Economics for Managers

Microeconomics-I

Economics for Managers

Block

I

MICROECONOMICS – I

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COURSE INTRODUCTION

The course Economics for Managers provides an introduction to microeconomics and macroeconomics. The course introduces students to basic concepts, theory, and application in economics. It provides an introduction to the understanding of a number of major current economic issues and problems.

Microeconomics involves the analysis of how consumers make decisions about what to consume, how firms decide what and how much to produce, and how the interactions of consumers and firms determine how much of a good will be sold, and at what price. The Microeconomics section of the course introduces the students to basic economic concepts such as demand and supply, elasticity, economic profit and marginal analysis. The course will equip the student to demonstrate an understanding of modern economic theories of factor pricing, consumer and producer behaviour and cost analysis through their application to personal and business decision making. The course also provides to the student an understanding of different types of market structures.

Macroeconomics is the analysis of important economic aggregates such as: the inflation rate, the unemployment rate, interest rates, GDP and GDP growth, and the exchange rate. The Macroeconomics section of the course considers concepts of the macro economy, measuring the economy's performance, economic growth, classical and Keynesian macro analysis, consumption, income and the multiplier effect, the theory of money and banking, factors influencing demand and supply of money, and analysis of policy issues. It also deals with issues of economic growth, inflation, unemployment and business cycles.

On successful completion of the course, the student will be able to discern when these concepts are legitimate concerns and when they are of little importance.

BLOCK I: MICROECONOMICS – I

The first block to the course on Economics for Managers deals with the fundamental concepts relevant to microeconomics. The block contains five units. The first unit talks about elementary concepts of microeconomics. The second and third units focus on the relationship of demand and supply of a product and behavior of consumers. Fourth and fifth unit examine the different aspects of production and cost.

The first unit, *Introduction to Microeconomic*, discusses the importance of microeconomics. As we know, resources are limited, and therefore, limited resources should be used efficiently. This unit helps us to understand how ideal combination of goods can be produced with given resources and technology.

The second unit, *Theory of Demand and Supply*, deals with the analysis of demand and supply, which plays an important role in decision making by firms. Various business activities like utilization of human resources, production planning, investment decisions, cost budgeting, pricing decisions and profit planning depend on demand and supply analysis. The unit provides a clear understanding of the relationship between demand and supply, their key determinants and various methods of demand forecasting.

The third unit, *Consumer Behavior*, provides the basic concept of utility and how that affects consumer behavior. The demand for a product is depended on consumer's acceptance, which again depends on price of the product and consumer's taste and preference. Therefore, a clear idea of the relation of utility and consumer behavior and consumer's reaction to change in price of a product helps a firm to anticipate the demand of the product. This unit provides a detailed discussion on the concept of utility and how that affects consumer behavior.

The fourth unit, *Production function*, gives an idea about production. A firm has to take decisions on various aspects of production, like the type of product, the method of production etc. Therefore, it is necessary for a producer to understand different stages involved in production and how production can be undertaken with change in the number of variable inputs. This unit deals with the theory of production.

The fifth unit, *Analysis of Costs*, provides different aspects of costs. There are different type of cost involve in production. For example, direct cost, indirect cost, opportunity cost, marginal cost, incremental cost, sunk cost etc. A profit maximizing firm has to minimize its costs. This unit deals with the relationship between production function and cost function.

Unit 1

Introduction to Microeconomics

Structure

1.1   Introduction

The science of economics was born with the publication of "An Enquiry into the Nature and Causes of Wealth of Nations" by Adam Smith in 1776. It was called at that time as 'Political Economy'. Different names were suggested at different times. However in 1890 Alfred Marshall used the term Economics which has been accepted since then. The word 'Economics' was derived from two Greek words – *Oikos* (a house) and *nemein* (to manage). In other words, the original meaning was household management. It implied using scarce resources carefully to satisfy many ends i.e. economizing. The key point here is that Resources are limited, but people's wants are unlimited. Therefore, limited resources need to be used carefully through efficient allocation among the various alternative uses. This is the basic situation that has led to the study of economics. Economics can be defined as the study of efficient utilization of scarce resources, which have various alternative uses to satisfy unlimited human wants. Economics deals with various aspects like production, distribution and consumption of scarce resources in an economy in order to satisfy human wants efficiently.

This unit will discuss the importance of microeconomics and provide an idea of different economic systems. The unit also provides an overview of Production Possibility Curve (PPC) which helps to determine the ideal combination of goods that can be produced with given resources and technology.

1.2   Objectives

By the end of this unit, students should be able to:

- Recognize the importance of microeconomics
- Explain how scarcity leads to necessity of making choices and how different market economies have evolved depending on who decides about the allocation of resources in an economy
- Use PPC to determine efficient possible combination of goods to be produced with given resources and technology and explain how with technological development, the efficient combination of output will change
- Identify the situational applicability of partial equilibrium analysis and general equilibrium analysis

1.3   Nature and Scope of Economics

Economics can be considered both as a science and as an art. Economics can be viewed as science because it explains the relationship between causes and effects. And it can be viewed as an art because it deals with needs and wants of human beings.

Economics can also be classified into pure economics and applied economics. Pure economics provide the tools through which applied science works as the distinction between economics as a positive science and as a normative science can also be made. Positive economics explains cause and effects and deals with questions like what is, whereas normative economics is concerned with the ideal situation and deals with questions like what ought to be.

Economics can be classified into two branches or levels. These levels are microeconomics and macroeconomics. The terms 'microeconomics' and 'macroeconomics' were first used by the Swedish economist Ragnar Frisch in the 1920s. Microeconomics is the branch of economics that is concerned with the behavior of individual units like the person, firm or household, whereas macroeconomics deals with the economy as a whole. Microeconomics is concerned about the individual behavior, forces of supply and demand at the level of a single market, etc. Macroeconomics is concerned about inflation, unemployment, economic growth, etc. at the level of the economy as a whole. Though micro and macroeconomics appear to be different, they actually deal with the same economic issues like production, pricing, unemployment, etc., but while microeconomics looks at these at the individual or market level, macroeconomics looks at them at an aggregated economy level.

1.4   Relevance of Microeconomics

Microeconomics plays an important role in the study of economic theory. It analyzes the behavior of consumers, producers and markets.

1.4.1 Importance of Microeconomic Analysis

Maximizes resource utilization: Resources are scarce but requirements are many, therefore, resources should be allocated efficiently. Microeconomics tries

to solve the problem of scarce resources and unlimited wants by allocating resources efficiently among competing requirements at the level of the individual and the firm.

Basis of welfare economics: Microeconomic theory determines the conditions of efficiency and can be used to compare various ways of improving efficiency and alternative ways of achieving particular levels of efficiency.

Provides tools for evaluating economic policies: The fallout of policies at the level of the firm and the individual can be studied, and this can help in evaluating policies.

Construction and use of models: Microeconomics facilitates the process of understanding complicated situations by constructing simplified models, which are of great help.

Exhibit 1.1 showcases a firm, Lemon Tree Hotel's decision for improving efficiency by allocating resources for improving energy efficiency measures.

Exhibit 1.1: Lemon Tree Hotels MoU with EESL

Lemon Tree Hotels Limited is one of the largest hotel chain companies in India, with 87 hotels spread across 59 destinations in India. The hotel chain, in June 2021, entered into a pact with EESL (Energy Efficiency Services Limited), a Joint venture under the Ministry of Power. Through this collaboration, Lemon Hotels is planning to improve efficiency in its business operations, as also reducing the company's carbon footprint.

The MoU (Memorandum of Understanding) between Lemon Hotels Limited and EESL will span over a three year period, with the objective of reducing energy consumption. During the three years, the MoU will be implemented by identifying the areas to improve efficiency, investing in energy efficient systems such as Electric Vehicles (EV) and EV charging, solar rooftop installations, energy efficient refrigeration systems etc.

The hotel company's decision is a microeconomic decision that not only aims to improve efficiency within the company but also contributes to welfare economics by reducing the carbon footprint.

Source: https://economictimes.indiatimes.com/industry/renewables/eesl-inks-pact-with-lemon-tree-hotels-to-implement-energy-efficiency-measures/articleshow/83333850.cms

1.4.2 Limitations of Microeconomics

One of the basic limitations of microeconomics is it deals with the individual perspective but does not look at the aggregate economy. Also, microeconomics is based on assumptions, which rarely hold in the real world.

1.5 Scarcity and Choice

There are many economic problems like unemployment, pollution, inflation, fiscal deficits, etc., which have an impact at the micro level. These problems arise due to the scarcity of natural resources and the unlimited wants of human beings. Scarcity leads to the necessity of making choices.

Block I: Microeconomics – I

For the effective utilization of scarce resources, the following questions need to be answered:

What to produce?

The productive potential of an economy cannot be used to do everything for everybody. Decisions must be made about what to produce and how much of each item to produce with the limited resources available. These decisions are political in nature, and they involve balancing needs and wants of various groups. For example, an increase in the use of productive capacity to provide military equipment inevitably reduces the availability of consumer goods such as VCRs, microwaves, and automobiles. Choices must be made about which goods and services to make available and which to forego.

How to produce?

There is more than one way to accomplish any given objective. For example, a certain quantity of iceberg lettuce can be produced on a large tract of land without the use of pesticides or fertilizers. However, the same amount of lettuce can be grown on less land with chemical agents. Goods and services can be produced by business firms or by government or non-profit enterprises. Crops can be harvested by many workers using hand tools or with specialized machines and fewer workers. Textiles can be loomed and finished by hand or in automated plants where machines rather than workers perform many of the required tasks. Machines or other products (such as chemicals) can be substituted for labor or land when producing any mix of goods. Productive methods that squeeze the most out of available means allow the greatest possible material well-being from limited resources.

For whom to produce?

Are they to be distributed equally to everyone so that each of us lives in the same type of house, eats the same kind of food, and wears the same clothes? Or are goods to be sold to those willing and able to pay? Under the latter method, people with higher incomes will enjoy more and better products and services than people with lower incomes. Will some of us be given special privileges to enjoy goods and services regardless of our ability to pay for those items? What rules will be used to decide who gets what?

The distribution of material well-being is never perfect. Some people have the financial resources to enjoy goods and services of the highest quality. Others, even in a nation with the vast productive potential of the United States, live in poverty. No society has yet discovered how to provide equally for the needs and wants of everyone while still offering the incentives that encourage high-quality production and technological innovation.

There are many economic problems like unemployment, pollution, inflation, fiscal deficits, etc., which have an impact at the micro level. These problems arise due to the scarcity of natural resources and the unlimited wants of human beings. Scarcity leads to the necessity of making choices.

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There are three basic economic systems which deal with these questions in different ways. The three economic systems are the market economy, the command economy and the mixed economy.

1.5.1 Market Economy

In this system, allocation of resources takes place on the basis of the market forces. Consumers indicate their preferences for various goods at various prices through their demand schedules while suppliers indicate what is available and at what price through their supply schedules. When the price of the good supplied matches with the price at which it is demanded, the market price is determined, and the amount of demand and supply coincides so that the market is cleared. The role of government is negligible and price plays a vital role.

1.5.2 Command Economy

In this system, allocation of resources is decided by the government. The government decides what needs to be produced, for whom to produce and how to produce.

1.5.3 Mixed Economy

A combination of free market economy and command economy is known as a mixed economy. Here, the government controls price fluctuation of certain essential goods to achieve certain objectives like low level of inflation, high level of unemployment, etc.

Example: Move from Command Economy to Mixed Economy

An economy which combines the features of a market economy and a command economy is known as mixed economy. In fact most of the countries in the world operate as mixed economies. In recent years, many command economies have changed to mixed economies. Among these are some countries that were part of the former USSR. To become market economies, these countries have increased the role of market and the private sector in the economy. Some of the ways of doing this are by:

- Increasing competition by deregulating the market and allowing entry of new firms.
- Ending state subsidies in a gradual manner.
- Privatization of government owned companies and industries.
- Encouraging foreign investment in the domestic economy.

Check Your Progress - 1

1. Which of the following statements is not true about positive and normative science?
   a. Positive economics explains cause and effects
   b. Positive economics deals with questions like what it is
   c. Normative economics does not deal with questions like what ought to be.
   d. Normative economics is concerned with the ideal situation

2. Which type of economics explains economic phenomena according to their causes and effects?

    a. Normative

    b. Positive

    c. Macro

    d. Micro

3. In which type of economy allocation of resources takes place on the basis of the market forces?

    a. Free market economy

    b. Command market economy

    c. Controlled market economy

    d. Regulated market economy

4. In which type of economy the government decides what needs to be produced, for whom to produce and how to produce?

    a. Market economy

    b. Command economy

    c. Mixed economy

    d. Regulated economy

5. _____ helps to determine what goods and services are produced, how they are produced, and for whom they are produced in an economy.

    a. Type of economy

    b. Cost of production

    c. Opportunity cost

    d. Price

1.6 Production Possibility Curve

The Production Possibility Curve (PPC) shows the combination of goods that can be produced with given resources and technology.

While constructing a PPC, certain assumptions are made. They are:

- Economic resources available during the year are fixed.

- Economic resources can be used to produce two broad classes of goods.

- Certain inputs are better used in producing one of these classes of goods rather than the other.

- Technology remains the same during the year.

Figure 1.1: The Production Possibility Curve with a Given Technology
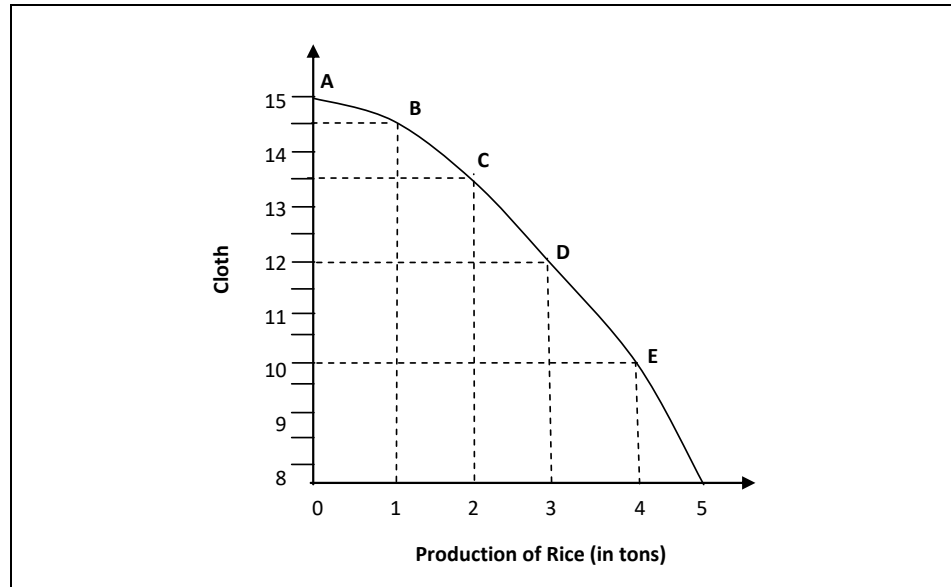
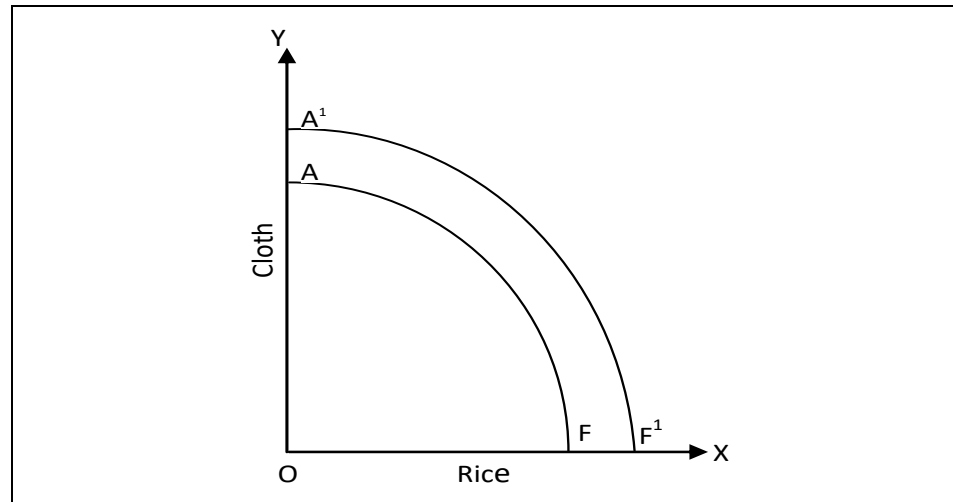*Source: ICFAI Research Center*

Activity 1.1

Assume that you are the head of a state. You want to learn about the level of production efficiency in the economy and the breakup of production among different goods. Some experts advise you to use a Production Possibility Curve (PPC) for this purpose. How will the PPC be useful in giving you an idea about the situation in the economy?

Answer:

Since resources are limited, in order to increase the production of one item, we have to forgo the production of some units of the other item. The value of the forgone goods is known as the opportunity cost. The slope of the PPC shows how much of one good has to be sacrificed, to produce the other good. The PPC shows the most efficient possible combined output of two goods. (Refer Figure 1.1). The PPC curve is concave to the point of origin, since increase in production of one good leads to decrease in the production of the other one. Any point below the PPC indicates a situation where available resources are not fully employed. In the long-run, the PPC may move outward due to increase in the quantity and quality of economic resources and advancement in technology. (Refer Figure 1.2).

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Figure 1.2: PPC along with Technological Development

Check Your Progress - 2

6. Which of the following is an important message that a production possibility curve conveys to an economy?

    a. It indicates the limited number of production possibilities during a given period of time

    b. It shows the maximum amount of any good that can be produced with the available resources

    c. It shows the expected demand in the near future

    d. Both a and b

7. _____ shows the maximum possible combined output of the two goods.

    a. Production possibility curve

    b. Distribution possibility curve

    c. Supply curve

    d. Demand curve

8. In a production possibility curve, at which point does the economy operate at its full productive capacity, that is, all the factors of production are fully employed?

    a. All the points on the production possibility curve

    b. Point where the total cost of production is minimized

    c. Point anywhere outside the production possibility curve

    d. Point anywhere inside or on the production possibility curve

Activity 1.2

Deeraj Yadav, an agriculturist has 2 acres of land. He has 10 laborers and a fixed amount of land, and has to make a decision on allocating these resources to produce two different goods i.e. wheat and rice. How should Deeraj Yadav allocate his resources between the two goods understanding the problem of scarcity with given resources and technology, to reach full productive capacity?

Answer:

1.7 Partial Equilibrium and General Equilibrium Analysis

Partial equilibrium analysis (PEA) and general equilibrium analysis (GEA) are two different approaches used for analyzing the functioning of an economy with inter-related markets.

1.7.1 Partial Equilibrium Analysis

In PEA, a market is studied in isolation from the rest of the economy. The impact of market forces (demand and supply) on price changes is analyzed. In order to properly explain the determination of price and quantity of a commodity or factor, each product or factor market is considered as independent and self-contained. However, as PEA ignores the inter-relationships among various markets, it becomes very complex to apply it to understand how the economy functions as a whole.

1.7.2 General Equilibrium Analysis

In an economic system, there are various markets for commodities and factors of production. There are many decision-making agents — consumers, producers, resource owners, and workers, whose decisions are made with a view to maximizing their individual profits. GEA studies how these various factors function simultaneously in an economy. Thus, it considers simultaneous equilibrium of all markets and studies the economy as a whole.

Activity 1.3

Identify whether partial equilibrium analysis or general equilibrium analysis should be applied in the following situations:

- To analyze what kind of impact the imposition of tariffs by a large nation on import of cotton related items has on world textile prices.

- To study the effect of an increase in demand for automobiles in a country.
- To analyze the impact of tariffs applied by a small country to regulate imports which are competing with the output of a particular industry of the country.

Answer:

1.8 Summary

- Unlimited human wants and scarce resources require people to make choices between various goods and services.
- Economics deals with the problem of scarcity and choice.
- The field of economics is divided into two areas: microeconomics and macroeconomics.
- The various kinds of economies are: market economy, command economy and mixed economy.
- As individuals have to choose between alternatives, opportunity cost i.e. the cost of the forgone alternative, plays a significant role in the decision making process.
- Partial equilibrium analysis and general equilibrium analysis are two different perspectives to study the functioning of an economy. Both PEA and GEA are useful and have to be applied appropriately according to the requirements of the study.

1.9 Glossary

Consumption: In macroeconomics, the total spending, by individuals or a nation, on consumer goods during a given period.

Economic growth: Economic growth represents the expansion of a country's potential GDP or national output.

Firms: Economic entities which buy or employ factors of production and organize them to create goods and services for sale.

Inflation (or **inflation rate**)**:** The inflation rate is the percentage of annual increase in a general price level.

General equilibrium analysis (GEA): GEA is applicable for analysis of markets that are interdependent. GEA explains simultaneous equilibrium of markets when prices and quantities of products and factors are considered as variables.

Industry: A group of firms producing similar products. Hence, the auto industry or the steel industry.

Labor: The economically productive capabilities of humans, their physical and mental talents as applied to the production of goods and services.

Land: All natural resources. The "gifts of nature" which are economically useful.

Markets: Any coming together of buyers and sellers of produced goods and services or the services of productive factors.

Macroeconomics: Analysis dealing with the behavior of the economy as a whole with respect to output, income, the price level, foreign trade, unemployment, and other aggregate economic variables.

Microeconomics: Analysis dealing with the behavior of individual elements in an economy – such as the determination of the price of a single production or the behavior of a single consumer or business firm.

Opportunity cost: The best alternative sacrificed to have or to do something else.

Price: What must be paid to acquire the right to possess and use a good or service.

Production possibility: Levels of output which are within the range of possibilities for a particular economy.

Production possibility curve: A graphical representation of the boundary between possible and unattainable levels of production in a particular economy.

Profit: When a firm's revenues exceed its costs, profit is the difference between the two.

Partial equilibrium analysis (PEA): PEA studies a market in isolation as it facilitates the detailed analysis of the impact of forces in a particular market, such as the forces of demand and supply as related to changes in price.

Resources: All those things which can be used to produce economic satisfaction.

Rent: Rent can be termed as the reward for land which is one of the four factors of production. For economists, the term 'land' indicates natural resources like ground water, forests, rivers, oil fields, mineral deposits, etc., apart from the physical soil.

Scarcity: The fact that human wants exceed the means of satisfying them

Tariff: A tax imposed on an imported good.

Technology: Knowledge which permits or facilitates the transformation of resources into goods and services.

Unemployment: The non-utilization of labour resources; the condition in which members of the labour force are without jobs. Sometimes used more broadly to refer to the waste of resources when the economy is operating at less than its full potential.

Wants: The apparently limitless desires or wishes people have for particular goods or services.

1.10 Self-Assessment Test

1. Explain how production possibility curve is helpful in determining the combination of goods that can be produced with given resources and technology.

2. What are the different types of economic systems? Discuss them in detail along with examples.

3. Explain partial and general equilibrium analysis.

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1.12 Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit.

1. **(c) Normative economics does not deals with questions like what ought to be.**

   Positive economics explains economic phenomena according to their causes and effects. On the other hand, normative economics explains how things ought to be.

2. **(b) Positive**

   There is an ongoing debate among economists on the nature and scope of economics. Various economists have come out with their own ideas. Economists like Milton Freidman and Keynes believed that the nature of economics is positive, as it deals with how economic problems are solved and is based on facts.

3. **(a) Free market economy**

   In a free market economy, allocation of resources takes places on the basis of market forces. Consumers indicate their preferences for various goods at various prices through their demand schedules while suppliers indicate what is available and at what price through their supply schedules. When the price of the good supplied matches with the price at which it is demanded, the market price is determined, and the amount of demand and supply coincides so that the market is cleared.

4. **(b) Command economy**

   In command economy, allocation of resources is decided by the government. The government decides what needs to be produced, for whom to produce and how to produce.

5. **(a) Type of economy**

   There are mainly three types of economy- market economy, command economy and mixed economy. Based on the nature of each type of economy, goods and services are allocated in the economy.

6. **(d) Both a and b**

   Points on the PPC represent the possible alternative combinations of two goods that can be produced in an economy, assuming that no other products are made. Each point on the PPC indicates the maximum amount of one good that can be produced, in combination with a given output of the other good. Every point on the curve represents a situation where resources are fully and most efficiently utilized.

7. (a) Production possibility curve

The production possibility curve helps analyze the best available production level that can be attained with the given resources. It helps us know the maximum amount of production that can be obtained by an economy with the technological knowledge and quantity of inputs available.

8. (a) All the points on the production possibility curve

The production possibility curve shows the maximum combination of output that the economy can produce using all the available resources.

Unit 2

Theory of Demand and Supply

2.1 Introduction

The previous unit discussed the importance of microeconomics and how with given resources and technology, Production Possibility Curve (PPC) helps to determine efficient combination of goods. This unit is about the theory of demand and supply.

Demand analysis plays a significant role in the area of business. Various business activities like manpower utilization, production planning, investment decisions, cost budgeting, pricing decisions and profit planning depends on demand analysis. Demand analysis is extensively used in decision-making by managers and business firms. Multinational companies Kellogg's and McDonalds entered Indian market in the mid 1990s. Both these companies did not properly estimate the demand for their products in India and their operations ran into losses. These examples show us the significance of estimating demand correctly through proper demand forecasting and also understanding the relationship between demand and supply.

This unit will discuss the relationship between demand and supply, and the key determinants of demand, elasticity of demand and supply, and demand forecasting.

2.2   Objectives

By the end of this unit, students should be able to:

* Analyze the theory of demand and supply and explain the relation between demand and supply
* Describe the concepts of elasticity of demand and elasticity of supply
* Discuss how demand and supply of a good, can determine equilibrium price and explain the effect of change in demand and supply on equilibrium price and equilibrium quantity
* Explain different methods of demand forecasting and judge which of these techniques is appropriate to forecast demand in a specific situation

2.3   Demand Theory

Demand can be defined as the desire to buy a product backed by the ability to pay for it.

2.3.1 Law of Demand

The law of demand states that an inverse relationship exists between the price of a good and its quantity demanded, keeping other factors constant. It states that a rise in the price of a commodity reduces the demand, and a reduction in the price increases the demand for the good, when the other factors remain constant.

The demand curve is a graphical representation of the inverse relationship between the price and the demand. It always slopes downwards from left to right to indicate that demand for a product increases when there is decrease in the price of that particular product. The demand curve can be looked at from the individual and the market points of view.

Individual demand: Individual demand is the demand of an individual consumer for a product in a given period of time.

Market demand: It is the sum of demand of all individual consumers in the market for a product in a given period of time. Therefore, market demand indicates the sum total of the individual demand at a given price level.

2.3.2 Nature of Demand Curve

For normal products, the demand curve slopes downwards to the right. The downward slope reflects the inverse relationship between price and quantity demanded. Along the demand curve, the quantity demanded increases as the price of the product decreases. A change in the quantity demanded could be defined as the change in the amount of products that buyers are willing and able to buy in response to a change in the price of the product. The change in the quantity demanded is represented by a movement along a given demand curve.

2.3.3 Shift in Demand Curve

Extension and contraction of demand occurs as a result of change in price. If the demand of a product increases due to fall in price then it is known as extension

of demand. A fall in demand of a product as a result of the rise in price is called as contraction of demand. A change in demand, due to factors other than price is described as shift in demand.

Exhibit 2.1 explains the change in demand for palm oil imports as a result of reduction in import price

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Exhibit 2.1: Indian Palm Oil Imports Increase Due to Reduction in Import Duties

Ministry of Finance in India reduced the base import duty that is applied to all types of crude vegetable oil to 2.5%. Before this change, crude m oil was charged a base import duty of 10%. This reduction in import duty spurred the demand for palm oil imports. The imports are set to touch 800,000 to 900,000 metric tonnes in September in comparison to 750,134 metric tonnes in August, 2021. In August, 2021, the palm oil imports saw a 61% rise. According to Solvent Extractors' Association (SEA), palm oil import has increased to 63,65,163 tonnes from 57,96,953 tonnes between November, 2019 to August, 2020.

Another factor that is seen to create the spur in demand for palm oil imports is the upcoming festive season that is likely to push the consumption of palm oil further. Bulk buyers are looking towards the reduction in import duties to stock up their inventories and cash in on the demand surge during the festive season.

Source: https://economictimes.indiatimes.com/news/economy/foreign-trade/palm-oil-imports-increased-due-to-lower-duty-says-sea/articleshow/86226471.cms

2.4 Elasticity of Demand

Elasticity of demand can be defined as the measure of degree of change in the quantity demanded in relation to a given change in price or other determinants of the demand. It can be expressed as:

E = percentage change in x / percentage change in y

Determinants of Demand

- Income of the consumer

- Price of the substitute product

- Price of complementary product

- Change in policy

- Tastes and preferences of the consumer

- Existing wealth of the consumer

- Expectation regarding future price changes

Elasticity of demand can have either a positive or a negative value. If the proportionate change in one variable is equal to the proportionate change in the

other variable, then it is called as unitary elastic (E = 1), if the change in one variable is greater than the proportional change in the other variable, then the demand is relatively elastic (E > 1). When any change in one variable result in no change in the other variable, then the demand is perfectly inelastic (E = 0). If a proportionate change in one variable has an infinite effect on the other variable, then the demand is perfectly elastic (E = infinity). If the proportionate change in one variable is less than the proportionate change in the other variable, then the demand is relatively inelastic.

Example: Price Elasticity of Demand

Demand for polymers in India is growing at a substantial rate. The factors that have contributed to the increased demand are greater urbanization, rapid growth of the middle class segment, application of plastics in a wide number of industries and products, etc. The increase in prices of conventional resources (e.g. wood) due to their scarcity is also one of the reasons for the increase in the demand for polymers; this can be considered as a substitution effect. Prices of key polymers have also been falling, and this has been another reason for the increase in demand in the last three years.

Elasticity of demand can be classified into four types. They are:

2.4.1 Price Elasticity of Demand

Price elasticity of demand can be defined as the percentage change in quantity demanded of a product in relation to the percentage change in its price with other factors remaining constant. Availability of substitutes for the product, income of the consumer, time period and consumer habits are some of the factors that affect the price elasticity of demand. It can be expressed as:

E_p = Percentage change in quantity demanded / Percentage change in price

The different categories of price elasticity of demand are as follows:

If one percent change in price results in one percent change in quantity demanded, then it is called unitary elastic demand (E = 1). If one percent change in price results in more than one percent change in quantity demanded, then it is called relatively elastic demand (E > 1). If one percent change in price results in less than one percent change in quantity demanded, then it is called as relatively inelastic demand (E < 1). If any change in price results in no change in quantity demanded, then it is called perfectly inelastic demand (E = 0). The demand curve in this case is parallel to the Y-axis. If any change in price results in infinitely large change in quantity demanded, then it is called perfectly elastic demand (E = infinity).

Price elasticity of demand can be applied and used for various decisions such as pricing decisions of business organization, pricing regulation by governments, solving balance of payments problems and fiscal policy measures.

2.4.2 Numerical Example

If the demand for a product increases by 3% due to a decrease in its price by 6%, what is the price elasticity of the product?

Price elasticity of demand for a product = % Change in quantity demanded/ % Change in price.

If the demand for a product increases by 3% due to a decrease in the price by 6%, then the price elasticity of the product = 3/6 = 0.5.

Exercises

A. If the demand for cricket balls increases from 50 to 55 because of a fall in the price from ₹ 25 to ₹ 24, what is the price elasticity of demand for cricket balls?

  a. (1.5)

  b. (2.5)

  c. (2)

  d. (5)

B. A footwear manufacturer who makes shoes exclusively for children sells 2100 pairs of shoes per month. He plans to reduce the price from ₹ 155 to ₹ 148 per pair to encourage sales. The elasticity of demand for shoes is estimated at 0.68. What would be the new demand for the shoes as a result of the decrease in the price?

  a. 1965

  b. 2065

  c. 2165

  d. 2265

C. Assume that an automobile dealer knows the demand variations in the industry from his past experience. According to him, price elasticity of demand for cars is unitary (=1). The price of the cars is currently ₹ 20, 000 and the dealer wants to increase the quantity demanded from 30 units to 60 units. At what price should the dealer sell the cars if he has to sell 30 additional cars?

  a. ₹ 12,000

  b. ₹ 10,000

  c. ₹ 16,000

  d. ₹ 18,000

2.4.3 Cross Elasticity of Demand

Cross elasticity of demand can be defined as the ratio of percentage change in the quantity demanded of one product to a percentage change in the price of another related product with other factors remaining constant. Cross elasticity for a

product will be positive when the two products are substitutes and negative when the products are complementary. It can be mathematically represented as:

E_{cp} = % change in the quantity demanded of product X / % change in the price of product Y

Example: Complementary Goods

When the price of Tata Indica rises, the demand for Indica falls and the demand for Maruti Zen - a close competitor - rises. Also important is the price of complements, or goods that are used together. When the price of petrol rises, the demand for cars falls.

2.4.4 Income Elasticity of Demand

Income elasticity of demand can be defined as the percentage change in the quantity demanded to a given percentage change in the income of a consumer. The nature of the product, level of income in a country and consumption pattern of consumers are some of the key factors that influence the income elasticity of demand. It can be expressed mathematically as:

E_y = % change in the quantity demanded of product X / % change in the income of the consumer

2.4.5 Advertising or Promotional Elasticity of Demand

Advertising elasticity of demand can be defined as the degree of change in the quantity demanded of a product to a given change in the expenditure of the advertisements and other promotional activities. Some of the important factors affecting advertising elasticity of demand are: the type of product, stage of the product in the product life cycle and the reactions of competitors of the firm to its advertising campaigns.

Check Your Progress - 1

1. What will happen to the quantity demand if there is a reduction in the shipments of petroleum products due to a war or a war-like situation in the Middle East?

    a. The supply curve will shift to the right
    b. Quantity demanded will increase
    c. The demand curve will shift to the left
    d. Quantity demanded will decrease

2. Which of the following helps the manager to decide the demand for a product?

    a. Price of the product
    b. Price of the substitute product
    c. Elasticity of the product
    d. All the above

3. Which type of elasticity helps the government in formulating the fiscal policy?

    a. Income elasticity

    b. Price elasticity

    c. Cross elasticity

    d. Advertisement elasticity

4. The cross elasticity between tea and sugar is _____.

    a. Less than 0

    b. Greater than 1

    c. Zero

    d. Greater than 0, but less than 1

5. The demand for water consumption is inelastic. If water charges increase, which of the following is likely to occur?

    a. Quantity demanded will fall by a relatively large amount

    b. Quantity demanded will fall by a relatively small amount

    c. Quantity demanded will rise in the short run, but fall in the long run

    d. Quantity demanded will fall in the short run, but rise in the long run

2.5 Supply Theory

The supply of a product refers to the various quantities of a product that could be offered by the seller at various prices in a specific period of time. Apart from prices, there are other factors affecting the supply of a product. They are the cost of production, possibility of the supplier switching to complementary or substitute products, climatic conditions and changes in government policies.

2.5.1 Law of Supply

The law of supply states that price and quantities supplied are positively related, when other factors remain constant. It means more quantity will be supplied by the supplier at higher prices and lower quantity will be supplied by the supplier at lower prices. Put in other words, the quantity of the product supplied increases with an increase in the price of the product, and similarly the quantity supplied decreases with decrease in the price, keeping other factors constant. Since the law of supply considers price of the product as the most important determinant of supply, the supply function is represented as:

SX = f (PX), keeping other things constant

Where SX stands for amount of product X supplied and PX stands for price of the product X.

The supply curve graphically represents the relationship between the price and supply. The shape of the supply curve is upward sloping. There are various

factors that influence the supply of a product. They are price of the product, prices of related products, prices of factors of production and changes in the production technology of a firm.

Shift in supply: Shift in supply refers to a change in the quantity supplied due to other factors, when the price remains constant.

Exhibit 2.2 explains the shifts in supply and demand for office spaces during the Covid pandemic.

Exhibit 2.2: Impact of Covid Pandemic on the Supply of and Demand for Office Spaces India

The Covid Pandemic drove a majority of the workforce to work from home. This impacted the demand for office space. A Nirmal Bang report says that net absorption of office space declined from 42 million sq.ft in Financial Year 2109-20 to 20 million sq,ft in Financial Year 2020-21. At the same time vacancy levels increased from 11.5% to 14% in the same period.

The Commercial Real estate sector was one of the worst hit sectors due to the Pandemic, as many companies gave the "work from home" option to their employees. Though the sector is on a recovery path in 2021, the impact of work from home is likely to continue with 20-25% staff opting for permanent WFH.

But, industry experts and analysts predict a revival at least in the metros. This is evident from the survey report of CRISIL in September, 2021 that indicated an increase in office rentals in Bengaluru, Mumbai and Delhi, with Bengaluru clocking an increase of 2.8%, Mumbai registered 1.5% growth and Delhi showed a 6% increase.

On the supply side, the Pandemic has put a number of commercial office space projects on hold with uncertainty on demand revivals. Leading developers such as Brigade, Tata Reality, Mindspace Business Parks etc., opined that supply additions will be slower and the full recovery may take 3-4 years.

Source: https://economictimes.indiatimes.com/industry/services/property-/-cstruction/bengaluru-mumbai-delhi-may-witness-increase-in-office-rental-rates-say-experts/articleshow/86708705.cms

2.6   Elasticity of Supply

Elasticity of supply refers to the percentage change in quantity supplied of a product to a given percentage change in the price of the product. Supply is considered as elastic when the change in the quantity supplied is more than the proportionate change in price. It is inelastic if the change in quantity supplied is less than the proportionate change in price.

2.6.1 Numerical Example

If the supply of a product increases by 2% due to an increase in its price by 4%, what is the supply elasticity of the product?

Supply elasticity for a product = % Change in quantity supplied/ % Change in price.

If the supply for a product increases by 2% due to an increase in the price by 4%, then the supply elasticity of the product = 2/4 = 0.5.

Exercise

D. Lalwani Stationers supplies 100 printer cartridges at the rate of ₹ 500 per cartridge. When the price increases to ₹ 600, the company is willing to increase its supply to 120 cartridges. Determine the elasticity of supply for the cartridges.

   a. 0.5
   b. 1.5
   c. 1
   d. 2

2.6.2 Types of Supply Elasticity

There are five types of elasticity. They are:

Perfectly elastic supply: It indicates that a slight change in price causes an infinitely large change in the quantity supplied. The supply curve in this case is parallel to the X-axis.

Perfectly inelastic supply: It is a case in which supply does not respond to the changes in the price. The supply curve is parallel to Y-axis.

Relatively elastic supply: In this case, a given change in price causes a more than proportionate change in quantity supplied.

Relatively inelastic supply: In this case, a given change in price causes a less than proportionate change in quantity supplied.

Unitary elastic supply: In this case, a proportionate change in price causes an equal change in the quantity demanded.

Activity 2.1

Indicate whether the changes mentioned below causes any shift or movement of the supply curve, demand curve or both.

a. What will happen to the demand of houses when consumer's income increases?

b. What will be the demand for cameras when the price of film goes up?

c. What will be the position of sugar market, when the yield of sugarcane declines due to drought?

d. What will be the effect on the fast food market if more fast food centers are established in the area?

e. What would be the state of rental value of movie CDs when the number of consumers who watch movies at home decreases?

Answer:

Check Your Progress - 2

6. Which of the following is the only determinant that the law of supply takes into account?

    a. Technology
    b. Quality of the product
    c. Price of the product
    d. Purchasing power of sellers

7. What happens to the supply curve when supply changes due to reasons other than price?

    a. There will be change in the supply curve
    b. There will be a shift in the supply curve
    c. There will be a contraction in the supply curve
    d. There will be an extension in the supply curve

8. When supply is perfectly inelastic, elasticity of supply is equal to _____.

    a. +1
    b. 0
    c. –1
    d. Infinity

9. The supply curve is a vertical line when the supply is _____.

    a. Perfectly elastic
    b. Unitary elastic
    c. Perfectly inelastic
    d. Relatively inelastic

2.7 Equilibrium of Demand and Supply

The price at which the total demand for any product in the market is equal to the total supply of that product is known as the equilibrium price. If the supply curve remains the same and the demand curve shifts to the right, then the equilibrium price and equilibrium quantity increases. If the demand curve shifts to the left, then the equilibrium price and equilibrium quantity decrease simultaneously. If the demand curve remains same and the supply curve shifts to the right, the equilibrium price will fall and the equilibrium quantity will increase. If the supply curve shifts to the left, the equilibrium price will increase and the equilibrium quantity will decrease.

In the real world, various forces influence supply and demand for a product. Here, both the demand and supply curves may change their positions simultaneously.

Activity 2.2

From the following schedule, draw the supply and demand curves. Also determine the equilibrium price and quantity.

Price	Supply and demand of the product	
	Quantity demanded	Quantity supplied
100	0	200
80	50	150
60	100	100
40	150	50
20	200	0
0	500	0

Answer:

Activity 2.3

The preference of many Indians has shifted away from scooters toward bikes. Using demand and supply analysis, explain how this change affects the equilibrium price and quantity in the market for scooters and the market for bikes.

Answer:

When unregulated markets act against the interests of the public, the government has to intervene. Therefore, in such circumstances, prices are either controlled or set by the government authorities. The government controls prices through a price ceiling. A price ceiling is the maximum price that can be legally charged for that product. For instance, rent control is a type of price ceiling. But excessive control through price ceilings reduce the supply thus causing shortages.

A price floor is the opposite of a price ceiling. Here, a minimum price is established by law. Two commonly used price floors are minimum wages and agricultural price supports.

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Exhibit 2.3 gives the example of a price ceiling.

Exhibit 2.3: Price Ceiling on Medicines and Formulations

NPPA or the National Pharmaceutical Pricing Authority is the regulatory body in India that monitors and controls the drug prices in the country. On 27th July, 2021, NPPA fixed price ceilings on 355 medicines and 882 formulations under the National List of Essential Medicines, 2015 Act. The regulatory body decided to cap these medicines and formulations as most of them were part of Covid-19 pandemic management control.

In addition to these measures, the regulator also capped the trade margin for oxygen concentrators at 70% on price to distributors. Also capped were the margins on pulse oximeter, glucometer, BP monitor, nebulizer and digital thermometers.

Since 2013, as many as 1,600 formulations have been fixed price ceilings.

While this is an example of price ceiling, where prices were capped at a level which makes them affordable; there have been instances where NPPA has resorted to change in the price ceiling. For instance, in December 2019, the regulator had increased the price cap on certain essential drugs such as BCG vaccine, Anti-malaria drugs, Vitamin C owing to an increase in the cost of pharmaceutical ingredients that were being imported from China for manufacture of these drugs

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Source: https://www.livemint.com/news/india/nppa-has-fixed-ceiling-prices-of-355-medicines-882-formulations-mandaviya-11627396163815.html

2.7.1 Numerical Example

The demand function of a firm is $Q_D = 200\text{-}10P$ and supply function is $Q_S = 50\text{+}5P$. The supply function shifts to $Q_S = 110\text{+}5P$. What will be the difference between the new equilibrium and the old equilibrium price?

Earlier, $Q_D = 200\text{-}10P$ and $Q_S = 50\text{+}5P$

At equilibrium, $Q_D = Q_S$

$\Rightarrow 200\text{-}10P = 50\text{+}5P \Rightarrow 15P = 150 \Rightarrow P = 10$

When the supply function is shifted to $Q_S = 110\text{+}5P$, then

At equilibrium price, $200\text{-}10P = 110\text{+}5P \Rightarrow 15P = 90 \Rightarrow P = 6$

Therefore the new equilibrium price is 6.

The difference between new equilibrium and old equilibrium price $= 6\text{-}10 = \text{-}4$

Exercises

E. The market demand function of a product is $Q_d = 13,500 - 50\,P$ and its supply function is $M_s = 3000 + 20\,P$. Determine the equilibrium price of the product.

   a. 75
   b. 50

    c. 20

    d. 150

F. A firm has a certain equilibrium price, when the demand function is $Q_D = 100 – 5P$ and the supply function is $Q_S = 10 + 5P$. If the firm's demand function shifts to $Q_D = 200 – 5P$, what would be the difference between the new equilibrium price and the old equilibrium price?

    a. 10

    b. –10

    c. 15

    d. –15

Check Your Progress - 3

10. Which of the following statements is true?

    a. If the supply curve remains the same and the demand curve shifts to the right, then the equilibrium price and equilibrium quantity decreases

    b. If the supply curve remains the same and the demand curve shifts to the left, then the equilibrium price and equilibrium quantity decreases

    c. If the demand curve remains same and the supply curve shifts to the right, the equilibrium price will increase and the equilibrium quantity will fall

    d. Changes in demand for and supply of the good will not have any influence on the price of the good

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2.8   Demand Forecasting

Demand forecasting can be described as prediction of the future level of demand on the basis of past and present knowledge and experience, with a view to avoiding underproduction and overproduction. Various types of demand forecasting techniques are used to estimate demand. There are quantitative and qualitative techniques in demand forecasting.

2.8.1 Quantitative Techniques

Time series: This is a widely known method in which past sales and demand are taken into account. Time series are classified into four categories- trends, seasonal variations, cyclical variations, and random fluctuations. There are two types of time series analysis – moving average and exponential smoothing. The moving average is a series of arithmetic averages. One can use simple moving average or weighted moving average. In the simple moving average method, we have to sum up the sales for a specified period of time (e.g. weeks or months) and then divide the total sales by the number of periods used. In the weighted moving average method, weights are assigned to the periods, but the sum of weights must be equal to one.

Barometric analysis: Barometric analysis can be defined as "the prediction of turning points in one economic time series through the use of observations on another time series called the barometer or the indicator." The economic time series of barometric analysis is categorized into three groups- leading indicators, coincident indicators and lagging indicators. Leading indicators compare the existing data available. Examples of coincident indicators are employees on nonagricultural payrolls, industrial production, personal income less transfer payments, manufacturing and trade sales. The lagging indicator composite includes labor costs per unit, ratio of inventory to sales, and figures on installment credit and loans, among other items. These indicators provide signals of changes in economic activities.

2.8.2 Qualitative Techniques

Expert opinion: The expert opinion method is also known as expert consensus method. In this method, the findings of market research and the opinions of management executives, consultants, trade association officials and sector analysts are considered, and based on these the demand is estimated. There are various methods of acquiring the opinions of experts regarding future demand.

Survey: Surveys are forecasting methods where information is collected through mail, e-mail, telephone, or personally interacting with respondents in order to determine demand.

Market experiment: There are two types of market experiments. They are test marketing and controlled experiments.

Test marketing: It is a method where a test area, which represents the whole market, is chosen to launch the product. The consumer's response is measured and the demand for the market as a whole is determined.

Controlled experiments: This is a method where a sample of consumers of the target market is selected and controlled experiments are conducted to test the demand for a new product launched or to test the demands for various brands of a product.

Activity 2.4

Anirudh is the CEO of Crimson Electronics Ltd, a company which produces electronic appliances. The company recently decided to introduce its product – an electric dishwasher – in the southern region of India. Before planning the various functions like production, marketing, etc., it decided to estimate the demand for the product in the market. What are the various techniques available to Anirudh for forecasting the demand for the product?

Answer:

Check Your Progress - 4

11. In which of the following forecasting techniques past sales and demand are taken into account?
    a. Market experiments
    b. Expert opinion
    c. Barometric method
    d. Time series analysis

12. Which of the following technique can be defined as "the prediction of turning points in one economic time series through the use of observations on another time series called the barometer or the indicator?"
    a. Expert opinion
    b. Market experiments
    c. Time Series analysis
    d. Barometric analysis

13. In which method of demand forecasting, are the findings of market research and the opinions of management executives, consultants and trade association officials utilized?
    a. Survey
    b. Expert opinion
    c. Barometric method
    d. Time series analysis

14. In which of the following forecasting techniques, information is collected through mail, e-mail, telephone, or personally interacting with respondents?
    a. Market experiments
    b. Survey
    c. Barometric method
    d. Time series analysis

2.9   Summary

- Demand analysis plays a significant role in business planning. The law of demand posits an inverse relationship between the price of a good and its quantity demanded, with other factors remaining constant.

- Elasticity of demand can be defined as the measure of the degree of change in the quantity demanded in relation to a given change in price or other determinants of the demand. Elasticity of demand can be classified into four types. They are price elasticity of demand, cross elasticity of demand, income elasticity of demand and advertising elasticity of demand.

- The law of supply posits a direct relationship between price and supply. The supply of a product refers to the various quantities of a product that could be offered by the producer at various prices in a specific period of time. Elasticity of supply refers to the percentage change in quantity supplied of a product to a given percentage change in the price of the product.

- Demand forecasting can be described as the prediction of the future level of demand on the basis of past and present knowledge and experience, in order to avoid underproduction and overproduction. Various types of demand forecasting techniques are used to estimate demand. There are quantitative and qualitative techniques in demand forecasting.

2.10 Glossary

Balance of payments: A statement showing all of a nation's transactions with the rest of the world for a given period. It includes purchases and sales of goods and services, gifts, government transactions, and capital movements.

Budget: An account, usually for a year, of the planned expenditures and the expected receipts.

Cross elasticity of demand: The (percentage) change in the quantity demanded of a good consequent upon a (one percent) change in the price of an associated good.

Coincident indicators: An economic indicator that moves along with the economy i.e. that moves in tandem with the economy is known as a coincident indicator.

Elasticity: When used without a modifier (such as "cross", or "income"), elasticity usually refers to price elasticity which is the percentage change in quantity demanded of a good or service divided by the percentage change in its (own) price.

Elasticity of supply: The (price) elasticity of supply is the percentage change in the quantity supplied of a good or service divided by the percentage change in its (own) price.

Equilibrium price: A price at which the quantity supplied equals the quantity demanded. At this price there is no excess of quantity demanded or supplied, nor is there any deficiency of either and consequently the price will remain at this level.

Equilibrium quantity: The quantity of a good demanded and supplied at the equilibrium price.

Fiscal policy: A government's program with respect to (1) the purchase of goods and services and spending on transfer payments, and (2) the amount and type of taxes.

Income elasticity of demand: The percentage change in quantity demanded divided by the percentage change in income.

Interest: The payment made for the use of funds to create capital goods with.

Law of demand: The inverse relationship between price and quantity of a good or service demanded.

Lagging indicators: Economic indicators that change following a given trend of an economy are known as lagging indicators.

Leading indicators: Economic indicators that change before the occurrence of changes in the economy are known as leading economic indicators.

Market demand: The relationship between the total quantity of a good demanded and its price.

Price elasticity of demand: The percentage change in the quantity of a good demanded by the percentage change in its own price.

Substitution effect: The change in the quantity of a good demanded resulting from a change in its relative price, leaving aside any change in quantity demanded that can be attributable to the associated change in the consumer's real income.

Tastes: The preferences of consumers.

Wages: The general term applied to the earnings of the factor of production, labor.

2.11 Self-Assessment Test

1. Explain the different types of elasticity of demand

2. Give a brief account of law of supply and elasticity of supply. List out the different types of elasticity of supply.

3. What is demand forecasting? What are the different quantitative techniques that managers use to facilitate the decision-making process?

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2.13 Answers to Check Your Progress Questions

2.13.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit

1. **(d) Quantity demanded will decrease**

    When the demand for petroleum products remains the same, and there is a reduction in the supply of petroleum products, the prices will increase. Since there is an inverse relationship between the price and the quantity demanded, the demand curve shifts towards the left showing a reduction in the quantity demanded due to the rise in the price level.

2. **(d) All the above**

    There are various factors that determine the demand for a product. Price is an important component in determining demand. If the price of the product is low, the demand tends to be more. Similarly, price of the substitute products influences demand for the product. Elasticity of the product is another factor that determines the demand for a product. Higher the elasticity, greater will be the change in demand due to change in price.

3. **(b) Price elasticity**

    Price elasticity comes in handy for the government in imposing taxes. If the fiscal policy of the government levies more tax on an elastic good, it will not serve the purpose. This is because an increase in tax will lead to a rise in prices, and for an elastic product, demand decreases with the rise in prices. So the government's aim to earn more revenue will be defeated.

4. **(a) Less than 0**

    If the price of sugar increases, the demand for sugar as well as tea comes down. When the price of sugar increases, demand for tea decreases i.e. they move in opposite direction. Thus, their cross elasticity is negative.

5. **(b) Quantity demanded will fall by a relatively small amount**

    The demand for necessities like water is relatively inelastic. Necessities continue to be consumed even if their price is increased, though the quantity of usage may come down. Water being a necessity, a rise in water charges may have just a little impact on consumption, and demand may fall by a relatively small amount.

6. **(c) Price of the product**

    The law of supply states that other factors remaining constant, higher the price, greater the quantity supplied and lower the price, lower the quantity supplied. Hence, the price of the product is the only determining factor in the law of supply.

7. **(b) There will be a shift in the supply curve**

    Other things remaining the same, the supply curve shows the relationship between the price and the quantity supplied at a given period of time. Here, when there is a change in the other factors except price, there will be a shift in supply. Other factors can be in the form of technological advancement, government policies, cost of goods used in production, etc. For example, when there is technological advancement, the firm can produce more at the same cost of production. This increases the supply i.e. the supply curve shifts towards the right.

8. **(b) 0**

    In perfectly inelastic supply, the quantity supplied does not change at all when the price changes. Hence, the elasticity of supply is zero.

9. **(c) Perfectly inelastic**

    When elasticity of supply is equal to zero, it is known as perfectly inelastic supply. A product is said to have a perfectly inelastic supply, when the quantity supplied does not change at all when the price changes. A perfectly inelastic supply curve is a vertical straight line passing through the origin.

10. **(b) If the supply curve remains the same and the demand curve shifts to the left, then the equilibrium price and equilibrium quantity decreases**

    If the demand curve shifts to the left, and the supply curve remains the same, the equilibrium point will change. As a result, equilibrium price and equilibrium quantity both will increase.

11. **(d) Time series analysis**

    In time series analysis, past sales and demand are taken into consideration.

12. **(d) Barometric analysis**

    Barometric analysis can be defined as "the prediction of turning points in one economic time series through the use of observations on another time series called the barometer or the indicator." The economic time series of barometric analysis is categorized into three groups- leading indicators, coincident indicators and lagging indicators.

13. **(b) Expert opinion**

    The expert opinion method, as the name suggests is based on the opinion of the experts. This method is also known as expert consensus method and is widely used for demand forecasting.

14. **(b) Survey**

    In surveys information is collected through mail, e-mail, telephone, or personally interacting with respondents in order to determine demand.

2.13.2 Model Answers to Exercises

Following are the model answers to the Exercises given in the unit.

A. **(b) (2.5)**

   Price elasticity of the product $= \Delta q / \Delta p \times P/Q$

   $\Delta q = 55 - 50 = 5$

   $\Delta p = 25 - 24 = 1$

   Therefore $e_p = 5/(1) \times 25/50 = (2.5)$

B. **(c) 2165**

   Elasticity of price $(e_p) = \Delta q / \Delta p \times p / q$

   $P = 155$

   $Q = 2100$ pairs of shoes

   $\Delta P = 155 - 148 = 7$

   $e_p = 0.68$

   $\Delta Q = x$

   Substituting the values

   $0.68 = x / 7 \times 155/ 2100$

   $x = 0.68 \times 7 \times 2100/ 155$

   $\Delta Q = x = 64.5$

   As the price has decreased, the change in quantity demanded is 64.5. So the new quantity demanded will be $2100 + 64.5 = 2164.5$ or 2165

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C. (b) ₹ 10,000

In this problem, the elasticity of demand for cars is unitary elastic. Therefore, for every one percent increase in demand, the price has to be reduced by one percent. So, to increase the quantity demanded from 30 units to 60 units, i.e. double the existing demand, the price needs to be reduced by exactly half i.e. 20,000/2=10,000.

D. (c) 1

Elasticity of supply $(E_S) = \Delta q / \Delta p \times p / q$

$\Delta q = 120 - 100 = 20$

$\Delta p = 600 - 500 = 100$

$p = 500, q = 100$

$E_S = 20/100 \times 500/ 100$

$= 0.2 \times 5 = 1$

E. (d) 150

Market would be in equilibrium at the price at which $Q_d = Q_s$

$13,500 - 50 P = 3000 + 20 P$

$70P = 10,500$

$P = 150$

F. (a) 10

Demand function $= Q_D = 100 - 5P$

Supply function $= Q_S = 10 + 5P$

At Equilibrium price, $Q_S = Q_D$

$10 + 5P = 100 - 5P$

$10P = 90$

$P = 9$

When the firm's demand function shifts to $Q_D = 200 - 5P$,

At Equilibrium price, $Q_S = Q_D$

$10 + 5P = 200 - 5P$

$10P = 190$

$P = 19$

Hence the new equilibrium price is 19

Difference between the new and the old equilibrium price is $19 - 9 = 10$.

Unit 3

Consumer Behavior

Structure

3.1   Introduction

The previous unit discussed the relationship between demand and supply, the concept of elasticity of demand and supply, and different methods of demand forecasting.

The demand for a product is determined by the acceptance of the product by the consumer. The consumer's acceptance of a product is influenced by the price of the product, the consumer's wants, tastes and preferences, etc. In fact, every consumer would like to maximize his satisfaction while making a purchase decision. Therefore, it is very important for a firm to know the impact of changes in prices on demand for a product.

In economics, consumer behavior theory explains the relationship between changes in price and consumer demand. Since factors like customers' tastes and preferences, variations in price, play a significant role in determining the demand for a product, before launching their products, firms have to take into consideration all these factors.. Thus, a study of consumer behavior helps manufacturers in their decision-making.

This unit will discuss the concept of utility and how that affects consumer behavior, consumer's reaction to a change in the relative prices of two products, effect of a change in the price of a product on the consumer's purchasing power, the concept of indifference curve and the uses of consumer surplus.

3.2   Objectives

By the end of this unit, students should be able to:

- Analyze the utility theory and evaluate the importance of diminishing marginal utility and equimarginal utility
- Use the indifference curve analysis to arrive at the consumer equilibrium given a budget constraint
- Explain the concept of consumer surplus and its applications.

3.3   Choice and Utility Theory

Consumers have unlimited wants or preferences and numerous choices are available to satisfy those wants. Since any consumer will have certain budget constraint, consumers have to choose the best alternative whose net benefit is at the maximum level in order to maximize their satisfaction. Net benefit is calculated as the difference between benefits and cost.

Utility in economics means the extent of satisfaction obtained from the consumption of products and services by consumers. The concept of utility was developed by economists to explain the basic principles of consumer choice and behavior. However, the concept of utility is purely subjective in nature. In fact, utility cannot be measured but can be compared. This helps sellers in understanding how consumers make better choices.

3.3.1   Measurement of utility

Utility can be measured through two approaches. They are the cardinal approach and the ordinal approach. The cardinal approach was proposed by Alfred Marshall. Under Marshall's approach, it is assumed that utility can be measured in terms of units called 'utils', which are measurable and quantifiable. The approach also assumes that the utility is derived from a particular product is independent by itself and not dependent on the utility derived from other products. The approach conveys the price a consumer is willing to pay for a given unit of product. Theories like law of diminishing marginal utility and law of equimarginal utility were derived based on this approach.

The ordinal approach to utility was proposed by J.R. Hicks. The approach assumes that utility cannot be measured but can only be ranked in order of preferences. The approach states that since utility can be ranked in order of preference, a consumer can compare different degrees of satisfaction. This approach assumes that the consumer is consistent in ranking, and that the preferences of the consumer are based on the choice of products available.

3.3.2   Assumptions of utility theory

Utility theory is based on certain assumptions. They are:

Consumers are rational: Consumers try to maximize their benefits from consumption. It is assumed that consumers can make a choice between products, and that they make the choice which provides them maximum satisfaction.

Consumers always prefer a larger quantity: It is assumed that consumers prefer a situation where the quantity of consumption is higher to a situation where the quantity consumed is smaller, given that the amount paid is the same in both situations.

Consumers are ready to make tradeoffs: It is assumed that the consumer is willing to substitute some amount of one of the products being consumed at present, and increase consumption of some other products, if the total benefits from consumption remain unchanged.

Diminishing marginal rate of substitution: It is assumed that keeping utility constant, when more and more additional units of a product are consumed, the value of each additional unit, (i.e. the amount of the other product the consumer is willing to forgo), declines.

3.3.3 Total utility

Total utility can be defined as the amount of utility derived by a person from the consumption of a particular product in a specific period of time. The total utility varies with the number of units consumed by the person. The total utility increases at the initial stages of consumption, becomes constant after the consumption of certain units and decreases with additional consumption beyond a certain point.
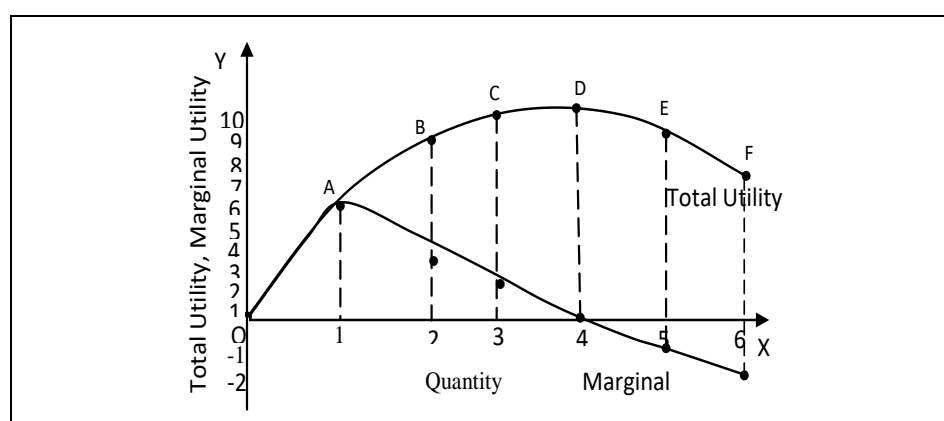
3.3.4 Marginal utility

Marginal utility can be defined as the increase in total utility due to an increase in consumption by one unit. Marginal utility starts diminishing as the consumer starts consuming more and more units of a product. When marginal utility reaches zero, the total utility reaches its maximum. Total utility starts diminishing when marginal utility is negative.

To understand the concept better, assume that a person consuming the first packet of biscuits gets a certain level of satisfaction. His total utility goes up when he consumes the second packet of biscuits. Now if he consumes one more packet he reaches the satisfaction quantity. Now any additional consumption beyond this point will not add to the person's utility but will make him sick.

Total and Marginal Utility		
Quantity of a Product Consumed	**Total Utility**	**Marginal Utility**
0	0	-
1	5	5
2	8	3
3	10	2
4	10	0
5	9	-1
6	7	-2

The above table shows that when the first two units of a product are consumed total utility increases. When the consumer consumes the third unit, total utility reaches its maximum point 10. The utility remains constant even after the consumption of the fourth unit. But when the consumer starts consuming the fifth and sixth unit of the product, total utility reduces. In Figure 3.1, it shows point A and B with increasing total utility. Total utility reaches its maximum at the point C, and after the consumption of the fourth unit it remains constant up to point D. A further increase in consumption, (fifth and sixth unit) shows that the total utility curve starts sloping downwards (points E and F), showing a negative impact on consumption.

Figure 3.1: Derivation of Total Utility and Marginal Utility

Source: ICFAI Research Center

Activity 3.1

Based on the following information, find out the marginal utility of a product at different levels of consumption by filling in the schedule and drawing the TU and MU curves on a graph.

Quantity consumed	Total utility	Marginal utility
0	0	?
1	10	?
2	16	?
3	20	?
4	20	?
5	17	?
6	12	?

Answer:

39

Exercises

A. The total utility that Sam derives after eating 4 mangoes is 10, and the total utility after eating 5 mangoes is 9. What is the marginal utility for the 5th mango?

   a. 1
   b. 0
   c. −1
   d. ±1

B. Sandhya maximizes her consumption of ice-cream with 3 scoops of ice cream, where the total utility is 100 utils. When she consumes the 4th scoop of ice cream the total utility becomes 120 utils. What is Sandhya's marginal utility for the fourth scoop of ice cream?

   a. 115

   b. 100

   c. 30

   d. 20

Check Your Progress - 1

1. A consumer stops consuming a product when _____.

   a. Total utility is equal to marginal utility
   b. Marginal utility reaches its maximum
   c. Marginal utility is equal to price
   d. Marginal utility becomes negative

2. At what point does total utility start diminishing?

   a. When marginal utility is positive
   b. When marginal utility is increasing
   c. When marginal utility is negative
   d. When marginal utility remains constant.

3. Utility of a good can be termed as the _____.

   a   Monetary value a consumer gains from consuming a particular good
   b   The difference between what a consumer is willing to pay and actually pays
   c   The satisfaction a consumer derives from the consumption of a particular good
   d   The desire to consume a good

4. Assume that Ann likes burgers and pastries and the marginal utility she derives from burgers is 12 and from pastries is 10. How will she maximize her total utility?

    a   By consuming more burgers and fewer pastries

    b   By consuming more pastries and less burgers

    c   By consuming equal quantity of burgers and pastries

    d   By consuming only burgers

3.4 Law of Diminishing Marginal Utility

The law of diminishing marginal utility, as stated by Alfred Marshall, is: "The additional benefit which a person derives from a given increase of his stock diminishes with every increase in the stock that he already has." The law of diminishing marginal utility states that as more of the product is consumed, the satisfaction derived from each additional unit is less than that obtained from the preceding unit, which means the marginal utility decreases with the consumption of each additional unit of the product.

3.4.1 Application and uses of the law of diminishing marginal utility

The law of diminishing marginal utility has certain practical uses. The law of diminishing marginal utility explains the factors, which determine the value of a product. It provides the basis for the law of demand and explains the downward slope of the demand curve. It also explains consumer surplus and how it is derived. The law is also useful in framing taxation policies and other fiscal measures. The law also helps in explaining the value of a good to the consumer.

3.5 Equimarginal Utility

Marshall states the law of equimarginal utility as follows: "If a person has a product which can be put to several uses, he will distribute it among these uses in such a way that it has the same marginal utility. If the product has a greater marginal utility in one use than in another, the person would gain by taking away some of the product from the second use and applying for the first." The law states that consumers spend their income on various products in such a way that the marginal utility of each product is proportional to its price.

Therefore, the demand curve for a single product is:

$MU_x = P_x$

Where MU_x stands for marginal utility of product X and P_x stands for price of the product X.

The consumer will go on consuming the product till he reaches a point where $MU_x = P_x$.

Now let us understand how a consumer would allocate his scarce resources for the two products to reach a point where he equalizes the marginal utility of both the products. When the consumer allocates his scarce resources among both products, he has to forgo a part of one product to get a part of another.

The consumer will go on reallocating his limited income in such a way that he gains equal satisfaction from both products. Thus, we can say that the consumer reaches an equilibrium point where MUx/Px = MUy/Py.

MUx and MUy stands for the marginal utilities of products x and y respectively and Px and Py stand for the prices of the products x and y.

3.5.1 Numerical Example

The prices of two pens are ₹ 10 and ₹ 15 respectively. The marginal utility of owning the first pen is 30. If the consumer is at equilibrium, then what is the marginal utility of owning the second pen?

At equilibrium, Marginal utility of product A/ price of product A = Marginal utility of product B/ price of product B.

As per the problem, Marginal utility of owning the first pen = 30 and price of the first pen = ₹ 10

Price of second pen = ₹ 15.

Therefore at equilibrium, 30/10 = Marginal utility of owning the second pen/ 15

=> 3 = Marginal utility of owning second pen/ 15

=> Marginal utility of owning second pen = 3 x15 = 45.

Exercises

C. The marginal utilities of Product A and Product B are 300 and 450 at equilibrium respectively. If the price of the product B is ₹ 60, what is the price of Product A at equilibrium?

    a. ₹ 45

    b. ₹ 90

    c. ₹ 40

    d. ₹ 50

D If the prices of ice-cream and chocolate are ₹ 40 and ₹ 30 respectively, and the marginal utility of chocolate is 150, what is the marginal utility of ice cream assuming that the consumer is at equilibrium?

    a. 112.5

    b. 125

    c. 200

    d. 225

<u>Check Your Progress - 2</u>

5. Which of the following laws state that the more a consumer consumes of a product, the less is the utility he derives from the additional consumption?
   a. Law of equi-marginal utility
   b. Law of ordinal utility
   c. Law of cardinal utility
   d. Law of diminishing marginal utility

6. Which law states that the consumer will spend his income on different products in such a way that the marginal utility of each product is proportional to its price?
   a. Law of diminishing marginal utility
   b. Marginal utility theory
   c. Equimarginal utility
   d. Total utility theory

3.6   Substitution and Income Effect

3.6.1 Substitution effect

When there is a reduction in the price of a product, there is an increase in the quantity demanded of this product and at the same time there is a decrease in the demand for its substitute product. Consumers substitute cheaper products for relatively more expensive products. This is known as the substitution effect. The substitution effect indicates that a decrease in price causes an increase in quantity demanded. The substitution effect is always positive.

Example: Substitution Effect

A drop in monthly rental charges of private telecom players to below the rental charge for a Bharat Sanchar Nigam Limited (BSNL) connection might cause a decrease in demand for BSNL connections. If BSNL increases the monthly rental charges, a few existing customers of BSNL may also switch to a cheaper service provider.

Another example is a rise in the price of Esso petrol leading to a substitution effect, where customers turn to Shell or other competing brands.

3.6.2 Income Effect

The income effect refers to the effect of a change in the price of a product on the consumer's purchasing power. A reduction in the price of a product allows a consumer to buy more of the same product or other products. The income effect indicates that a reduction in the price of a product results in an increase in the quantity demanded. The fall in the price of a product increases the real income of the consumer. The income effect is negative in the case of inferior goods.

3.7 Indifference Curve Analysis

Example: Tradeoff between butter and guns by the US

During Second World War, the United States faced a budget constraint and had to decide between the production of civilian goods (e.g. butter) and defense goods (e.g. guns) from its existing factories. It decided to convert factories that were used for producing products for civilian use (butter) to the production of armaments (guns).

An indifference curve is a curve that describes various combinations of two products or services between which the customer is indifferent at a particular level of income. The consumer is indifferent towards the various combinations of the products on an indifferent curve, thus all the points on the IC give the same level of utility. Indifference curves have certain characteristics which reflect the assumptions made about them:

- Higher indifference curves represent higher levels of satisfaction.
- Indifference curves are negatively sloped.
- Indifference curves are convex to the origin.
- Indifference curves can never intersect each other.

3.7.1 Marginal rate of substitution

The marginal rate of substitution is the rate at which a consumer is willing to substitute one product for another while maintaining the same level of satisfaction. The ratio of the marginal utilities of the two products and the rate at which a consumer is willing to trade one product for another can be derived by measuring the marginal rate of substitution between keeping the total utility constant.

| Combination of Two Products that Yield same Level of Utility		
Utility	**Quantity of pastries Consumed**	**Quantity of patties Consumed**
20	11	2
20	9	6
20	6	9
20	2	11

3.7.2 Budget constraint

The budget constraint is also known as budget line or consumption possibility line. The budget constraint indicates the total money available to spend on consuming products. Thus the total consumption of goods must be less than or equal to the money income available for consumption. Put in other words, the budget line shows the various combinations of the two commodities which the consumer can buy by spending his entire income for the given prices of the two commodities.

3.7.3 Consumer equilibrium

A consumer is said to be in equilibrium at the point of tangency between the budget line and indifference curve. (Refer Figure 3.2). At that point, the slope of the budget line is equal to the slope of the indifference curve. The budget line represents the fixed income available to the consumer to spend on two products. Thus a consumer can attain a state of equilibrium when he maximizes his satisfaction with the limited resources available to him. Consumer satisfaction can be measured by the ranking provided for the consumption of goods and services.

Figure 3.2: Consumer Equilibrium
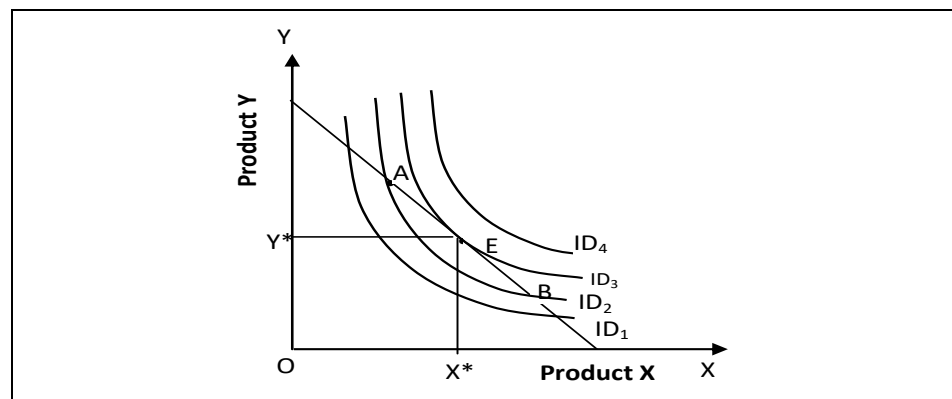
Source: ICFAI Research Center

Check Your Progress - 3

7. _____ refers to the effect of a change in the price of a product on the consumer's purchasing power.

   a. Law of equi-marginal utility
   b. Income effect
   c. Substitution effect
   d. Consumer surplus

8. Keeping the total utility constant, a consumer's reaction to a change in the relative prices of two products is known as _____.

   a. Income effect
   b. Substitution effect
   c. Price effect
   d. Effect of taxation

9. Which of the following statements regarding indifference curve is not true?

   a. An indifference curve has a negative slope
   b. Indifference curve slopes downward to the right
   c. Two indifference curves intersect each other at equilibrium
   d.   Higher level of indifference curve shows higher level of utility

10. Indifference curve indicates _____
    a. The various combinations of two products or services to which the customer is indifferent at a particular level of income
    b. A point where consumer stops consuming a product
    c. A point where the consumer prefers one combination over the other
    d. A point where the budget line and the indifference curve intersect

11. Which of the following is false with reference to the indifference curve?
    a. Every point on the curve yields exactly the same level of satisfaction to a given consumer
    b. It is a curve whose axes measure the amount of goods consumed
    c. It can be used to explain the downward sloping demand curve
    d. The consumer is indifferent to the price of the consumption along the curve

12. _____ is the rate at which a consumer is willing to substitute one product for the other maintaining the same level of utility.
    a. Rate of increase in marginal utility
    b. Marginal rate of substitution
    c. Income effect
    d. Substitution effect

3.8 Consumer Surplus

Alfred Marshall also introduced the concept of consumer surplus, which is based on the law of diminishing marginal utility. He said, "the excess of price which he (the consumer) would be willing to pay (rather) than go without the thing, over that (the price) which he actually does pay, is the economic measure of his surplus satisfaction," and can be called the consumer surplus. Consumer surplus is the difference between the price which a person is willing to pay for a commodity and what he actually paid.

3.8.1 Applications of consumer surplus

The concept is helpful in the implementation of tax policies. Consumer surplus is also of great importance to a monopolist in setting the prices for his products. It helps him to practice price discrimination to different consumers. The concept is also useful in measuring the gains from international trade.

Consumer surplus can be gained by importing products from other countries which are cheaper than the domestic products. The status of the economy can be measured by the consumer surplus. A higher surplus indicates stability in the economy whereas a negative surplus denotes that major fluctuations are in the offing. Look at the exhibit given below for insights into the concept of consumer surplus for free digital goods and services,

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Exhibit 3.1: Measuring the Consumer Surplus of Digital Goods and Services

We are all living in a digital world. A world that offers a number of digital services that are free and involve no cost to the consumer. For instance, look at Wikipedia, email, you tube, google etc. All these off digital services some of which are freely accessible. So if these are available free of cost, then can we call them as "zero value" services.

No, says a research report of MIT Sloan's economists' research on the value of digital goods and services. As per their research, internet is the most valued of all digital goods. A median user would seek a compensation of $17,530 to forgo use of search engines for a year. Users need $8,414 to lose access to email and so on.

So, how is this value perceived and quantified? The research says that GDP (Gross Domestic Product) which is considered as a measure of economic well-being does not capture the contribution of digital goods and services to the well-being of an individual. Their search for answers led them to the concept of consumer surplus. Though these digital goods and services are free for use, their value in terms of consumer surplus is high. Changes in consumer surplus provide a meaningful and more superior measure of the well-being that these goods and services bring to a consumer. The consumer surplus is measured through the consumers' willingness to accept compensation for losing access to these goods and services. Having measured this way, the research study also found that social media, especially Facebook in US, required a median compensation of $40 -$50 for leaving the usage of Facebook for a month.

Source: https://mitsloan.mit.edu/ideas-made-to-matter/how-much-are-search-engines-worth-to-you

3.8.2 Numerical Examples

A consumer consumes four units of a product. Marginal utilities derived from first three units are ₹ 500, ₹ 475, and ₹ 400 respectively. The price of the good is ₹ 300. The consumer surplus is 550. What is the marginal utility of the fourth unit?

Consumer surplus of the product = (marginal utility of first unit- price of the product) + (marginal utility of second unit- price of the product) + (marginal utility of third unit- price of the product) + (marginal utility of fourth unit- price of the product).

=> 550 = (500-300) + (475-300) + (400-300) + (marginal utility of fourth unit-300)

=> 550 = 200+ 175+ 100+ (marginal utility of fourth unit-300)

=> 550 = 475+ (marginal utility of fourth unit-300)

=> 550 = Marginal utility of fourth unit+ 175

=> Marginal utility of fourth unit = 550-175

=> Marginal utility of fourth unit = 375

<u>Exercises</u>

E. A consumer consumes three units of a product. Marginal utilities derived from the three units are ₹ 400, ₹ 350 and ₹ 300, respectively. If the price of the good is ₹ 300 per unit, the consumer surplus is

   a. 0

   b. 50

   c. 100

   d. 150

<u>Check Your Progress - 4</u>

13. What does a higher consumer surplus in an economy indicate?

   a. Economy is stable

   b. Economy is reaching its equilibrium stage

   c. Higher inequality in the economy

   d. Though economy is functioning efficiently, financially it is not sound.

3.9 Summary

- In economics, consumer behavior theory explains the relationship between changes in price and consumer demand. The scarcity of resources restrains consumers from satisfying all their wants.

- Utility can be defined as the extent of satisfaction obtained from the consumption of products and services by consumers.

- There are two approaches to the utility analysis. They are the cardinal and ordinal approaches.

- Total utility can be defined as the amount of utility derived by a person from the consumption of a particular product in a specific period of time.

- Marginal utility can be defined as the additional utility derived by a consumer by consuming an additional unit of a commodity.

- The law of diminishing marginal utility states that as more of the product is consumed, the satisfaction derived from each additional unit is less than that obtained from the preceding unit. In other words, the marginal utility decreases with the consumption of each additional unit of the product.

- The law of equimarginal utility describes how the consumer spends his income on various goods and services in order to gain the same marginal utility on each good consumed.

- An indifference curve is a curve that describes various combinations of two or more products or services that give the same level of satisfaction to the consumer at a particular level of income.

- Consumer surplus is the difference between the price which a person is willing to pay for a commodity and what he actually paid.

3.10 Glossary

Consumer surplus: The net benefit realized by consumers when they are able to buy a good at the prevailing market price. It is equivalent to the difference between the maximum amount consumers would be willing to pay and the amount they actually do pay for the units of the good purchased.

Diminishing marginal utility: The proposition that the satisfaction derived from consuming an additional unit of a good or service declines as additional units are acquired.

Income effect: The effect of a change in income on the quantity of a good or service consumed.

Indifference curve: A curve showing all possible combinations of two goods among which the consumer is indifferent.

Inferior good: A good for which the demand decreases when income increases. When a household's income goes up, it will buy a smaller quantity of such a good.

Money: The means of payment or medium of exchange.

Price discrimination: The selling of a good or service at different prices to different buyers or classes of buyers in the absence of any differences in the costs of supplying it.

Real income: Real disposable income is the per capita disposable income.

3.11 Self-Assessment Test

1. Define consumer surplus and discuss application of consumer surplus.

2. Define indifference curve and explain the concept of consumer equilibrium with the help of a diagram.

3.12 Suggested Reading / Reference Material

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3.13 Answers to Check Your Progress Questions

3.13.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit

1. **(c) Marginal utility is equal to price**

    The marginal utility of each unit a consumer consumes at a given point of time declines gradually. The satisfaction that a consumer derives after consuming the first unit of a product will not be the same for the second unit. The consumer goes on consuming the product, till its marginal utility is equal to its price. If a consumer consumes an additional unit of the product, it gives negative utility.

2. **(c) When marginal utility is negative**

    Utility can be defined as the total satisfaction a person derives from the consumption of goods and services. Marginal utility is the additional utility a person derives when he consumes one more unit of a product. When a person has reached the maximum satisfaction by consuming a particular product, any further addition to consumption will give him a negative satisfaction. In other words, marginal utility becomes negative and total utility starts diminishing.

3. **(c) The satisfaction a consumer derives from the consumption of a particular good**

   In economic terms, utility means the extent of satisfaction that a consumer obtains from the consumption of products and services. The purpose of developing the concept was to explain the basic principles of consumer choice and behavior.

4. **(a) By consuming more burgers and fewer pastries**

   Utility can be defined as the total satisfaction a person derives from the consumption of goods and services. Marginal utility is the additional utility a person derives when he/she consumes one more unit of a product. Here, the marginal utility of the burger (12) is more than the marginal utility of pastries (10). So to maximize total utility, Ann should have more burgers and fewer pastries.

5. **(d) Law of diminishing marginal utility**

   The law of diminishing marginal utility states that if a consumer goes on consuming more units of a particular product, after a given point of time, his total utility increases but only at a diminishing rate. In other words, the satisfaction derived from that product goes on decreasing as he consumes more and more units of the product.

6. **(c) Equimarginal utility**

   The theory of equimarginal utility can be better explained using Marshall's definition, which says that if a person has a product which can be put to several uses, he will distribute it among these uses in such a way that it has the same marginal utility. If the product has greater marginal utility in one use than in another, the person will gain by taking away some of the product from the second use and applying it to the first.

7. **(b) Income effect**

   If the price of a product decreases, the consumer is left with some money that can be used to buy additional units of the same product, or a different product. The income effect rule says that a decrease in price leads to an increase in quantity demanded because of the increase in the consumer's purchasing power.

8. **(b) Substitution effect**

   According to the theory of substitution effect, a consumer will substitute more of the product the price of which has fallen. It also says that the decrease in price causes an increase in quantity demanded.

9. **(c) Two indifference curves intersect each other at equilibrium**

   Two indifference curves of a consumer will not intersect because the consumer is assumed to have well-ordered utility levels for the two products.

He cannot have two different levels of utility for the same product at the same level of consumption. Therefore the ICs cannot intersect. An IC at a higher level shows a higher level of utility.

10. **(a) The various combinations of two products or services to which the customer is indifferent at a particular level of income**

An indifference curve explains the various combinations of two products which give the customer the same level of satisfaction at given point of time while income remains constant. A higher indifference curve shows a higher level of satisfaction. An indifference curve can be defined as the locus of all those points representing various combinations of two commodities giving the same satisfaction to the consumers.

11. **(d) The consumer is indifferent to the price of the consumption along the curve**

An indifference curve can be defined as the locus of all those points representing various combinations of two commodities giving the same level of satisfaction to the consumer. In an indifference curve, the price of a product and its demand are not compared, only the combinations of two different products, by which the consumer maximizes his satisfaction are considered.

12. **(b) Marginal rate of substitution**

If a consumer has to choose between two goods, the ratio of marginal utilities of the two products and the rate at which a consumer is willing to trade one product for another can be derived by measuring the marginal rate of substitution between them, keeping the total utility constant.

13. **(a) Economy is stable**

Consumer surplus can be defined as the difference between what the consumers would like to pay for a product and what they actually pay. Consumer surplus can also be used to measure the health of an economy. For instance, if consumers are willing to pay more for the product then it conveys that they are having more disposable income indicating better standard of living. Therefore, a higher consumer surplus indicates that the economy is stable.

3.13.2 Model Answers to Exercises

Following are the model answers to the Exercises given in the unit.

A. **(c) -1**

At a particular point of consumption, the consumer maximizes his satisfaction. This is known as the "satisfaction quantity." Further consumption of that particular product decreases his satisfaction level and marginal utility becomes negative.

B. **(d) 20**

Marginal utility can be defined as the additional utility that a consumer derives after consuming one more unit of the same commodity. In this case,

the utility after consuming the third ice cream was 100 utils, whereas, after consuming the fourth scoop, utility was 120 utils. Hence, the marginal utility is 20 utils.

C. (c) ₹ 40

If A and B are the products, and MU and P represents marginal utility and price respectively, consumer reaches an equilibrium point where $MU_a/P_a = MU_b/P_{b...}$ $300/P = 450/60$

$P = 300 \times 60/450$. Therefore, replacing the values in the formula, we get the price of product A as ₹ 40.

D. (c) 200

If Ice cream (I) and chocolate (C) are the products, and MU and P represents marginal utility and price respectively, consumer reaches an equilibrium point where $MU_i/P_i = MU_c/P_c$. Marginal utility of ice cream is $40 \times 150/30$. Therefore, replacing the values in the formula, we get the marginal utility of chocolate.

E. (d) 150

Consumer surplus can be defined as the difference between what a consumer would like to pay for a product and what he actually pays. In the given problem;

Consumer surplus from 1st product $= 400 - 300 = 100$

Consumer surplus from 2nd product $= 350 - 300 = 50$

There is no consumer surplus for the consumer after consumption of 3rd product as the satisfaction level is same as the price.

Therefore, total consumer surplus $= 100+50 = 150$

Unit 4

Production Function

Structure

4.1   Introduction

The previous unit discussed the concept of utility theory and the importance of indifference curve in consumer equilibrium. This unit will discuss different aspects of production function.

A firm has to make various decisions with regard to production. Some of the issues which arise are: what type of product is to be produced, the method of production to be used if there are more than one ways of production, the quantity to be produced, etc.

Production can be defined as the transformation of inputs into outputs. Inputs are essential elements in the process of production. Economists have categorized inputs into four basic factors of production – land, labor, capital and organization. Transformation of inputs into outputs is of three types – change in form, change in place and change in time.

In this unit, we will discuss the behavior of firms in producing goods, the different stages of production and the various ways in which production can be undertaken with changes in the number of variable inputs and the concept of expansion path.

Before studying the unit, students should recall the concepts of diminishing marginal utility (Section 4 in Unit 3) and the indifference curve (Section 7 in Unit 3).

4.2 Objectives

By the end of this unit, students should be able to:

- Discuss the theory of production and describe various stages of production

- Explain the concept of returns to scale and identify which type of returns to scale operate in a particular situation

- Analyze how production can be undertaken with changes in the number of variable inputs

- Compare and contrast the concepts of isoquant and the isocost line

- Define the concept of expansion path

4.3 Production Function

The production function is the relationship between inputs and outputs, generally represented in a mathematical form. It can be expressed in several forms like tables, graphs and equations, etc. For example, let us assume that the factors of production can be categorized as labor (L) and capital (K). The equation for the production function is as below:

$Q = f(K, L)$

The production function is a quantified relation, which shows the overall output generated at a given level of input, with the technology and manpower available. Production functions can be used to obtain the least cost combination of inputs required to produce a given output, since they provide the technological information on input combinations to the firm.

4.4 Concepts of Product

The physical production process consists of three product concepts – total product, average product and marginal product.

4.4.1 Total product

Total product refers to the total amount of output produced using a given quantity of one factor, assuming other factors to be constant. With an increase in the quantity of the factor input, the output also increases.

4.4.2 Average product

Average product can be defined as the total product per unit of a factor employed in the production process. Mathematically, this can be expressed as:

Average product = total product / number of units of a factor employed

The average product can be represented as $AP = Q / L$, where Q is total product and L is the number of a variable factor employed.

4.4.3 Marginal product

The marginal product of an input is the extra output added by one extra unit of that input, while other inputs are held constant.

Let us assume that when labor is increased by ΔL units, the output increases by ΔQ units. The marginal product can be represented as:

$MP_L = \Delta Q / \Delta L$

The three product concepts can be understood through a schedule.

Unit of labor	Total product (Kgs)	Marginal product (Kgs)	Average product (Kgs)
1	100	100	100
2	220	120	110
3	360	140	120
4	440	80	110
5	480	40	96
6	420	- 60	70

Check Your Progress - 1

1. Which of the following statements regarding production function is false?
    a. It just shows the relationship between output and input
    b. It does not provide any information on the least-cost capital labor combination
    c. It reveals the output that yields the maximum profit
    d. Both a and c

2. In economic terms, what does Total Product refer to?
    a. The total output that a laborer produces in a given time period
    b. The total amount of output produced using a given quantity of a factor, assuming other factors to be constant
    c. The product which is ready for sale
    d. The product which comprises of small components, where each component is itself a small product

3. The marginal product of labor in a production process equals _____
    a. Total output divided by total labor
    b. Sum of total output and the total capital stock
    c. The change in total output as a result of a change in the labor
    d. Total output produced by labor

4. If labor is increased by L units, and output by Q units, the marginal product will be represented as:
    a. MPL = Product of change in Q and change in L
    b. MPL= Sum of change in Q and change in L
    c. MPL= Change in Q divided by change in L
    d. MPL=Change in L divided by change in Q

4.5 The Three Stages of Production

When one factor of production is varied and the other factor is kept constant the production process can be divided into three stages. They are:

Stage I

The first stage is called the stage of increasing returns to the factor of production. In this stage, MP increases at first and then decreases. AP increases throughout this stage i.e. upto point A. That is why this stage is called the stage of increasing returns. Why do average returns to the fixed factor increase during this stage? This happens because in the beginning, the quantity of fixed factor is high relative to the quantity of variable factor. The efficiency can be increased with an increase in the variable factor. TP increases sharply during this stage.

Stage II

The second stage is also known as stage of diminishing returns. In this stage, AP starts to diminish while MP continues to diminish although MP is still positive. Here, TP increases at a diminishing rate until it reaches the maximum point 'C'. (Refer Figure 4.1).

Figure 4.1: Total, Average and Marginal Productivity
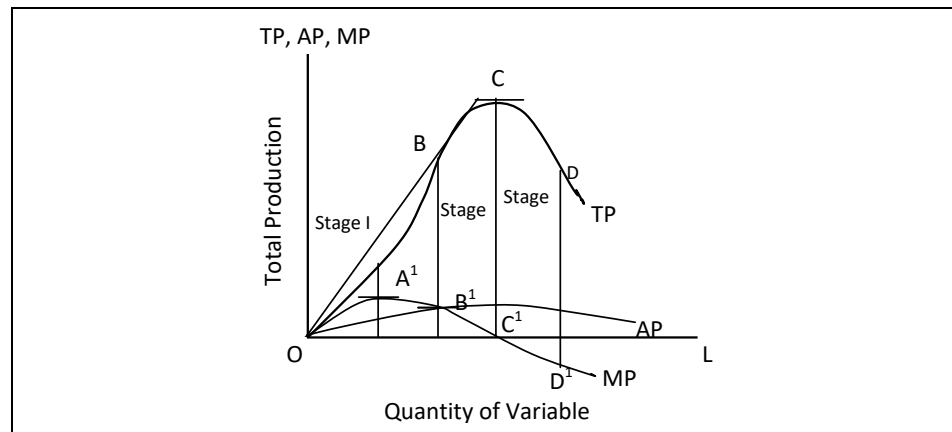
Source: ICFAI Research Center

According to Joan Robinson, "The law of (diminishing returns) as it is usually formulated, states that with a fixed amount of any factor of production, successive increases in the amounts of other factors will, after a point, yield diminishing increments of output."

Stage III

This stage is called the stage of negative returns. In this stage, TP declines, MP becomes negative and falls below the X-axis. The efficiency of the variable factor and the fixed factor both decline. In this stage, the quantity of the variable factor is so large compared to the fixed factor that the former comes in the latter's way, thereby reducing the efficiency of the fixed factor, thus resulting in fall in the total product.

Entrepreneurs do not prefer to operate within stage I and stage III. In stage I, the entrepreneur will increase his employment of the variable factor (the fixed factor is constant), since if he does not, some portion of the fixed factor remains unutilized. Therefore, he moves into stage II. In stage III, TP decreases and MP is negative. Therefore, no entrepreneur wants to operate in this stage.

Stage II is the suitable stage for an entrepreneur to operate. AP and MP are falling but TP has not yet reached the maximum point so it makes sense for the entrepreneur to operate in this stage. Therefore, the entrepreneur will employ the variable factor in such a way that the fixed factor is fully utilized, while the amount of the variable factor is not excessive and unnecessary.

Activity 4.1

Ranbir has 5 acres of land. At present, 4 acres are under cultivation by 20 laborers with an output of 400 bags. Ranbir decides to increase his total output by employing 10 more laborers on an increased area of land i.e. on 5 acres of land. However, to his dismay, the output on 5 acres of land now falls to 370 bags. Explain why this happens.

Answer:

Numerical Examples

1. The production function of a firm is $TP_L = 45L^2 - L^3$, where L stands for labor. How many units of labor should be employed to maximize output?

    Output is maximized when $MP_L = 0$

    $TP_L = 45L^2 - L^3$

    Therefore, $MP_L = \partial\,TP_L\,/\,\partial\,L = 90L - 3L^2$

    Therefore, $90L - 3L^2 = 0 \Rightarrow L\,(90 - 3L) = 0$

    Either $L = 0$ or, $90 - 3L = 0$

    Since labor can not be zero, therefore, $90 - 3L = 0$ or $L = 30$

2. The production function of a firm is $Q = K^3 - 3K^2 + 2K$. Find the level of capital at which the firm will have diminishing marginal returns?

    A firm has diminishing returns when Marginal Product (MP_K) is maximum.

    MP_K is maximum when $\dfrac{\partial MP_K}{\partial K} = 0$

    $$MP_K = \frac{\partial Q}{\partial K} = \frac{\partial(K^3 - 3K^2 + 2K)}{\partial K}$$

    $MP_K = 3K^2 - 6K + 2$

    $$= \frac{\partial(MP_K)}{\partial K} = \frac{\partial(3K^2 - 6K + 2)}{\partial K}$$

$$\frac{\partial(MP_K)}{\partial K} = 6K - 6$$

Equating $\frac{\partial(MP_K)}{\partial K}$ with zero

$6K - 6 = 0$

$K = 1$

∴ When K is equal to 1, the firm will have diminishing returns.

Exercises

A. The production function of S. V. Rice Mills is $Q = -K^3 + 6K^2 + 48K$. (K represents the units of capital employed). At what point of capital, will the mill yield diminishing marginal returns?

   a. When K = 1

   b. When K = 2

   c. When K = 1.5

   d. When K = 0. 5

B. The production function of a firm is $TP = 15 L^2 - L^3$. How much labor (L) should the firm has to employ to maximize output?

   a. 10

   b. 15

   c. 12

   d. 20

4.6 Short-Run and Long-Run

As far as production theory is concerned, a short-run period is a period of time during which the quantity of variable factors can be altered to increase the output whereas the fixed factors cannot be changed (they remain constant). Output in the short-run period follows the pattern shown by the law of variable proportions.

In the long-run period, all the inputs are variable, and this enables a change in the scale of production. The change in the quantity of inputs brings about a change in the size of the firm and scale of output. The relationship of the output to the changes in the inputs in the long-run is known as returns to scale.

Check Your Progress - 2

5. Which of the following statements best describes the total product curve?

   a. It rises initially at an increasing rate and later at a diminishing rate

   b. It rises initially at a decreasing rate and later at an increasing rate

   c. It rises at an increasing rate only

   d. It is always constant

6. In which stage of production is the marginal product greater than the average product?

    a. Stage of decreasing returns

    b. Stage of increasing returns

    c. Stage of negative returns

    d. Both a and c

7. Which of the following activities cannot take place in the short run?

    a. Changing the quantity of labor employed

    b. Changing the input combination

    c. Regular maintenance of the plant, to ensure efficient production

    d. Installation of an additional plant to meet future requirements

8. Which statement best represents the characteristic of long run production?

    a. No factors of production can be adjusted according to the production level

    b. A few factors of production can be adjusted according to the production level

    c. All factors of production including capital can be adjusted according to the production level

    d. All factors of production excluding capital can be adjusted according to the production level

9. In the formulation of the short-run production function _____.

    a. The capital investment can be varied

    b. The quantity of capital employed is assumed to be fixed

    c. The quantity of both labor and capital employed are assumed to be fixed

    d. The quantity of output is usually fixed

4.7 Technological Change

Technological change can be described as the advancement in the procedures and processes of production of goods and services. Technological advancements help to increase productivity by reducing costs and preventing wastage in the production process.

Technological innovations can be divided into two types – process innovations and product innovations. Process innovations are improvements in the systems and methods of the production of existing products. In process innovation, output is increased with the same input, or the same output is produced with less input. Product innovation is the introduction of a new product in the market with new features. It is difficult to determine the value of product innovation, when compared to process innovation. But product innovation helps improve the standard of living of people and can also generate fresh demand.

Exhibit 4.1: Explains the Process Innovations Taken up by Apple Inc.

Apple Inc., is known to be at the forefront of technological innovations. Their innovations pertain to hardware, software and services. While most organizations concentrate on the products for innovations, Apple introduced innovation through the organization structure. Perhaps the most innovated product from Apple is the iphone, especially, the iphone camera. The camera went through a series of innovative technologies from High dynamic range imaging (2010), to panorama photos (2012), true tone flash (2013), optical image stabilization (2015), the dual lens camera and portrait mode (2016), portrait lighting (2017), and night mode (2019).

All these innovations require an agile organization structure. The structure at Apple is based on functional expertise. At every step of the product development process, it is the functional expertise that brings in the innovation. Every minute detail is innovated. For instance, Apple was the foremost to have brought in products with 'rounded corners'. While the standard method of rounding was to use an arc of a circle, innovators at Apple brought in continuous curves which is referred to in design community as " squircle". Apple's operations heads undertake extremely precise manufacturing tolerances in each of the Apple's product to evolve the perfect "squircle"

Source: https://hbr.org/2020/11/how-apple-is-organized-for-innovation

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Check Your Progress - 3

10.   _____is the improvement in the production techniques for existing products.

   a.   Process innovation
   b.   Product innovation
   c.   Plant innovation
   d.   Production function

11.   What is the impact of technological advancement on productivity?

   a.   It remains constant
   b.   It declines
   c.   It rises
   d.   It rises initially and starts declining later

4.8   Production with One Variable Input

In the short-run, one of the inputs is fixed and other input is variable. The time period is not long enough for all (or both) the inputs to be varied. Usually, firms plan and consider changes in operations involving changes in all inputs. Therefore, while firms plan for the long-run, they operate in the short-run.

> ### Example: Types of Returns to Scale
>
> If the owner of a supermarket chain has increased the inputs like workers, stock, area of the store, etc. by 50% and if the output (sales) increases by 60%, we have increasing returns to scale in the supermarket.
>
> If we increase the number of operators and machines, each by 50%, and the number of standard pieces produced (output) increases also by 50%, we have constant returns to scale.
>
> If a farmer increases inputs like fertilizers, workers, equipment, etc. by 50% and the output increases by only 40%, we have decreasing returns to scale.

4.8.1 Diminishing marginal returns

As we have seen earlier, the law of diminishing marginal returns states that the combination of a variable input at an increasing rate with a fixed input, decreases the marginal product of the variable input after reaching a certain point. The law of diminishing returns is based on three assumptions –

- The rate of technology is given
- One factor of production is kept constant at a given level
- The law is not applicable when the two inputs are used in a fixed proportion.

These assumptions are valid only in the short run. Therefore, diminishing marginal returns will operate in the second stage of production and in the short run period only.

4.9   Returns to Scale

Changes in the scale of production are made only in the long-run period. In the long run, all the inputs are variable, as factors like land and capital can also be increased over a sufficient period of time. Returns to scale can be defined as the responsiveness of the output to changes in the quantities of inputs. There are three different types of returns to scale that are experienced –

- Increasing returns to scale
- Constant returns to scale
- Decreasing returns to scale

4.9.1 Increasing returns to scale

Increasing returns to scale come about when the increase in the total output is greater than the proportional increase in inputs.

4.9.2 Constant returns to scale

Constant returns to scale occur when the increase in the total output is proportional or equal to the increase in inputs.

4.9.3 Decreasing returns to scale

Decreasing returns to scale are seen when the increase in the total output is less than the proportional increase in inputs.

Check Your Progress - 4

12. Which of the following is not an assumption of the law of diminishing returns?

    a. One factor of production must always be kept constant at a given level

    b. This law is not applicable when the two inputs are used in a fixed proportion

    c. Steady growth in technology

    d. Both b and c

13. The "law of diminishing returns" is applicable in_____.

    a. The short run

    b. The long run

    c. Both the short run and the long run

    d. Neither in the short run nor in the long run

14. According to the law of diminishing returns, if more labor is employed, capital remaining the same,

    a. The marginal productivity of labor is zero

    b. The marginal productivity of labor decreases initially but starts increasing after reaching a high

    c. The marginal productivity of labor is negative

    d. The marginal productivity of labor will increase initially but start decreasing after reaching a high

15. According to the law of diminishing marginal returns, if labor is a variable input, then _____.

    a. Additional labor always yields negative output

    b. Additional labor always yields extra output

    c. Additional labor leads to lower average total cost

    d. After a point any addition in the labor causes a reduction in total output

16. In a small-scale rubber plant, factors of production like labor, material, and capital are increased by 10%. As a result output increased by less than 10%. It implies that the firm is experiencing _____.

    a. Constant returns to scale

    b. Decreasing returns to scale

    c. Increasing returns to scale

    d. Increasing as well as decreasing returns to scale

17. Which of the following statements describes increasing returns to scale?

   a.   Doubling the inputs used results in more than double the output

   b.   Increasing the inputs by 50% leads to a 25% increase in output

   c.   Increasing inputs by 1/4 leads to an increase in output of 1/4

   d.   None of the above

18. Increase in all inputs leading to less than proportional increase in output is called _____.

   a.   Increasing returns to scale

   b.   Decreasing returns to scale

   c.   Constant returns to scale

   d.   Both increasing and decreasing returns to scale

Activity 4.2

Kwality Bakery, a small bread shop owned by Fred, produces 1000 loaves of bread per day. Fred initially employed 9 people. To increase the output, Fred decided to hire one more person and the total number of workers reached 10 and the output increased to 1200. Not satisfied with the output, Fred hired one more person who was equally efficient and the total number of workers reached 11. To his surprise, Fred found that output was only 1250 loaves, against his expectation of 1400. Explain why the output did not increase as expected after the 11th worker was hired.

Answer:

4.10 Production with Two Variable Inputs

When capital and labor (inputs) are both variable, the analytical techniques applied to determine optimal input rates must be completely different. There are different methods that can be adopted for the efficient allocation of resources. They are maximization of production for a level of given resources, minimization of the production costs for a given level of output, and production of output at a level that maximizes profit.

Properties of Isoquants

- An isoquant is downward sloping to the right.
- A higher isoquant represents a higher output.
- No two isoquants intersect each other.
- Isoquants are convex to the origin.

4.10.1 The production isoquant

An isoquant is also known as isoproduct curve, equal product curve or a production indifference curve. An isoquant is the curve which shows all the combinations of the two factors of production which will produce the same output. Without taking costs into consideration, the producer will be indifferent between these combinations, since they produce the same amount of output.

4.10.2 Marginal rate of technical substitution

A production function with more than one variable input is drawn up assuming that different combinations of inputs can be used to produce a given level of output. The marginal rate of technical substitution (MRTS) is similar to the marginal rate of substitution in indifference curves. The marginal rate of technical substitution is the rate at which one input can be substituted for another in order to maintain a constant level of output.

MRTS of labor for capital is defined as the number of units of capital that can be replaced by one unit of labor while the level of output remains unchanged. The properties of isoquants are: they are downward sloping to the right, a higher isoquant represents a higher output, and no two isoquants intersect or touch each other.

4.10.3 The production isocost

Isoquant denotes different ways to produce a given rate of output. After determining the optimal combination of capital and labor, the next step is to add information on the cost of these inputs. The information regarding costs is introduced by a function called production isocost. An isocost line is defined as the locus of various combinations of factors which a firm or an organization can buy at a given level of output. As the isocost line also shows the prices of various combination, it is also referred as price line.

4.10.4 Least cost combination

The aim of any firm is to maximize its profits, which can be achieved by producing maximum output at minimum costs. This can be achieved at the output where the isoquant touches the isocost line which shows the least cost combination available for a particular firm. Thus, we can say that the equilibrium point is where isocost line is tangent to isoquant curve. The salient feature of this equilibrium point is that a specific isoquant is tangent to an isocost line. At this point, the firm is in a state of equilibrium since there is no benefit to be derived by altering the input combination in any way. This point is the least cost input combination for the highest production level achievable.

4.10.5 Expansion path

The expansion path for the firm is the locus of different equilibrium points when the firm's expenditure increases without any change in the price of inputs. It represents a change in the level of factor inputs when output and expenditure changes while input prices are constant.

19. When the slope of the isocost is equal to the slope of the isoquant, it represents _____.
    a. The point at which the firm starts making profits
    b. The best combination of variable and fixed cost
    c. The least-cost input combination
    d. The point at which the firm has to shut down its operations

20. The least cost combination of input mix depends on _____.
    a. Isoquant
    b. Isocost lines
    c. Both isoquant and isocost lines
    d. Neither isoquant nor isocost line

21. What is the locus of different equilibrium points, when the firm's expenditure increases without change in the price of the inputs, known as?
    a. Expansion path
    b. Break even point
    c. Shut down point
    d. Isoquant

4.11 Summary

- Production can be defined as the transformation of inputs into outputs. Economists have categorized the inputs into four factors of production – land, labor, capital and organization.

- The production function refers to the physical relation between inputs and outputs generally represented in a mathematical form.

- The production process can be divided into three stages in the short run. In the short run, one factor is taken as fixed or constant, while the other is variable. The first stage is the stage of increasing returns to the variable factor. The second stage is the stage of diminishing returns. The third stage is the stage of negative returns.

- In the long run, both factors can be varied i.e. the overall scale of production can be changed.

- Returns to scale can be studied in the long run period. Returns to scale refers to the responsiveness of the output to the changes in the quantities of inputs. There are three possibilities – increasing returns to scale, constant returns to scale and decreasing returns to scale.

4.12   Glossary

Average product: Total product or output divided by the quantity of one of the inputs. Hence, the average product of labor is defined as total product divided by the amount of labor input, and similarly for other inputs

Capital: Usually used in the "real" sense in economics to refer to machinery and equipment, structures and inventories, that is, produced goods for use in further production. Distinguished from "financial capital", meaning funds which are available to finance the production or acquisition of real capital.

Diminishing returns: The tendency for additional units of a productive factor to add less and less to total output when combined with other inputs which are to some degree fixed in quantity.

Long run: In the context of the theory of the firm, the long run is a period of time long enough for the firm to vary the quantities of all the inputs it is using, including its physical plant.

Short run: In the theory of the firm, a period of time which is too short for changes to be made in all inputs. For example, a period not long enough to permit the size of the physical plant to be altered.

4.13   Self-Assessment Test

1. Define production function. Define total product, average product and marginal product and describe the changes in them as the variable input is increased.

2. Explain the concepts of isoquant curve, isocost curve and expansion path.

4.14   Suggested Reading /Reference Material

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4.15 Answers to Check Your Progress Questions

4.15.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit

1. **(c) It reveals the output that yields the maximum profit**

   The production function just shows the relationship between output and input rates. The production function neither provides any information on the least-cost capital labor combination, nor does it reveal the output rate that will yield maximum profit. The production function simply reveals the maximum output that can be obtained from any and all input combinations.

2. **(b) The total amount of output produced using a given quantity of a factor, assuming other factors to be constant**

   Total product refers to the total amount of output produced using a given quantity of factors assuming other factors to be constant.

3. **(c) The change in total output as a result of a change in the labor**

   The marginal product is the additional product that is added to the existing one. Marginal product of labor in a production process means the change in total output as a result of a change in the labor.

4. **(c) MPL= Change in Q divided by change in L**

   The marginal product of an input is the extra output added by one extra unit of that input, while other inputs are held constant. In this situation, marginal productivity of labor has to be analyzed, keeping other things constant. The marginal productivity of labor can be arrived by calculating the ratio of change in the quantity produced and the change in the input variable i.e. labor.

5. **(a) It rises initially at an increasing rate and later at a diminishing rate**

    Other things remaining the same, total product refers to the total output produced using a given quantity of factors of production. Keeping other factors constant, an increase in one factor input increases total production till it reaches the maximum point. After that, any further addition will not increase total product; instead it diminishes it.

6. **(b) Stage of increasing returns**

    In the stage of increasing returns of production, average product increases and marginal product is greater than the average product. In this stage both marginal product and the average product increases, but marginal product is greater than average product. As a result, a given increase in the variable factor leads to a more than proportionate increase in the output.

7. **(d) Installation of an additional plant to meet future requirements**

    The short run is the period in which variable factors such as labor and material can be changed to modify the level of production but one cannot change fixed factors such as capital.

8. **(c) All factors of production including capital can be adjusted according to the production level**

    In the short run, a firm can make changes in variable factors like labor and raw material, but it cannot make any changes in the fixed inputs like capital. In the long run, however, a firm has enough time to make changes in any of its inputs. It can bring in more capital, install new plants, adopt new technology, etc. Thus, in the long run, all inputs are variable.

9. **(b) The quantity of capital employed is assumed to be fixed**

    Short-run can be defined as the period in which firms can vary production by changing the variable inputs. Since capital cannot be varied with the change in production during this period, it is assumed to be fixed.

10. **(a) Process innovation**

    Process innovation is the improvement in the production techniques for existing products. Process innovation allows firms to produce more output with the same inputs or to produce the same output with fewer inputs. In other words, process innovation is equivalent to a shift in the production function.

11. **(c) It rises**

    With technological advancement, the productivity rises. This is because with technological superiority, the same quantity of output can be produced with fewer resources.

12. **(c) Steady growth in technology**

The law of diminishing returns to factors is based on three assumptions. First, it is assumed that the rate of technology is given. Second, one factor of production must always be kept constant at a given level. Thus, this law is not applicable when all the factor inputs are variable. Third, this law is not applicable when the two inputs are used in a fixed proportion.

13. **(a) The short run**

When one of the inputs is fixed for a particular period of time, it is defined as the short run, whereas in the long run all the inputs are variable. The law of diminishing returns holds good when some inputs are fixed and some are variable. Hence it is applicable only in the short run.

14. **(d) The marginal productivity of labor will increase initially but start decreasing after reaching a high**

According to the law of diminishing marginal returns, by keeping other things constant and adding only a factor of production, there is an increase in production in the initial stage, but it starts diminishing later. This is because by increasing only one input (labor) and holding other inputs constant, the land gets more crowded; machines are overworked leading to diminishing marginal returns.

15. **(d) After a point any addition in the labor causes a reduction in total output**

According to the law of diminishing returns, when an increasing amount of a variable input is combined with a fixed level of another input, a point is reached where the marginal product of the variable input starts declining. If a firm has labor as one of its variable inputs, when the labor is increased, the marginal productivity of labor increases initially, but starts decreasing later.

16. **(b) Decreasing returns to scale**

Returns to scale in the production process tend to differ in the long run. In the initial stages, there is an increase in returns to scale, where the proportion of output will be more than the input. But when production process reaches its maximum, any further increase in input will result in a less than proportionate output due to increase in cost management, ineffective management, etc. This, in turn, will lead to decreasing returns to scale.

17. **(a) Doubling the inputs used results in more than double the output**

When an increase in all inputs leads to a more than proportional increase in output, it is called increasing returns to scale.

18. **(b) Decreasing returns to scale**

Decreasing returns to scale occurs when an increase in all inputs leads to less than proportional increase in output. When processes are scaled up, they reach a point beyond which inefficiencies set in.

19. (c) The least-cost input combination

The isoquant curve represents various factors of production that give the same level of output. Isocost represents prices that a firm incurs. Thus, the point at which these two lines touch each other is the least cost combination for any firm.

20. (c) Both Isoquant and Isocost lines

Isoquants show different combinations of factors of production which yield equal production. As all the combinations on the isoquant give the same amount of production, the producer is indifferent to any of these changes. On the other hand, the isocost line shows the different combinations of two products which a producer can obtain from the market with a given outlay.

21. (a) Expansion path

When a firm's expenditure increases without increase in the price of input, there will be a parallel shift in the isocost line. Each isocost line gives a new tangency point and a new equilibrium point. The curve we get after joining all the equilibrium points is called the expansion path.

4.15.2 Model Answers to Exercises

Following are the model answers to the Exercises given in the unit.

A. (b) When K = 2

A firm yields diminishing returns when Marginal Product (MP_K) is maximum.

MP_K is maximum when $\dfrac{\partial MP_K}{\partial K} = 0$

$MP_K = \dfrac{\partial Q}{\partial K} = \dfrac{\partial(-K^3 + 6K^2 + 48K)}{\partial K}$

$MP_K = -3K^2 + 6K + 48$

$= \dfrac{\partial(MP_K)}{\partial K} = \dfrac{\partial(-3K^2 + 12K + 48)}{\partial K}$

$\dfrac{\partial(MP_K)}{\partial K} = -6K + 12$

Equating $\dfrac{\partial(MP_K)}{\partial K}$ with zero

$- 6K + 12 = 0$

$K = 2$

∴ When K reaches 2, the firm starts yielding diminishing returns.

B. (a) 10

Total production (TP) of a firm is maximum when MPL = 0.

$TPL = 15 L^2 - L^3$

$MPL = 30L - 3L^2$

$30L - 3L^2 = 0$

$L (30 - 3L) = 0$

$L = 0$ or $L = 10$.

Labor cannot be zero, hence the output can be maximized by employing 10 labor

Unit 5

Analysis of Costs

Structure

5.1   Introduction

In the previous unit, production function and the different types of returns to scale were discussed.

Expenses incurred on factors of production are known as the cost of production or the cost. For maximization of profits, a firm has to monitor revenues and costs closely. The cost of production is an important element in the firm's decisions regarding the quantity of production, expansion or contraction of the output, etc. Hence, the concept of costs plays a significant role in the price theory and output determination.

In this unit we will discuss cost and production function, types of costs, break-even analysis and economies of scale.

Before studying this unit, students should recollect the concepts described in the previous unit.

5.2   Objectives

By the end of this unit, students should be able to:

- List different types of costs;
- Classify cost function both in the short run and in the long run;
- Describe break-even point and shut down point of a firm;
- Explain different types of economies of scale.

5.3 Types of Costs

There are various types of costs that are relevant for a firm in decision making. The relevant costs may vary from situation to situation. A firm should be clear about the different types of costs, to enable them to take better decisions. The various types of costs are:

5.3.1 Opportunity cost

According to Leftwitch, the "opportunity cost of a particular product is the value of the forgone alternative product that resources used in its production could have produced." In other words, opportunity cost conveys the next best alternative that was abandoned in order to pursue the other (best) alternative. It is useful to take opportunity cost into consideration in short-term decisions like sales strategy, inventory management, and hiring of labor. A firm should always consider the opportunity cost while evaluating the alternatives.

5.3.2 Implicit costs

According to Leftwich, implicit cost is the, "cost of self owned,self employed resources that are frequently overlooked in computing the expenses of a firm." Implicit costs are also known as imputed costs. Implicit costs are the value of forgone opportunities but they do not involve a physical cash payment. Implicit costs include the wages the entrepreneur could have earned if he worked for some other company, the interest the entrepreneur could have earned on his capital, etc.

Example: Implicit Costs

Family Inn is a restaurant owned by Shekar and run by him and his own family members. They would have drawn salaries, had Shekar and his family members been employed in some other company. Thus, the salaries they don't get, which are not mentioned in the books of accounts are known as implicit costs.

5.3.3 Explicit costs

Leftwich defines explicit costs as, "those outlays made by a firm that we usually think of as its expenses. They consist of resources bought or hired by the firm." Explicit costs are the actual expenditure incurred by the entrepreneur on the factors of production which are purchased from other parties. These are also known as out-of-pocket costs. They include the cost of raw material, payment of salaries and wages, interest on borrowed capital, etc. Explicit costs are recorded in the account books.

5.3.4 Economic costs

Total costs for a business should ideally include a normal payment for all the factors of production, including managerial and entrepreneurial skills and capital provided by the owners of the firm. Hence, economic costs refer to the costs of all factors of production - those purchased from outside as well as those owned by the firm. Economic costs are explicit costs + implicit costs.

5.3.5 Marginal, incremental and sunk costs

Marginal cost can be defined as the extra cost that is incurred to increase the quantity produced by one unit. The cost per unit produced depends on the total number of units produced. The marginal cost helps in short-term decision-making.

Incremental costs are the total additional costs that are incurred in the execution of a major change in the nature of business activity or managerial decisions. The change can take several forms such as – extension of a product line, replacement of a machine or equipment, etc.

Sunk costs are costs that have already been incurred in the past or that have to be incurred in the future as a result of contractual agreement and which cannot be recovered to any significant degree.

5.3.6 Direct and indirect costs

Direct costs are costs that are associated with the production of output. These are also called as traceable costs.

Indirect costs are the overheads incurred in the production. For example, office and administrative expenses, stationery, etc. These costs are not directly associated with the production of the output. These are also called as non-traceable costs.

5.3.7 Fixed and variable costs

Fixed costs are the costs that do not vary with the changes in the output of a product. Put in other words, these costs remain constant even when there is a change in the output produced. These are unavoidable costs, which must be incurred even at the zero level of output. Fixed costs include interest on borrowed capital, rent for equipment or factory building, depreciation charges on machinery, salaries of permanent employees, etc.

Example: Variable costs

Precious Footwear Ltd. is a shoe manufacturing unit. It incurs costs in purchasing raw material for producing the footwear. The cost of raw material like leather is variable. When output is decreased, a smaller quantity of raw materials are used and thus, the variable cost (of raw materials) goes down. When output is increased, more raw materials are used and therefore variable costs increase.

Variable costs are the costs that vary with output. These include cost of raw materials, costs of production, wages of daily labor, etc. Variable costs are nil at a zero level of output.

Example: Sunk cost

Raghu recently started a toy showroom called Raghu Toys. Recently he took a big building for lease in order to utilize it as a warehouse for storing toys. As part of the lease agreement, Raghu is supposed to pay certain amount every month. This cost is known as sunk cost.

Check Your Progress - 1

1. Which of the following can be defined as the extra cost that is incurred to increase the quantity produced by one unit?

    a. Marginal cost
    b. Incremental cost
    c. Sunk cost
    d. Explicit cost

2. An entrepreneur who manages his firm has to forgo his salary, which he could have earned if he had worked elsewhere. The foregone cost (salary) is known as _____.

    a. Implicit costs
    b. Explicit costs
    c. Hidden costs
    d. Actual costs

3. _____ costs are important in short-term decision making of the firm to determine the output at which profits can be maximized.

    a. Fixed
    b. Sunk
    c. Opportunity
    d. Marginal

4   _____ cost must be paid even if the firm's level of output is zero.

    a. Variable
    b. Direct
    c. Incremental
    d. Fixed

5.4 Cost Function and Production Function

A cost function describes the responsiveness of costs in relation to a change in output. The cost-output relationship plays a significant role in resource allocation and price determination for the product. The cost function can take several forms like a schedule, graph or a mathematical relationship, and these help in identifying the least possible costs for production of various quantities of output. The cost function can be expressed mathematically as:

$$C = f(Q)$$

Where C is total cost and Q is level of output, and f indicates a functional relationship.

5.4.1 Short-run cost functions

The cost-output relationship in the short-run can be determined by the short-run cost functions. The cost-output relationship in the short-run can be described in terms of total, average and marginal costs. The short-run average total costs (SRATC) and average variable costs (AVC) are slightly U-shaped. The marginal cost (MC) curve intersects both the average variable cost curve and short-run average total cost curve at their lowest points. The output level where the average total cost is minimum is known as the short-run capacity of a firm which is also considered as optimum level of output.

The short-run capacity of the firm in Figure 5.1 is at the output Q_1, and any variation of output from Q_1 leads to a higher short-run average total cost. Output level below the short-run capacity of a firm is an underutilization of its plant and machinery and at such levels, average fixed cost is high. Output above the short-run capacity is over utilization of the firm's plant and machinery. If the quantity produced goes beyond Q_1, the short-run average total cost of the firm rises as a result of high marginal costs.

Figure 5.1: The Short Run Cost Curve
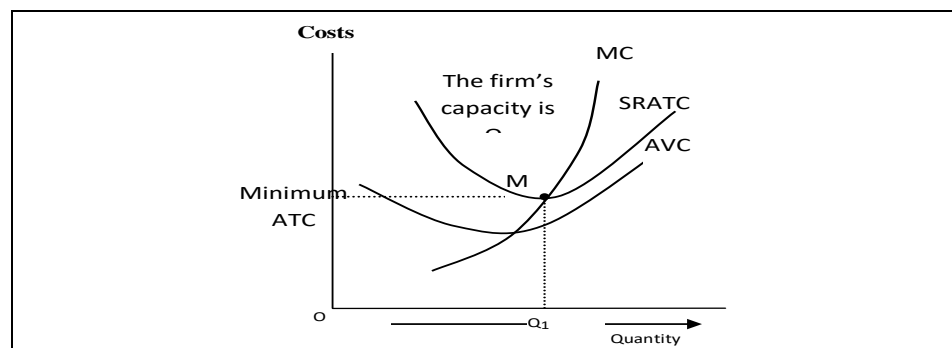
Source: ICFAI Research Center

Numerical Example

The total cost function of a firm is $TC = 36Q - 6Q^2 + 3Q^3$. Find the output (Q) which minimizes average cost. Prove that at this level of output, average cost will be equal to marginal cost.

$$AC = \frac{TC}{Q} = \frac{36Q - 6Q^2 + 3Q^3}{Q}$$

AC = 36 -6Q +3Q²

Marginal Cost (MC) = $\dfrac{\partial(TC)}{\partial Q} = \dfrac{36Q - 6Q^2 + 3Q^3}{\partial(Q)}$

MC = 36 -12Q +9Q²

Average cost is at its lowest when, AC= MC

Equating AC & MC

36 -6Q +3Q² = 36 -12Q+9Q²

6Q² = 6Q

Q =1

Therefore, when output is one unit, Average cost is at its lowest.

Activity 5.1

If the total cost function of a firm is TC $= 100Q-10Q^2+5Q^3$. Find the output (Q) which minimizes average cost. Prove that at this level of output, average cost will be equal to marginal cost.

Answer:

5.4.2 Long-run cost functions

The long run is the period in which a firm is capable of changing the levels of all the inputs used. The firm is able to adjust the amount employed of each of the factors of production in a way that best suits it, e.g. in order to meet market demand for the product. If there is a rise in demand and the firm wants to increase the output from Q_1 to Q_2, the firm can increase variable inputs like labor and raw materials in the short run. Here, the short-run average cost will be high. But in the long run (if demand continues to be high), the firm can undertake a larger investment in the plant and equipment. This would reduce per unit cost to C_2. A short-run average cost function like SAC_2 can be determined for the new set of inputs.

The long-run average cost curve is thus like an envelope encompassing successive short-run cost curves. (Refer Figure 5.2). There is no lower-cost combination of inputs at each level of output Q, than the points on the long-run average cost (LAC) curve. However, only at the output level N, which corresponds to the minimum cost point on the LAC curve, the long-run average cost is equal to the minimum of short-run average cost (SAC_4).

Figure 5.2: The Long-run Cost Curve

Source: ICFAI Research Center

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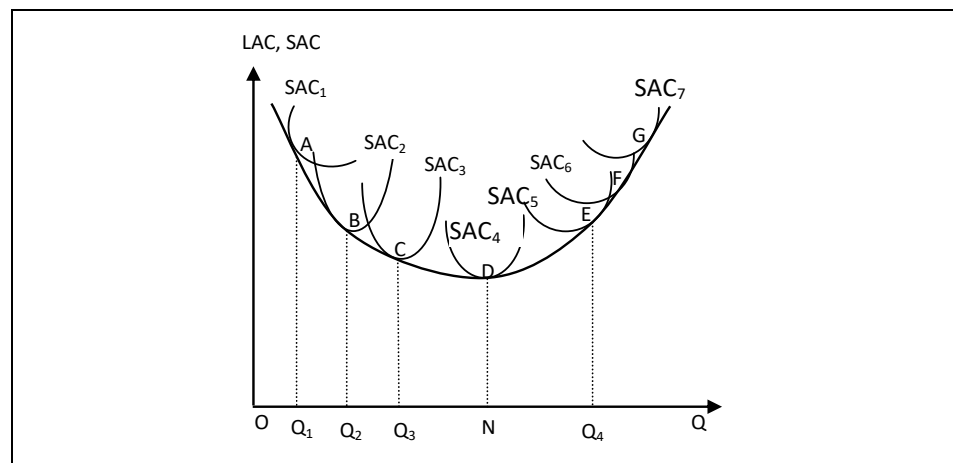
Numerical Examples

1. The average costs of producing three units of a product are ₹ 60, ₹ 67 and ₹ 75 respectively. What is the marginal cost of producing the second unit?

    Marginal utility of the second unit = (average cost of producing second unit x number of units) - (average cost of producing first unit x number of units)

    Therefore, Marginal cost of the second unit = (₹ 67 x2) - (₹ 60 x1) = ₹ 134 – ₹ 60 = ₹ 74

2. The total cost function of a firm is TC = $0.5Q^3$-$1.5Q^2$+30Q+3575. What will be the output of the firm when the average variable cost is at the minimum level?

    TC = $0.5Q^3$ -$1.5Q^2$ +30Q+ 3575

    MC = ∂ TC / ∂ Q = (3x 0.5) Q^2 - (1.5x 2)Q+30 = $1.5Q^2$-3Q+30

    TVC = TC-fixed cost = ($0.5Q^3$ -$1.5Q^2$ +30Q+ 3575)-3575 = $0.5Q^3$-$1.5Q^2$ +30Q

    Therefore, AVC = TVC/Q = 0.5 Q^2-1.5 Q +30

    AVC is minimum when AVC = MC

    => AVC is minimum when $0.5Q^2$-1.5Q +30 = $1.5Q^2$ -3Q+30

    i.e when Q^2 = 3.5Q => when Q = 3.5 [as Q can not be zero]

Exercises

A. If the average total cost is ₹ 30 for 5 units of output and ₹ 32 for 6 units of output, the marginal cost of producing the 6th unit is:

    a. 2

    b. 42

    c. 32

    d. 12

B. A firm producing fancy hairpins incurs a total cost of ₹ 14,500 to produce 3,750 units of hairpins. If the firm decreases its production to 1,450 units, the total cost incurred is ₹ 8,500. What would be the average variable cost of producing each hairpin?

    a. ₹ 1.50

    b. ₹ 2

    c. ₹ 1.80

    d. ₹ 2.60

C. The total cost function of ABC Limited is $48Q+16Q^2- 8Q^3$. The firm is operating in a perfectly competitive environment, and manufactures machines for heavy industries. Find the level of production at which the average cost will be lowest.

  a. 1

  b. 2

  c. 1.5

  d. 3

Check Your Progress - 2

5. The shape of short-run average total costs (SRATC) is_____

   a. L shaped

   b. Falling downwards

   c. U shaped

   d. Rising upwards

6. If output increases in the short run, total cost will

   a. Increase due to an increase in fixed costs only

   b. Increase due to an increase in variable costs only

   c. Increase due to an increase in both fixed and variable costs

   d. Decrease if the firm is in the region of diminishing returns

7. At the optimum level of output, Marginal cost (MC) curve intersects

   a. Short run average variable cost curve when it is rising

   b. Short run average total cost curve when it is falling

   c. Both the average variable cost curve and short-run average total cost curve when they are rising

   d. Both the average variable cost curve and short-run average total cost curve at their lowest points

8. Which of the following is a variable cost for a firm?

   a. The interest payments made on loans

   b. Payment of wages and salaries of temporary staff

   c. The monthly rent on office space that it leased for a year

   d. The annual pollution clearance fee

5.5 Break-Even Analysis

The break-even point can be defined as a situation where a firm makes no profit and no loss. It depends on the inter relationships between the firm's revenues, costs and operating profit at various levels of production. The break-even point depends upon the revenue output and cost output functions. Break-even analysis enables firms to measure the effects of changes in selling prices, fixed costs, and variable costs on the breakeven output level. Break-even analysis is a relatively simple tool for managerial decision making. It can be used for dealing with unknown variables like demand. By specifying the levels of known variables, such as cost or profit, a required or minimum level can be found for the unknown variable.

Exhibit 5.1 discusses the issues in EV manufacturers attaining a break even.

Exhibit 5.1: Break even for EV Manufacturers

The EV (Electric Vehicle) market is one of the most promising markets with projections of high volume growth. The reason for this is that consumers are showing eagerness to consider buying EVs and sales are on the rise. Major EV markets in the world have registered a consistent 50 to 60 percent growth in recent years. There are new models that OEM (Original Equipment Manufacturers) are launching every year that make EVs perform better.

But, OEMs are facing one critical issue in this near perfect scenario. It is that they are not making a profit out of EV sales. The major reason being the cost of manufacture. The manufacture of a EV is often more than $12,000 in comparison to a fuel backed engine. Battery costs are the single largest component of this extra cost. This cost disadvantage is stopping the OEMs from breaking even and generating profits.

So what is the road ahead for these manufacturers?

Design simplifications can reduce costs by $6,000. This could include eliminating unnecessary switches, displays, wiring, additional structural components etc. As most EVs are used for urban travel and an occasional rural side travel, reducing the battery capacity can also bring cost savings. Finally, the end assembling can be kept simple to save costs and realize break even faster.

Source: https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/making-electric-vehicles-profitable, March 2019

5.5.1 Merits of Break-even analysis

- It is an inexpensive method.
- It helps in analyzing the costs with different designs or product specifications.
- It helps in forecasting the required level of unknown variables.

5.5.2 Demerits of Break-even analysis

- Break-even analysis is based on the assumption that the selling price and variable costs per unit are known for each level of production. But in practice, these are not known. Therefore, the relevance of its application depends upon the accuracy of determining the costs of production.

- Proper evaluation of cash flows is not possible with the break even analysis.

- Break-even analysis is based on the assumption that projects exists in isolation, but firms have several alternatives with regard to usage of their funds, and break even analysis does not help in comparing the alternatives.

Activity 5.2

Compute the break-even point in terms of **a.** Quantity (physical units) **b.** Revenue (sales value) and **c.** percentage of full capacity (break-even point is usually expressed as a percentage of full capacity) based on the following information: Selling price per unit – ₹ 30, variable expenses per unit – ₹ 15, annual fixed cost – ₹ 20,15,000, annual operating capacity – 2,00,000 units.

Answer:

Numerical example

1. The selling price of one doll is ₹ 500 and the variable cost of one doll is ₹ 150. If the break-even revenue is ₹ 7, 50,000, then what is the fixed cost of the doll producer?

    Break-even revenue = Quantity required to break-even x selling price

    => Quantity required to break-even = Break-even revenue/ selling price

    According to the problem, Break-even revenue = ₹ 750,000; Selling price = ₹ 500.

    Therefore, Quantity required to break-even = ₹ 750,000/ ₹ 500 = 1500

    Quantity required to break-even = Fixed cost/ (selling price-average variable cost)

    => Fixed cost = Quantity required to break-even x (selling price-average variable cost)

    Average variable cost = ₹ 150.

    Therefore, fixed cost = 1500 x (₹ 500- ₹ 150) = 1500 x ₹ 350 = ₹ 525, 000.

2. The total revenue and total cost functions of a particular product are TR = 1500-9Q and TC = 750+6Q. If Q is the quantity and total revenue at the breakeven point is ₹ 750, then what is the selling price of the product?

    At break-even point, TR = TC

In this problem, TR = 1500-9Q and TC = 750+6Q.

Therefore, 1500-9Q = 750+6Q

=> 9Q+6Q = 1500-750 => 15Q = 750 => Q = 50

Total revenue = Quantity x price

Total revenue at the breakeven point is ₹ 750

Therefore, as per the problem, ₹ 750 = 50 x price

=> Price = ₹ 750/50 = 15

Exercises

D. Assume the total revenue function of a firm is TR = 5Q, and the total cost function is 10,000 + 3 Q.

Determine the breakeven quantity of the firm.

a. 10,000

b. 2,000

c. 2,500

d. 5,000

E. If a company breaks even at 500 units, at a fixed cost of ₹ 2,00,000 and the average variable cost is ₹ 50. At what price is the company selling the product?

a. 400

b. 350

c. 500

d. 450

F. The total cost function of a firm producing a particular electrical switching system is TC = 40,000 – 300Q + Q². If the revenue function of the firm is TR = 15000 + 200Q +Q², What will be the breakeven quantity of the firm?

a. 200

b. 100

c. 50

d. 150

5.6 Shutdown Point

The shutdown point is the point at which price equals the minimum of average variable cost. It is a situation where the firm cannot cover its average total cost of production. However, the firm cannot shutdown its operations in the short run due to the heavy investments it has made such as land and building, machinery, etc. But to continue its operations, the firm should earn revenue that should be at least equivalent to the average variable cost in the short-run.

In the long run, the average total revenue of the firm should be in equilibrium with the average total cost. Thus, the firm has to be able to cover both its fixed cost and variable cost in the long run. If the firm cannot cover its average total cost, then it should not try to stay in the business. The firm should shut down its operations, otherwise it will go into losses. This can be represented diagrammatically as in Figure 5.3.

Figure 5.3: Shutdown Point

Shutdown Point (P = AVC)
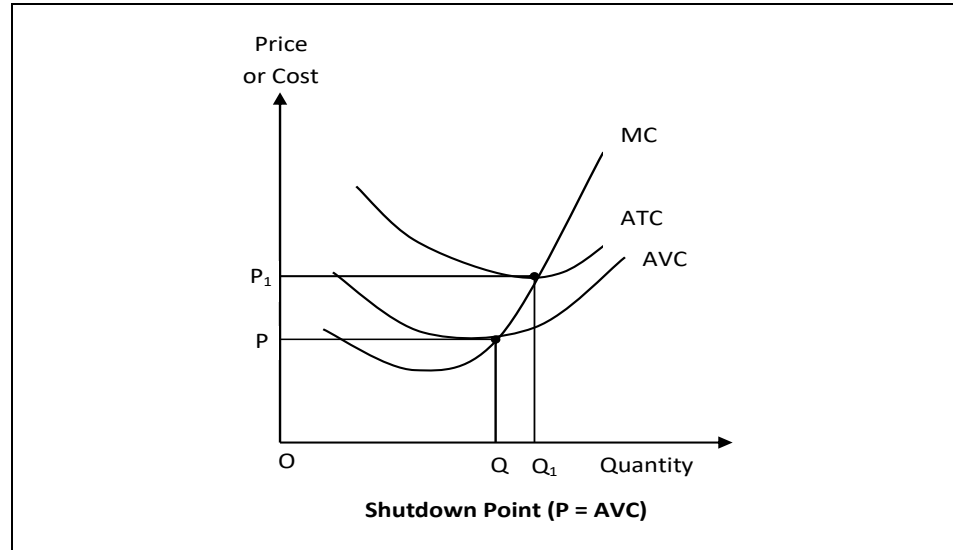
Source: ICFAI Research Center

Quantity is represented on the X-axis and price on Y-axis. In the figure, the average total cost curve is considerably higher than the price OP in the short run. However, the firm has to shut down only if the selling price is below OP (OP is the point where it just covers its AVC). In the long run, the firm is in equilibrium when the average total cost is equal to the price of the output (OP$_1$). The firm has to shut down production in the long run if it is unable to cover the average total cost i.e. if the firm sells below the price OP$_1$.

Exhibit 5.2 recounts the Ford's decision to shut down its manufacturing facilities in India.

Exhibit 5.2: Ford's shutdown of India Operations

In September 2021, Ford India, the subsidiary of Ford Motor Company, the American multinational automobile manufacturer, announced its decision to shut down its India manufacturing operations. The company decided to shut down its operations owing to accumulated business losses of around $ 2billion. Ford India was not the first Multinational to do so. Earlier, General Motors and Harley Davidson also forged similar paths to exit the Indian market.

Contd....

A poor market share in a very competitive market spelt doom for the multinational automobile maker. While Ford India had a market share of 1.4% of the Indian market, other companies such as Hyundai Motors and Maruti Suzuki together held more than 60% market share. Ford India, after staying in the market for 25 years, could not sustain long term profitability. It also made a failed attempt to forge a Joint venture with Mahindra and Mahindra.

Source: https://www.ndtv.com/business/why-us-carmaker-ford-is-shutting-manufacturing-plants-in-india-2536578

Check Your Progress - 3

9. In the short run, in which of the following conditions should a firm shut down its operations?

    a. If the firm cannot cover its total costs

    b. If the firm cannot cover its fixed costs

    c. If the firm cannot cover its total variable costs

    d. If the firm covers only its variable costs

10. In the long run if the average variable cost is not less than the price, the firm ___.

    a. Makes profits

    b. Experiences a decline in profit

    c. Has to shut down the operation

    d. Continues with the same level of production

5.7   Economies of Scale

Economies of scale occur when a firm produces goods on a large scale. Increase in production leads to reduction in the costs of production. Economies of scale are classified into real and pecuniary economies of scale.

Example: Application of various types of economies of scale in Gillette and Nissan

Technical economies: Companies like Gillette or Nissan operates with very large modern factories using automated production technology. This resulted in the reduction of cost of production, while quality control is kept to a very high level with virtually zero defects.

Managerial economies: These firms employ skilled production managers who have experience in working with modern technologies. This enables them to manage highly sophisticated state-of-the-art factories.

Contd....

Commercial economies are concerned with the purchase of stocks (and the selling of end products) using a large-scale approach. Modern production plants are operated on the just-in-time principle, where raw materials are purchased just-in-time for use. The production line is managed at a particular pace so as to meet the needs of end consumers, just-in-time. Since they use mass production techniques, they are able to operate their plant at high levels of capacity thus benefiting from bulk purchases of equipment and materials.

5.7.1 Real economies of scale

Real economies of scale are achieved through reduction in the quantity of inputs like raw materials, labor and capital, per unit of output. There are four types of real economies.

Production economies of scale: Production economies of scale are categorized into – labor, technical and inventory economies.

Labor economies: Labor economies occur when the output is increased through division of labor. Division of labor enables a worker to improve his skills and abilities, which raise the company's productivity. Workers become more efficient as they gain experience in specific activities through the specialization of labor. This results in increase in productivity.

Technical economies: Technical economies are attained when a firm uses improved techniques and advanced technology when it increases the scale of production.

Inventory economies: Maintenance of a large inventory enables a firm to gain quantity discounts and results in reduction of ordering costs. It helps in preventing interruption in production, supply, delayed deliveries, lost sales and customer dissatisfaction.

Selling economies: Selling economies are obtained in the promotion and distribution activities relating to the product. Advertising economies are achieved because the costs of advertising are spread over more units of goods. Similarly the costs of the managing sales force and distributing the product also can be reduced on an average basis.

Managerial economies: The efficiency of management increases with an increase in the size of the company. Here division of managerial tasks are undertaken as the firm employs persons for each separate task such as sales manager, production manager, etc.

Storage and transport economies: Storage and transportation costs fall per unit of output with economies of scale. While an increase in the capacity of warehouses increases the total cost, but unit or average costs are lower for a larger output. Transportation costs can also be reduced through the full utilization of the space in the vehicles used for moving the goods.

5.7.2 Pecuniary economies of scale

Pecuniary economies of scale can be obtained by gaining discounts on large-scale operations.

They can be achieved by:

- Reduction in prices (discounts) on raw materials due to purchase in large volumes

- Lower costs of external finance by banks for large organizations

- Lower advertising rates if advertising is done on a large scale

- Lower transportation rates if the amount of goods transported is large

Pecuniary economies of scale arise due to changes outside an individual firm but within the entire industry. Firm reap the benefits due to discounts that it can obtain due to its large scale operations. These economies have the effect of increased production or lower costs.

The following are the major factors of pecuniary/external economies of scale:

- **External Economies of Scale of Production:** Larger firms are able to reduce the average cost substantially due to discounts that they can obtain due to buying of raw materials in large volumes. Lower advertising prices may be granted to larger firms if they advertise on a large scale. Larger firms may be able to pay lower earnings to their workers if they attain a size which gives them monopsonistic power, or due to the brand/prestige associated with the employment by big well known firms

- **Infrastructure Economies of scale:** Infrastructure economies of scale occur based on public infrastructure that is put in place to benefit a specific industry. If particular industry grows larger or becomes clustered in one location, the government will usually expand public infrastructure (e.g., roads, water, electricity, public transport) in those areas to meet their/industry needs. With better infrastructure facilities, firms are able to reduce the average cost.

- **Financial Economies of Scale:** Larger firms have higher credit ratings as they are rated by the financial markets/rating agencies to be more 'credit worthy'. So they have access to credit with favorable rates of borrowing. In contrast, smaller firms often pay higher rates of interest on overdrafts and loans. And also larger companies can raise funds through stock market with an initial public offering (IPO). With these financial benefits larger firms can achieve the economies of scale by reducing the marginal and average costs.

- **Network Economies of Scale:** This kind of economies of scale occurs primarily in online businesses (e-commerce) and transport networks. The marginal cost of adding one more user to the network is close to zero, but the resulting financial benefits may be huge because each new user to the network can then interact, trade with all of the existing members or parts of the network.

5.7.3 Diseconomies of scale

Diseconomies of scale occur when the cost of producing a good increases with an increase in the scale of production. Any increase in the scale of production beyond an optimum level leads to diseconomies of scale. These results from several factors like managerial difficulties, low employee morale, higher input prices, etc.

Check Your Progress - 4

11. _____ occur when the cost of producing a good increases with an increase in the scale of production.

    a. Marketing economies of scale

    b. Selling economies of scale

    c. Managerial economies of scale

    d. Diseconomies of scale

12. Reduction in prices (discounts) on raw materials given by suppliers to large purchasers is an example of

    a. Managerial economies of scale

    b. Pecuniary economies of scale

    c. Selling economies of scale

    d. Production economies of scale

5.8   Summary

- Costs are significant in determining prices and output, as well as in other decision making. There are various types of costs like opportunity costs, implicit costs, explicit costs, direct and indirect costs, marginal costs, etc.

- A cost function describes the responsiveness of costs in relation to a change in output. The cost-output relationship plays a significant role in resource allocation and price determination for a product.

- The break even point is the situation where a firm makes no profit and no loss. It depends on the inter-relationships between the firm's revenues, costs and operating profit at various levels of production.

- The shutdown point (in the short run) is the point at which price equals the minimum of average variable costs. The firm should shut down production when the price falls below the minimum point of the average variable costs.

- Economies of scale occur when a firm undertakes production on a large scale. Increase in production leads to reduction in the cost of production. Economies of scale are classified into real and pecuniary economies of scale.

5.9 Glossary

Average cost curve, long-run (*LRAC* or *LAC*): The graph of the minimum average cost of producing a commodity for each level of output, assuming that technology and input prices are given but that the producer is free to choose the optimal size of plants.

Average cost curve, short-run (*SRAC* or *SAC*): The graph of the minimum average cost of producing a commodity, for each level of output, using the given state of technology, input prices, and existing plant.

Break-even point: For an individual, family or community, that level of income at which 100 percent is spent on consumption i.e a point where there is neither saving nor dissaving.

Economies of scale: If *all* the inputs in a production process are increased and the output increases by proportionately more than the inputs were increased, economies of scale are being realized.

Explicit cost: The amount spent to obtain or produce something.

Interest rate: The percentage rate which must be paid for the use of investable funds.

Marginal cost: The increase in total cost consequent upon a one unit increase in the production of a good.

5.10 Self-Assessment Test

1. Define economies of scale and describe the various types of economies of scale.

2. List out the different types of costs and explain them briefly.

3. If the fixed cost for a company is ₹ 20,000 per year, variable costs are ₹ 4 per unit, and the selling price is ₹ 8 per unit, what will the break-even point for the company be?

5.11 Suggested Reading /Reference Material

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3. H.R. Appannaiah. Essentials of Managerial Economics. 3rd edition. Himalaya Publishing House, 2021

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6. H.L.Ahuja, "Advanced Economic Theory", revised edition, Sultan Chand Limited, New Delhi, 2017

7. Gaurav Datt & Ashwani Mahajan, "Indian Economy", 70thedition, S. Chand & Company Ltd., 2016

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Additional References:

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2. World Bank open knowledge repository. India Development Update. 2020. https://openknowledge.worldbank.org/bitstream/handle/10986/34367/India-Development-Update.pdf?sequence=1&isAllowed=y

3. IMF Working Paper. Make in India: Which exports can drive the next wave of Growth? 2016.

5.12 Answers to Check Your Progress Questions

5.12.1 Model Answers to Check Your Progress Questions

Following are the model answers to the Check Your Progress questions given in the Unit

1. **(a) Marginal cost**

   Marginal cost is the change in the total cost of a firm as a result of change in one unit of output.

2. **(a) Implicit costs**

   Implicit costs are the value of forgone opportunities that do not involve a physical cash payment. Though implicit costs are not included in accounts, they do play an important role in a decision making process.

3. **(d) Marginal**

   Marginal costs can be defined as the change in the total cost of a firm as a result of a change in one unit of output. These costs are important in short-term decision making of the firm to determine the output at which profits can be maximized.

4. **(d) Fixed costs**

   Fixed costs are those costs which do not vary with the changes in the output of a product. They are associated with the physical existence of the firm and, therefore, must be paid even if the firm's level of output is zero.

5. **(c) U shaped**

   The short-run average total cost (SRATC) is U-shaped. It first declines, then reaches its minimum and then starts rising

6. **(b) Increase due to an increase in variable costs only**

   In the short run, the fixed cost remains the same, and only the variable cost increases. So, any addition to the output in the short run can be made only by changing the variable cost.

7. **(d) both the average variable cost curve and short-run average total cost curve at their lowest points**

   Marginal cost (MC) curve intersects both the average variable cost curve and short-run average total cost curve at their lowest points. The output level where the average total cost is minimum is known as the short-run capacity of a firm which is also considered as optimum level of output.

8. **(b) Payment of wages and salaries of temporary staff**

   Variable costs are those costs that vary with the level of output. They include payment for raw materials, charges for fuel and electricity, payment of wages and salaries of temporary staff, payment of sales commission, etc. The salary and wages of the temporary staff varies as the output varies, hence it is a variable cost. Fixed costs are associated with the existence of a firm's plant and, therefore, must be paid even if the firm's level of output is zero.

9. **(c) If the firm cannot cover its variable costs**

   In the short run, as long as the firm recovers its total variable costs it would continue its operation. But when the firm cannot cover its total variable costs, it would prefer to shut down the plant to minimize its loss equal to the total fixed cost.

10. **(c) Decides to shut down the operation**

    In the long run, the firm will be in equilibrium when the average total cost is equal to the price of the output, and the firm is expected to cover its average total cost. Thus, if the firm is unable to cover its total cost, it decides to shut down.

11. **(d) Diseconomies of scale**

    Diseconomies of scale occur when the cost of producing a good increases with an increase in the scale of production. Any increase in the scale of production beyond an optimum level leads to diseconomies of scale. These results from several factors like managerial difficulties, low employee morale, higher input prices, etc.

12. **(b) Pecuniary economies of scale**

    Pecuniary economies of scale are accrued when a firm has large-scale operations. Such a firm makes bulk purchases, and if it gets discounts from the suppliers, it results in pecuniary economies of scale.

5.12.2 Model Answers to Exercises

Following are the model answers to the Exercises given in the unit.

A. (b) 42

Marginal cost is the change in the total cost of a firm as a result of change in one unit of output. In this case, the additional total cost incurred to produce the 6th unit is

= (average cost of producing sixth unit x number of units) - (average cost of producing fifth unit x number of units)

= 32× 6 – 30×5

=192 – 150 = 42.

B. (d) ₹ 2.60

Total cost incurred to produce 3,750 units = ₹ 14,500

Total cost incurred to produce 1,450 units = ₹ 8,500

Number of additional units produced (N) = 2,300

Cost incurred to produce additional number of units(C) = ₹ 6,000

AVC = C /N

AVC = 6,000/ 2,300

AVC = 2.6

C. (a) 1

$$AC = \frac{TC}{Q} = \frac{48Q + 16Q^2 - 8Q^3}{Q}$$

$$AC = 48 + 16Q - 8Q^2$$

Marginal Cost (MC) = $\frac{\partial(TC)}{\partial Q} = \frac{48Q + 16Q^2 - 8Q^3}{\partial(Q)}$

$$MC = 48 + 32Q - 24Q^2$$

Equating AC & MC

$$48 + 16Q - 8Q^2 = 48 + 32Q - 24Q^2$$

$$16Q^2 = 16Q$$

$$Q = 1$$

Therefore, when output is one unit, Average cost is at its lowest.

D. (d) 5,000

At break even point, the total revenue and the total cost of the firm are equal.

Hence, equating TR and TC

$5Q = 10,000 + 3Q$

$2Q = 10,000$

$Q = 5,000$

E. **(d) 450**

BEP = Fixed Cost / P - AVC

$500 = 2, 00, 000 / P - 50$

$500 (P – 50) = 2,00, 000$

$500P - 25,000 = 2,00, 000$

$P = 2, 25, 000 /500$

$P = 450$

F. **(c) 50**

At break even quantity, firm has zero profit, hence TR = TC

Equating TR and TC

$40,000 – 300Q + Q^2 = 15000 + 200Q + Q^2$

$500Q = 25,000$

$Q = 50$

Economics for Managers

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