one that is perfectly competitive?
   (b) If an imperfectly competitive firm wishes to increase quantity sold, what must it do to price?
2. What is monopoly and how does its definition depend on how the industry is defined?
3. Bangladesh Railway is generally given exclusive right to provide rail transportation service throughout the country. Is Bangladesh Railway a monopolist? Explain.
4. (a) What is marginal revenue (MR) and why is MR less than price for a firm facing a downward-sloping demand curve?
   (b) Draw a demand curve facing a monopoly firm and its corresponding marginal revenue curve. Do the same for a perfectly competitive firm.
5. Explain the sources of monopoly?

Lesson 2: Price and Output Determination under Monopoly: Equilibrium of Monopolist

Lesson Objectives

After studying this lesson, you should be able to:

- determine profit maximizing levels' of output and price in the short-run;
- determine profit maximizing levels of output and price in the long-run;
- why a monopolist does not have a supply curve; and
- the rule of thumb for pricing in monopoly.

Short-Run Equilibrium of a Monopolist

Like a firm owner in perfect competition, a monopolist undertakes production activities with the sole objective of maximizing profit. The conditions of profit maximization here are the same as in perfect competition:

Necessary condition: MR = SMC

Sufficient condition: SMC increases in the neighborhood of equilibrium point

The intuitive explanation is simple. Total profit will increase as long as the addition to total revenue (MR) is greater than the addition to total cost (SMC) when the firm increases its output level by one unit at each step. In other words, total profit increases as long as MR remains greater than SMC. The SMC curve initially falls and then rises with increase in the level of output whereas the MR curve is downward sloping in monopoly market. It means that the monopolist will face a level of output where SMC equals MR. At this level of output, marginal profit is zero and total profit is the maximum. If the monopolist increases her/his output level by one unit beyond the profit maximizing level, MC becomes greater than MR yielding negative marginal profit and making total profit less than the maximum.

The preceding discussion shows how the profit maximizing conditions developed earlier in the context of perfect competition remains valid in the case of monopoly. There is, however, one difference between the monopoly and competitive equilibrium points, with regard to the price level at equilibrium point. Since price or AR is greater than MR in monopoly market, price will be higher than both MR and MC at the monopoly equilibrium. The extended condition of profit maximization in monopoly market can then be rewritten as Price > MR = SMC.

In perfect competition, price equaled SMC at the equilibrium level of output. We now turn to graphical presentation of short-run equilibrium of the monopolist. In monopoly, the question of entry and exit of firms does not arise in the long-run. The monopolist changes its output and price levels by changing its plant size in the long-run. Since the monopolist cannot change the plant size in the short-run, she/he can bring changes in her/his output level by changing the variable inputs of production. Figure 7.4 shows that the monopolist can face any of the four situations of profit in the short-run. These four situations have been depicted in four panels of Figure 7.4. The vertical axis in each of the four panel measures short-run costs, price and MR, whereas the horizontal axis measures output level. In each panel, the equilibrium output is determined corresponding to the point where the SMC curve intersects the MR curve. A vertical line drawn from the equilibrium point to the output axis determines the profit maximizing level

of output. The vertical line is then extended upward to the AR curve to find the price level at the equilibrium level of output. The point at which the vertical line intersects the SATC curve is also located and the difference between the AR and SATC curves is taken as a measure of profit per unit of output. Multiplying the profit per unit of output by the equilibrium level of output gives the maximum total profit.

In panel A, the equilibrium point is E_1 which determines the equilibrium output q_1. Price is q_1 A_1 or P_1 and average cost is q_1B_1 so that profit per unit of output becomes A_1B_1 and total profit becomes $P_1A_1B_1C_1$. In panel B, equilibrium output is q_2 corresponding to equilibrium point E_2. Both AR and SATC here are equal to q_2 A_2 yielding normal profit for the monopolist. In Panel C, equilibrium output is q_3 at which price q_3A_3 is less than average cost (SATC) q_3B_3.

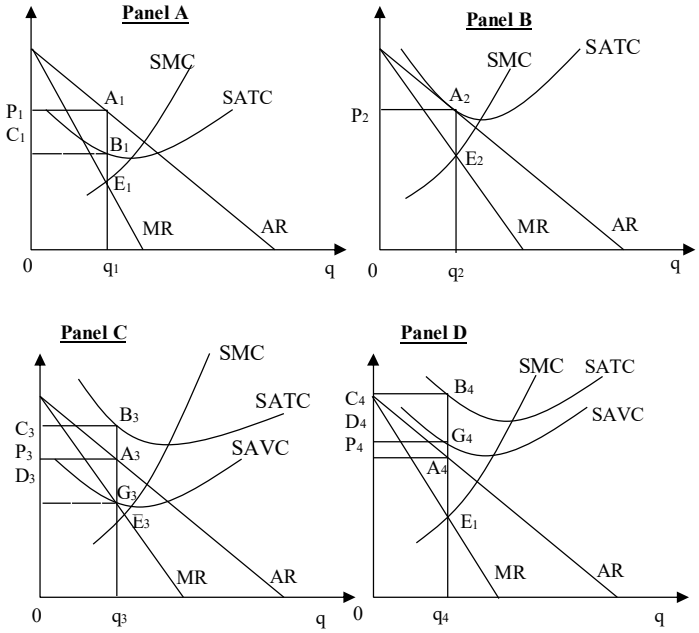


Figure 7.4: Four situations of profit in monopolist's short-run equilibrium

The monopolist incurs a loss of B_3A_3 per unit of output and her/his total loss is $P_3A_3B_3C_3$. Since the monopolist's total loss is less than her/his total fixed cost $D_3G_3B_3C_3$, it means the portion $D_3G_3A_3P_3$ of his total fixed cost is being covered in the short-run. Since the monopolist's loss becomes less when she/he runs the production firm than when she/he shuts down, it pays the monopolist to keep the firm open in the short-run. In panel D of the figure, the loss minimizing level of output q_4 dictates a price level of q_4A_4 which is even less than short-run average variable cost (SAVC) of q_4G_4. The monopolist's total loss will be equal to total fixed cost when it shuts down and it will be more than total fixed cost when it operates. Since the monopolist's total loss

becomes more when it operates than when it shuts down, he would certainly shut down her/his plant in a situation depicted in panel D.

Long-run Equilibrium of the Monopolist

In the long-run, the monopolist can change her/his plant in order to increase her/his profit. The monopolist does not run with any risk of losing profit due to entry of firms in the long-run. Different types of barriers to entry successfully prevent new firms from entering the monopoly market.

The monopolist tries to maximize her/his profit lying within the constraints of given demand and cost conditions. Her/his choice of output and price levels change when these constraints change. Depending on the nature of demand and cost conditions, the monopolist may make supernormal profit or normal profit, but she/he will never incur a loss in the long-run. At the worst situation, the monopolist may quit the production process in the long-run. Unlike the competitive firm, in the long-run, the monopolist may not produce at the minimum point of LAC. The monopolist may produce at the optimum plant or at less than optimum plant or at more than the optimum plant. The long-run equilibrium of the monopolist is attained when the following two conditions are met:

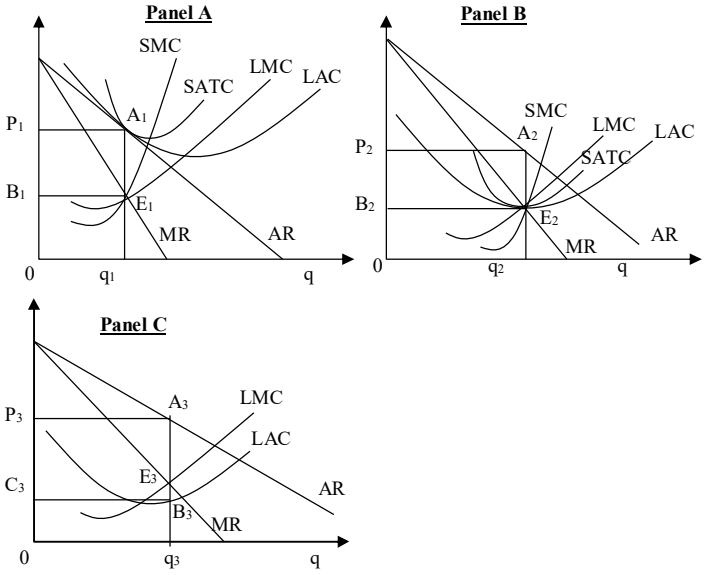


Figure 7.5: Long-run equilibrium of monopolist

Necessary condition: SMC = LMC = MR < Price

Sufficient condition: LMC and hence SMC increases at the neighbourhood

The long-run equilibrium of the monopolist can be characterized by one of the three probable situations shown in three panels of Figure 7.5.

In Panel A, the equilibrium point E_1 gives rise to equilibrium output q_1. At equilibrium level of output, both price and long-run average cost are equal to q_1A_1 so that the monopolist earns only normal profit. The monopolist is, however, producing at less than the optimum plant in the long-run. In panel B, the conditions of profit maximization are met at point E_2, which is also the minimum point of LAC. The firm is producing at the optimum plant in the long-run. At equilibrium output q_2, price q_2A_2 is found to be greater than long-run average cost q_2E_2 so that the monopolist earns supernormal profit equal to the area $B_2E_2A_2P_2$. In panel C, profit maximizing level of output is q_3 corresponding to long-run equilibrium point E_3. It is easily seen that the equilibrium output q_3 is produced by using a plant larger than the optimum plant. At q_3, price is q_3A_3 and long-run average cost is q_3B_3 yielding a total profit equal to area $C_3B_3A_3P_3$. Examination of the three diagrams in Figure 7.5 reveals two facts about the monopolist. First, a monopolist in the long-run equilibrium may use or may not use the optimum plant of production. Second, in the long-run, the monopolist may earn normal profit or supernormal profit, but she/he will never incur loss.

The Monopolist Does Not Have a Supply Curve

In perfect competitions, the firm is a price taker. The competitive firm tries to maximize its profit by adjusting its output level to given price level which is determined at the intersection point of the industry demand and supply curves. When the price level changes due to changes in demand and supply conditions, the competitive firm also changes its output level to obtain maximum profit in the changed situation. There is thus a relationship between price and quantity supplied by a competitive firm, which is shown by the firm's supply curve. The monopolist is a price maker. He can set one of the price and output levels and leave another to be determined by the consumers' preferences. When demand conditions change, her/his profit maximizing level of output may be different, but the price level may remain the same as before. Alternatively, shifts in demand curves may lead to change in price with no change in output. Finally, changes in demand may lead to changes in both price and output. In other words, there is lack of a definite relationship between price and output of a monopolist. Figure-7.6 shows how shifts in AR and MR curves give rise to the same price with change in output or to the same output with change in price. In panel A, the initial average revenue and marginal revenue curves are AR_1 and MR_1, respectively. With the straight line

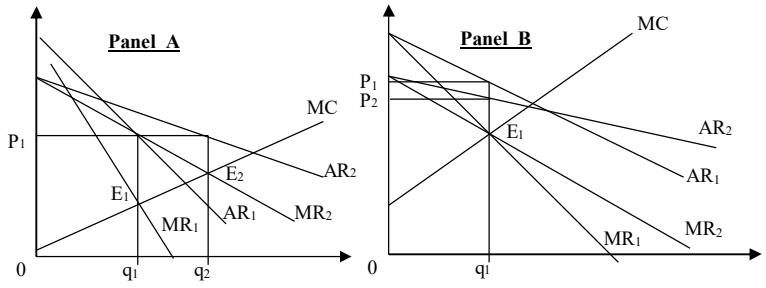


Figure 7.6: Effects of changes in demand conditions

marginal cost curve MC, the initial equilibrium point is E_1, which gives rise to equilibrium

output q_1 and equilibrium price P_1. Suppose the AR curve shifts to AR_2 with the corresponding change of the MR curve to MR_2.

The new equilibrium point E_2 leads to a different equilibrium output level q_2, but the price level remains the same as before at P_1. In panel B_1, the initial average revenue and marginal revenue curves AR_1 and MR_1 give rise to output level q_1 and price level p_1 corresponding to equilibrium point E_1. The equilibrium point remained the same after change in AR and MR curves to AR_2 and MR_2 respectively. Profit minimizing level of output remained the same as before at q_1, but the price level changed to P_2. Changes in demand conditions lead to changes in price with output remaining the same. These results support the view that the monopolist does not have a supply curve.

Rule of Thumb for Pricing in Monopoly

We derived the profit maximizing conditions for a monopolist. The two conditions are as follows:

(i) MR = SMC

(ii) SMC increases in the neighborhood of equilibrium point.

Most managers of production firms are not familiar with the concept of marginal revenue and they might have information on marginal cost over a limited range of output. We would like to translate the profit maximizing conditions of a monopolist into a rule of thumb that can easily be applied in everyday decision making process. We use the equation on the relationship between price and marginal revenue derived in the last section:

$$MR=AR\left(1-\frac{1}{E_P}\right)$$

Since in equilibrium MR = SMC, the above equation can be rewritten as

$$SMC=AR\left(1-\frac{1}{E_P}\right)$$

Rearranging and writing p for AR and MC for SMC, we get,

$$\frac{P-MC}{P}=\frac{1}{E_P}$$

The left-hand side of the above equation shows price as a mark-up over the marginal cost as a percentage of price.

The profit maximizing level of price in a monopoly market can be regarded as a process of mark-up pricing. The right hand side of the equation, however, sets a limit on mark-up pricing by the monopolist. The mark-up of price over marginal cost as a percentage of price is equal to the inverse of price elasticity of demand. The percentage of mark-up pricing increases with decrease in price elasticity of demand. Equivalently, the equation can be rearranged to give.

$$P=\frac{MC}{1-\frac{1}{E_P}}$$

In perfect competition, price elasticity of demand is equal to infinity for a firm ($E_P = \infty$). Hence, we get price equal to marginal cost (P = MC) at the equilibrium level of output. In monopoly, the AR curve is downward sloping so that price elasticity of demand is less than infinity ($E_P < \infty$). In that case price becomes equal to some multiple of marginal cost. In other words, price becomes greater than marginal cost (P > MC) in a monopoly market.

Review Questions

1. Explain the equilibrium of a monopoly firm in the short-run. Is monopoly price always higher than the competitive price?
2. Explain the equilibrium of a monopoly firm in the long-run.
3. How is pricing under monopoly different from that under perfect competition? Can a monopoly firm fix any price for its product?
4. A monopoly firm may earn normal or abnormal profits or may even incur losses in the short-run. Do you agree with this statement? Give reasons for your answer.
5. Why is monopoly considered socially undesirable?
6. Unlike a firm under perfect competition, a monopolist does not have a supply curve. Discuss.
7. Compare monopoly and perfect competition with regard to the following: price
   (i) output
   (ii) welfare
   (iii) relationship between MC and price

Lesson 3: Monopoly Power, Regulating the Monopoly and the Comparison Between Competitive and Monopoly Markets.

Lesson Objectives

After studying this lesson, you should be able to:

- compare between competitive and monopoly markets;
- state the measures of monopoly power; and
- state how the monopoly can be regulated.

Comparison Between Competitive and Monopoly Markets

Here we compare the monopoly market with the competitive market and note its implications for social welfare of the country. We use Figure 7.11 for this comparison. In the figure, the AR and

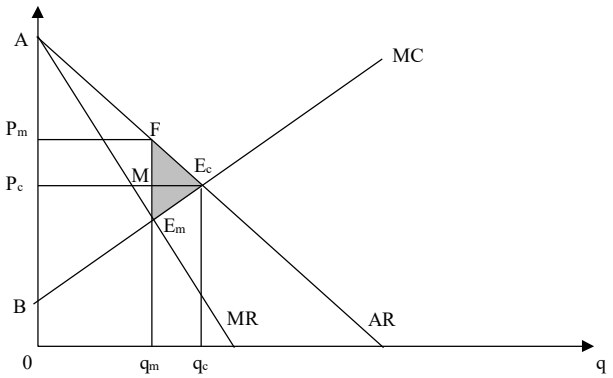


Figure 7.11: Comparison between competitive and monopoly market

MR curves represent the average

the revenue and marginal revenue curves of the industry when we take the case of perfect competition. Alternatively, the AR and MR curves represent the average revenue and marginal revenue curves of the monopolist. Suppose, initially, the market was competitive. Since in competitive equilibrium price equal marginal cost, the Point E_c in Figure 7.11 represents the competitive equilibrium yielding competitive output q_c and the competitive price P_c. Under perfect competition, consumer's surplus is equal to the area of the triangle ΔAP_cE_c and producer's surplus is equal to the area of the triangle ΔBE_CP_C. Now suppose the competitive market turns into monopoly market for reasons not mentioned here. The equilibrium Point under monopoly market becomes E_m where the MC curves intersect the MR curve. Monopoly output and price are q_m and P_m, respectively. As we can see in the figure, the immediate effect of the transformation of the competitive market into the monopoly market is a reduction in output and a rise in price. Consumer's surplus decreases by an amount equal to the area of the trapezium $P_mP_cE_cF$ of which the amount represented by the area of rectangle P_mP_cMF goes to the monopolist in the form of higher price. There is a redistribution of income from the consumers to

the monopolist. the rectangle P_mP_c MF is a portion of the loss of consumer's surplus compensated by the gain to the monopolist, but the loss shown by the area of the triangle FME_c is not compensated. Due to reduction in output, the producer loses total revenue equal to the area of the rectangle qm ME_cq_c of which the area of the trapezium $q_mE_mE_cq_c$ represents savings in total cost of the producer. The area of the triangle ME_mE_c is not compensated by savings in cost. Total loss of the economy which cannot be compensated by any gain due to the emergence of a monopoly market is equal to the area of the triangle FE_mE_c, which is known as the ***dead weight loss*** of the monopoly. It is the presence of this deadweight loss of monopoly which instigates most of the public opinions against monopoly. Even most economists publicly claim their dislike for monopoly markets and would like the monopoly markets to be regulated by the government authorities.

Measures of Monopoly Power

Earlier we derived rule of thumb followed in monopoly pricing. Pricing at the maximum profit was shown to be equivalent to mark-up pricing where the mark-up is the difference between price and marginal cost. This mark-up expressed as a percentage of price is equal to the inverse of absolute value of price elasticity of demand. The ratio of mark-up to price was used as a measure of monopoly power by economist *Ababa Lerner* in 1934 and is called ***Lerner's degree of monopoly power:***

$L = (P-MC)/P = (1/Ep)$

Here Ep is the absolute Value of price elasticity of firm's demand. In the case of perfect competition, price equals marginal cost making the measure of monopoly power L zero. Equivalently, substitution of an infinite value of Ep for a competitive firm makes L zero.

Two other measures of monopoly power frequently used are the ***concentration ratio*** and the Herfindhal ***index***. The concentration ratio expresses total output of the top firms of the industry as the percentage of the total industry output. There may be many concentration ratios depending on how many top firms are being considered for calculating these ratios. The most commonly used concentration ratio is four-firm concentration ratio which considers output of the top four firms of the industry for calculating the concentration ratio. The market is a monopolistically competitive market for a concentration ratio of less than 40%, an oligopoly market for concentration ratio between 40% and 60% and a monopoly market for concentration ratio greater than 60%. One problem with concentration ratio is that it shows the share of four firms' output in total industry output without giving any information about share of each firm. The Herfindahl index is calculated by summing the squares of all firms, percentage shares in total industry output. The US Department of Justice considers a Herfindahl index of less than 1000 as an evidence of competitiveness of an industry. An industry having a Herfindahl index greater than 1000 is deemed to possess monopoly power.

Regulation of Monopoly

A lower level of output sold at a higher price is the undesired effect of a monopoly market. A monopoly market also gives rise to deadweight loss to society as well as a redistribution of income in favor of the monopolist. The harmful effects of monopoly necessitate regulation of

monopolies taking the long-run equilibrium of the competitive firm as a benchmark. The three features of long-run equilibrium of a firm under perfect competition are as follows:

1. Price equals marginal cost eliminating monopoly power,
2. The firm earns normal profit eliminating supernormal profit
3. The firm produces at the minimum LAC eliminating excess capacity.

Regulation of monopolies can take different forms depending on the relative positions of the demand and cost conditions of the monopolist. It also depends on which of the two desired features of the competitive equilibrium the authority wants to achieve through the regulation of monopolies. We select three specific situations of relative positions of the demand and cost conditions of the monopolist and examine how the desired features of the competitive equilibrium can be attained. The three specific situations are as follows:

1. The AR curve intersects the MRC curve above the AC curve.
2. The AR curve intersects the MC curve below the AC curve.
3. The case of natural monopoly where both the AC and MC curves are downward sloping.

First Case: The intersection point of the AR and MC curves lies above AC.

We illustrate the first situation with the help of Figure 7.12 E_m is the equilibrium point of the profit maximizing monopolist whose output and price are q_m and P_m respectively. Since AR>AC at the equilibrium output q_m, the monopolist is earning supernormal profit. The regulatory

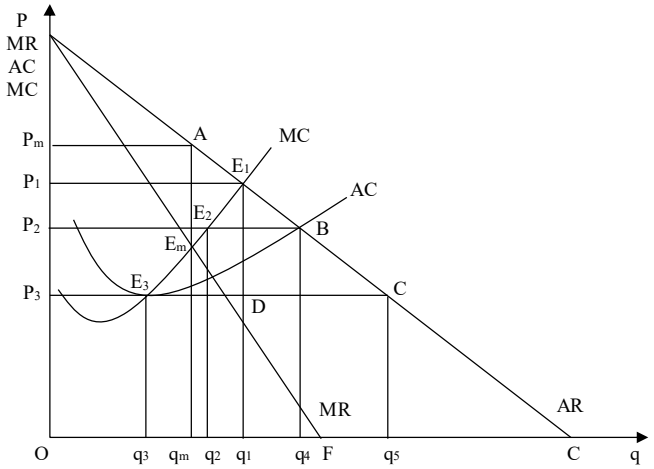


Figure 7.12: Regulation of monopoly

agency of the government can fix the price at p_1 corresponding to Point E_1 on the AR curve where price equals marginal cost. The effective marginal revenue curve then becomes P_1E_1DF with the discontinuous portion between E and D. The effective marginal revenue curve intersects the MC curve at E_1, which determines the output q_1. Though the monopolist is still earning supernormal profit at the regulated price P_1, monopoly power has been reduced to zero form the initial level of AEm/P_m. If the regulatory agent wants to eliminate supernormal profit, it can set

the price P_2 corresponding to the Point where price equals average cost. The horizontal straight line P_2E_2B then becomes a portion of the effective marginal revenue curve which intersects the MC curve at E_2. The equilibrium output is q_2 corresponding to the Point E_2. Since the regulated price P_2 is equal to MC at E_2, monopoly power is still zero, but supernormal profit has not been eliminated altogether. Moreover, an excess demand for the commodity by an amount q_2q_4 develops at the regulated price p_2. If price is regulated at further low levels, supernormal profit decreases and excess demand for the commodity increases. If price is regulated at P_3, equilibrium occurs at E_3, the minimum Point of the average cost curve AC. Both the monopoly power and supernormal profit of the firm disappear at equilibrium output q_3, but excess demand for the commodity increases to the level of q_3q_5. If price is set below P_3, the level of minimum average cost, the monopolist cannot break even and goes out of business. Regulation of monopoly should be handled cautiously because excess demand for the commodity develops when price is set below the level which eliminates monopoly power. There will be a tendency in the market to evade such price regulations and the cost of monitoring price regulation may indeed be very high.

Second Case: ***The intersection Point of the AR and MC curves lies below AC***

The situation mentioned above has been depicted in Figure 7.13. The price and output levels of profit maximizing monopolist are found to be q_m and p_m respectively given by the equilibrium Point E_m. Since at the equilibrium level of output AR>AC, the monopolist is making supernormal profit if the regulatory agency aims at abolishing supernormal profit here, it will set the price at p_1 corresponding to the Point B where average revenue equals average cost. At the regulated price p_1, the marginal revenue becomes p_1BE_1CDFG of which the portion E_1C is discontinuous. The MC curve intersects the new marginal revenue curve at E_1, which determines

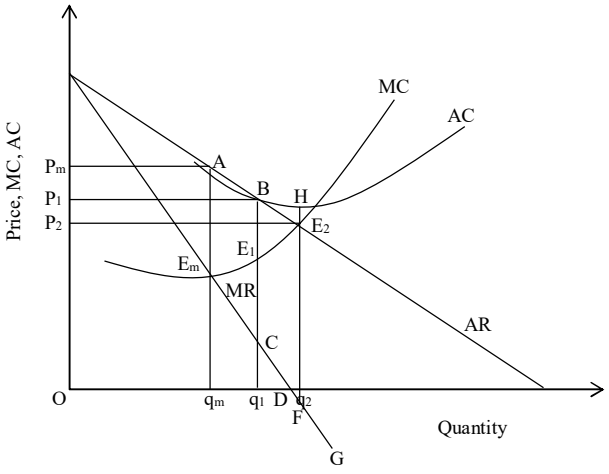


Figure 7.13: Regulation of monopoly

the equilibrium output q_1. The equilibrium price level P_1 is now equal to average cost q_1B yielding normal profit for the monopolist. Since at the equilibrium output q_1, marginal cost q_1E_1 is less than price q_1 B, monopoly power still exists though it has been reduced from the earlier

level. The price level can also be fixed at p_2 corresponding to Point E_2 where marginal cost equals price. The effective marginal revenue curve now becomes $p_2E_2q_2FG$ which intersects the MC curve at E_2. The equilibrium output and price levels are now q_2 and p_2 respectively. Though the monopoly power has been eliminated at the regulated price p_2, price is less than average cost by an amount E_2H at output level q_2. The monopolist incurs a loss and goes out of business in the long-run if he is not supported financially by giving subsidies.

Third Case: ***Regulation of Natural Monopolies***

The process of regulating natural monopolies has been explained with the help of Figure 7.9 in the context of second degree price discrimination discussed in Lesson-3 of this unit. It was shown in Figure 7.9 that regulating price at the level where average cost equals price could be a feasible method of controlling natural monopolies.

We analyzed the mechanism of regulating monopoly under different demand and cost conditions. It is almost impossible to achieve the twin goals of eliminating both monopoly power and supernormal profit through price regulation. Suppose, cost of production is low so that the intersection point of the average revenue and marginal cost curves lies above the average cost curve. Fixing price at less than the competitive level of price being equal to marginal cost (P = MC) results in excess demand for the commodity. The excess demand would put upward pressure on the price jeopardizing the ultimate objective of price regulation. Implementing and monitoring such price controls may be very much expensive. When cost of production is high so that the intersection point of the average revenue and marginal cost curves lies below the average cost curve, fixing price at the competitive level results in loss for the firm in the long-run. Operating firms in such a situation necessitates the provision of subsidy. Controlling a monopoly through price ceiling and then subsidizing it to compensate for the loss may seem paradoxical to the lay public. Instead the firm may be brought under state ownership. Even the transfer of ownership may not solve the problem of price being less than average cost under marginal cost pricing. Giving subsidy to the state-owned firm may worsen the problem by creating wide spread corruption and inefficiency in production and management. As a result, the amount of subsidy increases gradually and the economy gets trapped into an irreversible culture of subsidy. Even a private firm may suffer from the same problem, though the problem is not acute in this case. The method of subsidizing the private and the state-owned firms cannot be justified on efficiency grounds. Another method of avoiding the undesirable effects of monopoly is to resist the formation of monopoly through anti-trust laws. Further, the existing monopolies can be disintegrated and broken down into small-scale enterprises by passing laws.

Review Questions

1. (a) Compare the profit-maximizing price and quantity for a monopoly with the values in a monopoly with the values in a perfectly competitive industry. Assume the same marginal cost and demand for both.

(b) In attempting to maximize profits, do owners of a monopoly act differently than owners of perfectly competitive firms? Explain.

2. How is pricing under monopoly different from that under perfect competition? Can a monopoly firm fix any price for its product?
3. Explain the equilibrium of a monopoly firm in the short-run. Is monopoly price always higher than the competitive price?
4. What is monopoly power? How it can be measured?
5. Why is it needed to regulate monopoly? Describe different cases of regulating monopolies.
6. Compare monopoly and perfect competition with regard to the following:

   (a) Price

   (b) Output

   (c) Welfare

   (d) Relationship between MC and price

Unit 8: Monopolistic Competition and Oligopoly

Lesson 1: Monopolistic Competition

Lesson Objectives

After studying this lesson, you should be able to:

- state the characteristics of monopolistic competition;
- explain the short-run equilibrium of a monopolistically competitive firm;
- explain the long-run equilibrium of a monopolistically competitive firm;
- explain the concept of excess capacity that arises in monopolistic competition;

Technologies Used for Content Delivery

- BOUTUBE
- BOULMS
- WebTV
- Web Radio
- Mobile Technology with Micro SD Card
- LP+Office365
- BTV Program
- Bangladesh Betar Program

Characteristics of Monopolistic Competition

Monopolistic competition is characterized by many firms selling differentiated products to the buyers. The number of sellers in monopolistic competition is large but not so large as to make each firm a price-taker as in perfect competition. Since there are many sellers in monopolistic competition, a single firm does not take into account the reactions of its rivals when it makes output and pricing decisions. The rivals are not likely to take any retaliatory action because the pricing and output decision of a particular firm will have a very negligible effect on their price and output levels. Most often such effects go unnoticed and un-assessed so that the rivals don't show any reactions. There is, of course, one reason for a firm's being price-maker in monopolistic competition. The monopolistically competitive firms sell differentiated products in the market. Each firm's product is made different from the similar products of other firms for attracting customers. All the monopolistically competitive firms producing and selling similar but differentiated products comprise what may be called a product group. Product differentiation can be real or fancied, but its effectiveness in stimulating the sale level depends on the perception of the customers about the superiority and peculiarity of the product. The perception of product differentiation can be created using different techniques and a few familiar techniques of product differentiation in making differences in the quality and quantity of the product, brand names and packages, salesmanship and post-sale customer services. Since the commodities are similar though not homogeneous, they are close substitutes for each other. Cross elasticity of demand for any pair of these commodities is very high. Product differentiation leads to attachment of some customers to the product of a firm. The physical traits and the external appearance of the product match with the preferences of these consumers who are rather willing to pay a high price for the commodity than going for some other products. The association

between customers and the product enables the monopolistically competitive firm to exert some influence on the price and quantity of the product. In other words, the firm possesses some monopoly power for the product and the average revenue curve of the firm slopes downward to the right. Though the demand curves for both the monopolist and monopolistically competitive firm are downward sloping, they differ in values of price elasticity of demand. The presence of a large number of close substitutes for the product of a monopolistically competitive firm makes its demand curve highly elastic - more elastic than the demand curve of the monopolist. The monopolistically competitive firm has policy instruments other than price to choose for maximizing its profit. Sometimes a firm under monopolistic competition is reluctant to engage in price wars because such price changes may lead to reduced sale or reduced revenue. Instead it can increase its profit by making changes in the variety of the product. It keeps changing the variety of the product until it selects the best product which brings the maximum profit at a given price. Similarly, the firm can increase its profit by spending some money on advertising while keeping the price and variety of the product fixed. The advertisement expenditures known as selling costs help a firm hold on to its old customers as well as attract new customers and other customers from its rivals. The firm chooses the profit maximizing level of selling costs while the variety and price of the product are kept fixed. Finally, the firms in monopolistic competition can leave or exit the group in the long-run. This feature of monopolistic competition is identical with that of perfect competition. It is said that monopolistic competition contains elements of both perfect competition and monopoly. The competitive elements are the presence of a large number of sellers in the market and the independence to enter or leave the group in the long-run. The monopoly element stems from the privilege of creating product differentiation which make the demand curve of the monopolistically competitive firms downward sloping. To sum up, there are four essential features of monopolistic competition:

1. Many Sellers;
2. Differentiated products;
3. Multiple policy variables viz. price, product and selling cost; and
4. Free Entry or exit.

Short-Run Equilibrium of a Monopolistically Competitive Firm

As in other market structure, the goal of a firm in monopolistic competition is to maximize its profit. The profit maximizing conditions are also the same as in other market forms:

Necessary condition: MR=SMC

***Sufficient condition*:** SMC increases in the neighborhood of equilibrium

Since the profit maximizing and entry conditions are the same as in perfect competition, the short-run equilibrium of a monopolistically competitive firm is identical with that of a perfectly competitive firm with regard to profit. In other words, the firm under monopolistic competition may earn normal profit, or it may earn supernormal profit or it may incur loss in the short-run. The firm shuts down in the short-run if its total loss exceeds total fixed cost. Figure 8.1 shows the four positions of short-run equilibrium of a firm under monopolistic competition. There are four panels in Figure 8.1, Panel A shows the short-run equilibrium point E_1 at which output and price are q_1 and P_1 respectively. The firm makes a supernormal profit equal to area $P_1B_1C_1A_1$. In panel B, the equilibrium point is E_2 which gives rise to output q_2 and price P_2. Here the firm earns

normal profit. In Panel C, corresponding to equilibrium point E_3, output is q_3 and price is P_3. The firm here incurs a loss equal to area $A_3C_3B_3P_3$ which is, however, less than total fixed cost $D_3F_3C_3B_3$. In panel D, the equilibrium point E_4 shows a total loss equal to area $P_4A_4C_4B_4$ which is greater than total fixed cost $F_4D_4C_4B_4$. The firm shuts down in a situation depicted by Panel D of Figure 8.1.

Long-Run Equilibrium of Monopolistically Competitive firm In monopolistic competition, firms can enter or leave the group in the long-run. This feature of monopolistic competition makes it impossible for a firm to earn supernormal profit and incur loss in the long-run. The long-run equilibrium of a monopolistically competitive firm is characterized by the presence of

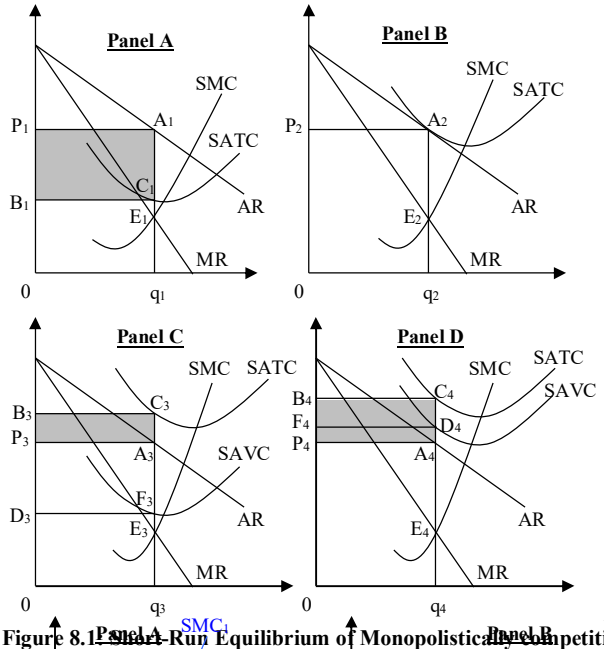


Figure 8.1: Short-Run Equilibrium of Monopolistically Competitive firm

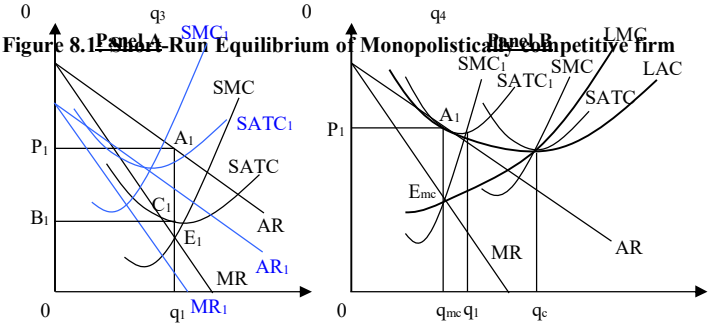


Figure 8.2 : Long-run equilibrium of a firm in monopolistic competition

normal profit. To see why it is so, we consider the case of a firm which makes supernormal profit

in the short-run as shown by Panel A of Figure 8.2. We assume identical cost and demand conditions of all firms in the group, though their products are differentiated. Since each of the firms in the group is making supernormal profit equal to the area $B_1C_1A_1P_1$ in Panel A, new firms will enter the group and produce similar but differentiated products. As a result, the share of each firm in total output of the group will fall as shown by the leftward shift of the AR and MR curves in Panel A. The falling share of each firm will reduce the level of supernormal profit and in an attempt to regain the previous level of supernormal profit, the firm will improve the variety of the product. Such improvement and innovations entail some expenses which cause the AC and MC curves to shift to the right. This process of shifting the demand and cost curves will continue until the demand curve becomes tangent to the average cost curve at the falling portion of the average cost curve. Supernormal profit will be totally eliminated and in the long-run each monoplolistically competitive firm will only earn normal profit. Similarly, if each firm incurs loss in the short-run, some firms will leave the group enabling some of the existing firms to earn normal profit. It should be noted that the firm will also try to minimize its cost of production in the long-run by changing the production plant. In other words, each firm will be producing at some point on the long-run average cost curve. We can summarize the following features of long-run equilibrium of a monopolistically competitive firm:

Necessary condition: MR=LMC=SMC
Sufficient condition: (i) LMC increases in the neighbourhood of equilibrium point.
(ii) LAC=AR

In Panel B of Figure 8.2, we show the long-run equilibrium of the firm under monopolistic competition. At equilibrium point E_{mc}, LMC equals MR. Equilibrium output level is q_{mc} at which the LAC curve is tangent to AR. Since at q_{mc}, LAC equals AR, the firm earns only normal profit.

Excess Capacity in Monopolistic Competition

It is alleged that the long-run equilibrium of a monopolistically competitive firm is characterized by excess capacity. It can be seen in Panel B of Figure 8.2 that at the long-run equilibrium of the firm, the AR curve is tangent with the LAC curve at its falling portion to the left of minimum LAC. Unlike the perfectly competitive firm, the firm in monopolistic competition is not minimizing long-run average cost in the long-run equilibrium. In other words, the firm is not utilizing its resources efficiently and is not taking advantage of economies of scale to reduce the cost of production when it could do so. In Panel B of Figure 8.2, this excess capacity is given by the range of output q_c-q_{mc}. This excess capacity is composed to two components:

$$q_c\text{-}q_{mc}=q_1\text{-}q_{mc}+ q_c\text{-}q_1$$

At output q_{mc}, the firm used the production plant with the short-run average cost curve $SATC_1$. The firm is producing at point A which is on the falling portion of $SATC_1$ and is not producing at B which is the minimum point of $SATC_1$. The firm could use the lowest cost plant with the short-run average cost curve SATC instead of using the plant with $SATC_1$. The output range q_c-q_1 then shows the portion of excess capacity that results due to the failure of the firm to use the lowest cost plant in the long-run.

From the preceding discussion, the presence of excess capacity seems to be a measure of inefficiency of monopolistically competitive market. Professor Chamberlin, one of the two pioneers of the theory of monopolistic competition, opined that excess capacity reflects cost of product diversity provided by monopolistic competition. He held the view that the consumers benefit from having the opportunity to choose from a number of similar but differentiated products. There are many brands of a commodity with different quality, style and appearance. The benefits from this opportunity may well outweigh the cost of the opportunity measured by excess capacity.

Comparison Between Perfect Competition and Monopolistic Competition Here we compare the long-run equilibrium of a monopolistically competitive firm with that of a perfectly competitive firm. We use Figure 8.3 for this purpose. In both the markets, the entry or exit of

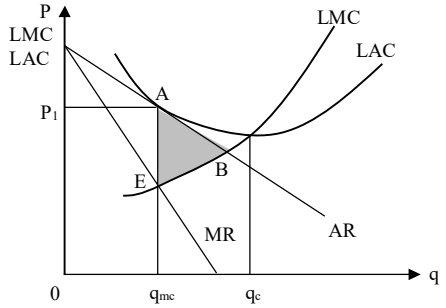


Figure 8.3: Perfect competition versus monopolistic competition

firms in the long-run drives the supernormal profit to zero. As we can see from Figure 8.3, the long-run equilibrium of a competitive firm occurs at the minimum point of long-run average cost curve whereas the long-run equilibrium of a firm under monopolistic competition occurs to the left of the minimum point. The output segment q_c-q_{mc} measures excess capacity in monopolistic competition. In long-run equilibrium of a monopolistically competitive firm price exceeds marginal cost. It means that the firm enjoys some monopoly power and the consumers value the benefits of additional output more than the cost of additional output. By restricting output to q_{mc}, the monopolistically competitive firm is depriving the consumers of this additional net benefit shown by the shaded area AEB in Figure 8.3. This is, in fact, the ***deadweight loss*** that results from the monopoly power of the monopolistically competitive firm.

Comparison Between Monopoly and Monopolistic Competition

We can also compare the long-rum equilibrium of a monopolist with that of a firm in monopolistic competition. The two equilibrium points are different with regard to nature of profit. A monopolist may earn supernormal or normal profit whereas a monopolistically competitive firm can earn only normal profit at the long-run equilibrium output level. The size of production plant may also be different in two market structures. A firm in monopolistic competition uses a plant smaller than the optimum plant in the long-run. A monopolist, on the other hand, may use the optimum plant or any other plant which can be smaller than or lesser than the optimum plant. The consumers are adversely affected in the two markets since price exceeds long-run marginal cost in both cases.

Deciding the Profit Maximizing Level of Advertising Expenditure

As we said earlier, the monopolistic competition has other policy tools than price to choose for maximizing his profit. One such tool is advertising expenditure or selling cost. Selling cost can increase the profit of the firm in two ways. First, more consumers know and hear about product through advertisements. As a result, the demand for the commodity increases at the same price. Second, if there are economies of scale, increased sales due to advertisements may reduce cost of production. Advertisements entail costs which may be very high at times. The average cost curve shifts upward when the firm advertises its product through newspaper, television, radio and many other devices of mass media. At the same time, the sales of the firm increases. Figure 8.4 shows the effects of advertisement expenditures. Initially the firm used to produce the quantities q_1 at an average cost of C_1. The short-run average cost curve shifts to SAC` from SAC when the firm undertakes advertisement expenditures.

The Sales and hence production of the firm increases to q_2 from q_1 after advertisements As we

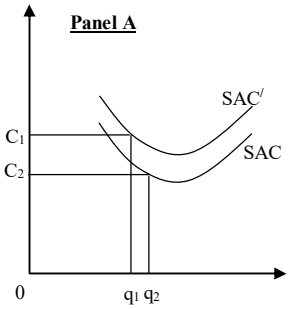


Figure 8.4: Effect of Advertisement

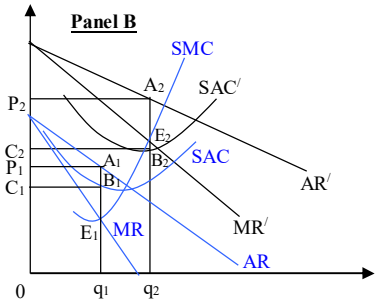


Figure 8.5: Profit maximization with selling cost

can see from Figure 8.4, the average cost of production falls to C_2 from C_1 due to economies of scale involved with higher level of production. But these economies of scale may not always be obtained. We illustrate the process of determining the profit maximizing level of selling cost by Figure 8.5.

In Figure 8.5, the AR, MR, SAC and SMC curves show the demand and cost conditions of the firm before advertising costs are incurred. Accordingly, the initial equilibrium point E_1 determines output q_1, price P_1 and a profit equal to area $P_1C_1B_1A_1$. A given amount of advertisement cost shifts the average revenue curve to AR_1, the marginal curve to MR_1 and the average cost curve to SAC_1. The marginal cost curve does not shift because the total advertisement cost is treated as an item of total fixed cost. The new equilibrium point is E_2 which gives rise to new output level q_2 and a profit level equal to area $P_2C_2B_2A_2$. This figure shows the effect of a fixed level of advertising expenditure on the price, output and profit of the firm. It is difficult to show in this figure how the profit maximizing level of advertising cost is determined. Instead we can provide a verbal explanation of the process of determining the optimum level of selling cost. The monopolistic competitor can change the amount of fixed advertising cost and see how much profit it brings for each level of advertising expenditure. The firm can adopt a trial

and error process for determining the profit maximizing level of selling cost. We should remember that the AR, MR and SAC curves shift upward each time the entrepreneur changes the level of selling cost and the extent of shift of these curves depends on the amount of change of selling cost. We can, however, deduce the conditions for such an optimum level of advertising expenditure. When the firm spends one taka on advertising, it increases the firm's sale level. To meet the additional demand for its product, the firm needs to incur some expenses for producing the additional output. It is natural to expect that at the profit maximizing level of advertising cost, the additional taka spent on advertising plus the additional cost per unit of increased output brought about by advertising cost should be equal to additional revenue per unit of increased output. This condition can be put in an equation form :

$$P\frac{\Delta Q}{\Delta A} = 1 + MC\frac{\Delta Q}{\Delta A} \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (1)$$

where P = Price

ΔQ = increased sale due to advertising

MC = Marginal cost

ΔA = Change in advertising expenditure

PΔQ measures the change in total revenue brought about by additional advertising expenditure of an amount ΔA. MCΔQ shows the change in total production cost for additional output from advertising. PΔQ/ΔA then reflect the additional revenue per unit of taka spent on advertising. MCΔQ/ΔA shows the additional production cost per unit of increased output. The above condition for profit maximizing level of advertising costs can be rearranged so that it can be used in everyday business practice.

$$P\frac{\Delta Q}{\Delta A} - MC\frac{\Delta Q}{\Delta A} = 1 \cdots\cdots\cdots\cdots\cdots\cdots (2)$$

$$or, (P - MC)\frac{\Delta Q}{\Delta A} = 1 \cdots\cdots\cdots\cdots\cdots\cdots (3)$$

Multiplying both sides by A/PQ, the advertising to sales ratio, we get

$$\frac{P - MC}{P}\left(\frac{A}{Q}\cdot\frac{\Delta Q}{\Delta A}\right) = \frac{A}{PQ} \cdots\cdots\cdots\cdots\cdots\cdots (4)$$

The bracketed term on the left-hand side of Equation 4 can be called advertising elasticity of demand. It shows the ratio of percentage change in quantity demanded to percentage change in advertising expenditure. In previous chapter (P-MC)/P was found to be equal to inverse of

$$\frac{A}{PQ} = \frac{E_{AD}}{E_P} \cdots\cdots\cdots\cdots\cdots\cdots (5)$$

absolute value of price elasticity of demand. Using the notations E_{AD} for advertising elasticity and E_p for price elasticity, equation (4) can be rewritten as shown below:

Equation (5) says that to maximize profit from advertising, the expenditure on advertisement should be chosen such that the ratio of advertising expenditure to total sale should be equal to the ratio of advertising elasticity to price elasticity of demand. It is easy to collect information from a monopolistic competition market, which can be used to estimate the relevant elasticity.

Review Questions

1. Discuss the characteristic features of monopolistic competition. How does it differ from perfect competition?
2. What is monopolistic competition? What are the effects of product differentiation on:
   (i) Firm's MR and AR curves; and
   (ii) Firm's equilibrium
3. Discuss the equilibrium of a firm under monopolistic competition under the condition of price competition among the firms.
4. How is the equilibrium of a firm affected under monopolistic competition where there is no barrier to entry of new firms?
5. How is the long-run equilibrium of a firm under monopolistic competition affected by the entry of new firms indulging in price competition?
6. (a) What are the characteristics that cause monopolistic competition?
   (b) Give some examples of monopolistically competitive firms.
   (c) How can two retail stores that sell the same brand of product be considered as selling differentiated products?
7. Suppose by lowering its price from $1.20 to $1.15 per gallon, a service station can sell 15,000 gallons of gasoline per week as opposed to 10,000. Can we infer from these figures that the marginal revenue of an extra gallon sold in this range of output is $1.15? Why or why not? What is MR in this case?
8. Using the appropriate diagrams, illustrate the case where a monopolistically competitive firm is making:
   (a) pure profits
   (b) just normal profits
   (c) a loss
9. Describe the process of adjustment that would occur if a grocery store in an expanding resort area is making pure profits.
10. What are the two ways in which pure profits are competed away in a monopolistically competitive industry?
11. (a) Why do firms advertise?
    (b) Would society be better off if advertising was banned? Explain.
12. How is the profit maximizing level of advertising expenditure decided?
13. Explain the excess capacity in monopolistic competition.
14. Compare:
    a. perfect competition and monopolistic competition.
    b. monopoly and monopolistic competition.

Lesson 2: Oligopoly

Lesson Objectives

After studying this lesson, you should be able to:

- state the characteristics of oligopoly;
- state the concept of Nash equilibrium;
- state how price and output are determined in Cournot Model;
- state why price remains rigid in the Kinked demand curve Model; and
- state how Game theory can be applied in oligopoly market.

Characteristics of Oligopoly

In oligopoly, there are a few sellers so that in any decision it makes, each firm takes its rival's reactions into account. Unlike the monopolistically competitive firms, the oligopolistic firms are interdependent in decision making. The products produced by these firms may be homogenous or differentiated. Often, the firms in an oligopoly market are large scale production enterprises and a few firms account for all or most of total production. It may happen that some or all of the oligopoly firms earn substantial amount of supernormal profit in the long-run because barriers to entry prevents other firms from entering the market.

Making price and output decisions in oligopoly is very difficult because each firm may not know precisely what other firms' reactions will be when it implements a decision about price and output. Suppose, for example, a firm lowers its product's price. Its rivals may also lower their prices so that the firm's sales will not increase significantly. Or, the rivals may keep their prices fixed, consequently the firm's sales fall drastically. On the whole, the firm is not certain about the possible consequences of its decision to reduce its product's price. A firm can only make guesses about its rivals' reactions under different strategies or policies it adopts. But different firms may make different assumptions about rivals' retaliatory actions depending on the size and financial positions of the firms. This variation in assumptions about rivals' reactions is called ***conjectural variation*** and any action undertaken in logical response to perceived reaction of the rivals' is called strategic decision making. Since there is no commonly accepted assumption about rivals reactions, there is no single model of price and output determination in oligopoly. Instead, a few oligopoly models based on different assumptions about reactions of the rivals have been developed to explain price and output determination in an oligopoly market.

We can classify these assumptions about reactions of the rivals into three broad groups and discuss a few popular models from each group.

The Concept of Nash Equilibrium

Before discussing the different oligopolistic models, we mention one general principle underlying oligopolistic equilibrium known as the Nash equilibrium. It is stated as follows:

Each firm is doing the best it can given what its competitors are doing

In the case of Nash equilibrium, one question then naturally arises. If a firm does the best it can give what its competitors are doing, what does it assume that its competitors are doing? It is natural to assume that the competitors are doing the best they can give what the firm is doing.

The concept of Nash equilibrium is pertinent for the equilibrium of an oligopolistic firm which acts under a strategic consideration about the reactions of its rivals. This principle is not relevant to pricing and output decisions made by the oligopolistic firms under formal and informal agreements. The general principle of Nash equilibrium is different from general principle of Non-Nash equilibrium used in the context of other market structure like perfect competitions, monopoly, etc. In these markets, a firm does not have strategic considerations about the behavior of other firms. The nature of equilibrium in absence of strategic considerations is stated as follows:

A firm is doing its best it can do and has no reason to change its price and output. The firms in an oligopoly market may operate in two situations. They may work in an environment of uncertainty about reactions of rivals, though each firm may make a certain assumption about the behavior of its competitors. Alternatively, these firms may cooperate with each other eliminating all uncertainties about actions and reactions of the competing firm. The first situation may be called the non-cooperation environment, and the second situation, the cooperation environment. Some models have been developed for each situation. Next we discuss these models.

Assumption 1: Non-cooperation and Ignore Interdependence

Here it is assumed that other firms will not retaliate when a firm takes any decisions about price and output. There are two reasons for making such an assumption. First**,** the rivals' reactions patterns can be so complex and diversified that it is better to ignore the reactions by other firms. Second**,** in most of the oligopolistic firms, management decisions are taken by salaried executives, not by the owners who happen to be the share holders. The executives and managers are more interested in successful running of enterprises by maximizing sales revenue rather than profit. Consequently, they can ignore the possible retaliations from their competitors. It should be noted that the assumption does not reject the existence of interdependence among the firms. This will be clear when we discuss the assumptions of the Cournot Model next.

The Cournot Model

This model was introduced in 1838 by Augustin Cournot who was a French economist. The model is based on certain assumptions which are discussed below:

1. There are two firms producing and selling a homogeneous product in the market.
2. Each firm is fully aware of market demand curve.
3. Price of the product depends inversely on total sales by two firms.

4. Marginal cost of production is constant for each firm.
5. Each firm has two considerations at the time of deciding its output level. Firstly, its output level depends negatively on rival's output level. Secondly, the firm assumes that another firm will not change its current level of production when the firm produces and sells its chosen level of output.

   The last assumption plays a significant role in determining the behavioral pattern of the model shown in Figure 8.5. We show relationship between Firm 1's chosen level of output and Firm 2's level of output. In the Figure, D(o) is the market demand curve for the product. It is also the market demand curve for the product of Firm 1 based on the assumption that Firm 2 does not produce and sell any output. It should be noted that zero is in the brackets of the notation D(o) signifies the zero output of Firm 2. Corresponding to the demand curve D(o) the marginal revenue curve of Firm is MR(o). The horizontal marginal cost curve of Firm 1, MC_1, intersects the MR(o) curve at E(o). Equilibrium output of Firm 1 corresponding to Firm 2's output of zero is q_{10}. If Firm 2's assumed output is q_2, Firm 1's demand curve and marginal revenue curve become $D(q_2)$ and $MR(q_2)$ respectively. We find Firm 1's equilibrium output q_{12} corresponding to Firm 2's output of q_2 from equilibrium point E(2) where MC_1 equals $MR(q_2)$. Similarly, we can find other equilibrium output levels of Firm 1 corresponding to different output levels of Firm 2. We notice from the Figure that Firm 1's equilibrium output level decreases when Firm 2's assumed output level increases. There is

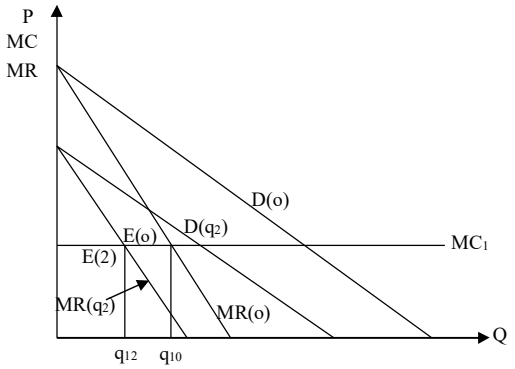


Figure 8.5: Derivation of reaction function in Cournot Model

thus an inverse relationship between Firm 1's equilibrium output level and that of Firm 2.

Equilibrium output level and Firm 2's assumed output level, which is called the reaction function of Firm 1. We can also obtain the reaction function of Firm 2 by reversing the derivation process. In that case, we find the equilibrium output level of Firm 2 corresponding to different output levels of Firm 1. Reaction function of one Firm shows the desired level of output of the Firm for each of the different output levels of another Firm. Firm-1's decision to produce a given level of output is based on its observation and assumption about Firm 2's output level, which may or may

not be true. If firm 1's assumption about Firm 2's output turns out to be true, then Firm 2's

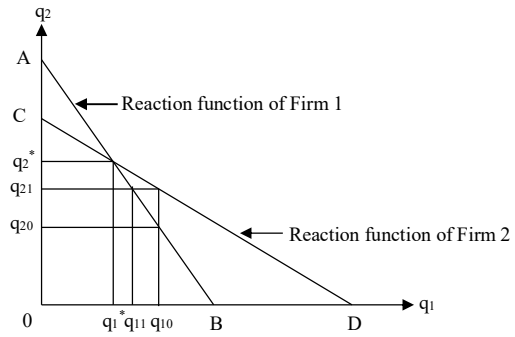


Figure 8.6: Equilibrium in Cournot Model

assumption about Firm 1's output also turns out to be true. The two Firms assumptions about each other are realized and equilibrium for both Firms is obtained at the intersection of the two reaction functions. If the two Firms assumptions about each other prove to be wrong, equilibrium is not attained and the two Firms keep changing their output level until expectations of both about each other are realized. We have drawn the two reaction functions in Figure 8.6 where the vertical and horizontal axes measure the output levels of Firm 1, (q_2), and Firm 2,(q_0). The downward sloping straight lines AB and CD in the figure are the reaction functions of Firm 1 and Firm 2, respectively.

Suppose Firm 1 observes that Firm 2 is initially producing the output q_{20}. According to Firm 1's reacting function, the intended output of Firm 1 is q_{10} corresponding to Firm 2's output of q_{20}. But Firm 2's reaction function determines its output q_{21} given output q_{10} of Firm 1. Again the reaction function of Firm 1 shows output q_{11} for Firm 1 corresponding to output q_{21} of Firm 2. This process of adjusting and readjusting output levels by two Firms continues until both Firms reach the equilibrium point E where both Firms' expectations about each other come true. In the end, Firm 1 produces output q_1* and Firm 2 produces q_2*. It is easily seen that the equilibrium in Cournot Model is a Nash equilibrium mentioned earlier. This is because q_1* turns out to be the profit-maximizing level of output for Firm 1 given Firm 2's output level q_2* and q_2* turns to be the profit-maximizing level of output for Firm 2 given Firm 1's output level q_1*.

Assumption 2: Non-Cooperation and Recognize Interdependence

The Firms in an oligopoly market may be fully aware of interdependence prevailing among the Firms; still they cannot cooperate with each other to negotiate a formal agreement or act under an informal agreement for different reasons. It seems that each Firm lives in a world of uncertainty about behavior of its competitors and no solution in the form of an equilibrium is possible here. One logical consequence of lack of an equilibrium is price rigidity practiced by many oligopolistic Firms. A model known as kinked demand curve model shows how price rigidity is created. We discuss this model next.

The Kinked Demand Curve Model

This model is based on the assumption that a rise in price is not matched by similar price rise by other Firms whereas a fall in price is always followed by similar fall in prices by rivals. When a Firm raises its price, other Firms do not raise their prices. The Firm then loses most of the customers in the market. As a result, the portion of demand curve above the prevailing price level becomes elastic. When the Firm lowers its price, other Firms will follow it. The sale of the Firm then increases by a small amount. This makes the portion of the demand curve below the current price level less elastic. The asymmetry in responses of other Firms to price changes gives rise to a demand curve with two line segments having different price elasticity Such a demand curve has been shown in Figure 8.7 where P_0 is the prevailing price level. It is seen that the

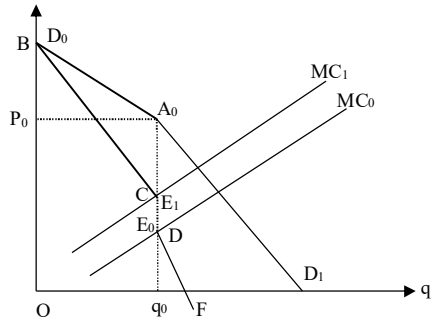


Figure 8.7: Price rigidity in Kinked Demand Curve Model.

portion D_0A_0 is more elastic and the portion A_0D_1 is less elastic. There is a kink at point A_0. The curve BCDF is the marginal revenue curve corresponding to demand curve $D_0A_0D_1$. The marginal revenue curve has a discontinuous segment between C and D. MC_0 is the initial marginal cost curve of the Firm. The marginal cost curve MC_0 intersects the marginal revenue curve at E_0 giving rise to initial price level P_0 and initial output level q_0. Due to some external reasons, the marginal cost curve shifts to MC_1, which intersects the marginal revenue curve at E_1. The new equilibrium point E_1 leads to the same price level P_0 with no change in output level. The kinked demand curve model thus explains why the price level remains rigid at the current level in most cases. The problem with this model is that it cannot explain how the current price was determined initially. It shows price rigidity without explaining the reason for such price rigidity. Perhaps Game theory can provide some logical explanations for such price rigidity.

Game Theory

The main problem of an oligopolistic Firm is that it does not know what its rivals will do when it takes any decision about price, product variety, selling cost and so on. Game theory suggests that some kind of equilibrium solution for the Firm can be obtained in such an uncertain situation if

the Firm behaves according to some predetermined pattern. One such pattern is called game theory with dominant strategy.

Dominant Strategy

The Game theory is traditionally explained with the help of a pay-off matrix which shows the expected returns accruing from different strategies. Suppose, there are two Firms in a industry producing a homogeneous product. Each of the two Firms is considering the possibility of increasing its net profit through selling cost but it is unaware of the action taken by another Firm. Each Firm then has two strategies viz., advertise and do not advertise. Since there are two Firms, there will be four combinations of strategies by the two firms. The first number in each cell of the following pay-off matrix shows the profit of Firm 1 and the second number the profit of Firm 2.

Pay-off Matrix 1

		Firm 2	
		Advertise	Do not Advertise
Firm 1	Advertise	12,6	18,1
	Do not Advertise	3, 12	8, 3

There are two strategies for Firm 2. If Firm 2 advertises, Firm 1 makes a profit of Tk 12 if it advertises and a profit of Tk. 3 if it does not advertise. So, the best strategy for Firm 1 is to advertise when Firm 2 advertises. If Firm 2 does not advertise, Firm 1 earns Tk. 18 if it advertises and Tk. 8 if it does not. So the best strategy for Firm 1 is to advertise when Firm 2 does not advertise. Firm 1's best strategy is to advertise under the two strategies of Firm 2.

Similarly, the best strategy of Firm 2 is to advertise under the two strategies of Firm 1. Both Firms decide to advertise and Firm 1 earns a profit of Tk. 12 and Firm 2 earns a profit of Tk. 6. A solution here exists because each Firm has a dominant strategy which is valid under two strategies of another Firm. This may not be the case always. Suppose, we change the expected returns in the bottom right-hand corner cell as shown below the pay-off matrix 2.

Pay-off Matrix 2

		Firm 2	
		Advertise	Do not Advertise
Firm 1	Advertise	12, 6	18, 1
	Do not Advertise	3,12	19, 13

Firm 1 earns Tk. 12 if it advertises and Tk. 3 if it does not under the first strategy of Firm 2. So, the best strategy of Firm 1 is to advertise when Firm 2 advertises. Firm 1 earns Tk. 18 if it advertises and Tk. 19 if it does not advertise. So the best strategy of Firm 1 is to advertise when Firm 2 advertises and not to advertise when Firm 2 does not advertise. Similarly, the best strategy for Firm 2 is to advertise when Firm 1 advertises and not to advertise when Firm 1 does

not advertise. The second pay-off matrix is such that it does not yield any optimal strategy for either of the Firms. Best strategy to one Firm depends on the strategy taken by another Firm. There is no equilibrium solution here.

These examples of pay-off matrix show that application of Game theory in interdependent decision making process of the oligopolistic Firms may sometimes yield an equilibrium solution. At other times, Game theory cannot give any solution.

Review Questions

1. (a) What is an oligopoly?
   (b) What characteristics are necessary to have an oligopoly?
2. Using the appropriate diagram, illustrate the profit-maximizing price and quantity for an oligopoly.
3. State and explain the concept of Nash equilibrium.
4. Why is no single theory of oligopoly possible?
5. (a) Draw a kinked demand curve for a firm and identify the region on the corresponding MR curve where a shift in the MC curve will not change the profit maximizing price or quantity.
   (b) Why is the upper portion of the kinked demand curve drawn to be more elastic than the lower portion?
   (c) In constructing the kinked demand curve, what is assumed about the profit-maximizing behavior of competing firms?
6. What are the characteristic features of an oligopolistic industry. How does it differ from monopolistic competition?
7. Explain Cournot's duopoly model and examine his solution to duopoly.
8. Discuss the game theory used to obtain the equilibrium solution of an oligopolistic firm.