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Microeconomics

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D. N. Dwivedi

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ISBN 81-7758-648-3

First Impression, 2006
Second Impression, 2008

Published by Dorling Kindersley (India) Pvt. Ltd., licensees of Pearson Education in South Asia.

Head Office: 482, F.I.E., Patparganj, Delhi 110 092, India.
Registered Office: 14 Local Shopping Centre, Panchsheel Park, New Delhi 110 017, India.

Laser typeset by Bukprint India, Delhi.

Printed in India at Sanat Printers.

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PART I

INTRODUCTION

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1 Introduction to Microeconomics

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1.1 AN OVERVIEW OF ECONOMICS

Economics is a social science. The basic function of a science is to study a certain kind of natural or social phenomenon. Economics as a social science studies *economic behaviour* of the people and *economic phenomena. Economic behaviour* is essentially a *conscious effort* of the people to derive maximum gains from the use of scarce resources and opportunities available to them. *Economics is, fundamentally, the study of how people allocate their limited resources to their alternative uses to produce and consume goods and services to satisfy their endless wants or to maximize their gains.* In their efforts to maximize their gains from their limited resources, people (individuals, households, firms, and the government) as *producers* and *consumers* have to make a number of choices regarding the use of their resources and spending their earnings. The need for making choices arises due to following basic facts of economic life:

- ***human wants are unlimited***
- ***resources available to satisfy human wants are scarce***
- ***people want to maximize their gains***

Let us look at these facts in some detail. Human wants, desire and needs are endless in the sense that they go on increasing with increase in people's ability to satisfy them. Human wants continue to increase without meeting their end because (i) people have insatiable desire to raise their standard of living, comforts and efficiency; (ii) human tendency is to accumulate things beyond their present need; (iii) human wants increase with increase in knowledge, inventions and innovations; (iv) satisfying one want (e.g., buying a car) creates want for many other things (e.g., petrol, driver, parking place, safety locks, spare parts, insurance, etc.); (v) the moment one want is satisfied, other wants come up from nowhere; (vi) biological needs (e.g., food, water, etc.) are repetitive; and (vii) in modern times, advertisements influence consumer's taste and preferences and create new kind of

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wants. The end of wants for an individual comes only with the end of his/her life. But, human wants continue to increase. Another and an equally important feature of human wants is that they are not equally urgent and equally important. Satisfying some wants gives more pleasure than others. Therefore, gain maximizing consumers have to make a choice between wants.

Resources can be classified as (i) *natural resources* (including land, space, water, minerals, forest, climate, jointly called *land*); (ii) *human resources* (including man-power, its energy, talent, professional skills, and innovative ability and organizational skill, jointly called *labour*); (iii) *man-made resources* (including machinery, equipments, tools, technology and building, jointly called *capital*). To this economists add another category of resource called *entrepreneurship*, i.e., those who organizes the resources and assume *risk* in business. *Time* and *information* are two other kinds of resources which have economic value. All these resources available to a person, society, country—howsoever rich—at any point of time are limited. Resource scarcity is a relative term. It implies that resources are scarce in relation to the demand for resources. The *scarcity of resources is, in fact, the mother of all economic problems.* If resources were unlimited, like human wants, there would be no economic problem and no economics. It is the scarcity of resources in relation to human wants which forces people to make choices.

Furthermore, the problem of choice arises also because resources have *alternative uses* and alternative uses have *different returns or earnings*. For example, a building in Delhi used to set up a 'public school' yields more income than when used for residential purpose. Therefore, gain maximizing resource owners have to make choices between the alternative uses of scarce resources. Economics as a social science analyses how people (individuals and society) make their choices between the economic goals they want to achieve, between the goods and services they want to produce, and between the alternative uses of their resources with the objective of *maximizing their gains*. The gain maximizers will have to evaluate the cost and benefit of alternative options in making their choices. Economics studies the process of evaluation of alternatives.

In addition, economics provides logic and reasoning, tools and technique, and analytical framework to analyse economic phenomena and to predict the consequences of change in economic conditions. It may, thus, be concluded that *economics as a science studies economic behaviour of the people and its consequences; it brings out cause-and-effect relationships between economic events; provides the tools and techniques of analysing economic phenomena and the tools and techniques for predicting the consequences of economic decisions and economic events.* Economics studies economic phenomena *systematically and methodically.* This approach to economic inquiry imparts economics the status of a 'social science'.

The *subject matter of economics* continues to grow and expand in scope, size and character right from the days of its founders, Adam Smith to date. Boundaries of economic science are not yet precisely marked, nor can it be. In the opinion of some economists, "Economics is still a very young science and many problems in it are almost untouched" (Charles Schultz) and "Economics is an unfinished science" (Zeuthen). Yet, economics is claimed to be 'the oldest and best developed of the social sciences' and continues to grow in content and level of analytical sophistication. However,

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1. Some economists do not agree with the division of Economics into Microeconomics and Macroeconomics. Fritz Machlup remarks, " ... there is no agreement on the meaning and scope of the concept of micro and macro theory". (For details see his "Micro and macroeconomics: Contested Boundaries and Claims of Superiority" in Machlup (ed.), *Essays on Economic Semantics*, New York, W.W. Norton, 1977), pp. 98-103. A.P. Lerner is of the opinion that the division of economics between micro-and macroeconomics "often contributes more to fuzzy confusion than to rigorous understanding" (See his paper "Microeconomic Theory" in *Perspective in Economics — Economists Look at Their Fields of Study*, ed. by A.A. Brown, E. Neuberger and M. Palmatier, (McGraw-Hill, New York), p. 36.

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the mainstream *economics* is divided, though imperfectly[1], into two major branches:[1] ***Microeconomics*** and ***Macroeconomics***.[2] This division crystallized after the Great Depression of 1930s. Until 1936,[3] there was only one *Economics* which conformed to what is now called 'microeconomics'. In this book, we are concerned with *Microeconomics*.

In brief, ***microeconomics*** studies the economic phenomena at micro level, i.e., at the individual level, and **macroeconomics** studies them at national aggregate level. *Microeconomics* studies how consumers and producers make their choices; how their decisions and choices affect the demand and supply conditions; how consumers and producers interact to settle the prices of goods and services in the market; how prices are determined in different market settings; and how total output is distributed among those who contribute to production, i.e., between landlords, labour, capital supplier, and the entrepreneurs. For our limited purpose in this text, we will confine to the study of the *theory of consumer behaviour, theories of production and cost, theory of commodity pricing, theory of factor pricing,* and *the most efficient allocation of output and factors of production* called *welfare economics*. These theories make the main theme of *microeconomics*. We will look at the subject matter of *microeconomics* in detail in the subsequent section.

Macroeconomics, on the other hand, studies the working and performance of the economy as a whole. It analyses behaviour of the national aggregates including national income, aggregate consumption, savings, investment, total employment, the general price level and country's balance of payments. Macroeconomics analyses how these aggregate variables interact with one another, how they are determined and how they determine the aggregate national output. It also studies the impact of public revenue and public expenditure, government's economic activities and policies on the economy. An important aspect of macroeconomic studies is the consequences of international trade and other economic relations between the nations. The inclusion of these aspects of economic phenomena constitutes the major themes of *macroeconomics*.

Let us now turn to our main subject of study, the *microeconomics*.

1.2 WHAT IS MICROECONOMICS?

As mentioned above, *microeconomics* is, fundamentally, the study of how individuals and firms find solution to the problem of maximizing their gains from their limited resources. To maximize their gains, the individuals have to make a number of choices between the endless wants and alternative uses of their resources. Microeconomics studies how individuals make their choices, how their choices determine 'what to produce', 'how to produce', 'for whom to produce' and what price to charge. Microeconomics is the study of decision-making behaviour at the *micro* level. It makes a microscopic study of the various elements of an economic system, not the system as a whole. As Lerner puts it, "Microeconomics consists of looking at the economy through a microscope, as it were, to see how

1. There are many other specialized branches of economics, e.g., public economics, monetary economics, industrial economics, agricultural economics, rural economics, labour economics, international economics, environmental economics, growth or development economics, managerial economics, etc.
2. The terms 'Microeconomics', and 'Macroeconomics' were first used by a Norwegian economist, Ragnar Frisch in 1933 in his paper "Propagation Problems and Impulse Problems in Dynamic Economics", in *Economic Essays in Honour of Gustav Cassel*, (London, Frank Cass & Co., 1933). The prefixes 'micro' and 'macro' meaning 'small' and 'large', respectively, have been derived from Greek language.
3. It was in this year that John Maynard Keynes published his revolutionary book, *The General Theory of Employment, Interest and Money*. This book laid the foundation of Macroeconomics.

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the millions of cells in the body economic—the individuals or households as consumers, and the individuals or firms as producers—play their part in the working of the whole economic organism".[1] From analysis point of view, decision-makers are classified broadly as consumers, producers and resource owners. Microeconomics studies economic behaviour of consumers, producers and factor owners at their individual level—individual consumer, individual producer, and individual resource owner. A consumer may be an individual or an individual household. An individual producer may be an individual entrepreneur or a corporate firm. A resource owner may be a worker and an investor (the capital owner).

A systematic study of choice-making behaviour of consumers and producers (individuals, households, firms and government), allocation of resources (land, labour and capital) between goods and services that are produced and consumed and determination of their prices make the **central theme of microeconomics**. The individuals and households as consumers make choices between various goods and services they want to consume. The study of consumer behaviour makes the ***theory of consumer behaviour, theory of consumption*** or the ***theory of demand***. The individuals and individual firms make their choices about 'what to produce' and 'how to produce', i.e., the techniques to be used. The study of producer's behaviour constitutes the ***theory of production*** or the ***theory of supply*** including the ***cost theory***. ***Theory of demand*** and ***theory of supply*** combined together form the ***theory of price determination*** or ***theory of price***. The study of the behaviour of factor owners (labour and capital owners) make the ***theory of distribution*** or the ***theory of factor-price determination***. An extension of the distribution theory is *the study of what kind of allocation of productive resources between goods* and of *consumer goods and services* make the distribution *most efficient*. This aspect is studied under ***economics of welfare***. The study of these economic theories and their application to real life conditions, constitute the subject matter of ***modern microeconomics***.

1.3 MICROECONOMICS: A POSITIVE OR A NORMATIVE SCIENCE?

Before we answer the question whether microeconomics is a *positive* or a *normative science*, let us know what is a *positive science* and what is a *normative science*. According to J.N. Keynes, " ... a *positive science* is a body of systematized knowledge concerning *what is* [and] a *normative* or regulatory *science* is a body of systematized knowledge relating to criteria of *what ought* to be and is concerned therefore with ideal as distinguished from actual."[2] Friedman has defined 'positive science' more elaborately and clearly. In his words, "The ultimate goal of a positive science is the development of a 'theory' or 'hypothesis' that yields valid and meaningful (i.e., not truistic) predictions about phenomena not yet observed."[3] Judged against these definitions, *economics* as a social science deals with both *positive* and *normative* economic questions: 'what is' and 'what ought to be'. Thus, *microeconomics is both a positive and a normative science*. The positive and normative aspects of economic studies are described below.

Microeconomics as a Positive Science

Microeconomics as a positive science seeks to analyse and explain economic phenomena as they are. It

1. A.P. Lerner, "Microeconomic Theory" in *Perspectives in Economics—Economists Look at Their Fields of Study*, ed. by A.A. Brown, E. Neuberger and M. Palmatier, (McGraw-Hill, New York), p. 37.
2. John Neville Keynes, *The Scope and Method of Political Science*, 4th edn., (New York, Kelley and Millman, 1955), pp. 34-45 (emphasis added).
3. Milton Friedman, "Methodology of Positive Economics", in his *Essays in Positive Economics*, (Chicago, University of Chicago Press, 1953).

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seeks to answer the questions 'what is', 'why it is' and 'what will be ...'. For example, what is the trend in car prices in India? Why are car prices stable despite increase in demand for cars; what will be the demand for cars if prices go up? These are questions of positive nature. Microeconomics explains the economic behaviour of individual decision-makers under given conditions; their response to change in economic conditions; and brings out the relationship between the change in economic conditions and economic decision of the people. In fact, *the main function of microeconomics is to establish cause-and-effect relationship, if there is any, between two or more economic events at micro level and to provide the basis for prediction.* Emphasizing the positive character of economics, Friedman says, "Economics as a positive science is a body of tentatively accepted generalizations about economic phenomena that can be used to predict the consequences of change in circumstances."[1] What Friedman said about economics is more true about microeconomics. One of the main tasks of microeconomics is 'to provide a system of generalizations' or microeconomic theories capable of being used to predict economic phenomena at micro level. This makes microeconomics a *positive science.* Here, the word *'positive'* does not mean that theoretical statements are *positively* true: it means that it has a great possibility to occur if conditions are fulfilled.

Microeconomics as a Normative Science

Microeconomics as a normative science deals also with the normative question 'what ought to be'. 'What is' or 'what happens in the market' may not be desirable or in the interest of the society. For example, production and sale of harmful goods like alcohol and cigarettes may be a very profitable business. But, 'Is production and sale of these goods desirable for the society?' is a normative question—a question in public interest. Microeconomics as a *social science* examines this question from the angle of social desirability of production and sale of such goods. It examines the social costs and benefits of production and sale of goods like alcohol and cigarettes and prescribes the control and regulatory measures.

Consider another microeconomic problem. Given the growth of population and supply of houses in India, house rents if not controlled, will increase and have, in fact, increased exorbitantly. 'Should house rents be allowed to increase depending on the market demand and supply conditions or be controlled and regulated to protect the interest of tenants?' is a normative question—a question in *public interest.* Microeconomics as a normative science examines the issue in the interest of both landlords and the tenants and prescribes the reasonable rate of house rents and measures to implement it.

Microeconomics, as *a normative science,* involved *value judgement* on 'what is good' and 'what is bad' for the society. The *values* are drawn from the moral, ethical, social and political aspirations of the society. Since microeconomics prescribes methods to correct undesirable economic happenings, it is also called a *prescriptive science.*

To have a comparative view of *positive* and *normative* character of microeconomics, consider the issue of foodgrain prices in India. Recall that in 2001, on one hand, there was surplus foodgrain production[2] in India, while on the other hand, large scale starvation and starvation deaths were reported from different parts of the country. This was a paradoxical situation. Yet, the Food Corporation of India (FCI), responsible for fixing the foodgrain price, did not allow foodgrain prices

1. "Methodology of Positive Economics", *op. cit.*
2. As reported by the news media, production of wheat was so high that neither the farmers nor the FCI had sufficient godown space to stock grains safely. Foodgrain bags were left in the open to rot.

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to go down. This problem can be examined from both positive and normative angles. Examining 'how price of foodgrains is determined?' is a question for *positive microeconomics* and 'how should the prices of foodgrains be determined?' is a question for *normative microeconomics*. It may, thus, be ***concluded*** that *microeconomics is both a positive and normative science*. However, it is ***important*** to note that *microeconomics is, fundamentally, a positive science*. It acquires its *normative* character from the application of microeconomic theories to examine the economic phenomena from their social desirability point of view, to show the need for a public policy action and to evaluate the policy actions of the government.

1.4 METHODOLOGY OF POSITIVE ECONOMICS: MODEL BUILDING AND THEORIZATION

The economic theories that constitute the body of economic science are the result of scientific investigation of economic phenomenon. Scientific method of investigation involves *observation of economic phenomena and collection and analysis of relevant facts and making predictions. Predictive statement gives the cause-and-effect relationship between two or more economic variables*. When the relationship between the selected variables is established with a high degree of confidence, it is presented in the form of a theory or a hypothesis. This process is called ***theorization*** or *formulation of theory*.

An important element of scientific method of inquiry is ***model building***. A ***model*** is an abstraction from reality. It represents reality in a simplified form. Economic models may take the form of a logical statement, graphs or mathematical equations specifying the relationship between the economic variables. Models are used to work out the implications of a theory, to deduce the consequences of the assumptions and to make predictions. ***Economic variables*** are measurable quantities, e.g., consumer goods, output, inputs, money, income, etc. The economic variables assumed to remain constant are called *parameters*. In this section, we will discuss briefly the process of model building and theorization in economics in general. This applies to *macroeconomics* as well.

Model building and economic theorization. A scientific method of inquiry consists of the following steps:

- specifying the problem
- formulating hypothesis
- making assumptions
- collection of relevant data or facts
- deducing the testable predictions
- testing the validity of predictions

The ***first step*** in scientific method of study is to specify the *problem* or the economic phenomenon chosen for the purpose of study. For example, the problem of study may be specified as finding the effect of increase in the petrol price on the demand for cars.

The ***second step*** is to *formulate the* ***hypothesis***. A hypothesis is a statement expressing the relationship between the cause and effect. A hypothesis may be expressed in the form of a statement, e.g., 'when price of petrol increases, demand for cars decreases'. Here, increase in petrol prices is the *cause* and decrease in the demand for cars is the *effect*. It may also be stated in the form of an equation, e.g., $Q_c = C - cP_p$ (where Q_c = number of cars demanded; C = cars demanded at zero price of petrol; $-c$ = a parameter showing the effect of change in petrol price on the demand for car; and P_p = price of petrol.

The ***third step*** is to make necessary ***assumptions***. Assumptions are made to simplify the problem, to specify the components of the model, and to avoid the complexities that might arise due to the change in extraneous factors—factors operating outside the model. In economic model building, assumptions, in general, include : (i) *behavioural or motivational assumptions* pertaining to the behaviour of the decision-makers and their motivation or the objective that they set for themselves; (ii)

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institutional assumptions pertaining to the institutional set-up or market conditions under which the economic players (consumers and producers) seek to achieve their goals; (iii) *technological assumptions* relating to production technique; and (iv) *input related assumptions*—those pertaining to the supply position of the inputs.

The ***fourth step*** is to collect the relevant data and other facts related to the problem of study and their analysis according to the model.

After data is collected, assembled and analyzed, the next or the ***fifth step*** is to make the deduction(s) about the relationship between the causal factor and its effect. In our example, the deduction may be stated as 'when petrol price increases, demand for car decreases'. This deduction is the same as the hypothesis.

The ***final step*** is to test the validity of the model. The test of validity of a model is determined by its power to predict. The test of validity of the model, in case of our example, is to find whether it can be used to predict the demand for car when price of petrol increases (or decreases) by a certain percentage. If the model predicts the car demand fairly accurately, it is taken to be a valid model. Otherwise, it is an invalid model. In case a model turns out invalid, it needs to be modified by including other relevant and explanatory variables that influence the demand for car and put to test again. When the model is tested and retested and found to be valid, its outcome is stated in the form of a theory.

1.5 USES AND LIMITATIONS OF MICROECONOMIC THEORIES

Economic laws—micro and macro– have their uses and applications and also their limitations. The applicability and limitations must be borne in mind while applying economic laws to find solution to real life economic problems. The uses and limitations of economic theories in general, briefly described here, are also applicable to microeconomics.

1.5.1 Uses of Microeconomic Theories

First, microeconomics explains the economic behaviour of individual decision-makers—individual consumers, firms, industries and factor owners—and brings out the nature of relationship between the dependent and independent variables and interdependence of the diverse elements of the economic system. This contributes a great deal to the understanding of the complexity of the economic system and its working. In the words of Lerner, "Microeconomic theory facilitates the understanding of what would be a hopelessly complicated confusion of billions of facts by constructing simplified models of behaviour which are sufficiently similar to the actual phenomena, to be of help in understanding them. These models enable the economists to examine the degree to which actual phenomena depart from certain ideal constructions that would most completely achieve individual and social objective."[1] The clearer the understanding of the working of the economic system, the greater the efficiency in control and management of the economy.

Secondly, microeconomic theories establish *cause-and-effect relationship* between two or more economic events and, thereby, provide the basis for predicting the future course of economic events. Economic predictions are of great importance in planning future course of economic activities by individuals, business firms, and the government. Economic predictions may be conditional and inaccurate. For example, prediction of future price of a commodity may take the following form of a statement: if

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1. A.P. Lerner, "Microeconomic Theory" in *Perspectives in Economics—Economists Look at Their Field of Study* (ed.) by A.A. Brown, E. Neuberger and M. Palmatier, (McGraw–Hill Book Company, New York), p. 36.

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demand for a commodity increases, *other things remaining the same*, its price will increase. Despite the fact that a prediction of this nature is conditional, future trend of price is known more precisely than it would have been in the absence of any prediction. If one has information regarding the demand trend of a commodity and *other related factors*, one can predict the future trend in price with greater accuracy. Approximate predictions are also of great importance for the consumers to make adjustment in their expenditure pattern; for the producers to plan their production; and for the public policy-makers to formulate policy regarding price of the commodity.

Thirdly, microeconomic theories contribute a great deal in formulating economic policies and in examining the appropriateness and effectiveness of economic policies. Policy-makers may, therefore, apply relevant microeconomic theories to explain the problem at hand and analyse the implications of alternative policies and select one which seems to be most appropriate. Public economic policies which go against the economic laws may not only prove infructuous but may also create more problems than they solve. For example, if government increases the rate of tax on a commodity without analysing the nature of its demand and supply curves, the tax revenue may not increase; it may instead decrease. Besides, it may reduce both production and consumption and impose extra burden on the consumers. Microeconomic theories may be applied to examine the implications and effectiveness of the policies adopted by the government.

Fourthly, microeconomic theories, particularly price theory, can be and are, infact, profitably used in *business decision-making*. Although microeconomic theories may not offer a practical solution to a problem of the real business world, they do help business decision-makers in building analytical models, which help in specifying the nature of managerial problems and in determining appropriate policy actions.

Lastly, one of the most important uses of microeconomic theories is to provide the basis for formulating propositions that maximise social welfare. Microeconomics examines how imperfect market conditions distort the allocation of resources (money, men and material), create inefficiency and lead to reduction in production, consumption and social welfare. The normative part of micro-economics, viz., *welfare theories*, suggests conditions for achieving 'Pareto-optimality' in resource allocation with a view to maximising social welfare. It also suggests ways and means to correct inefficient allocation of resources and to eliminate inefficiency. Although theoretical welfare propositions are of little practical importance, their analytical value is not reduced by their impracticability.

1.5.2 Limitations of Microeconomic Theories

Microeconomics, like other social sciences, does not provide ready-made solution to the practical problems. It provides only tools and techniques of solving real life problems. Microeconomics has certain limitations which restrict its applicability. Most of the limitations of microeconomic theories arise from the assumptions on which they are based. Some major assumptions and the resultant limitations of microeconomic theories are as follows.

First, microeconomic theories assume a given level of national income, employment, savings and investment, supply and demand for money and the general price level. In reality, however, these factors are not constant; they are subject to change following the changes in their determinants. As such, validity of microeconomic theories is limited to their framework.

Secondly, microeconomic theories assume, in general, the existence of a free enterprise system in which the 'invisible hands' or market forces are assumed to play their roles freely. Microeconomics assumes also the absence of any government intervention in the economic activities of the society. In practice, however, government controls and regulations of economic activities are the rules of the

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day and are all-pervasive. Therefore, microeconomic propositions have only limited applicability—limited to the conditions assumed in the microeconomic models.

Thirdly, another limitation of microeconomics arises out of its very scope of study. It is concerned with the behaviour of individual elements of the economic organism and not with the organism as a whole. It provides only a partial analysis of economic phenomenon. Microeconomic theories, therefore, cannot be applied to study the complex economic system treated as one unit. "Description of a large and complex universe of facts like economic system is impossible in terms of individuals items"[1] and microeconomics is concerned with only 'individual items'.

These limitations of microeconomics, however, do not reduce its importance. There are many important and practical reasons for studying and making use of microeconomic theory. Emphasising the importance of 'price theory', a relatively older name of 'microeconomics', Liebhafsky has said, "*.....there is a very practical reason for acquiring a knowledge of price theory: the language and concepts of price theory permeate the whole of economics, and in all fields of economic analysis they serve the practical purpose of economy of effort and constitute a generally accepted method of organising and classifying ideas about economic activities and magnitudes.*"[2]

As Marshall has observed, "By the fundamental impulse of our nature, we all—high and low, learned and unlearned—are in our several degrees constantly striving to understand the course of human action, and to shape them for our purposes, whether selfish or unselfish, whether noble or ignoble."[3] Furthermore, the primary objective of economic analysis is not to formulate exact and precise economic laws but to provide a framework for logical economic thinking. In the words of Boulding, "The objective of [economic] analysis is not to provide a machine or method of blind manipulation, which will furnish an infalliable answer, but to provide ourselves with an organized and orderly method of thinking out particular problem."[4]

Apart from satisfying the human urge to understand the economic world, economic principles and laws serve many useful purposes in our practical life in so far as they: (i) provide logic and techniques for predicting the possible consequences of economic activities and thus provide the basis for rational decision making; (ii) provide rules for optimum allocation of resources and also the test for optimality; and (iii) provide guidelines for formulating appropriate public policy actions to control and regulate economic activities to achieve social goals.

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REVIEW QUESTIONS AND EXERCISES

1. The origin of economics lies in endless human wants and scarcity of resouces. Elaborate.
2. "Scarcity of resources is the mother of all economic problems." Discuss with examples.
3. Do you think your wants are unlimited at this moment? If your answer is 'yes', count your wants and you will find they are limited. Then why do you accept the proposition that 'human wants are endless'?
4. Why can't you buy anything you want? What is your main consideration in deciding what to buy and what not to?
5. Suppose time, money and labour are the only resources that you possess as a student. How do you decide how to use these resources?
6. What is microeconomics? Is microeconomics a positive or a normative science? Give arguments for your answer.
7. What is the purpose of model building in economics? What process is generally followed in model building?
8. What is scientific method of investigation? What are the steps that are generally followed in scientific study of economic problems? Use a suitable example to answer this question.
9. How will you define economic theory? What process is followed in economic theorization?
10. What kind of assumptions are made in the analysis of microeconomic problem? What behavioural assumptions are made in microeconomic theories?
11. Economic theories are not as exact and precise as the laws of natural sciences. Why are then economic theories formulated? What purpose do they serve in practical life?

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2 The Economy, Its Working and Basic Problems

CHAPTER OUTLINE

2.1 What is an Economy?
2.2 How an Economy Works
2.3 Basic Problems of an Economy
  2.3.1 Problems in Achieving Efficiency in Production and Distribution
  2.3.2 Problems in Achieving Growth, Full Employment and Stability
2.4 How Market Mechanism Solves the Basic Economic Problems
2.5 Drawbacks of the Free Enterprise System
2.6 The Government and the Economy
2.7 Production Possibility Frontier
Further Readings
Review Questions and Exercises

In Chapter 1, we have discussed the nature, scope and methods of microeconomics. We have noted that microeconomics is the sudy of economic behaviour of human beings in their individual capacity. People do not carry out their economic activities in isolation. They are a part of a social system and their economic activities are a part of an economic system. In an economic system, economic activities of various economic agents—individuals, households, firms, etc.—are interrelated and interdependent. Therefore, economic behaviour of the people is determined and governed largely by their economic environment and the economic system in which they operate. Therefore, before we commence our study of economic theories, it will be useful to have an idea of the functioning of the economic system and its basic problems. In this chapter, we will briefly describe the functioning of a simplified economic system, the basic problems of an economy and how the problems are solved by the price mechanism. Finally, we will discuss the production possibilities of an economy.

2.1 WHAT IS AN ECONOMY?

An economy is a social organism through which people make their living. It is constituted of all the individuals, households, farms, firms, factories, banks and government who act and interact to produce and consume goods and services. Individuals and households put their resources (land, labour, capital and skill) to one or more of their alternative uses and make their living. Firms buy or hire factors of production and organise them in the process of production; produce goods and services; and sell them to their users to make profits. Traders and shopkeepers work as intermediaries between the producers and consumers to make their living. Financial institutions, e.g., commerical banks and LIC, and other financial institutions like IDBI, ICICI and mutual funds, collect savings from the

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households and firms and provide it to their prospective users. Transport companies transport goods from one place to another and so on. In the process, all those who contribute to these services make their living. The system often works smoothly even if nobody controls and regulates these activities. Consumers are able to get goods and services they want; producers are able to produce goods and services they can sell; factors of production are able to find employment, and so on. The system is operated in an orderly manner by what Adam Smith called, 'invisible hands,' that is, the market forces of demand and supply.

In a modern economy, economic activities of the people are interrelated and interdependent. For example, if some persons want to buy computers, there is a computer company (say, IBM) to produce and sell computers. Thus, the activities of computer users and computer producers are interrelated. Their activities are interdependent in the sense that computer company will produce only as many computers as users demand, and users can use only as many computers as producers can produce and sell. The interdependence and interrelatedness of the economic activities of the people is reflected in the form of their *interaction, cooperation* and *competition*. The economic activities of people—individuals, households and firms—affect economic interest and activities of one another, directly or indirectly, positively or negatively. Economic activities and interactions among the consumers, producers and resource owners make the *economy*. An economy works on a complex mechanism.

Government is an important element in the modern economy. It taxes people's income and hires factors of production and produces certain goods and services for the people. In addition, it intervenes with the economic activities of the people. It controls, regulates and guides their economic activities, with the purpose of achieving certain social and economic goals. The level of intervention and participation of the government in overall economic activities of the people determines whether an economy is a *capitalist* or *free enterprise economy, a socialist* or *command economy* or *a mixed economy*. In a *free enterprise economy*, government intervention in the form of control and regulation of economic activities of the people is minimum. It is total and all pervasive in a *command economy*, also known as *communist economy* and it is partial in a *mixed economy*.

2.2 HOW AN ECONOMY WORKS

Working of a modern economy is extremely complex. Millions of persons participate and contribute to its working in different ways and in different capacities—as producers, traders, workers, financiers, and consumers. Thousands of goods and services are produced and consumed and thousands of persons are engaged in production and distributions of a single commodity. All those who are involved in economic activities act and interact with different interests and motivations. The interdependence and interrelatedness of their economic activities add to the complexity of the economic system. To present a complete picture of the economic system, showing the role of each individual participant in respect of each commodity, is an extremely difficult task, rather impossible. We present below the working of a simple economy in a simplified model.

Model of a Simple Economy

In the simplified model, the economic players are classified in three categories or sectors: (i) households; (ii) business firms; and (iii) the government. The *functions* and the roles of these economic entities in the model economy are described below.

(i) The ***households*** participate in the economic system in two different capacities: (a) as suppliers of productive resources (land, labour and capital), and (b) as consumers of all goods and services produced by the business firms. (ii) ***Business firms*** include all firms, farms, factories and shops operated by individual proprietors, partnership firms, and joint stock companies engaged in

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production and distribution of goods and services. *Business firms* perform two functions: (a) hiring productive resources from the households and transforming them into final goods and services, and (b) selling their product to the households, the consumers, (iii) ***Government*** collects taxes from the households and firms. It uses tax revenues to buy men and material to perform its functions.

The *functions* and the mode of *interaction* among the three kinds of economic entities and working of the economic system are exhibited in Fig. 2.1. Households and firms interact in two ways: (i) as sellers and buyers of inputs, and (ii) buyers and sellers of output. The sale and purchase of inputs makes ***factor market*** where factor prices are determined, and sale and purchase of final goods and services creates ***product market*** where product prices are determined.

As Fig. 2.1 shows, factors of production (land, labour, capital, etc.) flow from the households to the ***factor market***. The interaction between households (the input suppliers) and business firms (the input demanders) determines the factor prices. Once factor prices are determined, inputs move to business firms. In return, factor payments (wages, rent and interest, etc.) flow to the households. The business firms transform the factor inputs into finished products. Finished products flow to the ***product market***. The interaction between the business firms, the suppliers, and the households, the buyers, determine the product prices. Once product prices are determined, products flow to the households. In return, the payments made by the households for their purchases flows to the firms. They use their receipts to hire inputs again and the process continues. In this process, two circular flows are generated; (i) ***real flows***, i.e., flows of inputs and final products as shown by the outer circle, and (ii) ***money flows***, shown by the inner circle. Note that real and money flows go in *opposite directions*.

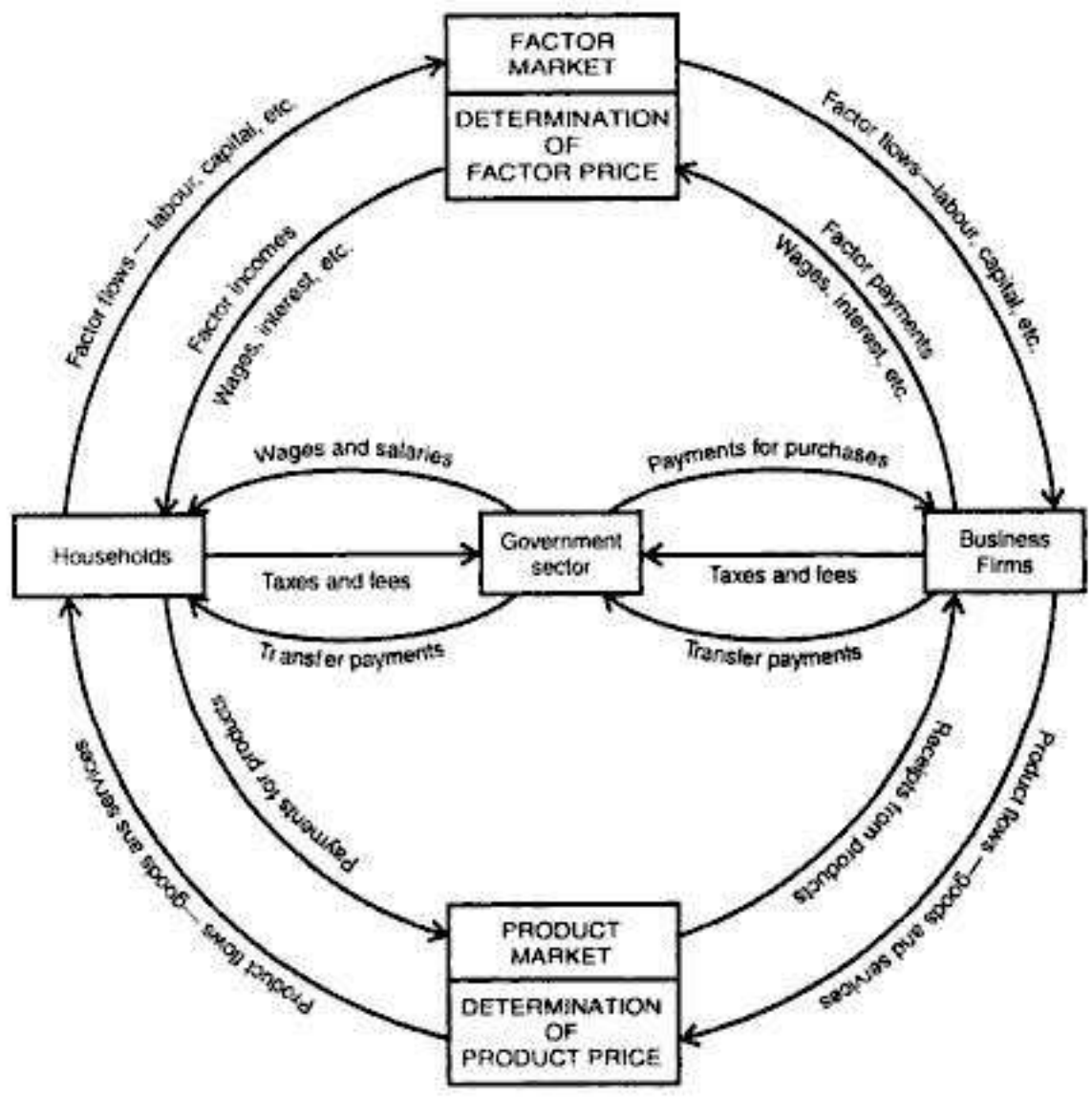


Fig. 2.1 Working of the Economy: Real and Money Flows

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Government plays a significant role in the economy. It hires or buys a part of social resources to carry out its administrative and economic functions. It employs labour from households and pays wages and makes payments for the purchases it makes from the firms. In addition, it makes *transfer payments* to both households and business firms in the form of *subsidies* and *grants*.

The economic system works in an orderly manner. It meets the requirement of all those who participate in the system. Households are able to sell the services of their resources and to make their living—earn their income. The income which they earn becomes the means of buying goods and services of their need. Their purpose is well served. Similarly, this system also serves the interest of the business firms. The basic objective of the firms is to make profit for their owners. In pursuit of their objective, business firms are able to procure means of production which they transform into usable goods and services. They are able to dispose of their product in the product market and make profit. The households and business firms continue to interact with each other in pursuit of their objective and thereby make the economic system function continuously and in an orderly manner.

2.3 BASIC PROBLEMS OF AN ECONOMY

As already noted, ***human wants are endless*** whereas ***resources are scarce***. This is true of all kinds of economies—rich and poor, developed and underdeveloped. In their effort to meet the ***ever-growing needs*** of their people by using ***limited resources***, societies aim at (i) achieving *efficiency* in production and distribution of commodities; and (ii) achieving full employment, growth in output and stability in employment and growth. In their effort to achieve these goals, societies face certain problems. For pedagogic reasons, the problems faced by the economies can be grouped under two categories: (a) *problems in achieving efficiency in production and distribution of goods and services;* and (b) *problems in achieving growth, full employment and stability*. The ***nature and sources*** of the two kinds of problems are discussd below.

2.3.1 Problems in Achieving Efficiency in Production and Distribution

The need for ensuring efficiency in production of goods and services and their efficient distribution among the consumers arises due to (i) *scarcity of resources;* (ii) *ever growing human wants;* and (iii) *desire to maximize gains*. The problems that arise in ensuring efficiency in production and distribution of goods and services, often referred to as the ***basic problems***, are of three kinds:

(i) *What to produce*
(ii) *How to produce*
(iii) *For whom to produce*

Let us now discuss the *nature* and *sources* of these problems.

(i) What to produce? The problem 'what to produce' is the problem of choice between commodities. This problem arises mainly for two reasons: (i) scarcity of resources does not permit production of all the goods and services that people would like to consume; and (ii) all the goods and services are not equally valued in terms of their *utility* by the consumers. Some commodities yield higher utility than the others. Since all the goods and services cannot be produced for lack of resources, and all that is produced may not be bought by the consumers, the problem of making choice between the commodities arises. The problem 'what to produce' is essentially the problem of efficient allocation of scarce resources so that the *output is maximum* and the *output-mix is optimum*. The objective is to satisfy the maximum needs of maximum number of people.

The question 'how much to produce' is the problem of determining the quantity of each commodity and service to be produced. This problem too arises due to scarcity of resources. For, surplus production

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would mean wastage of scarce resources. This problem also implies an efficient allocation of resources to various goods and services to be produced.

(ii) How to produce? The problem 'how to produce' is the problem of *choice of technique*. Here the problem is how to determine an optimum combination of inputs—labour and capital—to be used in the production of goods or services. This problem, too, arises mainly because of scarcity of resources. If labour and capital were available in unlimited quantities, any amount of labour and capital could be combined to produce a commodity. But, since resources are not available in unlimited quantity, it becomes imperative to choose a technology which uses resources most economically.

Another important factor which gives rise to this problem is that a given quantity of a commodity can be produced with a number of alternative techniques, i.e., alternative input combinations. For example, it is always technically possible to produce a given quantity of wheat with more of labour and less of capital (i.e., with a labour-intensive technology) and with more of capital and less of labour (i.e., with a capital-intensive technology). The same is true of most commodities. In case of some commodities however choices are limited. For example, production of woollen carpets and other items of handicrafts are by nature labour-intensive, while production of some other goods like machinery, aircraft, turbines etc. are by their nature capital-intensive. In case of most commodities, however, alternative technology is available. But the alternative techniques of production involve different costs. Therefore, the problem of choices of technology arises.

(iii) For whom to produce ? The problem 'for whom to produce' is the problem of matching the production pattern with the demand pattern, so that those who have the ability and willingness to pay, get the commodity and there is no surplus production. Demand pattern is determined by the pattern of choices and preferences and income distribution. Given the choice and preferences, income distribution is determined by the employment pattern and factor prices. Factor prices are determined in the factor market by the factor demand and supply conditions. Factor price multiplied by the quantity of factors employed gives the share of each factor in the national income. Those who possess a large quantity of highly priced resources, are able to claim a higher share in the national output and are able to consume a larger proportion of the national output than those who possess low-priced factors. Thus, once income distribution pattern is determined, the consumption or demand pattern is also simultaneously determined. In a free-enterprise economy, market mechanism is supposed to match production pattern with demand pattern. In general, however, production pattern is not matched by the demand pattern. The reason is all pervasive ***market imperfection***. Due to market imperfections, there is unemployment of some resources (especially labour), inefficient allocation and utilization of resources, extreme poverty, on the one hand and wasteful affluence, on the other. The societies continue to face the problems of unemployment and inequitable distribution of resources and national output.

2.3.2 Problems in Achieving Growth, Full Employment and Stability

The economic problems discussed above are of micro nature. Apart from microeconomic problems, there are certain macroeconomic problems of prime importance confronted by an economy including the problems of growth, full employment and stability. Following Lipsey, these problems may be specified as follows:

(i) How to increase production capacity of the economy? The need for increasing production capacity of the economy arises for at least two reasons. ***First***, most economies of the world have realised by experience that their population has grown at a rate much higher than their productive resources. This leads to the poverty of the nations. Poverty in itself is a cause of many social evils. Besides, it has frequently jeopardised the sovereignty and integrity of the nations. Colonisation of poor nations by the richer and powerful imperialist nations during pre-twentieth century period is

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evidence to this fact. Therefore, creating conditions for growth of the economy and generating resources for defence purposes has become a necessity. ***Secondly***, some economies have grown over time faster than the others while some others have remained almost stagnant. The poor nations have been subjected to exploitation and economic discrimination by economically powerful nations. This has impelled the poor nations to make their economies grow, to save themselves from exploitation and to give their people a respectable place in the international community.

(ii) How to stabilise the economy? Economic fluctuation has been an important feature of free enterprise economies. Though economic ups and downs are not unknown in the controlled economies, free enterprise economies have experienced it more frequently and more severely. Economic fluctuations cause wastage of resources, e.g., idleness of manpower or involuntary unemployment, idle capital stock, etc., particularly during the periods of depression. Economists have devoted a good deal of attention to explain this phenomenon and to suggest measures to stabilize the economy. However, economic fluctuation, though of mild magnitude, continues to remain a vexing problem.

(iii) Other problems of macro nature. In addition to the macro problems mentioned above, there are many other economic problems of this nature, which economists have studied extensively and intensively. The major problems of this category are the problems of economic growth, inflation, unemployment and foreign trade deficits. The major questions to which economists have devoted a good deal of their attention are: How is national income determined? How is the equilibrium between the product market and the money market is determined? What is the basis of trade between the nations? How are the gains from trade shared between the nations? Why do deficits and surpluses arise in trade balanced? How is an economy affected by deficits in its balance of payments.

2.4 HOW MARKET MECHANISM SOLVES THE BASIC ECONOMIC PROBLEMS

The way the basic problems of an economy are solved depends on the nature of the economy. While in a socialist economy they are solved by the government agencies like central planning authority, in a free enterprise or mixed capitalist economy this task is performed by the ***price mechanism*** or ***market mechanism***. We discuss here how price mechanism solves the basic economic problems in a free entreprise and a mixed capitalist economy. For other economic systems, a brief answer is provided in the next section.

Market mechanism is discussed in detail in the next chapter. In brief, ***market mechanism*** is a process through which market economy functions. A market economy functions through the market forces of demand and supply. The demand and supply forces interact to determine the price of goods and services. Thus, a price system is generated. Prices perform two functions in the market system. ***First***, prices serve as signals for the producers to decide 'what to produce' and for the consumers to decide 'what to consume' and 'how much to consume'. ***Secondly***, prices force the demand and supply conditions to adjust themselves to the prevailing prices. Let us now see how each of the basic problems is solved by the market mechanism or price mechanism.

(i) What to produce? The goods and services that are produced in a market economy are determined by consumer demand. The consumer is 'sovereign' in a free enterprise market economy. Each penny a consumer spends on a commodity is treated as a vote for producing that commodity. Continuing demand is a continuous process of voting. Increasing demand for a good, causes increase in its price. Rise in price makes profits go up. The profit-seeking producers will concentrate on the production of this commodity. If they produce a commodity not in demand, it will go waste and their profit motive will be defeated. This solves the problem of 'what to produce'.

(ii) How to produce? 'How to produce' is the question of choice of technology. The proportion of labour and capital used to produce a commodity is also determined by the market forces, i.e., the

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supply of and demand for labour and capital. Firms produce for profit and try to maximise it. It requires, among other things, minimizing cost of production. Costs can be minimized by using more of a cheap factor and less of a costly factor. If labour is cheaper than capital then more of labour and less of capital is used to produce a commodity. On the contrary, if capital is cheaper, more of capital and less of labour is used. In fact, cost minimizing firms combine labour and capital in such a proportion that minimizes the cost of production for a given output. This solves the problem of 'how to produce'.

(iii) For whom to produce? The problem 'For Whom to Produce' is also solved by the market mechanisms. The simple market rule is: produce for those who have the ability and willingness to pay. Ability to pay depends on incomes and incomes are determined by employment pattern of factors. Market mechanism determines the pattern of demand for factors of production. Given the supply of factors, market mechanism determines the price of each factors—rent, wages, interest and profits, for land, labour, capital and organisation, respectively. Once factor prices and employment pattern of factors of production (i.e., what factor is employed *in what quantity and at what price*) are determined, the distribution pattern of national income is simultaneously determined. In simple words, employment pattern determines the share of labour, property owners, investors and entrepreneurs in the national income. Once the pattern of income distribution is determined, it determines the demand pattern for the goods and services. Briefly speaking, in a free enterprise economy, goods and services are produced for those who possess the ability to pay. Production pattern so determined is however not always socially desirable.

Market System is Orderly

In a perfectly competitive market economy, the whole system is supposed to function smoothly, efficiently and in an orderly manner. Despite the fact that millions of people, often with conflicting interests and motivations, participate in working of the system at both individual and group levels, there is no chaos or anarchy. The market forces organise the whole economic system to the benefit of majority of its participants. Consumers get what they want to consume. Producers produce goods and services which maximize their profits. This social organism functions automatically—at least in theory.

Is all well with free enterprise economies? It may seem from the foregoing paragraph that all is well with the free enterprise economies. But not quite so. A genuinely efficient free enterprise system is supposed to ensure (i) that all those who are willing to work at the prevailing wage rate must get employment; (ii) that factor payments must be commensurate with their productivity; (iii) that all factors of production are optimally allocated; (iv) that, as Slitcher[1] has suggested, the goods must go to the consumers who derive the highest utility from them; and (v) that goods must be produced by the most efficient producers, i.e., by those who can produce them at the minimum possible cost.

The free enterprise system has, however, not worked as efficiently as expected at least during the post-War I period. Goods and jobs are not distributed optimally. Goods go to the persons who can pay the highest prices for them, but may not necessarily derive the highest utility too. It would be 'ridiculous to assert that ability to derive satisfaction from goods is proportionate to ability to pay for them'. Although it is difficult to quantify the satisfaction derived from a good by rich or poor persons, it cannot be denied that a woollen coat hanging idle in the wardrobe of a rich person would give more satisfaction to his/her scantily-dressed domestic servant during the winters. But the domestic servant

1. Slitcher, Sumner M., *Modern Economic Society*, Henry, Holt and Company, New York, 1928, reprinted in *Readings in Economics*, ed. by P.A. Samuelson, McGraw-Hill Company, New York, 1970.

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who needs it more does not get the coat because he does not have the adequate purchasing power. Similarly, in a free enterprise system jobs too are not distributed among the people on the least-pain basis. People are prepared to work for their living irrespective of pains and sacrifices they have to make for a meagre income. Under the condition of prolonged unemployment, people would be willing to work at an extremely low wage rate whatever the cost in terms of pains. Let us now look into the shortcomings of free-enterprise system in detail.

2.5 DRAWBACKS OF THE FREE ENTERPRISE SYSTEM

The major shortcomings of free enterprise system, as experienced over time by the free enterprise economies, are described below.

First, free enterprise system assumes the existence of perfect market conditions for its efficient working. The necessary conditions for the efficient working of the market system are: free competition, increasing cost in all markets, applicability of the exclusion principle in consumption, absence of public goods, perfect knowledge and free factor mobility. But the existence of such a perfect market system in the world economy is very rare. Besides, mere existence of perfect competition is not enough to ensure the efficient working of the system. As Scitovsky[1] has remarked, perfect competition would not ensure perfect efficiency if there are differences between social and private values and in social and private marginal products. It may not be possible to quantify the difference between social and private *values* and social and private *costs*, but the existence of such differences cannot be denied.

Secondly, free-enterprise system works on the philosophy and on the assumption that each individual is the best judge of his own interest and, therefore, his choices and decisions would best serve his interest. But most choices and decisions made by individuals, particularly in regard to consumer goods, are generally influenced by "impulses, habits, prejudice, ignorance, or clever sales talks, and too little by reflection, investigation of facts and comparison of alternative opportunities".[2] If it is not so, a person would not spend more on liquor and smoking and less on milk, education or health care; a couple would not produce children whom they cannot bring up properly, people will not throw their household garbage on road; factory-owners will not cause air and environment pollution; drivers will not drive their automobiles recklessly and flout traffic rules; ministers and politicians will not indulge in corrupt political practices; and people will not vote for corrupt and criminal politicians.

Thirdly, as mentioned above, the motivating force for private enterprise is profit. The private entrepreneurs would, therefore, not like to invest their capital in the industries or sectors which have lower profitability, even if the industries are of essential nature and of strategic importance for the national economy. So is the case with regional distribution of industrial undertakings. Under free enterprise system, the industries tend to concentrate in the regions having larger industrial and infrastructural facilities. This results in lopsided development of the national economy.

Fourthly, certain services, known as 'public utilities' like medical care, education, water, electricity, sanitation, etc., are equally important for all the individuals—rich and poor. Transport and communication facilities (including roadways, railways, airways, telephones, post and telegraph, etc.) are necessary for the overall growth of the economy. Private capital normally does not flow into these sectors in adequate measures, at least for three reasons: (i) they require huge initial investment;

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1. Scitovsky, Tibor, *Welfare and Competition*, Unwin University Books, 1968, p. 144.
2. Slitcher, Sumner, H., *op. cit.*, pp. 35-36.

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(ii) the rate of return in these sectors is very low and remote; and (iii) most public utility services are in the nature of collective consumption to which principle of exclusion cannot be applied. Apart from this fact, the 'public utilities' and other essential services cannot be left to the private sector. For, the pricing system of free enterprise system is such that only rich can afford these services, and hence there will be inequitable distribution of essential services.

Fifthly, free enteprise system works efficiently only when there is perfect competition. Perfect competition requires equality between the competitors. But two firms are hardly equal in efficiency. The competition, therefore, becomes imperfect, which leads to the growth of monopolies and unequal distribution of income. This is one of the greatest drawbacks of the free enterprise system.

Finally, free-market mechanism does not function efficiently where the *exclusion principle* is not applicable, specially where *externalities* are involved. Application of exclusion principle requires that those who do not pay for a good are excluded from the benefit from that good, and those who do not derive any benefit from a good are excluded from bearing the cost of that good. In a modern complex society, there are numerous activities, which impose disadvantage on those who do not benefit from them and there are those who benefit even if they do not pay for such goods and services. For instance, smoke-emitting factories, air polluting automobiles plying in the cities cause environment pollution and people using loudspeakers on marriage ceremonies and playing their radio loudly harm their neighbours by causing atmosphere and noise pollution. Such costs borne by the people are known as 'spill-over costs'. Similarly, planting trees on roadsides, creation of parks and gardens, spread of education etc., benefit the society by providing a beautiful landscape, spread of knowledge etc. Such benefits are known as 'spill-over benefits'. Spill-over costs and spill-over benefits are jointly called ***externalities***. The free enterprise system working on market principles does not compensate those who suffer and charge those who benefit from externalities. This makes market system inefficient and leads to sub-optimal allocation of resources.

Because of these drawbacks of the market mechanism, free enterprise system has failed in achieving optimum distribution on goods and services, optimum allocation of resources, maximum efficiency and maximum social welfare. Failures apart, the free enterprise system is alleged to have caused the growth of monopolies, unequal income distribution, unemployment, and poverty. Besides, though free enterprise system is capable of bringing economic growth, it does not ensure a stable, sustained and balanced growth. It becomes therefore inevitable for the government to intervene with the market mechanism through tax and subsidy measures to reduce market distortions, provide conditions for fair competition, and help the economy in achieving efficiency, stability, growth and economic justice.

It may, however, be noted that market mechanism works more efficiently than the government managed system.

2.6 THE GOVERNMENT AND THE ECONOMY

We have noted that the interference of the government with the market mechanism becomes inevitable because of failures of the system. Now, the question arises as to what should be the appropriate role of the government in economic management of the country and what should be the form, nature and extent of government interference with market mechanism. These questions have been discussed and debated for long but no precise answer has been provided by the economists. Nevertheless, the economic role of the government can be broadly categorised on the basis of the three economic systems which presently prevail in the world, viz., capitalist system or free enterprise system, socialist system, and the mixed-economy system.

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(i) Capitalist society. A capitalist society works on the principles of free enterprise system or what is also called a *laissez faire* system. In this system, the primary roles of the government are: (i) to preserve and promote free market mechanism wherever it is possible to ensure a workable competition; (ii) to remove all unnecessary restrictions on free working of a competitive market; and (iii) to provide a level playground and rules of the market game through necessary interventions of controls so that free competition can work effectively.[1] Besides, government intervention and its economic activities should deliver what free market mechanism cannot. Meade[2] has recommended eight kinds of activities for the State to perform for this purpose:

(i) control of inflation and deflation mainly through indirect measures, like fiscal and monetary regulations;

(ii) control and regulation of monopolistic powers of large corporate concerns with a view to avoiding unemployment and wastage of resources;

(iii) creation and ownership of state monopoly of essential goods and services, e.g., railway transport, generation and distribution of electricity and such like services on the ground of efficiency and economies of large scale;

(iv) promoting equality of opportunity by providing equal access to educational opportunities restricting the restrictive activities of trade unions, etc.;

(v) administration of justice and maintenance of law and order, and ensuring freedom of activities;

(vi) aiding private planning for the uncertainties of the future by some measure of government indicative planning;

(vii) making central planning for large structural changes in the economy; and

(viii) tackling the problems of environmental controls, of the use of exhaustible resources, and of population growth.

It may be inferred from the above that the government's role in a capitalist society is supposed to be limited to (a) restoration and promotion of necessary conditions for efficient working of free market mechanism; and (b) to enter those areas of production and distribution in which private entrepreneurship is lacking or is inefficient. Any planning by the government should be indicative and supplement to the private plans for future uncertainties.

(ii) Socialist economy. In contrast with the capitalist system, the role of government in a **socialist economy** is all pervasive. While in the former, the government is supposed to play a limited role in the economic sphere, in the latter, it exercises comprehensive control on almost all economic activities. In the socialist system, not only there is a complete disregard for free enterprise and market mechanism but also these systems are abolished by law. The private ownership of factors of production is replaced by the state ownership. All economic activities are centrally planned, controlled and regulated by the state. All decisions regarding production, resources allocation, employment, pricing etc., are centralised in the hands of government or the Central Planning Authority. The individual freedom of choice and decision-making in regard to economic activities is drastically curtailed. This, however, should not mean that there is no scope for individual decisions. Individuals are provided freedom to make their own choices, but within the policy framework of the socialist economy. The Soviet

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1. Meade, J.E., *The Intelligent Radical's Guide to Economic Policy*, (George Allen & Unwin Ltd., London), 1795, pp. 13-14.
2. *Ibid.*, pp. 14-16.

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economic system was till 1990 the most prominent example of socialist system of economic management. Other countries which had adopted socialist economic system were China, Poland, Slovakia and Yugoslavia. These economies are, however, liberalizing their economic system rapidly.

The social aims of the socialist economic system are the same as in free enterprise system, viz., efficiency, growth, social justice, and maximisation of social welfare. But, while the motivating force in a capitalist economy is ***private profit***, in the socialist economy, it is maximisation of ***social welfare***. Socialist way of management of the economy eliminates many evils of capitalist system, e.g., exploitation of labour by capitalists, elimination of forces generating economic fluctuations, prevention of unemployment, and providing social, political and economic equality.

(iii) Mixed economy. A **mixed economy** is an economic system which combines the features of both free enterprise and socialist (or centrally planned) economic systems. In this system, the economy is divided into two sectors, viz., (i) private sector, and (ii) public sector. **Private sector** is allowed to function on the principles of free enterprise system or free market mechanism within a broad political and economic policy framework. The other part of the economy, the **public sector,** is organised, owned and managed along the socialist pattern. The public sector is created by reserving certain industries, trade, services, and activities for the government control and management. The government prevents by law the entry of private capital into the industries reserved for the public sector. Another way of creating or expanding the public sector is *nationalisation* of private industries. The promotion, control and management of the public sector industries is the sole responsibility of the state.

Apart from controlling and managing the public sector industries the government controls and regulates the private sector through its industrial, monetary and fiscal policies. If necessary, direct controls are also imposed.

It is noteworthy that most free enterprise economies are conceptually mixed economies, since in all such economies there co-exist private and public sectors. A mixed economy is essentially a variant of the capitalist economy. The mixed economies of free enterprise system can however be distinguished from the mixed economies of 'socialist pattern' on the basis of the rationale of public sector in the two systems. The public sector in a free-enterprise system is a matter of pure economic necessity and is subservient to the free market mechanism. It functions on the principles and with the objective of aiding, supplementing and strengthening the free enterprise system. On the other hand, the creation of public sector in a 'socialist pattern of society' like India, is a matter of ideological and social choice. Its functioning is oriented towards the creation of a socialist pattern of society. In this system, social justice and equal opportunity are intended to be achieved through state policy measures rather than through market mechanism. Another point of distinction is that the public sector of the socialist pattern of society has a comprehensive *economic planning* whereas in a free enterprise system such plans are only indicative. Indian economy has since 1991 been oriented towards market mechanism by relaxing the government control on the economy by putting end to quota and 'licence raj'.

In the *mixed economy of a socialist pattern of society*, the roles and responsibilities of the government are much wider than free enterprise system, and much less than in the socialist society. The government, in this system, undertakes to perform all the functions that state performs in a free enterprise economy. In addition, it assumes the responsibility of making and implementing the plans for economic development of the country. The government has also to perform the task of coordinating private sector activities with the public sector, and controlling and regulating the former to bring it in tune with the public sector policies.

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2.7 PRODUCTION POSSIBILITY FRONTIER

As noted above, societies cannot have all that they want because resources are scarce and technology is given. In reality, however, both human and non-human resources available to a country, keep increasing over time and technology becoming more and more productive. Availability of human resources increases due to a natural process of increase in population, and non-human resources (especially capital goods and raw materials) increase due to creative nature of human beings. Non-human resources have been increasing due to human efforts to create more and better of capital goods, to discover new kinds and sources of raw materials, and to create a new and more efficient technique of production. Such factors change ***production possibilities*** and ***production possibility frontier*** of an economy.

In this section, we will describe the *production possibility frontier* and introduce the concept of ***opportunity cost***. To begin with, we will assume a **static model** with the following **assumptions**: (i) a country's resources consists of only labour and capital; (ii) availability of labour and capital is given; (iii) the country produces only two goods—food and clothing; and (iv) production technology for the goods is given.

The production possibility frontier. *Production possibilities refer to the alternative combinations of goods and services that a society is capable of producing with its given resources and state of technology.* With reference to our model specified above, *production possibilities are the alternative combinations of maximum food and clothing that the country can produce by making full use of its labour and capital, given the technology.* For example, let us suppose that, given the availability of labour, capital, and technology, the alternative production possibilities open to the country are given in Table 2.1. The production possibilities given in Table 2.1, can be presented in the form of a diagram as shown in Fig. 2.2. In this diagram, vertical axis measures food production and horizontal axis measures production of clothing. By graphing the alternative production possibilities given in Table 2.1, we locate points *A*, *B*, *C*, *D*, *E*, and *F* as shown in Fig. 2.2. A number of intermediate points can be located between any two of these points. By joining these points, we get a curve *AF*. This curve is called ***production possibility frontier (PPF)***. *The production possibility frontier, AF, shows all possible alternative combinations of the two goods (food and clothing) that can be produced by making full use of all the available resources (labour and capital), given the state of technology.* Each point on the *PPF* shows a different combination of two goods. For example, *production possibility frontier AF* shows that if the country choose point *A*, it can produce 7 thousand tons of food and no clothing.

Table 2.1 Alternative Production Possibilities

Alternative	Food (thousand tons)	Clothing (million meters)
A	7	0
B	6	33
C	5	48
D	4	60
E	3	68
F	0	80

Similarly, point *F* shows that the country can produce 80 million meters of clothing but no food. A large number of other alternative combinations of food and clothing can be located on the

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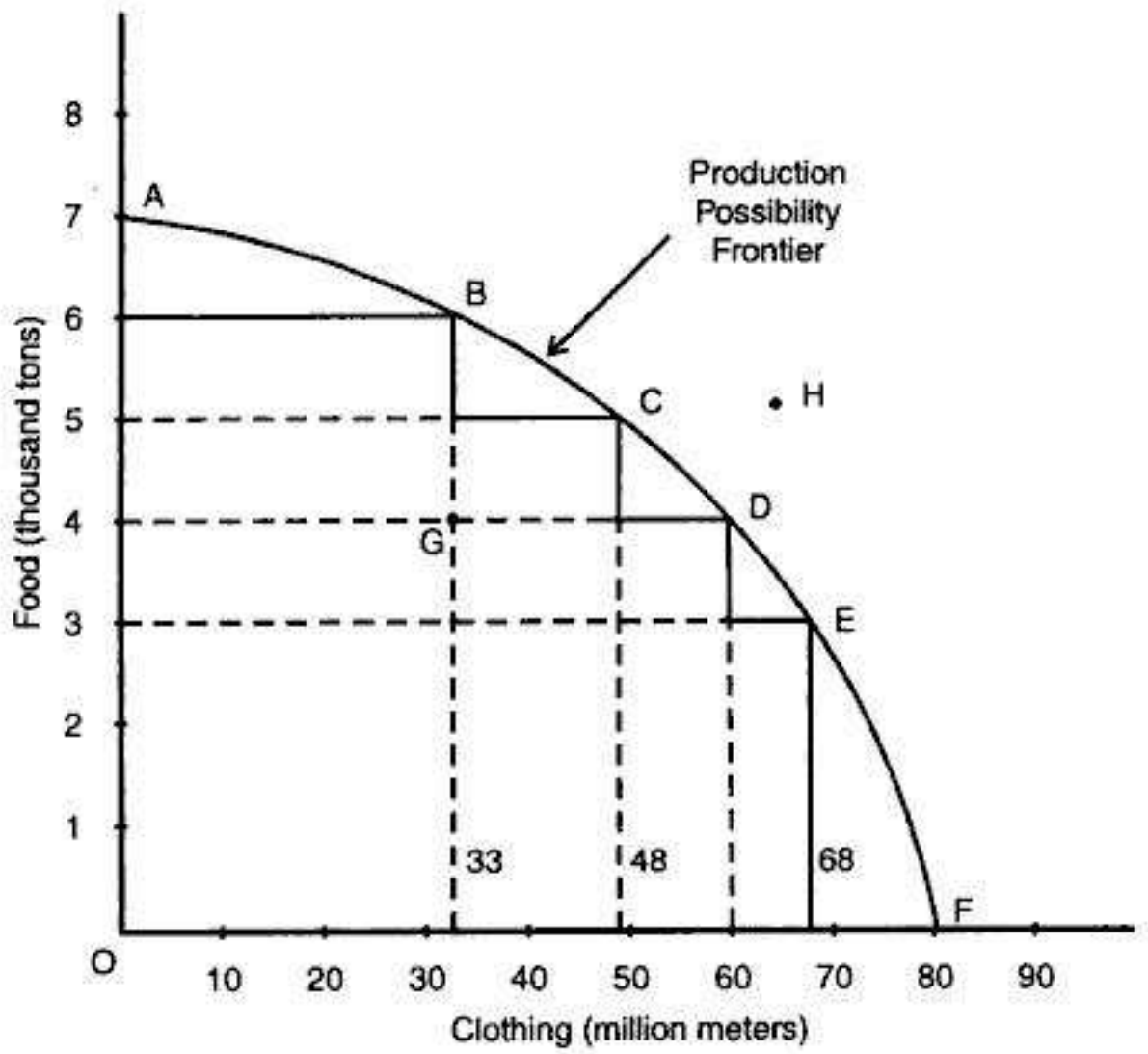


Fig. 2.2 The Production Possibility Frontier

curve *AF* that the country can produce by making full use of its resources, given the technology. For example, point *B* shows a combination of 6 thousand tons of food and 33 million meters of clothing and point C shows a combination of 5 thousand tons of food and 48 million meters of clothing, and so on. The combination of food and clothing that a society chooses to produce on the *PPF* depends on the demand for food and clothing.

Implications of points away from PPF. The *production possibility frontier* shows the alternative combinations of the two goods under the conditions that all the resources (labour and capital) are fully employed. Any point below the *PPF*, e.g., point G, implies underutilization or unemployment of resources. If resources are fully employed, an additional 2 thousand tons of food or 15 million meters of clothing or more of both the goods can be produced. Any point that falls beyond the *PPF*, e.g., point *H*, is unattainable for lack of resources. The scarcity of resources does not permit production of any combination of food and clothing indicated by a point outside the *PPF*.

The opportunity cost. Apart from showing the possible alternative combinations of two goods, *production possibilities frontier* indicates also the *opportunity cost* of one commodity in terms of the the other. Conceptually, *opportunity cost* is the benefit that is foregone to avail the benefit of another opportunity. In the present context, "The opportunity cost of an increase in the output of some product is the value of the other goods and services that must be foregone when inputs (resources) are taken away from production in order to increase the output of the product in question."[1] In our example, opportunity cost of food production is the quantity of clothing foregone to produce a certain quantity of food, and *vice versa*. The concept of 'opportunity cost' can be exemplified with

1. Baumol, William J. and Blinder, Alan S., *Economics: Principles and Policies*, 4th Edn., (Harcourt, Jovanovich, London, 1988), p. 632.

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the help of alternative options given by the *PPF*. As can be seen in Fig. 2.2, the movement along the *production possibilities frontier, AF*, shows decrease in the output of one commodity at the cost of the output of the other. For example, movement from point *A* to point *B* shows decrease in food production from 7 thousand tons to 6 thousand tons and increase in the production of clothing from 0 million meters to 33 million meters. It implies that 1 thousand tons of food can be produced only by sacrificing 33 million meters of clothing. It means that *opportunity cost* of the 1 thousand tons of food is 33 million meters of clothing. Likewise, movement from point *B* to point *A* implies that ***opportunity cost*** of 33 million meters of clothing is one thousand tons of food.

Increasing opportunity cost and concavity of PPF. The *production possibilities frontier* reveals ***another important fact*** that *opportunity cost* changes along the *PPF*. In Fig. 2.2, movement from point *A* downwards to points *B, C, D, E* and *F* shows increasing opportunity cost of clothing in terms of lost output of food. For example, movement from points *A* and *B*, means transferring resources (labour and capital) from food production to clothing production. As a result, food production is lost by 1 thousand tons for 33 million meters of clothing. It means that the opportunity cost of 33 million meters of clothing is 1 thousand tons of food. A further movement from point *B* to *C* means that the opportunity cost of only 15 million meters of clothing, a much lower quantity, is the same one thousand tons of food. It means that opportunity cost of clothing increases as we move downwards along the *PPF*. It increases further between points *C* and *D*. Similarly, movement from point *F* towards point *A*, shows increasing opportunity cost of food production in terms of clothing.

Why is PPF concave? It can be seen in Fig. 2.2 that *PPF* takes the form of a ***concave curve***. The *PPF* derives its concavity from the fact that opportunity cost increases along the *PPF*. Opportunity cost increases due to an economic law, i.e., the *law of diminishing returns to scale*. The law of diminishing returns states that when more and more units of two inputs are used to produce a commodity, the return on the marginal units of inputs goes on diminishing. The movement from one point on the *PPF* to another means transfer of resources from the production of one commodity to that of the other. For example, movement from point *A* towards point *F* implies transfer of resources from food production to production of clothing. As more and more resources are employed to produce clothing, marginal productivity of resources in terms of clothing goes on diminishing. The result is increase in the opportunity cost.

Shift in Production Possibility Frontier

The *production possibilities frontier* for a country is not fixed for all times to come. In general, it keeps shifting upwards for two reasons: (i) *expansion of resources*, i.e., increase in the availability of resources (labour and capital); and (ii) *technological improvements*. The effects of resource expansion and technological improvements on the *PPF* is explained and illustrated below.

(i) Resource expansion and production possibility frontier. Increase in human and non-human resources of a country, technology remaining the same, causes a parallel shift in its *PPF*. In general, resources of a country increase over time with increase in labour supply due to increase in population and increase in the supply of capital. The upward shift in the *PPF* due to increase in country's resources (labour and capital) is illustrated in Fig. 2.3 assuming a given technology. Suppose that given the resources and technology of a country, its *PPF* is shown by the curve *AB* in Fig. 2.3.

Now, let the resources (labour and capital) of the country increase so that a larger quantity of labour and capital is available to produce food and clothing. With the increase in resources, the country can increase its food production by *AC* or, alternatively, production of clothing by *BD*, or a larger combination of both the goods. By joining the possible points, we get a higher *PPF* as shown by the curve *CD* in Fig. 2.3. This shows an upward shift in the *PPF* from *AB* to *CD* due to increase in

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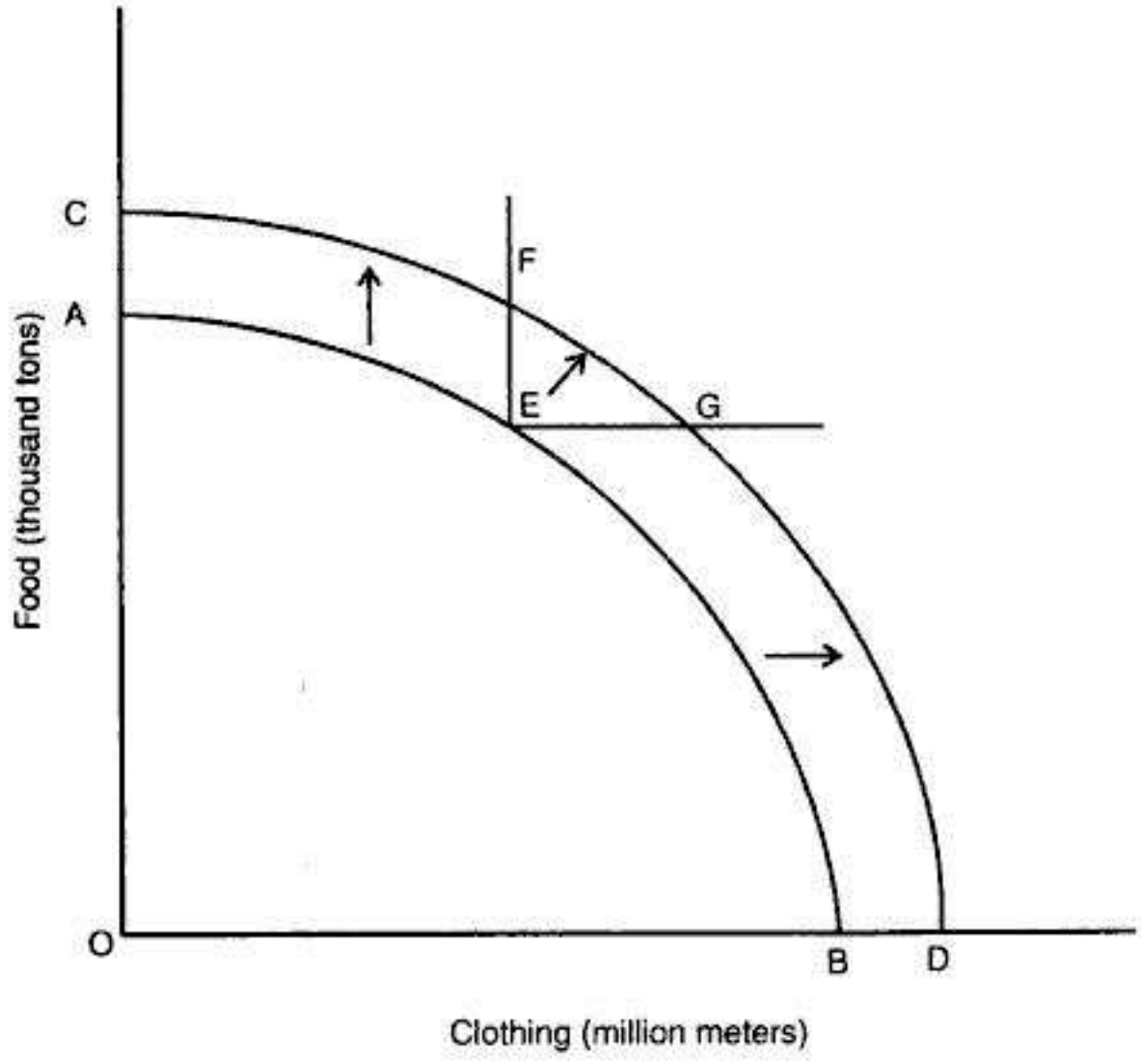


Fig. 2.3 Shift in Production Possibility Frontier

resources. Each point on the *production possibilities frontier CD* shows a larger combination of food and clothing. For example, suppose given its resources, the country was at point *E* on the *PPF* shown by *AB*. When its resources increase, its *PPF* shifts upward to *CD*. The country can then increase its production of food by *EF* or of clothing by *EG* or an addition quantity of both the goods indicated by points between *F* and *G*. This kind of production possibilities show ***economic growth*** of the country.

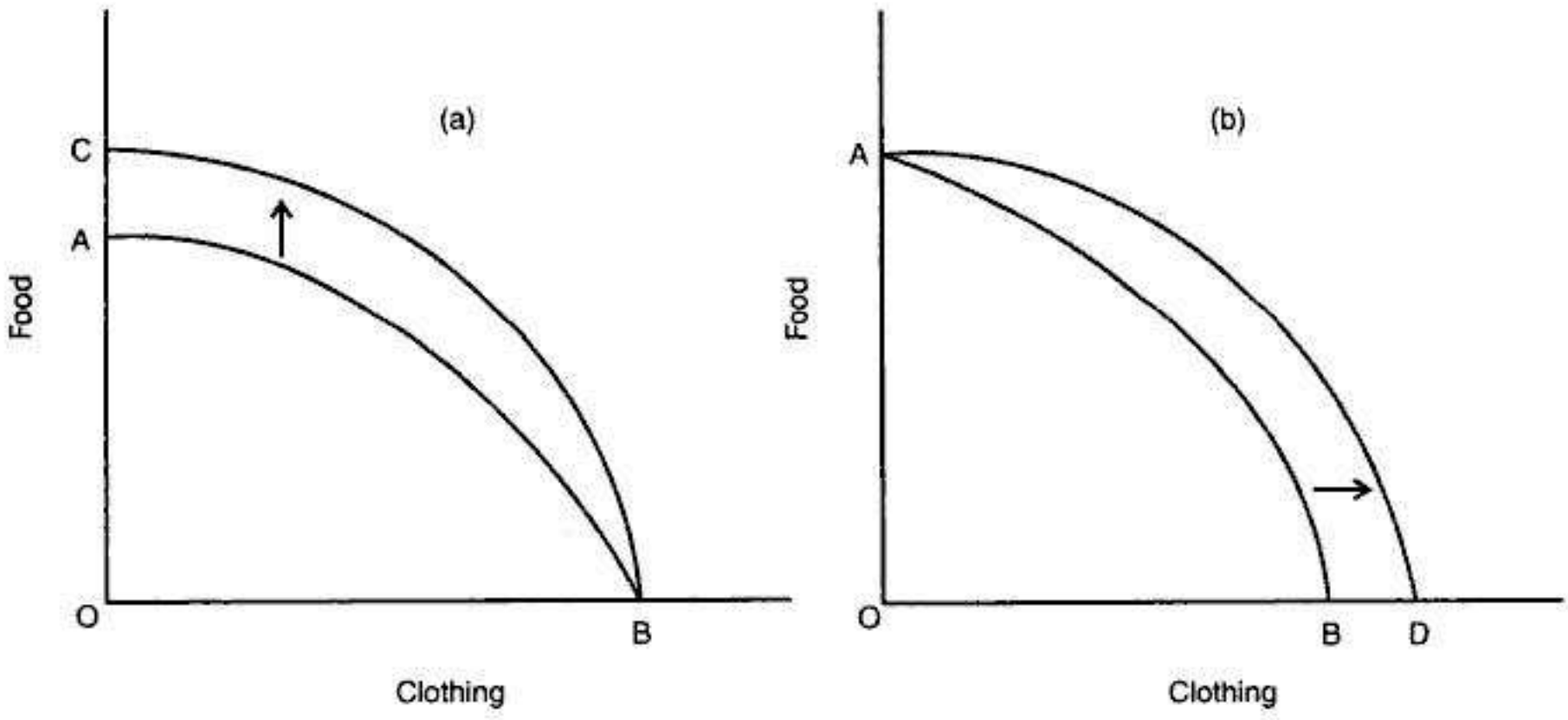


Fig. 2.4. Technological Improvement and Shift in *PPF*

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(ii) Technological improvement and production possibility frontier. Technological improvement refers to change in production technique so that more of goods can be produced per unit of time by using a given quantity of resources. That is, technological improvement increases the productivity of resources, both labour and capital. Technological improvement may be commodity-specific and at different points of time in different industries. In India, for example, technological break-through in food production was made during the 1970s whereas technological improvement in clothing industry had started much earlier. The *PPF* shift due to industry-wise technological improvement is illustrated parts (a) and (b) of Fig. 2.4. Part (a) illustrated shift in the *PPF* due to technological improvement in food production, assuming no improvement clothing technology, and part (b) illustrates shift in the *PPF* due to technical improvement in clothing industry, assuming no change in food technology.

In can be seen in part (a) of Fig. 2.4 that technological improvement in food production makes an upward shit in the *PPF* from *AB* to *CB*. The shift in *PPF* indicates (i) that total food production can be increased with no change in clothing production, (ii) that more of both the goods can be poduced. Similarly, part (b) shows the shift in the *PPF* when there is technological improvement in clothing industry and no such change in food industry. Due to technological improvement, total production of clothing can be increased by *DB* or more of both the goods can be produced.

(iii) What if Changes in Resources in Technology are Simultaneous? If *technological improvements* take place along the *resource expansion* and if technological improvements take place in both the industries simultaneously, then the shift in *PPF* is similar to that caused by resource expansion, though the shift may not be parallel.

FURTHER READINGS

Lipsey, Richard, G., *An Introduction to Positive Economics,* (ELBS, London), 6th Edn., 1983, Chapters 4 and 5.

Samuelson, Paul A. and Nordhaus, W., *Economics,* 15th Edn., (McGraw-Hill, Inc., New York, 1995), Chapter 1

Slitcher, Sumner H., *Modern Economic Society,* (Henry, Hold and Co., New York., 1928), reprinted in *Readings in Modern Economics,* ed. by P. A. Samuelson, (McGraw-Hill, New York, 1970).

REVIEW QUESTIONS AND EXERCISES

1. How will you define an economic system? What are the various constituents of the economic system? How do they act and react?
2. Explain the working of a simple economy with the help of an appropriate diagram using a simple model. How will the total real output be affected when households set aside a part of their income?
3. Illustrate the circular flows of product and money in a simple economy. Why are the two kinds of flows always equal in value terms? What will happen if one of the flows is reduced for some reason?

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3 The Laws of Demand and Supply

CHAPTER OUTLINE

3.1 The Concept of Market
3.2 The Demand Side of the Market
- 3.2.1 The Meaning of Demand
- 3.2.2 The Law of Demand
- 3.2.3 The Demand Schedule
- 3.2.4 The Demand Curve
- 3.2.5 Why Demand Curve Slopes Downward to the Right
- 3.2.6 Exceptions to the Law of Demand
- 3.2.7 The Concept of Market Demand
- 3.2.8 Other Determinants of Market Demand
- 3.2.9 Demand Function
- 3.2.10 Shift in Demand Curve

3.3 The Supply Side of the Market
- 3.3.1 The Law of Supply
- 3.3.2 The Supply Schedule
- 3.3.3 The Supply Curve
- 3.3.4 Shift in the Supply Curves
- 3.3.5 Supply Function

3.4 The Market Equilibrium: Equilibrium of Demand and Supply
3.5 Shift in Demand and Supply Curves and Market Equilibrium
- 3.5.1 Shift in Demand Curve
- 3.5.2 Shift in Supply Curve
- 3.5.3 Simultaneous Shift in Demand and Supply Curves

3.6 Stability of Market Equilibrium
- 3.6.1 Static and Dynamic Equilibrium
- 3.6.2 Equilibrium under Static Conditions
- 3.6.3 Equilibrium under Dynamic Conditions

Further Readings
Review Questions and Exercises

We have noted in Chapter 2 that **market mechanism** plays a crucial role in solving the basic economic problems in a free market economy and that the entire market system functions in an orderly manner, though some aspects of it may not be desirable. The market system works in an

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A desire accompanied by ability and willingness to pay makes a real or **effective demand**.

Individual and market demand. *Individual demand* can be defined as the quantity of a commodity that a person is willing to buy at a given price over a specified period of time, say per day, per week, per month, etc. *Market demand* refers to the total quantity that all the users of a commodity are willing to buy at a given price over a specific period of time. In fact, market demand is the sum of individual demands. Individual and market demand curves are illustrated ahead in section 3.2.7.

3.2.2 The Law of Demand

The law of demand states the relationship between the quantity demanded and price of a commodity. Although quantity demanded of a commodity depends also on many other factors, e.g., consumer's income, price of the related goods, consumer's taste and preferences, advertisement, etc., price is the most important and the only determinant of demand in the short run.

The law of demand can be stated as, *all other things remaining constant, the quantity demanded of a commodity increases when its price decreases and decreases when its price increases*. This law implies that demand and price are inversely related. Marshall states the law of demand as "the amount demanded increases with a fall in price and diminishes with a rise in price". This law holds under *ceteris paribus* assumption, that is, *all other things remain unchanged*. The law of demand can be illustrated through a *demand schedule* and a *demand curve*.

3.2.3 The Demand Schedule

A *demand schedule* is a tabular presentation of different prices of a commodity and its corresponding quantity demanded per unit of time. A hypothetical market demand schedule is given in Table 3.1. This table presents price of shirts (P_s) and the corresponding number of shirts demanded (Q_s) per month.

Table 3.1 Demand Schedule for Shirts

P_s (price in Rs)	Q_s (Shirts in '000)
800	8
600	15
400	30
300	40
200	55
100	80

Table 3.1 illustrates the law of demand. As data given in the table shows, the demand for shirts (Q_s) increases as its price (P_s) decreases. For instance, at price Rs 800 per shirt, only 10 thousand shirts are demanded per month. When price decreases to Rs 400, the demand for shirts increases to 30 thousand and when price falls further to Rs 100, demand rises to 80 thousand. This relationship between price and quantity demanded gives the law of demand.

3.2.4 The Demand Curve

A *demand curve* is a graphical presentation of the demand schedule. A demand curve is obtained by plotting a demand schedule. For example, when the data given in the demand schedule (Table 3.1) is

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presented graphically as in Fig. 3.1, the resulting curve *DD'* is the **demand curve.** The curve *DD'* in Fig. 3.1 depicts the law of demand. It slopes downward to the right. It has a negative slope. The negative slope of the demand curve *DD'* shows the *inverse relationship* between the price of shirt and its quantity demanded. It shows that demand for shirts increases with the decrease in its price and decreases with rise in its price. As can be seen in Fig. 3.1, downward movement on the demand curve *DD'* from point *D* towards *D'* shows fall in price and rise in demand. Similarly, an upward movement from point *D'* towards *D* reads rise in price and fall in demand.

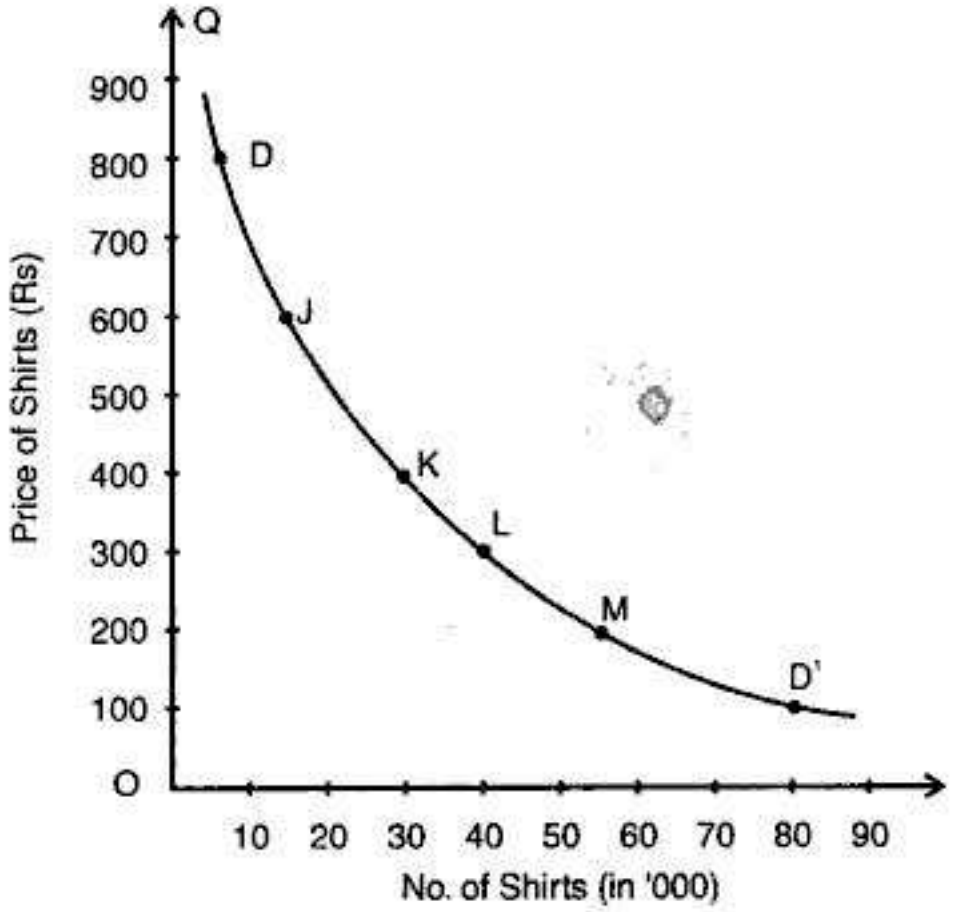


Fig. 3.1 The Demand Curve

The law of demand is based on an empirical fact. For example, when prices of cell phones and personal computers (PCs), specially of the latter, were astronomically high, only few rich persons and big firms could afford them. Now with the revolution in computer cell phone technology and the consequent fall in their prices, demand for these goods has shot up in India.

3.2.5 Why Demand Curve Slopes Downward to the Right

Figure 3.1 shows that *demand curve slopes downward to the right*. Why does it happen? The **reasons behind the law of demand** are following:

(i) Income effect. When price of a commodity falls, real income of its consumers increases in terms of this commodity. In other words, their purchasing power increases since they are required to pay less for the same quantity. According to another economic law, increase in real income (or purchasing power) increases demand for goods and services in general and for the goods with reduced price in particular. The increase in demand on account of increase in real income is called ***income effect***.

It should however be noted that the *income effect* is negative in case of *inferior goods*. In case price of an ***inferior good*** accounting for a considerable proportion of the total consumption expenditure falls substantially, consumers' real income increases. Consequently, they substitute superior goods for inferior ones. Therefore, *income effect* on the demand for inferior goods becomes *negative*.

(ii) Substitution effect. When price of a commodity falls, it becomes cheaper compared to its substitutes, their prices remaining constant. In other words, when price of a commodity falls, price

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of its substitutes remaining the same, its substitute becomes relatively costlier. Consequently, rational consumers tend to substitute cheaper goods for costlier ones within the range of normal goods—goods whose demand increases with increase in consumer's income—other things remaining the same. Therefore, demand for the relatively cheaper commodity increases. The increase in demand on account of this factor is known as ***substitution effect***.

(iii) Diminishing marginal utility. Marginal utility is the utility derived from the marginal unit consumed of a commodity. Diminishing marginal utility is also responsible for increase in demand for a commodity when its price falls. When a person buys a commodity, he exchanges his money income with the commodity in order to maximise his satisfaction. He continues to buy goods and services so long as marginal utility of his money (MU_m) is less than the marginal utility of the commodity (MU_c). Given the price (P_c) of a commodity, the consumer adjusts his purchases so that $MU_c = MU_m$. This proposition holds under both constant MU_m and diminishing MU_m.

If MU_m is assumed to be constant, then $MU_m = P_c$. Under this condition, utility maximising consumer makes his purchases in such quantities that

$$MU_m = P_c = MU_c$$

When price falls, $(MU_m = P_c) < MU_c$. The only way to regain his equilibrium is to reduce MU_c. So the consumer purchases more of the commodity. When the stock of a commodity increases, MU_c decreases. As a result, demand for a commodity increases when its price decreases.

This conclusion holds also under diminishing MU_m. When price of a commodity falls and consumer buys only as many units as before the fall in price, he saves some money on this commodity. As a result, his stock of money increases and his MU_m decreases, whereas MU_c remains unchanged because his stock of commodity remains unchanged. Since MU_m is less than MU_c, the utility maximizing consumer exchanges money with commodity to equate MU_m with MU_c, with a view to maximising his satisfaction. Consequently, demand for a commodity increases when its price falls.

3.2.6 Exceptions to the Law of Demand

The law of demand is one of the fundamental laws of economics. The law of demand, however, does not apply to the following cases:

(i) Expectations regarding future prices. When consumers expect a continuous increase in the price of a durable commodity, they buy more of it despite increase in its price, to avoid the pinch of still higher price in future. Similarly, when consumers anticipate a considerable decrease in the price in future, they postpone their purchases and wait for the price to fall further, rather than buy the commodity when its price initially falls. Such decisions of the consumers are contrary to the law of demand.

(ii) Prestigious goods. The law does not apply to the commodities which serve as a 'status symbol', enhance social prestige or display wealth and richness, e.g., gold,[1] precious stones, rare paintings and antiques, etc. Rich people buy such goods mainly because their prices are high.

(iii) Giffen goods. An exception of this law, is also the classic case of Giffen goods named after a British economist Sir Robert Giffen, (1837–1910). A Giffen good does not mean any specific commodity. It may be any essential commodity much cheaper than its substitutes, consumed mostly by the poor households and claiming a large part of their income. If price of such goods increases (price of its substitute remaining constant), its demand increases instead of decreasing. For instance, let us suppose that the *monthly minimum* consumption of foodgrains by a poor household is 30 kgs

1. Goods of this category are also accumulated to store value.

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including 20 kgs of *bajra* (an inferior good) and 10 kgs of wheat (a superior good). Suppose also that *bajra* sells at Rs 5 a kg and wheat Rs 10 a kg. At these prices, the household spends Rs 200 per month on food grains. That is the maximum it can afford. Now, if price of *bajra* increases to Rs 6 per kg, the household will be forced to reduce its consumption of wheat by 5 kgs[1] and increase that of *bajra* by the same quantity in order to meet its minimum monthly consumption requirement within Rs 200 per month. Obviously, household's demand for *bajra* increases from 20 to 25 kgs per month despite increase in its price and that of wheat falls to 5 kgs.

3.2.7 The Concept of Market Demand

Market demand for a commodity is the sum of all individual demands for the commodity at a given price, per unit of time. Suppose, there are only three consumers (*A, B* and *C*) of Pepsi and their weekly individual demand for Pepsi at its different prices is given as in Table 3.2. The last column of the table shows the market demand, i. e., the aggregate of individual demands for Pepsi.

Table 3.2 Individual and Market Demand for the Pepsi Cans

Price (Rs)	No. of Pepsi Cans demanded by			Market demand $= A + B + C$
	A	B	C	
12	0	0	0	0
10	0	0	4	4
8	0	4	8	12
6	3	8	12	23
4	5	12	16	33
2	8	16	20	44
0	11	20	24	55

The last column of Table 3.2 shows weekly market demand for Pepsi. The *market demand curve* can be obtained by plotting the data in the last column of the table.

Graphical Derivation. Alternatively, market demand curve can be derived graphically by horizontal summation of the individual demand curves at each price of Pepsi. Graphical derivation of the market demand curve is illustrated in Fig. 3.2. The individual demand curves of buyers *A, B* and *C* are shown by the demand curves D_A, D_B and D_C, respectively. Horizontal summation of these demand curves produces weekly *market demand curve* for Pepsi as shown by the curve D_M. Thus, a *market curve is horizontal summation of individual demand curves at different prices.*

It is ***important*** to note here that there is a significant difference between the individual demand curves and the market demand curve. The individual demand curves may not slope downward in case of many consumer goods, e.g., a book by an author, umbrella, cinema ticket for a show, or a passenger ticket, etc. But market demand for all such goods, slopes downward following the decrease in their prices, due to increase in the number of consumers.

---

1. The increase in demand for *bajra* by 5 kgs can be worked out as follows. Suppose the household maintains its food consumption at its minimum level of 30 kgs. For this, it will be required to substitute x kgs of *bajra* for the same quantity of wheat (x kgs). Its food consumption basket may be expressed as $(20 + x)$ kgs of bajra + $(10 - x)$ kgs of wheat = 30 kgs. Since household can afford only Rs 200 per month, its budget equation can be written as $6(20 + x) + 10(10 - x) =$ Rs 200. Solving this equation for x, we get $x = 5$ kgs.

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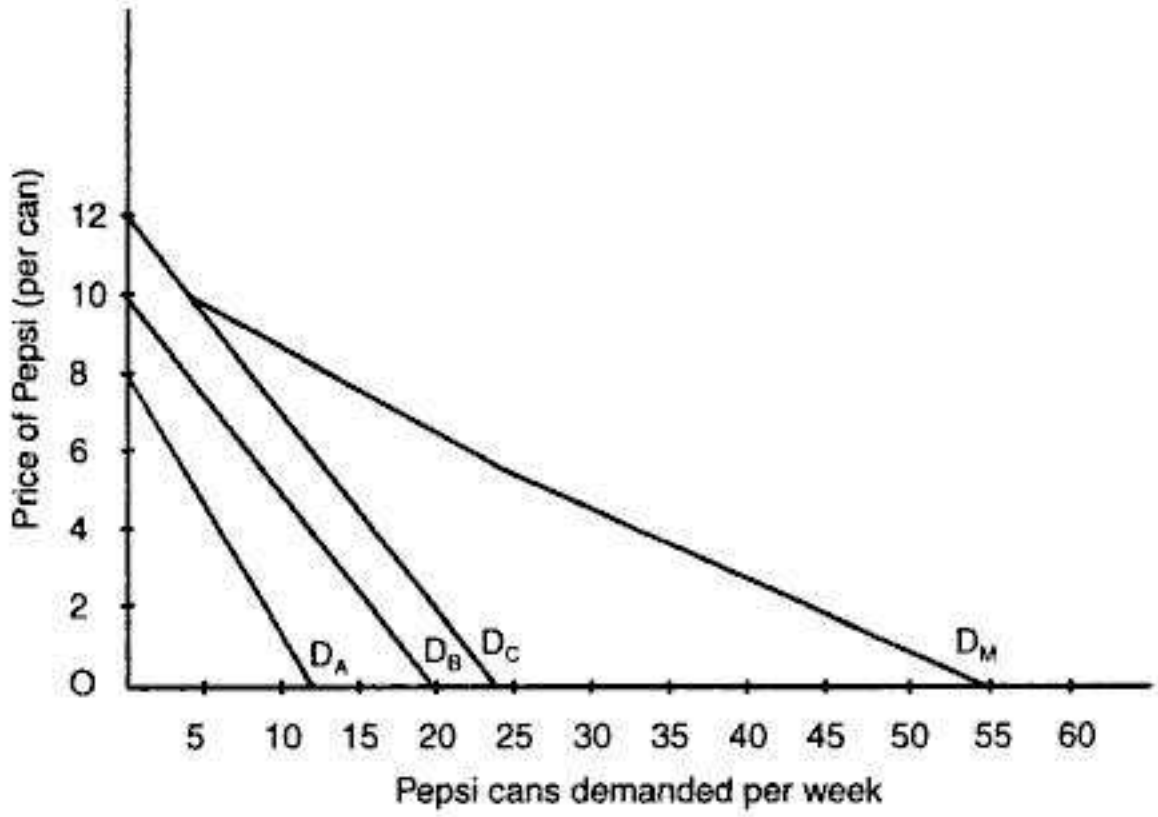


Fig. 3.2 Derivation of Market Demand Curve

3.2.8 Other Determinants of Market Demand

In the short run, price of a commodity is the main determinant of its market demand. In the long run, however, market demand for a product is determined by the number of other factors. We will discuss here, some other important quantifiable and non-quantifiable determinants of demand for a product.

(i) Price of substitutes and complementary goods. The demand for a commodity depends also on the prices of its substitutes and complementary goods. Two commodities are deemed to be ***substitutes*** for one another, if change in price of one affects the demand for the other in the same direction. For instance, commodities *X* and *Y* are, in economic sense, substitutes for one another if a rise in the price of *X* increases the demand for *Y*, and *vice versa*. Tea and coffee, hamburger and hot-dog, wheat and rice, alcohol and drugs are some common examples of common substitutes. By definition, the relation between demand for a product and price of its substitute is of **positive** nature. When price of a product (say, tea) falls (or increases), then demand for its substitute (coffee) falls (or increases). The relationship of this nature is given in Fig. 3.3 (a).

A commodity is deemed to be a ***complement*** of another when it complements the use of the other. For example, petrol is a complement to motor vehicles; butter and jam are complements to bread; milk and sugar are complement to tea and coffee and so on. Conceptually, two goods are complements for one another, if an increase in the price of one causes a decrease in the demand for another. By definition, *there is an inverse relationship between the demand for a good and the price of its complement.* For instance, an increase (or a decrease) in the price of petrol causes a decrease (or an increase) in the demand for car, other things remaining the same. The nature of relationship between the demand for a product and the price of its complement is given in Fig. 3.3 (b).

(ii) Consumers' income and Engel curves. Consumer's income is the basic determinant of the quantity demanded of a product. It is a common knowledge that the people with higher disposable income spend a larger amount on goods and services than those with lower income. Income-demand relationship is of a more varied nature than that between demand and its other determinants.

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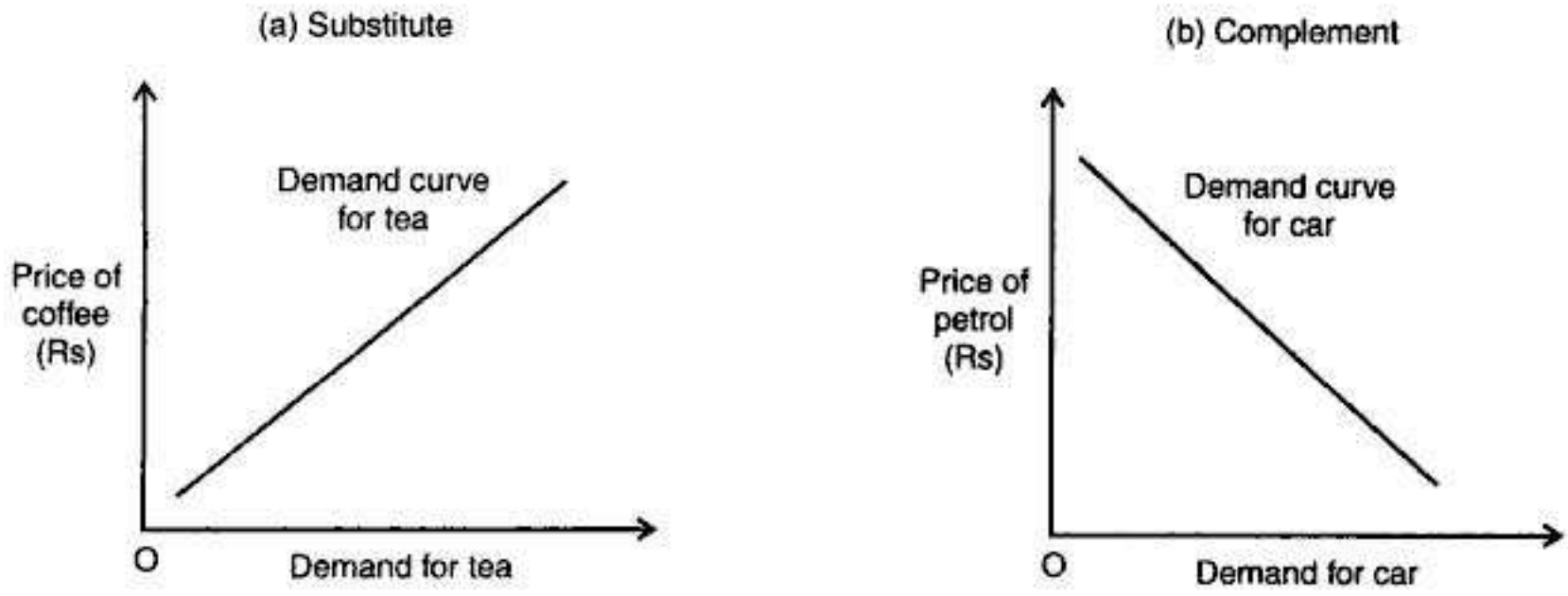


Fig. 3.3 Demand for Substitute and Complement

For the purpose of income-demand analysis, goods and services may be grouped under four broad categories, viz. (a) essential consumer goods; (b) inferior goods; (c) normal goods; and (d) prestige or luxury goods. The relationship between income and the different kinds of goods is presented through the **Engel Curves.***

(a) Essential consumer goods (ECG). The goods and services which fall in this category are essentially consumed by almost all persons of a society, e.g., food grains, clothes, vegetable oils, sugar, matches, cooking fuel and housing, etc. The quantity demanded of such goods increases with increase in consumer's income only upto a certain limit, other factors remaining the same. The relation between goods and services of this category and consumer's income is shown by curve *ECG* in Fig. 3.4. As the curve shows, consumer's demand for essential goods increases until his income rises to OY_2 and beyond this level of income, it does not.

(b) Inferior goods. Inferior and superior goods are generally known to both consumers and sellers. For instance, every consumer knows that *bajra* is inferior to wheat and rice; *bidi* (an indigenous cigarette) is inferior to cigarette, coarse textiles are inferior to refined ones, kerosene stove is inferior to gas-stove; travelling by bus is inferior to travelling by taxi, and so on. In economic terminology, however, *a commodity is deemed to be inferior if its demand decreases with the increase in consumers'* income. The relation between income and demand for an inferior good is shown by curve *IG* in Fig. 3.4 assuming that other determinants of demand remain the same. Demand for such goods may initially increase with increase in income (say upto Y_1) but it decreases when income increases beyond this level.

(c) Normal goods. In economic sense, normal goods are those which are demanded in increasing quantities as consumers' income rises. Clothing is the most important example of this category of goods. Household furniture, electricity, telephones, household gadgets, etc. are other examples of this category of goods. The nature of relation between income and demand for normal goods is shown by the curve *NG* in Fig. 3.4. As the curve shows, demand for such goods increases with increase in income of the consumer, but at different rates at different levels of income. Demand for normal goods initially increases rapidly with the increase in income and later, at a lower rate.

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* Engel Curve has been named after a German Statistician, Christian Lorenz Ernst Engel (1821–1986), who was one of the first to study systematically the relation between quantity demanded of a good and the consumer's income. According to Engel's law, proportion of expenditure on essential goods decreases as income increases.

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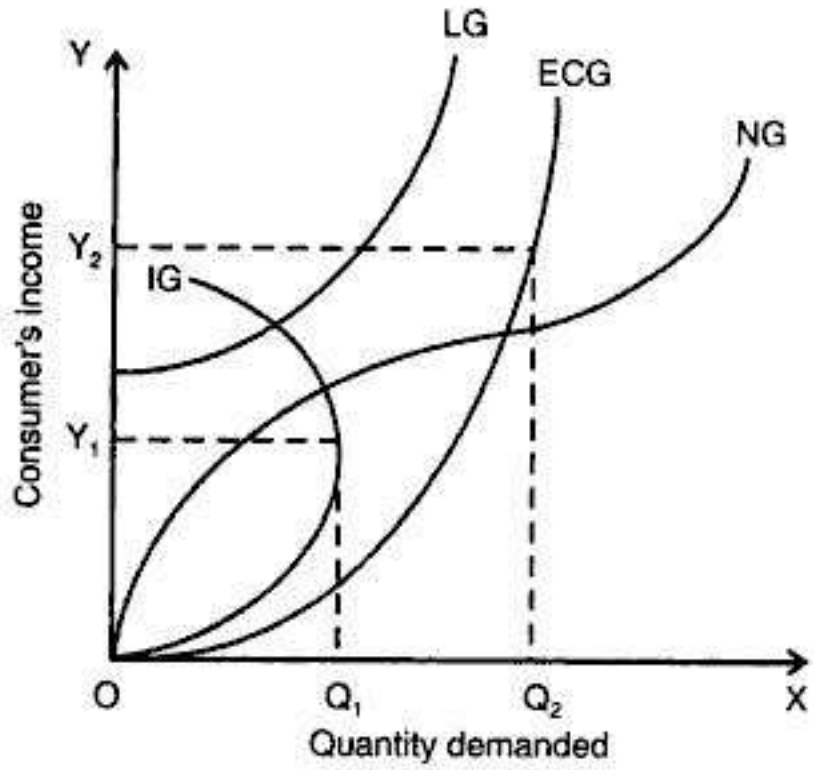


Fig. 3.4. Income-Demand Curves

It may be noted from Fig. 3.4 that upto a certain level of income (Y_1) the relation between income and demand for all types of goods is similar. The difference is of degree only. The relation between income and different kind of goods becomes distinctly different only beyond a certain level of income.

(d) Prestige or luxury goods. Prestige goods are those which are consumed mostly by the rich section of the society, e.g., precious stones, studded jewellery, costly cosmetics, luxury cars, airconditioners, costly decoration items (e.g., antiques), etc. Demand for such goods arises only beyond a certain level of consumer's income. The income-demand relationship of this category of goods is shown by the curve *LG* in Fig. 3.4.

(iii) Consumer's taste and preference. Consumer's taste and preferences play an important role in determining the demand for a product. Taste and preferences depend, generally, on the social customs, religious values attached to a commodity, habits of the people, the general life-style of the society and also the age and sex of the consumers. Change in these factors changes consumers' taste and preferences. When there is a change in consumers' liking, tastes and preferences for certain goods and services following the change in fashion, people switch their consumption pattern from cheaper and old fashioned goods over to costlier 'mod' goods, so long as price differentials commensurate with their preference. For example, preference for 'junk food' in the younger generation has increased as compared to normal home-made nutritious food. Consumers are prepared to pay higher prices for 'mod' goods even if their virtual utility is the same as that of old-fashioned goods. This fact reveals that tastes and preferences also influence demand for goods and services.

(iv) Expected utility at equilibrium. Most consumers have limited income to satisfy unlimited wants. They spend their income on various goods they consume in such a manner that the total satisfaction derived out of their limited income is maximum. A consumer maximises his total satisfaction or his total utility when marginal utility, per unit of expenditure, derived from each commodity is the same. For example, let us suppose that a consumer has to spend his limited income on bread (B), shirts (S), and cinema shows (C). Given their respective prices as P_b, P_s, P_c, he would spend his income on these items according to the law of equi-marginal utility* so that marginal

* This law is discussed in detail in Chapter 6.

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utility (MU) per unit of expenditure from each of these goods is the same, i.e.,

$$\frac{MU_b}{P_b} = \frac{MU_s}{P_s} = \frac{MU_c}{P_c}$$

where MU_b, MU_s and MU_c denote the MU of bread, shirts and cinema shows, respectively.

This is a necessary condition of consumer's equilibrium. Since MU schedule for each of these goods would be different, the consumer would buy different quantities of these goods with a view to equalising their MU per unit of expenditure. The equilibrium condition itself determines the quantity of each good (given their MU schedule) which a utility maximising consumer would like to buy. Although, in practice, a consumer may not be able to achieve the theoretical precision of his equilibrium, his pattern of expenditure and the quantity of each commodity that he would buy would approximate to the equilibrium condition stated above.

(v) Consumers' expectations. Consumers' expectations regarding the future course of economic events, particularly regarding changes in prices, income, and supply position of goods, play an important role in determining the demand for goods and services in the short run. If consumers expect a rise in the price of a commodity, they would buy more of it at its current price, with a view to avoiding the pinch of price-rise in future. On the contrary, if consumers expect prices of certain goods to fall, they postpone their purchases of such goods with a view to taking advantage of lower prices in future, mainly in case of non-essential goods. This behaviour of consumers reduces (or increases) the current demand for the goods whose prices are expected to decrease (or increase) in future. Similarly, an expected increase in income on account of the announcement of revision of pay-scales, dearness allowance, bonus, etc., induces increase in curent purchase, and *vice versa*.

(vi) Demonstration effect. When new commodities or new models of existing ones appear in the market, rich people buy them first. Some people buy new goods or new model of goods because they have genuine need for them while others buy because they want to exhibit their affluence. But once new commodities come in vogue, many households buy them, not because they have a genuine need for them but because others or neighbours have bought these goods. The purchase by the latter category of buyers are made out of such feelings as jealousy, competition, equality in the peer group, social inferiority and the desire to raise social status. Purchases made on account of these factors are the result of *'Demonstration Effect'* or the *'Bandwagon Effect'*. These effects have a positive effect on the demand. On the contrary, when a commodity becomes the thing of common use, some people, mostly rich, decrease or give up the consumptions of such goods. This is known as **'Snob Effect'**. It has a negative effect on the demand for the related goods.

(vii) Consumer-credit facility. Availability of credit to the consumers from the sellers, banks, relations and friends or from any other source encourages the consumers to buy more than what they would buy in the absence of credit facility. That is why the consumers who can borrow more consume more than those who can borrow less or cannot borrow at all. Credit facility affects mostly the demand for consumer durables, particularly those which require bulk payment at the time of purchase.

(viii) Population of the country. The total domestic demand for a product depends also on the size of population. Given the price, per capita income, taste and preferences etc., the larger the population, the larger the demand for a product of common use. With an increase (or decrease) in the size of population, employment percentage remaining the same, demand for the product increases (or decreases). The relation between market demand for a product (normal) and the size of population is similar to the income–demand relationship.

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(ix) Distribution of national income. The distribution pattern of national income also affects the demand for a commodity. If national income is evenly distributed, market demand for ***normal goods*** will be the largest. If national income is unevenly distributed, i.e., if majority of population belongs to the lower income groups, market demand for essential goods will be the largest whereas the same for other kinds of goods will be relatively low.

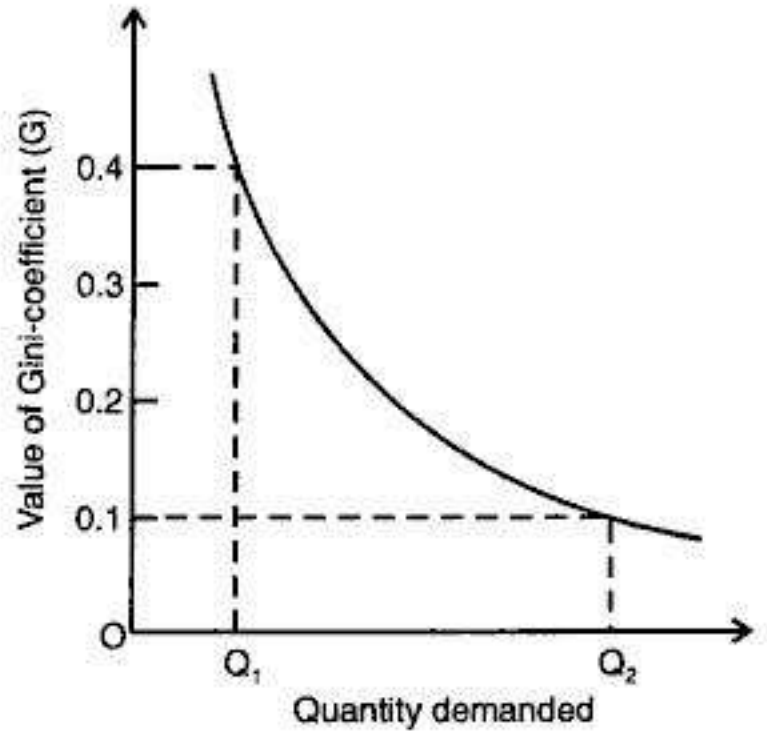


Fig. 3.5 Gini-coefficient and Demand

The relationship beteween market demand for a normal good and national income distribution is illustrated in Fig. 3.5. In the figure, vertical axis measures the Gini efficient[1] (a measure of national income distribution—*G*) and the horizontal axis measures the quantity demanded of a normal good. As Fig. 3.5 shows, at high value of $G = 0.4$, quantity demand of a normal good is small equal to Q_1. As *G* decreases from 0.4 to 0.1 (i.e., income distribution becomes more and more even) quantity of a normal goods demanded increases from Q_1 towards Q_2.

3.2.9 Demand Function

In mathematical language, a function is a symbolic statement of relationship between a dependent and independent variables. Demand function states the relationship between demand for a product (the dependent variable) and its determinants (the independent variables). Let us consider the most common form of a demand function, i.e., the short-run demand function, which consists of quantity demand (*Q*) and price (*P*). Assume that the quantity demanded of a commodity (D_x) depends only on its price, other factors remaining constant. The demand function will then read as 'demand for a commodity (D_x) depends on its price (P_x)'. The same statement may be written in its functional form as

$$D_x = f(P_x) \tag{3.1}$$

where D_x is demand for commodity *X*, the dependent variable, and P_x is price of *X*, the independent variable.

1. Gini-coefficient is a standard measure of national income distribution through Phillips curve. Gini-coefficient (*G*) having numerical value equal to zero indicates equal distribution of national income. $G > O$ indicates inequality. The higher the value of *G*, the greater the inequality in the distribution of national income.

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The function (3.1), however, does not give the quantitative relationship between D_x and P_x. When quantitative relationship between D_x and P_x is known, the demand function may be expressed in the form of an equation as

$$D_x = a - bP_x \tag{3.2}$$

where a and b are constants—a is intercept and b quantifies the relationship between D_x and P_x.

The form of equation depends on the empirical demand-price relationship. The two most common forms of demand-price relationship are ***linear*** and ***non-linear***. Accordingly, the demand function may take a linear or a non-linear form.

(i) Linear demand function. A demand function is said to be linear when the slope of the demand curve remains constant throughout its length. The simplest form of a linear demand function is given by equation (3.2). In equation (3.2), the alphabet a denotes total demand at zero price and $b = \Delta D/\Delta P$, also a constant, denotes slope of the demand curve.

Given the demand function (3.2), if values of a and b are known, total demand (D_x) for any given price (P_x) can easily be obtained. For example, let us assume that $a = 100$ and $b = 5$. Now the demand function (3.2) can be written as

$$D_x = 100 - 5P_x \tag{3.3}$$

Given the Eq. (3.3), the value of D_x can be easily obtained for any value of P_x. For example, if $P_x = 4$,

$$D_x = 100 - 5 \times 4$$
$$= 80;$$

and if $P_x = 10$,

$$D_x = 100 - 5 \times 10$$
$$= 50.$$

Thus, a demand schedule can be prepared assigning different values to P_x. When this demand schedule is plotted, it produces a linear demand curve as shown in Fig. 3.6.

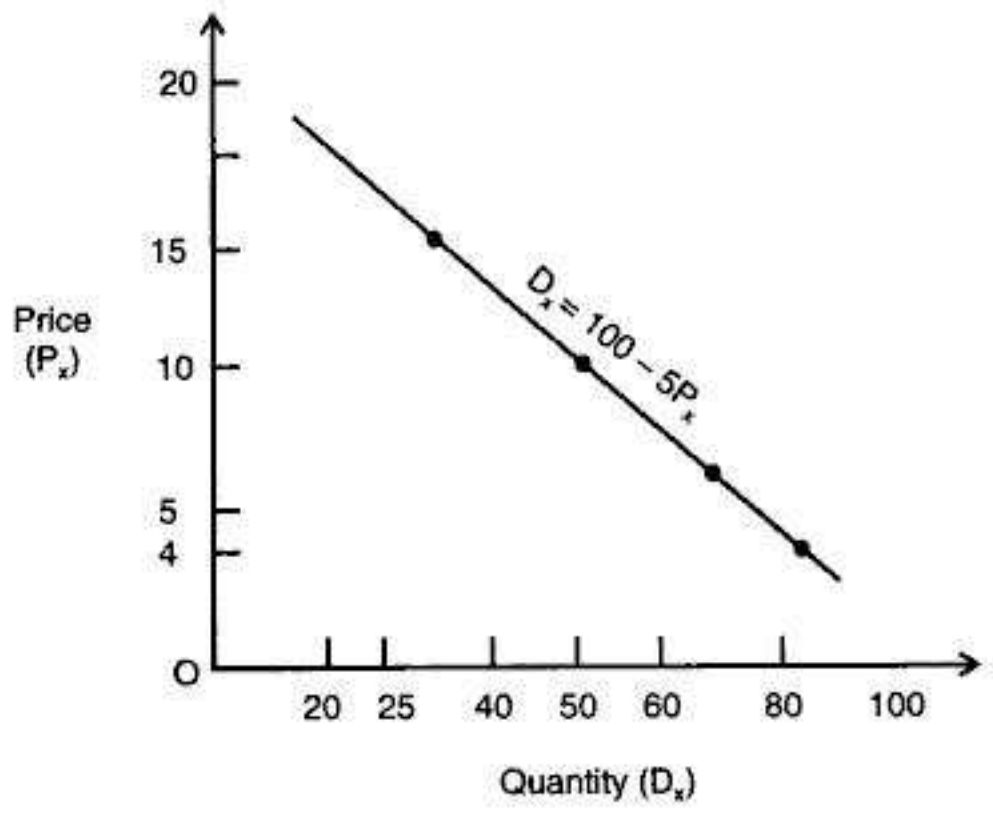


Fig. 3.6 Linear Demand Function

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From the demand function, one can easily derive a corresponding ***price function***. For example, given the demand function (3.2), the price function may be written as

$$P_x = \frac{a - D_x}{b} \tag{3.4}$$

or $$P_x = \frac{a}{b} - \frac{1}{b} D_x$$

Denoting a/b by a' and $1/b$ by b', Eq. (3.4.) may be written as

$$P_x = a' - b' D_x$$

Given the demand function (3.3), price function can be derived as follows.

If $$D_x = 100 - 5P_x$$

then $$P_x = 20 - 0.20\, D_x$$

(ii) Non-linear demand function. A demand function is said to be non linear or curvilinear when the slope of a demand curve ($\Delta P/\Delta Q$) changes all along the demand curve. Non-linear demand function yields a demand curve instead of a *demand line*, as shown in Fig. 3.7. A non-linear demand function, generally, takes the form of a power function as

$$D_x = aP_x^{-b} \tag{3.5}$$

or of a rectangular hyperbola of the form

$$D_x = \frac{a}{P_x + c} - b \quad \text{where } a, b, c > 0. \tag{3.6}$$

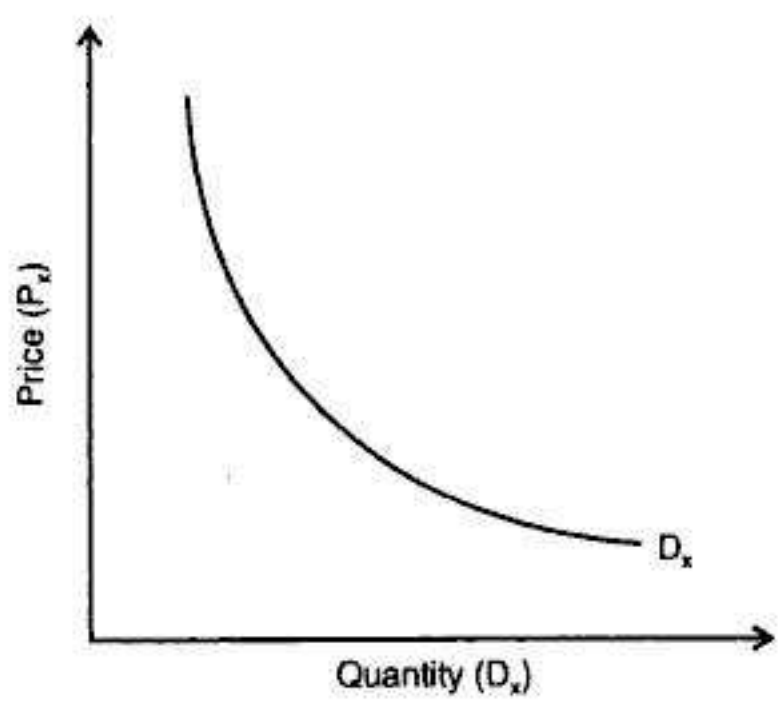


Fig. 3.7 Nonlinear Demand Function

Note that the exponent ($-b$) of the price variable in a non-linear demand function (3.5) is the coefficient of price elasticity of demand, which is constant.

(iii) Dynamic demand function. The demand function with price as a single independent variable, as described above, may be termed as ***short-term demand function***. A short-run demand function assumes all other factors than price to be given. In the long-run, however, the market demand for a product depends on the composite impact of all the determinants operating simultaneously. Therefore, in a ***long-run*** or ***dynamic demand function***, all the relevant determinants of demand for a product are included in the demand function. For instance, if individual demand (D_x) for a commodity X, depends

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on its price (P_x), consumer's income (Y), consumer's wealth (W), price of its substitute (P_y), price of complementary goods (P_c), consumer's taste (T), and advertisement expenditure (A), it can be expressed as

$$D_x = f(P_x, Y, W, P_y, P_c, T, A) \tag{3.7}$$

If relationship between D_x and the independent variables P_x, Y, W, P_y, P_c and A is of linear form, the estimable form of the demand function is expressed as

$$D_x = a - bP_x + cY + wW + dP_y + jA \tag{3.8}$$

where a is a constant term and b, c, w, d and j are the coefficient of relation between D_x and the respective independent variables.

In a *market demand function* for a product, other independent vaiables, viz., size of population (N) and a measure of income distribution, i.e., Gini-coefficient (G), may also be included.

3.2.10 Shift in Demand Curve

When demand curve changes its position retaining its shape (though not necessarily), the change is known as *shift in demand curve*. Let us suppose that the demand curve, D_2 in Fig. 3.8 is the original demand curve for commodity X. As shown in the figure, at price OP_2, demand equals OQ_2 units of X, other factors remaining constant. But if any of the other factors (e.g., consumers' income or price of the substitutes) changes, it will change consumer's ability and willingness to buy commodity X. For example, if consumer's disposable income decreases due to increase in income tax, he may be able to buy only OQ_1 units of X instead of OQ_2 at price OP_2. As a result, demand curve D_2 shifts downward D_1. This is true for the whole range of price of X, that is, consumers would be able to buy less at all other prices. This will cause a ***downward shift*** in demand curve from D_2 to D_1. Similarly, increase in disposable income of the consumer, say, due to reduction in taxes, may cause an ***upward shift*** from D_2 to D_3. The consumer shifts to point E_3 on demand curve D_3 and can buy OQ_3 of commodity X. Such changes in the location of demand curves are known as shifts in demand curve.

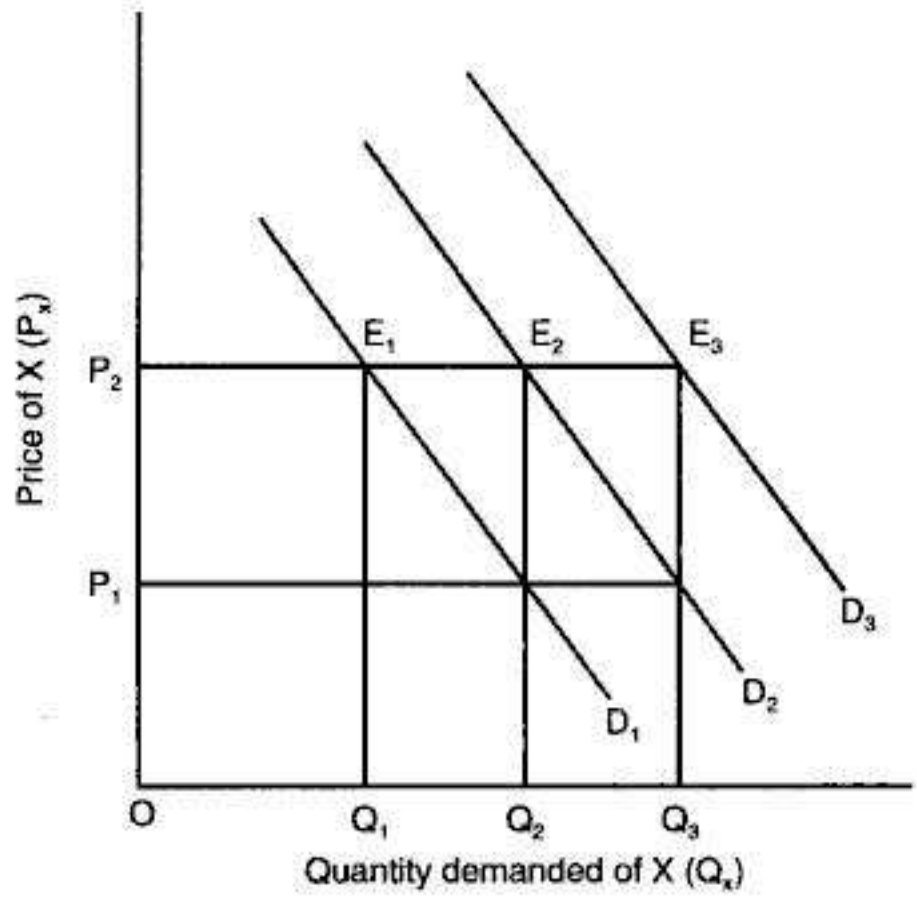


Fig. 3.8 Shift in Demand Curve

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Reasons for shift in demand curve. Shifts in a demand curve may take place owing to the change in one or more of the determinants of demand. Consider, for example, the decrease in demand for commodity X by Q_1Q_2 in Fig. 3.8. This fall in demand may have been caused by any of the following reasons:

(i) fall in the consumer's income so that consumer can buy only OQ_1 of X at price OP_2 — it is called *income effect;*

(ii) fall in the price of X's substitute so that the consumers find it gainful to substitute Q_1Q_2 of X for its substitute—it is *substitution effect;*

(iii) advertisement made by the producer of the substitute, changes consumer's taste or preference against commodity X so much that they replace Q_1Q_2 of it with its substitute—again a *substitution effect;*

(iv) increase in the price of complements of X so that consumers can afford only OQ_1 of X; and

(v) also for such reasons as commodity X is going out of fashion; its quality has deteriorated; consumers' technology has so changed that only OQ_1 of X can be used, and change in season if commodity X has only seasonal use.

3.3 THE SUPPLY SIDE OF THE MARKET

In a market economy, while buyers of a product constitute the demand side of the market, sellers of that product make the supply side of the market. In this section, we turn to discuss the law of supply.

Market Supply

Supply means the quantity of a commodity which its producers or sellers offer for sell at a given price, per unit of time. Market Supply, like market demand, is the sum of supplies of a commodity made by all individual firms.

3.3.1 The Law of Supply

The supply of a commodity depends on its price and cost of its production. In other words, supply is the function of price and production cost.[1] The law of supply is, however, expressed generally in terms of price-quantity relationship. The *law of supply* can be stated as follows: ***The supply of a product increases with the increase in its price and decreases with decrease in its price, other things remaining constant.*** It implies that the supply of a commodity and its price are positively related. This relationship holds under the assumption that "other things remain the same". "Other things" include technology, price of related goods (substitute and complements), and weather and climatic conditions in case of agricultural products.

3.3.2 The Supply Schedule

A supply schedule is a tabular presentation of the law of supply. A supply schedule is a table showing different prices of a commodity and the corresponding quantity that suppliers are willing to offer for sale. Table 3.2 presents a hypothetical supply schedule of shirts, i.e., number of shirts supplied per month at different prices.

1. Cost of production determines, in fact, the minimum price of a commodity.

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Table 3.2 Supply Schedule of Shirts

Price (in Rs)	Supply (Shirts in '000)
100	10
200	35
300	50
400	60
600	75
800	80

3.3.3 The Supply Curve

A supply curve is a graphical presentation of the supply schedule. The supply curve *SS'* given in Fig. 3.9 has been obtained by plotting the data in Table 3.2. The points *S*, *P*, *Q*, *R*, *T* and *S'* show the price-quantity combinations on the supply curve *SS'*. The supply curve, *SS'*, depicts ***the law of supply***. The upward slope of the supply curve indicates the rise in the supply of shirts with the rise in its price and fall in the supply with fall in prices. For example, at price Rs 200, only 35 thousand shirts are supplied per month. When price rises to Rs 400, supply increases to 60 thousand shirts.

As shown in Fig. 3.9, ***a supply curve has a positive slope***. The positive slope or upward movement of the supply curve is caused by seller's desire to make larger profit and, more importantly, by the rise in cost of production. The rise in cost of production results from the law of diminishing returns. In fact, supply curve is derived from the marginal cost curve. The derivation of supply curve from the marginal cost curve is discussed and illustrated ahead in Chapter 15.

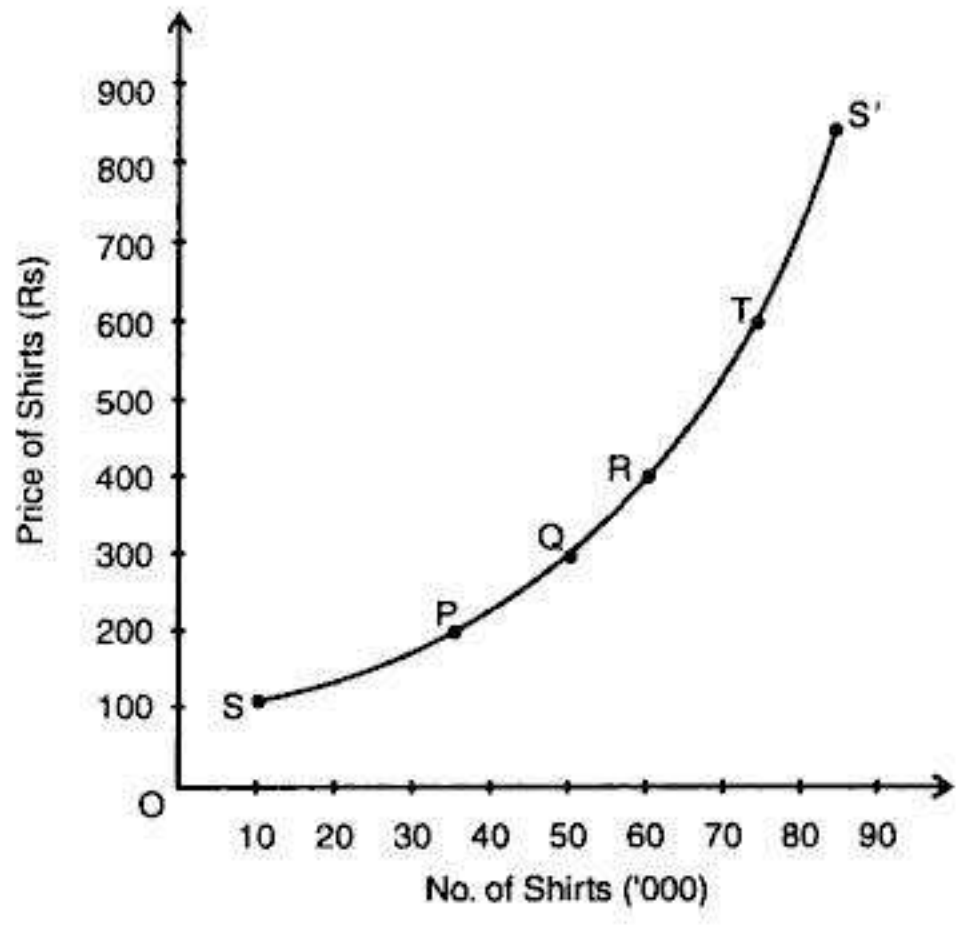


Fig. 3.9 Supply Curve of Shirts

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3.3.4 Shift in the Supply Curve

We have shown above that a change in the price of a commodity causes a change in its quantity supplied along a given supply curve. Although price of a commodity is the most important determinant of its supply, it is not the only determinant. Many other factors influence the supply of a commodity. Given the supply curve of a commodity, when there is change in its other determinants, the supply curve shifts rightward or leftward depending on the effect of such changes. Let us now explain how other determinants of supply cause shift in the supply curve.

(i) Change in input prices. When input prices decrease, the use of inputs increases. As a result, product supply increases and the supply curve *SS* shifts to the right to *SS"*, as shown in Fig. 3.10. Similarly, when input prices increase, product supply curve shifts leftward from *SS* to *SS'*.

(ii) Technological progress. Technological changes that reduce cost of production or increase efficiency cause increase in product supply. For instance, introduction of high yielding variety of paddy and new techniques of cultivation increased per acre yield of rice in India in the 1970s. Such changes make the supply curve shift to the right.

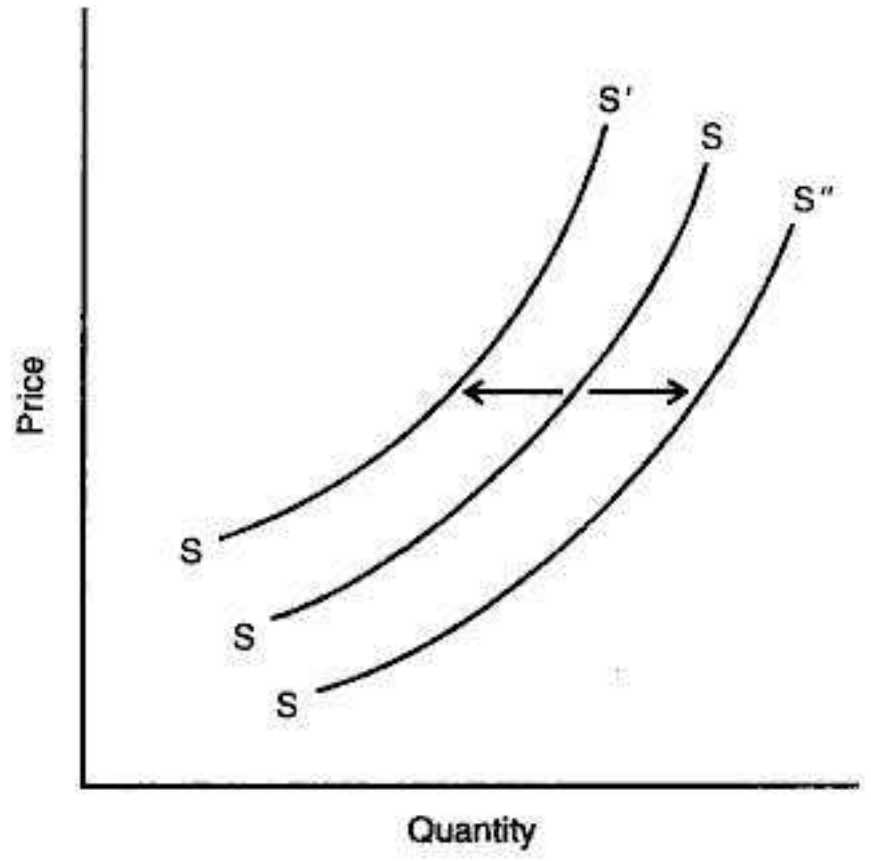


Fig. 3.10 Shift in the Supply Curve

(iii) Price of product substitutes. In production of many commodities, it is possible to produce some other goods which require a similar technology. For example, a refrigerator company can also produce ACs; Tatas famous for truck production can also produce cars; Maruti Udyog can produce trucks, and so on. Fall in the price of one of the product substitutes may lead to the rise in the supply of other due to capacity utilization for profit maximisation.

(iv) Nature and size of the industry. The supply of a commodity depends also on whether an industry is monopolized or competitive. Under monopoly, supply is fixed. When a monopolized industry is made competitive, the total supply increases. Besides, if size of an industry increases due to new firms joining the industry, the total supply increases and supply curve shifts rightward.

(v) Government policy. When government imposes restrictions on production, e.g., import quota on inputs, rationing of or quota imposed on input supply, etc., production tends to fall. Such restrictions make supply curve to shift leftward.

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(vi) Non-economic factors. The factors like labour strikes and lock-outs, war, drought, flood, communal riots, epidemics, etc. also affect adversely the supply of commodities.

3.3.5 Supply Function

The ***supply function*** is a mathematical statement which states the relationship between the quantity supplied of a commodity (as a dependent variable) and its determinants (as independent variables). Supply function is based on the law of supply. The law of supply states only the nature of relationship between the price and the quantity supplied. A supply function quantifies this relationship. A supply function may be written as

$$Q_x = 10\,P_x \tag{3.9}$$

(where Q_x denotes the quantity supplied of commodity X and P_x denotes its price).

Given the supply function, a supply schedule can be obtained by substituting numerical values for P_x. For example, if $P_x = 2$, $Q_x = 20$ and if $P_x = 5$, $Q_x = 50$. By plotting the supply schedule, a supply curve can be obtained. (For procedure, refer to the section on demand function).

3.4 THE MARKET EQUILIBRIUM: EQUILIBRIUM OF DEMAND AND SUPPLY

Determination of Price in a Free Market

In sections 3.2 and 3.4, we have explained the laws of demand and supply and how demand and supply behave in response to the change in price and other determinants. In this section, we explain how demand and supply strike a balance, how market attains **equilibrium**, and how **equilibrium price** is determined in a free market. A **free market** is one in which market forces of demand and supply are free to take their own course and there is no outside control on price, demand and supply.

The Concept of Market Equilibrium

In physical sense, the term equilibrium means the "state of rest". In general sense, it means balance in opposite forces. In the context of market analysis, ***equilibrium refers to a state of market in which quantity demanded of a commodity equals the quantity supplied of the commodity***. The equality of demand and supply produces an ***equilibrium price***. The **equilibrium price** is the price at which quantity demanded of a commodity equals its quantity supplied. That is, at equilibrium price, demand and supply are in equilibrium. Equilibrium price is also called ***market-clearing price***. Market is cleared in the sense that there is no unsold stock and no unsupplied demand.

Determination of Market Price

Equilibrium price of a commodity in a free market is determined by the market forces of demand and supply. In order to analyse how equilibrium price is determined, we need to integrate the demand and supply curves. For this purpose, let us use the example of shirts. Let us suppose that the market demand and supply schedules for shirts are given as shown in Table 3.3.

As the table shows, there is only one price of shirts (Rs 300) at which the market is in equilibrium: quantity demanded equals the quantity supplied at 40 thousand shirts. At all other prices, the shirt market is in ***disequilibrium***—the state of imbalance between supply and demand. When market is in the state of disequilibrium, either demand exceeds supply or supply exceeds demand. As the table shows, at all prices below Rs 300, demand exceeds supply showing *shortage* of shirts in the market. Likewise, at all prices above Rs 300, supply exceeds demand showing *excess supply*.

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By substituting supply and demand functions, we get

$$10\,P_x = 150 - 5\,P_x$$

$$P_x = 10$$

At equilibrium price P_x =10, the quantity supplied and demanded are in equilibrium.

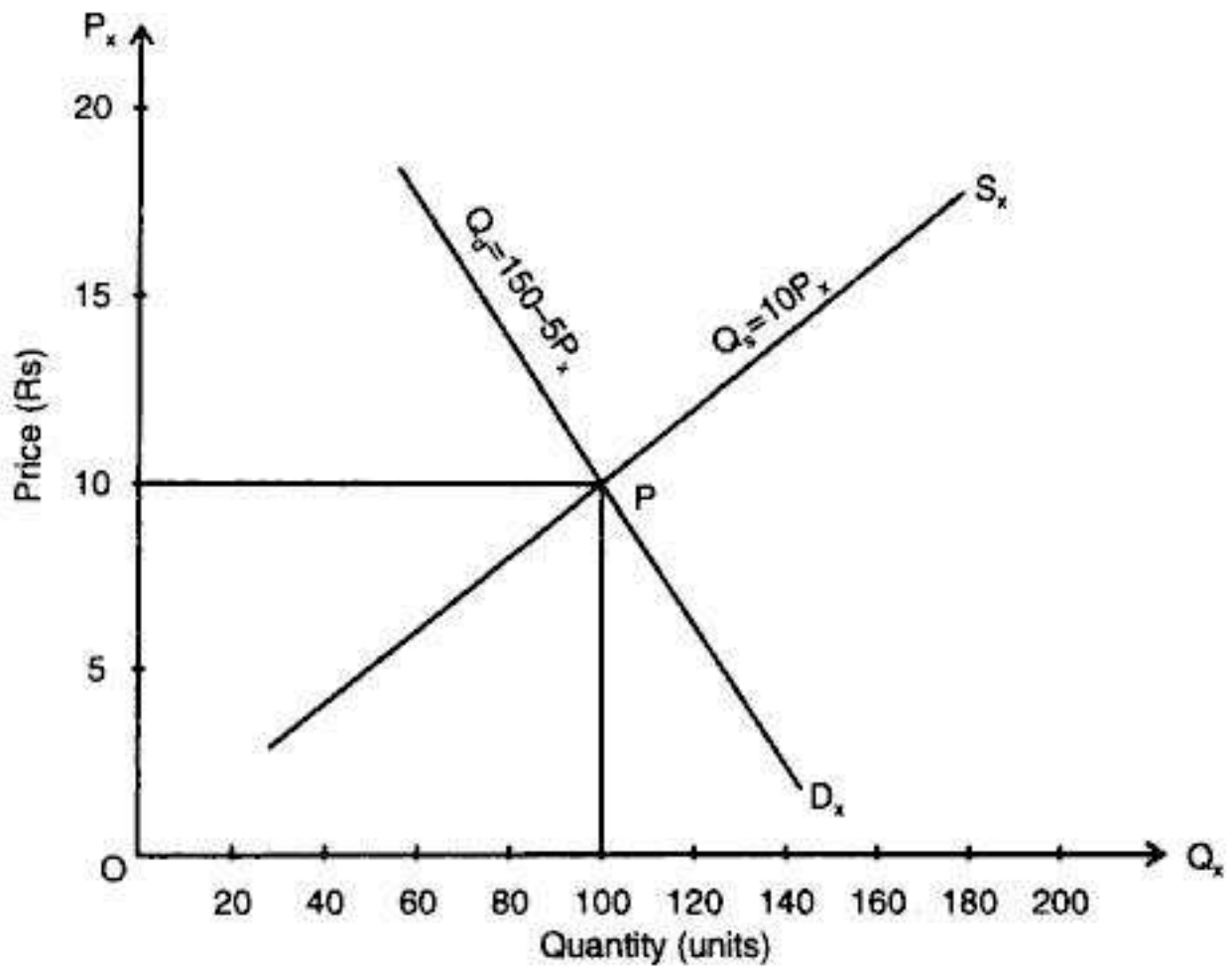


Fig. 3.12 Determination of Equilibrium Price and Quantity

The algebraic determination of equilibrium price and quantity is illustrated graphically in Fig. 3.12. The demand curve *DD'* has been drawn by using the demand function $Q_d = 150 - 5\,P_x$ and the supply curve *SS'* by using the supply function $Q_s = 10\,P_x$. As the figure shows, demand and supply curves intersect at point *P*. A perpendicular drawn from point *P* to the quantity axis determines the equilibrium quantity at 100 units and a line drawn from point *P* to the price axis determines the equilibrium price at Rs 10. At this price, the quantity demanded equals the quantity supplied and hence the shirt market is in equilibrium.

3.5 SHIFT IN DEMAND AND SUPPLY CURVES AND MARKET EQUILIBRIUM

3.5.1 Shift in Demand Curve

Whenever there is a shift in the demand and/or supply curve, there is also a shift in the equilibrium point. The effect of shift in the demand curve on the equilibrium is shown in Figure 3.13. Suppose that the initial demand curve is given by the curve *DD'* and supply curve by *SS'*. The demand and supply curves intersect each other at point *P*. The equilibrium price is determined at *PQ* and equilibrium quantity at *OQ*. Let the demand curve now shift from its position *DD'* to *DD''*, supply curve remaining the same. The demand curve *DD''* intersects the supply curve *SS'* at point *M*. Thus, shift in the demand curve causes a shift in the equilibrium from point *P* to point *M*. At the equilibrium, quantity demand and supplied increases from *OQ* to *ON* and price increases from *PQ* to *MN*. Note that, the supply curve remaining the same, a rightward shift in the demand curve results in a higher

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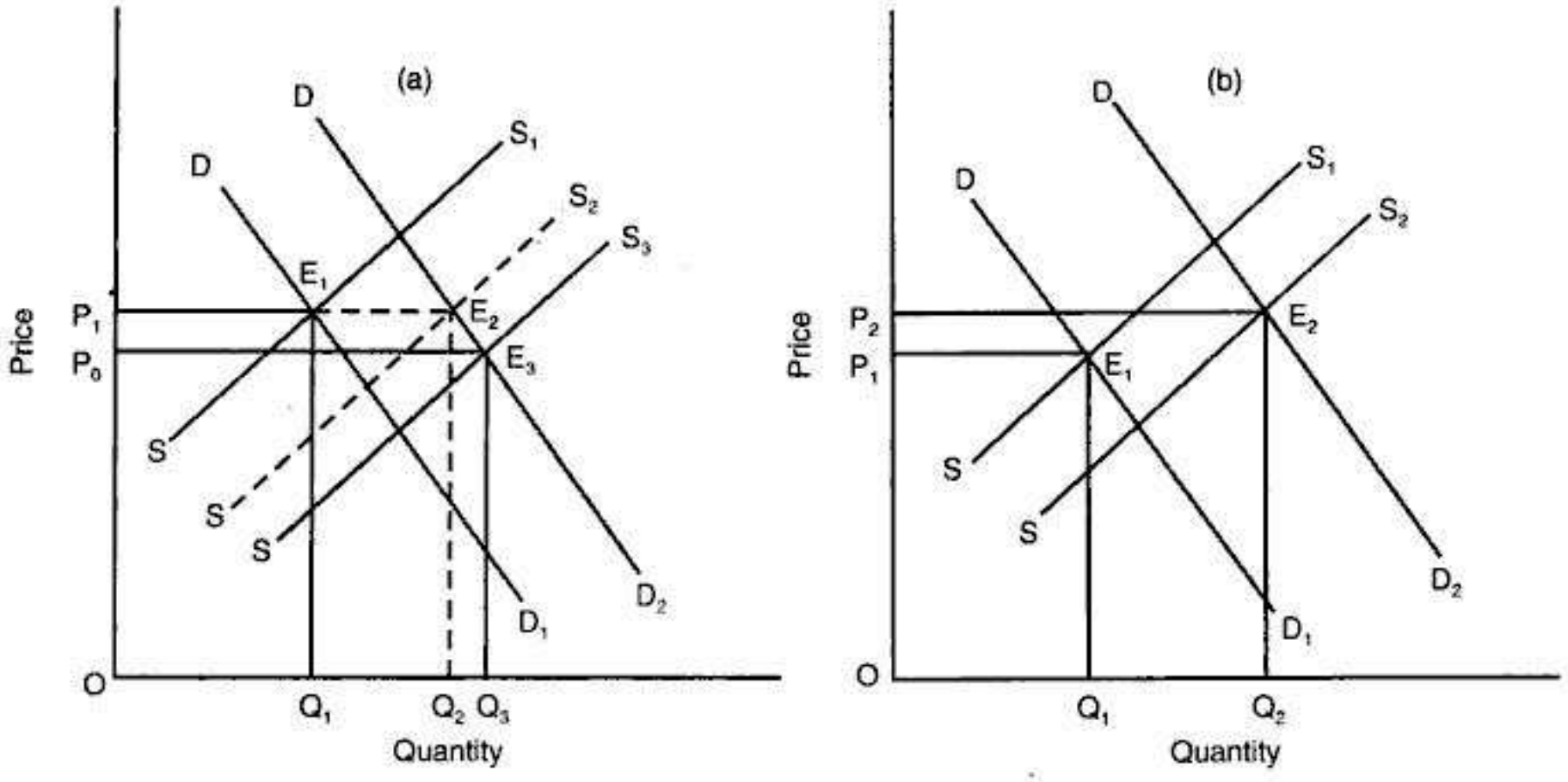


Fig. 3.15 Parallel Shift in Demand Supply Curves and its Effect on the Equilibrium Price and Output

Similarly, part (b) of the figure shows the effect of a bigger shift in the demand curve on the equilibrium price and output. It can be seen in the figure that the shift in demand curve from DD_1 to DD_2 is bigger than the shift in the supply curve from SS_1 to SS_2. In this case, both equilibrium prices and output increase.

3.6 STABILITY OF MARKET EQUILIBRIUM

In section 3.4, we have shown how demand and supply interact to determine market equilibrium. Our discussion so far gives the impression that equilibrium once determined remains stable and if equilibrium is disturbed by some extraneous factors, market forces interact to restore it to its orginal position. A question may be asked here: ***Is market equilibrium always stable***? The answer is 'not necessarily'. Economists analyse stability and instability of market equilibrium under ***static*** and ***dynamic conditions***. In this section, we will discuss the stability and instability of market equilibrium under *static* and *dynamic* conditions, called *static* and *dynamic equilibrium*.

3.6.1 Static and Dynamic Equilibrium

The concepts of static and dynamic equilibria are, generally, used as an analytical tool rather than as a realistic situation. The concept of static equilibrium is used to analyse a static economy—an economy in the state of motionlessness is an economy with no change. The concept of dynamic equilibrium is used to analyse equlibrium of a dynamic economy—an economy in motion. Let us, therefore, first know what is a static and what is a dynamic economy.

A ***static economy*** is one in which nothing is changing. It is like studying a "photograph" or "still", in which all objects are motionless. To analyse a static economy, it is assumed that nothing is changing in the economy; the types and number of economic organisations remain the same; people's taste and preferences do not change; all prices are constant; the output and employment are fixed; the quantity of goods and services that are produced and consumed remain unchanged—all at a given point of time. The equilibrium of an economy under these static conditions is called ***static equilibrium***.

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Close to static equilibrium is the concept of ***stationary equilibrium***. When an economy remains in static equilibrium between two points of time, it is said to be ***stationary***. If the economy today is exactly what it was yesterday or over any period in the past, it is in the stationary state "in which nothing ever happens".

A ***dynamic economy*** may be defined as one which is changing continuously. The change may be autonomous or induced. A dynamic economy is in the process of continuous change. Such an economy passes through the stages of equilibrium and disequilibrium. When a dynamic economy is in the state of equilibrium, it is said to be ***dynamic equilibrium.*** The equilibrium may be stable, unstable or neutral under both static and dynamic conditions. This aspect is explained below.

3.6.2 Equilibrium under Static Conditions

Equilibrium under static conditions may be stable or unstable. In this section, we will illustrate the conditions for stable and unstable equilibrium.

(i) Stable equilibrium under static conditions. In static analysis, all economic variables bear the same time subscripts, i.e., all variables belong to the same point of time. There is no time-lag in the adjustment between the variables when a change takes place. Let us now see how equilibrium becomes stable, unstable or neutral under static conditions.

To illustrate ***stability of equilibrium under static conditions,*** let us consider a simple competitive market in which price and output are determined by a downward sloping demand curve and an upward sloping supply curve. As shown in Fig. 3.16, equilibrium price OP_2 and output OQ_2 are determined at point P, the point of intersection between demand curve DD' and supply curve SS'. Under static conditions, this equilibrium position would remain *stable*. For, if equilibrium is disturbed due to a change in any of the variables (viz., quantity demanded and supplied and price), other things remaining the same, it will itself set forces to restore the equilibrium to its initial position.

There are two approaches—Walrasian and Marshallian—to look at the stability of equilibrium. Walrasian approach assumes *price* to change first whereas Marshallian approach assumes *quantity* to change first.

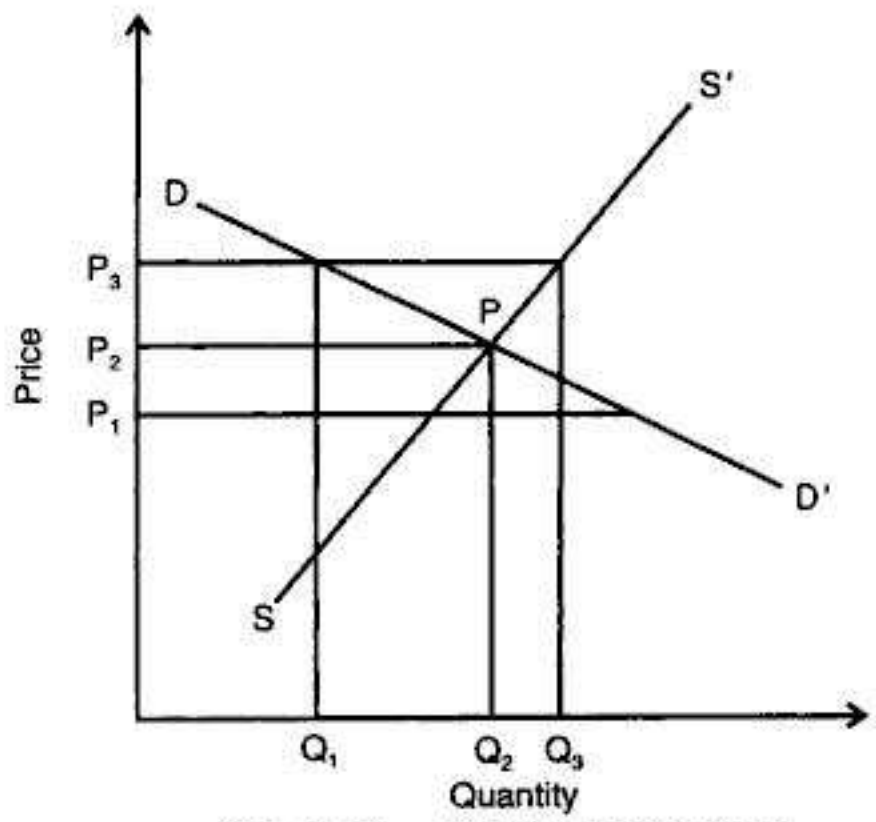


Fig. 3.16. Stable Equilibrium

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Going by the ***Walrasian approach***, let the price rise from OP_2 to OP_3 (see Fig. 3.16). As a result, demand decreases to OQ_1 and supply increases to OQ_3. Since supply exceeds demand by Q_1Q_3, price will fall till equilibrium point P is reached. Similarly, if price falls to OP_1 demand will exceed supply pushing the price upward to the equilibrium point. The equilibrium position at P is therefore stable. This is called *Walrasian stable equilibrium*. It should be borne in mind that change in price, demand and supply are simultaneous and instantaneous. Otherwise, equilibrium may not remain stable, particularly in case of an initial fall in price under the demand and supply conditions as given in Fig. 3.16.

To look at the ***Marshallian approach***, suppose quantity supplied increases from OQ_2 to OQ_3. At OQ_3, supply price is OP_3. At this price, demand falls to OQ_1. There is thus an excess supply of Q_1Q_3. Excess supply pushes price down to OP_2 at which demand equals supply. Similarly, if quantity falls to OQ_1, it means short supply, given the demand. Shortage of supply pushes price up to OP_2. At this price supply equals demand and equilibrium is stable. This is called *Marshallian stable equilibrium.*

(ii) Unstable equilibrium under static conditions. Let us now look at the conditions of ***unstable equilibrium under static conditions***. The cases of unstable equilibrium under static conditions, are extremely rare and temporary ones. Besides, the issue is not finally settled. Let us, however, describe here the famous Marshallian and Walrasian view on this issue. To begin with, consider a downward sloping demand curve and a *backward sloping* supply curve, as shown in Fig. 3.17. Note that the slope of supply curve is greater than that of the demand curve.

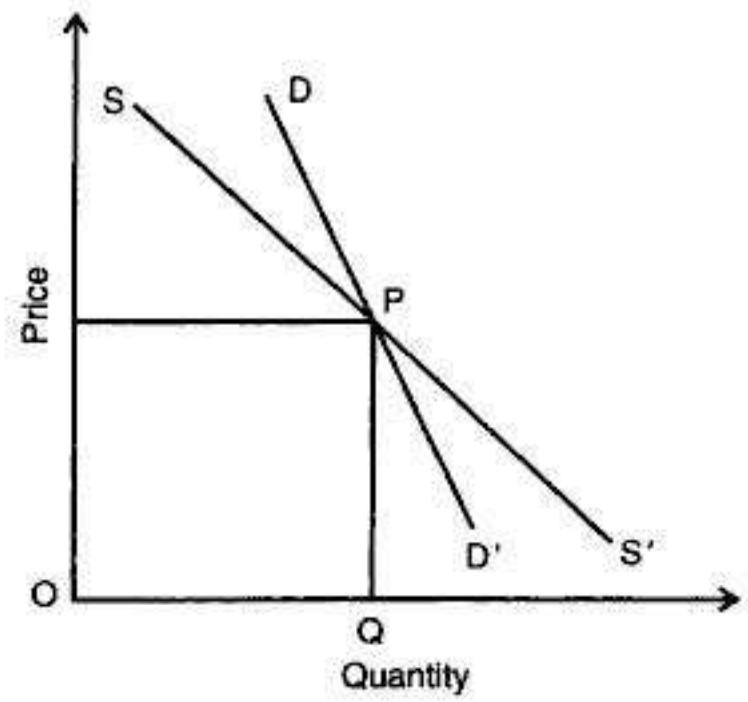


Fig. 3.17. Unstable Equilibrium: Negative Slope of Supply Curve

The negative slope of a supply curve indicates a peculiar behaviour of sellers in response to price change, that is, sellers sell less when price increases and sell more when price decreases. Such a behaviour of sellers may be attributed to ***distress selling*** by them. For example, suppose that a subsistence farmer capable of growing only one crop, sells only a part of his produce just sufficient to meet his non-food requirements. Given these conditions, he sells less when price is high and sells more when price is low so that supply curve has a negative slope. A similar supply curve may exist in the case of a labourer, who prefers leisure to income and works only as many hours per day as necessary to earn a minimum income sufficient to meet his basic requirements. Yet **another example** of negatively sloping supply curve is in case of an organised competitive market in a market period. If sellers in this market period try desperately to accumulate certain amount of cash, having no alternative to selling the existing stock of goods, they would have to sell more at lower price and less at higher price. In this case also, supply curve would have a negative slope. But such a case is temporary and very rare.

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Given the demand and supply conditions as described above, in the opinion of **Walras** and also of Hicks, if equilibrium is disturbed once, it will have no chance to return to its original position. For example, if equilibrium price rises above the level PQ, it will continue to rise as demand exceeds supply at all levels, beyond this point. Theoretically, there is no likelihood of equilibrium returning to its original position. Similarly, if equilibrium is disturbed due to fall in price, it will set a chain reaction between demand and supply, to push price further down because supply exceeds demand at levels below point P. Equilibrium is therefore ***unstable***.

In the opinion of **Marshall**, however, equilibrium at point P is **stable**. He has argued that for any quantity to the left of point P, demand price exceeds supply price. Demand price, being in excess of the supply price, will induce the expansion of supply, which will cause a fall in price to the equilibrium point. Similarly, for any quantity to the right of point P, the supply price exceeds the demand price. This will result in reduction in supply causing a rise in price and decrease in both supply and demand, all tending towards the equilibrium point P. Equilibrium is therefore **stable**.

Both the views are logically consistent in their own way. The conflict between Walrasian and Marshallian views, however, arises due to difference in (a) time periods they consider, and (b) the assumptions they make. While Marshall's view has a long run context, Walras and Hicks have a very short period (i.e., market period) in view.

Marshall assumes price to be an independent variable and supply and demand to be dependent variables. It implies that quantities demanded and supplied adjust themsleves to the change in price. On the contrary, Walras has considered the demand and supply as independent variables and price as a dependent variable. This means price adjusts itself to the change in demand and supply conditions, not otherwise.

It is important to note here that if both demand and supply curves have a negative slope, but, unlike those in Fig. 3.17, slope of demand curve is greater than that of the supply curve, Marshallian and Walrasian positions will be reversed, that is, equilibrium will be stable by Walrasian approach and unstable by Marshallian approach.

It should also be noted that if demand and supply curves *interchange* their positions, i.e., while both curves have a negative slope, and supply curve intersects demand curve from above, the equilibrium position will be ***stable***.

Granted their assumptions and the periods they consider, both the views are correct in their own way. However, in an attempt to resolve the controversy, Friedman has remarked, "...what determines the stability of equilibrium is not whether the market process is arbitrarily supposed to proceed alternatively by holding prices constant or quantities constant, but whether a negatively sloping supply curve is 'backward bending,' stability requires that the supply curve cuts the demand curve from above; if it is 'forward falling,' from below..."[1]

Another, though a very rare, case of unstable equilibrium is found where demand curve for a commodity has a *positive* slope and supply curve has a *negative* slope, as shown in Figure 3.18.

The positive slope of demand curve is generally attributed to "**Giffen goods**". The case of Giffen goods has been discussed in detail in a forthcoming Chapter. As noted in section 3.2.6 above, Giffen goods are the inferior goods—mostly necessities—which are consumed largely by very poor families and claim a large part of their subsistence income. When the price of such goods increases, poor families cut their expenditure on superior goods to be able to buy more of inferior goods to meet their basic minimum consumption needs. Therefore, the demand curve for inferior goods has

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1. M. Friedman, *Price Theory: A Provisional Text*, (Ludhiana, Lyall Book Depot, Indian Edition, 1970), p. 93n.

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a positive slope. In case of Giffen goods, the income effect of change in price of an inferior good is so strong that it more than offsets its negative substitution effect. In this case, demand increases as price of the goods increases and *vice versa*.

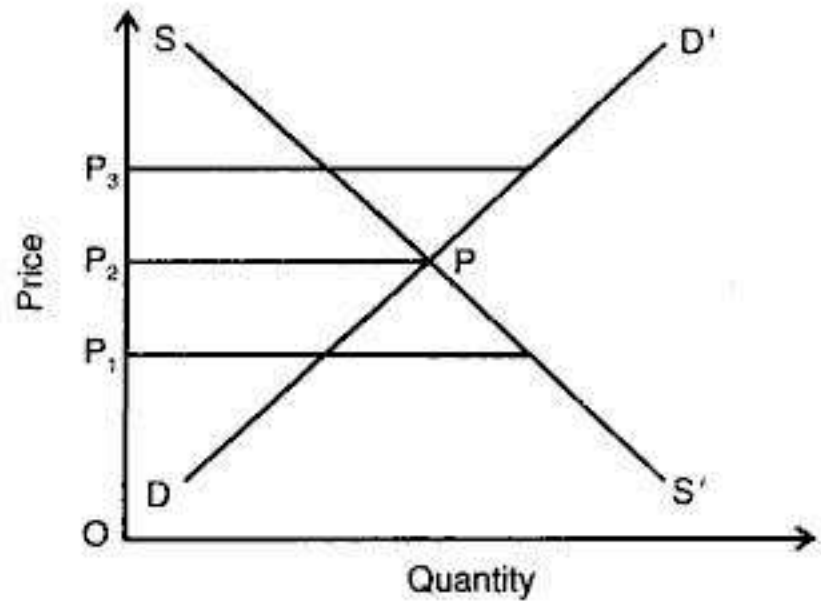


Fig. 3.18. Unstable Equilibrium: Demand with Positive and Supply with Negative Slope

The negative slope of supply curve may be the result of *increasing returns* over a fairly large output or of *distressed selling*. Given the reverse positions of demand and supply curves, if equilibrium is disturbed due to an increase in price to, say, OP_3, price will continue to move up because demand exceeds the supply at all the levels of prices beyond the equilibrium point P. Similarly, if price once falls it will continue to fall because below point P, supply exceeds demand at all the levels of prices. In both the cases, conditions are explosive. Therefore, given these conditions, there is no likelihood of the initial equilibrium position being ever restored.

Yet another case of unstable equilibrium is presented in Fig. 3.19. The curve SS' is a normal supply curve with a positive slope. But the demand curve DD' is an abnormal, upward sloping curve—i.e., the demand curve for the "Giffen good". In all such cases, the equilibrium is ***unstable***. As shown in Figure 3.19, the demand and supply curve intersect each other at point E, the point of equilibrium. Note that the supply curve intersects the demand curve from below or the demand curve intersects with the supply curve from above. At equlibrium point E, price is EQ and the quantity demanded and supplied is OQ. Given the position of the demand supply curves, if equilibrium is displaced by an external factor, it has no chance to come back again to point E. For example, suppose

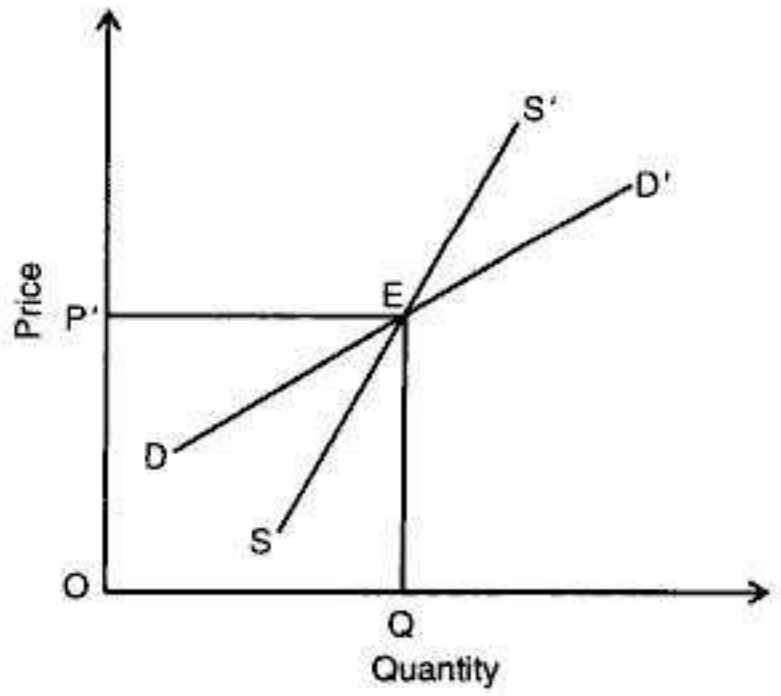


Fig. 3.19 Unstable Equilibrium: Upward Sloping Demand and Supply Curves

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(i) Stable equilibrium under dynamic conditions. As mentioned above, an equilibrium position is said to be stable if displacement of equilibrium itself sets forces into action that restore the initial equilibrium position. The simplest way to illustrate the stability and instability of equilibrium position under dynamic conditions is provided by **'Cobweb Theorem'**.

The name, 'Cobweb' Theorem, has been derived from the appearance of the diagram it produces. The Cobweb Theorem can be stated in the form of three theorems.

a) ***Theorem I:*** If slope of demand curve ($\Delta P/\Delta Q$) is less than that of supply curve ($\Delta P/\Delta S$), the equilibrium is stable: the system is *convergent*.

b) ***Theorem II:*** If $\Delta P/\Delta D > \Delta P/\Delta S$, equilibrium is unstable. The adjustment process is *divergent* or *oscillatory*.

c) ***Theorem III:*** If $\Delta P/\Delta D = \Delta P/\Delta S$, equilibrium is nondamped oscillating: it keeps circulating around the original equilibrium with a constant change in price and quantity.

Figure 3.21 illustrates the ***stable equilibrium***, the theorem I. As the figure shows, demand and supply[1] curves intersect each other at point P determining equilibrium price at OP_3 and equilibrium output at OQ_4. If price rises for some reason in, say period t, to OP_5, equilibrium will be disturbed. For, at the new price, demand falls to OQ_1 which is much less than the expected supply OQ_6 at this price. In period $t + 1$, supply rises to OQ_6 exceeding demand by Q_1Q_6. Consequently, price falls to OP_1 causing a rise in demand to OQ_6. But in response to fall in price, supply decreases in period $t + 2$ to OQ_2. The demand now exceeds supply by Q_2Q_6. Therefore, price rises to OP_4, causing an increase in supply by Q_2Q_5 in period $t + 2$. It is now the turn of price to adjust itself to the existing demand and supply conditions. This whole process is repeated period after period. Note that each time the process of adjustment is repeated, the magnitude of change in supply, price and demand goes on decreasing. For example, in period $t + 1$, supply increases by Q_1Q_6 in period $t + 2$ it decreases by Q_2Q_6, and in period $t + 3$ it increases by Q_2Q_5 that $Q_1Q_6 > Q_2Q_5 > Q_3Q_4$. So is the case with price and demand. As a result of decreasing magnitude in changes, the system in Figure 3.21 converges to

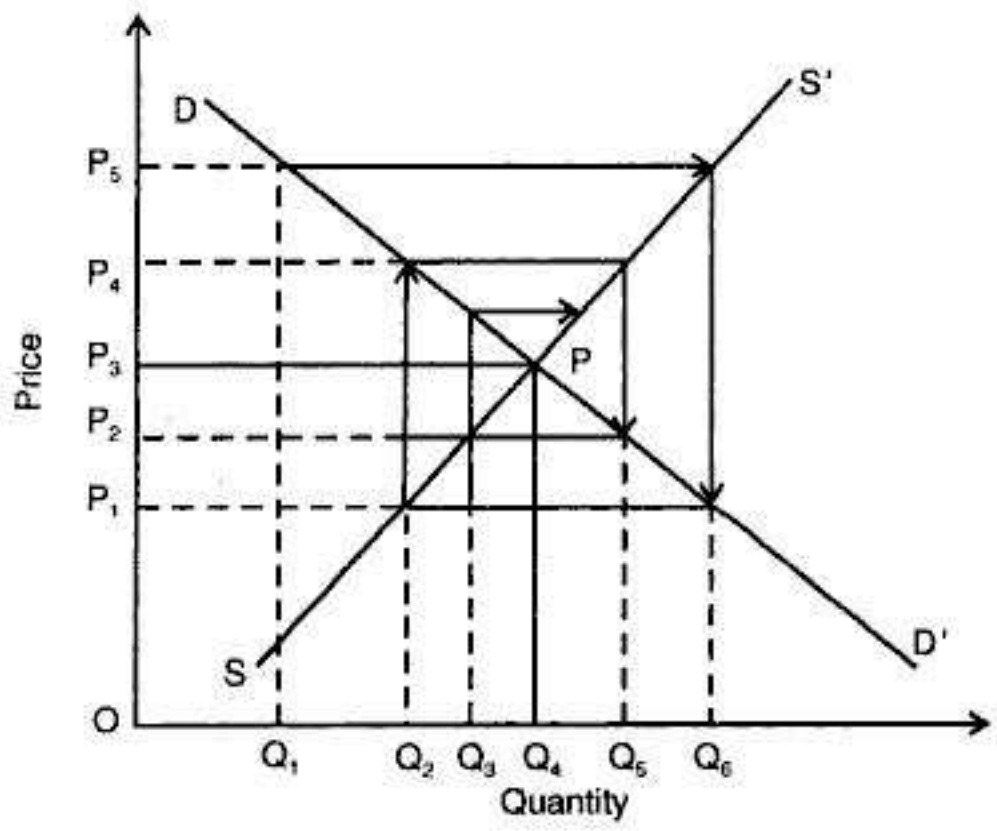


Fig. 3.21 Stable Equilibrium

1. Note that the slope of demand curve ($\Delta P/\Delta D$) is smaller than that of supply curve, ($\Delta P/\Delta S$), i.e., $\Delta P/\Delta D < \Delta P/\Delta S$.

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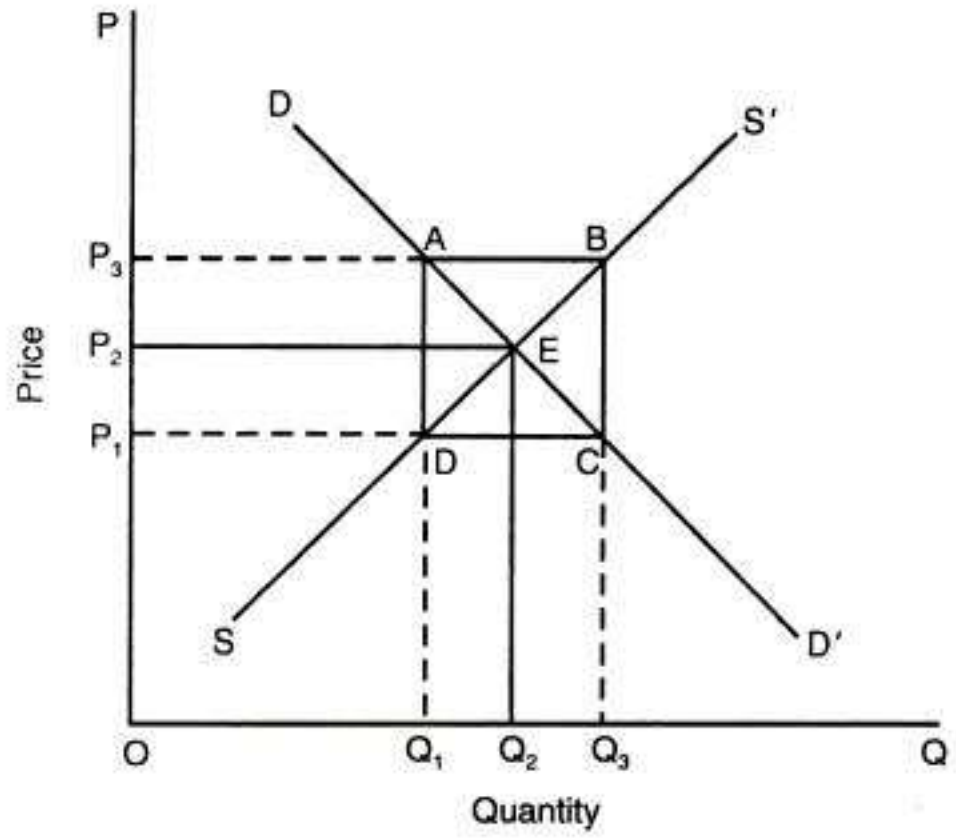


Fig. 3.23 Undamped Oscillating Equilibrium

Now, let the equilibrium point E be displaced either by a change in price to OP_3 (by the Walrasian approach) or by a change in quantity (by the Marshallian approach). In either case, equilibrium will keep circling around its original point E. For example, if price rises from OP_2 to OP_3, demand decreases from OQ_2 to OQ_1 and supply increases from OQ_2 to OQ_3. This causes an excess supply of $Q_1Q_3 = AB$. This excess supply causes a fall in price by $P_1P_3 = BC$. A fall in price by BC causes demand to rise and supply to fall which results in an excess demand of Q_1Q_3. This excess demand pushes price up by P_1P_3. This process of change in quantity and price continues indefinitely. Note that the change in price each time is the same $P_1P_3 = AD = BC$ and change in quantity each time is also the same $Q_1Q_3 = DC = AB$. Therefore, the path of equilibrium movement is fixed. This is because $\Delta P/\Delta Q = \Delta P/\Delta Q$.

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(Asterisked * readings are advanced, not meant for graduate students)

REVIEW QUESTIONS AND EXERCISES

1. 'Demand' is a word of common usage. What is the meaning of demand in economics? How is demand different from desire, want and need?
2. Define market demand. What are the determinants of market demand in the short run and in the long run? How do increase in consumers' income and price of the substitute goods affect the demand for a commodity?
3. What are the factors that are held constant while deriving an individual demand curve? What will happen when such factors are not held constant?
4. Define the law of demand. Why do demand curves for most goods slope downwards to the right?
5. Explain demand schedule, demand curve and demand function. Derive a demand curve from the demand function $Q = 50 - 10\,P$.
6. From the demand function $Q = 600/P$, show that the total expenditure on the commodity remains unchanged as price falls. Estimate elasticity of demand along the demand curve at P = Rs 4 and P = Rs 2.
7. Explain the law of supply through a supply schedule and a supply curve. Why does a supply curve slope upward to the right? What factors cause a rightward shift in the supply curve?
8. Explain why market equilibrium is determined at the intersection of the demand and supply curves. How is market equilibrium affected when consumers' income changes, all other factors remaining the same?
9. Find out equilibrium quantity from demand function $Q_d = 25 - 10\,P$ and supply function $Q_s = 25\,P$. What is the change in price of demand function changes to $Q_d = 30 - 10P$, supply function remaining the same?
10. The sales data of a book publishing company produces a demand function as $Q = 5000 - 50\,P$. From this demand function, find out:
    (a) demand schedule and demand curve,
    (b) number of books sold at price Rs 25,
    (c) price for selling 2500 copies,
    (d) price for zero sales.
    (e) sales at zero prices.
11. What is meant by equilibrium price and quantity? What factors cause an upward-right and upward left shift of the equilibrium point from its original position?

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12. From a demand function $Q_d = 2000 - 30\,P$ and a supply function $Q_s = 20\,P$, find out (a) equilibrium price, (b) equilibrium quantity, and (c) gap between demand and supply at P = Rs 20 and P = Rs 50.

13. From a demand function given as $P = (Q_d - 20)/3$ and a supply function as $P = Q_s/2$, find out (i) whether there is excess demand or excess supply at prices Rs 2 and Rs 5, and (ii) the quantity of excess demand or excess supply at these prices.

14. Which of the following statements are True or False?
    (a) The demand for a commodity is inversely related to the price of its substitutes.
    (b) When income increases, the demand for essential goods increases more than proportionately.
    (c) Decrease in input prices causes a leftward shift in the supply curve.
    (d) There cannot be a market without a place.
    (e) The desire for a commodity backed by ability and willingness to pay is demand.
    (f) The law of demand states the relationship between the quantity demanded and price of a commodity, consumers income, price of the related goods and advertisement.
    (g) An individual demand curve marks the upper limits of his/her intentions to buy a commodity at different prices.
    (h) A market demand curve represents the maximum quantity that an individual would be willing to buy at different prices.
    (i) The income-effect on demand for an inferior good is negative.
    (j) Demand for car and price of petrol are inversely related.
    (k) Most demand functions are of the form $D = a + b\,P$.
    (l) A straight line supply function is of the form $P = Q/b$.

    [(**Ans**. True: (e), (g), (h), (i), (l) False: (a), (b), (c), (d), (f), (j), (k)]

15. Which of the following conditions makes an approximate definition of 'market'?
    (a) Market is a meeting place for buyers and sellers.
    (b) The buyers and sellers meet to transact business.
    (c) The buyers and sellers must transact business by or without meeting in a place.

16. Suppose characteristics of three persons—*A*, *B* and *C* are given as follows:
    (a) *A* wants to buy a book on microeconomics but has no money to pay for it.
    (b) *B* has sufficient money to buy the book but prefers to borrow books from the library.
    (c) *C* has money and is willing to spend his money on a book on microeconomics.

    Who creates demand for books on microeconomics?

17. An individual demand curve slopes downward to the right because of :
    (a) income effect of fall in prices;
    (b) substitution effect of decrease in price;
    (c) diminishing marginal utility;
    (d) conditions (a), (b) and (c) hold; or
    (e) none of the above.

18. A Giffen good is one whose demand increases, other thing remaining the same, when:
    (a) its price increases;
    (b) consumer's income increases; or
    (c) price of its superior substitutes decreases;

    Give the correct answer.

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4.1.1 Arc and Point Elasticity

When price–elasticity of demand is measured between any two finite points on a demand curve, it is called ***arc elasticity*** and elasticity measured at a point on the demand curve is called ***point elasticity***. As noted above, the elasticity of demand measures the percentage change in quantity demanded due to a certain percentage change in price. The percentage change in price may be considerably high (e.g., 10 per cent, 20 per cent or even higher) or it may be very small—so small that it is not significantly different from zero. When change in price is significantly high, it shows a movement from one point on the demand curve to another point, making an *arc*. Therefore, price elasticity measured for a considerably high change in price, is called ***arc elasticity of demand***. And, when price elasicity is measured for very small changes in price—not significantly different from zero—it is called ***point elasticity***.

4.1.2 Measuring Arc Elasticity

The elasticity co-efficient between any two finite points on a demand curve, i.e., *arc elasticity*, can be measured by using the formula given in Eq. (4.1). For example, the measure of elasticity between points *J* and *K* on the demand curve *PM* in Fig. 4.1 is the measure of arc elasticity. The movement from point *J* to *K* on the straight line demand curve *PM* shows a fall in price of commodity *X* from Rs 25 to Rs 15 and the consequent increase in demand from 30 units to 50 units. Here, $\Delta P = 25 - 15 = 10$ and $\Delta Q = 30 - 50 = -20$. The arc elasticity between points *J* and *K* (moving from *J* to *K*) can be calculated as given below:

$$e_p = -\frac{\Delta Q}{\Delta P} \cdot \frac{P_0}{Q_0}$$

$$e_p = -\frac{-20}{10} \cdot \frac{25}{30} = 1.66 \qquad (4.2)$$

Interpretation: Elasticity coefficient is interpreted as percentage change in demand due to one percent change in price. For example, in Eq. (4.2), *elasticity coefficient is 1.66*. The *elasticity coefficient (1.66)* will be *interpreted as a 1 per cent decrease in price of commodity X results in a 1.66 per cent increase in demand for it*.

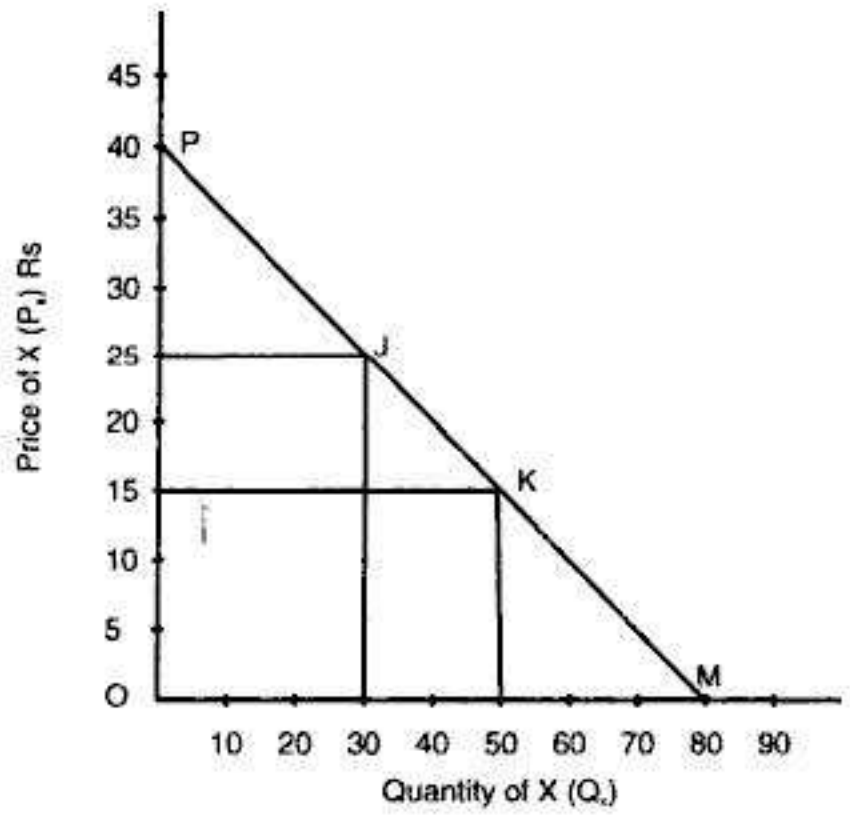


Fig. 4.1 Change in Price and Elasticity Coefficient

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Problem in Using Arc Elasticity

The arc elasticity coefficeint should be used carefully because the measure of arc elasticity between any two finite points on a demand curve produces *two different* elasticity coefficients for the same fall and rise in price. In other words, *the arc elasticity coefficient varies between the same two finite points on a demand curve when the direction of change in price is reversed.* It is, therefore, open to misinterpretation. Consider, for example, arc elasticity of the demand curve *PM* between points *J* and *K* (Fig. 4.1). Price elasticity of demand for a fall in price from Rs 25 to Rs 15 is estimated to be 1.66 (see Eq. 4.2). This measure of arc elasticity can be mistaken to be the price elasticity of demand curve *PM* between points *J* and *K*, irrespective of the direction of change in price, whereas this elasticity coefficient is relevant only for the downward movement on the demand curve. It is not relevant for the upward movement from point *K* to *J*. The movement from point *K* to *J* implies a different arc elasticity, as shown below.

In case of the movement from point *K* to *J*, i.e., for rise in price, we have

$$P = 15,\ \Delta P = 15 - 25 = -10$$

and $$Q = 50,\ \Delta Q = 50 - 30 = 20$$

Substituting these values into the elasticity formula (Eq. 4.1), we get

$$e_p = -\frac{20}{10}.\frac{15}{50} = 0.60 \tag{4.3}$$

Note that price elasticity coefficient (0.60) for increase in price by Rs 5 is materially different from price elasticity (1.66) the same for the same decrease in price. Clearly, arc elasticity between any two finite points on a demand curve depends also on the *direction of change in price.*

Suggested Modifications

Economists have suggested some modifications in the elasticity formula to remove this anomaly in the concept of arc elasticity.

One, it is suggested that the problem arising due to the change in the direction of price-change may be avoided by using the lower values of *P* and *Q* in the elasticity formula. The formula is then

$$e_p = -\frac{\Delta Q}{\Delta P}.\frac{P_l}{Q_l} \tag{4.4}$$

where subscript *l* denotes lower values of *P* and *Q*.

Going by this formula for measuring elasticity between points *J* and *K* in Fig. 4.1, we use $P_l = 15$ (the lower one of the two prices) and $Q_l = 30$ (the lower one of the two quantities). By sustituting these values in Eq. 4.4, for decrease in price, we get

$$e_p = -\frac{20}{10}.\frac{15}{30} = 1.0$$

This method, however, violates the rule of computing percentage change. The choice of the lower values of *P* and *Q* is arbitrary. This method is, therefore, devoid of any logic.

Two, another method suggested* to resolve this problem is to use average of the upper and lower values of *P* and *Q* in the fraction *P*/*Q*. The suggested formula can be written as

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* See, for example, K. Lancaster, *Introduction of Modern Microeconomics,* 2nd Edn., 1974, p. 28.

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$$e_p = -\frac{\Delta Q}{\Delta P} \cdot \frac{(P_u + P_l)/2}{(Q_l + Q_u)/2}$$

or
$$e_p = -\frac{Q_l - Q_u}{P_u - P_l} \cdot \frac{(P_u + P_l)/2}{(Q_l + Q_u)/2} \tag{4.5}$$

(where subscripts u and l refer to upper and lower values, respectively.)

Substituting the values from our example, we get

$$e_p = -\frac{30-50}{25-15} \cdot \frac{(25+15)/2}{(30+50)/2} = 1.0$$

This method measures the elasticity mid-way between points J and K. The elasticity coefficient (1.0) is not applicable to the whole range of price-quantity combination between points J and K (see Fig. 4.1). It does not resolve the problem that arises due to the change in the direction of the price. It gives only the mean of the elasticities between the two points.

An ***alternative method*** to avoid this problem is to use point elasticity.

4.1.3 Measuring Point Elasticity

Point elasticity *is the measure of price elasticity at a finite point on a demand curve.* Point elasticity is, in fact, the measure of the proportionate change in quantity demanded in response to a *very* small proportionate change in price. The concept of point elasticity is useful where change in price and the consequent change in quantity demanded are very small. Besides, it offers an alternative to the arc elasticity. Point elasticity may be symbolically expressed as

$$e_p = \frac{\partial Q}{\partial P} \cdot \frac{P}{Q} \tag{4.6}$$

The method of measuring price elasticity on linear and non-linear demand curves is explained below.

(i) Point elasticity of a linear demand curve. To illustrate the measurement of point elasticity on a linear demand curve, let us suppose that a *linear* demand curve is given by MN in Fig. 4.2 and that we need to measure elasticity at point P. Let us now substitute the values from Fig. 4.2 in Eq. 4.6. It is obvious from the figure that $P = PQ$ and $Q = OQ$. What we need to find now are the values for ∂Q and ∂P. These can be obtained by assuming a *very small* change in price. But it will be difficult to depict these changes graphically as $\partial P \to 0$ and hence $\partial Q \to 0$. There is, however, an easy way to find the value for $\partial Q/\partial P$. In fact, the ratio $\partial Q/\partial P$ gives the reciprocal of the slope of the demand curve, MN. *The reciprocal of the slope of a straight line,* MN, at point P is geometrically given by QN/PQ. Therefore,

$$\frac{\partial Q}{\partial P} = \frac{QN}{PQ}$$

Since at point P, P (price) $= PQ$ and $Q = OQ$, by substituting these values in (ignoring the minus sign), Eq. (4.6), we get

$$e_p = \frac{QN}{PQ} \cdot \frac{PQ}{OQ} = \frac{QN}{OQ} \tag{4.7}$$

It can be proved geometrically that

$$e_p = \frac{QN}{OQ} = \frac{PN}{PM}$$

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Proof: To prove that $QN/OQ = PN/PM$, let us draw a horizontal line from P to the vertical axis. We have now three triangles ΔMON, ΔMRP and ΔPQN (Fig. 4.2.). Note that $\angle MON$, $\angle MRP$ and $\angle PQN$ of these triangles are right (90°) angles. Therefore, the other corresponding angles of the three triangles are equal. Given these properties ΔMON, ΔMRP and ΔPQN are **similar triangles.**

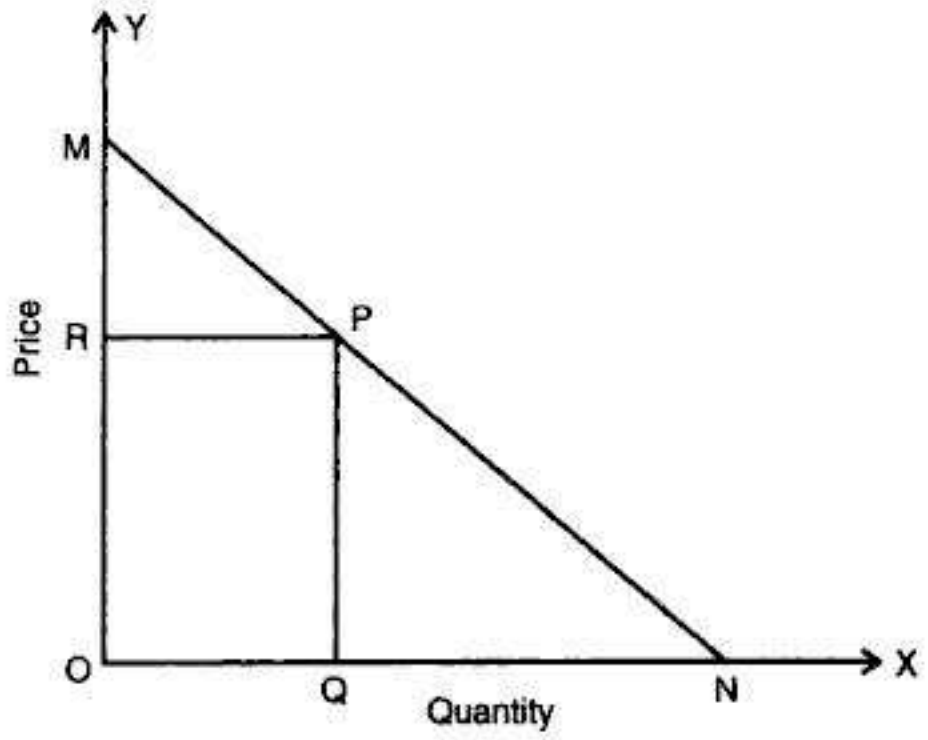


Fig. 4.2 Point Elasticity on a Linear Demand Curve

According to geometrical properties of similar triangles, the ratio of any two sides of a triangle is equal to the ratio of the corresponding sides of the other triangles. Therefore, in ΔPQN and ΔMRP,

$$\frac{QN}{PN} = \frac{RP}{PM}$$

Since $RP = OQ$, by substituting OQ for RP, we get

$$\frac{QN}{PN} = \frac{OQ}{PM}$$

By proportionality rule, $\frac{QN}{OQ} = \frac{PN}{PM}$ (4.8)

It is, thus, proved that $QN/OQ = PN/PM$.

Note that PN and PM are two lower and upper segments of the demand curve, MN. It may thus be said that price elasticity at any point on a straight line demand curve is given by

$$e_p = \frac{\text{Lower segment}}{\text{Upper segment}}$$

(ii) Measuring point elasticity on a non-linear demand curve. Point elasticity of a non-linear demand curve is measured by drawing a tangent to the demand curve at the chosen point and measuring the elasticity of the tangent at this point. This gives the elasticity of the demand curve at the chosen point. Suppose we want to measure the elasticity of demand curve DD' at point P in Fig. 4.3. Let us now draw a line tangent to the demand curve DD', at point P as shown by the tangent MN. Since demand curve DD' and the line MN pass through the same point (P), the elasticity of demand curve DD' at point P is equal to the elasticity to the tangent, MN, at point P. By measuring the elasticity at point P on the tangent MN, we get the elasticity at point P on the demand curve DD'. The elasticity of the tangent MN at point P is given by

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$$e_p = \frac{\partial Q}{\partial P} \cdot \frac{P}{Q}$$

By substitution,

$$e_p = \frac{QN}{PQ} \cdot \frac{PQ}{OQ} = \frac{QN}{OQ}$$

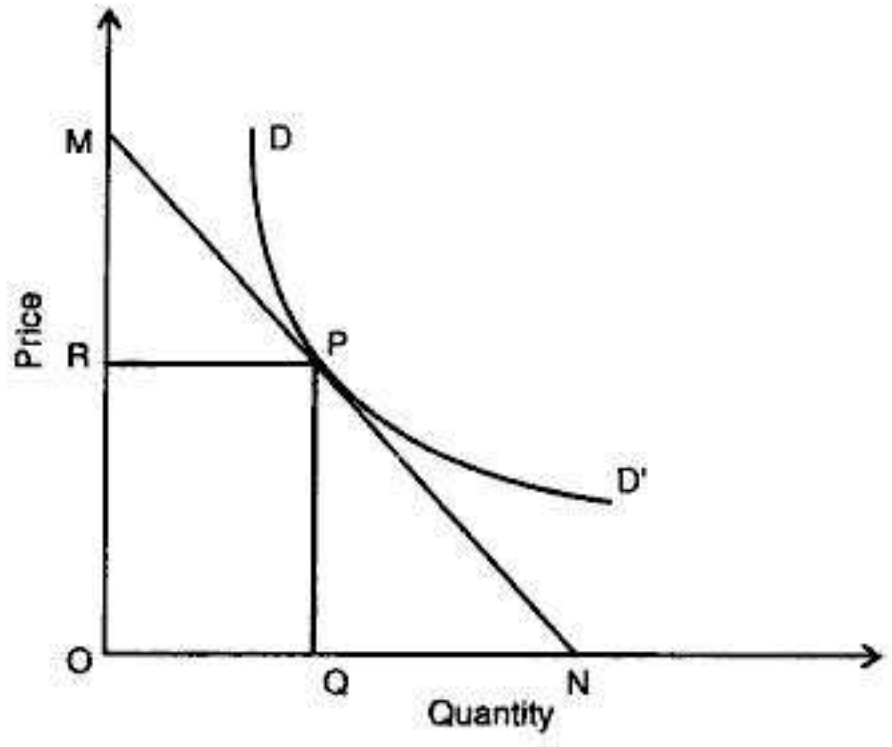


Fig. 4.3 Point Elasticity on a Non Linear Demand Curve

Geometrically, $QN/OQ = PN/PM = e$. (For Proof, see the preceding section).

4.1.4 Price Elasticity Along the Demand Curve

The price elasticity of demand varies all along a demand curve. Consider a linear demand curve MN in Fig. 4.4. At one and only one point, $e_p = 1$. At all other points (except terminal points), $e_p < 1$ or $e_p > 1$. At terminal point N, $e_p = 0$ and at terminal point M, elasticity is ***undefined***. This point is explained below.

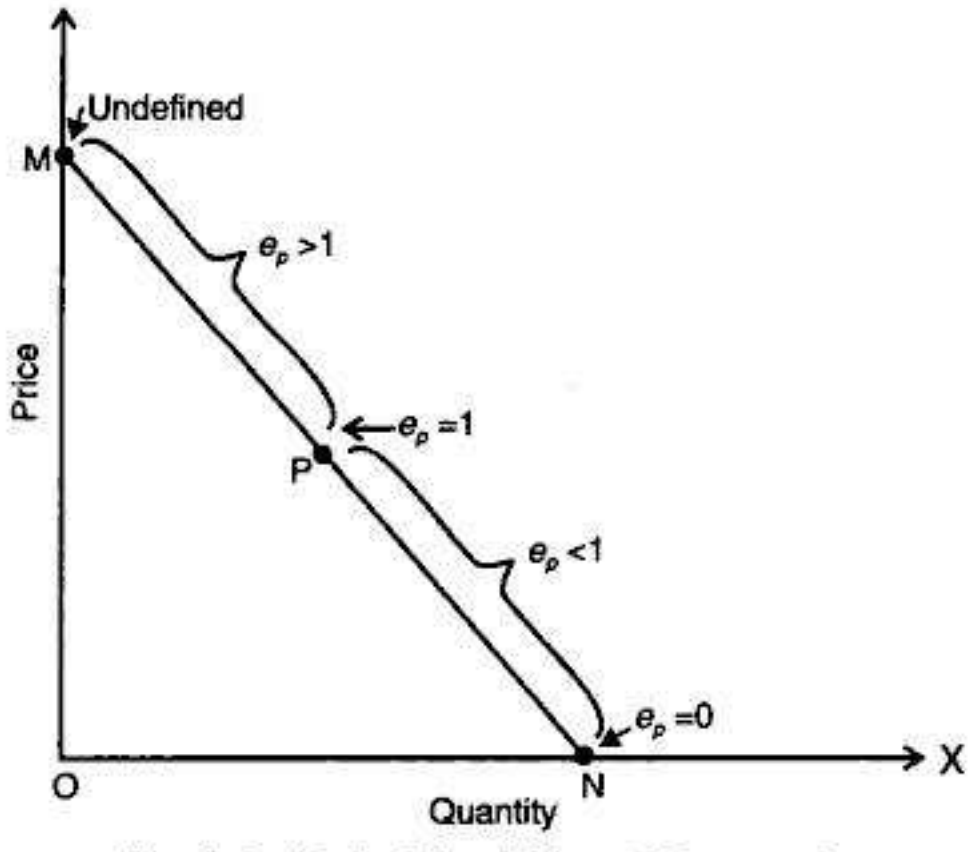


Fig. 4.4 Point Elasticities of Demand

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We know that if a point on a demand curve is marked, it divides the demand curve into two parts. For example, if we choose a point mid-way, point *P*, on demand curve *MN* in Fig. 4.4, it divides the demand curve into two parts: *PM* (the upper segment) and *PN* (the lower segment). Given the above measure of point elasticity ($e_p = PN/PM$), the elasticity at a point on a linear demand curve may be interpreted as the ratio of the lower segment (*PN*) to the upper segment (*PM*) of the demand curve. That is,

$$e_p = \frac{\text{Lower segment}}{\text{Upper segment}} = \frac{PN}{PM}$$

Since in Fig. 4.4, $PN = PM$, $e_p = 1$. It follows that:

(a) at mid-point on a linear demand curve, $e_p = 1$.
(b) at any point on the upper (half) segment, $e_p > 1$;
(c) at any point on the lower (half) segment, $e_p < 1$;
(d) at point *N*, $e_p = 0$; and
(e) at point *M*, elasticity is undefined reason given below.

Important. The last point needs a clarification. It is a general practice of the text book authors to show $e_p = \infty$ at terminal point on the vertical axis, i.e., at point *M* in Fig. 4.4. This is mathematically incorrect. The reason is, measuring elasticity at point *M* involves division by zero, and division by zero is undefined. For example, at point *M*, lower segment equals *MN* and upper segment equals zero. Therefore, elasticity at point *M* is undefined. To quote Baumol, "Here [at point *M*] elasticity is not even defined because an attempt to evaluate the fraction p/x at that point forces us to commit the sin of dividing by zero. The readers who have forgotten why division by zero in immoral may recall that division is the reverse operation of multiplication. Hence, in seeking the quotient $c = a/b$ we look for a number, c, which when multiplied by b gives us the number a, i.e., for which $cb = a$. But if a is not zero, say $a = 5$, and b is zero, there is no such number because there is no c such that $c \times 0 = 5$".[1]

(i) Constant elasticity demand curve. The elasticity of most demand curves is not the same throughout. It varies from zero (0) to close to infinity, i.e., $0 < e_p < \infty$. In case of some demand curves, however, elasticity remains the same throughout their length, as shown in Fig. 4.5. Such demand curves are placed in the following categories.

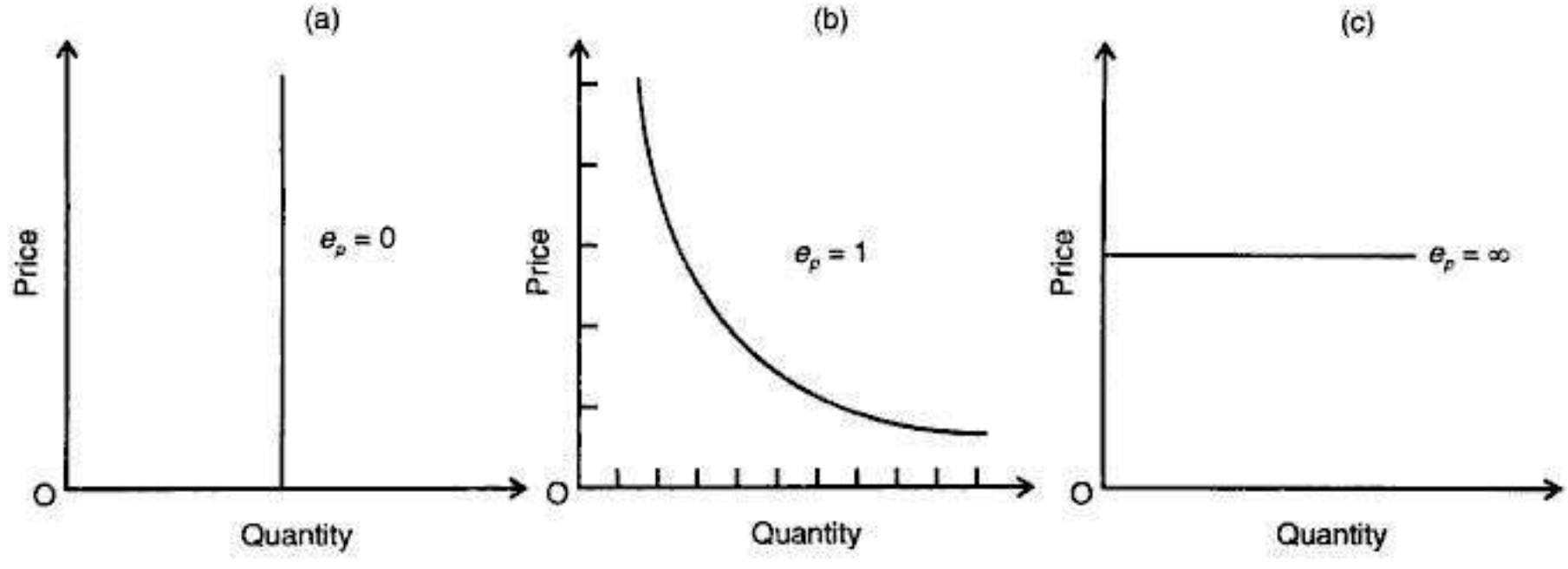


Fig. 4.5 Constant Elasticity Demand Curve

1. Baumol, W.J., *Economic Theory and Operation Analysis*, (Prentice Hall of India Private Limited, New Delhi), 4th Edn., p. 187.

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Following the logic of the preceding section, we can prove that

$$\frac{RK}{RJ} = \frac{PO}{PJ}$$

and

$$\frac{QM}{QL} = \frac{PO}{PL}$$

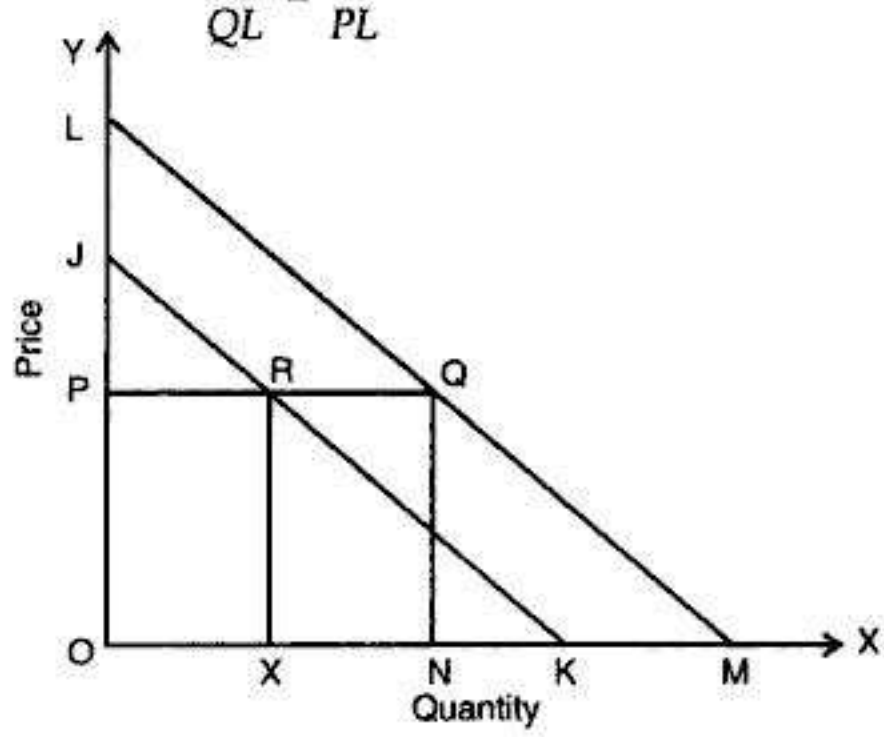


Fig. 4.7 Different Elasticities of Parallel Demand Curves

It can be seen from Fig. 4.7 that $PJ < PL$. Therefore,

$$\frac{PO}{PJ} > \frac{PO}{PL}$$

It is thus proved that

$$\frac{RK}{RJ} > \frac{QM}{QL}$$

It may be concluded from the above conclusions that demand curves having the same slope may have different elasticities, and demand curves having different slopes may have the same elasticities, both at a given price.

4.3 MEASURING PRICE ELASTICITY FROM A DEMAND FUNCTION

Price elasticity of demand can be measured directly from a demand function. In this section, we will describe the method of measuring price elasticities from a given demand function—linear and nonlinear.

(i) Measuring elasticity from a linear demand function. Suppose a linear demand function is given as follows.

$$Q = a - b\,P$$

At a given price, say, P_1, this demand function reads as

$$Q_1 = a - b\,P_1$$

When price changes from P_1 to P_2, then

$$Q_2 = a - b\,P_2$$

To measure the arc elasticity, we need two ratios: $\Delta Q/\Delta P$ and P/Q. Given the two demand functions, ratio $\Delta Q/\Delta P$ can be obtained as follows.

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4.4 DETERMINANTS OF PRICE-ELASTICITY OF DEMAND

The elasticity of demand varies from commodity to commodity depending on the nature of the commodity. While the demand for some commodities is highly elastic, for some it is highly inelastic. This section describes the main determinants of the price-elasticities of demand.

(i) Availability of substitutes. One of the most important determinants of price elasticity of demand for a commodity is the availability of its substitutes. ***The closer the substitute, the greater the elasticity of demand for a commodity.*** For instance, coffee and tea may be considered as close substitutes for one another. If price of one of these goods (say coffee) increases, then the other commodity (tea) becomes relatively cheaper. Therefore, consumers buy more of the relatively cheaper good (tea) and less of the costlier one. The elasticity of demand for both these goods will be higher. Besides, the wider the range of the substitutes, the greater the elasticity. For instance, soaps, toothpastes, cigarettes, etc., are available in different brand names, each brand being a close substitute for the other. Therefore, the price-elasticity of demand for each brand will be much greater than the generic commodity. On the other hand, sugar and salt do not have their close substitute and hence their price-elasticity is lower.

(ii) Nature of commodity. Price elasticity of demand depends also on the nature of a commodity. Commodities can be grouped broadly as luxuries, comforts and necessities, on the basis of their nature. Demand for luxury goods (e.g., air–conditioners, costly TV sets, cars, decoration items, etc.) is more elastic than the demand for other kinds of goods because consumption of luxury goods can be postponed when their price rises. On the other hand, consumption of necessities, (e.g., sugar, clothes, vegetables, etc.) cannot be postponed and hence their demand is inelastic. Demand for comforts is generally more elastic than that for necessities and less elastic than the demand for luxuries. Commodities may also be classified as durable goods and non-durable goods. Demand for durable goods is more elastic than that for non-durable goods, because when the price of the former increases, people either get the old one repaired instead of replacing it or buy a 'second-hand'.

(iii) Proportion of income spent. Another factor that influences the elasticity of demand is the proportion of income which consumers spend on a particular commodity. If proportion of income spent on a commodity is very small, its demand will be inelastic, and *vice versa*. Classic examples of such commodities are salt, matches, books, toothpastes, etc., which claim a very small proportion of consumers' income. Demand for these goods is generally inelastic because increase in the price of such goods does not substantially affect consumer's budget.

(iv) Time factor. Price-elasticity of demand also depends on the time consumers take to adjust to a new price: the longer the time taken, the greater the elasticity. For, consumers are able to adjust their expenditure pattern to price changes over a period of time. For instance, if price of TV sets is decreased, demand will not immediately increase unless people possess excess purchasing power. But over time, people may be able to adjust their expenditure patern so that they can buy a TV set at the (new) lower price.

(v) Range of alternative uses of a commodity. The wider the range of alternative uses of a product, the higher the elasticity of its demand. Decrease in the price of a multi-use commodity encourages the extension of their use. Therefore, the demand for such a commodity generally increases more than the proportionate decrease in its price. For instance, milk can be taken as it is, it may be converted into curd, cheese, *ghee* and butter milk. The demand for milk, will therefore, be highly elastic. Similarly, electricity can be used for lighting, cooking, heating, and for industrial purposes, therefore, demand for electricity is elastic, especially for decrease in price.

(vi) The Proportion of market supplied. The elasticity of market demand depends also on the proportion of the market supplied at the ruling price. If less than half of the market is supplied, elasticity of demand will be higher and if more than half of the market is supplied elasticity will be lower. That is, towards the upper end, demand curve is more elastic than towards the lower end.

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(vii) Direction of change in price. The direction of change in price also determines the elasticity. Between any two finite points on the demand curve, elasticity is higher for the fall in price and *vice versa* (see also pp. 71-72).

4.5 PRICE-ELASTICITY, MARGINAL, AVERAGE AND TOTAL REVENUE

In this section, we look into the relationship between (i) price elasticity of demand and marginal revenue; (ii) marginal revenue and average revenue; and (iii) price elasticity and total revenue. These relationships are of great importance in business analysis.

4.5.1 Price Elasticity and Marginal Revenue

Marginal revenue is the addition to the total revenue (TR) as a result of sale of one additional unit. It is also defined as the first derivative of TR-function, i.e.,

$$MR = \frac{\partial TR}{\partial Q}$$

The relationship between price elasticity and marginal revenue (MR) can be derived as follows. Let us suppose that a given output, Q, is being sold at a price P, so that the total revenue (TR) equals P times Q, i.e.,

$$TR = P.Q$$

The marginal revenue (MR) can be obtained by differentiating $TR = P.Q$ with respect to Q. Thus,

$$MR = \frac{\partial (P.Q)}{\partial Q}$$

$$= P\frac{\partial Q}{\partial Q} + Q\frac{\partial P}{\partial Q}$$

$$= P + Q\frac{\partial P}{\partial Q}$$

$$MR = P\left(1 + \frac{Q}{P}.\frac{\partial P}{\partial Q}\right) \tag{4.14}$$

Note that $\frac{Q}{P}.\frac{\partial P}{\partial Q}$ in Eq. (4.14) is the reciprocal of the price elasticity coefficient. It means that

$$\frac{Q}{P}.\frac{\partial P}{\partial Q} = -\frac{1}{e}$$

By substituting $-\frac{1}{e}$ for $\frac{Q}{P}.\frac{\partial P}{\partial Q}$ in Eq. (4.14), we get

$$MR = P\left(1 - \frac{1}{e}\right) \tag{4.15}$$

Eq. (4.15) gives the relationship between price elasticity (e) and MR.

4.5.2 Relation between MR and AR

In Eq. (4.15), P is the same as AR. Eq. (4.15) can therefore be written as

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

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

or
$$AR = MR\left(\frac{e}{e-1}\right) \tag{4.16}$$

Eq. (4.16) gives the relationship between *AR* and price elasticity.

Graphical Proof. Eq. (4.16) gives the relationship between *AR* and *MR* and between *AR* and price elasticity. The relationship beteween *MR* and *AR* can also be derived geometrically. Suppose *AR* curve is given by the curve *AR* in Fig. 4.8. Then *MR* curve is given by the curve *AM*.

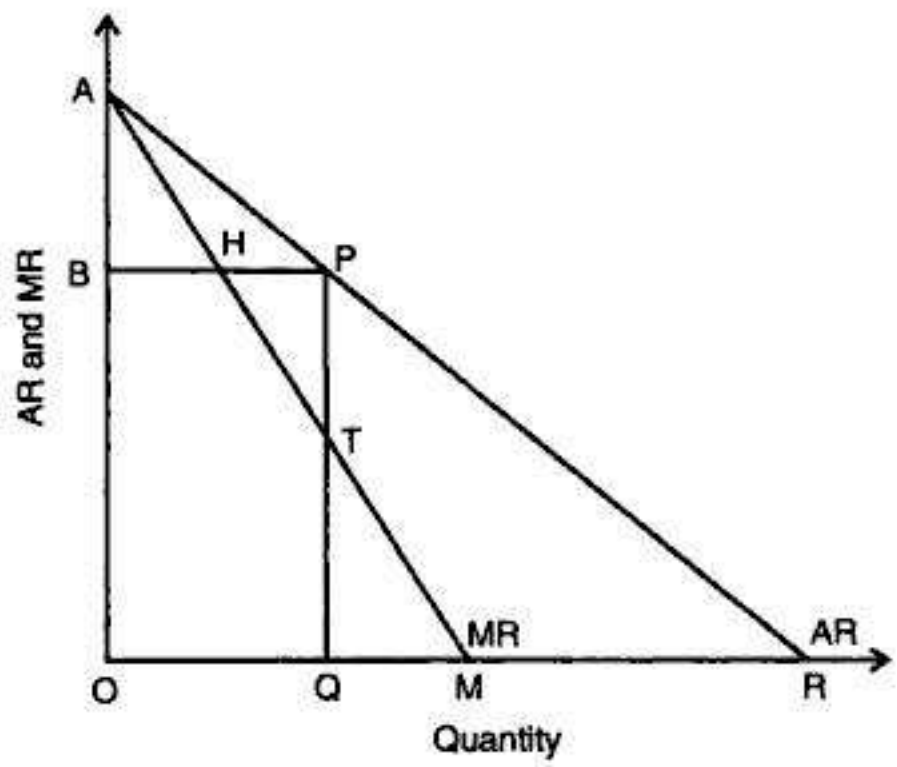


Fig. 4.8 Relationship between *AR* and *MR*

Let us suppose that price is given at *PQ* (= *BO*). As has been proved above, price elasticity at point *P* on the *AR* curve (which is the same as demand curve) can be expressed as

$$e = \frac{QR}{OQ} = \frac{PR}{AP} = \frac{OB}{AB}$$

Considering the last term, i.e., $e = OB/AB$, since $OB = PQ$,

$$\therefore \quad e = \frac{PQ}{AB} \tag{4.17}$$

In Fig. 4.8, $AB = PT$.[1] By substituting *PT* for *AB* in Eq. (4.17), we get

1. **Proof.** At price *PQ*, total revenue = *PQ* × *OQ*, which equals the area *OBPQ*. Considering from *MR* angle, the total revenue at price *PQ* is given by the area *OATQ*. Therefore, *OBPQ* = *OATQ*. It can be observed from Fig. 4.8 that area *OBHTQ* is common to the areas *OBPQ* and *OATQ*. Therefore, area of ΔABH = area of ΔTPH. Note that $\angle ABH$ and $\angle TPH$ are right angles. Therefore, $\Delta ABH = \Delta TPH$. The properties of right angle triangles of equal size tell that their corresponding sides are equal. Therefore, *BH* = *HP*, *AH* = *HT*, and *AB* = *PT*.

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$$e = \frac{PQ}{PT} \tag{4.18}$$

Since $PT = PQ - TQ$, Eq. (4.18) may be written as

$$e = \frac{PQ}{PQ - TQ} \tag{4.19}$$

It can be seen in Fig. 4.8 that $PQ = AR$ and $TQ = MR$. Therefore, Eq. (4.19) can be expressed as

$$e = \frac{AR}{AR - MR}$$

and
$$MR = AR - \frac{AR}{e} \tag{4.20}$$

or
$$MR = AR\left(1 - \frac{1}{e}\right) \tag{4.21}$$

Then,
$$AR = \frac{MR}{\left(1 - \frac{1}{e}\right)}$$

or
$$AR = MR\left(\frac{e}{e-1}\right) \tag{4.22}$$

Thus, we arrive at the same relationship between MR and AR as given in Eq. (4.16).

4.5.3 Price Elasticity and Total Revenue

Since *total revenue (TR)* and *marginal revenue (MR)* are interrelated, the relationship between TR and *price elasticity* of demand (e_p) can be traced through the relationship between MR and *price elasticity* (e_p). Given the relationship between MR and e_p in Eq. (4.21), the relationship between TR and e_p can be summed up as follows.

(a) where $e_p = 1$, $MR = 0$. Therefore TR does not change with change in price;
(b) where $e_p < 1$, $MR < 0$. Therefore TR decreases with decrease in price and increases with increase in price; and
(c) where $e_p > 1$, $MR > 0$. In this case, TR decreases with increase in price and increases with decrease in price.

This nature of relationships between TR and e_p can be illustrated graphically. We know that $TR = P.Q$. The value for P and Q can be obtained by assuming a demand function. Let us assume a demand function as

$$Q = 100 - 5P$$

Given the demand function, *price function* can be obtained as given below.

$$P = 20 - 0.2Q$$

Now, that we know the value of P, TR can be obtained as follows.

$$TR = P.Q = (20 - 0.2Q)\,Q$$
$$= 20Q - 0.2Q^2$$

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From the *TR*-function, *MR*-function can be derived as

$$MR = \frac{\partial TR}{\partial Q} = 20 - 0.4Q$$

The *TR*-function is presented graphically in panel (a) and the demand and *MR* functions are presented in panel (b) of Fig. 4.9. As the figure shows, at point *P* on the demand curve, $e_p = 1$ where output, $Q = 50$. Below point *P*, $e_p < 1$ and above point *P*, $e_p > 1$. It can be seen in panel (a) of Fig. 4.9 that *TR* increases over the range of demand curve having $e_p > 1$; *TR* reaches its maximum level where $e_p = 1$; and it decreases over the range $e_p < 1$.

The relationship between price-elasticity and *TR* is summed up in Table 4.1. As the table shows, when demand is *perfectly inelastic* (i.e., $e_p = 0$ as in the case of a vertical demand line) there is no decrease in quantity demanded when price is raised and *vice versa*. Therefore, a rise in price increases the total revenue and *vice versa*.

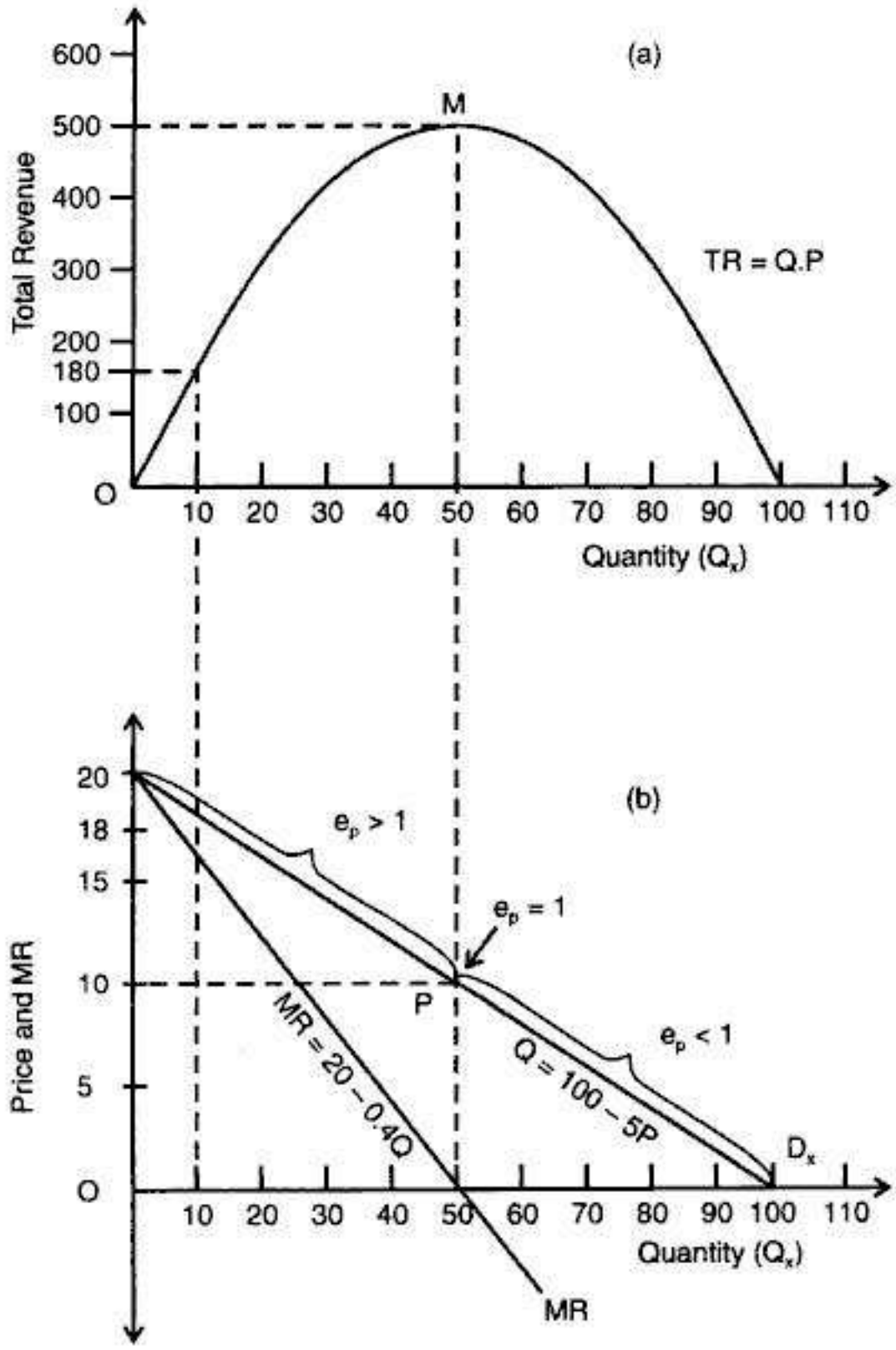


Fig. 4.9 Price Elasticity and Total Revenue

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In case of an *inelastic demand* (i.e., $e_p < 1$), quantity demanded increases by less than the proportionate decrease in price and hence the total revenue falls when price falls. The total revenue increases when price increases because quantity demanded decreases by less than the proportionate increase in price.

Table 4.1. Elasticity, Price-change and Change in *TR*

Elasticity Co-efficient	Nature of demand	Change in Price	Change in *TR*
$e_p = 0$	Perfectly inelastic	Increase Decrease	Increase Decreases
$e_p < 1$	Inelastic	Increase Decrease	Increase Decrease
$e_p = 1$	Unitary elastic	Increase Decrease	No change No change
$e_p > 1$	Elastic	Increase Decrease	Decrease Increase

If demand for a product is *unit elastic* ($e_p = 1$) quantity demanded increases (or decreases) in the proportion to decrease (or increase) in the price. Therefore, total revenue remains unaffected.

If demand for a commodity has $e_p > 1$, change in quantity demanded is greater than the proportionate change in price. Therefore, the total revenue increases when price falls and *vice versa*.

4.6 PRICE-ELASTICITY AND CONSUMPTION EXPENDITURE

Another important relationship which is often referred to in economic analysis is one between price elasticity and consumption expenditure. From the law of demand, we know that quantity demanded of a commodity increases when its price falls. But, ***what happens to the total expenditure on that commodity***—does it fall or increase?

The relationship between price elasticity and total consumption expenditure may be derived as follows. The total consumption expenditure (TE_x) on commodity X, at a given price P_x, all other prices remaining the same, is given by

$$TE_x = Q_x \cdot P_x \tag{4.23}$$

By differentiating Eq. (4.23) with respect to P_x, we get marginal expenditure (ME_x) as

$$ME_x = \frac{\partial Q_x \cdot P_x}{\partial P_x} = Q_x + P_x \frac{\partial Q_x}{\partial P_x}$$

$$= Q_x \left[1 + \frac{P_x}{Q_x} \cdot \frac{\partial Q_x}{\partial P_x} \right]$$

In Eq. (4.24), $\frac{P_x}{Q_x} \cdot \frac{\partial Q_x}{\partial P_x} = -e_p$ (4.24)

By substitution, Eq. (4.24) can be written as

$$ME_x = \frac{Q_x \cdot P_x}{\partial P_x} = Q_x (1 - e_p) \tag{4.25}$$

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It may be inferred from Eq. (4.25) that whether the total expenditure increases, decreases or remains constant as a result of change in price depends on whether

$$Q_x (1 - e_p) \gtreqless Q_x$$

Whether $Q_x (1 - e_p)$ is greater than, equal to or less than Q_x depends on whether $e_p \gtreqless 1$.

The relationship between, total consumer expenditure and price elasticity of demand has been summarised up in Table 4.2.

Table 4.2 Elasticity and Consumption Expenditure

Elasticity (e_p)	Price change	Marginal expenditure	Total expenditure
$e_p > 1$	Rise Fall	$ME < 0$ $ME > 0$	Decreases Increases
$e_p = 1$	Rise Fall	$ME = 0$ $ME = 0$	Constant Constant
$e_p < 1$	Rise Fall	$ME > 0$ $ME < 0$	Increases Decreases

As shown in the above table, when $e_p > 1$, i.e., demand is *elastic*, an increase in price causes more than proportionate decrease in quantity demanded. Hence, total expenditure decreases. And, if price decreases, quantity demanded increases more than proportionately. As a result, total expenditure increases.

When $e_p = 1$, a rise (or fall) in price causes a proportionate decrease (or increase) in quantity demanded leaving total expenditure unchanged.

When $e_p < 1$, i.e., when demand is *inelastic*, a rise in price causes increase in the total expenditure because demand decreases less than proportionately, and a fall in price reduces it as quantity demanded increases less than proportionately.

4.7 OTHER ELASTICITIES OF DEMAND

In this section, we will discuss elasticities of demand with respect to some of its other determinants often used in economic analysis.

4.7.1 Cross-Elasticity of Demand

Cross-elasticity is the measure of responsiveness of demand for a commodity to the changes in the price of its substitutes and complementary goods. For instance, cross-elasticity of demand for tea (T) is the percentage change in its quantity demanded due to a change in the price of its substitute, coffee (C). Formula for measuring cross-elasticity of demand for tea ($e_{t,c}$) with respect to price of coffee (P_c) is

$$e_{t,c} = \frac{\text{Proportionate change in demand for tea } (Q_t)}{\text{Proportionate change in price of coffee } (P_c)}$$

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$$= \frac{P_c}{Q_t} \cdot \frac{\Delta Q_t}{\Delta P_c} \tag{4.26}$$

The cross-elasticity of demand for coffee (Q_c) with respect to price of tea (P_t) is

$$e_{c,t} = \frac{P_t}{Q_c} \cdot \frac{\Delta Q_c}{\Delta P_t}$$

For a numerical example, suppose that price of coffee (P_c) increases from Rs 10 to Rs 15 per 10 grams, and as a result, demand for tea increases from 20 tons to 30 tons per week, price of tea remaining constant. By substituting these values in Eq. (4.26), we get cross-elasticity of demand for tea with respect to price of coffee, as

$$\begin{aligned} e_{t,c} &= \frac{10}{20} \cdot \frac{20-30}{10-15} \\ &= \frac{10}{20} \cdot \frac{-10}{-5} \\ &= 1.0 \end{aligned}$$

Note that cross–elasticity with respect to substitutes is always positive.

The same formula is used to measure the cross-elasticity of demand for a good in response to change in the price of its ***complementary goods***. Electricity to electrical gadgets, petrol to automobile, butter to bread, sugar and milk to tea and coffee, are the examples of complementary goods.

When two goods are substitutes for each other, their demand has a *positive corss-elasticity* because increase in the price of one increases the demand for the other. But, the demand for complementary goods has *negative cross-elasticity*, for increase in the price of a good decreases the demand for its complementary goods.

An ***important*** aspect of cross-elasticity is that if cross-elasticities between any two goods are positive, the two goods may be considered as substitutes for each other. Also the greater the cross-elasticity, the closer the substitute. Similarly, if cross-elasticity of demand for any two related goods is negative, the two may be considered as complementary for each other: the higher the negative cross-elasticity, the higher the degree of complementarity.

4.7.2 Income-Elasticity of Demand

Apart from price of a product and its substitutes, another important determinant of demand for a product is consumer's income. As noted earlier, the relationship between demand for normal and luxury goods and consumer's income is of positive nature, unlike the negative price-demand relationship. In simple words, the demand for normal goods and services increases with increase in consumer's income and *vice versa*. The responsiveness of demand to the change in consumer's income is known as ***income-elasticity*** of demand.

Income-elasticity e_y of demand for a product, say X with respect to change in money income (M) can be defined as:

$$e_y = \frac{\Delta Q_x / Q_x}{\Delta M / M} = \frac{M}{Q_x} \cdot \frac{\Delta Q_x}{\Delta M} \tag{4.27}$$

where Q_x = quantity of X demanded; M = disposable money income; ΔQ_x = change in quantity demanded of X; and ΔM = change in income.

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Unlike price-elasticity of demand (which is negative except in case of Giffen goods), income-elasticity of demand is positive because of a positive relationship between income and quantity demanded of a product. There is an exception to this rule. Income-elasticity of demand for an *inferior good* is negative, because of negative income-effect. The demand for inferior goods decreases with increase in consumer's income and *vice versa*. When income increases, consumers switch over to the consumption of superior commodities. That is, they substitute superior goods for inferior ones. For instance, when income rises, people prefer to buy more of rice and wheat and less of inferior foodgrains like *bajra*, ragi, etc. and use more of taxi and less of bus service and so on.

Nature of commodity and income-elasticity. For all normal goods, income-elasticity is positive though the degree of elasticity varies in accordance with the nature of commodities. As noted above, consumer goods are generally grouped under three broad categories, viz., necessities (essential consumer goods), comforts, and luxuries. The general pattern of income-elasticities for goods of different categories for increase in income and their impact on sales are given in Table 4.3.

Table 4.3. Nature of Commodities, Income Elasticity and Expenditure

Commodities	Coefficient of income Elasticity	Impact on Expenditure
1. Necessities	Less than unity ($e_y < 1$)	Less than proportionate change in expenditure
2. Comforts	Almost equal to unity ($e_y \cong 1$)	Almost proportionate change in expenditure
3. Luxuries	Greater than unity ($e_y > 1$)	More than proportionate increase in expenditure

Income-elasticity of demand for different categories of goods may however vary from household to household and from time to time, depending on choice, taste and preference of the consumers, levels of their consumption and income, and their susceptibility to 'demonstration effect'. The other factor which may cause deviation from the general pattern of income-elasticities is the frequency of increase in income. If income increases regularly and frequently, income-elasticities will conform to the general pattern, otherwise not.

Uses of Income-Elasticity. Some ***important uses*** of income-elasticity are as follows.

First, the concept of income-elasticity can be used to estimate the future demand for a product provided the rate of increase in income and income-elasticity of demand for the product are known. The knowledge of income-elasticity can be used for forecasting demand, when a changes in personal income is expected, other things remaining the same.

Secondly, the concept of income-elasticity can also be used to define the '***normal***' and '***inferior***' goods. The goods whose income-elasticity is positive for all levels of income are termed as 'normal goods'. On the other hand, the goods for which income elasticities are negative, beyond a certain level of income, are termed as '***inferior goods***'.

4.7.3 Elasticity of Price Expectations

Sometimes, consumer's price expectations play a much more important role in determining demand for a commodity than any other factor. The concept of price-expectation-elasticity refers to the expected change in future price (P_f) as a result of change in price of a product in the past (P_p). The elasticity of price-expectation is defined and measured by the following formula:

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4.9 PRICE ELASTICITY OF SUPPLY

Price-elasticity of supply is the measure of responsiveness of the quantity supplied of a good to the change in its market price. The coefficient of price-elasticity of supply (e_p) is the measure of percentage change in the quantity supplied of a good due to a given percentage change in its price. The formula of supply elasticity is given as

$$e_p = \frac{\%\text{ change in quantity supplied } (Q)}{\%\text{ change in price } (P)}$$

$$= \frac{\Delta Q / Q}{\Delta P / P} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

Note that the formula for measuring the price-elasticity of supply is the same as for the price-elasticity of demand, (without a minus sign). Given the formula, price-elasticity of supply can be easily measured.

Example. Suppose that the supply curve for a commodity is given as SS' in Fig. 4.10 and we want to measure the price-elasticity of the supply between points J and P for rise in price. In that case,

$\Delta Q = 60 - 100 = -40$

$\Delta P = 5 - 7.5 = -2.5$

$P = 5$ and

$Q = 60$

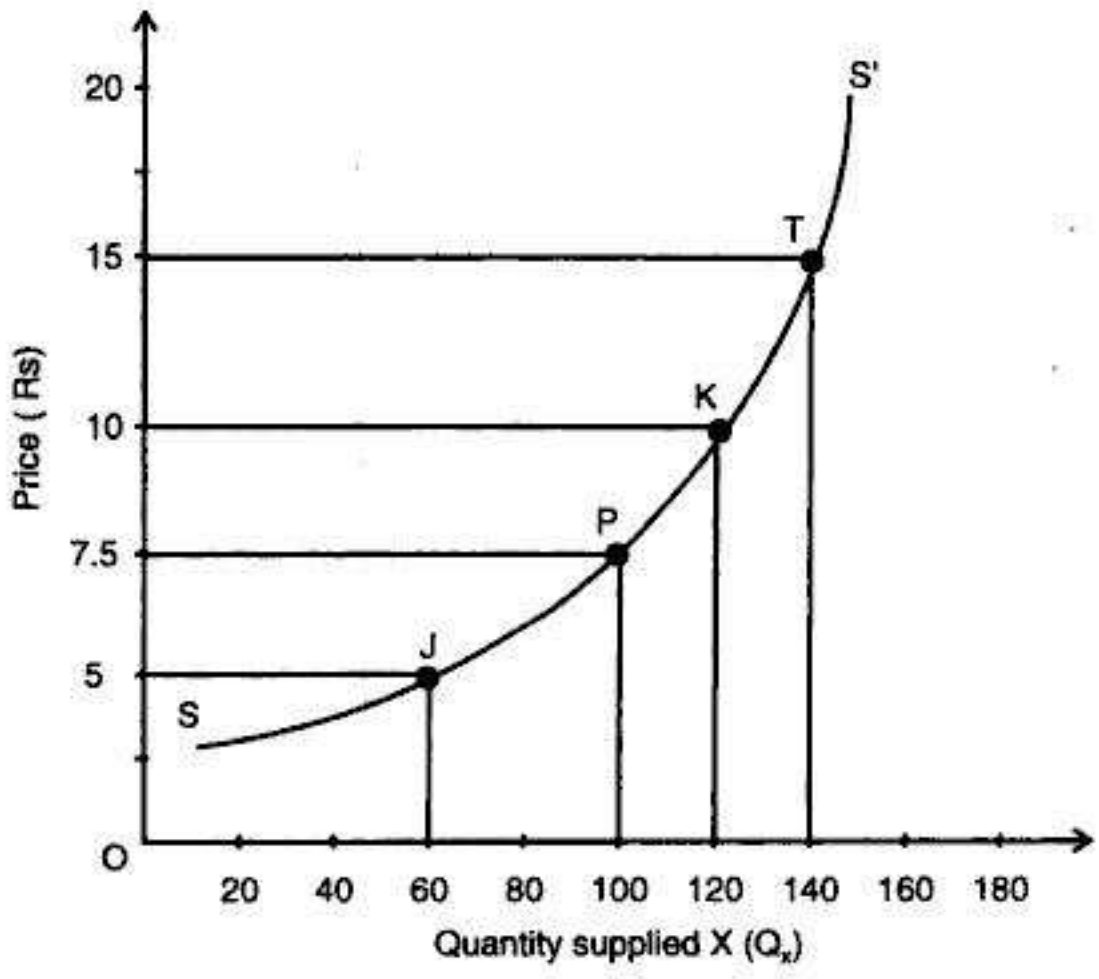


Fig. 4.10 Price Elasticity of Supply

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9. What are the different methods of calculating price elasticity of demand? Elaborate on any one method.

10. Suppose a demand schedule is given as follows:

Price (Rs)	100	80	60	40	20	0
Quantity	100	200	300	400	500	600

(a) Find the elasticity for the fall in price from Rs 80 to Rs 60.
(b) Calculate the elasticity for the increase in price from Rs 60 to Rs 80.
(c) Why is elasticity coefficient in (a) different form that in (b)?

11. Prove: (a) $MR = P\ [1 - 1/e]$,
(b) if $e = 1, MR = 0$

12. Which of the following statements are right or wrong?
(a) When percentage change in price is greater than the percentage change in quantity demanded, $e > 1$.
(b) The coefficient of the price-elasticity of a demand curve between any two points remains the same irrespective of whether price falls or rises.
(c) The slope of a demand curve gives the measure of its elasticity.
(d) The slope of demand curve multiplied by P/Q measures the elasticity of demand.
(e) Two parallel straight line demand curves have the same elasticity at a given price.
(f) Two intersecting straight line demand curves have the same elasticity at the point of their intersection.
(g) Two straight line demand curves originating at the same point on the price axis have the same elasticity at a given price.
(h) When income increases, the expenditure on essential goods increases more than proportionately.
(i) The demand for a commodity increases when price of its substitute increases.
(j) The greater the cross–elasticity, the closer the substitute.
(k) Price elasticity of supply of a commodity is always negative.
(l) Income elasticity of the demand for luxury goods always positive.
(m) If price elasticity is less than one and price rises, the total expenditure decreases.
(n) If $e_p = 1$, the total revenue increases with the increase in the price.

13. Which of the following gives the measure of price elasticity of demand?
(a) ratio of change in demand to change in price.
(b) ratio of change in price to change in demand.
(c) ratio of percentage change in demand to percentage change in price.
(d) none of the above.

14. Which of the following gives the measure of price elasticity of demand?
(a) $(\Delta Q/\Delta P)\,(P/Q)$ (b) $(\Delta P/\Delta Q)\,(P/Q)$ (c) $(\Delta Q/\Delta P)\,(Q/P)$

15. Suppose price of a commodity falls and its demand increases so much that elasticity is estimated to be 1.25. Suppose price increases back to its old level. Will price elasticity be
(a) the same (b) less than 1.25 (c) higher than 1.25?

16. At a given price, two parallel demand curves have
(a) the same point elasticity, (b) a different point elasticity?

17. Two intersecting demand curves have at the point of their intersection
(a) the same elasticity (b) a different elasticity?

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18. A less than zero income elasticity indicates that with an increase in income, consumption of a product
    (a) turns negative (b) increases
    (c) decreases (d) remains constant?

19. Given the demand function:
    $Q_d = 12 - P$
    (a) find demand and marginal revenue schedules,
    (b) plot *AR* and *MR* schedules,
    (c) find marginal revenue when $P = 10$, 6 and 2
    (d) estimate elasticity coefficient of the demand curve, when total revenue is at maximum.

20. Define *elasticity of price expectation* (E_e). In the context of an environment of business recession, state briefly the implication of:
    (i) $E_e > 1$ (ii) $E_e = 1$ (iii) $0 < E_e > 1$ (iv) $E_e = 0$ and (v) $E_e < 0$.

21. A publishing company plans to publish a book. From the sales data of other publishers of similar books, it works out the demand function for the book as $Q = 5000 - 5P$. Find out:
    (a) demand schedule and demand curve,
    (b) number of books sold at P = Rs 25,
    (c) price for selling 2500 copies,
    (d) price for zero sales,
    (e) point-elasticity of demand at price Rs 20, and
    (f) arc elasticity for a fall in price from Rs 25 to Rs 20 .

22. Suppose demand function for a product is given as $Q = 500 - 5P$. Find out:
    (a) quantity demanded at price Rs 15, (b) price to sell 200 units,
    (c) price for zero demand, and (d) quantity demanded at zero price.

23. Which of the following statements is true?
    (a) if price elasticity = 1, $MR = 0$
    (b) if price elasticity > 1, $MR > 0$
    (c) the price elasticity < 1, $MR < 0$ **[Ans. All Three]**

24. Suppose individual demand schedules for *A*, *B* and *C* are given as follows:

Price (Rs)	A's demand	B's demand	C's demand
5	80	40	20
10	40	20	10
15	20	10	5
20	10	5	0
25	0	0	0

Find:
(a) market demand schedule,
(b) market demand curve,
(c) elasticity when price falls form Rs 15 to Rs 10,
(d) elasticity when price rises from Rs 10 to Rs 15.

[Ans. 13 (c), 14 (a), 15 (b), 16 (b), 17 (b), 18 (c)]

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5 Applications of Market Laws and Elasticities

CHAPTER OUTLINE

5.1 Excise Tax: Its Effects and Incidence
- 5.1.1 Lump-sum or Specific Excise Tax
- 5.1.2 Ad Valorem or Proportional Excise Tax
- 5.1.3 Effect to Excise Tax on Production and Price
- 5.1.4 Who Bears the Tax Burden?

5.2 Production Subsidy and its Effects
- 5.2.1 The Effect of Production Subsidy
- 5.2.2 Who Benefits from Production Subsidy?

5.3 Effects of Price Controls

5.4 Import Tariffs and Export Subsidies
- 5.4.1 Import Tariffs
- 5.4.2 Export Subsidy

Further Readings

Review Questions and Exercises

In two previous chapters, we have discussed ***market laws***, i.e., the laws of demand and supply, and the concept and measurement of ***elasticity***. The laws of demand and supply, the way these laws have been explained in the previous chapters, work efficiently in a free market — a market free from government controls and regulations and other kinds of government interventions. Such markets are rare in reality. Government intervention with market mechanism through taxation, subsidy, price controls and regulations is the order of the day. Government interventions affect price, production and incomes of the people. The market laws and elasticities are the two most widely used economic theories and concepts to analyse the effects of government interventions with the market system. In this chapter, we will see how demand-and-supply tools can be applied in combination with elasticities, to find answers to certain important questions pertaining to the effects of government interventions with market. The major issues to which market laws are applied are given in the box above.

5.1 EXCISE TAX: ITS EFFECTS AND INCIDENCE

We begin our analysis with one of the most common types of government intervention, i.e., imposition of commodity tax. A ***commodity tax***, also called *indirect tax*, may be in the form of an excise duty or

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sales tax.[1] The excise (or sales) tax is imposed at a lump-sum or specific rate or at a proportional or at advalorem rate. Let us now examine the effect of specific excise duty on the market equilibrium, price, production and the distribution of tax burden between the producers and consumers.

5.1.1 Lump-Sum or Specific Excise Tax

Let us suppose that market demand and supply curves (prior to the imposition of tax) are given by curves DD' and SS_1, respectively, as shown in Fig. 5.1. The demand curve DD' and supply curve SS_1, intersect at point E determining equilibrium output at OQ_1 and price at OP_0.

Let the government now impose an excise tax on the commodity. The excise tax rate may be in the form of a lump-sum (per unit) tax or in the form of an *ad valorem* rate. A lump-sum tax rate is a fixed tax rate per unit of commodity whereas an ad valorem tax is a proportional tax rate imposed as a percentage of the commodity price. Figure 5.1 illustrates the effect of both lump-sum and advalorem tax.

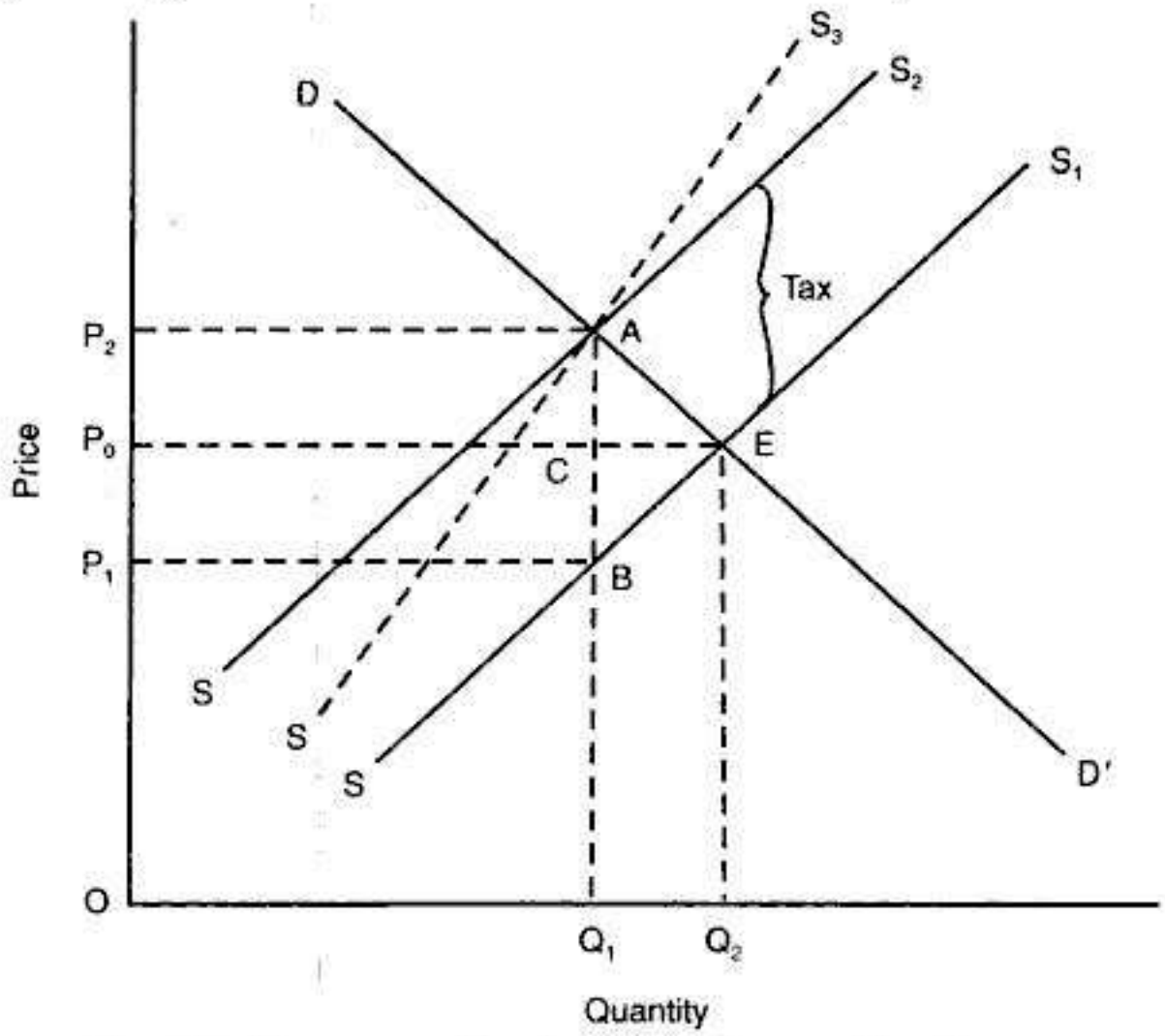


Fig. 5.1 Lump-sum Excise Tax, Price and Incidence

When a lump-sum tax is imposed on a commodity, tax is added to its sale price. As a result, supply curve shifts leftward remaining parallel to the original one, as shown by the suppy curve SS_2 in Fig. 5.1. The vertical distance between the two supply curves shows the excise tax per unit. For example, AB measures the lump-sum excise tax. Note that the new supply curve (SS_2) intersects the demand curve at point A, determining a new equilibrium price OP_2 and output OQ_1. As Fig. 5.1 reveals, imposition of excise tax causes a decrease in output from OQ_2 to OQ_1 and an increase in equilibrium price from OP_0 to OP_2. Note that the post-tax equilibrium has created a difference between the price buyers pay and the price sellers retain. At equilibrium point A, the price buyers pay equal to OP_2 ($=AQ_1$) and price sellers retain equals OP_1 ($= BQ_1$). The difference between the two prices is the unit excise tax, i.e., excise tax = $OP_2 - OP_1 = P_1P_2$ or tax = $AQ_1 - BQ_1 = AB$.

1. In India, excise tax is the most important indirect tax imposed by the Central Government and sales tax most important tax imposed by the State governments.

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5.1.2 Ad Valorem or Proportional Excise Tax

In case excise tax is imposed at an ad valorem or proportional rate (i.e., as some percentage of the supply price), the supply curve shifts leftward, as shown by the dashed supply curve, SS_3, in Fig. 5.1. Note that a proportional tax changes the slope of the supply curve : the vertical gap between the initial and the new supply curve goes on increasing because per unit tax increases in proportion to price rise. The new supply curve may pass through any point on the demand curve depending on the tax rate. In our case, post-tax supply curve (SS_3) passes through point A. It shows that the amount of specific tax and proportional tax is the same at equilibrium output.

5.1.3 Effect of Excise Tax on Production and Price

It can be seen in Fig. 5.1 that imposition of a tax affects both equilibrium output and price. The excise tax causes equilibrium output to decrease from its pre-tax level (OQ_2) to a lower post-tax level (OQ_1) and the price that buyers pay increases from its pre-tax level OP_0 to a higher level OP_2. This result holds under the condition that all other things remain the same. It is clear from the foregoing analysis that the laws of demand and supply can be applied to find answer to the question: how does commodity taxation affect price and production? An answer to this question is useful in formulating the ***tax policy***. For, if tax causes a heavy decline in output and rise in price, it may not be desirable to impose tax on essential and normal goods.

5.1.4 Who Bears the Tax Burden?

Excise and sales taxes are intended to be borne entirely by the final buyers and it is also generally believed that the entire tax burden is borne by the buyers. This is not true. The reason is that market system distributes the tax burden between the buyers and sellers. So a ***tax-policy question*** arises : *who bears the tax burden and in what proportion?* Economists apply the laws of demand and supply and elasticities to find answer to this question. An answer to this question can be obtained graphically and also numerically. Let us first illustrate the tax distribution graphically.

Graphical illustration of tax distribution. As Fig. 5.1 shows, the equilibrium price before tax was OP_0. This is the price which consumers ***paid*** and ***sellers*** received and retained. After the imposition of tax, the price that buyers pay rises to OP_2 and the price that sellers retain falls to OP_1. The difference between the two prices is the tax, i.e., $OP_2 - OP_1 = P_1P_2$ = tax. For buyers, price rises by P_0P_2. It means that buyers pay P_0P_2 part of the tax (P_1P_2). On the other hand, for sellers' price *falls* by P_0P_1. It means that sellers bear P_0P_1 part of the tax. Thus, buyers' bear P_0P_2 part and sellers bear P_0P_1 part of the tax. Note that $P_0P_2 + P_0P_1 = P_1P_2$ = tax.

How is tax burden distributed? The share of buyers and sellers in tax incidence depends on the ***price-elasticities of demand and supply***. It can be seen in Fig. 5.1 that both demand curve (DD') and supply curve (SS_1) have almost the same elasticity.[1] Therefore, as the figure shows, tax burden is distributed between the buyers and sellers almost equally. Note that $P_0P_2 \cong P_0P_1$. This means that if elasticities of demand and supply for a given change in price are equal, then the buyers and sellers share the tax burden equally. However, where elasticities of demand and supply are unequal, the distribution of tax is also unequal. As a general rule, ***the lower the elasticity, the higher the tax burden and vice versa***. This point is illustrated in Fig. 5.2.

---

1. Recall that $e_p = (\Delta Q/\Delta P)\ (P/Q)$. At point E, P/Q is the same for both DD' and SS_1. So the elasticities of the demand and supply curves can be obtained by comparing their respective slopes. The movement from point E to point A shows that ΔQ in both the cases is the same (CE) and ΔP is almost the same because $AC \cong CB$. Therefore, elasticities of demand and supply curves are almost equal.

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How elasticities determine tax burden. In part (a) of Fig. 5.2, demand curve has a steeper slope and hence it has a lower elasticity than the supply curve, at a given price. Since demand curve (DD') has a lower elasticity than the supply curve (SS_1), tax burden on the buyers is *larger* than that on the sellers. Buyers bear tax burden equal to $AB = P_2P_3$ and sellers bear the rest of the tax burden $BC = P_1P_2$. It is obvious from the figure that $AB > BC$ or $P_2P_3 > P_1P_2$.

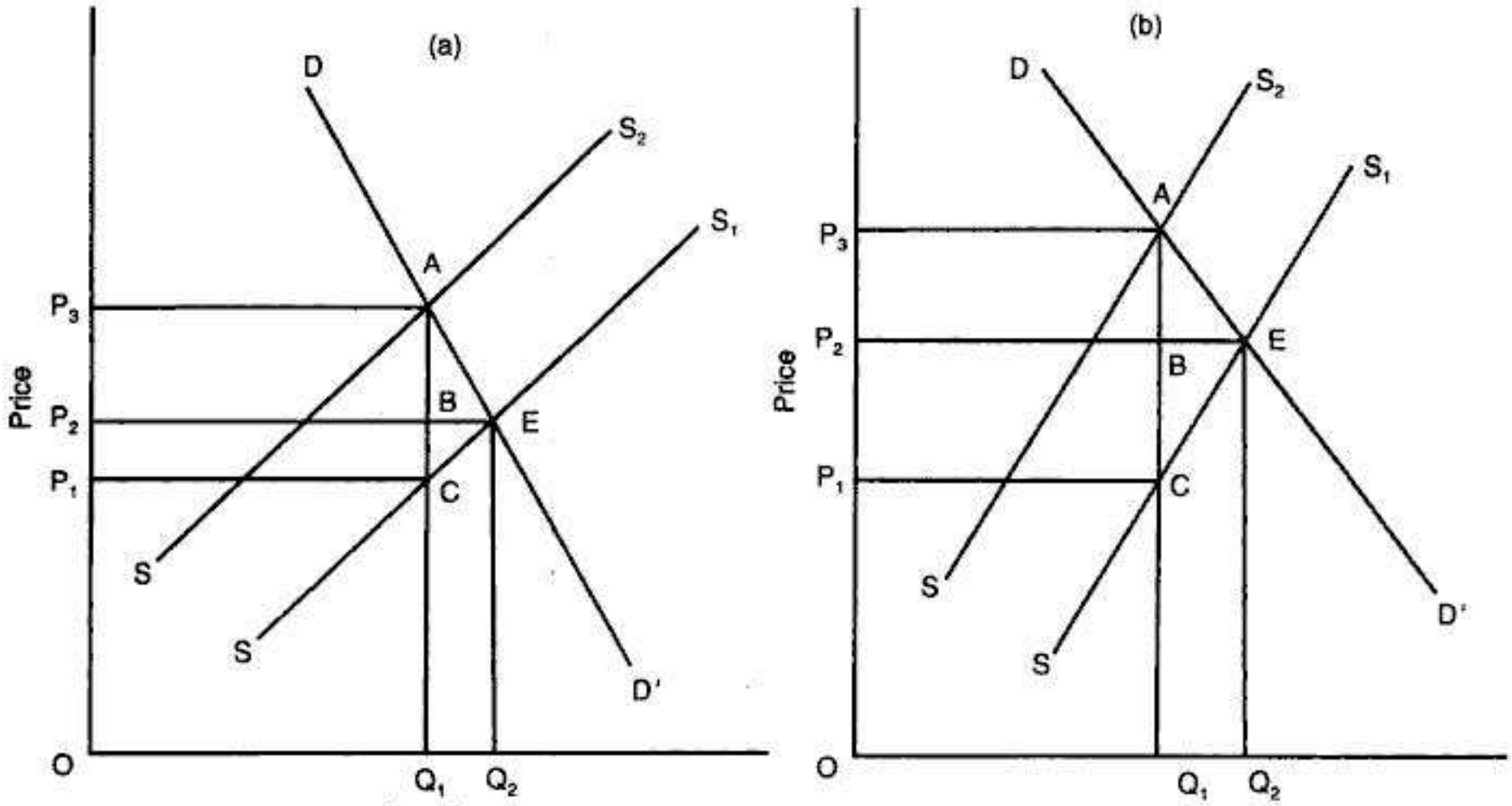


Fig. 5.2 Elasticities of Demand and Supply and Tax Burden

Part (b) of Fig. 5.2 presents a reverse case, supply curve having a greater elasticity than the demand curve. As the figure shows, supply curves SS_1 and SS_2 are less elastic[1] than the demand curve (DD'). Therefore, tax burden on the sellers is larger than that on the buyers. As the figure shows, the tax burden that falls on the sellers equals to BC and the tax burden that falls on the buyers equals AB. Since $BC > AB$, sellers bear a higher tax burden.

The formula for measuring tax incidence. Economists have devised the following formula[2] for measuring the tax incidence on the buyers and sellers. The formula for measuring the ***tax incidence on the buyer*** is given as follows:

$$\Delta T_b = \frac{e_s}{e_s - e_d} \Delta T$$

(where ΔT_b = buyer's share in tax; e_s = elasticity of supply; e_d = elasticity of demand; and ΔT = change in amount of tax)

For example, suppose elasticity of demand for computers is – 0.6, elasticity of computer supply

1. It can be judged by the slopes of demand and supply curves. As Fig. 5.2 (b) shows, demand curve has a lower slope than the supply curves.
2. For the derivation of the formula, see Jeffrey M. Perloff, *Microeconomics*, 2nd Edn., Addison Wesley, Boston, 2001, Appendix 3A.

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is 0.4, and government imposed a tax of Rs 100 per computer. Assuming this is a new tax, $\Delta T = T$. The tax burden on the computer buyers can be measured as follows:

$$\Delta P = \frac{0.4}{0.4 - (-0.6)} \text{Rs } 100 = \text{Rs } 40$$

This shows that the computer buyers bear only Rs 40 of a tax of Rs 100 and the rest (i.e., Rs 60) falls on the sellers. Computer buyers bear a lower tax burden because demand elasticity is higher (– 0.6) than the supply elasticity (0.4). If elasticity coefficients are reversed, then the distribution of tax burden will also be reversed. For example, if $e_s = 0.6$ and $e_d = -0.2$, the tax incidence on computer buyers will be much higher as shown below.

$$\Delta P = \frac{0.6}{0.6 - (-0.2)} \text{Rs } 100 = \text{Rs } 750$$

This proves the point that ***the lower the elasticity, the higher the tax burden***.

What about sales tax? A sales tax is imposed on the buyers at the point of sale of a commodity. The analysis of the effects and distribution of ***sales tax*** is similar to that of excise duty. There is, however, a difference. In case of sales tax, it is the price that buyers pay is affected. Therefore, in case of sales tax, it is the demand curve which shifts downward, supply curve remaining the same. Rest of the analysis is the same.

5.2 PRODUCTION SUBSIDY AND ITS EFFECTS

A ***subsidy*** is financial grant to the producers or the consumers of subsidized commodities, as the case may be. Accordingly, a subsidy may be in the form of (a) production subsidy, and/or (b) user subsidy. For example, central and state governments in India provide fertilizer and electricity subsidy to the farmers, food subsidy to the consumers, and education subsidy to the students. The question that we are concerned here are: (i) how does a subsidy affect the equilibrium price and output of the subsidized commodity? and (ii) who benefits from the subsidy? Let us first look at the effects of production subsidy and its distribution between the producers and consumers.

5.2.1 The Effect of Production Subsidy

A production subsidy may be in the form of a financial grant or in the form of input subsidy.[1] From an analysis point of view, production subsidy can be treated as a negative tax. Therefore, its effect on production and price is just reverse to that of excise duty. The effects of subsidy on production and price is illustrated in Fig. 5.3. The market demand curve is shown by the curve DD' and pre-subsidy supply curve by SS_1. The pre-subsidy equilibrium is shown at point A. The equilibrium output is OQ_1 and price is $OP_0 = AQ_1$.

Let us now suppose that a subsidy of AG (per unit of output) is granted to the producers. The grant of subsidy reduces the producer's cost to the same extent for each level of output. As a result, the supply curve shifts from SS_1 to SS_2, determining a new equilibrium at point C. As Fig. 5.3 shows, grant of subsidy causes an increase in production from OQ_1 to OQ_2 and reduces price for the consumers from OP_0 to OP_1. At equilibrium, subsidy equals $BC = AG$. Thus, the application of demand-and-supply model brings out the effect of production subsidy.

1. In both the cases, producers' cost decreases and hence the supply curve shifts rightward.

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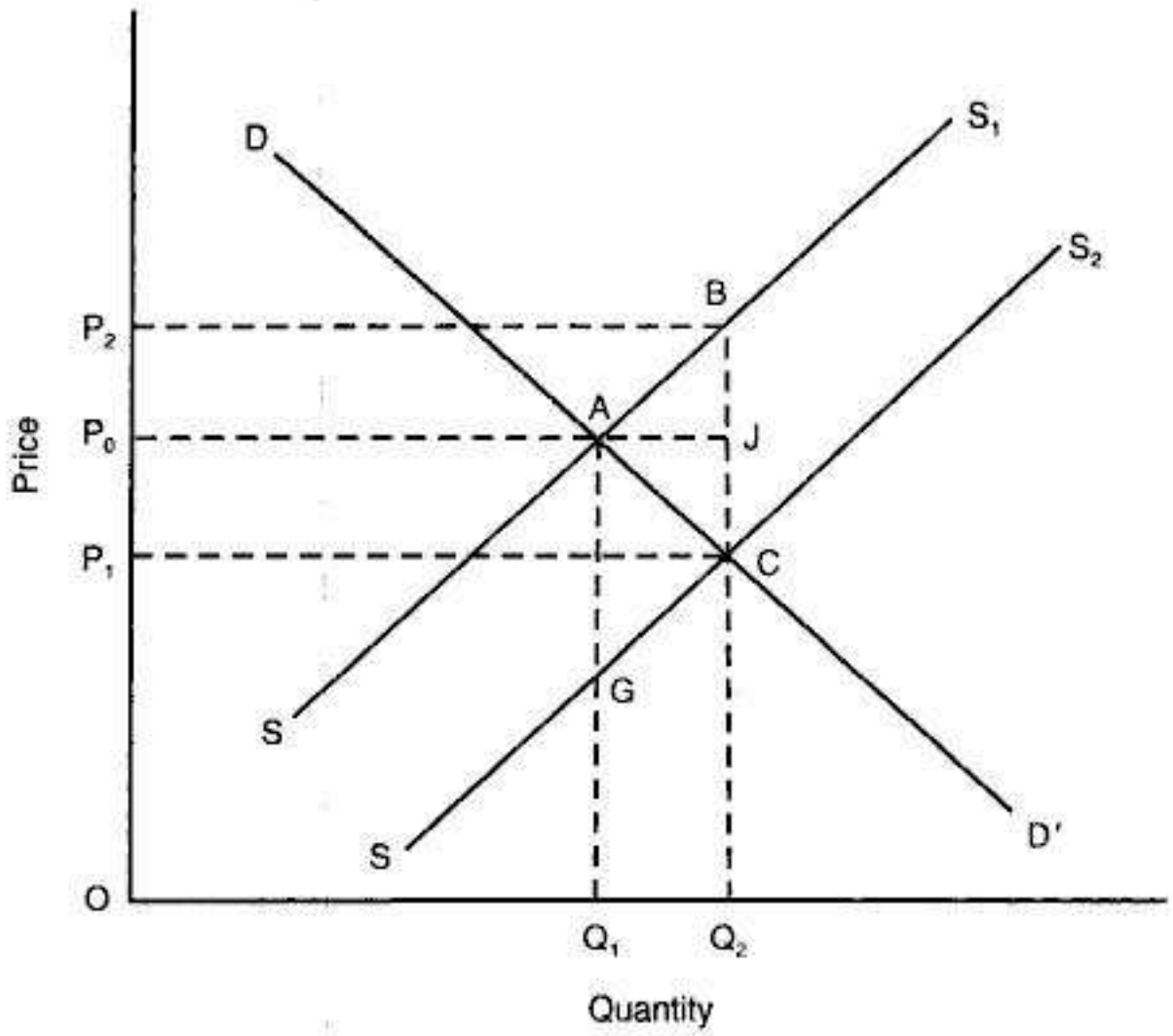


Fig. 5.3 Effect of Production Subsidy

5.2.2 Who Benefits from Production Subsidy?

The term production subsidy makes one feel that the entire benefit goes to producers. But not quite so. In fact, a part of the benefit gets passed on to the consumers. As Fig. 5.3 shows, grant of subsidy creates a difference between the price consumers pay and the price that producers receive. At new equilibrium, the price that consumers pay equals $OP_1 = CQ_2$ and the price that producers receive equals $BQ_2 = OP_2$. The difference between the two prices equals subsidy, i.e, $BQ_2 - CQ_2 = BC$ = subsidy. Note that at the new equilibrium, consumers are now required to pay a lower price, CQ_2 or OP_1. Therefore, consumers benefit by $OP_0 - OP_1 = P_0P_1 = JC$. Thus, a part of subsidy ($JC = P_0P_1$) goes to the consumers. The part of subsidy that is retained by the producers equals $BC - JC = BJ$ or $P_1P_2 - P_0P_1 = P_0P_2$. Clearly, subsidy benefits both the producers and the buyers. It may be noted at the end that the proportion of benefits that flows to the producers and to the buyers depends on the elasticities of demand and supply: ***the lower the elasticity, the higher the gains from subsidy and vice versa.***

5.3 EFFECTS OF PRICE CONTROLS

Market determined prices are, in some cases, unreasonably and unaffordably high. Such price levels are not desirable for the society: they hurt the weaker sections the most. Even otherwise, market mechanism does not always work efficiently. It has its own failures and shortcomings which make the government intervention inevitable. One of the most common forms of the government interventions is the statutory control of prices. In this section, we will apply the demand-and-supply model to see the effects of price controls.

Figure 5.4 illustrates the effects of price control on demand and supply. Demand curve DD' and supply curve SS' intersect at point E determining the pre-control equilibrium level of production at OQ_0 and price at OP_0. Price OP_0 is market clearing price in the absence of price control.

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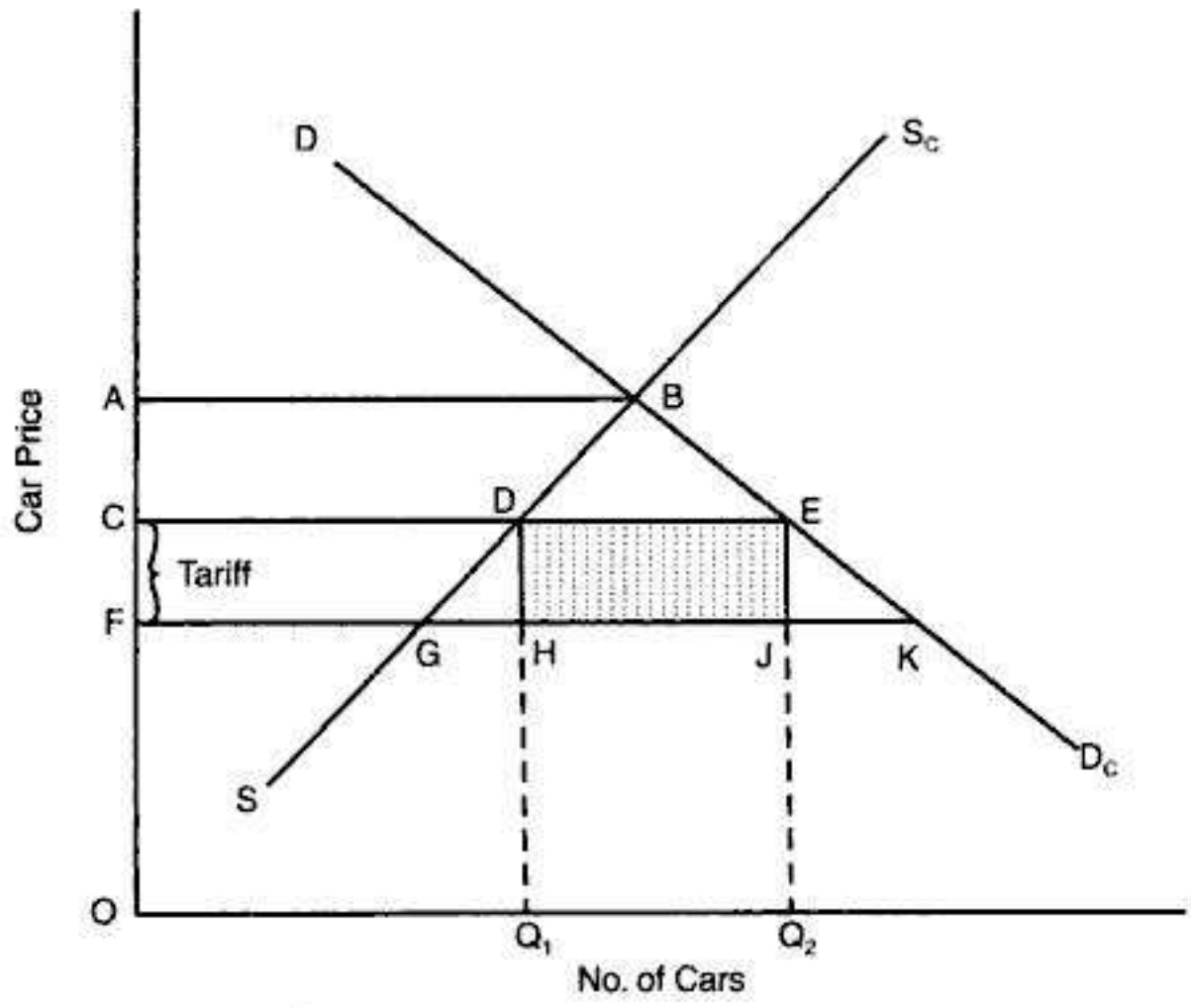


Fig. 5.5 Effects of Import Tariff

Fig. 5.5. In the absence of car import, car market equilibrium is determined at point B and the country produces and consumes AB number of cars at price OA.

Let the country now open trade in cars and allow import of unlimited number of cars. Suppose price of foreign cars is given at OF in Fig. 5.5. With trade opened, car price in the country falls from OA to OF. At car price OF, total demand for car increases from AB to FK. Of the total demand, FK, domestic car companies supply only FG and rest of the demand is met with imports. Total import of cars equals $FK - FG = GK$.

Let the government impose a specific tariff of CF on imported cars. As a result, car price increases in the domestic market from OF to $OC = OF + CF$. Due to increase in car price, domestic demand for car decreases from FK to CE of which CD is supplied domestically and DE is imported.

Look at the ***effects of import tariff***. Two obvious effects of import tariff are: (i) domestic production of car increases from FG to CD, and hence increases domestic employment, and (ii) government makes a revenue from import duty equal to $DE \times CF$. Since import tariff $CF = DH$, total revenue from import duty equals $DH \times DE = DEJH$ as shown by the shaded rectangle.

5.4.2 Export Subsidy

Export subsidy is similar to production subsidy. The objective of export subsidy is to increase exports with a view to increasing employment and export earning. The effect of export subsidy is illustrated in Fig. 5.6. The curve DD_C is the domestic demand curve and SS_C is the domestic supply curve for motor cars. In the absence of export of cars, the market equilibrium is given at point B which shows total production at OQ_2 at market clearing price $OA = BQ_2$.

Let us assume that car price in foreign market is OC. Therefore, cars will be exported at a price higher than the domestic price (OA). As a result, car price increases in the domestic market from OA to OC. At this price, total production increases from AB to CF. Of the total production (CF), CE is consumed domestically and EF is exported.

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REVIEW QUESTIONS AND EXERCISES

1. Explain and illustrate graphically how imposition of excise tax on a commodity affects its price and production. The entire excise tax is intended to be borne by the buyers. But do the buyers bear the entire excise tax in reality? If not, why? Illustrate your answer.
2. Suppose price-elasticity of demand for a commodity is 0.05 and price-elasticity of its supply is 1.0 and a tax of Rs 50 per unit is imposed on the commodity. Find the amount of tax that buyers and sellers will have to bear per unit of commodity.
3. Suppose that the government grants subsidy to the producers of a commodity. Does the entire benefit of production subsidy go to the producers? If not, what determines the share of producers and consumers in the subsidy? Illustrate your answer by using demand and supply curves.
4. Using demand and supply curves illustrate how a production subsidy affects the price and production of a subsidized commodity. Does the entire benefit of production subsidy go to the producers? If not, then what determines the share of producers and consumers in production subsidy?
5. Why does control of prices of some commodities by the government become inevitable? How does price control affect the availability of the commodity whose price is controlled by the government?
6. What is the objective of import tariff? Explain and illustrate graphically how import of a commodity imposed with import tariff is affected? What are its other effects?
7. What is the objective behind the grant of export subsidy? Illustrate graphically how export of commodity provided with export subsidy is affected? What are financial implications of export subsidy?

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PART III

THEORY OF CONSUMER BEHAVIOUR

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6 Theory of Consumer Behaviour: Cardinal Utility Approach

CHAPTER OUTLINE

6.1 Introduction
6.2 The Concept of Cardinal Utility and Its Measurement
6.3 Total and Marginal Utility
6.4 The Law of Diminishing Marginal Utility
6.5 Consumer Equilibrium: Cardinal Utility Approach
  6.5.1 Assumptions
  6.5.2 Consumer Equilibrium: One Commodity Case
  6.5.3 Consumer Equilibrium: The General Case
6.6 Derivation of Demand Curve
6.7 Drawbacks of Cardinal Utility Approach
Further Readings
Review Questions and Exercises

6.1 INTRODUCTION

In Chapter 3, we have discussed the theory of demand. Recall that the term 'demand' is defined as the quantity of a commodity that a consumer is willing to buy at a given price per unit of time. In this Part of the book, we are concerned with the questions: (i) *How does a consumer decide how much of a commodity to buy at a given price?* and (ii) *How does the consumer respond to change in price of the commodity,* given *his income, and prices of the related goods?* These questions take us to the ***theory of consumer behaviour***. The theory of consumer behaviour is based on an ***axiom*** that ***a consumer is a utility maximizing entity***. But the economists hold different views on whether utility is measurable in absolute terms. The classical[1] and neo-classical[2] economists held the view that *utility is cardinally or quantitatively measurable*: it can be measured in cardinal numbers like weight, height, length, temperature, air pressure, etc. Modern economists, on the other hand, hold the view that *utility is*

1. Most prominently, Jeremy Bentham, in his book *An Introduction to the Principles of Morals* (1789). For details, see Samuelson, P.A., *Economics*, 13th Edn., Ch. 19, and Hirshleifer, J., *Price Theory and Applications*, 3rd edn., (Prentice-Hall of India, New Delhi, 1987), pp. 61-64.

2. Including Gossen (1854) of Germany, William Stanley Jevons (1871) of England, Leon Walras (1874) of France, Karl Menger of Austria and Alfred Marshall (1890) of England (the numerals in parentheses are the years in which their view was published). Marshall made significant refinements in the 'neo-classical utility theory' which earned the name "Marshallian Utility Analysis".

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not cardinally measurable. It can be measured only in ordinal terms, i.e., in terms of 'less than' or 'more than'. Further advances and refinements[1] in the utility theory have not been able to resolve the issue of measurability of utility. However, based on ***cardinal*** and ***ordinal*** measures of utility, there are ***two approaches*** to the analysis of ***consumer behaviour***. In this chapter, we have discussed the ***cardinal utility theory of consumer behaviour***. Consumer theory based on ordinal utility approach will be discussed in the next chapter.

6.2 THE CONCEPT OF CARDINAL UTILITY AND ITS MEASUREMENT

The concept of 'utility' was introduced to social thoughts by Bentham in 1789 and to economic thoughts by Jevons in 1871. In general sense, utility is the 'want satisfying power' of a commodity. In economic sense, *utility is a psychological phenomenon : it is a feeling of satisfaction, pleasure, happiness or well-being which a consumer derives from the consumption or possession of a commodity.* As regards the measurement of utility, some early psychological experiments on individuals' response to different kinds of stimuli led the neo-classical economists to believe that 'utility' is measurable in cardinal terms, i.e., it can be expressed in terms of cardinal numbers– 1, 2, 3, ...

The neo-classical economists devised the following system to measure the utility of a commodity. A neo-classical economist, Walras, coined a term 'util', meaning 'units of utility' and used money as the measure of utility with the following assumptions:

(i) utility of a commodity equals the money a consumer is willing to pay for it;
(ii) marginal utility of money remains constant; and
(iii) one util = one unit of money, e.g., Re 1 = 1 util;

Going by this method of measuring utility, the utility of a commodity for a consumer equals the money (the price) which he or she is willing to pay for the commodity. For example, if a thirsty person is willing to pay Rs 50 for one can of Pepsi, his/her utility of one can of Pepsi is 50 utils.

This method of measuring utility has been rejected by the modern economists as it was realised over time that absolute or cardinal measurement of utility is not possible. The difficulties in measuring utility proved insurmountable. Money was not found to be a reliable measure of utility because the utility of money changes with its stock. Neither economists nor psychologists nor other scientists could devise a reliable technique or instrument for measuring the feeling of satisfaction or utility. The modern economists have, therefore, discarded the concept of cardinal utility.

Notwithstanding the problems in quantitative measurement of utility, the consumption theory based on cardinal utility concept provides a deep insight into the consumer psychology and consumer behaviour and it remains an indispensable part of economic theory. In fact, it serves as a starting point in the study of further advances in the theory of consumer behaviour. In this chapter, we discuss the theory of consumer behaviour based on cardinal utility concept. The consumer theory based on ordinal utility will be discussed in the next chapter.

6.3 TOTAL AND MARGINAL UTILITY

According to the cardinal utility approach, it is possible to measure and express ***total*** and ***normal marginal utility*** in quantitative terms. Total utility (*TU*) from a single commodity, may be defined as the sum of the utility derived from all the units consumed of the commodity. For example, if a

1. See for example, John von Neumann and Oskar Morgenstern, *Theory of Games and Economic Behaviour* (Princeton University Press, Princeton, 1947) and M. Friedman and L.J. Savage, "The Utility Analysis of Choices Involving Risk", *Journal of Political Economy*, August, 1948, pp. 273-304.

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consumer consumes 4 units of a commodity and derives U_1, U_2, U_3 and U_4 utils from the successive units consumed, then

$$TU = U_1 + U_2 + U_3 + U_4$$

If he consumes n units, then his total utility (TU) from n units may be expressed as

$$TU_n = U_1 + U_2 + U_3 + ... + U_n .$$

In case number of commodities consumed is greater than one, then

$$TU = TU_x + TU_y + TU_z + ... + TU_n .$$

where subscripts x, y, z and n denotes commodities.

The ***marginal utility*** can be defined as the utility derived from the marginal or the last unit consumed. Marginal utility is defined also as the addition to the total utility derived from the consumption or acquisition of one additional unit. More precisely, marginal utility (MU) is the change in the total utility resulting from the consumption of one additional unit. Thast is,

$$MU = \frac{\Delta TU}{\Delta C}$$

where ΔTU = change in total utility, and ΔC= change in consumption by one unit.

Marginal utility (MU) may also be expressed as

$$MU = TU_n - TU_{n-1}$$

where TU_n = total utility derived from the consumption of n units and TU_{n-1} = total utility derived from the consumption of $n-1$ units.

6.4 THE LAW OF DIMINISHING MARGINAL UTILITY

The law of diminishing marginal utility is central to the cardinal utility analysis of the consumer behaviour. This law states that as the quantity consumed of a commodity increases per unit of time, the utility derived by the consumer from the successive units goes on decreasing, provided the consumption of all other goods remains constant. This law stems from the facts (i) that the utility derived from a commodity depends on the intensity or urgency of the need for that commodity, and (ii) that as more and more quantity of a commodity is consumed, the intensity of desire decreases. For these reasons, the utility derived from the marginal unit goes on diminishing. For example, suppose you are very hungry and you are offered sandwiches to eat. The satisfaction which you derive from the first piece of sandwich would be the maximum because intensity of your hunger is the highest. When you eat the second piece, you derive a lower satisfaction because intensity of your hunger is reduced. As you go on eating more sandwiches, the intensity of your hunger goes on decreasing and therefore the satisfaction which you derive from the successive units goes on decreasing. If you continue to eat sandwiches, a point is reached when your hunger is fully satisfied and, therefore, the last piece of sandwich gives you zero utility. Eating sandwhiches any more will give you a negative utility in the form of discomfort or stomach ache. This relationship between quantity consumed and utility derived from each successive unit consumed is called the ***law of diminishing marginal utility***.

Numerical example. Table 6.1 presents a numerical illustration of the law of diminishing marginal utility. As the table shows, total utility increases with increase in consumption of sandwiches, but at a decreasing rate. It means that MU decreases with increase in consumption. This is shown in the last column of the table.

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Table 6.1 Total and Marginal Utility

Sandwiches	Total Utility	Marginal Utility = $TU_n - TU_{n-1}$
1	40	40 – 0 = 40
2	70	70 – 40 = 30
3	90	90 – 70 = 20
4	100	100 – 90 = 10
5	100	100 – 100 = 00
6	90	90 – 100 = –10

It may be seen in the table that the total utility reaches maximum at 100 at 5 sandwiches consumed. Here, $MU = 0$. Consumption of the 6th sandwich yields negative utility and the total utility starts declining.

Graphical illustration. The law of diminishing marginal utility is graphically illustrated in Figure 6.1. The total utility (TU) and marginal utility (MU) curves have been obtained by plotting the data given in Table 6.1. The total utility curve (TU) is rising till the 5th sandwich is consumed. Note that the TU curve is rising but at a diminishing rate. It shows decrease in the MU, i.e., the utility added to the total. The diminishing MU has been shown by the MU curve. Beyond 5 sandwiches consumed, the marginal utility turns negative. It means that additional consumption of sandwiches yields disutility in the form of discomfort.

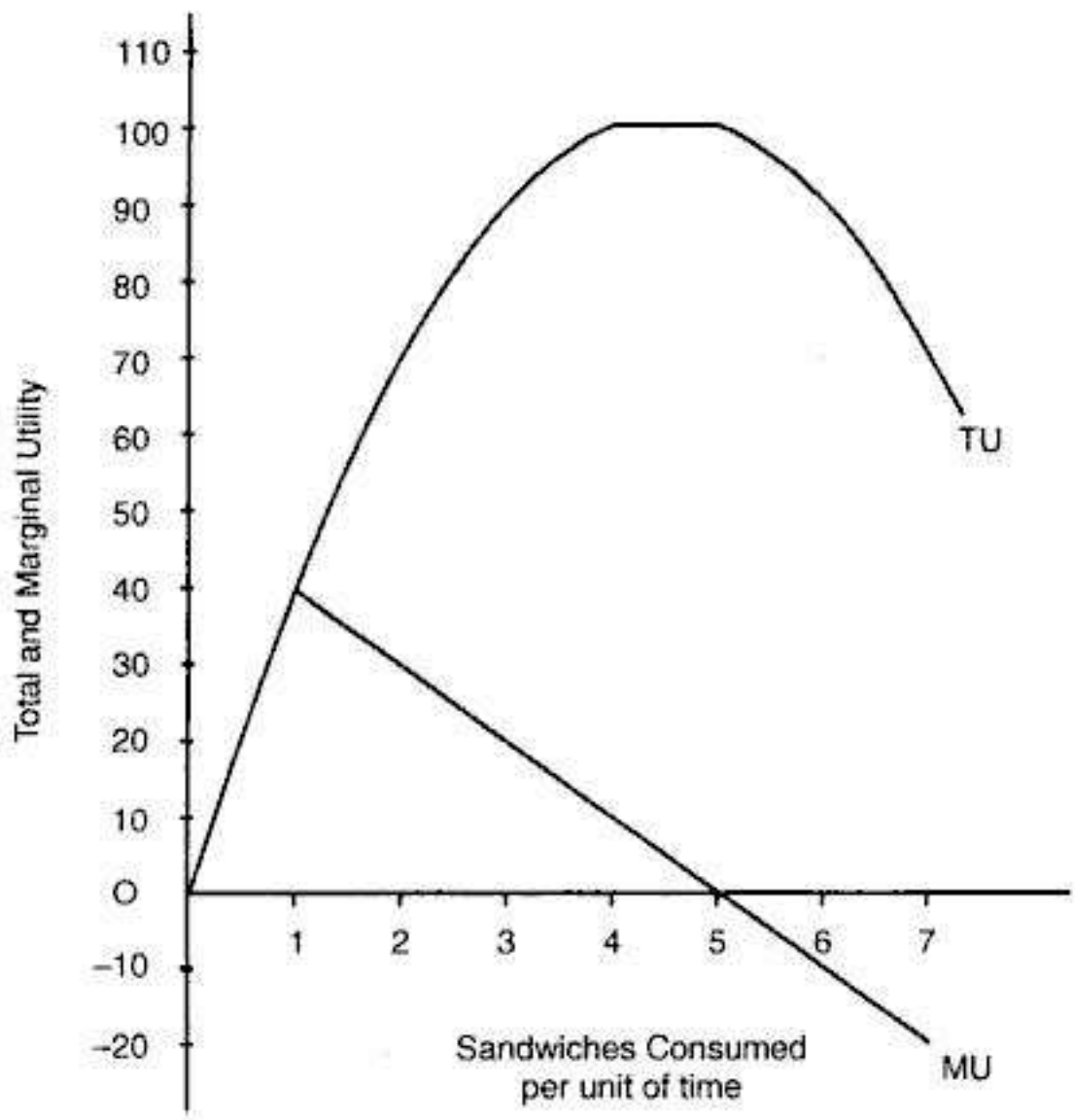


Fig. 6.1 Total and Marginal Utility

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Assumptions. The law of diminishing marginal utility holds only under certain given conditions. These conditions are often referred to as the *assumptions* of the law.

First, the unit of the consumer goods must be standard, e.g., a cup of tea, a bottle of cold drink, a pair of shoes or trousers etc. If the units are excessively small or large, the law may not apply.

Second, consumer's taste and preference remain unchanged during the period of consumption.

Third, there must be continuity in consumption and where break in continuity is necessary, it must be appropriately short.

Fourth, the mental condition of the consumer remains normal during the period of consumption. For, if a person is eating and also drinking (alcohol) the utility pattern will not be certain.

Given these conditions, the law of diminishing marginal utility holds universally. In some cases, e.g., accumulation of money, collection of hobby items like stamps, old coins, rare paintings and books, and melodious songs, marginal utility may initially increase rather than decrease, but it does decrease eventually. That is, the law of marginal utility generally operates universally.

6.5 CONSUMERS'S EQUILIBRIUM : CARDINAL UTILITY APPROACH

A consumer reaches equilibrium position when he maximises his total utility given his income and prices of commodities he consumes. Analysing consumer's equilibrium requires answering the question 'how does a consumer allocate his money income among the various goods and services he consumes to arrive at his equilibrium'?

The cardinal utility approach or what is called also as the Marshallian approach to consumer's equilibrium is based on the following assumptions.

6.5.1 Assumptions

1. Rationality. It is assumed that the consumer is a rational being in the sense that he satisfies his wants in order of their merit. It means that he buys first a commodity which yields the highest utility and he buys last a commodity which gives the least utility.

2. Limited money income. The consumer has a limited money income to spend on the goods and services he chooses to consume.

3. Maximisation of satisfaction. Every rational consumer intends to maximise his satisfaction from his given money income.

4. Utility is cardinally measurable. The cardinalists assume that utility is cardinally measurable, i.e., it can be measured in absolute terms and in cardinal numbers.

5. Diminishing marginal utility. The cardinalist assumed that the utility gained from successive units of a commodity consumed decreases as a consumer consumes more and more units of it.

6. Constant utility of money. The marginal utility of money remains constant whatever the level of consumer's income and each unit of money has utility equal to 1.

7. Utility is additive. Cardinalists maintain that utility is not only cardinally measuable but also it is additive. The additivity of the utility can be expressed through a utility function. Suppose that the basket of goods and services consumed by a consumer contains n items, and their quantities may be expressed as $x_1, x_2, x_3, ..., x_n$. The utility function of the consumer may be expressed as

$$U = f(x_1, x_2, x_3, ..., x_n)$$

Given the utility function, the total utility obtained from n items may be expressed as

$$U_n = U_1(x_1) + U_2(x_2) + U_3(x_3) .... + U_n(x_n)$$

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6.5.2 Consumer Equilibrium : One Commodity Case

Having noted the assumptions of cardinal utility approach, we turn to analyse consumer's equilibrium. As a general rule, a utility maximising consumer consuming several commodities reaches his equilibrium when he maximizes his total utility. To illustrate consumer's equilibrium, let us begin with a simple ***one commodity case***. Suppose that a consumer with certain money income consumes only one commodity, X. Since both his money income and commodity X have utility for him, he can either spend his money income on commodity X or retain it with himself. If he has total money and no commodity X, marginal utility of money will be lower than that of commodity X. So long as marginal utility of commodity X (*i.e.*, MU_x) is greater than marginal utility of money income (MU_m), total utility can be increased by exchanging money for the commodity. Therefore, a utility maximising consumer exchanges his money income for the commodity so long as $MU_x > MU_m$. As assumed earlier marginal utility of commodity of X is subject to diminishing returns (assumption 5), whereas marginal utility of money income (MU_m) remains consant (assumption 6). Therefore, the consumer will exchange his money income for commodity X so long as $MU_x > P_x (MU_m)$. The utility maximising consumer reaches his equilibrium with the level of his maximum satisfaction where

$$MU_x = P_x (MU_m) : (\text{where } MU_m = 1) \tag{6.1}$$

Alternatively, the consumer reaches equilibrium where,

$$\frac{MU_x}{P_x (MU_m)} = 1 \tag{6.2}$$

Consumer's equilibrium in a *single-commodity case* is illustrated graphically in Fig. 6.2. The horizontal line $P_x (MU_m)$ shows the constant utility of money weighted by P_x, the price of commodity X, and MU_m curve represents the diminishing marginal utility of commodity X.

The $P_x (MU_m)$ line and MU_x curve intersect at point E, where $MU_x = P_x (MU_x)$. Therefore, consumer is in equilibrium at point E. At any point above E, $MU_x > P_x (MU_m)$. Therefore, if consumer exchanges his money income for commodity X, he increases his satisfaction per unity of commodity. At any point below E, $MU_x < P_x (MU_m)$, the consumer can therefore increase his satisfaction by reducing his purchase. That is, at any point other than E, consumer gets satisfaction less than maximum. Therefore, point E is the point of consumer's equilibrium.

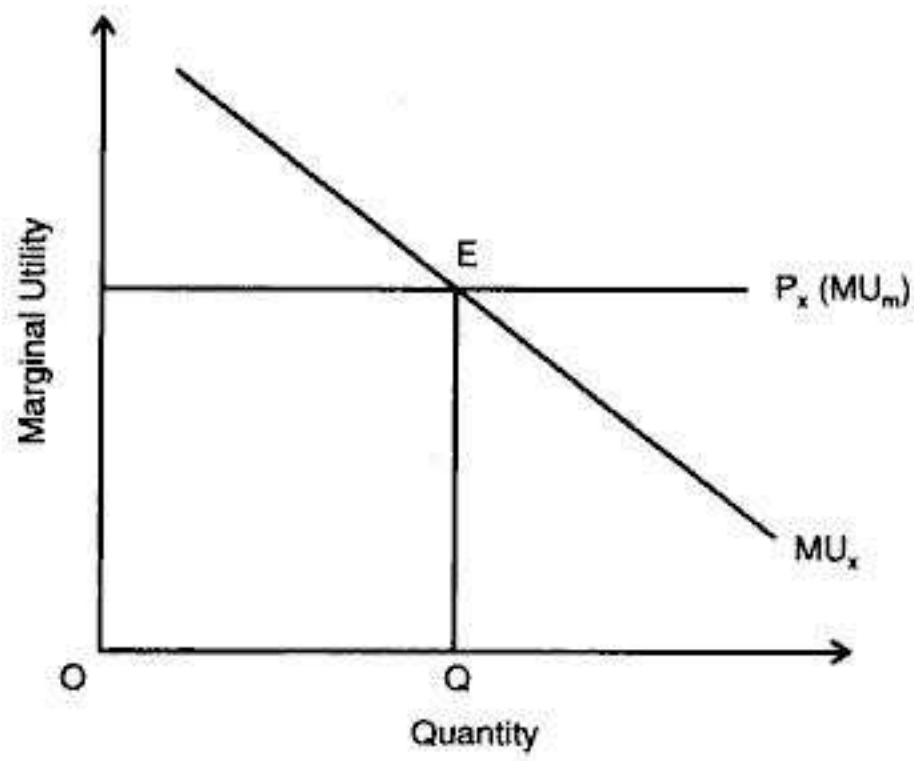


Fig. 6.2 Consumer's equilibrium: One Commodity Case

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6.5.3 Consumer Equilibrium : The General Case

We have explained above consumer's equilibrium in a single commodity case. In reality, however, a consumer consumes a large number of goods. Let us now see how a consumer consuming several goods reaches his equilibrium.

We know that the *MU* schedules of various commodities may not be the same. Some commodities yield higher utility and some lower. *MU* of some goods decreases more rapidly than that of others. A rational and utility maximising consumer consumes commodities in the order of their utilities. He picks up the commodity which yields the highest utility and next he picks up the commodity which yields the second highest utility and so on. He switches his expenditure from one commodity to another in accordance with their marginal utility. He continues to switch his expenditure from one commodity to the other till he reaches a stage where *MU* of each commodity *per unit of expenditure* is the same. This is called the **law of equi-marginal utility.**

The Law of Equi-Marginal Utility

Let us now present the law of equi-marginal utility in a simple two-commodity case. Let us suppose that a consumer consumes only two commodities *X* and *Y*, their prices being P_x and P_y, respectively. Following the equilibrium rule of single commodity case, the consumer distributes his income beteween commodities *X* and *Y* so that

$$MU_x = P_x(MU_m)$$

and $$MU_y = P_y(MU_m)$$

or alternatively, consumer is in equilibrium where

$$\frac{MU_x}{P_x(MU_m)} = 1 \tag{6.2.1}$$

and $$\frac{MU_y}{P_y(MU_m)} = 1 \tag{6.2.2}$$

Eqs. (6.2.1) and (6.2.2) may be combined to express consumer's equilibrium condition as follows.

$$\frac{MU_x}{P_x(MU_m)} = 1 = \frac{MU_y}{P_y(MU_m)}$$

or $$\frac{MU_x}{MU_y} = \frac{P_x(MU_m)}{P_y(MU_m)} \tag{6.3}$$

Since, by assumption 5, *MU* of each unit of money (or each rupee) remains constant, Eq. (6.3) may be rewritten as

$$\frac{MU_x}{MU_y} = \frac{P_x}{P_y} \tag{6.4}$$

or $$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = MU_m \tag{6.5}$$

Equation (6.5) gives the utility maximization rule that the consumer reaches his equilibrium when the marginal utility derived from each rupee spent on the two commodities *X* and *Y* is the same.

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The two-commodity case provides the basis for generalising the consumer's equilibrium by cardinal utility approach. In fact, a consumer consumes a large number of goods and services with his given income and at given prices. Supposing a consumer consumes A to Z goods and services, his equilibrium condition may be expressed as follows.

$$\frac{MU_A}{P_A} = \frac{MU_B}{P_B} = \frac{MU_C}{P_C} = \ \ldots \ = \frac{MU_Z}{P_Z} = MU_m \tag{6.6}$$

Obviously, a utility maximising consumer consuming several goods and services intends to equalise the marginal utility of each unit of his money expenditure on various goods and services. This conclusion is in conformity with the general rule mentioned at the beginning of this section.

6.6 DERIVATION OF DEMAND CURVE

The basic purpose of the analysis of consumer behaviour is to derive consumer demand curve. We now turn, in this section, to derive the demand curve following the cardinal utility approach. For the derivation of the demand curve, we consider a single-commodity (X) case. According to cardinal utility approach, as stated above, a consumer reaches his equilibrium where $MU_x = P_x (MU_m)$. This logic of consumer's equilibrium provides a convenient basis for the derivation of individual demand curve for a commodity. Marshall[1] was the first economist to explicitly derive the demand curve from consumer's equilibrium condition for a single commodity, say X, as $MU_x = P_x (MU_m)$. This equilibrium condition is used to derive consumer's demand curve for commodity X as shown in Fig. 6.3 (a).

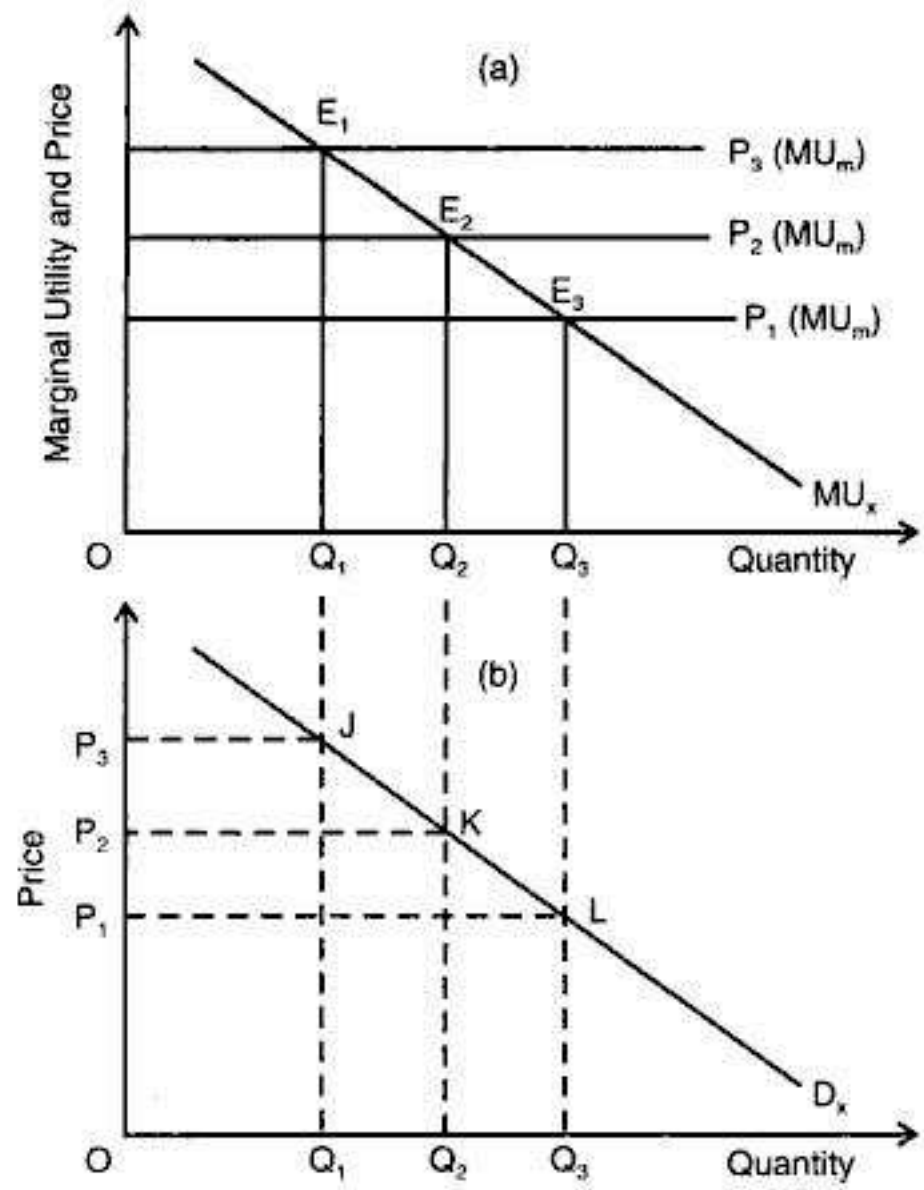


Fig. 6.3 Derivation of Demand Curve

1. A Marshall; *Principles of Economics*, Mathematical Appendix II.

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Suppose that the consumer is in equilibrium at point E_1, where given the price of X at P_3, $MU_x = P_3(MU_m)$. Here equilibrium quantity is OQ_1. Now, if price of the commodity falls to P_2, the equilibrium condition will be disturbed making $MU_x > P_3(MU_m)$. Since MU_m is constant, the only way to attain the equilibrium again is to reduce MU_x. This can be done only by buying more of commodity X. Thus, by consuming Q_1Q_2 additional units of X he reduces his MU_x to E_2Q_2 and, thereby, restores equilibrium condition, i.e., $MU_m = P_2(MU_m)$. Similarly, if price falls further he buys and consumes more to maximise his satisfaction.

Figure 6.3(a) reveals that when price is P_3, equilibrium quantity is OQ_1. When price decreases to P_2, equilibrium point shifts downward to point E_2 where equilibrium quantity is OQ_2. Similarly, when price decreases further to P_1 and $P(MU_m)$ line shifts downward, equilibrium point shift to E_3 where equilibrium quantity is OQ_3. It may be inferred from these facts that as price decreases, the quantity demanded increases. This price and equilibrium quantity relationship is presented in part (b) of Fig. 6.3. The price-quantity combination corresponding to equilibrium point E_3 is shown at point J. Similarly, the price quantity combinations corresponding to equilibrium points, E_2 and E_1 have been shown to point K and L, respectively. By joining the point J, K and L we get the demand curve for commodity X. The demand curve, D_x, is the usual downward sloping Marshallian demand curve.

Before we close the discussion on the cardinal utility theory, let us point out the major drawbacks of the cardinal utility approach.

6.7 DRAWBACKS OF CARDINAL UTILITY APPROACH

The following are the basic drawbacks of the cardinal utility theory, as pointed out by the economists.

First, the very first assumption of cardinal approach that utility is cardinally (or objectively) measurable is untenable. Utility is a subjective concept which cannot be measured objectively.

Second, cardinal utility approach assumes that marginal utility of money remains constant and serves as a measure of utility. This assumption is unrealistic because marginal utility of money, like that of all other goods, is subject to change. And, therefore, it cannot serve as a measure of utility derived from goods and services.

Third, the psychological law of diminishing marginal utility has been established from introspection. This law is accepted as an axiom without empirical verification.

Fourth, cardinal utility approach and derivation of demand curve on the basis of this approach, are based on the *ceteris paribus* assumption which is unrealistic. It is for this reason that this theory ignores the ***substitution*** and ***income effects*** which might operate simultaneously.

Finally, cardinal approach considers that the effect of price changes on demand curve is exclusively price effect. This assumption is also unrealistic because price effect may include income and substitution effects.

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REVIEW QUESTIONS AND EXERCISES

1. What is meant by utility? Distinguish between the cardinal and ordinal measures of utility. What are the problems in cardinal measurement of utility?
2. Distinguish between the total utility and the marginal utility. Show that total utility is maximum when marginal utility equals zero?
3. Explain the law of diminishing utility. Illustrate your answer with appropriate diagrams. Discuss also the assumptions and limitations of this law.
4. What is meant by the consumer's equilibrium? What is the condition of the consumer's equilibrium under cardinal utility approach?
5. (a) Suppose the price of a commodity is given at Rs 8 and the marginal utility schedule for 4 units consumed is given, respectively, as 12 utils, 10 utils, 8 utils, and 6 utils. What is equilibrium quantity?

   (b) Explain the limitations of the equilibrium under cardinal utility approach.
6. Explain the relationship between the law of diminishing marginal utility and the law of demand. Using this relationship derive a demand curve.
7. Suppose the marginal utility schedule for 6 units consumed of a commodity is given as follows.

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Units Consumed	1	2	3	4	5	6
Marginal utils	100	80	60	40	20	0

Find the equilibrium quantity at price Rs 110, Rs 80, Rs 50, and Rs 0.0 assuming (a) the commodity is divisible, and (b) the commodity is indivisible.

8. From the data given in the following table, derive *TU* and *MU* curves, and find equilibrium quantity at price Rs 15.

Units	1	2	3	4	5	6	7	8
TU	30	55	75	90	100	100	90	75

9. Which of the following statements is Not Correct?
   (a) Utility is an inherent quality of commodity.
   (b) Utility is an absolute concept.
   (c) A consumer is in equilibrium when per rupee *MU* from all the goods he/she consumes is the same.
   (d) The total utility is maximum when $MU = 0$.
   (e) The total utility falls when $MU < 0$.
   (f) At equilibrium, Price = *MU*.
   (g) At equilibrium, *MU* derived from all goods consumed by a consumer is the same even if price is different.
   (h) Any point on the *MU*-curve can be a point of equilibrium.
   (i) Marginal utility of money does not remain constant.

[Ans.(b) and (g)]

10. Cardinal utility approach assumes which of the following?
   (a) *MU* of money is variable,
   (b) *MU* of money remains constant, or
   (c) *MU* of money is greater than commodity utility?

11. A consumer consuming three goods, *A*, *B* and *C*, is in equilibrium when *MU* (*A*) = *MU* (*B*) = *MU*(*C*) under which of the following conditions.
   (a) prices of *A*, *B* and *C* remains constant.
   (b) prices of three goods are equal.
   (c) prices decrease with decrease in *MU*?

[Ans 10 (b), 11 (b)]

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7.12 Goods, Bads, Neuters
7.13 Comparison of Cardinal and Ordinal Utility Approach
7.13.1 Similarity between the Two Approaches
7.13.2 Superiority of Indifference Curve Approach
7.13.3 Critique of Indifference Curve Approach
Further Readings
Review Questions and Exercises

7.1 INTRODUCTION

We have explained the cardinal utility theory of consumer behaviour in the preceding chapter. This chapter presents ordinal utility analysis of consumer behaviour. Ordinal utility approach uses indifference curve to analyse consumer behaviour. The indifference curve was invented and used by Francis Y. Edgeworth[1] (1881) to show the possibility of commodity exchange between two individuals. About a decade later, Irving Fisher[2] used indifference curve in 1892 to explain consumer's equilibrium. Both Edgeworth and Fisher believed only in cardinal measurability of utility. It was Vilfred Pareto[3] who introduced, in 1906, the ordinal utility hypothesis to the indifference curve analysis. In the subsequent decades, many significant contributions were made by Eugene E. Slutsky[4], W.E. Johnson[5] and A. L. Bowley[6]. Yet, indifference curve technique could not gain much ground in the analysis of consumer behaviour till the early 1930s. It was in 1934 that John R. Hicks and R.G.D. Allen[7] developed the ordinal utility theory as a powerful analytical tool of consumer analysis. Later, Hicks provided a complete exposition of indifference curve technique in his *Value and Capital*, though in his later work, *A Revision of Demand Theory*, he dropped some of his earlier assumptions. Indifference analysis is regarded at present as the most powerful tool of consumer analysis. We begin our discussion on the ordinal utility approach with a brief description of the ordinal utility concept and indifference curve.

7.2 THE CONCEPT OF ORDINAL UTILITY

Ordinal utility is not a quantity or a numerical value. It is only an expression of the consumer's preference for one commodity over another or for one basket of goods over another. The concept of ***Ordinal utility*** is based on the following axioms.

(i) It may not be possible for a consumer to express his utility in quantitative terms. But it is always possible for him to tell which of any two goods he prefers. For example, an individual may not be able to specify ***how much*** utility he derives by eating a chocolate. But he can always tell what he prefers between chocolate and ice-cream, between a pair of shoes and a fancy hat, and so on.

(ii) A consumer can list all the commodities he consumes in the order of his preference.

---

1. Francis Y. Edgeworth, *Mathematical Physics*, London, C.R. Paul & Co., 1881.
2. Irving Fisher, *Mathematical Investigations in the Theory of Value and Prices*, 1892.
3. Vilfred Pareto, *Menual d' Economic Politique*, Paris, V. Giard and E Bre're/1909, First published in Italian in 1906.
4. Eugene E. Slutsky, "On the Theory of the Budget of the Consumer," reprinted in *Readings in Price Theory*, (eds) K.E. Boulding and G.I. Stigler, 1953.
5. W.E. Johnson, "The Pure Theory of Utility Curve," *Economic Journal*, December 1913.
6. A.L. Bowely, *Mathematical Groundwork*, 1924.
7. John R. Hicks and R.G.D. Allen, in their paper, "A Reconsideration of the Theory of Value, *Economica*, February–May 1934.

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many times as one wants, each time generating a new indifference curve. The set of indifference curves make the ***indifference map*** as shown in Fig.7.2.

In fact, the area between X and Y axes is known as ***indifference plane*** or ***commodity space***. This plane is full of finite points and each point on the plane indicates a different combination of goods X and Y. Intuitively, it is always possible to locate any two or more points indicating different combinations of goods X and Y yielding the same satisfaction. It is thus possible to draw a number of indifference curves without intersecting or touching the other, as shown in Fig. 7.2. The set of indifference curves, IC_1, IC_2, IC_3, and IC_4, drawn in this manner make the ***indifference map***. In fact, an indifference map may contain any number of indifference curves ranked in the order of consumer's preferences.

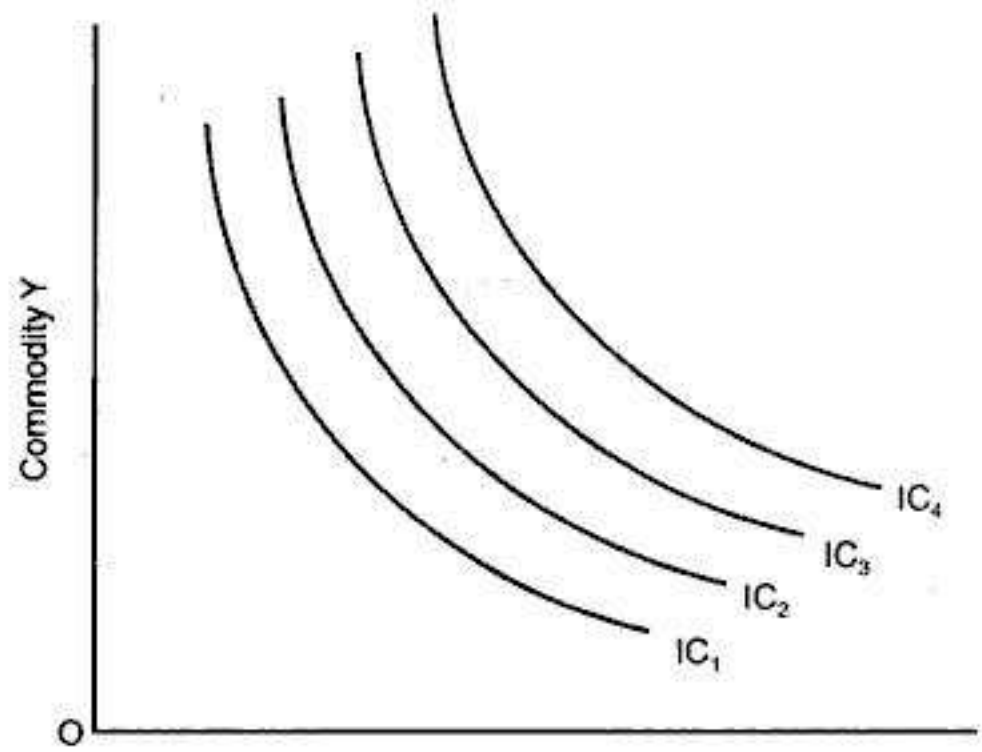


Fig. 7.2 The Indifference Map

7.3.2 The Marginal Rate of Substitution (*MRS*)

The marginal rate of substitution (*MRS*) is the rate at which one commodity can be substituted for another, the level of satisfaction remaining the same. *The MRS is given by the slope of the IC curve.*

To explain the concept of *MRS*, let us suppose that a consumer consumes only two goods X and Y and that utility function of the consumer is given as

$$U = f(X, Y) \tag{7.1}$$

(where X and Y are substitutes).

Let us now suppose that the consumer substitutes X for Y such that his total utility remains the same. When the consumer sacrifices some units of Y, his stock of Y decreases by ΔY and he loses a part of his total utility. His *loss of utility* may be expressed as

$$-\Delta Y \,.\, MU_y$$

On the other hand, as a result of substitution, his stock of X increases by ΔX. His *gain of utility* from ΔX equals

$$+\Delta X \,.\, MU_x$$

The total utility remains the same, only when

$$-\Delta Y \,.\, MU_y = \Delta X.\, MU_x \tag{7.2}$$

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Rearranging the terms in Eq. 7.2, we get,

$$-\frac{\Delta Y}{\Delta X} = \frac{MU_x}{MU_y}$$

Here, $\Delta Y/\Delta X$ is simply the slope of the indifference curve, which gives the $MRS_{y,x}$ when X is substituted for Y. Similarly, $\Delta X/\Delta Y$ gives $MRS_{x,y}$ when Y is substituted for X. Symbolically,

$$\left.\begin{aligned} MRS_{x,y} &= -\frac{\Delta X}{\Delta Y} = \frac{MU_y}{MU_x} \\ MRS_{y,x} &= -\frac{\Delta Y}{\Delta X} = \frac{MU_x}{MU_y} \end{aligned}\right\} = \text{Slope of indifference curve} \quad (7.3)$$

and

7.3.3 The Postulate of Diminishing Marginal Rate of Substitution

Diminishing marginal rate of substitution is one of the basic postulates of indifference curve analysis. The axiomatic assumption of ordinal utility theory is analogous to the assumption of 'Diminishing Marginal Utility' in cardinal utility theory. The postulate of diminishing marginal rate of substitution states an observed behavioural rule that when a consumer substitutes one commodity (say X) for another (say Y), the ***'marginal rate of substitution'*** (MRS) decreases as the stock of X increases and that of Y decreases. The diminishing $MRS_{x,y}$ computed from Table 7.1 is presented in Table. 7.2.

Table 7.2 The Diminishing *MRS* Between Commodities X and Y

Movements on IC	*Change in Y* $(-\Delta Y)$	*Change in X* (ΔX)	$MRS_{y,x} = (\Delta Y/\Delta X)$
From point *a* to *b*	– 10	2	– 5.0
From point *b* to *c*	– 5	5	– 1.0
From point *c* to *d*	– 4	8	– 0.5
From point *d* to *e*	– 2	10	– 0.2

As Table 7.2 shows, when the consumer moves from point *a* to *b* on the indifference curve (Fig. 7.1), he gives up 10 units of commodity Y and takes 2 units of commodity X. It gives

$$MRS_{y,x} = -\frac{-\Delta Y}{\Delta X} = -\frac{-10}{2} = 5$$

As he moves down from point *b* to *c*, he loses 5 units of Y and gains 5 units of X, giving

$$MRS_{y,x} = -\frac{-\Delta Y}{\Delta X} = -\frac{-5}{5} = 1$$

The $MRS_{y,x}$ goes on decreasing as the consumer moves further down along the indifference curve, from point *c* through *d* and *e*. The diminishing marginal rate of substitution causes the indifference curves to be *convex to the origin*.

The diminishing marginal rate of substitution can also be illustrated graphically as shown in Figure 7.3. The $MRS_{y,x}$ is given by the slope of the indifference curve.

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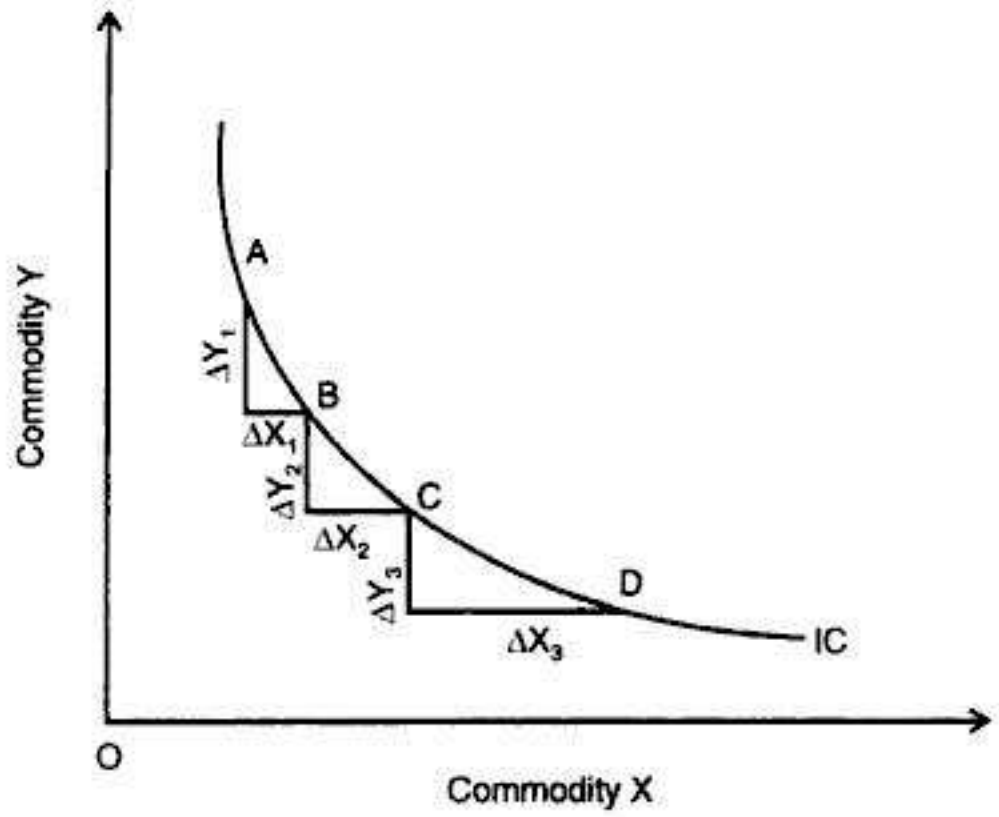


Fig. 7.3 Diminishing Marginal Rate of Substitution

As shown in Fig. 7.3, as the consumer moves from point *A* to *B*, from *B* to *C*, and from *C* to *D*, he gives up a constant quantity of *Y*, (i.e., $\Delta Y_1 = \Delta Y_2 = \Delta Y_3$). For a constant ΔY, he requires an increasing quantity of *X* (i.e., $\Delta X_1 < \Delta X_2 < \Delta X_3$) to maintain his utility at the same level. Since *MRS* equals the slope of the indifference curve, (i.e., $\Delta Y/\Delta X$), arranging slopes between point *A* through point *D* in the same order, we get

$$\frac{\Delta Y_1}{\Delta X_1} > \frac{\Delta Y_2}{\Delta X_2} > \frac{\Delta Y_3}{\Delta X_3}$$

It can be seen that $\Delta Y_1 = \Delta Y_2 = \Delta Y_3$, whereas $\Delta X_1 < \Delta X_2 < \Delta X_3$. Therefore, the $MRS_{y,x} = \Delta Y/\Delta X$ goes on decreasing as consumer moves from point *A* towards point *D*.

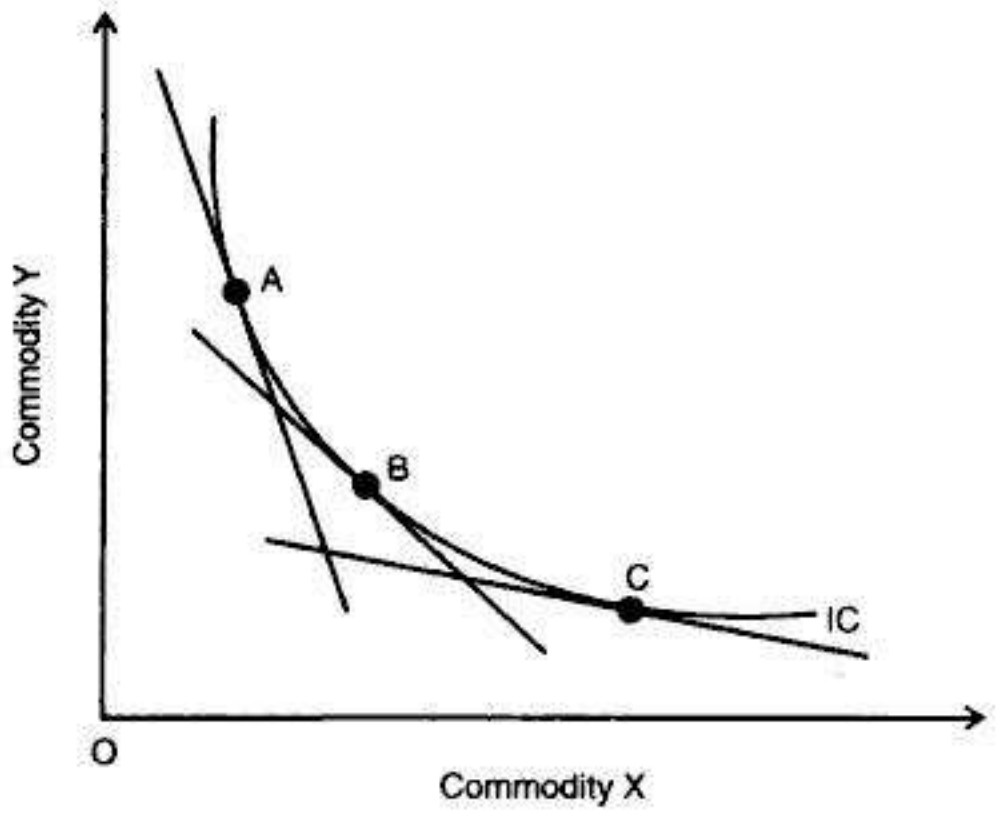


Fig. 7.4 Marginal Rate of Substitution at Different Point on IC Curve

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(*MRS*) between the two goods decreases as a consumer moves along an indifference curve. Convexity of the indifference curve is based on the postulate of diminishing marginal rate of substitution as discussed above.

(iii) Indifference curves do not intersect nor are tangent to one another. If two indifference curves intersect or be tangent to each other, it would imply that an indifference curve indicates two different levels of satisfaction or that two different combinations—one being larger than the other—yield the same level of satisfaction. Such conditions are improbable if consumer's subjective valuation of a commodity is greater than zero. Also, if two indifference curves intersect, it would mean violation of consistency or transitivity assumption in consumer's preferences.

Let us now see what happens when two indifference curves, IC_1 and IC_2, intersect at point A as shown in Fig. 7.4. Consider two other points—point B on indifference curve IC_1 and point C on indifference curve IC_2, both falling on a vertical line.

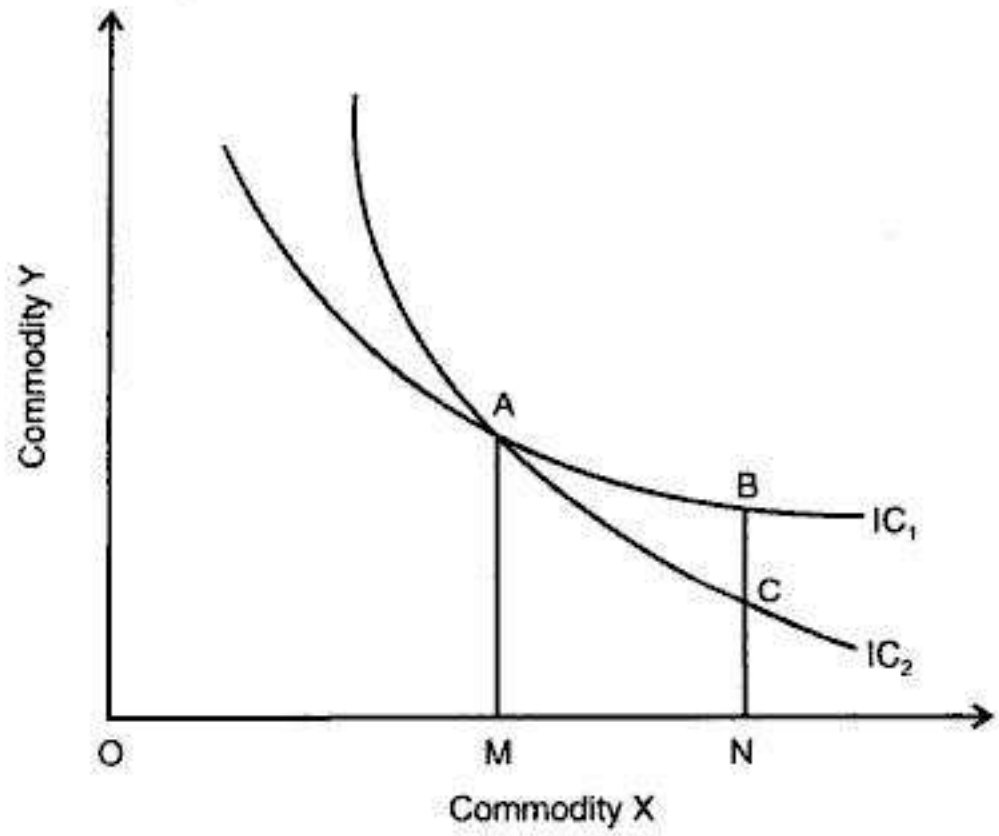


Fig. 7.5 Intersecting Indifference Curves

Points A, B and C represent three different combinations of commodities X and Y. Let us call these combinations, respectively, as A, B and C. Note that combination A is common to both the indifference curves. It implies that, in terms of utility,

$$A = B$$

and $$A = C$$

$$\therefore \quad B = C$$

But, if B equals C, it would mean that in terms of utility,

ON of X + BN of Y = ON of X + CN of Y.

Since ON of X is common to both the terms, it means that BN of Y is equal to CN of Y. But, this is not so. As Fig. 7.4 shows, $BN > CN$. Therefore, combinations B and C cannot be equal in terms of utility in the objective introspection of the consumer. The intersection, therefore, violates the transitivity rule which is a logical necessity in indifference curve analysis.

(iv) Higher indifference curves represent a higher level of satisfaction than the lower ones. An indifference curve placed above and to the right of another represents a higher level of satisfaction than the lower one. The reason is that an upper indifference curve contains all along its length a

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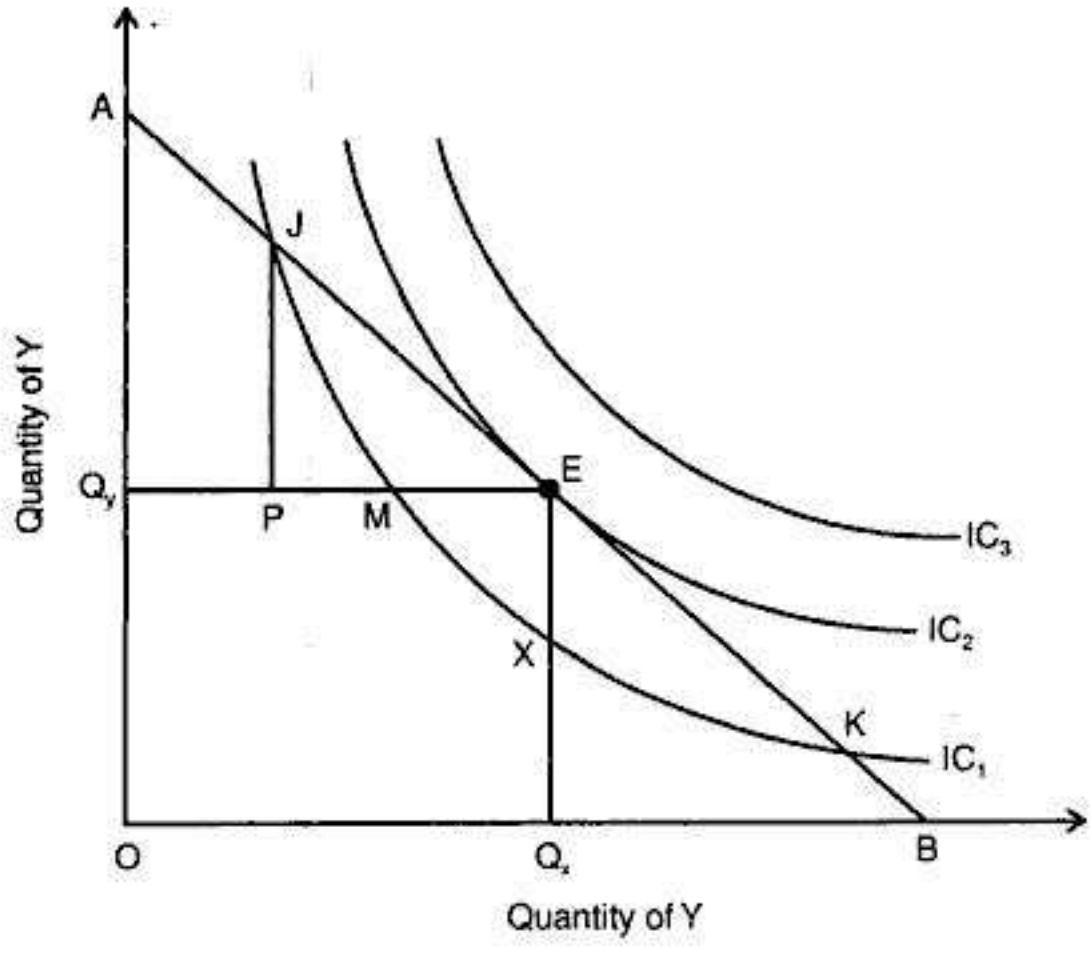


Fig. 7.10 Equilibrium of the Consumer

From the information contained in Fig. 7.10, it can be proved that the level of satisfaction at point E is greater than that on any point on IC_1. Suppose that the consumer is at point J. If he moves to point M, he will be equally well-off because points J and M are on the same indifference curve. If he moves from point J to M, he will have to sacrifice JP of Y and take PM of X. But in the market, he can exchange JP of Y for PE of X. That is, he gets extra ME (= PE – PM) of X. Since ME gives him extra utility, point E yields a utility higher than that at point M or J. Therefore, point E is preferable to points M and J. The consumer will therefore, have a tendency to move to point E from any point on IC_1, in order to reach the highest possible indifference curve, all other things (taste, preference, and prices of goods) remaining the same.

7.6.1 The Corner Solution : The Extreme Choice

Sometimes some consumers make extreme choices between a set of two substitute goods. For example, some consumers prefer to spend total money on clothing and no money on making trips to hill stations, even though they have the option of making a choice between various combinations of these goods. Some consumers behave just on the contrary. Similarly, some people prefer buying books to spending on movies and some people prefer travelling to leisure, and so on. In such cases, ***the necessary equilibrium conditions, i.e., $MRS = P_x/P_y$, does not apply.*** In this section, we use indifference curve analysis to show the choice-making behaviour of such consumers.

Figure 7.11 illustrates the case of such extreme preference of a consumer. Let us suppose that a consumer has to make choice between clothing and tours and is faced with budget line CT. His indifference map is given by indifference curves IC_1, IC_2 and IC_3. Given his budget line and indifference map, the consumer is shown to be in equilibrium at point C, ***the corner point***. This kind of solution is known as ***corner solution***. As Fig.7.11 shows, consumer's indifference curve, IC_1, intersects the budget line. Since IC_1 is a lower one, the consumer cannot maximize his utility on IC_1. However, his indifference curve IC_2 meets the budget line at corner point C. This is the point of consumer's equilibrium, the point of his maximum satisfaction. Note that in case of ***corner solution*** or ***corner***

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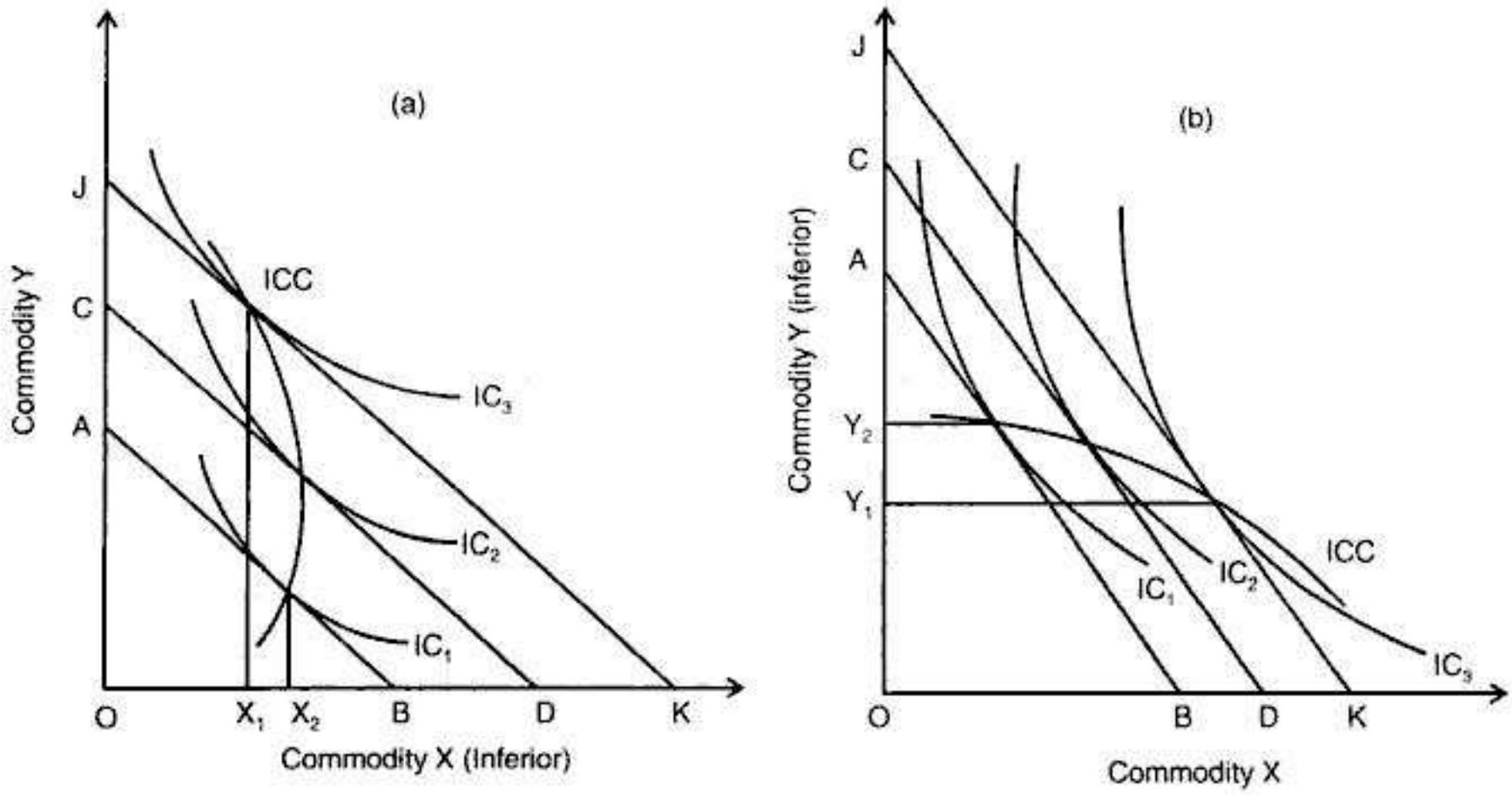


Fig. 7.14 Income Consumption Curves of Inferior Goods

7.7.3 The Engel Curve[1] and Its Derivation

Engel curve *is the graphical presentation of the relationship between equilibrium quantity purcahsed of a commodity and the consumer's income.* It should be borne in mind that *income-consumption curve (ICC) and Engel curve are not the same.* While income-consumption-curve (*ICC*) shows the relationship between consumer's income and *quantity* consumed of a commodity, Engel curve shows the relationship between money income and *money expenditure* on a particular good. However, income-consumption-curve does provide the necessary information required to draw the Engel curve. The derivation of Engel curve from the income-consumption-curve is illustrated in Fig. 7.15 (a) and (b). The income-consumption-curve in Fig. 7.15 (a) shows that consumption of commodity X increases from OX_1 to OX_2 to OX_3 and then to OX_4 as income increases from M_1 to M_2 to M_3 and to M_4 and the consumer moves from equilibrium E_1 to E_2 to E_3 to E_4. In Fig. 7.15(a), income levels have been shown on the vertical axis. The quantities demanded of X plotted in relation to the corresponding levels of income represents Engel curve, as shown in Fig. 7.15(b).

1. The 'Engel Curves' are named after a 19th-century German Statistician, Christian Lorenz Ernst Engel (1821-1896). He made a pioneering study of relationship between consumer's income and the quantity purcahsed of a commodity.

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detail the effect of price change on consumer's behaviour.

The consumer's response to change in the price of *X* and the resulting change in combination of the two goods are illustrated in Fig. 7.18.

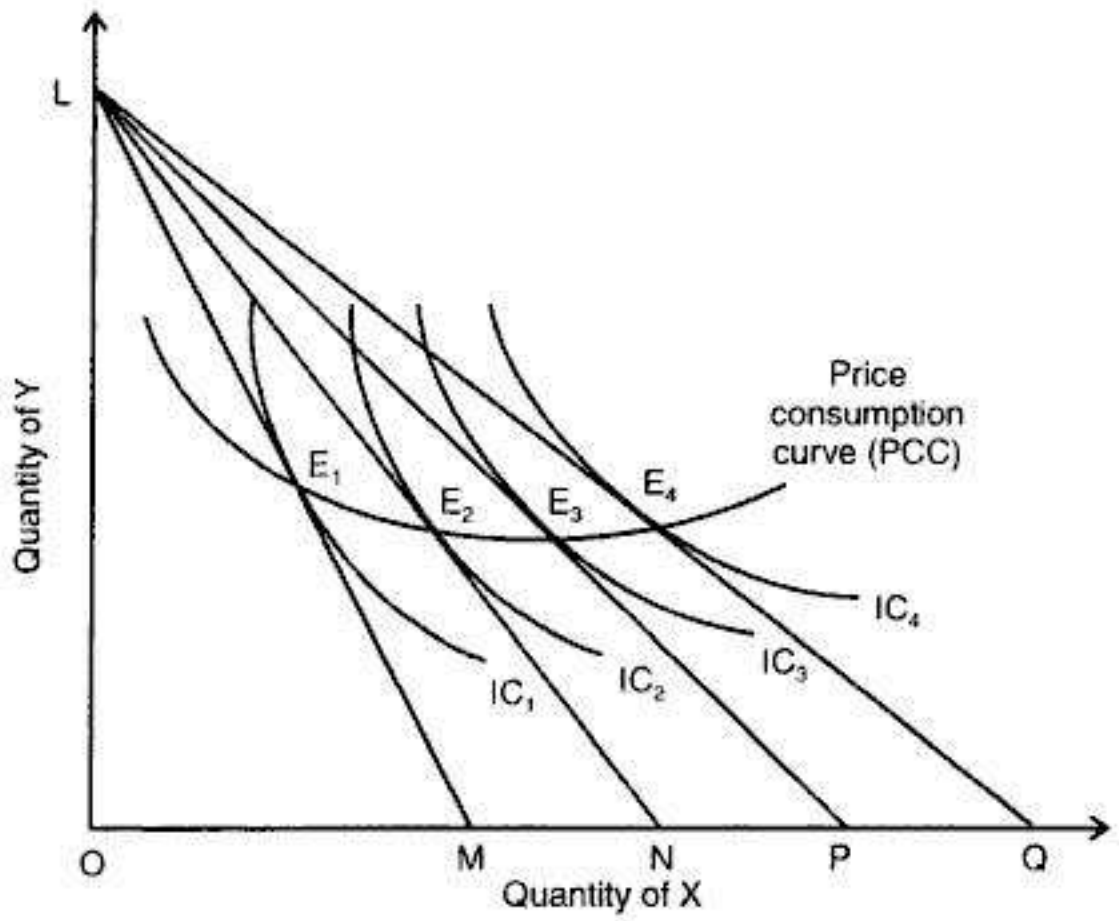


Fig. 7.18 Price Consumption Curve

Suppose that the consumer is initially in equilibrium at point E_1. Now let the price of *X* fall, *ceteris paribus*, so that consumer's budget line shifts from its initial position *LM* to the position of *LN*. This shift takes place due to increase in consumer's purcahsing power in term of *X*. With increased purcahsing power, the consumer can buy more of *X* (or more of both the goods). As a result, the consumer reaches a higher indifference curve IC_2 and his new equilibrium at E_2 occurs to the right of his original equilibrium, provided *X* is a 'normal good'. As shown in Fig. 7.18, with successive fall in the price of *X*, consumer's equilibrium shifts from E_2 to E_3 to E_4. The shift in equilibrium shows the change in equilibrium quantities of *X* and *Y*. By joining the points of equilibrium E_1, E_2, E_3 and E_4, we get a curve called ***price-consumption curve*** (*PCC*). Price-consumption-curve is a locus of points of equilibrium on indifference curves, resulting from the change in price of commodity *X* all other things remaining the same. It shows the change in consumption basket due to change in the price of commodity *X*. In other words, *PCC* show consumer's response to change in price of *X*.

7.8.2 Derivation of Consumer's Demand Curve

Consumer's demand curve for a commodity, say, commodity *X*, can be derived by using the indifference curve technique. We have illustrated the derivation of *price consumption curve (PCC)* in Figure 7.18. The *PCC* curve provides the necessary data required for drawing the demand curve. To draw individual demand curve for a commodity *X*, we need data on different prices of commodity *X* and the corresponding quantity demanded of *X*. This information is provided by the *PCC*. Derivation of demand curve for commodity *X* is illustrated in Fig. 7.19.

Figure 7.19(a) shows the derivation of *PCC*. Given his income, prices of goods *X* and *Y* and his indifference map, the consumer is shown to be initially in equilibrium at point E_1 where he consumes OX_1 of *X*. When price of *X* decreases he moves to equilibrium point E_2 where he consumes OX_2 and

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Hicksian method of measuring income effect is to reduce consumer's income (by way of taxation) so that he returns to his original indifference curve, IC_1, in accordance with the new price ratio. Hicks calls it 'income compensation approach'. This has been done by drawing an imaginary budget line ($M'N'$) parallel to MN'' and tangent to indifference curve IC_1. It means that when consumer's income is taxed away to the extent of real income-effect, his budget line MN'' shifts downward to $M'N'$. The budget line $M'N'$ is tangent to indifference curve IC_1 at point R. Point R represents the equilibrium of the consumer at new price ratio of X and Y, after the elimination of the real income-effect. It means that, after income adjustment, the consumer will move from point Q to R. The consumer's movement from point Q to R means decrease in quantity demanded of X by X_2X_3. This change in quantity demanded of X results from decrease in consumer's real income due to taxation. Therefore, X_2X_3 is the ***income effect***.

Once income effect is measured, it is easy to find the substitution effect. It can be obtained by subtracting income effect (IE) from the price effect (PE). Thus, subtracting income-effect, X_2X_3, from the price effect, X_1X_3, we get the ***substitution effect*** as follows.

$$\text{Substitution effect} = PE - IE = SE$$
$$= X_1X_3 - X_2X_3 = X_1X_2$$

In Fig. 7.20, the substitution effect (X_1X_2) occurs when the consumer moves from point P to R. In other words, consumer's movement from P to R and the corresponding change in quantity demanded (X_1X_2) is the substitution effect caused by the fall in price of X.

Income and substitution effects of price rise. Fig.7.21 illustrates the decomposition of *price effect* into *income* and *subtitution* effects of a price rise. Suppose that the consumer's initial budget

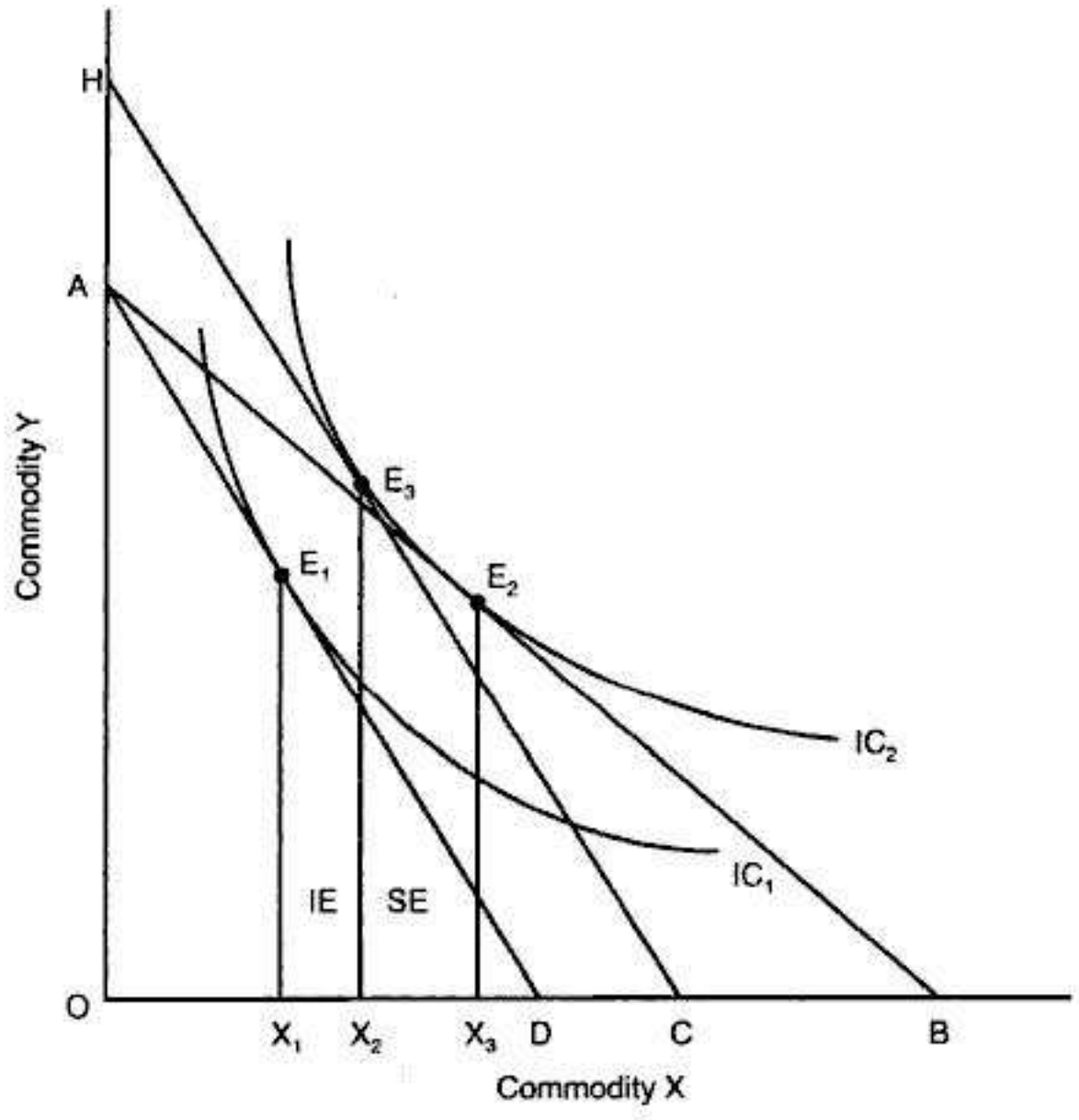


Fig. 7.21 Income and Substitution Effects of Price Rise

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7.13 COMPARISON OF CARDINAL AND ORDINAL UTILITY APPROACHES

Having outlined the indifference curve technique, let us now compare the cardinal and ordinal utility approaches to consumer's analysis and look into their relative merits.

7.13.1 Similarity Between the Two Approaches

Similar Assumptions. Most of the assumptions made under the two approaches are the same. For example, both cardinal and ordinal approaches assume consumer's rationality, transitivity of choices, limited income, perfect kknowledge and utility maximization. The *diminishing marginal utility* assumption of the cardinal utility approach is implicit in the *diminishing marginal rate of substitution* assumption of the ordinal utility approach.

Equilibrium Conditions are Identical. Both cardinal and ordinal utility approaches use identical equilibrium condition. The necessary equilibrium condition of cardinal utility approach is given as

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

and the first order equilibrium condition under ordinal utility approach is given as

$$MRS_{x.y} = \frac{P_x}{P_y}$$

Since $MRS_{x.y}$ equals MU_x/MU_y, the first order equilibrium condition under the two approaches is the same.

The second order equilibrium condition of cardinal utility approach is that the total expenditure must not exceed consumer's total income. Ordinal utility approach makes a similar assumption in the form of budgetary constraint. That is, if a consumer having money income M, consumes only two goods, X and Y, given their prices as P_x and P_y, then

$$Q_x \cdot P_x + Q_y \cdot P_y = M$$

Thus, inspite of the fact that cardinal and ordinal approaches are based on different assumption regarding the measurability of utility, both arrive at the same conclusion.

7.13.2 Superiority of Indifference Curve Approach

In spite of their similarity in assumptions and equilibrium conditions, Hicksian indifference curve analysis is in many respects superior to the Marshallian caridnal utility approach. The indifference curve analysis has made major advances in the theory of consumer behaviour at least in the following respects.

First, the assumptions of indifference curve approach are less stringent or restrictive than those of cardinal utility approach. While cardinal utility approach assumes cardinal measurability of utility, ordinal utility approach assumes realistically only ordinal measure of utility. Besides, unlike cardinal utility approach, the ordinal utility approach does not assume constancy of utility of money. Marshallian assumption of constancy of marginal utility of money is incompatible with demand functions involving more than one good.

Secondly, indifference curve approach provides a better criterion for the classification of goods into substitutes and complements. This is considered as one of the most important contributions of

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1. The cross-elasticity between two goods, X and Y is given by $(\Delta Q_x/\Delta P_y).(P_y/Q_x)$

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8. What is meant by consumer's equilibrium? Show that consumer's equilibrium condition under ordinal utility approach is the same as that under the cardinal utility.
9. What are the conditions for consumer's equilibrium in ordinal utility approach? Why does a consumer choose a combination of two goods where marginal rate of substitution equals the commodity price ratio?
10. Suppose a domestic servant spends her total income on only two goods, food and clothing. What will be the effect of increase in her income on her consumption of food and clothing? Illustrate the derivation of her income consumption curve.
11. What is Engel curve? Illustrate graphically the derivation of Engel curve. When does it tend to bend backwards?
12. What is price consumption curve (*PCC*)? Can you prepare a demand schedule on the basis of data provided by the *PCC*? Illustrate the derivation of demand curve for a normal good and a Giffen good.
13. Define income and substitution effects of a price change. Using Hicksian method illustrate graphically the decomposition of substitution and income effects of change in price of a commodity.
14. Illustrate the difference between the Hicksian and Slutsky methods of separating income and substitution effects of price change of a normal good. Which method gives, in your opinion, a better measure of the two effects and why?
15. Suppose Rajat likes chocolates more than ice–creams. How do his indifference curves look like? In what way are they different from the usual indifference curves? Show graphically Rajat's equilibrium combination of chocolates and ice–creams?
16. Suppose a consumer consumes two goods *X* and *Y*. Draw indifference curves assuming (a) *X* and *Y* are normal goods, and (b) *X* is an inferior good and *Y* is a superior good. Are the indifference curves different in the two cases? If not, how are they different?
17. 'All Giffen goods are inferior goods but all inferior goods are not Giffen goods'. Explain this statement showing graphically the difference between the substitution and the income effects of a price change on the demand for the two kinds of goods.
18. What is meant by 'composite goods convention'? In what way are the slopes of budget line and indifference curves in composite goods case different from those in case of two normal goods? How does a consumer achieve his equilibrium point in composite goods case?
19. Write the correct answer.
    (a) Indifference curve was invented by (i) Edgeworth, (ii) J. R. Hicks, (iii) Marshall, or (iv) Slutsky?
    (b) Each point on an indifference curve shows (i) different combinations of goods and different levels of utility, (ii) the same combinations and the same utility, (iii) different combinations and the same utility, or (iv) none of the options?
    (c) Along the indifference curve, the marginal rate of substitution between two goods (i) decreases, (ii) increases,or (iii) remains constant?
    (d) The marginal rate of substitution between two normal goods is always positive or always negative?
    (e) The marginal rate of substitution is (i) equal to, (ii) greater than, or (iii) less than the slope of the indifference curve?
    (f) The indifference curves for two normal goods are always (i) convex to origin, (ii) concave to origin, or (iii) neither convex nor concave?

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8.4 DERIVATION OF LABOUR SUPPLY CURVE

Like commodity supply curve shows the relationship between the price of the commodity and it's quantity supplied by the firms, the labour supply curve shows the relationship between supply of labour and wage rate. Labour supply curve is ***a backward bending curve***. The labour supply curve is the result of labour's choice between income and leisure. We will show below the use of indifference curve in the analysis of labour's choice between income and leisure and in deriving the supply curve of labour.

8.4.1 Income-Leisure Choice

Let us assume that utility function of an individual worker is given as

$$U = f(M, L)$$

(where M = money income from work, and L = leisure).

Assume also that an individual divides his daily time into work and leisure so as to maximise his utiliy function. Given the number of hours at his disposal, if he increases his hours of work, his income increases but his hours of leisure decrease and *vice versa*. His working-hours yield income. It implies that the individual divides his time between income and leisure. The income-leisure choice of the worker is illustrated in Fig. 8.4. in which X-axis measure the hours available to the worker and Y-axis his money income. Let us assume that the total hours available to the individual are OH and that hourly wage rate is $\overline{w}$. If he works for OH hours and enjoys no leisure, his total income will be $OM = OH.\overline{w}$. If the individual enjoys his whole time (OH) as leisure, he will be at point H with zero income. And, if he enjoys no leisure, i.e., he works for OH hours, he will be at point M. By joining the points M and H by a line, we get his ***income-leisure curve,*** MH. This curve shows income-leisure combinations at a given wage rate, $\overline{w}$. Another significant point to be noted is that the slope of the income-leisure curve, $OM/OH = \overline{w}$.

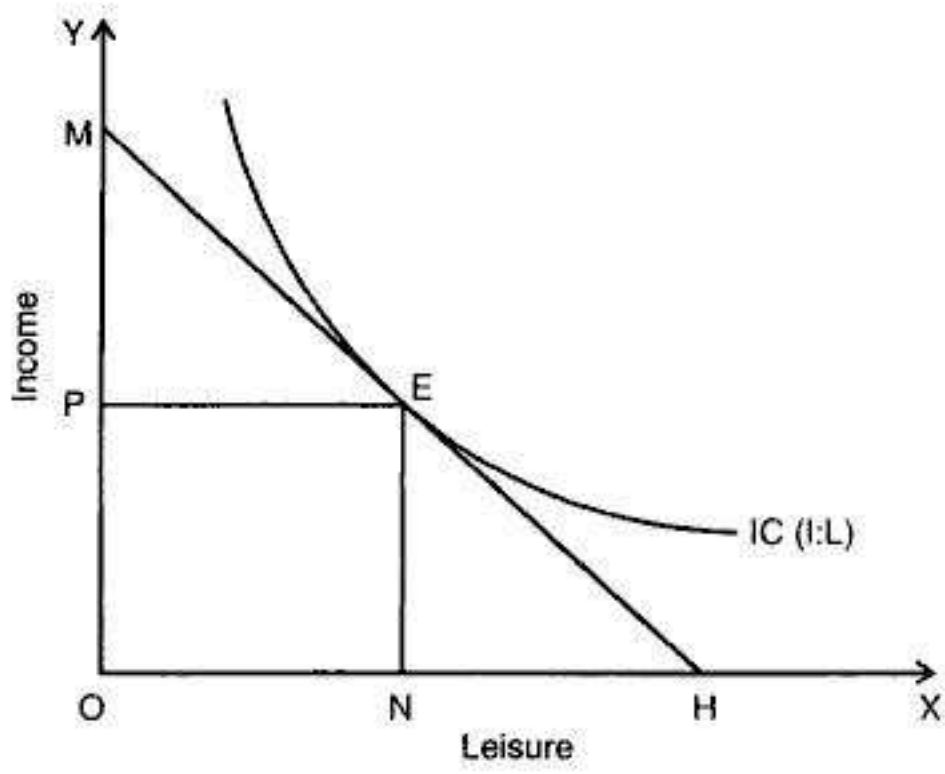


Fig. 8.4 Equilibrium of Individual Worker

Let us now assume that individual's indifference curve for income and leisure (I:L) is given by the curve IC in Fig. 8.4. This curve is known as ***income-leisure trade-off curve***. Its slope indicates the MRS_{LM} between income and leisure, i.e., $\Delta M/\Delta L$. The individual's equilibrium is determined at

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(ii) Effective rationing. Fig. 8.8 presents the case of fully *effective rationing*. The budget line *MN* and area under it represent the 'market opportunity set' available to the consumers. In the absence of rationing, the consumers would be in equilibrium at point *U* on indifference curve IC_2. After the imposition of rationing at *OR*, consumers move to a constrained equilibrium at point *C* on a lower indifference curve, IC_1. Their consumption of *X* falls from *OQ* to *OR*. Rationing is, therefore, ***completely effective***. It is doubly effective if rationing aims at reducing consumption of *X* and increasing that of *Y*. This kind of rationing has a serious welfare implication. However, it cannot be judged from Fig. 8.8 whether loss of consumers' welfare is matched with gains of rationing.

8.5.2 Rationing of More Commodities

(i) Precautionary rationing. The government imposes rationing generally on more than one commodity. We will illustrate rationing on two commodities. In case two goods, e.g., *X* and *Y*, are subjected to rationing, its effectiveness depends again on the limits of permissible consumption. If permissible consumption limits of both the goods are in excess of what consumers consume in the absence of rationing, then rationing would be ineffective in the sense that it does not displace consumers' equilibrium. This situation is illustrated in Fig. 8.9. Given the budget line *MN*, the consumers would be in equilibrium at point *U*. If the government imposes rationing at OM_y for *Y* and at OR_x for *X*, it would be ineffective. For, consumers are in equilibrium at point *U* which is well within their 'market opportunity set' and rationing limits. They will consume only OX_0 of *X* and OY_0 of *Y*, both being less than their respective rationing limits. This kind of rationing may, however, be used as a precaution against expected increase in consumption of *X* and *Y* or expected accumulative demand for these goods in anticipation of deterioration in supply position.

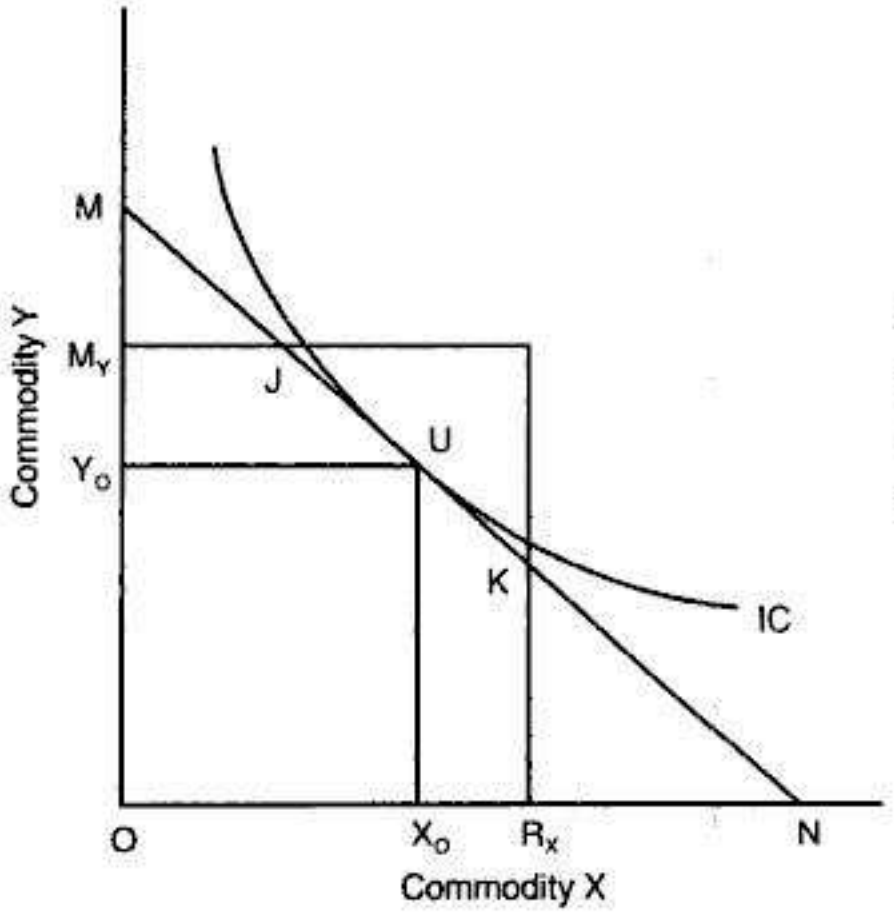


Fig. 8.9 Preventive Rationing *X* and *Y*

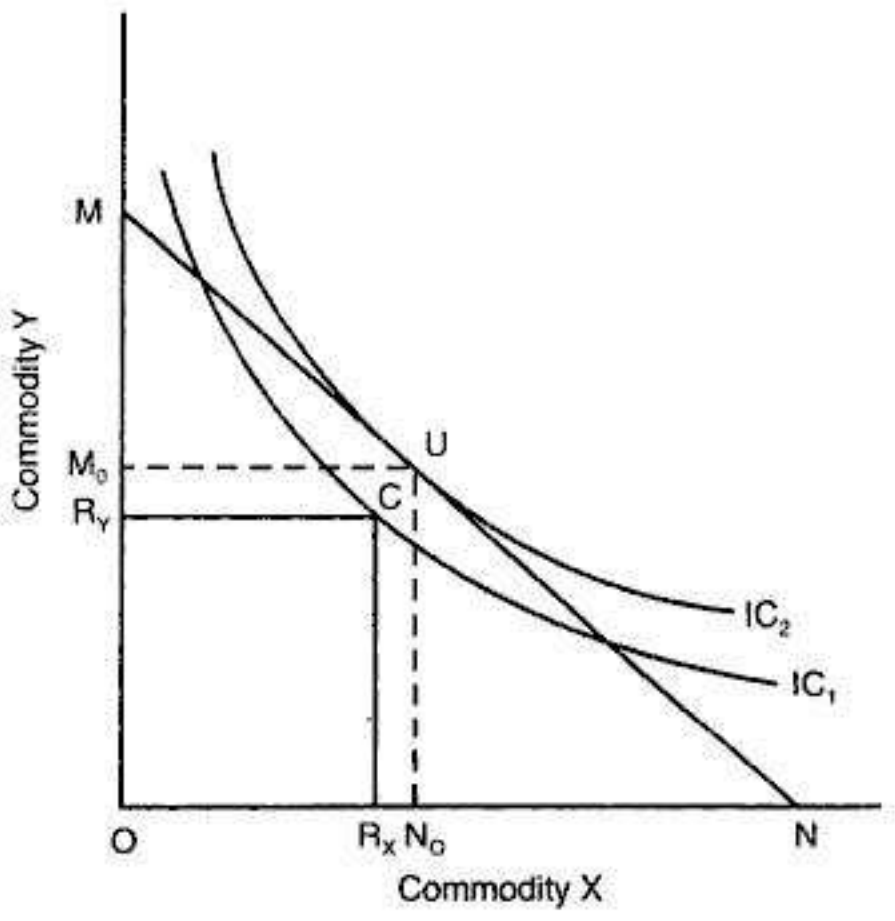


Fig. 8.10 Effective Rationing of *X* and *Y*

(ii) Effective rationing. Figure 8.10 presents the case of effective rationing of both the goods, *X* and *Y*. In the absence of rationing, consumers would be in equilibrium at point *U* consuming ON_0 of *X* and OM_0 of *Y*. With rationing imposed at OR_x for *X* and OR_y for *Y*, the consumers will be forced to move to point *C* on a lower indifference curve. At point *C*, their consumption is limited to

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to incorporate the **'external effects'** on the personal utility, such as **'bandwagon effect'**[1] **'snob effect'**[2], and **'Veblen effect'**[1] into the 'current theory of demand'. Because of some of these developments, perhaps, Hicks felt it necessary to revise his 'theory of demand' which he had developed in his *Value and Capital*. In mid-sixties, Kelvin Lancaster added another dimension to the theory of demand by exploring what he calls *technology of consumption*, a technique similar to indifference curve. Given the target readership of this book, however, we present in this chapter a brief description of only one of these developments, i.e., Samuelson's 'Revealed Preference Theory' of consumer behaviour.

9.2 REVEALED PREFERENCE: ASSUMPTIONS AND AXIOMS

In succession of Hicks-Allen ordinal utility approach, Samuelson[2] proposed in 1947, another theory, called the 'Revealed Preference Theory' of consumer behaviour. The main merit of the revealed preference theory is that 'law of demand' can be directly derived from the ***revealed preference axioms*** without using indifference curve and most of its restrictive assumptions. What is needed is simply to record consumer's observed behaviour in the market, i.e., the basket of goods a consumer buys at different prices. Besides, the revealed preference theory is also capable of establishing the existence of indifference curves and their convexity. For its merits, revealed preference theory is treated as 'the third root of the logical theory of demand'. The revealed preference theory is discussed here briefly.

Assumptions

Revealed preference theory is based on the following assumptions:

1. **Rationality** — The consumer is a rational being: he prefers a larger basket of goods to the smaller ones.
2. **Transitivity** — Consumer's preferences are transitive. That is, given the alternative baskets of goods, A, B and C, if he considers $A > B$ and $B > C$, then he considers $A > C$.
3. **Consistency** — Consumer's taste remains constant and consistent. Consistency implies that, it a consumer, given his circumstances, prefers A to B, he will not prefer B to A under the same conditions.
4. **Price Inducements** — Given the collection of goods, the consumer can be induced to buy a particular collection by providing him sufficient price incentives.

Revealed Preference Axiom

The revealed preference can be stated as follows. ***Given the budgetary constraint and alternative baskets of goods having the same price, if a consumer chooses a particular basket, he reveals his preference.*** For example, suppose that a consumer has a given income which he spends on two commodities, X and Y. Suppose also that there are two alternative baskets A and B of the two goods, X and Y, and that both the baskets are equally expensive. ***Given these conditions, if the consumer chooses basket A rather than basket B, he reveals his preference for basket A.*** This is the basic axiom of the revealed preference theory.

---

1. 'Veblen effect' means decrease in consumption of a commodity because it has become cheaper. It implies a positive relationship between price and quantity consumed.
2. Samuelson, P.A., *Foundation of Economic Analysis*, (Cambridge, Mass., Harvard University Press, 1947), Chapters 5 and 6; and "Consumption Theory in Terms of Revealed Preference." *Economica*, November 1948, pp. 243-53. Samuelson had however conceived the idea much earlier in his paper "A Note on the Pure Theory of Consumer's Behaviour," *Economica*, February and August 1938.

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any point on this segment is inferior to *B*. Since the consumer chooses point *B*, as *revealed preference axiom* suggests, any other point on or below *PT* is inferior to *B*. Therefore, any combination in the area *NBT* is *revealed inferior* to *B*. Thus, the triangle *NBT* which is a part of the *ignorance zone, KAN*, is clipped off because consumer's ranking of this area is now known.

This procedure can be repeated for as many points as one wishes and the area of *ignorance zone* can be reduced bit by bit. For example, we may select a point *C* on the *BT* segment of *PT* and draw a probable price line *QR*. Following the same procedure, we may show that points in the area marked by the triangle *TCR* are revealed inferior to *A* and chop off the area from the *ignorance zone*. Moving up along the budget line *MN*, we may choose point *D* and hack away triangle *UDM*.

The same procedure may be adopted to whittle away the 'upper ignorance zone' marked by triangle *JAM* and to find points in relation to *A*. The procedure is illustrated in Fig. 9.5. The consumer is assumed to be initially at point *A* on the budget line *MN*. Let us now suppose that P_x increases and P_y decreases and the new budget line, *PT*, passes through the point *A* and that the consumer chooses point *L* on the budget line *PT*. At new prices, bundle *A* is as much expensive as bundle *L*. We know from the revealed preference theory that point *L* is preferable to point *A* and any point in the area *ALD* is revealed preferred to *L*. Therefore, any point in zone *SLD* is preferable to point *A*. This ranking of area *SLDJ* reduces the area of 'upper ignorance zone'. This procedure may be repeated by drawing other price lines through point *A* and the 'upper ignorance zone' can be reduced bit by bit.

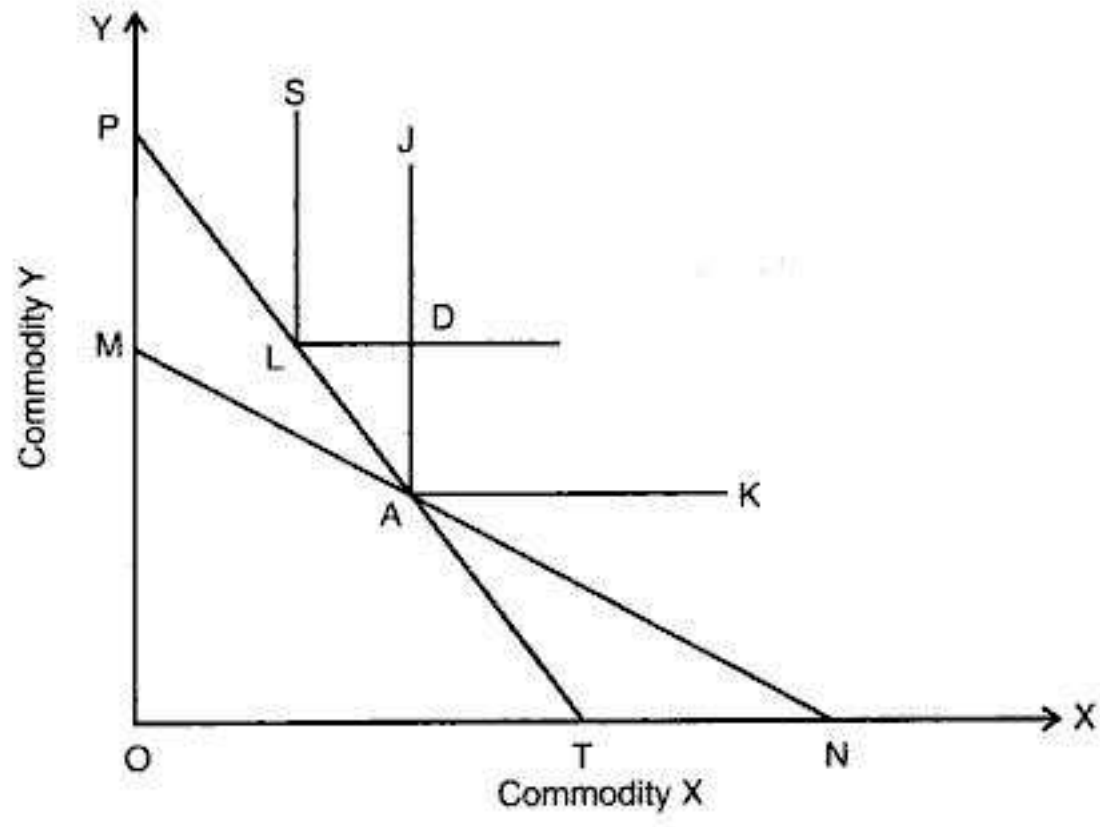


Fig. 9.5 Derivation of Indifference Curve through Revealed Preference Theory

If we join all the points—*A, B* and *C* in Fig. 9.4 and *A* and *L* in Fig. 9.5—which have been located on the various budget lines, we get a curve which Samuelson called ***offer curve*** as shown by the curve *FF'* in Fig. 9.6. The position of the offer curve is the probable position of ***indifference curve***.

This probability of the existence of an indifference curve can be established by the following inferences which can be drawn from the foregoing discussion.

First, the indifference curve cannot be a straight line like *MN* because choice of point *A* shows that all other points on *MN* are revealed inferior to *A*, and therefore, the consumer cannot be indifference between point *A* and any other point on the budget line.

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10.2 MARSHALLIAN CONCEPT OF CONSUMER SURPLUS

Although the concept of consumer surplus was originated by Dupuit as early as 1844, it remained an immeasurable concept until Marshall suggested, as late as 1920, a method of measuring consumer's surplus in money terms. Marshall defined consumer's surplus as **"the excess of the price which [a consumer] would be willing to pay rather than go without the thing, over that which he actually does pay."** According to Marshallian theory of demand, what a consumer is willing to pay for one unit of a commodity measures the money value of his expected utility and what he actually pays measures the monetary cost of the expected utility. The difference between the two values is called *'consumer surplus'*. For example, suppose you are prepared to pay Rs 500 for a ticket to a cricket match but you pay only Rs 200, the actual price of the ticket, you have a consumer surplus of Rs 300.

The concept of consumer's surplus can be expressed also in terms of utility (or satisfaction). Since Marshall assumed marginal utility (*MU*) of money, what a consumer is willing to pay indicates his expected utility and what he actually pays measures the loss of utility (of money). The difference between the utility gained and the utility lost in acquiring the commodity is consumer's 'surplus satisfaction' which Marshall called **'consumer's surplus'**.

The Marshallian concept of consumer's surplus and its measurement are graphically illustrated in Fig. 10.1. The consumer's willingness to pay is shown by his straight line demand curve *MN*. The curve *MN* also indicates the utility derived from each successive unit of a commodity. The market price, i.e., the price which a consumer actually pays, is given by *OP*. At price *OP*, the consumer buys *OQ* units. The total utility derived by the consumer from *OQ* units is shown by the area *OMBQ*, for which the consumer pays *OPBQ* = *OQ.OP*. Thus, in Marshallian sense, total consumer surplus equals *PMB* = *OMBQ* – *OPBQ*. That is, the shaded area *PMB* represents the consumer's surplus in Marshallian sense when consumer buys *OQ* units of a commodity *X*.

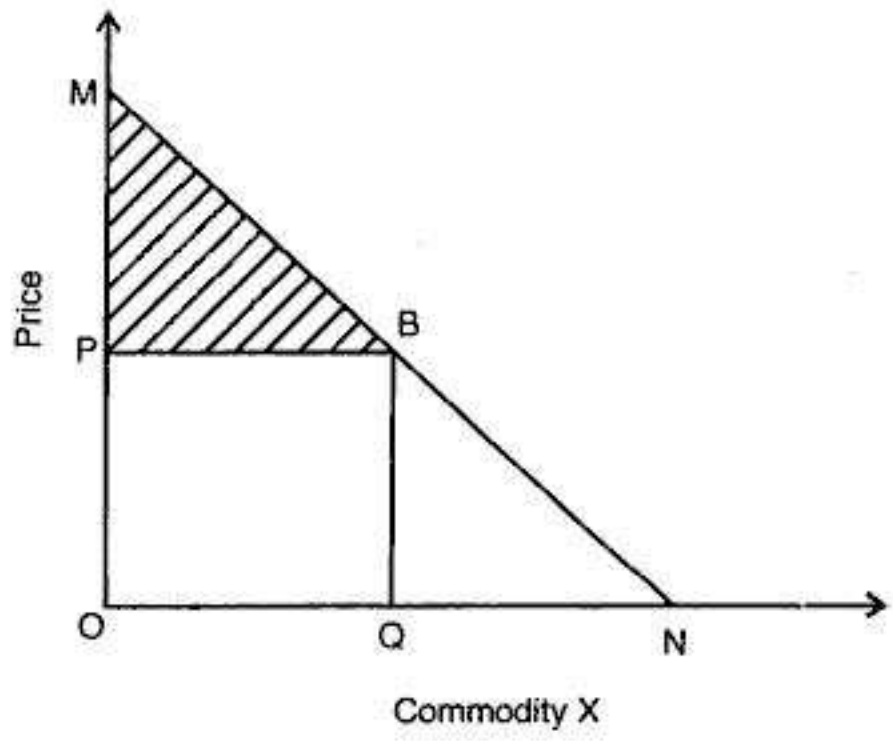


Fig. 10.1 Consumer's Surplus

Assumptions

The above analysis of consumer's surplus is based on the following assumptions.

First, it is assumed that the market price is given so that neither the sellers nor the buyers can affect

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REVIEW QUESTIONS AND EXERCISES

1. What is consumer's surplus? Explain and examine critically the Marshallian measures of consumer's surplus.
2. Using indifference curve technique measure consumer's surplus if (i) the marginal utility of money is constant, (ii) marginal utility of money is variable.
3. Discuss the uses of the concept of the consumer's surplus in economic analysis and policy formulation.
4. Explain briefly the Hicksian measure of consumer's surplus under (i) the quantity variation, (ii) the price compensating variation, (iii) the quantity-equivalent variation, and (iv) the price-equivalent variation.
5. In what way does Hicksian measure of consumer surplus offer a superior way of looking at consumer surplus than one provided by Marshall?

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A ***variable input*** is defined as one whose supply in the short-run in elastic, *e.g.*, labour and raw material, etc. All the users of such factors can employ a larger quantity in the short-run. Technically, a variable input is one that changes with the change in output. In the long run, all inputs are variable.

11.2.3 Short-Run and Long-Run

The reference to *time* period involved in production process is another important concept used in production analysis. The two reference periods are *short run* and *long run*. The *shot run* refers to a period of time in which the supply of certain inputs (*e.g.*, plant, building, machinery, etc.) is fixed or is inelastic. In the short-run, therefore, production of a commodity can be increased by increasing the use of only variable inputs like labour and raw materials.

It is important to note that 'short-run' and 'long run' are economists' jargon. They do not refer to any fixed time period. While in some industries short run may be a matter of few weeks or few months, in some others (e.g., electricity and power industry), it may mean three or more years.

The *long run* refers to a period of time in which the supply of all the inputs is elastic, but not enough to permit a change in technology. That is, in the long run, all the inputs are variable. Therefore, in the long-run, production of a commodity can be increased by employing more of both variable and fixed inputs.

Economists use another term, *i.e., very long run* which refers to a period in which the technology of production is also supposed to change. In the very long run, the production function also changes. The technological advances result in a larger output from a given quantity of inputs.

11.3 PRODUCTION FUNCTION

A production function is a mathematical statement used to describe the technological relationship between inputs and output in physical terms. In its general form, it tells that production of a commodity depends on certain specific inputs. In its specific form, it presents the quantitative relationships between inputs and output. Besides, the production function represents the technology of a firm, of an industry or of the economy as a whole. A production function may take the form of a schedule or table, a graphed line or curve, an algebraic equation or a mathematical model. But each of these forms of a production function can be converted into its other forms.

Before we illustrate the various forms of a production function, let us see how a complex production function is simplified and the number of inputs in the production function (used as independent variables) is reduced to a manageable number, especially in theoretical analysis or models.

An empirical production function is generally very complex. It includes a wide range of inputs, viz., (i) land; (ii) labour, (iii) capital, (iv) raw material, (v) time, and (vi) technology. All these variables enter the actual production function. The long-run production function is generally expressed as

$$Q = f(L_B, L, K, M, T, t)$$

where L_B = land and building L = labour, K = capital, M = materials, and T = technology, and t = time.

Economists have however reduced the number of variables used in a production function to only two, viz., *capital (K)* and *labour (L)*, for the sake of convenience and simplicity in he analysis of input-output relation. Production function is generally expressed as

$$Q = f(L, K)$$

The reasons for ignoring other inputs are following. *Land* and *building* (L_B), as *inputs*, are constant for the economy as a whole, and hence it does not enter into the aggregate production function.

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Marginal Productivity of Labour

Marginal productivity of labour (MP_L) can be obtained by differentiating the production function (11.4) with respect to labour (L) as follows.

$$MP_L = \frac{\partial Q_C}{\partial L} = -3L^2 + 30L + 10 \tag{11.5}$$

By substituting numerical value for labour (L) in eq. (11.5), MP_L can be obtained at different levels of labour employment. However, this method can be used only where labour is perfectly divisible and $\partial L \to 0$. Since, in our example, each unit of $L = 1$, calculus method cannot be used. Alternatively, where labour can be increased at least by one unit, MP_L can be obtained as

$$MP_L = TP_L - TP_{L-1}$$

The MP_L worked out by this method is presented in column 3 of Table 11.1.

Average Productivity of Labour

Average productivity of labour (APL) can be obtained by dividing production function by L.

$$AP_L = \frac{Q_C}{L} = \frac{-L^3 + 15L^2 + 10L}{L} \tag{11.6}$$

$$= -L^2 + 15L + 10$$

Now AP_L can be obtained by substituting numerical values for L in Eq. (11.6). AP_L obtained by this method is given in col. 4 of Table 11.1

The information contained in Table 11.1 is presented graphically in panels (a) and (b) of Fig. 11.1. Panel (a) of Fig. 11.1 presents the total product curve (TP_L) and panel (b) presents marginal product (MP_L) and average product (AP_L) curves. The TP_L schedule demonstrates the law of diminishing returns. As the curve TP_L shows, the total output increases at an increasing rate till the employment of the 5th worker, as indicated by the increasing slope of the TP_L curve. (See also col. 3 of the table). Beyond the 6th workes, TP_L increases (until the 10th worker) but the rate of increase in TP_L (i.e., marginal addition to TP_L) begins to fall and turns negative 11th worker onwards. This shows the operation of the law of diminishing returns.

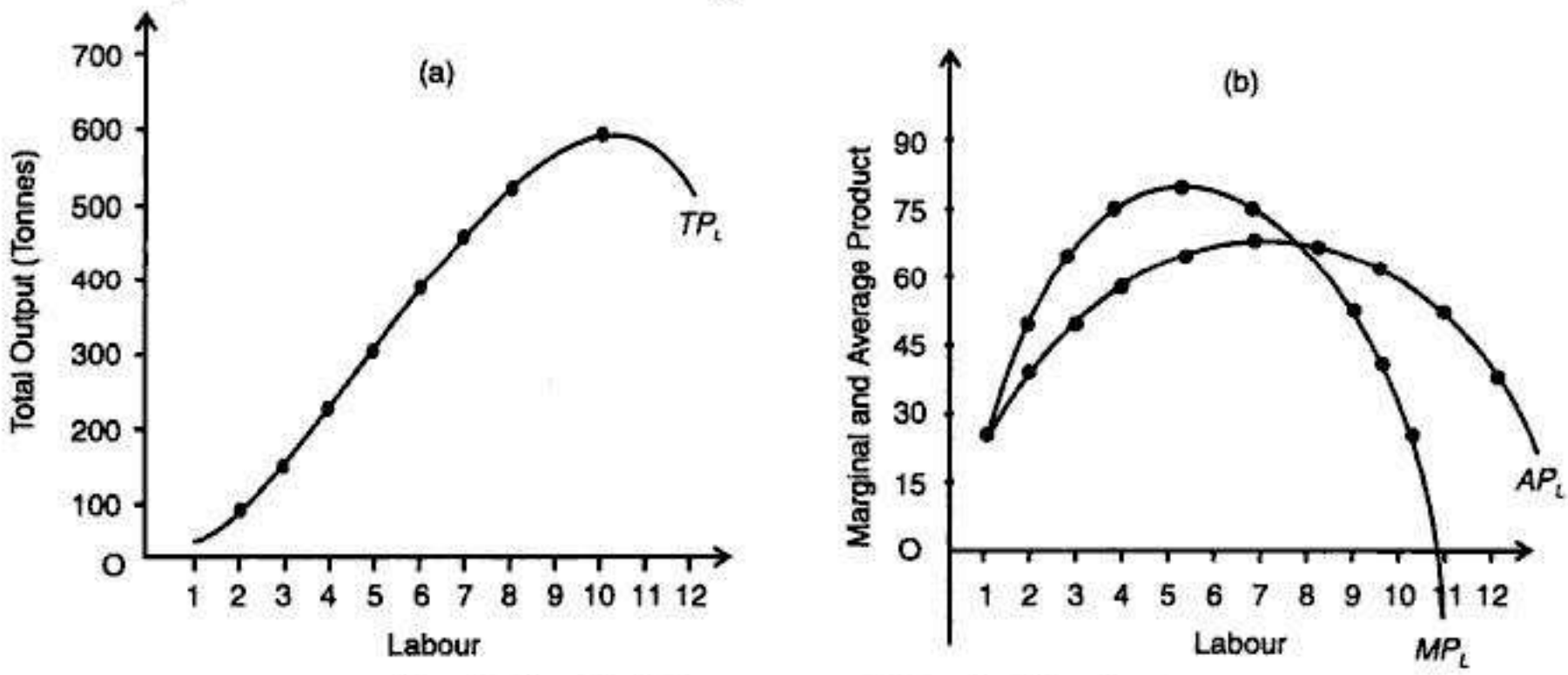


Fig. 11.1 Total, Average and Marginal Products

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The three stages of production are illustrated in Fig. 11.4. The *total product* (TP_L) curve in part (a) of the figure is similar to one shown in Fig. 11.1. *Marginal product* (MP_L) and *average product* (AP_L) curves shown in part (b) are derived as explained in Fig. 11.2 and 11.3. Fig 11.4 shows the behaviour of MP_L and AP_L at different stages of production.

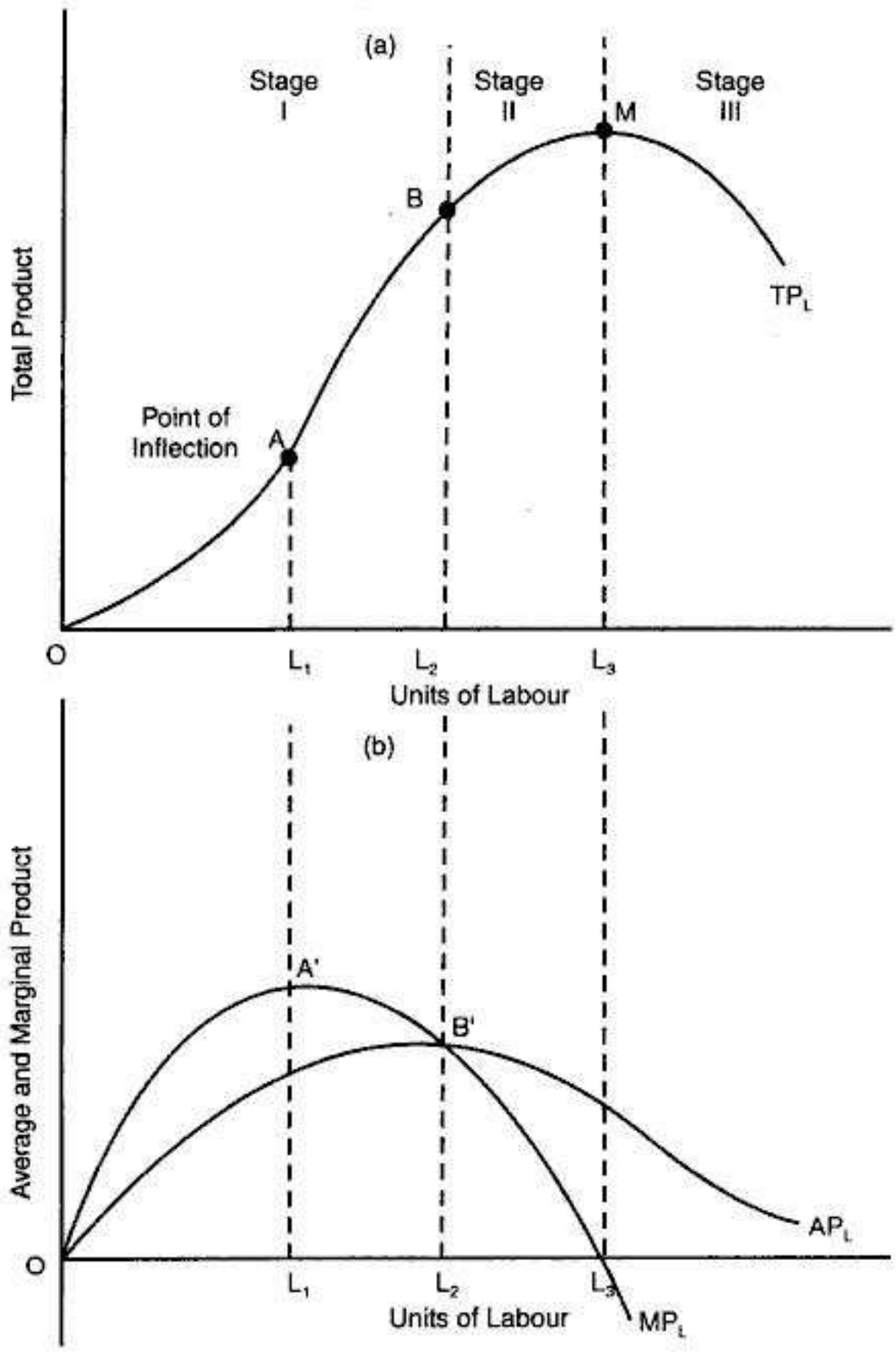


Fig. 11.4 The Three Stages of Production

As Fig. 11.4 (b) shows, ***Stage I*** of production extends till the employment of OL_2 units of labour. In this stage, marginal product of the variable input, labour, increases till the use of OL_1 units of labour and then begins to decline whereas average product of labour continues to increase till OL_2 units of labour. In Stage I, marginal product is throughout higher than the average product of labour. Marginal and average products get equalized at OL_2 units of labour employed, as shown by point B'. Point B' marks the end of Stage I and beginning of Stage II.

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$$MP_K = \frac{\partial Q}{\partial K} = a$$

and $$MP_L = \frac{\partial Q}{\partial L} = b$$

Since $MRTS = \frac{MP_L}{MP_K}$, by substitution

$$MRTS = -\frac{b}{a}$$

Therefore, $MRTS = -\frac{b}{a}$ =slope of the isoquant

The production function exhibiting perfect substitutability of factors is, however, considered to be a rare phenomenon in the real world production process.

2. Fixed Factor Proportion and L-shaped Isoquant

When production functions assume a ***fixed proportion*** between K and L, the isoquant takes 'L' shape, as shown by Q_1 and Q_2 in Fig. 12.6. Such an isoquant assumes ***zero substitutability*** between K and L. Instead, it assumes ***perfect complementarity*** between the factors. That is, K and L are treated as perfect complements to one another. Perfect complementarity implies that a given quantity of a commodity can be produced by one and only one combination of K and L and that the proportion of the inputs is fixed. In other words, K and L are required in a fixed proportion to produce a given quantity of a commodity. It implies also that if quantity of an input is increased, quantity of other inputs held constant, there will be no change in the output. Thus, output can be increased only by increasing both the inputs proportionately.

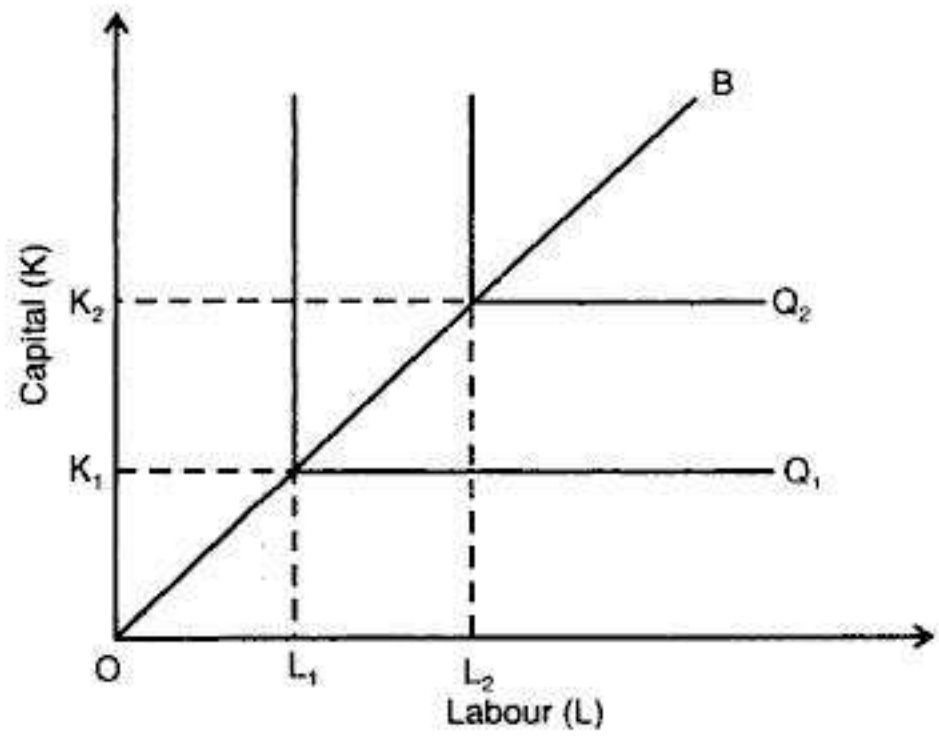


Fig.12.6 The L-Shaped Isoquant

As shown in Fig. 12.6, to produce Q_1, a minimum of OK_1 units of K and OL_1 units of L is required. It means that if OK_1 units of K are being used, OL_1 units of labour must be used to produce Q_1 units of a commodity. Similarly, if OL_1 units of labour are employed, OK_1 units of capital must be used to produce Q_1. In either case, if units of K or L are increased, output will not increase. For example, if OL_2

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Three Laws of Returns to Scale

When all the inputs are increased *proportionately* (i.e., by some multiple of the existing scale), there are technically three possible ways in which total output may increase:

(i) it may increase more than proportionately,
(ii) it may increase proportionately, and
(iii) it may increase less than proportionately.

For example, if both the inputs (labour and capital) are doubled, the resulting output may be more than double, equal to double or less than double. This kind of inputs-output relationship gives three laws of returns to scale:

(i) the **law of increasing returns to scale,**
(ii) the **law of constant returns to scale, and**
(iii) the **law of decreasing returns to scale**

These three laws of return to scale are illustrated and explained below first graphically with the help of isoquants and then through the ***production function***.

12.8.1 Increasing Returns to Scale

As stated above, the law of increasing returns to scale implies that output increases more than proportionately to the increase in input and the rate of increase in output goes on increasing with each subsequent increase in input. For example, suppose inputs are increased by 50% and output increases by more than 50%, say by 75%, and when inputs are again increased again by 50% and output increases by 100% and so on. This kind of input-output relationship shows that the law of increasing returns to scale is in operation. This kind of returns to change in scale is illustrated in Fig. 12.9. The three isoquants—Q_1, Q_2 and Q_3— represent three different levels of production—10 units, 25 units and 50 units, respectively. Product lines OA and OB show the relationship between inputs and output. For instance, movement from point a to b denotes doubling the inputs, labour and capital. As Fig. 12.9 shows, input combination increases from $1K + 1L$ to $2K + 2L$. The movement from a and b also indicates increase in output from 10 units to 25 units. This means that when inputs are doubled, output is more than doubled.

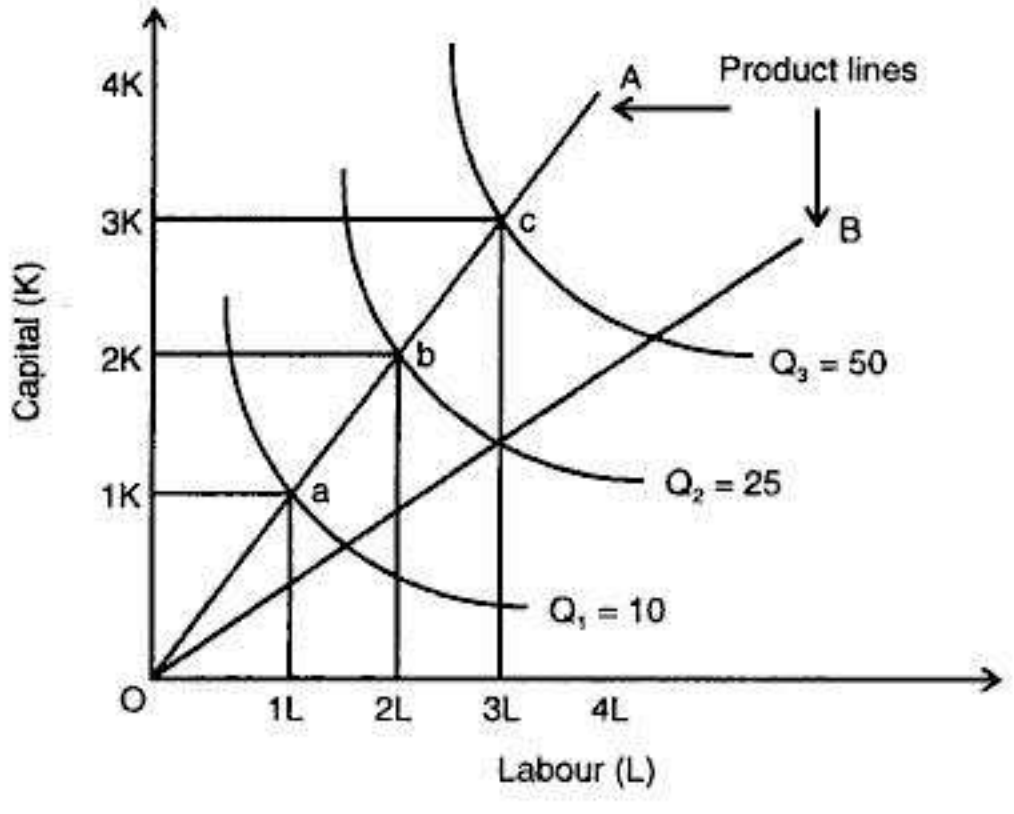


Fig. 12.9 Increasing Returns to Scale

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In Eq. (12.6), the proportion h may be greater than, equal to or less than k. Accordingly, it shows the three laws of returns to scale.

(i) If $h = k$, the production function reveals ***consant returns*** to scale.
(ii) If $h > k$, the production function reveals ***increasing returns*** to scale.
(iii) If $h < k$, production function reveals ***decreasing returns*** to scale.

12.9.1 Cobb-Douglas Production Function[1] and Returns to Scale

We have used above a simple Cobb-Douglas type of *linear homogenous production function* to illustrate the laws of returns to scale. We will now use Cobb-Douglas production function to illustrate the laws of returns to scale. The Cobb-Douglas production function is given as

$$Q = A\,K^{\alpha}\,L^{\beta} \tag{12.7}$$

(where A, α and β are positive constants and $\beta = 1 - \alpha$).

It is *important* to note here that exponent α gives the *elasticity of output with respect to capital* (i.e., change in output for one percent change in capital) and also the *relative share* of capital in the output. Similarly, exponent β gives the *elasticity of output with respect to labour* (i.e., change in output for one percent change in labour) and also its *relative share* in output.

Let us, now, illustrate the application of Cobb-Douglas production function for deriving the laws of returns to scale. Given the production function in Eq. (12.7), if inputs, K and L, are multiplied by a factor k, then Eq. (12.7) can be written as

$$hQ = A\,(k\,K)^{\alpha}\,(k\,L)^{\beta}$$

By factoring out k, as common factor, we get

$$\begin{aligned} hQ &= A\,k^{\alpha}\,k^{\beta}\,(K^{\alpha}\,L^{\beta}) \\ &= Ak^{\alpha+\beta}\,(K^{\alpha}\,L^{\beta}) \end{aligned}$$

or
$$hQ = k^{\alpha+\beta}\,(A\,K^{\alpha}\,L^{\beta}) \tag{12.8}$$

Eq. (12.8) gives the rules for the laws of returns to scale. Sine $Q = A\,K^{\alpha}\,L^{\beta}$, factor $h = k^{\alpha+\beta}$. From this relationship, one can derive the rules for the laws of returns to scale as follows.

(i) If $\alpha + \beta > 1$, $h > k$, the production function gives ***increasing returns to scale.***
(ii) If $\alpha + \beta = 1$, $h = k$, the production function gives ***Constant returns to scale.***
(iii) If $\alpha + \beta < 1$, $h < k$, the production function gives ***decreasing returns to scale***

For example, in a Cobb-Douglas production function of the form $Q = A\,K^{0.40}\,L^{0.75}$, the exponent $\alpha = 0.40$ and $\beta = 0.75$. The sum of exponents $(\alpha + \beta) = 0.40 + 0.75 = 1.15$. Since $(\alpha + \beta) > 1$, this production function shows ***increasing returns to scale***. Likewise, in a production function $Q = A\,K^{0.25}\,L^{0.50}$, the sum of exponents $(\alpha + \beta) = 0.25 + 0.50 = 0.75$. Therefore, this production function shows ***decreasing returns to scale.***

It is important to note here that Douglas[2] found in his empirical study of the US manufacturing industries that, in most cases, $\alpha + \beta = 1$. However, the possibility that $\alpha + \beta = 1$ may not hold in all

---

1. The production function widely known as Cobb-Douglas production function was first developed by Paul A. Douglas in his book *The Theory of Wages* (Macmillan, NY, 1924). It was improved further by Charles W. Cobb and Paul H. Douglas in their paper "A Theory of Production", *Am. Eco. Rev.*, March 1928(Suppl.) and was used by Paul H. Douglas, 20 years later, in his paper "Are There Laws of Production", *Am. Eco. Rev.*, March 1948.

2. In his *"Are There Laws of Production?"* (*op. cit.*) Cobb-Douglas production function for US manufacturing in 1948, based on both time-series and cross-section data and estimated labour-elasticity (β) of output at 0.73 and capital-elasticity of output at 0.25. This makes $\beta + \alpha \cong 1$.

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scale can also be shown in another way. At point *A*, total input combinations is 1*K* + 1*L*. This input combination yields an output of 100 units. When we move from point *A* to *B*, input combination increase from 1*K* + 1*L* to 2*K*+ 2*L*. It means doubling the inputs. When inputs are doubled, output is also doubled - from 100 units to 200 units. A movement from point *B* to *C* means a 50 percent increase in inputs and a 50 percent increase in output. This also shows constant returns to scale.

The right half of the table shows diminishing returns to the variable factor, labour. The movement each from point *A* to *J*, from *J* and *K* and from *K* to *L*, shows subsequent use of one additional unit of labour, capital remaining constant. Each subsequent addition of 1 unit of labour contributes diminishing units of output. This shows diminishing returns to variable proportion. The first labour produces 100 units, the second one produces 150–100 = 50 units, and the third produces only 175 – 150 = 25 units. This input-output relationship shows diminishing returns to the variable factor (labour).

Are the Laws of Returns Compatiable?

It can be concluded from the above description that constant returns to scale and diminishing returns to variable propotions are compatible with each other. It can be, similarly, shown that the law of diminishing returns is compatible with the laws of increasing and decreasing returns to scale. The reason is, while the law of diminishing returns is a shot run phenomenon, the laws of returns to scale are long run phenomenon. In the short run, increasing production is feasible only by way of increasing the variable factors because other factor (capital) is available in a fixed supply. In the long run, however, the supply of all the inputs becomes elastic. Therefore, more and more of all the inputs can be used to increase the production. In fact, the two kinds of laws operate on different time scales. There is, therefore, no conflict between the two kinds of laws of production. Both kinds of laws can be presented on the same scales of a diagram.

Can the Two Kinds of Laws Operate Simultaneously?

If time distinction is eliminated or if it is possible, by assumption, to increase output either by increasing only one input or by employing more of both the inputs, then compatibility of the law of diminishing returns and the law of returns to scale depends on the nature of production function. If production function is such that labour and capital are treated as perfect substitutes in the production process, then these laws will be compatible. But, if they are not perfect substitutes for one another, then these laws will not be compatible. In other words, if some of the inputs are subject to diminishing returns, then the two kinds of laws would not be compatible. They would be compatible, only if productivity of one of the inputs is so high, that it compensates or more than compensates the decreasing productivity of the other input(s).

FURTHER READINGS

Baumol, William J., *Economic Theory and Operations Analysis* (Prentice Hall of India, New Delhi, 1985), 4th Edn, Chapter 11.

Cassels, J., "On the Law of Variable Proportions" in *Readings in Theory of Income Distribution*, American Economic Association, 1946.

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13 Optimum Combination of Inputs

CHAPTER OUTLINE

13.1 Introduction
13.2 Derivation of Isocosts
13.3 The Least Cost Criteria
13.4 Maximisation of Output with a Given Cost
13.5 Choice of Optimal Expansion Path
13.6 Effects of Change in Input Prices
13.6.1 Change in Input Prices and Isocosts
13.6.2 Change in Input Prices and Expansion Path
13.6.3 Change in Relative Price of Inputs
13.7 Substitution and Resource Effects of Change in Input Prices
Further Readings
Review Questions and Exercises

13.1 INTRODUCTION

In the previous chapter, we have discussed the laws of returns to scale assuming (implicitly) that firms can expand the scale of production to any level—they have no resource constraint. In reality, however, firms have limited resources and are supposed to maximize their profit from their given resources. A profit maximising firm has to minimise its cost for a given output or to maximise the output from a given total cost. Given the technology, a given output can be produced with different input combinations. But all inputs-combinations do not conform to *the least cost criterion*. Our analysis so far does not provide any rule or criterion for cost-minimization. In this chapter, we will show how a firm finds the *least-cost-combination of inputs* for a given output and how it can maximise the output given the costs.

To begin with, let us consider the information contained in Fig. 13.1. As the figure shows, 100 units of a commodity X, can be produced with all the combinations of K and L that can be formed on the isoquant Q_1. For example, points J, K and L represent three different combinations of K and L: (i) $OK_3 + OL_1$; (ii) $OK_2 + OL_2$; and (iii) $OK_1 + OL_3$. All these input combinations can produce 100 units of X. Similarly, all other combinations of capital and labour that can be formed on the isoquant Q_1 can be used to produce 100 units of commodity X. Therefore, any of these combinations may be chosen for producing 100 units of X. But, given the input prices—interest and wages—the total cost of production varies from point to point, and only one of the combinations gives the minimum cost, not necessarily any of J, K and L. The problem now, is how to find the input-combination that gives

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$$MRTS = \frac{MP_L}{MP_K} = \frac{(MP_L)P}{(MP_K)P} = \frac{MRP_L}{MRP_K} \tag{13.5}$$

where MRP = marginal revenue productivity of the factor, and P = product price.

Thus, the least-cost criterion given in Eq. (13.3) can be put in terms of input and output price as

$$\frac{P_L}{P_K} = \frac{MRP_L}{MRP_K}$$

or
$$\frac{MRP_L}{P_L} = \frac{MRP_K}{P_K} \tag{13.6}$$

It may be inferred from Eq. (13.6) that ***the least-cost*** or ***optimal input combination*** **requires that the *MRP* ratios of inputs must be equal to their price ratios.**

13.4 MAXIMISATION OF OUTPUT WITH A GIVEN COST

In an alternative situation, a firm may be faced with a resource constraint and may seek to maximise the output. Like least-cost combination of inputs, there are ***first oder*** and ***second order conditions*** for maximising output under resource constraints.

The ***first order condition*** that must be fulfilled for maximising output is that the slope of the isocost must be equal to the slope of the isoquant. That is,

$$\frac{P_L}{P_K} = \frac{MP_L}{MP_K}$$

The ***second order condition*** that must be fulfilled is that the isoquant must be tangent to the isocost.

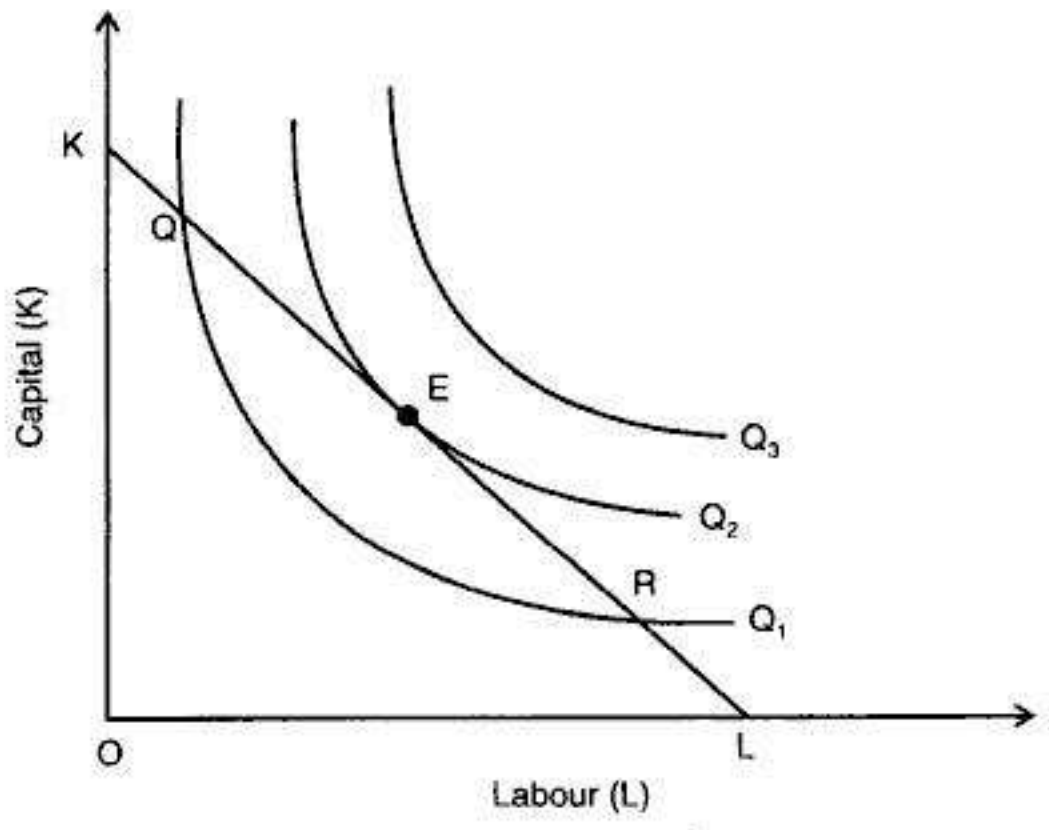


Fig. 13.4 Output Maximisation for a Given Cost

The output maximisation conditions are illustrated in Fig. 13.4. Both the first and the second order conditions are fulfilled at point E on the isoquant Q_2. Thus, Q_2 is the maximum output attainable under the given cost condition. Although the first order condition is fulfilled also at point Q and R

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14.2 SOME COST CONCEPTS

1. Actual Cost and Opportunity Cost

Actual costs are the expenditures which are actually incurred by the firm in payment for labour, material, plant, building, machinery, equipments, travelling and transport, fuel, etc. The total money expenses recorded in the books of accounts are, for all practical purposes, the actual costs. Actual cost concept comes under the accounting cost concept.

Opportunity cost is the loss of income due to opportunity foregone. Opportunity cost is also called ***alternative or economic cost***. It arises because of scarcity and alternative uses of resources. We know that the resources that are available, at any point of time, to a firm or any business organisation, are limited and resources have alternative uses. Therefore, profit maximizing firms have to choose the best from the alternatives available to them. When they opt for the best of the opportunities, they lose the returns expected from other alternatives. In fact, firms have to forego the gains expected from the second best alernative use of their resources. The foregone benefit is called opportunity cost of the gains from the chosen use of the resources. More precisely, ***the opportunity cost equals the expected returns from the second best use of the resources foregone to avail the gains of their best use.***

For example, suppose a man has Rs. 50,000 to invest. He has only two alternatives: he can invest this amount either in a printing machine or in a photocopier. He expects to earn an annual net income of Rs. 20,000 from the printing machine and Rs. 15,000 from the photocopier. If the man is an income-maximiser, he would invest his money in the printing machine. If he does so, he foregoes an annual income of Rs. 15000 expected from the photocopier. Thus, the opportunity cost of income from the printing machine is Rs. 15,000. Real life situation is full of such examples: if a student opts for a graduate degree in economics, he or she cannot be simultaneously a science graduate; if an MBBS opts for private practice, he/she foregoes the salary expected from employment in a government hospital; and so on.

Associated with the concept of opportunity cost is the concept of ***economic rent*** or ***economic profit***. *Economic rent* is the diference between the actual earning and the opportunity cost. In our example, economic rent of printing machine is the excess of its earning over the income from the photocopier. That is, economic rent = Rs. 20,000 – Rs. 15,000 = Rs. 5,000. The business implication of this concept is that investing in printing machine is preferable so long as its economic rent is greater than zero. Also, if firms know the economic rent of the various alternative uses of their resources, the choice of the best investment avenue will not be a problem.

2. Business Cost and Full Costs

Business costs include all the expenses which are incurred in carrying out the business. The concept of business cost is similar to the actual or real cost. Business costs "include all the payments and contractual obligations made by the firm together with the book cost of depreciation on plant and equipment."[1] Both these concepts are used in calculating actual profits and losses in the business, in filing returns for income-tax, and for other legal purposes.

The concept of ***full costs*** includes two others costs: ***opportunity cost*** and ***normal profit***. Opportunity cost includes the expected earning from the second best use of the resources, or the market rate of interest on the total money capital, and also the value of entrepreneur's own services which are not

1. Donald S. Watson, *Price Theory and Its Uses* (Houghton Mifflin Company, Boston, 1963), p. 126.

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14.4.1 Short-Run Cost-Output Relations

As noted above, the inputs that are used in the process of production in the short run can be classified as (i) ***fixed factors***, and (ii) ***variable factors***. ***Fixed factors*** include land, plant, building, machinery and equipments, etc. ***Variable factors*** include such inputs as direct labour, raw material, fuel, etc. The total cost incured on the *fixed inputs* are called ***fixed cost***[1] and total cost incured on *variable inputs* is called ***variable cost***[2]. Thus, the total short-run cost (*STC*) consists of (i) *total fixed cost (TFC)*, and (ii) *total variable cost (TVC)*. That is,

$$STC = TFC + TVC$$

The relationship between output and *TFC*, *TVC* and *STC* is shown in Fig. 14.1. As the figure shows, *TFC* remains constant (fixed) at *OF* for the entire short-run output. In the short run, *TFC-output* relationship is shown by a straight horizontal line labelled *TFC*.

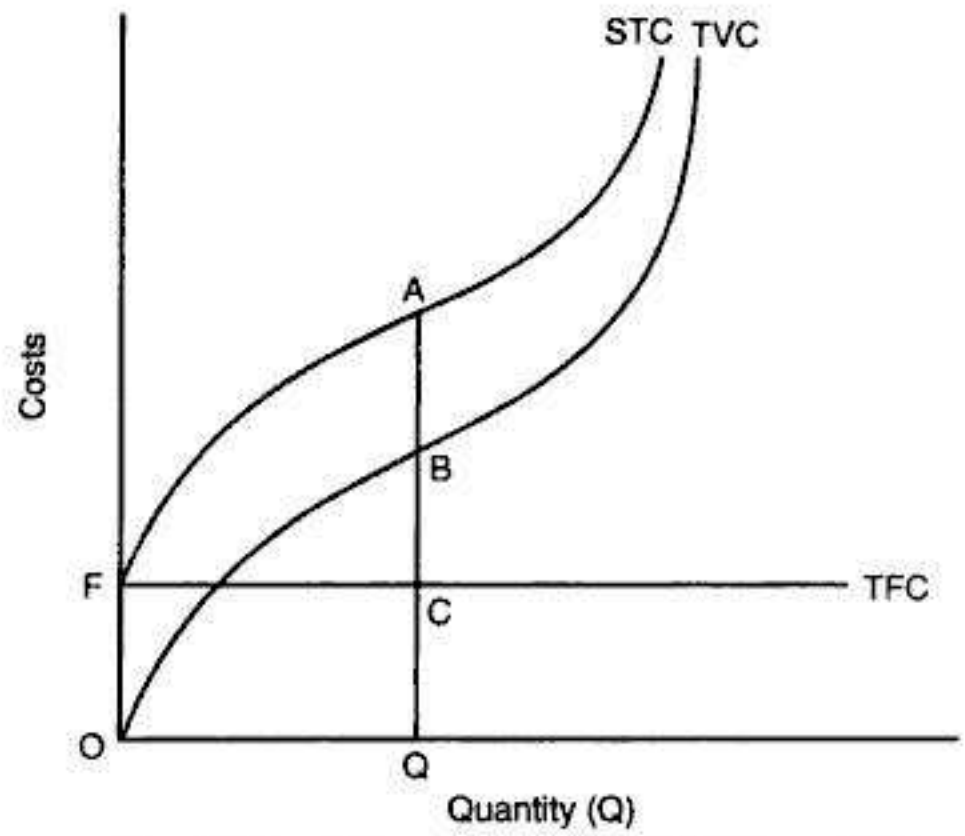


Fig. 14.1 Behaviour of *TFC*, *TVC* and *TC*

The *TVC* shows the relationships between the *total variable cost* and *output*. It can be seen in Fig. 14.1 that (unlike *TFC*) *TVC* increases with increases in output (*Q*) though at varying rates. It can be judged by the curvature of the *TVC* curve, that *TVC* increases first at *decreasing rate* and then at *increasing rate*, with increase in quantity produced. This trend in *TVC* conforms to the *law of dimishing returns*. (This aspect of relationship between *TVC* and *output* will be discussed, in detail, below in the derivation of the *average variable cost*).

The *total short-run cost (STC)* curve in Fig. 14.1 shows the relationship between *STC* and quantity produced (*Q*). The *STC* is obtained by vertical summation of the *TFC* and *TVC* curves. Recall that *STC* = *TFC* + *TVC*. Note that the vetical distance between *TVC* and *STC* curves equals *OF* for the entire range of the output (*Q*). For example, at output *OQ*, *AB* = *CQ* = *OF*. In fact, *STC* curve is the

---

1. *Total fixec cost* includes (a) salaries of managerial staff, (b) depreciation of machinery and building, (c) expenditure on maintenance of land, building and machinery, and (d) property tax, if any, and insurance premium.
2. *Total variable cost* includes (a) wages and salaries of direct labour, (b) cost of raw materials, and (c) running expenditure on fuel, electricity, routine repairs and transport. In economic theory, however, *cost of capital*, i.e., capital rental (*r*) is regarded as *fixed cost* and labour cost (*w*) is treated as *variable cost*.

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the *STC* curve to the point of origin (*O*). For example, suppose we want to find *SAC* at output OQ_2. An ordinate drawn from point Q_2 meets *STC* at point *J*. If a line is drawn from point *J* to the point of origin (*O*), it gives a line *OJ*. The slope of the line *OJ* gives the *SAC* for output OQ_2. The slope of the diagonal $OJ = JQ_2 / OQ_2$. Since slope of the line *OJ* equals *AVC*, we have

$$SAC = \frac{JQ_2}{OQ_2}$$

Following the same method, the diagonals can be drawn from point *P, L, M* and *N* as shown by the lines *OP, PL, OM* and *ON*, respectively. The slope of these diagonals gives *SAC* at point *P, L M* and *N*. As the figure shows, the diagonals rotate downward till point *M* showing decrease in their slope and decrease in *SAC*. Beyond point *M*, however, the diagonal begins to rotate upward as shown by the line *MN*. This indicates increase in the slope of the line and increase in *SAC*.

The *SAC*s corresponding to point *J, P, L, M* and *N* are indicated by points *J', P', L', M'* and *N'* in part (b) of Fig. 14.4. By joining these points, we get the *SAC* curve. The *SAC* curve shows the behaviour of *short-run average cost* in response to change in output. Note that *SAVC* and *SAC* are both U-shaped, though their values are different at the same level of output. Their relative position (along with other short-run average and marginal cost curves) is shown ahead in Fig. 14.6.

The U-shape of the *SAVC* and *SAC* is attributed to the *law of diminishing returns*. The *SAVC* and *SAC* decrease in the initial stage of production due to *increasing returns* to the variable input and begins to increase when returns to the variable input begins to decrease.

(iv) Derivation of the short-run marginal cost (SMC) Curve. The two short-run cost curves that matter most in economic analysis of production and pricing decisions are ***short-run average cost (SAC) curve*** and ***short-run marginal cost (SMC) curve***. We have shown above the derivation of the *SAC* curve. We will now describe and illustrate the method of deriving *SMC*.

The method of deriving the *SMC* curve is illustrated in Fig. 14.5. Note that *SMC at any level of output* equals the slope of the *STC* curve at that output. Let us suppose that, given the curve *STC*, we want to measure *marginal cost* at point *A*. What we need now is to draw a tangent to *STC* curve at piont *A* as shown by the tangent *TN*. The slope of the tangent *TN* at point *A* = *AM/TM*. Since slope of the tangent and that of the *STC* curve at the point of tangency is the same,

slope of the *STC* curve at point *A* = *AM/TM* = marginal cost.

Let us suppose that $AM/TM = A'Q_1 = SMC$ at point *A*. This measure of *SMC* is shown by the vertical distance $A'Q_1$ in part (b) of the figure. This method can be repeated for any number of points on the *STC* curve and *SMC* measured. We have illustrated the method for point *B, C* and *D* on the *STC* curve. The slope of the corresponding, tangents gives *SMC* at point *B, C* and *D*. Following the process we adopted in case of point *A*, we get *SMC* at these points as $B'Q_2$, $C'Q_3$ and $D'Q_4$, respectively. Note that the slope of the tangents goes on decreasing till point *C* and then it begins to increase as shown by the tangent at point *D* in part (a) of the figure. This implies that marginal cost goes on decreasing till output OQ_3 and then it begins to increase. The trend in SMC can be expressed as

$$AQ_1 > B'Q_2 > C'Q_3 < D'Q_4$$

By plotting these marginal costs, we get the *SMC* curve as shown in part (b) of Fig. 14.5.

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The various kinds of cost measures calculated on the basis of Eq. (14.6) are presented in Table 14.1. The *TFC*, *TVC* and *TC* have been graphically presented in Fig. 14.7. As the figure shows, *TFC* remains fixed for the whole range of output, and hence, takes the form of a horizontal line—*TFC*. The *TVC* curve shows that the total variable cost first increases at a decreasing rate and then at an increasing rate with the increase in the output. As already mentioned, the rate of incrase can be obtained from the slope of *TVC* curve. The pattern of change in the *TVC* stems directly from the law of increasing and diminishing returns to the variable inputs. As output increases, larger quantities of variable inputs are required to produce the same quantity of output due to diminishing returns. This causes a subsequent increase in the variable cost for producing the same output.

Table 14.1 Cost-Output Relations

Q	*FC*	*TVC*	*TC*	*AFC*	*AVC*	*AC*	*MC**
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
0	10	0.0	10.00	-	-	-	-
1	10	5.15	15.15	10.00	5.15	15.15	5.15
2	10	8.80	18.80	5.00	4.40	9.40	3.65
3	10	11.25	21.25	3.33	3.75	7.08	2.45
4	10	12.80	22.80	2.50	3.20	5.70	1.55
5	10	13.75	23.75	2.00	2.75	4.75	0.95
6	10	14.40	24.40	1.67	2.40	4.07	0.65
7	10	15.05	25.05	1.43	2.15	3.58	0.65
8	10	16.00	26.00	1.25	2.00	3.25	0.95
9	10	17.55	27.55	1.11	1.95	3.06	1.55
10	10	20.00	30.00	1.00	2.00	3.00	2.45
11	10	23.65	33.65	0.90	2.15	3.05	3.65
12	10	28.80	38.80	0.83	2.40	3.23	5.15
13	10	35.75	45.75	0.77	2.75	3.52	6.95
14	10	44.80	54.80	0.71	3.20	3.91	9.05
15	10	56.25	66.25	0.67	3.75	4.42	11.45
16	10	70.40	80.40	0.62	4.40	5.02	14.15

*$MC = TC_n - TC_{n-1}$.

Derivation of Behavioural Cost Equations

From Eq. (14.6), we can derive the behavioural equations for *AFC*, *AVC* and *AC*. Let us first consider *AFC*.

(i) Average fixed cost (AFC). As already mentioned, the costs that remain fixed for a certain level of output make the total fixed cost in the short-run. The fixed cost is represented by the constant term 'A' in Eq. (14.6) and A = 10. Substituting 10 for *TFC* in Eq. (14.2), we get

$$AFC = \frac{10}{Q} \tag{14.7}$$

Eq. (14.7) expresses the behaviour of *AFC* in relation to change in *Q*. The behaviour of *AFC* for *Q* from 1 to 16 is given in Table 14.1 (col. 5) and presented graphically by the *AFC* curve in Fig. 14.8. The *AFC* curve is a rectangular hyperbola.

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14.6.2 Derivation of Long-Run Average Cost (LAC) Curve

The derivation of the *LAC* is illustrated in panel (b) of Fig. 14.9. There are three *SAC*s corresponding to three *STC*s is panel (a). SAC_1 corresponding to STC_1 is given in panel (b) of the figure. The firm has its minimum SAC_1 equal to C_1Q_1 at output OQ_1. SAC_2 is related to STC_2. Note that *AC* of the second plant is lower than that of the second plant, as shown by the curve SAC_2 in panel (b) due to economies of scale (discussed in Section 14.7 of this chapter) when the second plant is added. One reason is that with the addition of the second plant, availability of capital per worker increases and productivity of labour increases, including workers employed in the first plant. Consequently, unit cost of output decreases, given the input prices. However, when the third plant is added, this kind of advantage is reduced. Therefore, SAC_3 does fall but less than SAC_2, and *SAC* begins to rise and it rises to C_3Q_3 after the inclusion of the third plant.

The long-run average cost curve (LAC) can now be drawn by drawing a curve tangent to SAC_1, SAC_2, and SAC_3, as shown in Fig. 14.9 (b). The *LAC* curve is also called as **'Envelope Curve'**. It is also called as **'Planning Curve,'** as it serves as a guide to the entrepreneur in his planning to expand the production in future. A more general process of deriving 'Envelope Curve' is illustrated in Fig. 14.10.

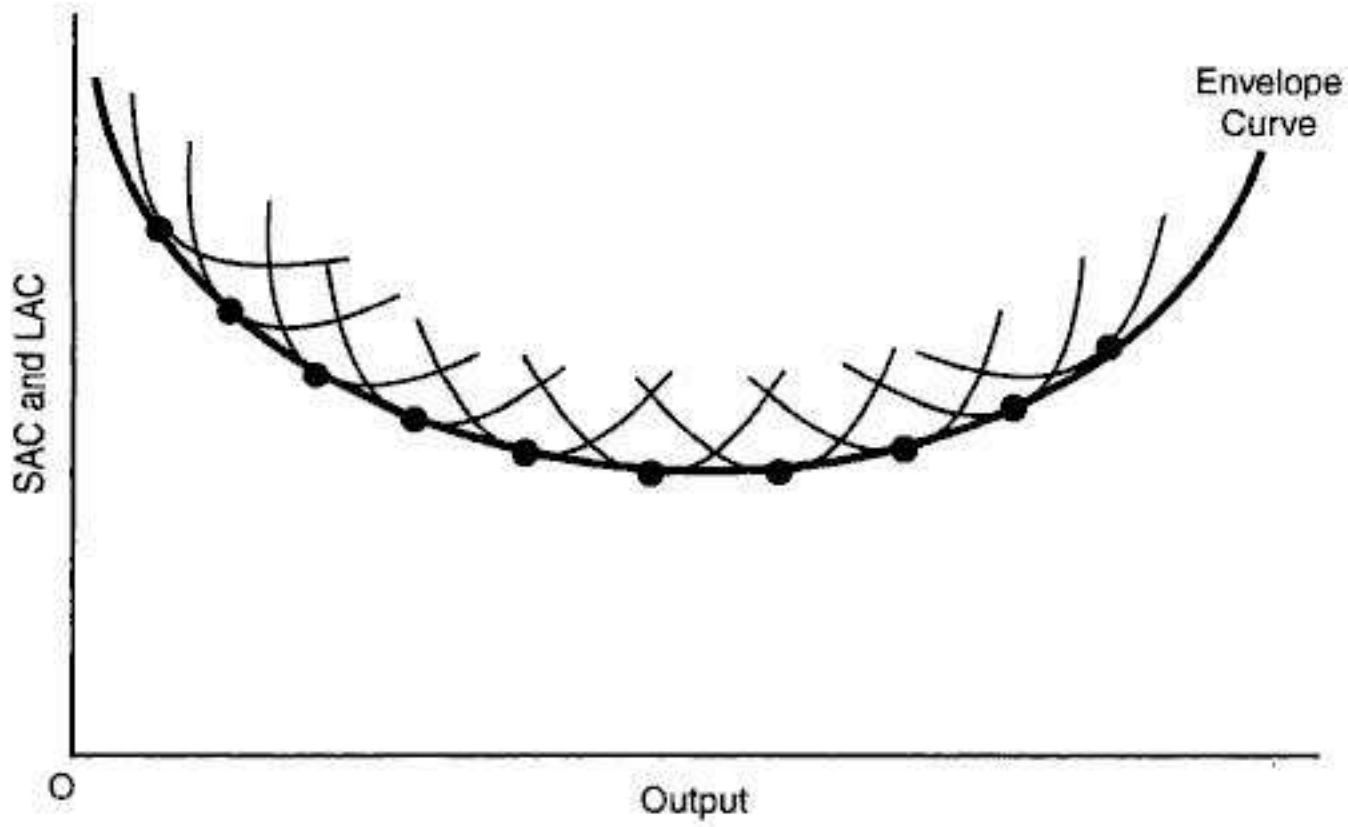


Fig.14.10 Derivation of Envelope Curve

The relationship between *LTC* and output and between *LAC* and output can now be easily inferred. As is obvious from the *LTC* Fig. 14.9(a), the long-run cost-output relationship is similar to the short-run cost-output relation. With the subsequent increase in the output, the *LTC* first increases at a decreasing rate, and then, at an increasing rate. As a result, *LAC* initially decreases until the optimum utilisation of the second plant. The addition of the third plant makes the *LAC* move upward because SAC_3 lies above the level of SAC_2. This trend in *LAC* implies that when the scale of the firm expands, per unit cost first decrease, but it increases ultimately as shown in Fig. 14.9(b). The decrease in per unit cost is the result of the internal and external economies and the eventual increase in cost, is caused by the internal and external diseconomies (discussed in Section 14.7 of this Chapter).

14.6.3 Derivation of Long-Run Marginal Cost (LMC) Curve

The long-run marginal cost curve (*LMC*) is derived from the short-run marginal cost curve (SMC_s). The derivation of *LMC* is illustrated in Fig. 14.11 in which *SAC*s and *LAC* are the same as in Fig.

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by the decrease in the production costs. Therefore, the *LAC* continues to fall but very slowly. *In case the decrease in production cost is just sufficient to offset the rise in the managerial cost, the LAC becomes constant*. This makes *LAC* an L-shaped curves.

Derivation of the LAC Curve

The derivation of the *LAC* curves is illustrated in Figs. 14.16 and 14.17. Fig. 14.16 shows the decreasing *LAC* curve. Let us suppose that, given the technology, the optimum scale of production consists of four plants and *SAC* curves from SAC_1 to SAC_4 in Fig. 14.16 represent the addition of four plants to the scale in each period of time. Clower and Due[1] have found that firms use 'normally' only 2/3 to 3/4 of the plant size. This is called 'load factor'. The ***load factor*** is the "ratio of average actual rate of use to the capacity or best rate of use, and this load factor will generally be smaller than one"[2]. The points *A*, *B*, *C* and *D* on the *SAC*s mark the 'load factor' in case of each plant, respectively – it may be any value between 2/3 and 3/4 of the plant size. By drawing a curve through the 'load-factor' points, we get the *LAC* curve. If there is a larger number of plants, we will get much larger number of 'load factor' points and draw a smooth *LAC* curve as shown in Fig. 14.16.

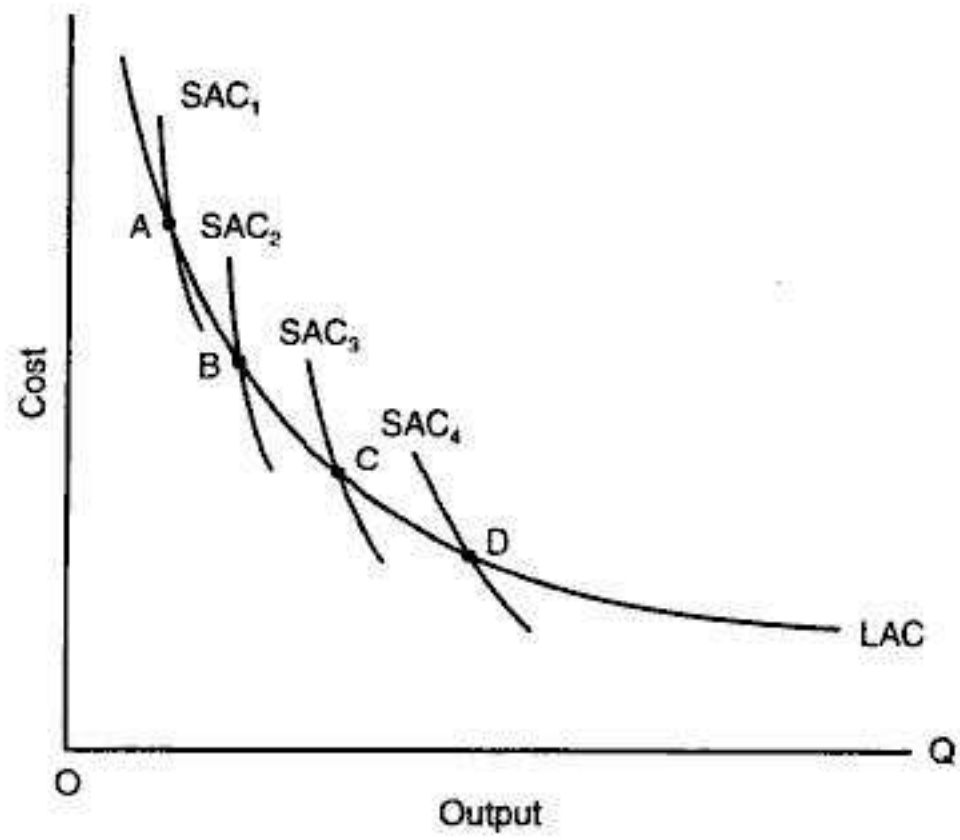


Fig. 14.16 Derivation of LAC Curve in Modern Theory

To compare the *LAC* of the modern and traditional theories of cost, two points need to be noted: (i) the *LAC* curve of the modern theory does not show the tendency to turn up even at a very large scale of production whereas the traditional *LAC* curve does turn up; (ii) unlike traditional *LAC* forming an *envelope curve*, modern *LAC* intersects the *SAC*s.

If case scale of production involves a ***minimum optimal scale of plant***, as shown by output level *OQ* in part (b) of Fig. 14.17, all economies of scale are achieved at output *OQ* and the *LAC* becomes constant even if scale of production is expanded. In this case, the *LMC* lies below the *LAC* till the *minimum optimal scale of plant* is reached, as shown in part (a) of Fig. 14.17. When the firm operates in the range of no-scale-economies, i.e., beyond output *OQ* in part (b) of Fig. 14.17, the *LAC* becomes

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1. Clower, R.W., and Due, J.F., *Microeconomics* (Irwin-Dorsey, 1972), P. 232 (quoted in Koutsoyiannis, *op. cit.*), p. 121.
2. J.S. Bain, *Barriers to New Competition* (Harvard University Press, Cambridge, Mass., 1956), p. 63.

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24. Derive the long-run average cost curve (*LAC*) according to the modern theory of cost. Explain why *LAC* curve under the modern theory is L-shaped.
25. The validity of the traditional theory of cost has been questioned on both theoretical and empirical grounds. Does the modern theory of cost provide a better alternative approach to explain and predict firm's behaviour in regard to price and output determination?

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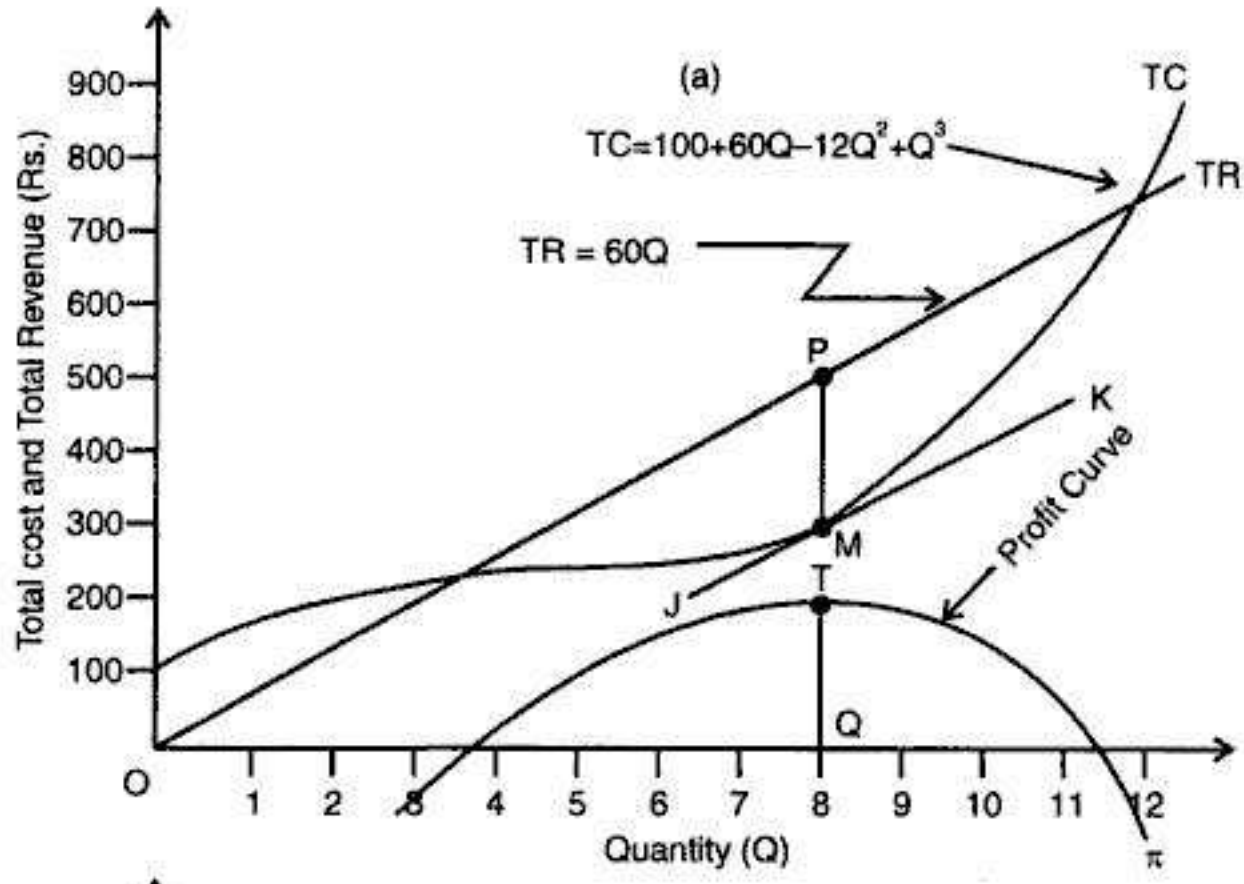


Fig. 15.1 Determination of Maximum Profit and Output

How to find maximum profit? Given the *TR* and *TC* functions, there are *three* ways to find the level of output at which profit is maximum.

Numerical Method. One simple method is to convert function into tabular form, as shown in Table 15.1, and find the numerical value of maximum profit. It can be seen in the table that profit is maximised at 156 at output of 8 units.

Graphical Method. There is a graphical and a more efficient method to find maximum profit. Given the *TR* and *TC* curves, this method requires drawing a tangent to *TC* and parallel to *TR*, as shown by the line *JK* in panel (a) of Fig. 15.1. The line *JK* is tangent to *TC* at point *M*. As Fig. 15.1(a) shows, the gaps between *TR* and *TC* is maximum at point *M*. A perpendicular drawn from point *M* to *TR* gives the maximum difference, *PM*, between *TR* and *TC*. Thus, *PM* is the maximum possible profit. The

* Except for zero output.

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of the firms. He has, further, argued that the relevance of marginal rules in actual pricing system of firms could not be established because of lack of communication between the businessmen and the researchers as they use different terminology. Businessmen are not quite familar with economic terminology like *MR*, *MC* and elasticities. Besides, businessmen, even if they do understand economic concepts, would not admit that they are making abnormal profits on the basis of marginal rules of pricing. They would instead talk of a 'fair profit'. Also, Machlup is of the opinion that the practice of setting price equal to average variable cost plus a profit margin is not incompatible with the marginal rule,[1] and that the assumptions of traditional theory are plausible.

It is however difficult to give judgement on the controversy between the marginal theorists and the empirical researches. The controversy remains unresolved. The proponents of profit maximisation hypothesis have put forward the following arguments in defence of the profit maximisation hypothesis.

First, it is argued that only those firms will survive, in a competitive market, which are able to make reasonable profits. That is, for their survival, the firms will have to make profits and maintain their total earnings above their total costs. Since they are in business, they would always try to maximise their profits ***All other objectives are secondary to this primary objective***. In their effort to maximise their profits, firms would eventually tend to behave in accordance with the marginal rules or profit maximisation, at least approximately.

Second, the strength of profit maximisation hypothesis lies in the fact that economists have found this hypothesis extremely accurate in predicting certain aspects of a firm's behaviour. Milton Friedman argues that one cannot judge the validity of profit-maxmisation hypothesis either by a *priori* logic or by asking business executives. The ultimate test is predictive ability of the hypothesis. And, predictive ability of profit maximisation hypothesis is greater than any alternaive hypothesis.[2]

Third, profit-maximisation is a time-honoured hypothesis and the evidence against this hypothesis is not unambiguous. "Most economists today....believe that the assumption of profit maximization provides a close enough approximation for the analysis of many problems, and it has become the standard assumption regarding the behaviour of the firm."[3]

For the sake of completeness, however, we have briefly discussed below some major alternative hypotheses which have been suggested to analyse firm's behaviour.

15.2.3 Alternative Objectives of Business Firms

Although profit-maximisation assumption continues to remain the most popular hypothesis in economic analysis, as Baumol[4] has argued "there is no reason to believe that all businessmen pursue that same objective." The observed facts reveal that business firms, in fact, pursue multiple objectives, often conflicting with each other. Some major alternative objectives of firms, suggested in economic literature, may be grouped as follows.

A. Maximisation of the managerial utility function;
B. Satisficing goals of the firms;
C. Long-run survival and market-share goals;
D. Entry prevention and risk-avoidance.

---

1. This piont has been discussed in detail in Chapter 19.
2. Milton Friedman, *The Methodology of Positive Economics. op. cit.*
3. Browning, E.K. and Browning, J.M., *Microeconomic Theory and Application*, op. cit., p. 231.
4. Baumol, W.J., *Economic Theory and Operations Analysis, op. cit.*, p. 378.

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nature and the characteristics of different kinds of market will be discussed in detail in the subsequent chapters along with price and output determination in each kind of market. Here, we present only an overview of the market structure.

The market structure is generally classified as follows:

(i) Perfect Competition
(ii) Imperfect Competition
(iii) Monopoly

The basic features of these kinds of market are summarised in Table 15.2. However, a brief description of each kind of market is given below.

(i) Perfect Competition

Perfect competition is a market situation in which a large number of producers offer a homogenous product, to a very large number of buyers of the product. The number of sellers is so large that each seller offers a very small fraction of the total supply, and therefore, has no control over the market price. Likewise, the number of buyers is so large that each buyer buys an insignificant part of the total supply and has no control over the market price. Both buyers and sellers are "price takers", not "price makers". The price of a commodity is determined in this kind of markets by the market demand and market supply. Each seller faces a horizontal demand curve (with $e = \infty$), which implies that a seller can sell any quantity at the market determind price. ***Each firm is in competition with so large number of firms that there is virtually no competition***. This kind of market is, however, more of a hypothetical nature rather than being a common or realistic one. Some examples of a perfectly competitive market include share markets, vegetable markets, wheat and rice *mandis* where goods are sold by auction.

Table 15.2 Kinds of Market Structure

Type of market	*No. of firms*	*Nature of Product*	*Firm's control over price*
Perfect Competition	Very large	Homogenous (wheat, sugar, vegetables...)	None
Imperfect Competition			
a) **Monopolistic Competition**	Many	Real or perceived difference in product (most retail trade)	Some
b) **Oligopoly**	Few	i) Product without differentiation, e.g., bread, steel, and chemicals, sugar, etc. ii) Differentiated products (e.g, tea, toothpastes, soaps, detergents, automobiles, etc.)	Some
Monopoly	Single	Products without close substitutes, like gas, electricity and telephones	Full but generally regulated

(ii) Imperfect Competition

Perfect competition, in strict sense of the term, is a rare phenomenon. In reality, markets for most goods and services have imperfect competition. Imperfect competition is said to exist when a number

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No control over cost. Because of its small purchase of inputs (labour and capital), a firm has no control over input prices. Nor can it influence the technology. Therefore, cost function for an individual firm is given. This point is, however, not specific to firms in a perfectly competitive market. This condition applies to all kinds of market except in case of bilateral monopoly.

What Are the Firm's Options

The firm's option and role in a perfectly competitive market are very limited. The firm has **no option** with respect to price and cost. It has to accept the market price and produce with a given cost function. The only option the firm has is to produce a quantity that maximises its profits given the price and cost. Under profit maximising assumption, a firm has to produce a quantity which maximises its profit and attains its equilibrium. This piont is explained further in the following section.

16.3 SHORT-RUN EQUILIBRIUM OF THE FIRM

A profit maximising firm is in equilibrium at the level of output which equates its $MC = MR$. However, the level of output which meets the equilibrium condition for a firm varies depending on cost and revenue functions. The nature of cost and revenue functions depends on whether one is considering ***short-run*** or ***long-run***. While the revenue function is generally assumed to be given in both short and long runs, the short-run cost function is not the same in the short and long-runs. The short-run cost function is different from the long-run cost function because in the short run, some inputs (e.g., capital) are held constant while all factors are variable in the long-run. In this section, we will discuss ***firm's short-run equilibrium***. Long-r1un equilibrium of the firm will be discussd in the forthcoming section.

Assumptions

The short-run equilibrium of a firm is analysed under the following assumptions.

(a) capital is fixed but labour is variable;
(b) prices of inputs are given;
(c) price of the commodity is fixed; and
(d) the firm is faced with short-run U-shaped cost curves.

The firm's equilibrium in the short-run is illustrated in Fig. 16.2. Price of a commodity is determined by the market forces—demand and supply—in a perfectly competitive market at OP. The firms, therefore, face a straight-line, horizontal demand curve, as shown by the line $P = MR$. The straight horizontal demand line implies that price equals marginal revenue, i.e., $AR = MR$. The short-run average and marginal cost curves are shown by SAC and SMC, respectively.

It can be seen in Fig. 16.2 that SMC curve intersects the $P = MR$ line at point E, from below. At point E, therefore, $SMC = MR$. A perpendicular drawn from point E to the output axis determines the equilibrium output at OQ. It can be seen in the figure that output OQ meets both the *first* and the *second order conditions* of profit maximisation. At output OQ, therefore, profit is maximum. The output OQ is, thus, the equilibrium output. At this output, the firm is in equilibrium and is making maximum profit. Firm's maximum pure profit is shown by the area $PEE'P'$ which equals $PP' \times OQ$ where PP' is the per unit super normal profit at output OQ.

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sloping demand curve. Under monopoly, however, there is no distinction between the firm and the industry. ***The monopoly industry is a single-firm-industry and industry demand curve has a negative slope.*** A monopoly firm faces, therefore, a downward sloping demand curve—it may be a linear or a non-linear demand curve. It is **important** to note here that, given the demand curve, a monopoly firm has the option to choose between price to be charged or output to be sold. Once it chooses price, the demand for its output if fixed. Similarly, if the firm decides to sell a certain quantity of output, then its price is fixed—it cannot charge any other price inconsistent with the demand curve.

For example, suppose that the demand curve for a monopolised industry is given as *DM* in Fig. 17.1. Demand curve, *DM*, shows the quantities that can be sold at different prices. For instance, if monopoly firm chooses price *OP*, the quantity that it can sell at this price if fixed at *OQ*—no other quantity can be sold at this price. Similarly, if it decides to sell quantity *ON*, its price is fixed at *OP'*—it cannot sell *ON* output at a higher price. This means that if demand curve is given, the options of monopoly firm becomes limited—it can choose either price or quantity at a time, not a price and a quantity inconsistent with the demand curve.

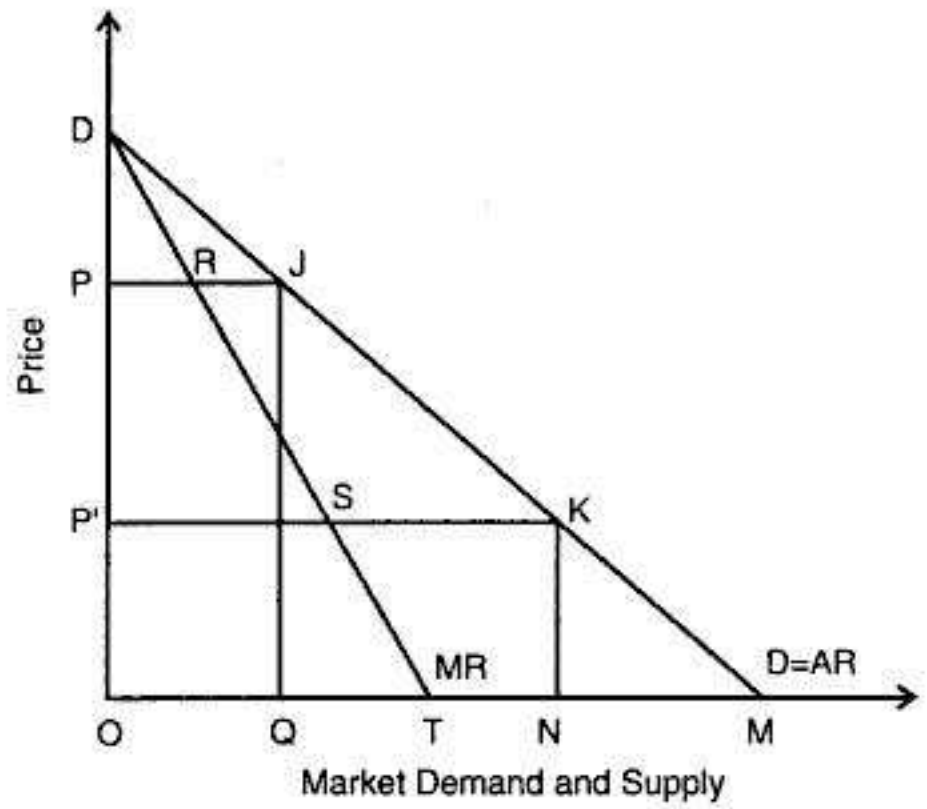


Fig. 17.1 AR and MR Curves for Monopoly

AR and MR Curves

Irrespective of the nature of the market, *AR* curve for a firm is the same as its demand curve. So is the case with a monopoly firm. Since a monopoly firm faces a downward sloping demand curve, its *AR* also slopes downward to the right. For example, the demand curve *DM* in Fig. 17.1 is the same as the firm's *AR* curve.

What is much more ***important*** in the analysis of equilibrium of a monopoly firm is the ***relationship between the AR and MR*** curves. As we have seen in the previous chapter, when price is fixed, as in case of perfect competition, firm's demand curve takes the form of a horizontal line. In that case, *AR* = *MR* and *MR* is a straight line too. But, in case of a monopoly firm, demand curve has a negative slope. Therefore, its *MR* curve too has a negative slope. There is, however, a ***specific relationship*** between *AR* and *MR*, i.e., *the slope of MR curve is twice that of that AR curve*. That is, given the linear demand function, marginal revenue curve is twice as steep as the average revenue curve.

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Given the price, total profit (π) can be obtained by using *TR-TC* approach as follows.

$$\pi = TR - TC$$

By substitution, we get

$$\pi = 500Q - 5Q^2 - (50 + 20Q + Q^2)$$
$$= 500Q - 5Q^2 - 50 - 20Q - Q^2$$

By substituting profit maximising output (40) for Q, we get

$$\pi = 500(40) - 5(40)(40) - 50 - 20(40) - (40 \times 40)$$
$$= 20{,}000 - 8{,}000 - 50 - 800 - 1600$$
$$= 9{,}550$$

Thus, the maximum profit is Rs 9,550. No other output and price can increase firm's profit.

17.3.4 Does a Monopoly Firm Always Make Pure Profit?

There is no certainty that a monopoly firm will always earn a pure or supernormal profit. Whether a monopoly firm earns supernormal profit or normal profit or incurs loss depends on (i) its cost and revenue conditions; (ii) threat from potential competition; and (iii) government policy in respect of monopoly. If a monopoly firm operates at the level of output where $MR = MC$, its profit depends on the relative levels of AR and AC. Given the level of output, there are three possibilities:

(i) if $AR > AC$, there is economic profit for the firms,
(ii) if $AR = AC$, the firm earns only normal profit, and
(iii) if $AR < AC$, the firm makes losses: a theoretical possibility in the short run.

Two Common Misconceptions

There are two common misconceptions about monopolies: (i) monopolies always make profits, and (ii) they can charge any price arbitratily. These misconceptions must be clarified before we proceed to discuss other related issues.

(a) A monopoly does not necessarily make profit in the short-run. There is no guarantee that a monopoly firm will always make profits in the short-run. In fact, as noted above, whether a monopoly makes profit or loss in the short-run depends on its revenue and cost conditions. It is quite likely that its *SAC* curve lies above its *AR* curve as shown in Fig. 17.4. At profit maximising output (OQ), *SAC* exceed *AR* by *PM*. The monopoly firm therefore, makes losses to the extent of $PM \times OQ = P_2MPP_1$ in the short-run. The firm may yet survive in the short run, in the hope of making profits in the long-run when economics of scale become available to the firm and it does happen. The monopoly firm will however stick to the profit maximisation rule (i.e. $MR = MC$) in order to minimise its losses in the short run. Furthermore, if monopoly firm operates in the short-run at a level of output where its $MR = SMC$ and $AR = SAC$, it makes just normal profits like a competitive firm in the long run.

(b) Monopolies cannot charge an arbitrary price. Another common misconception about monopoly is that a monopoly firm, by virtue of being a single seller of a commodity, can charge *any* price or an exhorbitantly high price for its product. In fact, the demand curve faced by a monopolist, is also the industry's demand curve. And, most market demand curves are negatively sloped, being highly elastic in the region of upper half and highly inelastic in the lower half. As shown in Fig. 17.5, point M marks the mid-point of the demand curve PQ. As proved earlier, at mid-point of the demand curve, i.e., at point M, $e = 1$. Over the upper half of the demand curve, $e > 1$; and over its lower half, $e < 1$. (For proof, see Chapter 4, Section 1.3). Therefore, a monopoly firm cannot charge any price. If it does so, it will do so at the cost of revenue and profit.

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3. Free entry and free exist. As in case of perfect competition, there is no barrier on the entry of new firms and exit of old ones from the industry. New firms are free to enter the monopolistically competitive industry and to quit at will. Entry of new firms reduces the market share of the existing ones and exit of firms does the opposite. These consequences of free entry and free exit lead to intensive competition among the firms for both retaining and increasing their market share.

4. Selling costs. Unlike firms under perfect competition and monopolies, firms under monopolistic competition make heavy expenditure on advertisement and other sales promotion schemes for their product. This is an important feature that distinguishes monopolistic competition from perfect competition and monopoly. *Selling costs* include all the expenditure on advertisement, sales promotion schemes, and salaries of sales personnel. Selling costs and their effect of firm's equilibrium will be discussed below in detail.

5. Downwad sloping demand curve. As in case of monopoly, a monopolistically competitive firms faces a downward sloping demand curve. The reason is that a monopolistically competitive firm can, by exercising its monopoly power, increase its price and still retain some buyers with brand loyalty and can increase the demand for its product by decreasing the price because of a relatively higher cross-elasticity of the competitive product.

18.3 BASIC ELEMENTS OF CHAMBERLIN'S THEORY OF MONOPOLISTIC COMPETITION

In the rest of this chapter, we will be concerned with Chamberlin's theory of monopolistic competition. For a better comprehension of his theory, it is essential to understand the implications of the following three basic elements of monopolistic competition as defined by Chamberlin.

(i) Product differentiation and firm's demand curve;
(ii) Selling costs and firm's cost structure, and
(iii) Product differentiation and the concept of industry

These aspects of monopolistic competition are briefly discussed below.

18.3.1 Product Differentiation and Firm's Demand Curve

Product differentiation is the basis of competition among the monopolistically competitive firms. Chamberlin has defined ***product differentiation*** in the following words. "A general class of product is differentiated if any significant basis exists for distinguishing the goods (or services) of one seller from those of others. Such a basis may be real or fancied, so long as it is of any importance whatever to buyers, and leads to a preference for one variety of product over another. Differentiation may be based upon certain characteristics of the product itself, such as exclusive patented features, trade marks, trade names, peculiarities of the package or container, if any, of singularity in quality, design, colour or style. It may also exist with respect to the conditions surrounding its sales. In retail trade, these conditions include such factors as the convenience of the seller's location, the general tone or character of his establishment, his way of doing business, his reputation for fair dealing, courtesy, efficiency, and all the personal links, which attach his customers either to himself or to those employed by him."[1]

Thus, the basic purpose of product differentiation is to make customers distinguish the product of a firm from those of the others in the industry and to develop a preference or band loyalty. Once brand loyalty is developed, it alters the course of the demand curve for the product. In the ultimate

1. Chamberlin, E.D., *Theory of Monopolistic Competition: A Re-Orientation of the Theory of Value (OUP)*, 7th Edn., 1956, p. 56.

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APC + ASC. The vertical distance between the *APC* and *APC + ASC* measures the *average selling cost (ASC)*. Finally, firm's overall *MC* (associated with *APC + ASC*) is shown by the *MC* curve.

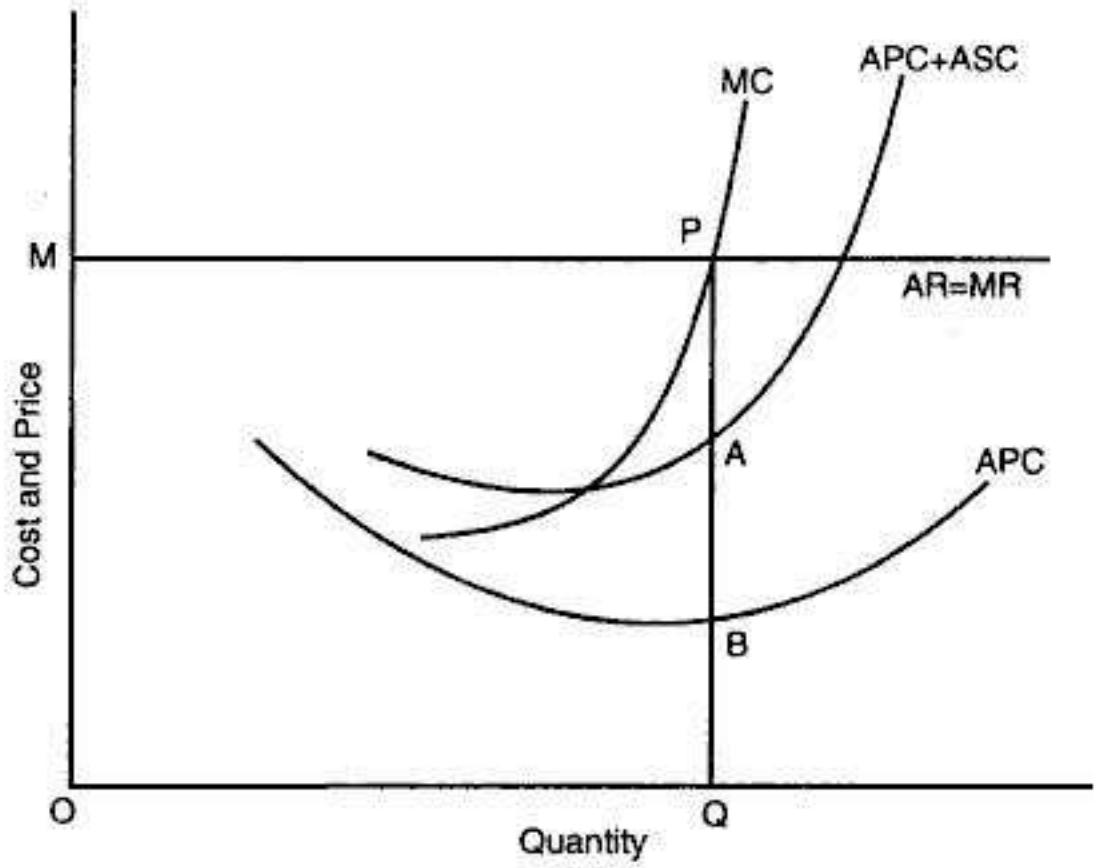


Fig. 18.3 Optimization of Selling Cost

As Fig 18.3 shows, price line, $AR = MR$, and *MC* curve intersect at point *P*. An ordinate drawn from point *P* to the quantity axis determines the profit maximizing output at *OQ*. Once profit-maximizing output is determined, the optimum level of all costs (given the cost curves) is automatically determined. It can be seen in Fig. 18.3 that at profit maximizing output *OQ*, price equals $PQ = BQ + AB + AP$. Note that at output *OQ*, average selling cost (*ASC*) equals *AB*. That is, at the profit maximizing level of output, average advertising cost equals *AB*. Therefore, *AB* is the *optimum average selling cost (ASC)*. The total optimum selling cost or advertisement expenditure can be obtained by multiplying *ASC* with output *OQ*. That is, *total optimum advertisement expenditure* $= OQ \times AB$.

18.3.3 Concept of Industry and Product Groups

An industry under perfectly competitive conditions is defined as a group of firms producing a homogeneous product. But, this concept of industry cannot be applied to the cases where products are differentiated. Where products are differentiated—slightly or substantially—each firm is, in a sense, an industry in itself, exactly as a monopoly firm is an industry in itself. The heterogeneity of the products, therefore, causes a problem in analytical treatment of the industry. Problem arises because ***industry demand curve under monopolistic competition is not the same as under perfect competition***. Since under perfect competition, product is homogeneous, demand curve for an industry can be obtained by adding individual demand curve of individuals firms. But, under monopolistic competition, product is made heterogoneous through product differentiation techniques and in case of heterogeneous products, the demand for individual products cannot be added to obtain market demand and supply curves.

For the reason given above, Chamberlin defines the monopolistically competitive industry as a 'group' of firms producing a 'closely related' commodity, called ***product group***. The products of the 'group' must be *close, technological and economic substitutes*. The two products are ***technological substitutes*** for each other if they technically satisfy the same want, e.g., soaps, cigarettes, toothpastes,

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APPENDIX

LONG-RUN EQUILIBRIUM OF FIRMS IN MONOPOLISTIC COMPETITION

As already mentioned in the text, long-run changes in monopolistic competition include (i) new firms enter the industry, (ii) firms begin price competition, (iii) firms make vigorous advertisement with a view to enhancing their market share or to retain their market share especially when there is entry of new firms into the industry or the product group. These changes affect the market share of the rival firms which leads to intensive competition. Chamberlin has used three models to analyse the effects of these changes on firm's equilibrium. His three models present, in fact, the four different stages of analysis. In this ***first model***, he analyses firm's equilibrium with free entry of new firms into the industry, all other things given. His ***second model*** analyses the effect of price competition between the firms on the their equilibrium, with no entry or exit. His ***third model*** presents a combined analysis of free entry and price competition on the firm's equilibrium. These models are discussed below in the same sequence.

MODEL 1: LONG-RUN EQUILIBRIUM WITH FREE ENTRY OF NEW FIRMS

The long-run equilibrium of firms with free entry of new firms, other things remaining the same, is illustrated in Fig. 18.1A. The *LAC* and *LMC* curves are the cost curves faced by the firms. The initial *AR* and *MR* curves, (i.e., prior to the entry of new firms) are given by $AR = D_2$ and MR_2, respectively. Given the cost and revenue curves, the firms will be in short-run equilibrium at price OP_2 and output OQ_2. The firms are making super-normal profit to the extent of *EB* per unit of output.

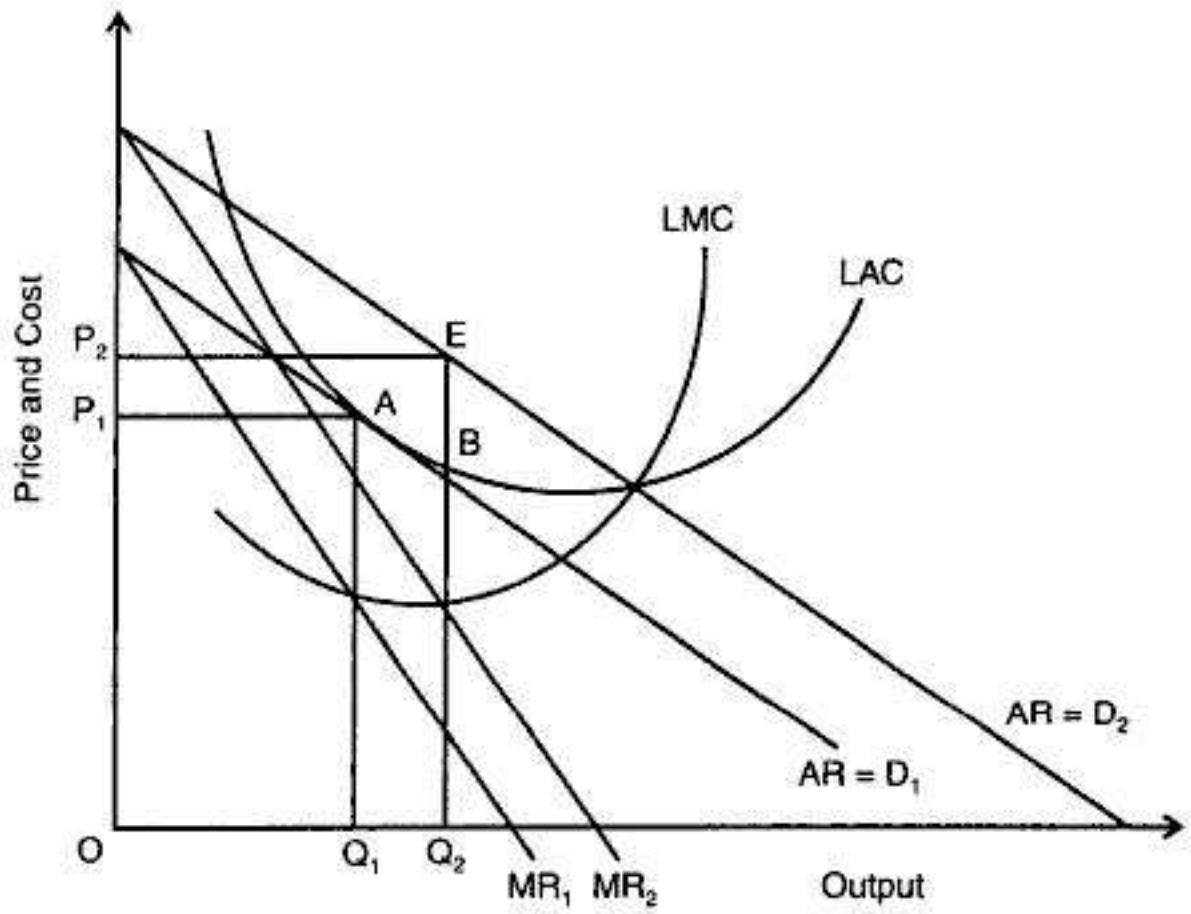


Fig. 18.1A Long-run Equilibrium with Free Entry

The existence of super-normal profit attracts new firms to the product group. With the entry of new firms, the sale of each firm in the group decreases. Consequently, the demand curve (i.e., *AR* curve) for the old firms shifts downward. Therefore, firms adjust their price and output to the new *AR* and *MR* conditions, cost conditions remaining the same. This process continues until the demand

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Profit maximising price (P_2) and average cost (AC_2) of Firm 2 can now be obtained by substituting output 8 for Q_2 in price function (19.20) and AC function (19.24), respectively. Thus,

$$P_2 = 100 - 2Q_2$$
$$= 100 - 2(8) = \text{Rs. } 84$$

and

$$AC_2 = (64 + 64Q_2 + 2Q_2^2)/Q_2$$
$$= [64 + 36(8) + 2(8^2)]/8$$
$$= \text{Rs. } 58$$

To summarize, given the market demand function and individual cost functions, the two firms will set their price and output in the absence of collusion between them as follows.

Firm 1 : $Q_1 = 10$ and $P_1 = 80$

and Firm 2 : $Q_2 = 8$ and $P_2 = 84$

Under the *price leadership model*, however, Firm 1, a low-cost firm, acting as price leader will set the price of its product at Rs. 80 and Firm 2 will also set the price of its product at Rs. 80, the price set by Firm 1. Note that the per unit profit of Firm 2 is reduced from Rs. 26 to Rs. 22. But this happens only when a high-cost firm has to accept the price-leadership of the low-cost firm.

(ii) Price Leadership by a Dominant Firm

Price leadership by a dominant firm is more common than by a low-cost firm. In the analysis of price leadership by a dominant firm, it is assumed that there exists a large size firm in the industry, which supplies a large proportion of the total market. The dominance of the large firm is indicated by the fact that it could possibly eliminate all its rival firms by price-cutting. In that case, the large firm gains the status of a monopoly which may invite legal problems. The dominant firm, therefore, compromises with the existence of the rival firms in the market. It uses its dominance to set its price so as to maximise its profit. The smaller firms recognise their weak position and behave like a firm in a perfectly competitive market, i.e., smaller firms accept the price set by the dominant firm.

The price leadership and market sharing between the dominant firm and the rival small firms as a group is illustrated in Fig. 19.12. Suppose that the market demand curve is given by DD_M and the supply curve of the small firms is given by the curve S_S in part (a) of the figure. The problem confronting the dominant firm is to determine its price and output that will maximise its profit, leaving the rest of the market to be jointly supplied by the small firms. To solve this problem, the dominant firm finds its demand curve by deducting the quantity supplied jointly by the small firms at different price from the corresponding market demand. The dominant firms considers the residual of the market share as the demand for its own product. Thus, at a given price the market share of the dominant firm equals the market demand *less* the share of small firms.

For example, when market price is set at OP_3, the total supply by the smaller firms is P_3E which equals the market demand. Therefore, at price OP_3, the market left for the dominant firm is zero. When price falls to OP_2, the demand for dominant firm's product is $CF = P_2F - P_2C$. Following this process, the market-share of the dominant firm at other prices can be easily obtained.

Note that the gap between demand curve DD_M and supply curve P_1S_s below point E in Fig. 19.12(a) measures the demand for the dominant firm.

The information so derived and plotted graphically gives P_3D_D as the demand curve for the dominant firm [Fig. 19.12 (b)]. Since the relation between AR and MR is known, the MR curve for the dominant firm can be dervied as MR_D [Fig. 19.12(b)]. If MC curve of the dominant firm is assumed to be given as MC_D, its profit maximising output will be OQ_D and price PQ_D.

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of labour increases; (b) with the increase in population and expansion of education and training facilities, supply of all types of labour increases; and (c) with the increase in information about job-market, young people are able to plan their education and career.

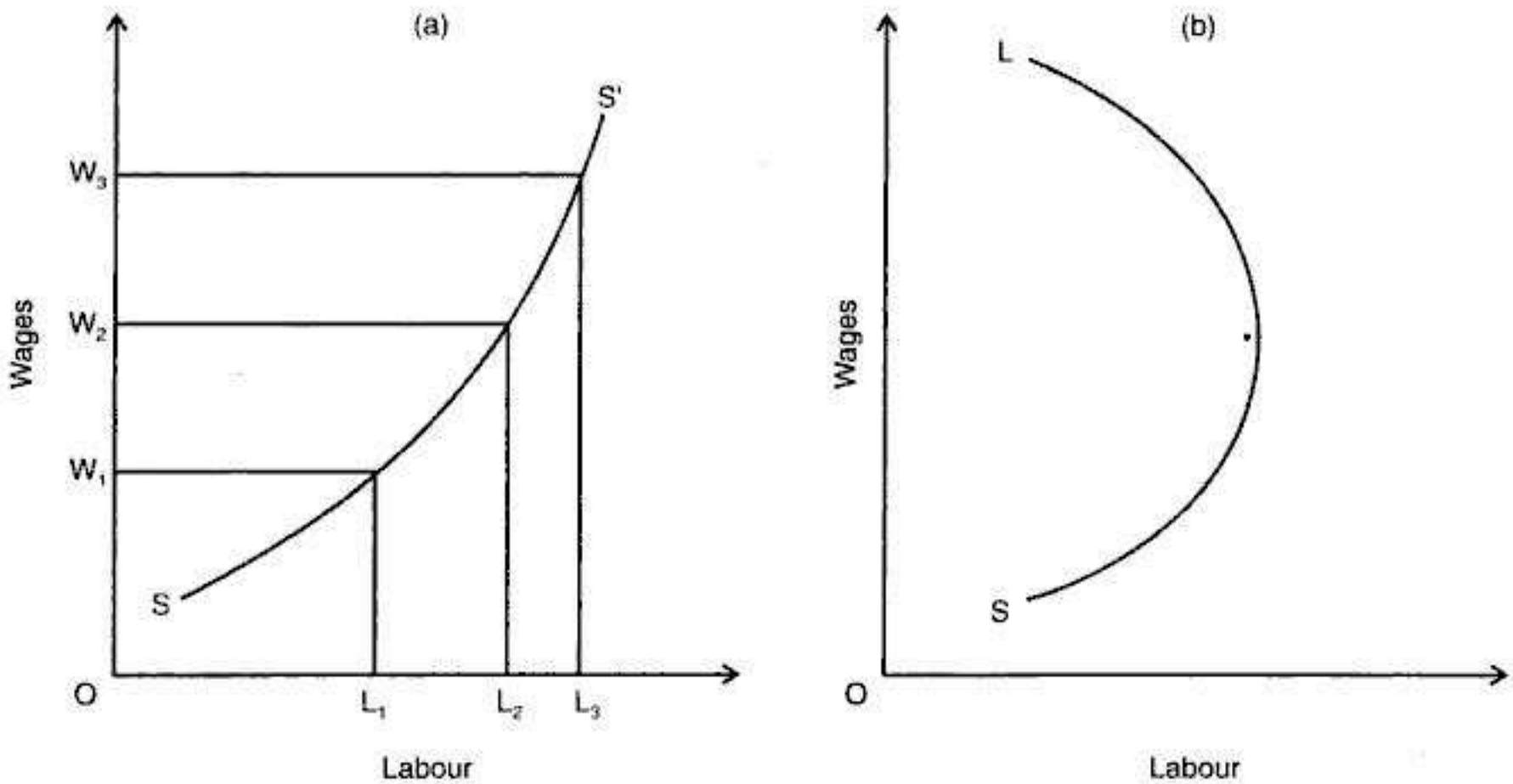


Fig. 20.10 Labour Supply Curve

In case of non-specialised labour, however, the shape of labour supply curve is generally predictable. It has a positive slope for two reasons. ***First,*** industries which plan to employ more labour, can draw it from other industries by offering higher wages. Hence the labour supply to such industries increases only at higher wage rates. ***Secondly,*** some industries lose their labour and hence their output falls. The fall in the output of such industries leads to a rise in the price of their products causing in upward pressure on the demand-price of labour. Therefore, such industries too obtain a larger supply of labour at increasing wage rates only. For these reasons, the industries attempting to employ larger units of labour must face a labour supply curve with a positive slope.

There is however, a likelihood that ***the market labour supply curve in an affluent country is a backward-bending one.*** The reason is when individual become richer and richer, they begin to prefer smaller number of working hours, longer holidays, and fewer hours of work per day, and so on, as they need longer time to enjoy their high earnings. This likelihood would however be limited to the rich nations in which the scope for further expansion is limited. It is, therefore, generally believed that ***labour supply curve in the long-run must have a positive slope.***

20.5.4 Wage Determination in Perfectly Competitive Markets

We have derived above the market demand and supply curves for labour. These tools may now be straightaway applied to illustrate the determination if wage rate in a perfectly competitive market. Figure 20.11 shows the determination of wage in a competitive market. The labour demand curve (D_L) and labour supply curve (S_L) intersect each other at point *P*. At this point, demand for and supply of labour are equal at *OL*, and wage rate is determined at *OW*. This wage rate, will remain stable in a competitive market so long as demand and supply conditions do not change. As mentioned above, this final analysis of factor price determination is similar to commodity price determination

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20.9 BILATERAL MONOPOLY IN FACTOR MARKET: THE CASE OF COLLECTIVE BARGAINING

The case of a bilateral monopoly[1] is said to exist in the factor market when there is a single buyer (the product monopolist being the monopsonist) and a single seller of factor (the labour union). This section analyses wage determination and employment under the conditions that *labour is supplied by monopolist (the labour union) and is demanded by a monopsonist*. We assume also that all buyers of a factor (labour) buy it from an Employers' Union which acts as a monopolist in the labour market. On the supply side, labour is organised in a Labour Union which acts as a monopolist. This kind of market situation is generally analysed under ***collective bargaining***.

It may be noted at the outset that economic theory does not predict a precise outcome of collective bargaining. The outcome of collective bargaining is not certain. ***The solution to bilateral monopoly situation is, in fact, indeterminate***. The economic analysis of bilateral monopoly (or collective bargaining) does, however, bring out the upper and lower limits within which wage rate can be determined through the process of collective bargaining. The determination of wage rate depends ultimately on a number of factors, e.g., bargaining powers and skills, economic and political power of labour unions and employer 's association, the effect of government intervention, etc.

We will first show the ***indeterminateness*** of equilibrium under bilateral monopoly and then analyse the effects of labour unions in respect of ***monopsonistic exploitation.***

Indeterminate Bilateral Monopoly

The indeterminateness of equilibrium under bilateral monopoly is illustrated in Fig. 20.22. The monopsonist's demand curve for labour is given by $D_L = MRP_L$. The monopolist (i.e, the labour union) considers MRP_L curve as its average revenue (AR_u). Given the AR_u curve, the marginal revenue curve of the labour union may be derived as MR_L— it must bisect the labour market midway. The labour supply curve from the monopsonist's point of view is given by $S_L = AW_m = MC_u$ and marginal cost of labour curve by MC_L.

Let us consider the situation from monopsonist point of view. The monopsonist must employ labour where $MRP_L = MC_L$ in order to maximise profit. Thus, given the cost and revenue curves, the monopsonist finds his equilibrium at point E where he would employ OL_u units of labour and pay wages OW_m.

On the other hand, the labour union[2] maximises its gains (earning per unit of time) where its marginal cost (MC_u) equals its marginal revenue (MR_L). The MC_u curve, from labour union's point of view, is the same are S_L curve. The MR_L and S_L curves intersect at point E_u. Thus, labour union's equilibrium condition is fulfilled at point E_u. At this point, employment is OL_m. Given the labour demand curve D_L, the labour union would press for wage rate OW_u.

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1. The term 'bilateral monopoly' means, in fact, a market situation in which two monopolists exchange their commodities.
2. The behaviour of labour union and Fig. 20.22 can be understood better if one looks at labour unions behaving as a commodity seller.

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24 Product Exhaustion Theorems

CHAPTER OUTLINE

24.1 The Adding–Up Controversy
24.2 Euler's Theorem
24.3 The Clark-Wicksteed-Walras Theorem
24.4 Change in Relative Factor Shares and Income Distribution
24.5 Technological Progress and Income Distribution
Further Readings
Review Questions and Exercises

Previous five chapters explain how factor prices are determined in different kinds of markets. What is explained above is the determination of price per unit of a factor, not the share of each factor in the total production. As mentioned earlier, the ultimate aim of the ***distribution theory*** is to explain how the share of factors of production in total output is determined. This part of the distribution theory is discussed in this chapter.

There has been a controversy on as to how the share of each factor in the national income is determined. The controversy is known as **"Adding-up Controversy"**. This controversy is discussed here first to focus on the nature of the problem. This is followed by Euler's theorem of distribution and then relative factor share. Finally, the issue of technological process and income distribution is discussed.

24.1 THE ADDING-UP CONTROVERSY

When the marginal productivity theory first gained acceptance by the end of the 19th century, a controversy arose whether distribution of national income among the various factors of production according to their marginal productivity was morally just. In the course of the debate, there arose another question as to whether the sum total of labour and capital incomes based on their marginal productivity equals the total product. Or, if each factor is paid the value of its marginal product (*VMP*), does this mean that the entire output is exhausted and nothing is left that falls into the hands of exploiting capitalist? Some economists attempted to show that if each factor is paid its *VMP*, the distribution of income under free enterprise (or capitalist) system must be equitable. Precisely, they attempted to demonstrate that if labour (L) and capital (K) are the only factors, then

$$Q = (MP_l)\, L + (MP_k)K \tag{24.1}$$

In terms of value,

$$P.\, Q = (MP_l .\, P)\, L + (MP_k .\, P)K \tag{24.2}$$

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welfare function, i.e., translating individual choices into group decisions. Arrow[1] has attempted to formulate social preferences. In this section, we briefly describe the Arrow's theorem of social choices.

Arrow's Axioms. Social preferences may be formed from individual preferences by legislators, directors or by majority rule applied to group choices. Not all methods are equally desirable or sensible. Arrow has stated axioms which social choices must meet in order to be minimally acceptable.

1. Social choices must be transitive. That is, if an event A is preferred to event B and B is preferred to event C, then C is not preferred to A.
2. Social choices must not be dictated by anybody within or without the group.
3. Social choices must reflect individual preferences and must not change in opposite direction, that is, a choice which would have been otherwise made must not be rejected just because some people favour it more than others. Furthermore, if no individual prefers A to B and at least one person prefrs B to A, society must prefers B to A.
4. The ordering of social choices must not change so long as individuals do not change their own ordering of alternatives. But, when individual ranking changes, the ranking of social choices must change.

Criticism

Arrow's axioms are said to be reasonable. They provide an appropriate set of conditions for making democratic choices. However, Arrow's axioms have *two serious problems.*

First, Arrow has himself demonstrated that it is not possible to formulate social preferences that satisfy all the axioms. Baumol[2] has illustrated the difficulties that arise in formulating social choices. Following the standard procedure of making a social decision is to go by the majority rule. But the majority rule may lead to social choices which are not transitive even if individual preferences are transitive. For example, suppose there are three individuals, X, Y and Z (each with 6 votes) to make choice from three alternatives, A, B and C, and their voting pattern for the three alternatives is given in the following table.

Individual	*Alternatives*		
	A	B	C
X	3	2	1
Y	1	3	2
Z	2	1	3

As the table reveal, X and Z prefers A to B; X and Y prefer B to C; and Y and Z prefer C to A. Obviously, majority (i.e., two out of three individuals) prefer A to B and B to C, and ***they also prefer C to A.*** Thus, majority rule leads to intransitive social choices.

Secondly, Arrow's fourth axiom is more restrictive than it appears. This axiom considers only the ranking, not the intensity of feelings. For example, suppose 50 percent population of a city prefers a flyover while the remaining 50 per cent prefer houses for homeless. But the feeling of those who prefer house for homeless may be much more intensive. Arrow's fourth axiom ignores this fact, although there is no measure of feeling. Despite these shortcomings, however, Arrow's contribution is regarded as an important addition to economists' analytical tools.

---

1. Kenneth, J. Arrow, *Social Choice and Individual Values,* (Cowless Commission Monograph No. 12, New York, and John Wiley and Sons, Inc., 1951).
2. Baumol, *op. cit.*, pp. 532-34.

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REVIEW QUESTIONS AND EXERCISES

1. What welfare economics is about? Is it positive or normative in character?
2. Distinguish between:
   (i) Classical and neoclassical welfare economics,
   (ii) Neoclassical and Paretian welfare economics,
   (iii) Paretian and New welfare economics.
3. State and exlain the marginal conditions of Paretian optimum in consumption and production. What is total condition of Paretian optimum?
4. What are the conditions that must be fulfilled to achieve Pareto optimality in exchange and production under perfect conditions?
5. "An equal division of income is an optimum division of income". Elucidate.
6. "A cake is divided between two individuals. Pareto optimality requires that they receive equal share". Do you agree with the statement? Why?
7. In any economy producing two goods, if one of the goods is a pure public good, how will you modify the Pareto-optimality conditions to arrive at the optimum?
8. Pareto optimality is a necessary but not a sufficient condition for welfare maximisation. Examine this statement in the context of a given social welfare function and grand utility possibility frontier.

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computers or low-price goods as electrical bulbs and tubes, their indistinguishable duplicates are available in the India's consumer market. There is virtually no or little information about the quality. A large number of pending cases with consumer courts is one evidence of uncertainty about the quality of the product. Under these conditions, market cannot work efficiently. We know that markets are working and people are getting whatever they want. But neither production nor consumption is efficient. This is ***failure of the market*** caused by imperfect market information.

27.4 EXISTENCE OF PUBLIC GOODS

While market system does work, though inefficiently, in providing for "pure private goods", it fails altogether in making an efficient provision for "pure public goods". Here, we explain briefly why market system fail to provide for pure public goods and why government is required to make provision for goods of this category through its budget. Let us first look at the concept and characteristics of pure public goods. The basic characteristics of pure public goods have already been noted in the previous chapter. Here we discuss them in detail.

27.4.1 What are Public Goods?

Economists have defined 'public goods' in different terms, emphasizing some unique feature thereof. Samuelson[1] has defined a pure public good as one whose total production at equilibrium equals the quantity consumed by each consumer and each consumer consumes the same amount. That is, a good is a public good if its total output $Q_T = C_A = C_B = C_C = ... = C_N$ (where Q_T is total production of a pure public good, and C_A, C_B, C_C and C_N is the quantity of the pure public good consumed by consumers A, B, C till Nth consumer. Samuelson's definition emphasizes that consumption of a pure public good by each consumer equals the total output thereof.

According to another author, "A pure public goods is defined as one whose benefits are consumed by all members of a community as soon as it is produced for, or by, any one member."[2] A pure public good can also be defined as one which is *consumed jointly* by all the members of a society even if it is produced by an individual, and no one can be *excluded* from its consumption even if one does not pay for the good. Production of a *pure public good* generates external benefits and costs which go to all the members of a society whether intended or not. National defence, law and order system, flood control, control of epidemics, and pollution-free atmosphere are some classic examples of *pure public goods.*

27.4.2 Characteristics of Pure Public Goods

It is easier to identify a pure public good by its characteristics than to define it in distinct terms. As mentioned earlier (Ch. 26) there are three basic characteristics of public goods, viz., ***collective consumption***, ***non-rival consumption*** and ***non-exclusion***. These two characteristics stem from another features of pure public goods, i.e., its indivisibility forcing their *joint consumption*. Let us discuss these characteristics of pure public goods in contra-distinction with *pure private goods.*

(i) Collective or joint consumption. A pure private good is consumed individually. For example, a shirt cannot be put on by two or more persons simultaneously. In contrast, a pure public good is consumed jointly by all the members of a society because of its ***indivisibility***. In simple words, a pure

1. In his classic papers "The Pure Theory of Public Expenditure", *Rev. of Eco. and Stat.*, November 1954 and "Diagrammatic Exposition of the Theory of Public Expenditure", *Rev. of Eco. and Stat.*, November 1955.
2. David N. Hyman, *Public Finance: A Contemporary Application of Theory to Policy* (Dryden Press, Chicago, 1983), p. 127.

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in Fig. 30.4 correspond to autarky equilibrium points E_A and E_B in Fig. 30.3. At point Q, country A produces and consumes OX_2 of commodity X and QX_2 of commodity Y, and at point P, country B produces and consumes PX_1 of Y and OX_1 of X. This is their equilibrium in autarky. As noted above, with specialization and trade between the nations, relative product price tends to get equalized. With the equalization of relative product prices, the relative price line for the countries becomes a uniform straight line as shown by the price line JK in Fig. 30.4. The new relative price line JK is tangent to A's production possibilities frontier at point T and at point R on B's production possibilities frontier. This shows clearly that with trade, equilibrium point of each country shifts away from its position without trade. The equilibrium of country A has shifted from point Q to T and that of country B from point P to R.

Given the new production pattern, we can now find the trade between the two countries and their gain from trade. Note that the relative price line JK is tangent to an upper indifference curve IC_2 at point E. This implies that country A produces at T and consumes at point E. Similarly, country B produces at point R and consumes at point E.

As regards the ***trade between the two countries,*** the triangle ENT shows the trade pattern of country A and triangle RME shows that of country B. Triangle ENT shows that country A exports NT of its capital-intensive commodity X and imports EN of labour-intensive commodity Y. Likewise, triangle RME shows that country B exports RM of labour-intensive commodity Y and imports ME of capital-intensive commodity X.

The ***gain from trade*** is clearly indicated by the fact that both the countries move to a higher social indifference curve — from IC_1 to IC_2.Note that point E falls much above the production possibilities frontiers of both the countries. This means that foreign trade makes it possible for the trading nations to consume beyond their production possibilities frontier. It means international trade increases their respective levels of consumption and raises their levels of living.

30.5 FACTOR PRICE EQUALISATION THEOREM: THEOREM II

Heckscher-Ohlin-Samuelson Theorem

The factor price equalisation theorem is, in fact, a corollary to the Heckscher-Ohlin trade theorem. It holds only so long as Heckscher-Ohlin trade theorem holds. It was Samuelson who provided a rigorous proof to the Heckscher-Ohlin theorem of factor-price equalisation. For this reason, the above theorem is also referred to as Heckscher-Ohlin-Samuelson theorem. In this section, we have very briefly presented the basic idea of the theorem.[1]

The factor price equalisation theorem states that international trade brings about equalisation in the absolute and relative returns to homogeneous factor of production and in their prices. In other words, the wages of homogeneous labour and rentals to homogeneous capital will be the same in all the nations trading between themselves.

Figure 30.5 illustrates the factor-price equalization theorem in our 2-country (A and B), 2-commodity (X and Y) and 2-factor (K and L) model with our earlier assumptions (i) that country A is capital-abundant and country B is labour-abundant; and (ii) that commodity X is capital-intensive and commodity Y is labour-intensive. Lines K_AL_A and K_BL_B are pre-trade isocost of countries A and B,

1. For a detailed and rigorous proof, see, P.A. Samuelson, "International Trade and Equalisation of Factor Prices", *Eco. Jl.*, June 1948, and his "International Factor Price Equalization—Once Again" *Eco. Jl.*, June 1949, Reprinted in Jagdish Bhagwati (ed.), *International Trade: Selected Readings*, (Cambridge, Massachusets, MIT Press 1981). For a good summary see, Sodersten, B., *International Economics, op. cit.*, Chapter 4.

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Studies Supporting Leontief Paradox

Despite its criticism, many studies carried out in respect of exports and imports of other countries produce results in support of the Leontief paradox. For instance, Baldwin[1] carried out a similar study and concluded that, in 1962, the US import substitutes were 27 per cent more capital-intensive than its imports. Baldwin's findings fully support the Leontief paradox. Some would argue on this basis that Leontief paradox tended to disappear in the later years.

Tatemoto and Ichimura[2] examined Heckscher-Ohlin theorem by using Japanese exports and imports data and produced results supporting the Leontief paradox. According to their findings, Japan, an intermediate country from resources endowment point of view, exported goods which embodied relatively more capital and less labour than its import-competing goods. This implies that Japan exported capital-intensive goods and imported labour-intensive goods. This finding is in contradiction of Heckscher-Ohlin theorem and in line with the Leontief paradox.

In his study of Canada's trade with the United States, Wahl[3] found that Canada exported capital-intensive goods and imported labour-intensive goods. Wahl's finding too negates Heckscher-Ohlin theorem and supports Leontief paradox. In a similar study, Bharadwaj[4] found that India, a labour-abundant country, exported capital-intensive goods to and imported labour-intensive goods from the United States.

It may be noted here, that all the studies mentioned above confine to trade with the United States. Their findings are, therefore, bound to be in line with Leontief paradox. Their findings are, therefore, not of great significance. A more sound support could have come from the studies of foreign trade between other sets of countries excluding the United States. It may thus be concluded that the Leonief paradox continues to remain a controversial issue and so is the case with Heckscher-Ohlin theorem.

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Theory and Applications

D.N.Dwivedi

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ISBN 81-7758-648-3



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