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FOUNDATION PROGRAMME

PAPER 1

ECONOMICS AND STATISTICS

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TEST PAPER 1/2007

TEST PAPER 2/2007

QUESTION PAPERS OF PREVIOUS SESSIONS

FOUNDATION PROGRAMME
ECONOMICS & STATISTICS
PART A — ECONOMICS
STUDY I

NATURE AND SCOPE OF ECONOMICS

INTRODUCTION

The discipline of economics has gained widespread popularity in both academic circles and in the deliberations relating to formulation of policies. The usefulness of the knowledge of **economics** is recognised by everyone - individuals, households, business units, institutions, as well as Governments. This is explained by the fact that economic issues and problems are all pervasive. There is no aspect of our existence which is not affected by them either directly or indirectly. And, for this reason, we cannot remain indifferent to them. Moreover, the very nature of economic issues and problems tends to change when we try to solve them. This implies that we seldom reach the final solution. Our effort to tackle them is a continuous process. As a consequence, the boundaries of economics tend to expand.

Some of the basic elements of the discipline of economics have always been in existence and known to the thinkers. However, for a long time, the science of economics did not exist as a separate discipline. It was mixed with elements of several inter-related disciplines, which covered non-economic aspects of human knowledge and philosophy. The main reasons for this phenomenon lie in the following facts :

- (i) The primary task of the discipline of economics is to study the working of an economy and the issues and problems faced by it. And, for centuries, the typical economy of a country continued to remain relatively simple and underdeveloped.
- (ii) The nature of economic problems and their solutions is closely linked with the structure of the economic system, and its progress and development. Economic problems faced by a more efficient industrial economic system are expected to be different from the ones generated by an underdeveloped simple agricultural economy. In a simple economy, human beings are mainly confronted with the problems of poverty and economic insecurity. In contrast, in a developed industrial economy, the problems are mainly of distributive justice and economic instability. As a result, there is little scope for a fully developed science of economics in a non-industrialised simple economy. Science of economics tends to develop along with the economic growth of the world.
- (iii) Economic problems of individuals and societies are not independent of other social, cultural and political aspects of human existence. These deeply effect one another.

For the reasons noted above, the discipline of economics, as it stands today, is the result of comparatively recent developments. Most of these came into existence over the last two centuries. Systematic development of the science of economics

started with the advent of modern capitalism under which several economies experienced rapid growth, expansion and diversification. There was also a phenomenal increase in population, number of occupations and per capita income. This period also witnessed a parallel development of the financial system. Consequently, the character and severity of economic issues and problems also gained in complexity. The totality of this process gave birth to several additional issues and problems. And science of economics developed in response to the need for studying the working and intricacies of a modern economy and solving their problems. For example, a need was felt to analyze the manner in which production and employment are determined and the steps that are needed to encourage these in order to raise living standards. It is also noteworthy that a typical modern economy is unable to solve all its problems once for all. Instead, a host of new economic issues and problems keep emerging. The net result of this ongoing interaction is that the discipline of economics keeps evolving both in terms of coverage and in terms of depth of analysis.

While talking of the coverage of economics as a subject, we should take note of the increasing intensity of some specific problems faced by the market economies. These problems related to labour-management relations, exploitation of labour, widespread and increasing inequalities of income and wealth distribution, cyclical fluctuations in income and employment, and the like. It was but natural that some thinkers should be concerned with these problems and suggest solutions thereof, including the possibility of restructuring the economic system itself. As a result, several new ideas and theories regarding alternative economic systems, their working, their merits and demerits were identified and incorporated in the subject matter of economics. For example, these thinkers were able to give us the frameworks of some alternative economic systems, such as, socialist, communist and mixed economies. It is clear that this line of thinking also contributed to the growth of economic discipline.

Like many other disciplines, economics has also made a phenomenal progress during the last few decades. This has happened on account of a rapid discovery of fresh tools and techniques of economic analysis. There has also been a vast expansion in the availability of data. Consequently, in recent decades, the scope of economics has also widened tremendously and several specific areas of specialisation have been incorporated into it.

Economics is a Study of an Economy

Briefly speaking, economics can be defined as a study of an economic system in all its aspects - structure, working, performance, problems, their possible solutions. The meaning of the term, "study of an economy" includes :

- (a) alternative forms of an economy like capitalism, socialism, a mixed economy, etc.;
- (b) economic decisions and their implementation by
 - (i) individual economic units, like individuals, households and business units;
 - (ii) groups of economic units, institutions, and so on; and
 - (iii) public authorities ;

- (c) interrelationships between economic units and their groups;
- (d) the performance of individual economic units, their groups, and the economy as a whole; and
- (e) interrelationship between different economies with each other.

An Economy: However, the phrase 'study of the economy' remains vague and unclear unless we know the meaning of the term "an economy". The subject matter of economic is the study of an economic system, its activities, its problems, the manner in which it tries to improve its performance, and other aspects of its working. In economics, we also cover the interrelationship between different economies of the world. Therefore, let us briefly see what is meant by an economy or an economic system.

To get a working idea of an economic system, let us think of some basic facts:

- We, the human beings, have a variety of wants. For our purpose, we can adopt a simple classification of these wants into economic and non-economic ones. Broadly speaking, these wants of ours, which can be satisfied by the consumption of goods and services, are economic wants. In contrast, non-economic wants are those which do not need the consumption of goods and services.
- Our economic wants have several characteristics. At this stage, we take note of only two of them :
 - (i) even if satisfied, they have a tendency to re-emerge, and
 - (ii) with the passage of time, they tend to increase in number and variety.
- (a) The "means" available for their satisfaction are insufficient in comparison with the wants to be satisfied. The means or resources do not increase rapidly enough to match their growing requirement of human wants.
- (b) This mismatch between the available means of satisfaction and our economic wants, becomes a permanent problem for individual economic units and the society as a whole.
- (c) As a result, every society and its component economic units, adopt a two-fold course of action, namely, the following.
 - (i) They try to increase the availability of means of satisfaction by their own efforts.
 - (ii) They try to ensure that the available means are not wasted, that is, they are used most economically. This also means that they are used for satisfying the most pressing wants to the exclusion of the less pressing ones.
- Accordingly, the society under consideration creates a set of institutions like those of money and credit, markets, a system of sales and purchase etc. It also creates a system of facilities relating to production, transport, storage etc.

The entire set of arrangements and institutions etc. meant for meeting the above-said two-fold objective of (i) increasing the availability of resources, and (ii) ensuring their economical use, is known as the economy or economic system of the society

under consideration.

It is well known to us that the economic systems, as created by different societies, differ from each other. The economic system of even a given society keeps evolving and changing over time, partly under its own momentum, and partly on account of ongoing efforts of the society to meet the problem of scarcity of resources. The resources in an economy can be increased through appropriate rates of capital accumulation, technological growth, and the like. These differ from one economy to another. Similarly the pattern of distribution of income and wealth among the economy individual members of the society differ from economy.

Growing Complexity of the Subject of Economics

Since the discipline of economics deals with the economic problems faced by a society and individual economic units, therefore,

- (a) it is an integral part of our knowledge and thinking; and
- (b) it responds to the changing character of our economic problems.

The discipline of economics continues to exist because no society can ever get rid of its economic problems. Over time, newer forms of problems keep emerging which are more complex and intense, such as those of population, unemployment, inflation, stagflation, balance of payments, growth, inter-sectoral balances, flow and cost of credit and so on. Economics tries to tackle them by evolving newer and more rigorous concepts, by improving data availability, and its analysis, and by developing new tools and techniques of analysis. Fresh investigation is undertaken for better understanding the role of several economic magnitudes, such as, infrastructural facilities, capital formation, financial system, developmental expenditure, public debt, and deficit financing, and so on. Accordingly, economics is always on a path of evolution. Over years, this process has been facilitated by a rapid addition to quantitative information relating to economic variables.

The fact that development of economics is deeply associated with and dependent upon the dynamism (that is, ever-changing nature) of a modern economy, there is no finality as regards its exact scope and boundaries. This fact was highlighted by J. M. Keynes when he said that “ the theory of economics does not furnish a body of settled conclusions immediately applicable to policy. It is a method rather than a doctrine, an apparatus of the mind, a technique of thinking, which helps its possessor to draw correct conclusions...” Basically, economics is a set of techniques for identifying economic problems and for forging tools and techniques of their analysis and solution.

The question of defining economics should be approached in view of the foregoing observations, which pinpoint its ever-changing nature.

Definition of Economics

A good definition of economics should be able to describe its subject matter (that is, its coverage and boundaries) in a precise manner. In practice, however, it is very difficult to satisfy this criterion. Boundaries of economics are always expanding. Therefore, definitions given by most economists cover only some specific parts of its vast field. Moreover, there is no uniformity as between different economic systems. Economies of even a similar type (such as a capitalist one) differ from each other. Not

only this, even the economy of a given country keeps changing and evolving over time. Every modern economy tends to be dynamic, that is, it has an inherent tendency to change. As a result, we come across a large number of definitions of economics, which appear to differ from each other. It is noticed that, essentially, any specific definition is influenced by

- (i) the thinking and preferences of the economist who is providing that definition, and
- (ii) the general level of development of the discipline of economics.

To elaborate the above statement, we note the fact that most economists have their own views of what an economic system should be. And they try to define economics in line with their respective viewpoints. For example, some economists want that we should only study the manner in which an economy operates and stop there. In contrast, some other economists want to study the working of an economy so that they can use their findings

- (i) for improving its efficiency, and
- (ii) for increasing the overall economic well being of the members of the society.

They, therefore, want that economics should be 'normative' in character. It should be used for formulating policy prescriptions for removing the drawbacks of the economy.

In addition, the economists differ from each other in their technical expertise. They do not view and understand an economic system in an identical manner. As, the nature of problems faced by a modern economy keeps changing, this necessitates the need for re-defining boundaries of economics.

To summarise, the main reasons for a large variety of definitions of economics are:

- (i) the structure of the economy with reference to which the definition is being given,
- (ii) the stage of its development,
- (iii) the expertise of the economist providing the definition, and
- (iv) the purpose for studying economics.

Some Leading Definitions

It is in this light that we deal with a sample of some leading definitions.

1. *Economics as a Science of Wealth* : In the initial stages of the development of the science of economics, it was but natural for the economists to concentrate their attention on the issues relating to economic development. The widespread poverty and low per capita incomes prompted them to think of the nature of wealth and the ways in which an economy could become "opulent" or rich. This preference of viewing economics as a science of wealth is highlighted in the stand taken by the "Father of Economics", namely, Adam Smith. In his classic work *An Enquiry into the Nature and Causes of the Wealth of Nations*, published in 1776, he maintains that the discipline of economics is meant to identify the factors (that is causes) which make one economy richer than the other. He emphatically says that :

"The great object of Political Economy of every country is to increase the riches and power of that country."

He was of the view that the objective of a country should be both (a) to grow rich and (b) acquire political and military strength. The “wealth definition” of economics also ignores the problem of distributive justice, that is the problem of inequalities of income and wealth.

The term ‘wealth’, however, does not have a universally accepted meaning. It has been assigned several alternative meanings by thinkers. To Adam Smith and his contemporaries, wealth represented material goods. It is for this reason that to Adam Smith labour was ‘productive’ if it produced material goods. In contrast, those persons who produced non-tangible ‘services’ like teaching, music, etc. were non-productive. These persons were ‘parasites’ living on the wealth produced by others. This led Adam Smith to conclude that for increasing the wealth of a nation, the use of labour should be primarily for “productive purposes”.

Evaluation

Merits

- (a) Adam Smith was primarily concerned with the question of creation of wealth, that is, the means of consumption and the capacity to produce such means. In that sense, he was justified in defining economics as a science of wealth, which highlighted the need for an economy to acquire capacity to produce more.
- (b) During Smith’s days, most economies including that of Britain were so poor that the problem of income inequalities did not attract sufficient attention. Therefore, Adam Smith also chose to ignore this problem.

Demerits

- (a) Critics of the wealth definition of economics are unhappy about the fact that it accords primary place to ‘wealth’ to the neglect of the welfare aspects of man. It is maintained that after all, an economy is meant to serve the society and its members rather than the other way round..
- (b) Though Adam Smith could ignore the problem of income distribution because of the underdevelopment of the economy during his days, it could not be ignored for long, particularly because the fruits of economic growth and riches were not reaching the masses. With growing national income, the rich were becoming richer and the poor were becoming poorer.
- (c) Adam Smith’s definition of economics in terms of wealth was also criticised by philosophers and social thinkers for ignoring the ‘higher’ values of life and reducing it to a ‘dismal science’.
- (d) The concept of wealth has also been subjected to severe criticism. It is maintained that what matters is not just the production and consumption of tangible goods, but services also matter. The relevance of services can be judged by this fact that provision of certain services is essential even for the maintenance and addition to the productive capacity of the economy. Examples can be given of education, health, medical care, and the like. Even defence, law and order, efficient systems of administration and justice also add to the security and working capacity of the society and thereby add to its riches.
- (e) These days, the concept of wealth also stands extended. It is maintained that the term wealth should include all those things which are desired by the society.

The criticism of the wealth definition of economics is not however fully justified. The

fact remains that the problem of distribution of income and wealth comes only after they have been created. An economy should first aim at increasing its capacity to produce more of goods and services, since without them we can only distribute poverty and not riches. It is for this reason that a major portion of even modern day economics is devoted to the study of production, capital formation, growth, employment, and the like.

2. *Shift by Ricardo* : However, once the economy developed, the problem of distribution of national income between members of the society could not be ignored for long. Accordingly, while Adam Smith had emphasised the volume and variety of production as the primary subject matter of economics, Ricardo (in early 19th century) emphasised the distribution of wealth. In his own words, "The produce of the earth- all that is derived from its surface by the united application of labour, machinery and capital is divided among three classes of the community, namely, the proprietor of the land, the owner of the stock of capital necessary for its cultivation, and the labourers by whose industry it is cultivated." Thus, to "determine the laws which regulate this distribution, is the principal problem in Political Economy".

With the development of capitalist economies, problems of inequalities and "exploitation of labour" came to get prominence. Alternative views were adopted by economists regarding what economics was about. Some economists concentrated upon the tools and techniques of analysis, while others gave greater attention to the questions of economic well-being of the society. Therefore, on the one hand, we find the emergence of what is called the Historical School of Economics and on the other, that of deductive reasoning. Economists belonging to the former tradition believed in deriving generalisations from historical, or fact and data-based studies of economies. This technique was termed "inductive reasoning". In contrast, the economists belonging to the latter tradition specialised in abstract or deductive reasoning. Still others explored the possibility of restructuring and improving the economic system for solving the problems like those of unemployment and inequalities of income and wealth. These economists gave us the theory of a socialist economy.

3. *Welfare Definition* : By the end of 19th century, economists started taking note of the fact that actions of human beings are not guided by only economic motives. Non-economic considerations also play an equally important role in them. For this reason, theories dealing with the determination of wage rates of labour, prices of other inputs, and the distribution of national income between members of society, became an integral part of economics. But, for the sake of analytical simplicity, economists still *viewed economics as a study of that part of human behaviour which could be measured in money terms and which could be attributed to a desire for economic gain. Marshall's definition is an admirable example of this approach, while Pigou adopted a definition of economics which was primarily concerned with the welfare dimension only.*

- A. *Marshall's Definition* : In Marshall's words, "Political Economy or Economics is a study of mankind in ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of material requisites of well-being". " Thus, it is on the one side a study of wealth; and on the other, and more important side, a part of the study of man."

According to Marshall, Economics is neither a study of only wealth, nor only of man and his actions. It is a study of man's actions which he plans and performs for his

own economic benefit and which should be studied in the context of his well-being—both as an individual and as a member of the society. In Marshall's opinion, economics is a study of both wealth and man, but between the two, the latter is more important. Economics does not study man because he is creating and consuming wealth. It studies wealth because it is being created and consumed by man. The focus of attention in economics is the man and not wealth.

Marshall further maintained that the core of the subject matter of economics is not the creation and consumption of goods and services as such, but economic well-being or economic welfare of members of society. It is for this reason that he said that economics is that part of individual and social actions which is most closely connected with the attainment and with the use of material requisites of well-being. However, at this stage, it should be noted that according to Marshall, economics was concerned with that part of human welfare which is derived from material goods and services, and not from other social and political aspects of his life.

B. Pigou's Definition : The welfare dimension of economics was emphasised to a much greater extent by some other economists like **A. C. Pigou**. Pigou restricted the boundaries of economics to only that part "of social welfare which can be brought directly or indirectly into relationship with the measuring rod of money." Pigou's definition of economics, therefore, was restricted to only such economic systems

- which were guided by the market forces, and
- in which production and investment were undertaken with the business motives.

Clearly, the coverage of this definition was quite wide in one sense and restrictive in another. Since it covered the entire question of economic welfare, it was quite wide. At the same time, it was a restrictive definition because it excluded economies, which were not guided by monetary and market forces. In contrast, some economists preferred that the definition of economics should be extended to cover economic welfare, which can be derived from alternative forms of an economic system.

The welfare definition of economics may be criticised on grounds of several details.

- It is not possible to define the concept of welfare in a precise manner. It has not been found how to measure economic welfare accurately and in a universally acceptable manner. One way of defining welfare is to say that it is the same thing as the objectives desired by the society as a whole. But even this way of defining welfare is full of difficulties, including the following:
 - (a) A society cannot achieve everything it wants, because resources are always scarce as compared to wants.
 - (b) Therefore, a society has to have a method of deciding which wants to satisfy. And till now, it has not possible to discover accurate and reliable methods of knowing the real needs and aspirations of a society. Different techniques of finding out the preferences of the society have been suggested. But all of them suffer from some drawback or the other. And most of them are not practicable.

- In economics, we have to study even those activities which are not expected to add to economic welfare of the society. For instance, those activities which reduce its welfare, such as activities leading to environmental degradation, etc.
- In economics, we study the production and consumption of both tangible goods and non-tangible services, and both affect our welfare. In price theory, for example, we study the determination of prices of all goods and services. Therefore, it is wrong to restrict economics to the study of only tangible or material goods. That will unnecessarily restrict the scope and subject matter of economics. Moreover, it is impossible to restrict ourselves to the study of welfare derived from material goods because it cannot be accurately separated from the welfare derived from non-tangible services. Further, in view of social thinkers and medical professionals, there are several goods and services the consumption of which does not add to the welfare of either the consumers or the rest of the society. Leading examples of such items include tobacco and addictive drugs. Such items may be termed “bads” instead of goods.

4. *Scarcity Definition* : Marshallian approach towards defining economics was not universally accepted. As an alternative, its critics wanted economics to be a discipline of pure reasoning and logical investigation, and they proposed the adoption of “scarcity approach” for defining it. This approach is best represented by **Lionel Robbins**. According to him,

“Economics is the science that studies human behaviour as a relationship between ends and scarce means which have alternative uses.”

Elaboration : Robbins bases his definition of economics on the following facts.

- An economy always has shortage of resources compared with to the wants to be satisfied.
- The ends or wants of an economy are unlimited in number and variety, and they keep increasing with the passage of time.
- It is possible to select between several alternative resources for satisfying a given want..
- Similarly, it is possible to use a given resource for the satisfaction of several alternative wants.

For example, several food items are available for satisfying the hunger of a person. Similarly, it may be possible to use a certain type of wood for, say, manufacturing pieces of furniture, doors and windows, or as a fuel for cooking,, and so on. In practice, therefore, an economy is always working out alternative combinations of means and ends. These combinations also keep changing due to several reasons, which include changes in (i)needs, (ii) resources, (iii) technology, (iv) market structures, and (v) tastes of the consumers.

Robbins maintains that if we define economics with an emphasis on its welfare aspects, we will have to judge the existing performance of the economy and suggest possible improvement in its structure and working. Such a use of economics for “normative purposes”, that is, for drawing policy inferences, necessitates that the society should have a widely accepted set of goals.

However, this condition is satisfied only in theory. In reality, no society possesses a universally agreed set of goals. Moreover, there is no agreement regarding the relative emphasis to be accorded to even the accepted goals.. For example, modern economies are usually faced with the problem of both unemployment and inflation. And it is generally agreed that an economy should get rid of them. In practice. However, it is not possible to do so. If an attempt is made to reduce unemployment, inflationary forces become stronger and prices go up. And if price are prevented from rising, unemployment level increases to an unacceptable level. In other words, though both goals are desirable in themselves, it is not possible to achieve them simultaneously. They are contradictory to each other. At the most they can be achieved only partially. But there is seldom any agreement as to the exact balance between the two which the economy should aim at. Similarly, another example of the society facing contradictory goals is the choice between consuming away its current national income or saving it for capital accumulation and economic growth. This choice is more difficult for developing countries where the existing level of consumption is very low and there is a strong need for economic growth as well. Yet another example, we can expect a general agreement that eradication of unemployment, poverty and regional economic disparities should be achieved. But there is bound to be a difference of opinion in deciding the order of their priority.

For this reason, amongst others, Robbins believe that, as *economists*, we should not go into the question of policy inferences. This task should be left to other disciplines. Economists should only study economics in terms of “what is” and not what “ought to be”. According to Robbins, economists should concentrate upon the study of the manner in which an economy tries to solve its problem of scarcity of means of satisfaction as compared with its needs. The job of an economist should be restricted to only investigation and reporting the findings. He should not say anything about its welfare aspects. He should accept the facts as they are and should not make recommendations for “improving the working of the economy”. Robbins says that “Whatever Economics is concerned with, it is not concerned with the causes of material welfare as such.” Whatever be the goals which the society is trying to achieve, the economists should maintain their neutrality between them. “*The ends may be noble or they may be base.*” But economics has nothing to say about it.

Of course, having acquired the requisite knowledge, economists are *better equipped* to make recommendations for improving the working of the economy. Over years, their capacity to do so has increased rapidly on account of the development of statistical, mathematical and econometric methods. They are in a better position in exploring the issues connected the problem of “choice”. But they should do so only because they are better informed and concerned citizens and not in their capacity as economists.

Evaluation

Robbins raised economics to the status of a science in which personal opinions do not play a part, and there is only pure reasoning based upon relationship between causes and their effects. In this respect, the position taken by Robbins was supported by many others like Stigler and Scitovsky. Though they used different words and phrases, their definitions were very similar to the one given by

Robbins. These economists were all emphasising one thing, that is, an economy is permanently faced with scarcity of resources for satisfying its wants and it has to solve this problem by selecting between alternative combinations of means and ends. According to these economists, economics should confine itself only to studying the way in which the economy makes this choice.

It is but natural that the critics of this definition claimed that it is a waste of effort not to investigate the possibilities of improving the working of the economy for the benefit of the society. They maintain that there is always a scope for improvement in the working of the economy. It is possible to increase its efficiency, that is, reduce the resource-cost per unit of wants satisfied. They also recognize the fact that fiscal and other policies pursued by the authorities exert an all-pervading effect on the economy. An indifference towards these policies implies that the authorities may pursue haphazard policies even if it causes a lot of harm to the society. Obviously, a better course for the authorities is to formulate their policies after assessing the costs and benefits of alternative measures. It also follows that the authorities should take the help of economists in drafting their policies.

Critics of scarcity definition also hold the view that since it is possible to use knowledge of economics in our attempt to curing the ills of the economy, there is no justification in adopting an attitude of indifference. How can we be indifferent to the problems of unemployment, poverty, inflation, regional disparities, low rate of economic growth etc. A better course would be to use our knowledge of economics in devising policies for achieving maximum possible economic welfare with minimum possible resource cost and human labour.

The shortage of “merit goods” provide a very strong argument in hands of the critics of scarcity approach. Merit goods are those the consumption of which benefits not only the consumers, but also the non-consumer. Examples of such goods are education, health, cleanliness, etc. Generally, the cost of production of such goods is high and a large section of the population is not able to pay their market-determined prices. Therefore, left to the market forces, their supplies tend to be insufficient. Obviously, the authorities should step in with measures to supplement their supplies and make them available to the society at affordable prices.

Another argument for not agreeing with Robbins is the existence of several public services (like defence, law and justice, etc.) which cannot be provided by the market. It is not possible to sell them and recover production costs. Only the authorities can provide them by incurring expenditure out of their budgetary resources.

5. *Samuelson's Definition* : However, the definition provided by P. A. Samuelson is far more comprehensive. He says that :

“Economics is the study of how people and society end up choosing, with or without the use of money, to employ scarce productive resources that could have alternative uses, to produce various commodities and distribute them for consumption now or in future, among various persons and groups in society. It analyses the costs and benefits of improving patterns of resource

allocations.”

Current Position

Currently, subject matter of economics is *not confined to only the factual* study of economic problems and attempts at their solution. It also *incorporates the issue of economic welfare and the manner in which it is possible to improve the performance of the economy*. Modern-day economists are as much concerned with the problems faced by their respective societies and the world as a whole as they are with sharpening their *tools of analysis* for gaining a deeper knowledge. It is for this reason that the discipline of economics has diversified into several important branches including those of growth, welfare, alternative structures of an economic system, planning, interaction between financial and real dimensions of the economy and so on.

A Comprehensive Definition

We have noted earlier that in economic literature, we have a large number of definitions of economics. Most of them, however, are defective in the sense that they cover only a part of what is actually studied in economics. Accordingly, we need a definition which does not suffer from these deficiencies. It should be able to describe what is actually studied in economics. We may therefore, define economics

as a science which studies an economy in its diverse aspects, assesses its performance, identifies its shortcomings and suggests solutions to its problems. It studies decision-making and activities of not only of individual economic units and government but also of the economy as a whole.

SCOPE OF ECONOMICS

The discussion above leads us to the conclusion that economics is a very vast subject, and its scope and coverage are increasing with the passage of time on account of the following reasons :

1. A modern economy is a dynamic one. It is trying to solve its existing problems and in the process is always giving birth to new ones. Moreover, along with economic development, the nature of problems faced by it keeps changing.
2. In the process of studying economic issues and problems, economists keep developing a vast body of tools and techniques of analysis, together with a host of new concepts, phrases and technical terms. By way of examples, we may mention :
 - (i) the concepts of economic rent, optimum, distributive justice, circular flow and equilibrium;
 - (ii) the tools of margin, time interval, and differentiation ,
 - (iii) the techniques of indifference curves, elasticities, econometric models, maximisation and minimisation, etc.
3. Economists are taking the help of model-building in their effort to understand the complex working of a modern economic system. A model is a simplified picture of selected variables to explain an economic phenomenon. It is built

so as to focus some essential aspects of the working of an economy and then use it for deriving economic generalisations and laws. Comparison of these models with reality helps the economists in assessing the extent to which they are valid and reliable. If need be, these models are improved step by step to make them more realistic. The entire approach of model building helps the economists in developing and improving economic theory as well in explaining certain aspects of functioning of the economy.

4. Since a modern economy is an ever-changing one, the scope of economics can neither be fixed nor pre-defined for all times to come. In line with this fact, economics is not expected to confine itself to only an investigative role or to only welfare aspects. Its coverage is continuously expanding to incorporate new areas of investigation. Some of the broad lines along which the discipline of economics developed and diversified are the following ones :

- In 19th century, a section of economists chose to study economic history in deriving relevant economic principles and practices. They established the so-called 'historical school'. This approach is highly useful in the sense that the main body of economic theory is derived from the historical facts and therefore remains associated with economic reality. However, this approach also suffers from certain drawbacks. Historical facts are very complex and non-repetitive in details and this makes it very difficult to derive economic principles of universal application. Therefore, economic principles derived from historical facts, by their very nature, tend to reflect the most common or average behaviour of the economic forces. They fail to explain several significant variations which occur from one situation to another.
- Another approach used by economists is that of studying a specific type of an economic system and within it, study the actual behaviour of individuals and business units etc. in response to alternative sets of circumstances. The most popular type of economic system for this method of study happens to be the one which is commonly known as a "capitalist economy" or a "market-guided" economy. It is characterised by the institutions of private property, inheritance, and money and credit and a major portion of modern day economic theory has been derived from the study of its working. It is also worth recollecting that a major portion of modern economic theory has been developed by the economists living in "market economies".
- A large section of economists want to use their knowledge of economics for benefiting the society by
 - (a) increasing its collective welfare,
 - (b) accelerating the rate of its economic growth,
 - (c) reducing fluctuations in income and employment.

In other words, they prefer that economics should not be only a 'knowledge-giving' science, but also a fruit-bearing one. And in the process, they contribute to the development of economic science in several ways like the following :

- (i) They assess the actual performance of an economic system against the goals commonly desired by the society (such as

achieving and retaining a high level of employment, reducing poverty and inequalities, controlling inflationary price rise etc.). This task requires the development of tools and techniques of gathering data, their analysis and application. In the process, several additional theoretical concepts are developed and used, and the science of economics widens in coverage and scope.

- (ii) The economists find that for fuller understanding of the performance of the economy, they should understand the manner in which it works and changes in response to various forces including alternative government policies. This further adds to the coverage of economics.
- (iii) The fact that several economic and social goals are contradictory to each other also contributes to the development of economics. Respective costs and benefits of alternative courses of action have to be worked out and appropriate techniques have to be developed for handling this analysis.

SCIENCE OR AN ART

The question of what is to be studied in economics, is closely connected with the question of whether we should consider it a science or an art, or both. Clearly its scope is wider in the latter case.

Economics as a Science

The term science is defined as a body of knowledge which describes the relationships between a set of given causes and their effects. In that sense, economics is also a science. It is a body of generalisations or 'laws'. Each law describes the relationship between some causes and their effect (s). For example, the 'law of demand' states that if the price of a consumption good goes up (falls), a typical consumer reduces (increases) its quantity purchased by him, provided remaining causes affecting the quantity demanded by that consumer are ignored (or they are not at work). A major portion of economics laws of this type and is, therefore, a science.

It should however be noted that economics is "not an exact science" like physical sciences. The fact is that we cannot rely upon the accuracy of the economic laws. The predictions made on the basis of economic laws can easily go wrong. However, it does not mean that the reasoning used by economists is defective. The reasoning used in economics is flawless. A set of assumptions (or initial conditions) is selected, the initial position of an economic variable(s) [like national income, etc.] is assumed, the process of interaction between forces at work is described and the end position is estimated.

The problem of actual results differing from the predicted ones arises on account of the fact that in economics we cannot have controlled experiments. That is to say, it is not possible to ensure that only selected conditions apply and there is no modification in them. For further clarification, let us elaborate this statement and see how predictions made on the basis of economic laws may differ from reality.

- Economic decisions are made by human beings. It is they who implement these decisions and also undertake economic activities. However, their motivation is very complex. It is influenced by a large number of varied forces, situations and circumstances and which collectively provide a mixture

of both economic and non-economic causes. However, in economic reasoning, we cannot take into account changes in non-economic factors. We have to assume that there remain fixed and given. It follows, therefore, that if two individual economic units are facing (i) similar economic forces but (ii) dissimilar non-economic situations, their decisions and behaviour will differ from each other. Similarly, actions of the same individual may differ from one point of time to the next. There is no fixed pattern of human response which may be used to formulate economic laws applicable in all circumstances.

- Economic causes at work are so large in number that it is often not possible to take into account all of them. We are compelled to select only “the most important” of them for deriving economic laws. However, the very fact that some economic causes are being left out of the reasoning, reduces the reliability of economic predictions. Moreover, the selection of “the most important” causes is a matter of opinion. There is no scientific basis of selecting some and leaving out others. Consequently, the predictions made by different economists also differ from each other.
- In the case of physical sciences, we can have controlled experiments. We can make sure that the causes at work do not change till the process of their interaction is completed. In economics, however, we cannot ensure that the causes at work do not change in between the process. The forces at work frequently undergo a change during the interaction process itself. In addition, some of the existing forces cease to be there, while some new ones may come in.

We may conclude this part by saying that in spite of our inability to have controlled economic experiments, economics should be termed a science on account of the nature and quality of its reasoning.

Economics as an Art

A discipline of study is termed an art if it tells us how to do a thing, that is to achieve an end (objective). It is noteworthy that the final justification for studying economics lies in the possibility of our ability to use it for solving economic problems faced by us. Prof. J. M. Keynes says that “An art is a system of rules for the achievement of a given end.” We know that in practice, economics is used for achieving a variety of goals. Every individual economic unit, whether acting as a consumer, as a producer, as an investor, as a supplier of an input, or in any other capacity, has an economic goal to achieve. It decides its course of action by keeping in mind the end to be achieved and the situation faced by it. Even at national level, the authorities formulate a variety of policies. In certain cases, they attempt to plan and operate the entire economy so as to achieve a given set of ends. Therefore, whether some theoreticians like it or not, economic laws are widely used and relied upon at all levels of our economic activities. And that makes economics an art.

Positive or Normative Economics

A division of economics, corresponding to the one of it being a science or an art, runs in terms of it being positive or normative. We should note that to say that ‘economics is a science’ and to say that ‘economics is a positive science’ mean the same thing. However, the terms ‘an art’ and ‘normative’ can be interpreted to mean

two related but different things. The term 'normative' is derived from the word 'norm' or a 'standard' implying 'what ought to be'. And the term 'art' denotes the method of achieving that objective.

The above mentioned distinction may be stated in the following words.

- When we consider economics only as a science or a positive science, we only try to investigate 'what is' and stop there.
- When we adopt a normative approach, we decide the 'norms' or 'standards' which the economy should adhere to or should aim at. The 'what ought to be' aspect of our decision-making stands for the 'normative' dimension of economics.
- Having decided the norms or the standards to be achieved, we treat economics as an 'art'. We work out the measures for achieving the selected goals.
- In practice, however, the 'normative' and 'art' dimensions of economics are so intermixed that it is often difficult to draw a clear cut line of division between them. Accordingly, in general, these two dimensions of economics are considered to represent one segment in contrast to its being a positive science.

Why have a Normative Approach in Economics ? Partly we have answered this question. It has been said that we should put our knowledge of economics to the solution of practical problems faced by us. Otherwise what is the use of studying economics?

Therefore, it is unnecessary to debate the question as to whether economics is a science or an art, whether it is positive or normative. It is both and should remain so. We should acknowledge the usefulness of both. The need and scope for improving the performance of the economy will always be there. It, however, does not mean that by adopting normative approach, we are able to solve all our economic problems satisfactorily. In practice, there are always several hurdles which prevent us from achieving that happy state of affairs.

Firstly, there is a lack of uniformity in the choice of objectives. Members of society do not have identical views as to what ought to be, that is, what objectives are to be achieved. This is because, our preferences differ from each other on account of several economic and non-economic causes. For example, while fixed income earners would prefer that prices should not increase, business people would like a steady increase in them so as to generate higher profit incomes.

Secondly, the information regarding the working of the economy is generally incomplete. Therefore, we can never be sure as to the exact steps with which the selected goals can be achieved.

Thirdly, even with given information, it is found that we can adopt several alternative courses of action. And normally there is a difference of opinion regarding their choice. For example, let us assume that an underdeveloped country wants to industrialise. However, having taken this decision, it is confronted with additional questions. Should industries be developed in the public sector? Should they be in the private sector ? Should they be the responsibility of cooperatives? Should there be more industrialisation than one sectors simultaneously ? To what extent should we

should allow direct foreign investment ? To what extent should we depend upon borrowings from abroad? It is very difficult to have an agreed set of opinions regarding such important questions.

It may be emphatically noted that positive economics is needed not only for its own sake, but also as a basis for normative economics. The reason is that the choice of economic goals, and the measures needed to achieve them, require the findings of positive economics regarding

- actual working of the economy, and
- the methods by which its working can be modified. .

MICRO AND MACRO ECONOMICS

These terms were first used by the Swedish economist Rognar Frisch in 1920s to represent the “*level of aggregation*” of economic variables analysed in an economic problem. The word micro means “small”, while macro stands for “large”.

In microeconomics, variables under discussion are “*not aggregated*” and pertain to individual economic units or their “*small*” groups. In contrast, in macroeconomics, variable under discussion are “*aggregated*” and relate to “*large*” groups of economic units. However, the level of aggregation can vary from case to case and depends upon the nature of problem at hand, and the purpose of analysing them. The aggregation may extend to the entire economy, particularly when we are studying the issues of inflation, cyclical fluctuations in national income, balance of payments and do on.

In microeconomics, individual economic units are considered as components of a big organism, namely, the economy as a whole. In it, we study the behaviour of the individual economic units or their small groups in their alternative capacities, such as a consumer, producers, investors, suppliers of labour and other inputs, and the like. For example, we study the way in which a typical consumer decides whether to buy a consumption good or not, or the manner in which to divide his total expenditure on alternative consumption goods. Similarly, we take a single good and study the determination of its demand in the market. In the same manner, we study the behaviour pattern of a typical firm, or an industry, in response to alternative cost and demand conditions faced by it.

In microeconomics, we adopt the approach of breaking a big problem into small parts and study one bit at a time. This ‘bit by bit’ approach makes the task of analysis simpler and easier. It enables us to use our findings for extending them to the study of economy as a whole. In the absence of microeconomics, the analysis of simultaneous interaction involving a large number of variables and the responses of individual economic units becomes next to impossible. Therefore, conclusions drawn from microeconomics are suitably adjusted for use in the analyse of problems at macro level.

It is noteworthy that the field of study of microeconomics is not a narrow one. Its coverage is quite wide and comprehensive. Some of its leading components are :

- the entire theory of consumer behaviour;
- the theory of a firm;
- the theory of an industry;

- theory of production;
- theory of product pricing;
- theory of pricing of factors of production;
- theory of welfare of individuals as compared with each other; and so on.

In contrast, the study of economic phenomenon at the aggregate level is termed as macroeconomics. For this reason, it is also known as aggregative economics. The economic variables studied in macroeconomics cover the entire economy, or “big” chunks of it. Macroeconomics also deals with the interrelationship between these variables, such as the interaction between employment, output and prices. Thus, for example, while in microeconomics, we study the behaviour pattern of an individual worker in response to alternative wage rates, in macroeconomics, we study the effect of changes in wage rates on the supply of entire labour force or a major portion of it. Another example of distinction between micro and macroeconomics is that of price determination. In the former, determination of an individual price is analysed, while in the latter we analyse the determination of price level in general and therefore the problems of inflation and deflation.

As can be seen, the coverage of macroeconomics is also quite wide and is not limited to only a few topics. For example, macroeconomics covers the study of

- national income;
- labour force and population;
- unemployment;
- cyclical fluctuations;
- inflation and deflation;
- problems of economic growth, capital formation and infrastructure;
- problems of regional economic disparities;
- Inter-sectoral imbalances;
- structure of an economic system;
- fiscal and monetary issues and policies;
- balance of payments;
- international capital flows; and so on.

However, in this respect, we should note two things :

- There is no hard and fast rule by which we can say that we have crossed from the micro to macro level of economic analysis. Any line of demarcation chosen by us is bound to be arbitrary and subject to arguments both for and against. There are many parts of economic discussion where arguments can be advanced simultaneously in favour of their classification into microeconomics and macroeconomics. Whenever the analyst believes that the aggregation is of a sufficiently high level, he puts it in macroeconomics.
- In macroeconomics, the level of aggregation can vary between the extreme of the entire economy to only a part of it, provided that part of the economy is considered large enough.

Justification

What is the justification for making a distinction between microeconomics and macroeconomics ? And why should we be interested in both ? The answer lies in the following:

1. There are a number of rules and conclusions which fail to apply when we move from individual economic units to their aggregates. Let us note some examples of the non-applicability of laws of microeconomics in the field of macroeconomics.
 - A bank has thousands of depositors. The bank maintains some cash reserves to pay them in case they come over to encash their deposits. However, the cash reserves of the bank are always a fraction of its total deposit liability. Accordingly, at any given time, it can pay only some of them. Therefore, a single depositor is assured of getting cash from the bank as and when he needs it. But if all depositors want to encash their deposits at the same time, the bank is not able to meet their demand.
 - Similarly, when a product has a large number of consumers and an individual consumer changes the quantity of his purchase, the impact on the total demand is so insignificant that price remains unchanged. In this situation, the individual consumer is “a price taker” in the market. However, if all consumers or a majority of them change the quantity bought by them the price of the product also changes. They are no longer the price takers. For this reason, it is sometimes not possible to switch over from micro to macro level simply by changing “the scale” of variables involved.
 - Money balances owned by an individual can be used by him to buy goods and services. They form a part of his claim upon the resources of the economy, and therefore can be regarded as a part of his wealth. However, when we consider the economy as a whole, additions of money balances do not make it richer. This is because money represents claims of the individual economic units upon the resources of the economy itself. That is to say, they are claims of the economy upon itself. Had it been possible for the economy as a whole to acquire wealth by creation of money supply, no economy in the world would have remained poor.
 - An individual can add to his wealth by saving out of current money income. He can also add to his future income by earning an interest on his savings. But if the economy as a whole reduces its money expenditure, there will result in a reduction in real output and employment also. And the economy will become poorer. As a result, even the savings of the economy as a whole will fall.
2. There are many economic problems which can be solved only by the economy as a whole. They include, for example, the problems of unemployment, inflation, regional disparities, balance of payments and so on. The problem of providing infrastructure and increasing the rates of capital accumulation and investment can be solved only at the level of the economy as a whole.
3. Though some conclusions drawn from microeconomics fail to apply to macroeconomics, still we need both of them, because they supplement each

other- both theoretically and in practice. If we confine ourselves to only one of these, our understanding of economics principles remains incomplete and our conclusions remain faulty. Analytical concepts and variables used at both levels are deeply influenced by each other.

An individual economic unit has to operate within the overall limitations imposed by the economy as a whole. It has to act on the assumption that “other things would remain the same irrespective of its own action”. On the other hand, the impact of individual actions adds up and determines the overall position of the economy. And for that reason, we cannot ignore their collective behaviour.

4. Usually, a change in a variable at the macro level (such as a change in the size of national income) does not affect all individual economic units evenly. In macroeconomics, therefore, these problems are overcome by dealing with aggregates and averages.

Thus both microeconomics and macroeconomics have their respective uses, which may be highlighted as below :

- (a) Microeconomics helps in determining standardised decisions and activities of typical economic units under alternative situations. Microeconomics also enables us to study the activities of individual economic units and their small groups in their alternative capacities, such as consumers, producers, etc. The information gathered in this manner can then be extended to the working of the economy as a whole. This approach of analysing economic decisions and activities ‘bit by bit’ makes the task of building of economic theory easier.
- (b) Microeconomics provides a basis for welfare and growth economics, but their fuller development needs the use of macroeconomics also. The conclusions of microeconomics can be used, in a selective manner, as building blocks for formulating policy at macroeconomic level. Let us take some typical examples of this fact.
 - (i) At micro level, we find that each consumer wants to maximise his ‘consumer’s surplus’, that is, the excess of expected satisfaction over the price paid by him for his purchases. Accordingly, we come to the conclusion that the overall economic policy should be directed to ensure that the collective ‘consumer’s surplus’ of the society as a whole is maximised.
 - (ii) In the same way, once we realize the way in which individual firms respond to shifts in costs, prices, and technology etc., we can use these findings to encourage or discourage the production of specific goods and services.
- (c) When we examine the actual performance of the economy we find that it suffers from several deficiencies. For example, we often find that it has more income and wealth inequalities than are considered acceptable. There are more regional economic disparities than there ought to be. The level of employment is not high enough. The rate of growth in national income is not sufficiently high. And so on. These disparities between actual and desirable level of performance of the economy establishes the need for studying macroeconomics so that the reasons for faulty performance of

the economy may be identified and remedial measures undertaken.

- (d) Another reason which justifies the study of macroeconomics is the fact that the economy is not just the sum total of its individual economic units. It is more than that. The economy has its own existence over and above that of its individual members.

Working of an Economic System

We come across a variety of economic systems. They differ from each other not only in details but also in broad outlines. Even so-called two capitalist or socialist systems are not identical with each other. There are differences in their structural details. Similarly, there are also differences in their markets, level of economic development, extent of capital accumulation, and technology, etc. Under these circumstances, therefore, it is but natural that their working should also differ from each other.

Given this lack of uniformity of economic systems, how do we study their working? For answering this question, let us note the following :

- (a) All economic systems have a common characteristic of there being a permanent shortage of resources in comparison with their need. It is, therefore, faced with some basic (or central) problems arising out of this phenomenon of resource scarcity. These central problems may be summarised as follows.
 - Since the economy is not able to produce every thing, therefore it has to decide between which goods and services to produce and which ones to leave out. It has also to decide the respective quantities of the goods and services to be produced.
 - Since the available resources can be used in several ways for producing goods and services, it has to decide allocation of resources that is which resources should be employed for producing which goods and services.
 - The goods and services produced constitute the national income of an economy. The society must decide its distribution among its members. The mechanism of income distribution determines (i) share of national income received by different factors of production, and (ii) the goods and services comprising this share.
 - All these problems are inter-related. None of them can be solved without simultaneously solving the others. Therefore, an economic system has to work in such a way that its overall performance is the best possible attainable.
- (b) Every economic system adopts its own set of solutions for meeting the problem of resource scarcity and tries to increase their availability on the one hand and use them in the best possible manner on the other.
- (c) Every economy decides whether to use “price mechanism” [also called “market mechanism”] or not, and if so, to what extent.

Market mechanism is an interaction between (i) forces of demand and supply (ii) prices of goods and services. It is noteworthy that the exact manner in which market mechanism operates depends upon the extent to which this interaction is permitted to take place. Thus for example, at one extreme, we may have a fully “free” market mechanism, and on the other, a fully “frozen” one. In the former, all economic

units are allowed to respond to the changes in prices of goods and services and take their decisions relating to demand and supply. The level of prices and changes in them act as signals for individual economic units. And they revise their demand and supply decisions in response to these price signals. Their decisions, in turn, affect the prices and lead to further revision of demand and supply decisions. In this manner, a continuous action-reaction between demand, supply and prices goes on.

Whenever any one of the three components of price mechanism (namely, demand, supply or prices) are not allowed to change in response to the other two, price mechanism no longer remains free. In the extreme case, none of the three components is allowed to respond to the other two. In this situation, the economic system is not guided by changes in prices, or demand and supply decisions of individual economic units. Instead, it is guided by some central planning authority which takes decisions relating to the solution of the central problems of the economy described above.

Let us, therefore, study the working of an economic system by looking at the extent to which it makes use of the market mechanism. In this unit we shall cover a typical (i) capitalist system, (ii) a socialist system, and (iii) a mixed economy.

A Capitalistic System

Features : A capitalist system (or Capitalism) is characterised by certain features. They, in turn, determine the manner in which it operates and tries to solve its basic problems. These features are :

1. Capitalism derives its name from the fact that in this system, means of production are not owned by the government or by cooperatives. They are owned privately, that is by individuals and households. Business units (and therefore, the resources owned by them) also belong to individuals and households. The institution of private property also covers the right to inheritance. The institutions of property and inheritance have two strong implications.

Firstly, people acquire a motive for earning more, because they are allowed to keep their earnings both for current and future use. For this reason, they are always on the look out for opportunities of increasing their income. In the process, if need be, they are also ready to work hard. The net result is that a capitalist system is characterised by a high production potential.

Secondly, private property and inheritance lead to ever-increasing inequalities of income and wealth. These inequalities, in their turn, result in unequal opportunities of earning an income. The market prices of various goods and services fail to correspond to their relative worth to the society. Therefore, a cumulative process develops in which the owners of capital are able to add to their incomes faster than the workers can add to their incomes, since they have to depend upon the income from their labour only.

2. Capitalism is also characterised by what is known as the policy of laissez-faire on the part of the authorities. The term laissez-faire means absence of state intervention in the working of the economy. The solution of the basic problems of the economy is left in the hands of market mechanism. In other words, the authorities do not try to regulate the prices, demand or supply. The market mechanism, through the interaction between demand and supply

forces, brings about changes in prices. The prices, in turn, act as signals for individual economic units and guide them in their respective activities as consumers and producers, etc.

3. In theory, it is usually assumed that the market structure of a capitalist economy is competitive in nature. In practice, however, it need not be so. It is possible that while the authorities are following a policy of laissez-faire, the market itself is not competitive enough. It may have strong monopoly elements. It may be what we call a 'monopolistic competition', or there may be other forms of technical or institutional hurdles in the way of competition.

— Another salient feature of capitalism is the use of money and credit. This is so because a capitalist system, by its very nature, tends to become quite complex with a large variety of goods, services and occupations. The producers undertake production mainly for sale in the market and not for self-consumption. Similarly, a capitalist economy tends to have production projects which have a long technical life. All these aspects of capitalism necessitate an elaborate system of financing its economic activities and therefore the use of money and credit.

4. In capitalism, all economic activities are guided by market forces. Producers produce only those goods and services which are demanded by consumers in the market. The entire economy operates to meet the needs and preferences of the consumers. This characteristic of capitalism is known as that of 'consumer sovereignty'.

Working

As we have said before, a capitalist system is guided in its working by the market mechanism. An economic unit acts in several alternative capacities - as a consumer, as a producer, as an investor, and the like. In each decision, it is guided by the objective of promoting its own economic interest. It studies changes in prices, uses them as guide signals to assess its economic interest, and decides what it should do. In this manner, a set of economic decisions are taken and implemented collectively and simultaneously. It is these decisions by which the economic system is guided regarding 'what to produce', 'how to produce', 'for whom to produce'. These decisions also provide answer to the other associated question : how much to save out of current income, and the like. Let us, therefore, have a brief look at the manner in which economic units take decisions in their alternative capacities.

1. *Decisions as Consumers* : A consumer compares utility (that is, the expected satisfaction) from the good purchased with the price to be paid for it. He considers the purchase worthwhile so long the utility exceeds (or is at least equal to) the price paid. Moreover, he compares the 'consumer's surplus' (that is the excess of utility over the price paid) from one good with that from the other. In this manner, he decides
 - (i) which goods and services to buy, and
 - (ii) in what quantities to buy them.
2. *Decisions as Producers* : A producer is guided in his decision by the goal of maximising his profit income. He therefore, assesses the profitability of

alternative investment projects which he can undertake with the resources at his command. He basis his assessment of profitability of a project on the expected prices of inputs and the expected sales proceeds of the output of the project. The production decisions, therefore, include answers to several questions, namely, 'what to produce', ' what quantities to produce', and ' how to produce them'.

3. *For Whom to Produce* : It is also seen that the producers employ various productive resources (labour, land, capital, etc.) in their production activities. The decisions by the producers, in turn, determine the incomes of the members of society. (This is because, as we have seen above, these incomes are determined by the amounts of the resources employed in production activities, their prices and their ownership). The recipients of income decide what to buy and the producers (guided by the expected profitability) produce them. In other words, the decisions of the producers are also an answer to the question 'for whom to produce'. Production is undertaken for those persons who can and want to pay for what they demand.
4. *Decisions Regarding Saving, Capital Accumulation and Growth* : Every economic unit has to decide about dividing its income between current consumption and saving. An individual (or a household) decides this by comparing the satisfaction expected from current consumption with that from future consumption, where the future expenditure includes interest income on the amount saved. A business unit, similarly, decides about the savings on the basis of its plans for expansion, upgradation and modernisation, as also the expected market conditions.

Merits

- 1 Capitalist system is self regulatory. It is regulated by market mechanism leading to several benefits for the economy.
 - (i) Though the market structure has its own cost in terms of some resources used up in advertising etc., these costs are far smaller than those which have to be incurred where the government has to regulate it through some form of central planning. In the latter case, the authorities have to incur expenditure in collecting and processing information, in formulating policies, in issuing directions and in monitoring their implementation.
 - (ii) The decision-taking process of the government is always more time consuming than in the case with private enterprise. This also causes an additional waste of resources.
2. It is claimed that the process of economic growth is faster under capitalism. This is because the investors try to invest in only those projects which are economically viable as dictated by the market forces.
3. The capitalist system decides 'what to produce' and ' how to produce' in consonance with the forces of demand and supply. Every producer tries to maximise his profit by employing resources in such a manner that the cost of production is reduced to the minimum possible. It, therefore, means that resources are used to produce those goods and services in which they are most productive. This results in an optimum allocation of productive resources of the economy.

4. It is generally believed that long term projects are more productive. The financial system of the capitalist economy helps the entrepreneurs in selecting long term projects by providing sufficient credit facilities.
5. Every economic unit tries to adopt a set of activities which are in its best interest. Advocates of capitalism claim that on account of this reason, there is an harmony of decisions in the economy as a whole. They admit that in reality, capitalism is not able to remove the problems of unemployment or cyclical fluctuations in national income etc. But they say that this is because, in practice , capitalism is not allowed to work in a smooth and perfect manner. It faces several hurdles in the form of unfair competition, monopoly elements, and activities of trade unions etc.
6. Capitalist system provides an incentive for efficient decisions and their implementation in the form of economic gains to the decision makers. This ensures a high degree of operative efficiency in the system.
7. The net result is that a capitalist economy has a tendency to register a high growth rate both in national income and per capita income. It also produces a large and growing variety of products, and has an inherent tendency to develop technology.

Demerits

However, as in the case of every other economic system, capitalism also suffers from several demerits. The leading ones are as follows.

1. Capitalism generates inequalities of income and wealth. They keep widening with the development of capitalism. In the initial stages of capitalism, therefore, there is widespread poverty of the masses. In later stages, the poverty is not acute in absolute terms, but inequalities remain. Some economists are of the view that inequalities reduce aggregate economic welfare of the society as a whole.
2. The inequalities of income and wealth, together with the institution of inheritance, leads to wide differences in economic opportunities. Those with more wealth and capital are able to get better education and training. They are also able to get better employment; or they can manage the businesses inherited by them. As a result, some members of the society start their career with higher income simply because of inheritance.
3. The composition of production in capitalism follows the pattern of demand. However, on account of inequalities, the pattern of demand does not represent real needs of the society. The result is a distortion in the production pattern also.
4. It is maintained by critics that capitalism wastes its productive resources in several ways. We can give the example of large scale advertisement and other forms of selling expenses. To a large extent, the expenses incurred by one firm get neutralised by the impact of selling expenses incurred by its rivals. As a result, while competing firms do not gain, the resources of the economy are used up in the process.
5. In a capitalist economy, it is not profitable to produce a number of 'merit goods' because they have a high cost of production and large sections of consumers are not able to pay for them. Merit goods are those the

consumption of which benefits even those who are not consuming them. Examples of merit goods are education, health care, and the like.

6. In contrast, the capitalist system may be producing a number of goods and services which are positively harmful for the society. Business units produce only those goods and services which are profitable to do so even when they are harmful, such as cigarette and tobacco.
7. On account of rapid technological progress, the existing capital machinery and equipment have a high rate of obsolescence. The need to replace them keeps arising much before they are used for their full technical life.

SOCIALISM

The concept of a socialist economy has its origin in the drawbacks of capitalism. There are no pre-determined details of a socialist system, but its main features are well recognized. This system tries to get rid of the drawbacks of capitalism and incorporate those features which are considered to be desirable. For example, it aims at removing the problems of inequalities of income and wealth, inequalities of economic opportunities, unemployment, cyclical fluctuations, and waste of productive resources. The advocates of socialism believe that most of these drawbacks come into being because of certain basic features of capitalism including the institutions of private property and inheritance, and the use of market mechanism. Accordingly, socialism is designed to have the following salient features.

Features

1. In a socialist economy, the institutions of private property and inheritance are abolished. The 'private sector' as we understand by this term, does not exist. It means that the ownership of means of production is not in the hands of individuals and households. Instead, they are owned by the government authorities and/or cooperatives. Individuals and households do not own any business concerns. And no one is an employee of a private business. Private ownership is allowed only in the case of consumption goods and personal belongings, and that too only to a limited extent. And to that extent, even inheritance of 'private property' may be allowed.

An important implication of the abolition of private property and inheritance is that economic decision-making is no longer left in private hands.

2. A socialist economy is not guided by free working of a market mechanism. It is rendered ineffective. In a sense, its operation is "frozen". Consumers and producers are not allowed freedom in their decision-making. The consumers have to take decisions within the limits set by the authorities. They also lay down production schedules and decide what to produce, how much to produce, and what resources to be used as inputs. Thus, demand and supply forces are not to respond to changes in prices. Instead they are regulated with the objective of serving the national interests as a whole. Similarly, prices are not allowed to fluctuate in response to changes in demand and supply. They are also controlled and regulated by the authorities. Only in some cases, cooperatives may be permitted to change the prices within certain limits.

Systematic operation of a complex economy necessitates a complex and vast set up of decision-making. In capitalism, this complex task is handled by

market mechanism. But in socialism, its substitute has to be created. This is usually done in the form of centralised economic planning.

3. A socialist economy recognises the ill-effects of money and credit. In capitalist system, these create cyclical fluctuations and inequalities of income and wealth. Ideally, therefore, a socialist economy prefers not to have these institutions. But the hard reality is that it cannot do without them. In an economy, which produces a large number of goods and services, cannot have an efficient system of physical rationing. It has to create and operate a complex system of income distribution which is not possible without using money in some form. Accordingly, it is not able to completely discard the use of money and credit but restricts it to the minimum necessary extent.

Merits

Thus, a socialist economy discards the use of market mechanism and replaces it with some form of regulatory authority, such as the planning commission. It also abolishes the institutions of private property and inheritance. Given these features of the socialist economy, it tries to remove the basic demerits of capitalism by pursuing the objectives of

- distributive justice, and
- social security.

Elaboration

1. *Distributive Justice*: It is not the same thing as 'equal' distribution. It does not amount to wiping out 'inequalities'. Instead, it means that in socialism, distribution of income takes place on the basis of comparative needs of the members of the society. However, it should be noted that it is difficult to achieve this objective on account of the following difficulties.
 - (a) It is extremely difficult to establish the comparative needs of the members of the society, particularly when the country has a large population. Till now, we have not been able to find a scientific (that is, non-discretionary) method of solving this problem. Moreover, if we follow any scheme of asking the people themselves about their needs, each person will insist that his need is more pressing and urgent than that of the others. It is also stated that even if we accept the opinions as expressed by individuals as correct ones, we may reach contradictory conclusions. Another problem with investigation of individual needs through some kind of enquiry is that it is an expensive exercise. The resources used up in such an exercise can be used for producing additional goods and services.
 - (b) If income is divided on the basis of relative needs of the members of the society, every one is assured of his share of the national income irrespective whether he has contributed to its creation or not. For this reason, the incentive to work and produce is lost. The economy is pushed to a low level of output and poverty.
 - (c) Since the working of a socialist economy is directed by official machinery, all decisions are subject to rules framed for the purpose. As a result, the

process of decision-making becomes slow and wasteful. The rate at which productive capacity of the economy increases declines. And its existing productive capacity also remains under-utilised.

2. *Social Security* : Socialism also tries to remove another drawback of capitalism, namely the absence of social security. The term social security represents a system by which every member of the society is assured of an income which is sufficient for satisfying his basic needs. He is entitled to this minimum income irrespective of whether he is able to work or not. Thus, he continues getting this income even when is ill, old, too young, or otherwise unemployed.

A major defect with providing social security is that members of society lose initiative and become indifferent to work. By their very nature, human beings are willing to work and take initiative if they are rewarded for the same. Factually, therefore, a socialist economy tries to overcome this hurdle by providing social security not fully, but only partially. Essentially, it means that every one is assured of an income which is sufficient to meet his basic needs but no more. For getting additional income, one has to work. And this additional income is directly related to the nature of work and initiative undertaken by its recipient.

Demerits

Thus, while socialism is able to get rid of the problems of income inequalities, unemployment and cyclical fluctuations of national income and prices, it is not able to provide economic incentives and disincentives for hard work and initiative. As a result, it continues to suffer from slow growth rate, poor productivity of labour and low per capita income. On account of these weaknesses of the economy, it becomes difficult to raise the consumption standards of the masses. And this gives rise to the necessity of restructuring the economic system for better results.

A MIXED ECONOMY

A mixed economy tries to

- avoid the ill-effects of both capitalism and socialism, and at the same time
- secure the benefits of both.

For this reason, it incorporates some elements of both capitalism and socialism. However, there is no pre-determined and standardised proportion in which their features could be selected and combined.

Features

The exact selection of the features and the extent to which they should be adopted depends upon the circumstances faced by a country. In other words, in deciding the details of a mixed economy, we have to look at each component of the two systems and decide whether it should form a part of the our mixed economy or not. Also, we have to decide the exact form in which it should be incorporated.

Generally, the form of a mixed economy is adopted by that country which is not only underdeveloped with a low per capita income but also suffers from widespread inequalities of income and wealth. It is in need of simultaneously achieving a number

of objectives some of which appear self-contradictory. For example, it finds that for accelerating rate of growth, it should increase rates of saving and investment. At the same time, because of widespread poverty of masses, it wants to reduce income inequalities by transferring some national income from the richer people to the poor. But, the poor have a low capacity to save. And this reduces the capacity of the economy to save and invest.

1. The selection of detailed features of a mixed economy is made with reference to the working of market mechanism, and its expected effects (both beneficial and harmful) on the society as a whole. In other words, we take up one segment of the economy at a time, and adopt the following procedure.

It is decided that working of the selected segment of the economy should be guided by free market mechanism if the net effect of this arrangement is expected to be beneficial for the society as a whole.

- If the working of the segment under consideration can be made beneficial for the society by subjecting the working of market mechanism to some regulatory measures, then the said segment is subjected to be governed by a regulated market mechanism. In other words, in this case, the interaction between demand, supply and prices is regulated in a manner and to the extent found necessary.
- Working of a segment under free market mechanism may be harmful for the society in certain respects. If it is possible to make its working beneficial by regulating the market mechanism, the said segment is again subjected to a regulated market mechanism. However, the extent and nature of regulatory measures are revised from time to time in light of the changing circumstances.
- In some other cases it may be found that market mechanism continues to have net ill-effects even after restrictions and regulations. In such cases, therefore, market mechanism is not allowed to operate at all. The authorities take over one or more functions of market mechanism, namely, demand decisions, supply decisions and prices. This is generally done through public sector undertakings, which need not be guided by market forces.

Thus, in a mixed economy, the net result is that market mechanism is not totally abolished. It is allowed to operate with different degrees of freedom in different segments of the economy. Indian economy provides a very good example of a mixed economy as it operates in practice.

Elaboration with reference to India

- Some sectors of the economy are expected to suffer if they are put under government regulation and control. On the other hand, they are expected to work more efficiently if they are allowed to operate under free forces of demand and supply. Such sectors include, for example, agriculture, small scale industrial units, tiny and village industries, self-employed artisans, and so on. It is generally believed that if government tries to regulate these sectors of the economy through some form of central planning, there would be a large scale resource wastage. Moreover, working of the government machinery causes lots of difficulties and delays which these sectors are not

able to deal with.

However, it is also recognised that individuals and families engaged in these sectors have very weak bargaining strength. Their economic weakness can lead to their exploitation by other sections of the society. Therefore, the authorities decide that they should be helped in various ways to compensate for their weak economic and bargaining strength. Accordingly, the authorities assist them in several ways such as, assured and timely availability of raw materials, assistance in marketing at reasonable rates through cooperatives, regulated mandis, and so on. In some case, even tax concessions and subsidies are extended to help them.

If market mechanism is allowed to operate freely, some sectors tend to develop monopolies. Monopolistic elements are considered harmful for the economy and welfare of the society in several ways. A part of productive capacity of the economy remains under-utilised and actual output tends to fall below what the economy is capable of producing. Prices also tend to remain high in the absence of competition. Economic power tends to get concentrated in the hands of a small number of individuals and families. As a result, economic and welfare interests of the society as a whole tend to suffer. Large scale industries and financial institutions (and to some extent, even the medium scale firms) belong to this category.

Therefore, these sectors are put under a regulated framework. These regulations may take several forms and may vary from industry to industry or even from case to case. Thus, in some cases, the producers may not be allowed to decide the prices of their products. Instead, they may be obliged to charge only those prices which represent their cost of production plus some specified margins. Similarly, a part of the output may be sold through quotas and other forms of rationing.

- Existence of public sector undertakings is another feature of a mixed economy like India. It is possible that the government may assume the responsibility of developing some basic and strategic industries. It may even reserve for itself the right to establish and run them. Or it may decide to have some of them in what is commonly known as the joint sector.
- 2. In a mixed economy, by its very nature, the role assigned to market mechanism is not uniform for the entire economy. Therefore, the system of economic incentives and punishment also varies from one sector of the economy to the other. Thus, where market mechanism is allowed full freedom to operate, the system of incentives and punishment is also applicable fully. In India, this is the case with agriculture, small scale industries, and self employed sections, etc. On the other hand, the operation of market mechanism is partly restricted in the case of large and medium scale industries, and the working of the system of incentives is also restricted to that extent. Similarly, in the public sector, the role of incentives is reduced to the minimum. The employees of these undertakings have to work under detailed regulations and procedures. They have very little freedom of initiative.
- 3. Public sector happens to be an important feature of a mixed economy. By

public sector, we do not mean the administration, justice, law and order, and defence, etc. These services happen to be with the authorities even in a capitalist system. Instead, in a mixed economy, public sector includes the production and supply of several economic goods and services which in a capitalist economy are typically provided by the private sector. Though public sector undertakings may try to earn a profit, most of them are not run with that objective in mind. Actually, these undertakings are not closed down even when they are incurring losses because of various social compulsions.

Public sector undertakings find a prominent place in a mixed economy for the following important reasons.

- (a) The authorities can use public sector undertakings for accelerating capital formation and economic growth. They can develop machine building, basic industries and infrastructure even when they are not commercially viable.
 - (b) Public sector undertakings can play a crucial role in correcting imbalances in the economy, including those between different sectors and different regions of the country. For this purpose, the authorities can adopt a policy of establishing those industries which help in filling the gaps in supplies. Similarly, preference may be given to backward areas while locating public sector undertakings.
4. A mixed economy also tries to achieve distributive justice to the extent it can. For this purpose, relative needs of the members of the society are given due importance in distribution of income. A mixture of both need-based and incentive-based criteria is adopted. Some measures are adopted to ensure that income inequalities are minimised and gainful employment is available to the labour force. Through measures like rationing, poorer sections of the society are assured the availability of some essential goods. At the same time, however, an incentive for work and initiative is retained by linking additional incomes of individuals to their work and initiative.

Evaluation

In theory, a mixed economy is far superior to either capitalism or socialism since it tries to acquire beneficial features of both. In practice, however, it suffers from many drawbacks. Some of these arise on account of the fact that it is extremely difficult to work out the details of a mixed economy. The system has a tendency to suffer from several inner contradictions. Once the rules and procedures for its working have been formulated, it is not possible to revise them frequently or rapidly. The economy, therefore, fails to adjust itself to changing circumstances as rapidly as it should. The success of a mixed economy also depends upon the integrity and expertise of the government administration, the expertise and freedom of the management, and the willingness of the workers to recognise their moral duty of increasing productivity.

SELF-TEST QUESTIONS

*(These are meant for recapitulation only.
Answers to these questions are not to be submitted for evaluation)*

1. How would you explain the rapid growth of the science of economics ? Does it serve a useful purpose in the solution of our practical problems ?
2. Why do we have a large number of definitions of economics ? How do you reconcile them with each other ?
3. What do you mean by an economic system ? Why does it come into existence? What are its basic problems ?
4. We cannot have a fixed and permanent definition of economics because its coverage is always undergoing a change and expansion. Elaborate this statement and illustrate your answer with suitable examples.
5. Critically comment on Adam Smith's view that economics is a science of the nature and causes of the wealth of nations. Highlight the drawbacks of this view.
6. "We cannot define economics in general acceptable terms. The definition will follow the objective of defining it." Elaborate.
7. State and discuss Marshallian definition of economics.
8. "Economics discusses the use of scarce resources for satisfying unlimited ends." Critically elaborate this definition of economics.
9. Distinguish between economics as an art and economics as a science. Which of the two do you prefer and why ?
10. What is the difference between positive and normative economics? What are their merits and demerits ?
11. How do you differentiate between microeconomics and macroeconomics? Why do we need both ?
12. Give a few examples where the conclusions drawn from microeconomics fail to apply to macroeconomics.
13. What are the salient features of a capitalist economy? How does it solve its basic problems?
14. Evaluate the performance of a capitalist economy and make a case for a socialist economic system.
15. What do you understand by market mechanism ? How is it used in guiding the working of a capitalist economy ?
16. What are the salient features of a socialist economy ? What is the role of market mechanism in it ? Assess its merits and demerits.
17. "Theoretically, it is ideal to have a mixed economy. However, it suffers from several drawbacks." Critically evaluate this statement.

Suggested Readings :

1. H. L. Bhatia, Microeconomic Theory.
2. H. L. Ahuja, Modern Microeconomics.
3. D. N. Dwivedi, Microeconomic Theory.

4. J. M. Joshi and Rajendra Joshi, Microeconomic Theory.
 5. Lionel Robbins, Nature and Significance of Economics, 1932.
 6. Alfred Marshall, Principles of Economics, 8th edition, Chapter 1.
 7. P. A. Samuelson and William D. Nordhans, Economics, Chapter 1.
 8. P. N. Chopra, Advanced Economic Theory.
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1. Adam Smith, An Enquiry into the Nature and Causes of Wealth of Nations, 1776, Modern Library Edition.
 2. David Ricardo, Principles of Political Economy and Taxation, 1821, Preface.
 3. Alfred Marshall, Principles of Economics, 8th edition, p.1.
 4. A. C. Pigou, Economics of Welfare, 4th edition, p.11.
 5. Lionel Robbins, Nature and Significance of Economics, 1932, p.16.
 6. P. A. Samuelson, Economics, p.3.
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STUDY II

DEMAND AND SUPPLY ANALYSIS

INTRODUCTION

Analysis of the determination of prices of goods and services in the market is an indispensable part of the subject matter of economic theory. When an economy is guided by market mechanism, prices are determined by interaction between demand and supply forces, that is, they are the result of an interaction between decisions taken by buyers and sellers. This is so at all levels of prices, right from the price of an individual good to where all prices are considered simultaneously. To analyze the determination of all prices simultaneously is obviously a very complex task and can be handled only in stages. Therefore, we begin with a small part of the problem and extend the findings, in stages, to the economy as a whole. It goes without saying that, at each stage, both demand and supply sides have to be studied and analysed.

In this task, we begin with the question of determination of price of a single good or service (the terms good or service will be used interchangeably by us). Decisions relating to its supply are taken by the body of its suppliers comprising all the 'firms' of an 'industry'. As is obvious, their decisions vary with the market structure and other circumstances. Similarly, decisions relating to its demand are taken by the body of its buyers. Their decisions are also influenced by the market structure and several other relevant considerations. While analysing the demand side, we assume that the good/service in question is a consumption good. We start with the factors, which determine the decision-making of a typical consumer, and extend the conclusions to the market and the economy as a whole. Therefore, as a first step, various relevant questions are asked and their answers used to determine the demand behaviour of a typical individual consumer. These findings are then extended to arrive at the 'market demand' for the good, that is, the demand by all the potential consumers taken together. Finally, the determination of price of an individual good is analyzed by incorporating its supply side, that is the decision-making behaviour of its suppliers.

Demand for a good by a consumer is not the same thing as his desire to buy it. A desire becomes a demand only when it is 'effective' which means that, given the price of the good, the consumer should be both willing and able to pay for the quantity which he wants to buy. Thus, we note that an individual's demand for a good should be considered in the following manner.

We assume that the consumer's decisions are guided by several considerations, such as his income, tastes and preferences etc. and further assume that these remain constant and do not vary. Thus 'other things remaining the same', we note that:

- (a) With a change in the price of the good, the consumer changes the quantity purchased by him. Normally, the consumer buys more of a good when its price falls and reduces the quantity when its price increases.
- (b) The quantity demanded must be related to the time interval over which it is purchased. For example, it is meaningless to say that a consumer buys 5 kg of sugar when its price is Rs. 12 per kg. We must know whether the quantity bought is per day, per week, per month, or over some other period.

Three Alternative Ways of Expressing Demand : Demand for a good by an individual or the market as a whole is conventionally expressed in three alternative forms, namely, a demand function, a demand schedule, and a demand curve.

- (a) *Demand Function* : A demand function of an individual buyer is an algebraic form of expressing his demand behaviour. In it, the quantity demanded per

period of time is expressed as a function of (that is, determined by) several variables. A demand function may be in a generalised form or a specific form. In the latter case, the function describes the exact manner in which quantity demanded is supposed to vary in response to a change in one or more independent variables. Some typical examples of a demand function for good X are :

$$(i) \quad D_x = f(P_x, Y, T) ; \text{ and}$$

$$(ii) \quad D_x = 2000 - 10P_x .$$

Here, D_x denotes quantity of good demanded, P_x denotes the price of good X, Y represents income level of the consumer and T is a measure of his tastes and preferences.

- (b) *Demand Schedule* : A demand schedule is a tabular form of describing the shifts in quantity demanded of a good in response to shifts in its price per unit, while all non-price determining variables are remaining unchanged. A demand schedule has two columns, namely (i) price per unit of the good (P_x), and. (ii) quantity demanded per period (D_x). The demand schedule is a set of pairs of values of values of P_x and D_x . The first column records the hypothetical values of P_x , and the second column records the corresponding quantity (D_x) which the consumer would decide to buy if faced by that price.(See Table 2.1 Below)

Table : 2.1

Individual Demand Schedule for Commodity X

<i>Price Per unit of Commodity X (Rs)</i>	<i>Quantity Demanded for Commodity X (Units)</i>
10	6000
20	5000
30	4000
40	3000
50	2000
60	1000

The above is the case of individual demand schedule. From individual demand schedules one may draw the market demand schedule. Market demand schedule is the horizontal summation of individual demand schedule. The illustration of market demand schedule is given as under (See Table 2.2).

Table : 2.2

Market Demand Schedule for Commodity X

Price Per unit of Commodity X (Rs)	Quantity Demanded for Commodity X by Consumer – A	Quantity Demanded for Commodity X by consumer – B	Total Quantity Demanded for Commodity X in the Market
10	6000	9000	15000
20	5000	8000	13000
30	4000	7000	11000
40	3000	6000	9000
50	2000	5000	7000
60	1000	4000	5000

- (c) *Demand Curve*: A demand curve is a graphic representation of the demand schedule. It is a locus of pairs of per unit prices (P_x) and the corresponding demand-quantities (D_x). Demand curve may be for individual or market. We may draw the individual demand curve for the good X based on the data given in table 2.1 (See. Fig 2.1).

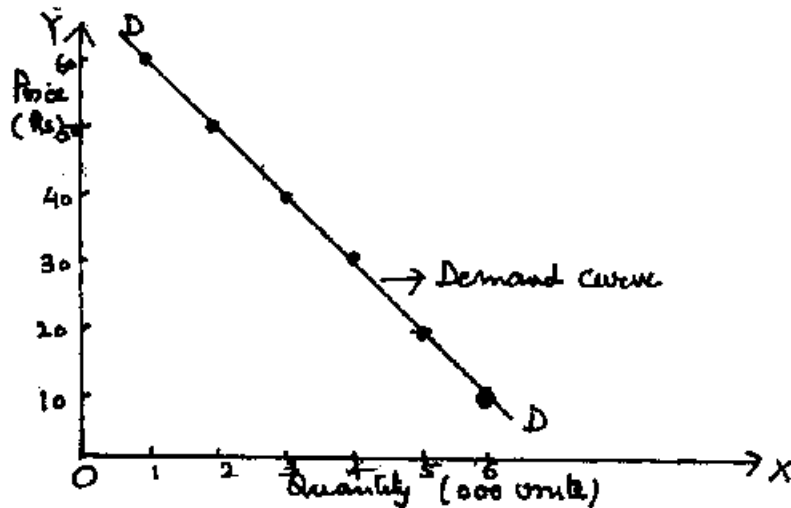


Fig. 2.1 : Demand Curve

Similarly the market demand curve for good X may be prepared. The basic difference between a demand schedule and a demand curve is that in the former, P_x and D_x are discrete variables. Their values vary in discrete steps and not continuously. In the case of a demand curve, however, both P_x and D_x are assumed to be continuous variables. As a result, the demand curve is continuous without gaps.

Two approaches have been very popular in analysing the demand behaviour of a typical individual consumer, namely those based upon the concepts of (a) utility, and

(b) indifference curves. We shall now study only utility approach.

UTILITY APPROACH

MEANING OF UTILITY

Utility of a good is its expected capacity to satisfy a human want. To a consumer, the utility of a good is the satisfaction which he expects from its consumption. It is the extent to which it is expected to satisfy his want(s). It is obvious that utility of a good to a consumer can differ from the satisfaction which he actually derives from its consumption.

The fact that utility of a good is the satisfaction which the consumer expects from its consumption implies that it is a subjective thing. It depends upon the mental assessment of the consumer and is determined by several factors which influence the consumer's judgement. These factors include, for example, the intensity of the want/s to be satisfied. Utility of a good varies with the intensity of the want to be satisfied by its consumption. This fact leads us to a few important inferences.

- Utility of a good differs from consumer to consumer. This is because a given want can be felt in different intensities by different consumers.

The utility of a good keeps changing even for the same consumer on account of changes in the intensity of the want(s) to be satisfied by its use. This change may be the result of a shift in the circumstances faced by the consumer, or it may take place in the process of the satisfaction of the want itself.

- The utility of a good is not to be equated with its usefulness. Satisfaction of a want need not add to the welfare of the consumer. For example, smoking, drug taking or consumption of similar other things is believed to be harmful for the health of the consumer. But the consumer believes that they have utility for him because he can use these to satisfy his wants. In economics, we are not concerned with the 'normative' aspect of utility. While studying the problem of price determination of a good, we are only concerned with the 'reasons for' and 'intensity of' its demand by the consumers. It does not matter whether its consumption adds to their well-being or not. So long as the consumers expect to derive some 'satisfaction' from a good (that is, so long the good has a 'utility' for them), they will be ready to buy it at some price and create a demand for it in the market.

Utility versus Realized Satisfaction

A consumer demands a good on the basis of its utility, that is, expected satisfaction and not on the basis of actual satisfaction derived from it. A good has to be actually purchased before it is consumed and the decision to buy it can be based only on the satisfaction which is expected from it. Utility of a good is not directly related to its actual consumption. The two can differ widely from each other. Of course, previous experience of the consumer (or other members of the market) with a good may affect his estimate of its utility and, therefore, its demand. But it is its utility (expected satisfaction) (and not its actual satisfaction) upon which a consumer bases his demand for a good.

Measurement of Utility

The need for measuring utility arises so that it can be used in the analysis of demand behaviour of individual consumers, and therefore, of the market as a whole. The basis of the reasoning is that a consumer compares utility of a good with the price he has to pay for it. He keeps buying its additional units so long as the utility from them is at least equal to the price to be paid for them. In economic theory, utility is measured in two ways, (i) cardinal and (ii) ordinal. In cardinal measurement, utility is expressed in absolute standard units, such as there being 20 units of utility from the first loaf of bread and 15 units from the second. In contrast, ordinal measurement of utility is the one in which it is not expressed in absolute units. Utility from two or more sources is only 'ranked' or 'ordered' in relation to each other. Utility from one source may be 'equal to', 'more than' or 'less than' utility from another source. But it is not possible to state the difference in absolute or numerical units.

The fact is that utility is a subjective thing and varies from person to person and from one situation to another. For this reason, it is not possible to measure it in absolute terms. Nor can we compare utility of a good for two individuals. It means that in practice, we cannot have a cardinal measurement of utility. It can be measured only in ordinal terms. At the most, a consumer can rank the utility from two goods or from two units of the same good.

However, in a number of cases, analysis of demand decisions require the use of a cardinal measurement of utility. For this reason, some economists suggested the adoption of a standard unit of utility and gave it the name of a "util". But "util" itself happens to be a subjective, discretionary and imprecise measure and, for therefore, does not enable us to determine the demand behaviour of consumers. To overcome this difficulty, economists like Marshall advocated that utility of a good to the consumer should be measured in units of money which he is ready to pay for buying it rather than go without it. For example, if a consumer is ready to pay, at the most, five rupees for the first bottle of a cold drink and only four rupees for the second one, then according to this approach, the utility of the first bottle to the consumer equals five rupees and that of the second equals four rupees. This approach helps us in analysing demand decisions of the consumers because, in practice, they pay for their purchases in terms of money.

Concepts of Total, Average and Marginal Utility

When a consumer buys a good, the utility derived from it is expected to vary with its quantity, and generates three concepts, namely those of (i) total utility, (ii) average utility, and (iii) marginal utility.

If a consumer buys n units of a good X then, for him, total utility (TU) from it is the summation of utilities derived from all the n units. If we divide this total utility (TU) by the number of units of X , that is n , we get average utility (AU) of these units of X to the consumer. Similarly, marginal utility (MU) is defined as the utility derived from the last (n th) unit. Symbolically, if U_i stands for the utility of i th unit of good X , then

$$TU_n = \sum U_i$$

$$AU = TU/N; \text{ and}$$

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

In the case of a “perfectly divisible” good, MU equals the first derivative of TU with respect to X, that is MUn (Marginal utility of nth unit of consumption) = TU / X

It is also clear that : utility of a good X to the consumer is directly related to the intensity of the want to be satisfied through its consumption. . For this reason, therefore, we should note the following :

- (a) For a given consumer, the three measures of utility depend upon the intensity of the want, which he expects to satisfy.
- (b) When a consumer consumes a good to satisfy his want, its intensity also undergoes a change. Therefore, the three measures of utility are also affected by the stock of X with the consumer.
- (c) The intensity of a want being satisfied tends to change over time. The capacity of different goods to satisfy wants also differs. These factors also cause a shift in the three measures of utility.
- (d) Generally speaking, wants are not felt with equal intensity by all consumers. Therefore, the measures of utility tend to vary from consumer to consumer.

TABLE 2.3
Total, Average and Marginal Utility of Slices of Bread

<i>Slices of Bread</i>	<i>Total Utility</i>	<i>Average Utility</i>	<i>Marginal Utility</i>
1	40	40	40
2	78	39	38
3	113	37.7	35
4	144	36	31
5	170	34	26
6	190	31.7	20
7	203	29	13
8	208	26	5
9	204	22.7	-4

Table 2.3 illustrates interrelationship between three concepts of utility by considering a hypothetical example of a consumer who consumes slices of bread to satisfy his hunger. It should be specifically noted that the consumer is to consume bread without allowing any unreasonable time gap between the intake of successive slices. This assumption is essential to ensure that the intensity of hunger of the consumer decreases as he consumes additional slices. By implication, the marginal utility of slices also falls, and depending upon the number of slices consumed, it can even become zero or negative. In Table 2.3, units of MU are shown in column 4. It

becomes negative when the consumer consumes 9th slice. Figures of TU are shown in column 2. At each stage, TU is the cumulative total of the MU in column 4. Thus, for example, for four slices, TU equals 144, that is, $(40 + 38 + 35 + 31)$. Average utility is shown in column 3. Its entries are obtained by dividing the figures in column 2 with their corresponding figures in column 1.

It should be noted that, for the first slice, all the three measures of utility are equal to each other. Moreover, since MU falls with successive slices of bread, therefore, TU increases at a decreasing rate. It reaches its maximum when MU falls to zero and actually declines when MU becomes negative. In our example, TU reaches its maximum with 8th slice and decreases with the consumption of 9th slice because its MU becomes negative (-)4. It should also be noted that when MU is falling, AU also falls but at a slower rate. This fact can be verified by comparing figures in column 3 with those in column 4.

Diagrammatic Presentation

In Fig. 2.2, information contained in Table 2. 3 is expressed in the form of a bar diagram. Each step along X-axis represents one slice of bread. Total height of a bar represents total utility corresponding to the number of slices consumed. The upper portion of a bar shaded by dots represents the MU of the corresponding number of slice. Similarly, the portion of a bar shaded diagonally represents the AU of the slices consumed. It should be noted that MU of 9th slice is negative. As a result, the height of the bar also decreases. And so is the case with the shaded portion representing AU.

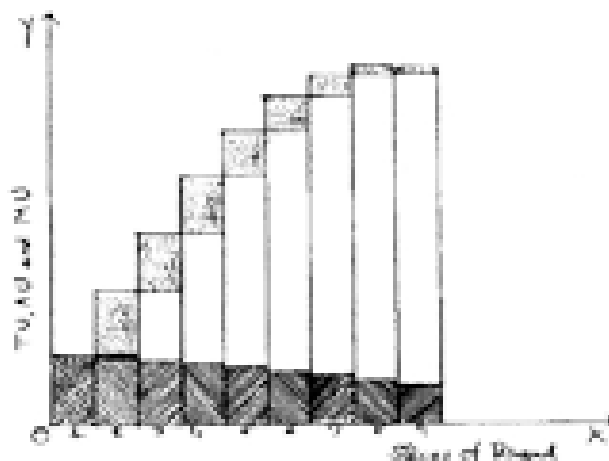


Fig. 2.2 : Total Utility (Height of the bar), Average Utility (line-shaded area) and Marginal Utility (dot-shaded area) of Slices of Bread

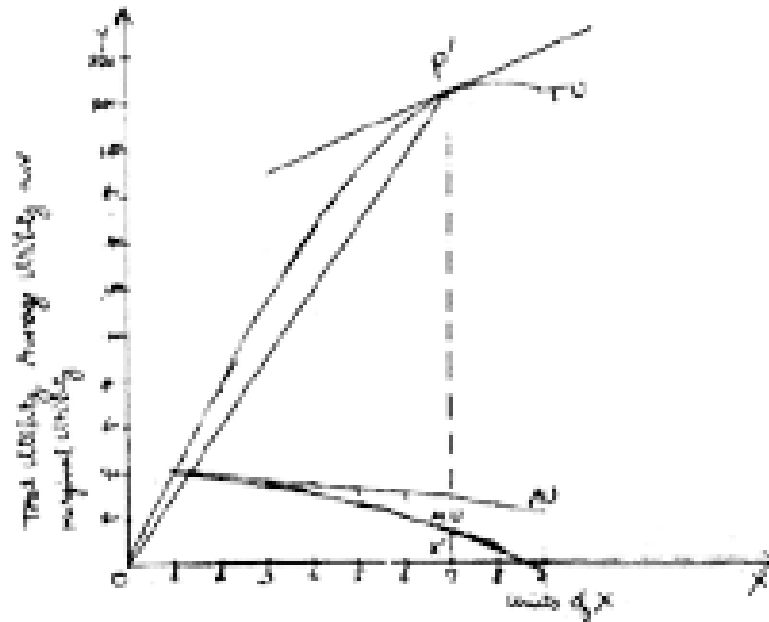


Fig. 2.3 : Total Average and Marginal Utility

A generalised way of showing the relationship between three measures of utility is to take a good X and assume that it is perfectly divisible, that is, it can be divided into infinitesimally small units. In this case, we can express TU, AU and MU of X in the form of curves. The three curves of utility become smooth with a type of interrelationship shown in Fig. 2.3 All the three curves start from the same point A on Y-axis. It is conventionally assumed that MU diminishes with successive units of good X. This shows :

- (i) MU curves slope downwards.
- (ii) Average utility falls slower than marginal utility. Therefore, AU curve has a smaller slope and lies above MU curve.
- (iii) TU curve rises at a diminishing rate. It reaches its maximum distance from X-axis when MU is zero. Thereafter, it also slopes downwards.

Geometrically, TU curve itself provides a complete information regarding total, average and marginal utility as follows. Given the quantity of good X (say, OX'), we consider the corresponding point (P') on TU curve. Then the perpendicular distance of P' from X-axis ($P'X'$) measures total utility of the quantity OX' of good X. The slope of the ray from the origin to P' (OP') measures its average utility. And the slope of the tangent to total utility curve at point P' measures marginal utility. Recall that marginal utility is also the first derivative of total utility with respect to quantity of the good, that is dTU/dX .

LAW OF DIMINISHING MARGINAL UTILITY (DMU)

The law of diminishing marginal utility states that as the stock of a commodity increases with the consumer, its marginal utility to the consumer decreases. It can eventually fall to zero and become even negative.

The law describes a familiar psychological tendency of the human beings. Marshall says that "the additional benefit which a person derives from a given increase in his stock of a thing diminishes with every increase in the stock that he already has." It has been discussed above that utility from the last unit of a good under consideration is termed its marginal utility. It has also been specifically noted that this marginal utility depends upon the intensity of want to be satisfied. The specific behaviour of marginal utility as described by the law of DMU follows from the conventional (and realistic) assumption that the intensity of a given want keeps decreasing if the process of its satisfaction is continued without interruption, that is, a single want can be fully satisfied provided the consumer consumes a large enough quantity of the relevant good/service. In other words, during the process of its satisfaction, nothing should happen to increase its intensity. For example, the consumer should not allow an unduly long interval between the consumption of any two units of the good ; he should not get a news of an unexpected change in his income or the price of the good, etc. It should also be noted that the good to be consumed should be homogeneous. Its successive units should have the same technical specifications. Any change in them can cause a change in the intensity of the want being satisfied and thereby violate the law of DMU.

The rate at which marginal utility of a good falls depends upon several factors and varies from individual to individual as also for the same individual from one situation to the other. This is because, it is generally possible to use several alternative goods or their combinations for satisfying a given want, and a given good is useful for satisfying several alternative wants. Moreover, as we have seen above, there is no constancy of the intensity of wants.

It is noteworthy that total utility keeps increasing so long as marginal utility is positive. The relationship between total, average and marginal utility measures has been explained and illustrated in the preceding paragraphs.

Exceptions to the Law

The law of DMU is violated only if one or more of the assumptions upon which it is based get violated. Since utility of a good is related to the mental perception of the consumer regarding the intensity of the want to be satisfied and the capacity of the good to satisfy it, therefore, the law of DMU is violated if for some reason,

- (i) the intensity of the want increases, or
- (ii) the consumer comes to think that the intensity of his want has increased.

It is for this reason that marginal utility of a good tends to increase if there is an unduly long interval between the consumption of two units of a good. Marginal utility of a good may also increase, if the want of the consumer is intensified by consuming a very small quantity of it (such as, a very little quantity of water given to a very thirsty person). Sometimes the marginal utility of a good increases during the process of its

consumption because the consumer comes to know better about it. A typical example of this is a piece of music which may be enjoyed better when listened to more than once.

Uses of the Law of DMU

The concept of marginal utility of a good and the manner in which it changes in relation to a change in its stock with a typical consumer, plays a central role in demand analysis.

- (i) It is directly linked with the price which the consumer is ready to pay for different quantities of the good under consideration. The analysis is based upon the assumption that the decision of the consumer is guided by his 'rationality', that is his economic interest. He buys an additional unit of a good only if its marginal utility is equal to or greater than the price to be paid for it. Given that the law of DMU applies to the good, we are able to derive the law of demand which states that the quantity demanded of a good is inversely related to its price per unit.
- (ii) The relationship between diminishing marginal utility of a good and its price helps us in explaining the determination of its price in the market. It also helps us in explaining paradoxes like water (which is so essential for life) being cheaper than diamonds.
- (iii) The law of DMU can be extended to the case where a consumer is faced with the decision to divide his total expenditure over a number of goods. This extension leads to the law of equi-marginal utility.
- (iv) Given the law of DMU, economic rationality of the consumer leads us to the conclusion to define and measure consumer's surplus which is defined as the excess of the maximum price which the consumer is ready to pay for the good over the price which he actually pays for it.
- (v) The law of DMU is highly useful to the authorities also in working out their social welfare programmes. They can take steps by which goods and services are allocated between members of the society in such a way that marginal utility of each good/service tends to be the same for every individual. If a particular good does not satisfy this condition, then its successive units should be transferred from those for whom it has smaller marginal utility to those for whom it has higher marginal utility. For example, marginal utility of a 'basic necessity' like nutritious food is expected to be higher for a poor family than for a rich one which has already enough of it. Therefore, if through rationing, taxes, subsidies, or other methods, some of it is transferred from richer families to the poorer ones, total utility of the society as a whole is expected to increase.

LAW OF EQUITY-MARGINAL UTILITY

The law of diminishing marginal utility plays a crucial role in explaining the demand behaviour of a typical consumer and determination of his equilibrium when he is facing the following circumstances.

- (i) The consumer is allowed to buy all or some out of specified goods, say A, B, C, D,...N.

- (ii) Each good obeys the law of DMU, and the its marginal utility schedule is known.
- (iii) Each good has a fixed price for the consumer. It does not vary with the quantity purchased by the consumer.
- (iv) The amount of expenditure to be incurred by the consumer is given. However, the consumer need not spend the same amount on each good, and their quantities can differ.

Consumer's equilibrium is the solution of this problem. It describes the respective quantities of goods A, B, C,....N which the consumer buys. The law of equi-marginal utility describes the rule by which the consumer takes this decision.

We assume that the consumer decides to divide his total expenditure between different goods by taking into consideration not only their respective marginal utilities but also their per unit prices. A consumer is guided by marginal utility which he can derive by spending each additional rupee. It is on this basis that he decides to allocate his expenditure between alternative goods. If, for example, he finds that a rupee spent on Good B brings greater utility than if it is spent on good C, he chooses to spend it on the B rather than on C. Thus, the consumer tries to satisfy the following two conditions :

- (a) The marginal utility derived from a good is not less than the price paid for it. That is, for good A, $MU_a \geq P_a$, where MU_a is the marginal utility of good A and P_a is its per unit price. We can also say that the ratio MU_a / P_a must be 1.
- (b) The ratio $MU_a / P_a = MU_b / P_b$, that is marginal utilities derived from the expenditure of last rupee on all goods are equal to each other. If for example, $MU_a / P_a > MU_b / P_b$, it means that the consumer can get greater marginal utility by shifting some of his expenditure from good B to good A. By doing so, he is able to get greater total utility by spending same amount of money. If however, the two ratios are equal, no addition to the consumer's total utility takes place by shifting his expenditure between goods.

Thus, the law of equi-marginal utility states that consumer distributes his expenditure between different goods in such a way that the marginal utility derived from the last rupee spent on each good is the same. Symbolically,

$$MU_a/P_a = MU_b/P_b = MU_c/P_c = \dots = MU_n/P_n \text{ (Consumer Equilibrium)}$$

Thus the consumer, while dividing his expenditure between goods considers both their marginal utilities and prices. By equating the ratios of marginal utilities to prices of goods, the consumer succeeds in deriving maximum possible utility from his expenditure. This is the best position which he can attain.

It is clear that the consumer's equilibrium will change if there is a change in (i) his total expenditure, (ii) marginal utility schedule of any good, or (iii) price of any good.

Table 2.4 provides a hypothetical application of the law of equi-marginal utility. It is assumed that our consumer is to spend 12 rupees and choose between four goods, A, B, C and D. Figures in the first row reveal that the first rupee spent on good

A yields 40 units of utility for the consumer. If same rupee is spent on good B, the utility derived by the consumer is 38 units. And so on.

Recalling that the consumer will spend each additional rupee on that good which brings him maximum marginal utility (that is having highest MU/P), we note that he will spend his 1st rupee on good D which brings him 45 units of utility. Similarly, the 2nd rupee is spent on good C (which brings 44 units of utility) ; the 3rd rupee is again spent on D (with marginal utility of 42); the 4th and 5th rupees are spent on goods A and C (not necessarily in this order); the 6th rupee goes to good D; 7th and 8th rupees are spent on goods A and B (not necessarily in this order); while the remaining four rupees are spent one each on A, B, C and D (not necessarily in this order). As a result, in all, he spends three rupees on A, two rupees on B, three rupees on C, and four rupees on D. The utility derived by him is 114 units from A, 74 units from B, 120 units from C, and 162 units from D, the total being 470 units. Any other division of his expenditure on these four goods would yield the consumer a smaller total utility. It should also be noted that when marginal utility from a rupee spent on two or more goods is the same, the consumer may spend it on either of them. Thus, in our example, we cannot say for certain whether the consumer will spend 4th rupee on A and 5th on C, or it will be the other way round. And if his total expenditure is only five rupees, the 5th rupee may be spent on either of the two goods with the same result.

Table 2.4

Application of the Law of Equi-marginal Utility

<i>Expenditure</i>	<i>MU_a/P_a</i>	<i>MU_b/P_b</i>	<i>MU_c/P_c</i>	<i>MU_d/P_d</i>
1st Rupee	40	38	44	45
2nd Rupee	38	36	40	42
3rd Rupee	36	32	36	39
4th Rupee	34	29	32	36
5th Rupee	32	26	28	33
6th Rupee	20	23	24	30
7th Rupee	18	20	20	27
8th Rupee	16	17	16	24
9th Rupee	14	14	12	21

Diagrammatic Representation

The Law of Equi-marginal utility may also be explained with the help of a diagram. In Fig. 2.4, we measure expenditure in rupees on a good along X-axis, and

the corresponding marginal utility, per rupee spent, from that good along Y-axis. This gives us a downward sloping curve (like MU_a/P_a) for each good to which the consumer allocates a part of his expenditure. In Fig. 2.4, we have four such curves. Therefore, the condition of equilibrium of the consumer is that :

$$MU_a/P_a = MU_b/P_b = MU_c/P_c = MU_d/P_d.$$

The consumer spends OA rupees on A, OB rupees on B, OC rupees on C, and OD rupees on D. The utility of the last rupee spent on each of the four goods is equal to OU

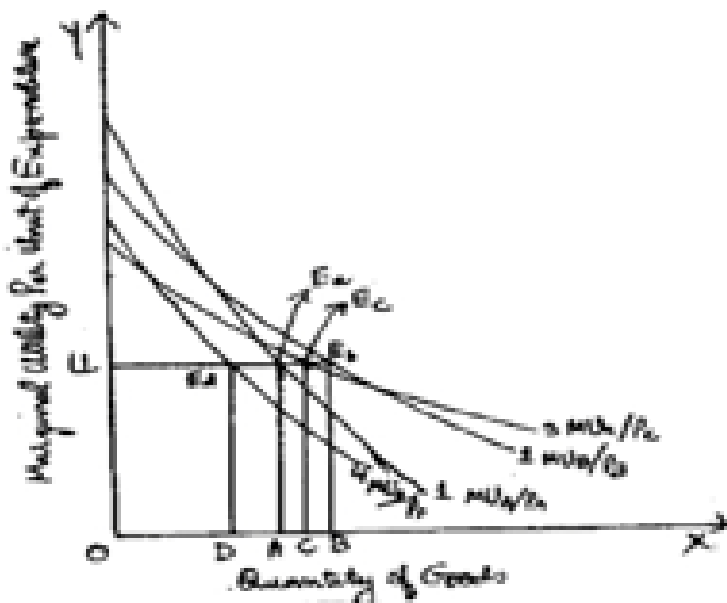


Fig. 2.4 : Law of Equimarginal Utility

Consumer Equilibrium Under Utility Analysis : Equilibrium means a position of rest characterized by absence of change. Consumer equilibrium is the situation when a consumer secures maximum satisfaction out of his expenditure. Basically, he attains the equilibrium position at a point when he maximizes his total utility given his income and price of commodities he consumes. Any deviation from this point places the consumer in the sub optimal situation. Under utility analysis, a consumer with a single commodity attains equilibrium at a point where

$$MU = \text{Price}$$

If MU of additional unit of a commodity is more than its price then Consumer will purchase the commodity, on the other hand if MU from the purchase of additional unit is less than the price then he will not purchase the commodity.. He will purchase the commodity up to the point where MU derived from the purchase of additional unit of Commodity is equal to its price.

In case of two or more commodities , consumer attains equilibrium at a point

where $MU_1 = MU_2 = \dots = MU_n$ if price for all commodities are the same. But in case of differences in prices, the equilibrium equation will be

$$MU_1/P_1 = MU_2/P_2 = \dots = MU_n/P_n$$

LIMITATIONS OF THE LAW

In reality, the Law of Equi-marginal Utility suffers from several limitations which come in the way of its implementation by the consumer. Briefly speaking these are as follows:

1. We have assumed that the goods on which the consumer spends his money are perfectly divisible. That is to say, these goods can be bought even in extremely small quantities. A strict use of this assumption is made when we draw smooth and continuous curves representing the ratios of marginal utilities of goods to their prices. In most cases, however, this assumption does not hold. The consumer is faced with lumpy goods. They are not divisible into very small quantities. He has to buy an entire quantity of a good or not at all. This is more so in the case of durable consumption goods. For example, he cannot buy half of a shirt, one-tenth of a bicycle, and the like. Consequently, he fails to apply the law of equi-marginal utility in practice.
2. The law also suffers from the unrealistic nature of its other assumptions. One such assumption is that the consumer has complete knowledge of the prices and availability of all consumer goods. However, this is generally not so. In several cases, the consumer does not possess sufficient information regarding the prices of goods he is interested in. In some cases, he may have incorrect information regarding the price and/or availability of a good.
3. The law assumes independence of utility schedules of goods. It means that utility derived from one good is not affected by the quantity purchased of other goods. In reality, however, many goods are related to each other by being substitutes or complements to each other. In such cases, the marginal utility derived from a given good depends not only upon its own quantity, but also upon the quantity of the related good.
4. The law makes a questionable assumption that the consumer is able to accurately determine the marginal utility schedules of all the goods.

DERIVATION OF LAW OF DEMAND — UTILITY ANALYSIS

Law of demand describes the changes in the market demand for a good in relation to its alternative prices. It says that in normal situations, quantity demanded of a good falls when its price increases and vice versa. In other words, the quantity demanded and the price of a good are inversely related to each other.

Utility approach helps us in deriving the law of demand. For this purpose, we start with the law of diminishing marginal utility and the marginal utility curve of a consumer good X, as in Fig. 2.5. We measure (a) units of good X along X-axis, and (b) units of marginal utility of X (MU_x) along Y-axis, and draw the marginal utility curve of X (MU_x). Thus, for example, point P on the MU_x curve shows that the consumer derives PM units of marginal utility when he buys OM units of X. In other words, the marginal utility of OMth unit of X equals PM. Similarly, in case the

consumer buys OM' units of X , then his marginal utility falls to $P'M'$.

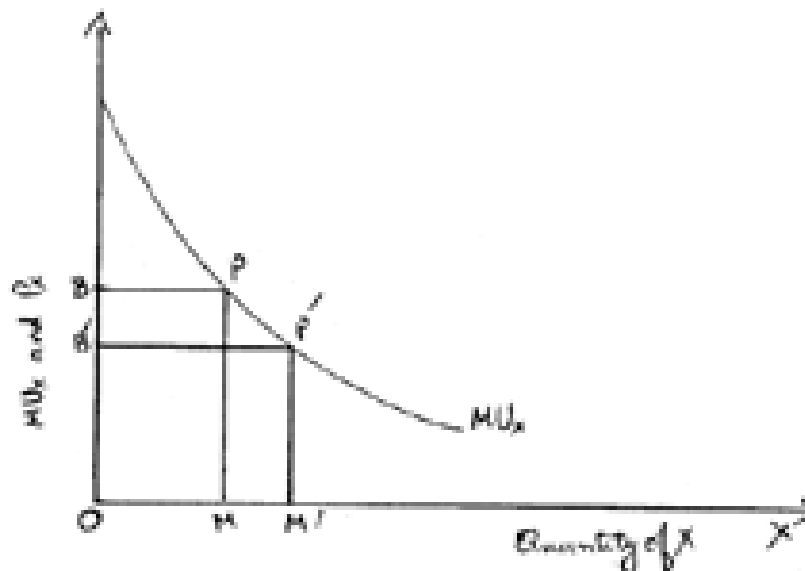


Fig. 2.5 : Marginal Utility of Goods and its Demand Curve

Changing marginal utility of X can be combined with the rationality of the consumer in deriving his demand decisions. Given the per unit price of X , he is ready to buy it only if its marginal utility equals or exceeds it. Thus, if the price per unit of X is $OB (= PM)$ units of utility, then the consumer will buy just OM units of it. No more and no less. If he buys a smaller quantity, he foregoes some surplus units of utility (which he gets over and above the price paid) from earlier units of X . This is because the price X does not change with its quantity purchased by the consumer. Though the consumer gets higher marginal utility from earlier units of X , the price paid by him for those units does not increase. And if he buys more than OM units of X , he gets smaller utility from those additional units, but has to pay the same price OB per unit. This reasoning can also be applied to the situation where price per unit of X is $OB' (= P'M')$. In that case the consumer buys just OM' of X - neither more, nor less. Translating these findings into overall demand decisions of the consumer, we can state that the consumer decides to buy more of X when its price falls and vice versa.

The next step in determining the demand behaviour of the consumer is to note that in effect, the price paid by the consumer is in terms of units of money. Therefore, it becomes necessary to either

- (i) convert units of utility into those of money, or
- (ii) convert units of money into those of utility.

This, in turn, necessitates that the rate of conversion of one into the other should be constant. In other words, it is essential to assume that marginal utility of money remains constant, that is, the law of diminishing marginal utility does not apply to money.

Advocates of utility approach recognize that, as in the case of other goods, the law of diminishing marginal utility does apply to money also. However, to provide a stable conversion ratio of units of utility into those of money, they are compelled to assume that marginal utility of money remains constant. Given this assumption, units of utility measured along Y-axis can be expressed in units of money. Accordingly, we can then say that if the price of X is OB rupees per unit, the consumer buys OM units of it. And if price of X falls to OB' rupees per unit, the consumer increases the quantity demanded to OM' units. In other words, we get the basic law of demand, which is represented by a downward sloping demand curve and which states that the quantity demanded of a good and its price are inversely related to each other.

The market demand curve of X is derived by the horizontal addition of demand curves of individual consumers.

Income Effect and Substitution Effect

The term “effect” is used to denote the change in demand for a good under consideration. Income effect on X measures the change in D_x , the demand for X on account of a change in the income of the consumer. Similarly, if price of X changes relative to the price of its substitute good Y (that is, if X becomes comparatively cheaper or costlier than Y), while real income of the consumer remains same, then the resultant change in its demand is termed substitution effect.

It is noteworthy that income effect need not be positive, that is, demand for X need not change in the same direction as the income of the consumer. In case of ‘inferior’ good, the income effect is negative. If negative effect is stronger than the substitution effect, then their summation, that is, the price effect will also be negative and the result will be a reduction in the demand for X.

LAW OF DEMAND

In law of demand, the quantity demanded of X is related to only its own price. All other factors determining its demand are assumed to be constant. Symbolically, the law of demand is derived from the demand function $D = f(P_x)$. The specific form of this function varies from case to case. But in each case of ‘normal goods’, the quantity demanded (D_x) and the price per unit (P_x) are expected to inversely related. The normal law of demand says that

“Other things being equal, an increase in P_x causes a reduction in D_x and an increase in P_x leads to an increase in D_x .”

Expressed graphically, the law of demand manifests itself in the form of a demand curve with a negative slope. (See Fig. 2.1)

Reasons for Negative Slope of the Demand Curve

Some of the major reasons for this behaviour of the demand curve, that is, of the normal law of demand, are listed below.

1. One of the causes of downward sloping demand curve is provided by the law of diminishing marginal utility. We have seen above that when a consumer buys additional units of a good, its marginal utility falls. Recalling that a consumer always compares the marginal utility from a good with the

price to be paid for it; the price which he is willing to pay for additional larger amount of a good falls. Conversely, if the price of a good falls, the consumer is induced to buy more of it. In other words, the price and quantity demanded of a good move in opposite directions and the demand curve assumes a negative slope.

2. The second explanation of the normal law of demand is provided by the law of equi-marginal utility. While deciding to buy a commodity, a consumer compares not only its price with its own utility, but also with the possibility of a gain of utility by buying its substitute goods. In other words, the consumer compares the ratio of marginal utility to price of one good with similar ratios of other goods. On account of a fall in price of a good, the consumer finds that the existing equality of ratios is disturbed. This induces him substitute the lower priced good for other items of expenditure.
3. A fall in the price of a good increases the real income of the consumer. He is able to buy more of the good under question, or buy more of other goods. Similarly, an increase in the price of a good reduces his real income. In this case, the income effect leads to a reduction in the demand of the good. This factor also contributes to the downward slope of demand curve.

An Increase / Decrease in Demand versus an Expansion/Contraction in Demand

We have seen earlier that the demand for a given good depends upon several determining factors out of which its own price is one of them. It should be noted that the 'location' of a demand curve (that is its distance from origin) is determined by factors other than its own price, while its slope is determined by its price. In other words, demand for a good changes when (i) a consumer moves from one point to another on the same demand curve, or (ii) when the demand curve itself shifts its position. Let us consider both these cases turn by turn.

Movement Along a Given Demand Curve : A demand curve is drawn on the assumption that all factors determining the demand behaviour of a consumer, other than the price of the good itself, remain the same. When price of the good changes, the consumer moves along the given demand curve and changes the quantity demanded of the good. A reduction in quantity of demand on account of an increase in price is termed 'a contraction' of demand for that good. In this case, the consumer moves upwards along the demand curve. In contrast, if the price of the good falls, the consumer moves downwards along the demand curve and buys more of the good. This is termed an 'expansion' in the demand for the good. This is illustrated graphically in Fig 2.6.. Consider demand curve D_1 . When price of good X falls from PM to P'M', the quantity of good X bought by the consumer increases from OM to OM' and MM' is the 'expansion in demand'. In contrast, the reduction in demand from OM' to OM (= MM') on account of increase in price from P'M' to PM is the 'contraction' in demand.

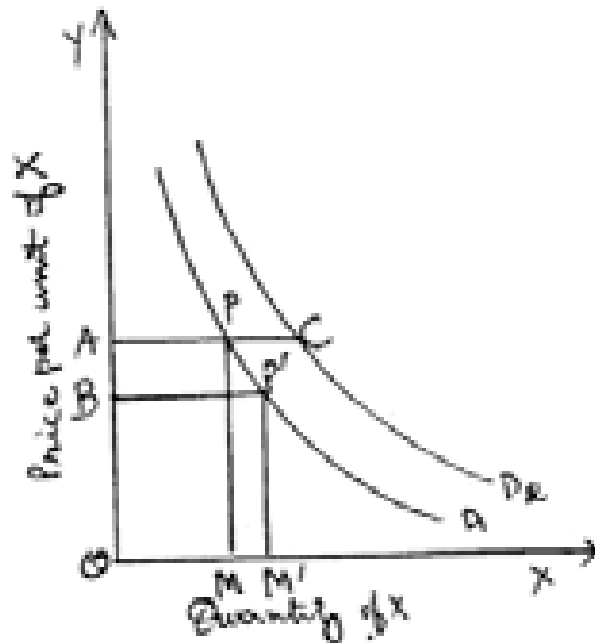


Fig. 2.6 : Expansion/Contraction and Increase/Decrease in Demand

2. Movement from One Demand Curve to the Other: If the quantity demanded changes without a change in price, the consumer shifts from one demand curve to the other. Such a movement is termed 'increase' in demand when the consumer moves to the outer demand curve. And it is termed a 'reduction' in demand when the movement is to the inner demand curve. Thus, in Fig 2.6, we may consider two demand curves D_1 and D_2 . With a given price OA per unit of X , the consumer buys OM if he is on demand curve D_1 and OM' if he is on demand curve D_2 . Thus, a shift from point P on D_1 to point C on D_2 is called an 'increase' in demand and a shift in the reverse direction is termed a 'reduction' in demand.

Exceptions to the Law of Demand

The normal law of demand is widely applicable to a large number of goods. However, there are certain exceptions to it on account of which a change in the price of a good does not lead to a change in its quantity demanded in the opposite direction.

1. *Expected Change in the Price of a Good* : While an actual change in the price of a good leads to a change in its demand in the opposite direction, an expected change in its price changes the demand in the same direction. When the price of a good is expected to increase, consumers increase the demand-quantity so as to avoid paying a higher price later. Similarly, when the price of a good is expected to fall, the consumers postpone their purchases of it.

2. The consumer may not consider a good as 'normal' or 'superior'. We can mention three varieties of such goods.
 - (a) *Inferior Goods* : Some goods are consumed generally by poorer sections of the society. It is believed that with an increase in income such a consumer should move to a 'better' quality substitute good. For example, with an increase in income, a typical poor consumer shifts his demand from coarse grains to finer varieties of cereals. Therefore, with a fall in the price of a good (more so a necessity on which the consumer is spending a large part of his budget), the real income of the consumer goes up. If, he considers the good under consideration an inferior good, he reduces its demand and buys more of its substitute(s). In certain cases, the negative impact of the income effect is so strong that it is able to more than counterbalance even the substitution effect with the result there is a net fall in the demand for the good. Such goods are called Giffen Goods.
 - (b) In some cases, the consumers suffer from the false notion that a higher priced good is of better quality. This happens mainly in the case of those goods where a typical consumer is not able to judge the quality easily. In such cases, the sellers may be able to sell more not by lowering the price but by raising it.
 - (c) *Status Symbol* : Certain goods are meant for adding to one's social prestige. These are for 'conspicuous consumption' that is, for showing that their user is a wealthy or cultured person. The consumers consider it a distinction to have these goods. In other words, a commodity may be purchased not because of its intrinsic value but because it is expected to add to the social prestige of the buyer. Diamonds and other forms of expensive jewellery, expensive carpets and similar items fall in this category. Their demand falls if they are inexpensive.
3. *Demonstration Effect* : Consumers are influenced in their decisions by what is known as a demonstration effect. Demand for certain goods goes up when people want to buy them because their neighbours have them. Due to growing popularity, the demand for such goods goes up even when their prices increase. In a sense, it may be said that these goods violate the normal law of demand because of a change in the tastes and preferences of the consumers.
4. *Complementary Goods* : Law of demand may be violated in the case of complementary goods also. If price of one of these goods falls sufficiently, the consumers would buy more of it. And this will necessitate that the consumers should have more of the other good as well. As a result, its demand goes up without a fall in its price. Actually, in some cases its demand may increase even with some increase in its price.

Determinants of Demand

We have seen that demand for a good X in the market is the quantity of X which the buyers are ready to buy, per period of time, at a specific price. Demand for a

good by a consumer can vary in response to several factors such as its own price, prices of other related goods, income of the consumer, tastes and preferences of the consumer and so on. Symbolically, $D_x = (P_x, P_1, P_2, P_3, Y, T, \dots)$ where P_x is the price per unit of good X, $P_1, P_2, P_3, \dots$ are the per unit prices of the related goods, Y is the income of the consumer, T represents the tastes and preferences of the consumer, etc. Let us briefly discuss some of the leading determinants of demand.

Price of the Commodity: The first determinant of the demand for a good is its own price. The consumer compares the marginal utility expected from a good with its price and decides whether it is worth buying or not. A fall in the price induces the consumer to buy more of the good and an increase in the price causes a fall in demand.

Prices of related goods: Prices of related goods also affect the demand of the good, say X. If the price of a substitute of X increases, the demand for that good falls and the consumer wants to buy more of X instead. In contrast, if the price of the substitute good falls the consumer increases the demand for that good and hence wants to buy less of X. Just the opposite happens when the price of a complementary good changes. An increase in the price of a complementary good causes a reduction in the demand for that good and a resultant reduction in the demand for good X also. In the same way, a fall in the price of a complementary good causes an increase in the demand for X. In other words, (i) the price of a substitute good and the demand for good X are directly related, and (ii) the relationship between the price of a complementary good and demand for good X is an inverse one.

Level of Income: The demand for a good is also affected by the level of the income of the consumer. Normally speaking, with an increase in income the consumer wants to buy more of a good. However, if the good is considered an 'inferior' one, he is expected to reduce its demand when his income increases.

Expected Change in Price : Demand of a good is inversely related to the direction of expected change in its price. A consumer wants to buy a good before its price goes up and wants to postpone its purchase if its price is expected to fall.

Other factors : Other factors which affect the aggregate market demand for a good include the size of population, the marketing and sale campaigns by the suppliers, the "selling expenses" incurred by the sellers, the tastes and preferences of the buyers, and distribution of income and wealth. For example, the richer sections are likely to spend a smaller proportion of their incomes on basic necessities and a larger proportion on luxuries and durable consumer goods.

SUPPLY

Meaning of Supply

The supply of a good or service refers to the quantities of that good or service that producers are prepared to offer for sale at a set of prices over a period of time. According to Watson, Supply always means a schedule—a schedule of possible prices and amounts that would be sold at each price. The supply is not the same concept as the stock of something in existence—if we talk of the stock of commodity X in Delhi, we mean the total quantity of Commodity X in existence at a point of time; whereas, if we talk of the supply of commodity X in Delhi, we mean the number of quantity actually being offered for sale, in the market, over a period of time.

LAW OF SUPPLY

The law of supply states that a firm will produce and offer to sell greater quantity of a product or service as the price of that product or services rises, other things being equal. There is direct relationship between price and quantity supplied. In this statement, change in price is the cause and change in supply is the effect. Thus, the price rise leads to supply rise and not other wise. It may be noted that at higher prices there is greater incentive to the producers or firms to produce and sell more. Other things Include cost of production, change of technology, price of related goods (Substitutes and Complements), prices of inputs, level of competition and size of industry, government policy and non economic factors. Broadly speaking, supply of a commodity is expressed in terms of following function:

$Q_x = f(P_x, C_x, T_x)$ where P_x is the price of commodity, C_x is the cost of production and T_x is the Technology of Production.

Supply schedule and Supply Curve

A supply schedule is a tabular statement that shows different quantity or service that are offered by the firm or producer in the market for sale at different prices at a given time. Basically supply schedule may be for (i) Individual or (ii) Market. Individual supply schedule refers to tabular statement which shows the quantity of a commodity which a producer or firm is ready to sell at different prices at a point of time. We can better understand the individual supply schedule with the help of following illustration:

Table : 2.5
Individual Supply Schedule

<i>Price (Rs)</i>	<i>Quantity (units)</i>
10	1000
20	2000
30	3000
40	4000
50	5000
60	6000

Individual supply schedule relates to the supply of a good or service by one firm at different prices, other things remains constant or equal. The market supply schedule, on the other hand, like market demand schedule is the sum of the amount of good supplied for sale by all the firms or producers in the market at different prices during a given time. Let us assume, there are two producers for a commodity or a good. Market Supply schedule from individual supply schedules producers may be prepared similar to market demand schedule as under:

Table-2.6**Market Supply Schedule**

<i>Price (Rs)</i>	<i>Quantity(units) Supplied by Producer A- (Q_A)</i>	<i>Quantity (units) Supplied by Producer – B- (Q_B)</i>	<i>Market Supply (Q_A+Q_B)=Q (Units)</i>
10	1000	2000	3000
20	2000	3000	5000
30	3000	4000	7000
40	4000	5000	9000
50	5000	6000	11000
60	6000	7000	13000

The individual supply curve is a graphical representation of the information given in individual supply schedule. The higher is the price of the commodity or product, the greater will be the quantity of supply offered by the producer for sale and *vice versa*, *other things remains constant*, the individual supply curve is based on the data given in in table 2.5 .(See Figure 2.7 below).

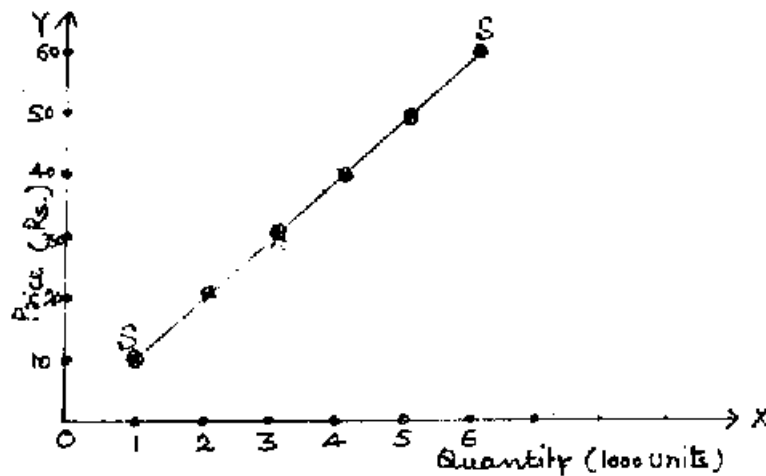


Fig. 2.7 : Supply Curve

The upward slopping supply curve from left to right is graphical representation of law of supply. It is important to realize that the supply schedule and curve represent producer plans, since at any one time in the market only a single price will exist and therefore all other price/quantity are hypothetical. Market Supply curve of a good is the horizontal summation of individual supply curves and can be prepared in similar way.

Reasons for Operation of Law of Supply

Law of supply states that there exist positive relationship between the price of a product and its quantity supplied, *ceteris paribus*. The supply curve slopes upward from left to right. It means that the supply of a product increases with increase in its price and decreases with decrease in its price. But here question emerges that why law of supply behave in this fashion and not otherwise. Some of the reasons or explanations given by the economists in this regard are stated as under:

Producers hire and use resources in order to make profits from the sale of the output produced, at least in the private enterprise sector of a mixed economy. In

economics, it is assumed that a common objective of firms is not only to make profits, but to maximize profits. Hence, since most firms could supply other products apart from the good or service in question, it is unlikely that they would be prepared to supply large amounts of this good or service if the price were very low, because this implies low profits after production costs have been taken into account. Indeed, there must be some price at which no firms would be prepared to supply a product because it is so low that it would not cover the minimum cost at which each unit of that product could be produced.

Conversely, the higher the price that firms can charge to sell a product, given the costs of the factors of production, the more profitable that product becomes and the larger the amount that will be supplied to the market. Hence, we can make the logical assumption that, other things being equal (including the number of firms in the market, the scale of production of each firm and the costs of factors), the higher the price of a good or service, the greater will be the quantity supplied of that good or service to the market, and vice versa.

Factors Influencing the Market Supply of a Good or Service

At any point in time, the total quantity supplied of a good or service in the market is influenced by number of factors. Some of the important factors include the following:

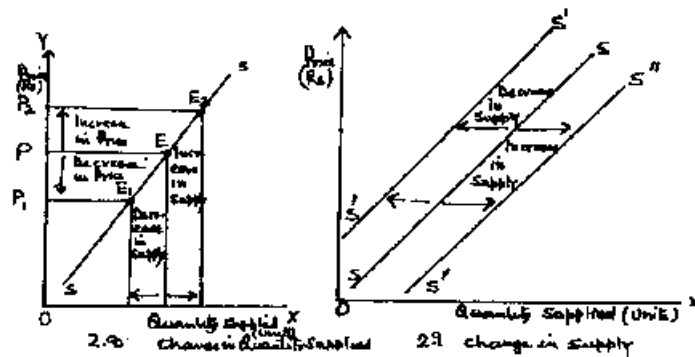
- (a) *The price of the good or service* : Price of a good or service is one of the important factors, which influences its supply. As law of supply states that higher is the price of a commodity, more of a good will be offered for sale in the market by the producer ceteris paribus on account of rise in his profitability and *vice versa*.
- (b) *Costs of the factors of production* : The cost of factor inputs such as land, labor, capital, raw materials etc. is another factor which influences the market supply of a product. If prices of any of these factors change, the production cost will change which in turn causes the changes in the market supply of the product.
- (c) *Changes in Technology* : The change in technology as a result of constant research and developments in terms of improved machinery, improved method of organization and management helps the business units or firms to reduce the cost of production. All this contributes significantly to increase the market supply at given prices.
- (d) *Price of Related goods*: The supply of a good also depends on prices of related goods(Substitute and Complementary) by affecting its relative profitability. For example, a reduction in the prices of related goods as a result of fall in demand for these goods will make the good under reference more profitable to firm. . Thus, resources would tend to move towards this

industry and the quantity supplied for the good at given range of prices would increase.

- (e) *Change in the number of firms in the industry (market)* : A change in number of firm in the industry as a result of profitability also influences the market supply of a good. For example, an increase in number of firms in the industry attracted by higher profit would increase the quantity supplied of good over the range of prices. On the other hand, a reduction in number would reduce the market supply.
- (f) *Government policy towards taxing or subsidizing the production of the good or service* : A change in government fiscal policy in terms of change in tax rate or amount of subsidy may influence the supply of a good in the market. A decrease / increase in the amount of tax on the good or service or an increase / decrease in the government subsidy on a good would allow firms to offer more / less amount of a good at a given range of prices.
- (g) *Goal of a Business firm* : The goal of a business firm such as profit maximization, sales maximization or both is also responsible to influence the market supply of a good or service. In case the firm is interested to maximise profit, the same may be attained by decreasing the market supply of a good under certain conditions whereas as goal of sales maximization will increase the supply.
- (h) *Natural Factors* : Natural Factors such as climatic changes, particularly in the case of agricultural products influence its supply.
- (i) *Changes in Producer or Seller Expectations* : The supply curve like the demand curve is drawn for a certain time period. If the expectations of the future prices change drastically in a market – for example , prices of good and service are expected to rise suddenly, the firm would hold current production from the market in anticipation of higher prices and thus influences supply of the good.

Changes in Quantity Supplied and Shifts In supply Curve

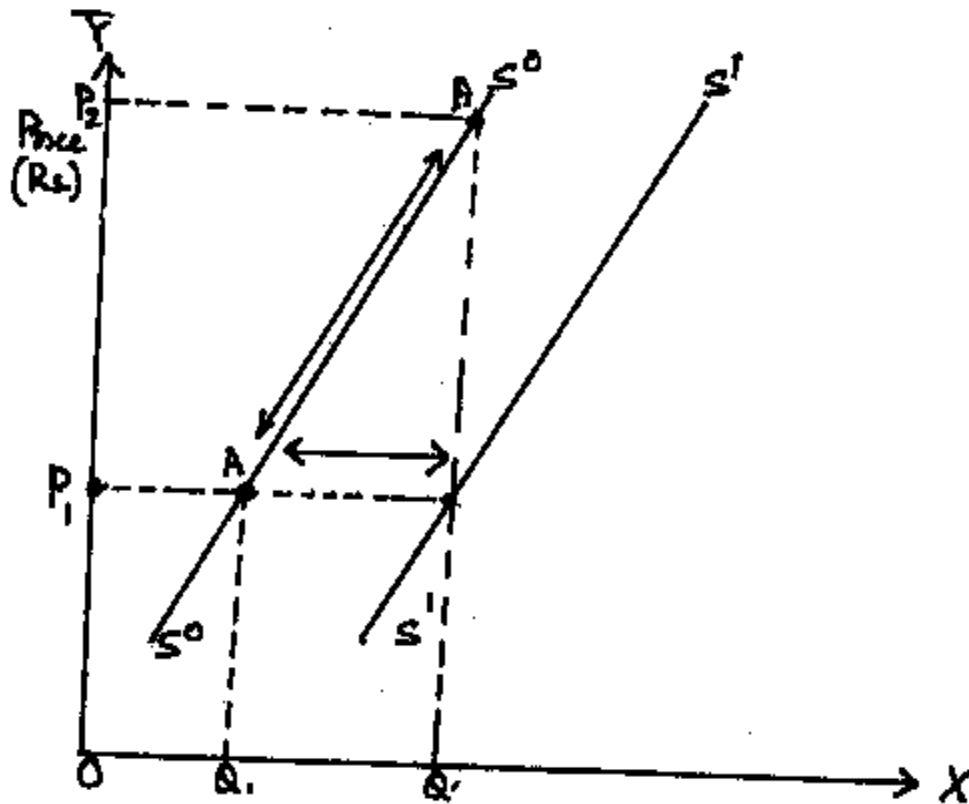
As in case of demand, a change in price will cause a change in quantity supplied indicated by a movement along a given supply curve, and a change in any other factor (such as technology or input costs, etc.) will cause a change in supply, indicated by a shift in the supply curve either right or left. An increase in price will increase the quantity supplied, but a decrease in price will reduce the quantity supplied. The supply curve is positively sloped- upward and to the right, as against the demand curve which is negatively sloped. In a situation when factors other than price of the good change, the whole supply curve shift either to left or right. The following figures 2.8 and 2.9 helps to understand the above situations.



The distinction between “changes in supply” and “changes in quantity supplied”

An increase or decrease in supply means a change brought about as a result of changes in the conditions of supply. These changes result in a different level of supply at any price; they are not caused by changes in the price itself. The price is separate from the conditions of supply.

If the price changes, this will be the result of a change in demand. We then say that there has been a change in the quantity supplied as a result of a change in price. This will result in a movement along the supply curve since the existing supply curve already shows how the quantity supplied changes as a result of a change in price. The distinction between changes in price and changes in the conditions of supply can be illustrated with the following Figure 2.10



Quantity supplied of X per period

Fig. 2.10. Change in price/change in conditions of supply

S^0 = Original supply curve

S^1 = New supply curve

P_1 = Original price

P_2 = New price

Q^1 = Original quantity supplied

Q^2 = New quantity supplied

There are two kinds of change, which can result in the quantity supplied changing from Q_1 to Q_2 . If the price of good is increased by the suppliers from P_1 to P_2 , then there will be a movement up in the supply curve from point A to point B—this is termed an extension of supply (a movement down a supply curve is termed a contraction of supply where the quantity supplied is reduced) but not an increase in supply since supply at the old price, P_1 , is still the same.

If the supply at P_1 increases, then Q_2 will be supplied instead of Q_1 at the same price P_1 —this is correctly termed an increase in supply. This is shown by moving the supply curve from S^0 to S^1 and the movement from A to C in Figure 2.10

SUPPLY, DEMAND AND DETERMINATION OF EQUILIBRIUM PRICE

Price and Value

Price as used in economics does not have the same meaning as “value”. The value which an individual places on a good or commodity cannot be estimated—it will be different for different people. Price represents “value in exchange”—the value of one good in terms of what it can be exchanged for. If the price of a dining table is Rs.1000 and the price of dining chair is Rs.250, this tells us the exchange value is one dining table for four dining chairs. Prices are normally expressed in terms of money, and determined by the interaction of demand and supply in markets for goods and services.

Determination of the Market Price

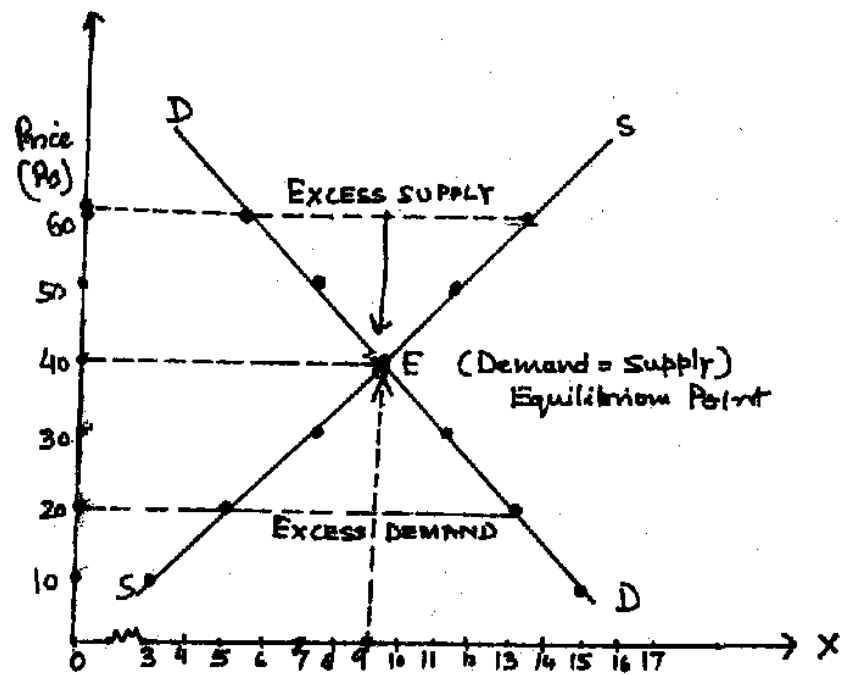
Up to now we have considered separately the “plans” of consumers as to how much they would buy if the price was so much and the “plans” of producers as to how much they would offer for sale if the price was so much. The demand curve and the supply curve really show what consumers and producers would do if they were given the opportunity. Although the demand would be very high, in practice consumers may never get the opportunity to buy the product at that low price because suppliers are not willing to supply at that price. Similarly, although suppliers may be prepared to offer a large amount for sale at a high price, they may not be able to sell it all because there is not sufficient demand at such a high price. Although the demand for a product and the supply of a product are separate plans of different members of the market, it is necessary to bring the two sides together to establish a price in the market in which the plans of both the consumers and the producers can be satisfied simultaneously. This can be better understood with the help of following illustration. (See Table 2.7). Let us take demand and supply and supply schedule for good X and analyse for equilibrium position.

Table 2.7

Demand and Supply Schedule for Commodity or Good X

<i>Price Per unit of Commodity or Good X (Rs)</i>	<i>Quantity Demanded for Commodity X in the market</i>	<i>Quantity Supplied for the Commodity or Good X in the Market</i>	<i>Remarks</i>
10	15000	3000	Excess demand
20	13000	5000	Excess demand

30	11000	7000	Excess demand
40	9000	9000	Demand= Supply (Equilibrium Point)
50	7000	11000	Excess supply
60	5000	13000	Excess supply



Quantity demanded and supplied of X per week in thousands

Fig. 2.11 : Demand and supply curves.

Let us consider what would happen in the market at three different prices : say Rs. 60, Rs. 40 and Rs.10.per unit of time.

At a price of Rs 60 per unit, the producers or firms are ready to supply 13,000 units of good X per unit of time for sale whereas the consumers are willing and able to buy 5000 units of X per unit of time. At this price, the plans of consumers and of producers are incompatible. There would be a excess supply of 8000 units on the market and thus the price of Rs 60 per unit would have to be changed. Since the suppliers are many and in competition with each other, its likely that some, faced with unsold stock, will lower their price in order to expand demand, and, at the same time, will contract supply.

At a price of Rs. 40 per unit, the consumers are willing to purchase the same quantity of good X what the producers or firm are willing to offer for sale i.e. 9000 units. At this price, the plans of consumers and of producers are compatible. There is no need for this price to be changed. This price is called the equilibrium price—a stable price that can be charged in the market.

At a price of Rs. 10 per unit, the consumers would be willing and able to buy 15000 units per unit of time, but since only 3,000 units are being offered for sale, there will be a shortage or excess demand at this price. Therefore, the plans of consumers and producers are incompatible at this price. Since there are many consumers in competition with each other and some cannot get all that they demand, this will tend to push the price up as suppliers realize that they can charge a higher price because of the excess demand.

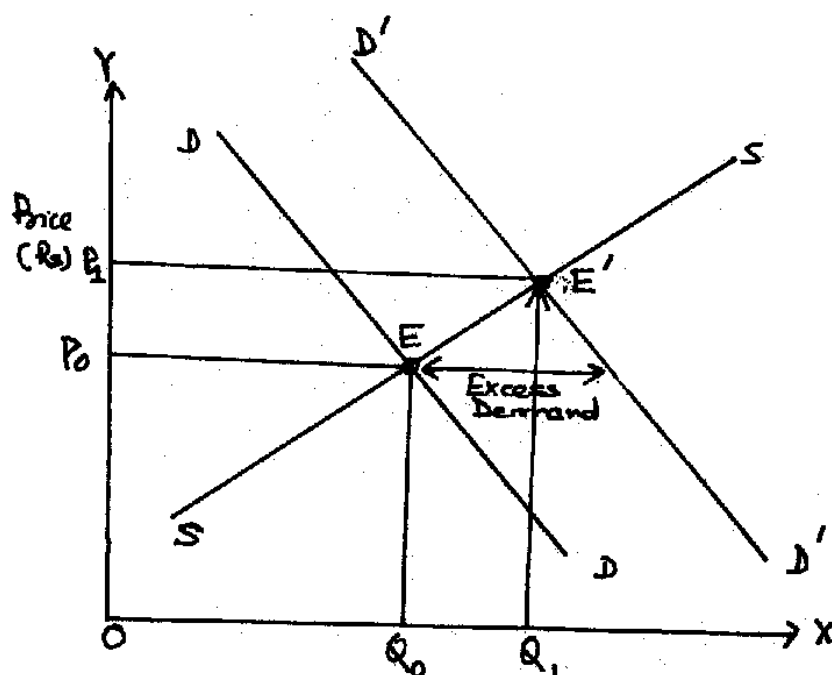
In general, it can be observed that at any price above the equilibrium price (where supply equals demand) there will be excess supply and the forces of supply and demand will cause that price to fall to the equilibrium price; and at any price below the equilibrium price, there will be excess and the forces of supply and demand will cause that price to rise to the equilibrium price. This is summarized in Table 2.7 and Figure-2.11.

The effect of changes in the conditions of demand and supply on market price

The market price, or equilibrium price, is determined by the interaction of demand and supply at a given time with given conditions of demand and supply. Remember that the demand curve and the supply curve for a commodity are both drawn up on the assumption that the conditions of demand supply (i.e., all other factors which might affect the demand for or supply of the commodity) remain constant. The equilibrium price will remain as a stable price in the market as long as the conditions of demand and/or supply do not change. If any of these conditions change, this will create excess demand or excess supply at the original equilibrium price and so this equilibrium price will itself change.

For example, a condition of demand is the level of consumer income. If the level of income increases, there will be an increase in demand for a commodity X at the existing market price. Hence, if the price remains the same, supply will be the same as before, and with increased demand there will be a shortage, causing pressure on the existing price, which suppliers will then raise. On other hand, if consumer's level of income decreases, other things remain constant, with decreased demand there will be shortage of demand, causing existing price to fall.

This effect can be represented diagrammatically as in Figure 2.12 making use of the technique of shifting the position of the demand curve to represent a change in conditions of demand.

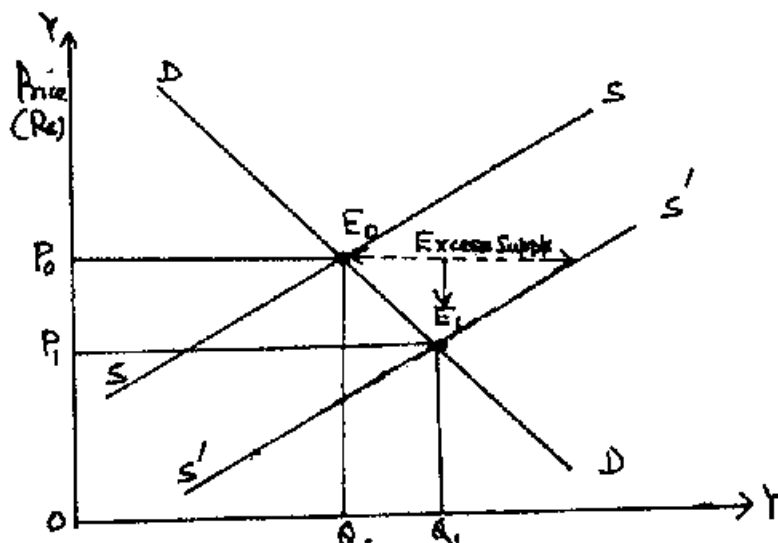


Quantity demanded and supplied of X per period in units.

Fig. 2.12 : Changes in the conditions of demand and supply on market price.

In Figure 2.12 , the demand curves DD and DD' show the effect of an increase in demand as a result of a favourable change in conditions of demand (such as an increase in consumers' income levels) -- DD being the new demand curve. Before the increase in demand, the equilibrium price was P_0 and the equilibrium output was Q_0 . As a result of the increase in demand, excess demand occurs at the price P_0 , causing suppliers to expand output and raise the market price. A new equilibrium is established at P_1 and a new higher equilibrium output at Q_1 . *Notice that a change in conditions of demand does not cause a movement of the supply curve—this could only result from changes in conditions of supply.* The expansion of supply is correctly shown by a movement up the existing supply curve. Similarly, the demand curve DD' shows the effect of decrease in demand as result of fall in consumers level of income. (Not shown in diagram)

We now consider the effect of a change in conditions of supply on the market price.



Quantity demanded and supplied of X per period in units.

Figure 2.13. Change in condition of supply on market price

In Figure 2.13, the supply curves SS and $S'S'$ show the effect of an increase in supply as a result of a favourable change in the conditions of supply (such as a reduction in the costs of production because of productivity increases)— $S'S'$ being the new supply curve. Before the increase in supply, the equilibrium price was P_1 and the equilibrium output was Q_0 . As a result of the increase in supply, excess supply occurs at the price P_0 , causing suppliers to lower the price in order to expand demand. A new the equilibrium price is established at P_1 with a higher the equilibrium output at Q_1 . Notice again that a change in conditions of supply does not cause a shift in the demand curve. The expansion of demand as a result of the lower the equilibrium price is correctly shown by a movement along the existing demand curve. Similarly, the supply curve $S''S''$ shows the effect of decrease in supply as result of rise in cost of production in consumers level of income.

It is useful to summarise the effects of changes in the conditions of demand and of supply on the equilibrium price and output, assuming that we are operating in a free market. This is done under the heading of the “laws of supply and demand”. (Not shown in diagram)

THE LAWS OF SUPPLY AND DEMAND IN A FREE MARKET

In economics a law is a statement of general tendency—a prediction of what is likely to happen in so many cases that it can be generalised into a law. The laws of demand and supply state that :

- (a) Excess demand for a commodity will cause a rise in its price.
- (b) Excess supply of a commodity will cause a fall in its price.
- (c) Price will settle at one point where the quantity demanded equals the quantity supplied—the equilibrium price.
- (d) An increase in demand (a movement of the demand curve to the right) will cause a rise in price and a rise in the quantity bought and sold.
- (e) A decrease in demand (a movement of the demand curve to the left) will cause a fall in price and a fall in the quantity bought and sold.
- (f) An increase in supply (a movement of the supply curve to the right) will cause a fall in price and a rise in the quantity bought and sold.
- (g) A decrease in supply (a movement of the supply curve to the left) will cause a rise in price and a fall in the quantity bought and sold.

ELASTICITY OF DEMAND

Elasticity of demand forms part of demand analysis and is useful in cases where demand curve analysis fails to provide reliable results. For example, demand curve provides a measure of responsiveness to price change in absolute terms but fails to compare the responsiveness of different commodities which might be measured in different units say labour in hour, land in acres, beer in quart, etc.

In economics, elasticity refers to the ratio of the relative change in a dependent variable to the relative change in an independent variable i.e. elasticity is the relative change in the dependent variable divided by the relative change in the independent variable. Elasticity of demand may be of various types i.e. price, income and cross elasticity of demand.

Price Elasticity of Demand

The price elasticity of demand is the responsiveness of the quantity demanded of a good to changes in the good's price, other things held equal. That is, the change in quantity demanded due to a change in price is known as price elasticity of demand. The formula for calculating price elasticity is :

There are five different possible relationships between a change in price and corresponding change in quantity demanded of a commodity.

- (i) *Unity Elasticity* : The change in demand is exactly equal to change in price say, by 5% in both cases :

$$\epsilon = \frac{\text{Relative change in quantity}}{\text{Relative change in price}} = 5\%/5\% = 1$$

- (ii) *High Elasticity (More than unity)* : The change in demand is more than change in price say by 5% and 2.5% respectively.

$$\epsilon = \frac{5\%}{2.5\%} = 2$$

- (iii) *Perfectly elastic* : It refers to situation where slight change in price of a commodity causes an infinite change in the quantity demanded of a commodity. The demand in such case is hyper sensitive and elasticity of demand is infinite. Then :

$$\epsilon = \frac{5\%}{0\%} = (\text{infinity})$$

- (iv) *Low Elasticity (less than unity)* : The change in demand is less than change in price, say 2.5% and 5% respectively. Then :

$$\epsilon = \frac{2.5\%}{5\%} = \frac{1}{2} = 0.5$$

- (v) *Zero Elasticity* : There is no change in demand and only price changes. Suppose price changes by 5%

$$\epsilon = \frac{0\%}{5\%} = 0$$

Different types of price elasticity discussed above can be shown in a diagram also (See Fig. 2.14).

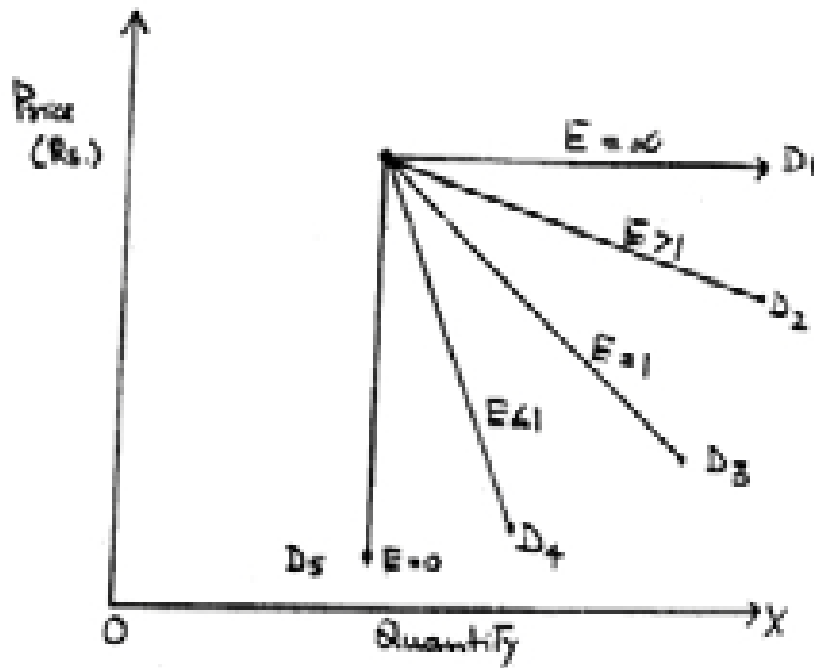


Fig. 2.14 : Types of Price Elasticity

Methods of Measuring Price Elasticity

Some of the important methods to measure price elasticity of demand include the following:

Total Expenditure Method : The underlying reasoning of this measure is that when price of a good X increases, its demand falls and vice versa. Demand, therefore, neutralises the change in expenditure on the X - partially, fully, or more than fully. Elasticity of demand for X (E_d) is a measure which reveals the extent to which a change in D^x is able to counterbalance the change in total outlay on X caused by a change in price of X (P^x).

If D_x in response to a change in price of X (P^x) is such that it exactly compensates the latter's impact on total expenditure on X, then the elasticity of demand is said to be one (or unity). In this case, the total expenditure remains unchanged after the change in P^x .

However, if response of D_x is comparatively weak, it will not be able to counterbalance the effect of price change on total expenditure. The elasticity of demand (E_d) will be less than unity. In this case total expenditure on the commodity falls with a fall in the price of X.

If the response of demand is comparatively stronger, it will more than counterbalance the effect of price change on total expenditure. The elasticity of demand is more than unity. In this case total expenditure increases with a fall in the price of X.

We may summarise the results as follows :

<i>Price</i>	<i>Total Expenditure</i>	<i>Elasticity of Demand</i>
Increases	Increases	Less than 1
Increases	Remains Same	Equal to 1
Increases	Falls	More than 1
Falls	Falls	Less than 1
Falls	Remains Same	Equals 1
Falls	Increases	More than 1

Total Expenditure or Total Outlay method has certain drawbacks. It is not able to give us an exact numerical measure of elasticity of demand. It only tells us whether elasticity is equal to, less than, or more than one. Therefore, this method fails to compare demand elasticities of different goods. Moreover, it is not possible to use this method in measuring demand elasticity when demand changes in the same direction as the price, as in the case of giffen goods.

Arc Elasticity of Demand : From a practical point of view, this method is highly useful in measuring the elasticity of demand. We take the initial and changed values of price and the corresponding initial and resultant quantities of demand and use them to estimate the elasticity of demand by the following formula :

$$E_d = \left[\frac{\Delta D}{\{(D_1 + D_2)/2\}} \right] / \left[\frac{\Delta P}{\{(P_1 + P_2)/2\}} \right]$$

$$= \left[\frac{\Delta D(D_1 + D_2)/2}{\Delta P(P_1 + P_2)} \right]$$

$$= [\Delta D / \Delta P] / [(P_1 + P_2) / (D_1 + D_2)]$$

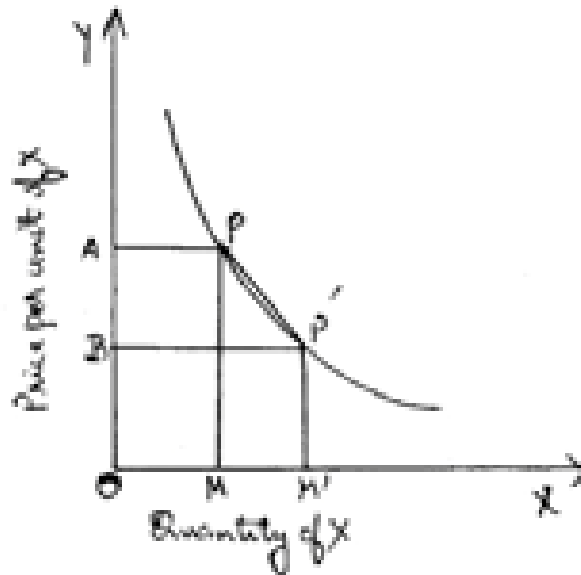


Fig. 2.15 : Measuring Arc Elasticity of Demand

It should be noted that arc elasticity is an average of all the elasticities associated with the range of prices between PM and P'M'.

Proportionate Method : According to this method, elasticity of demand is measured as a ratio of the proportionate change in demand to the proportionate change in price. If the proportionate change in demand equals that in price, elasticity of demand is to be taken as equal to one. In other words,

$$\text{Price Elasticity of Demand } E_d = (\Delta D/D) / (\Delta P/P) = (\Delta D/\Delta P) / (P/D)$$

where ΔD is the change in demand and ΔP is the change in price, while original demand and price are D and P respectively. Thus, the elasticity of demand is the product of two components, namely the

(change in demand/ change in price) and (original price / original demand).

If we reduce the change in price to an infinitesimally small amount, then this measure is reduced to $1 / (P/D)$.

It should be noted that elasticity of demand has a negative sign because changes in demand and price have opposite signs, though conventionally, the sign is ignored in writing its value.

Point Elasticity of Demand

A diagrammatic method of measuring elasticity of demand (see Fig. 2.16) enables us to measure it by referring to a single point on the demand curve and is

therefore is termed 'point method' of measuring elasticity. Referring to Fig. 2.16, let us assume that the initial price PM falls to $P'M'$ (that is price reduction = PC). The corresponding demand for good X increases from OM to OM' (an increase of MM'). Using the proportionate method of measuring elasticity of demand, we get,

$$\begin{aligned} Ed &= (MM'/OM) / (PC/PM) \\ &= (MM'/PC) / (PM/OM) \\ &= (CP'/PC) / (PM/OM) \quad (\text{since } MM' = CP') \end{aligned}$$

Now, Triangles PCP' and PMB are similar to each other. Therefore, $CP'/PC = BM/PM$.

Substituting CP'/PC with BM/PM we get

$$\begin{aligned} Ed &= (BM/PM) / (PM/OM) \\ &= BM/OM = BP/PA \end{aligned}$$

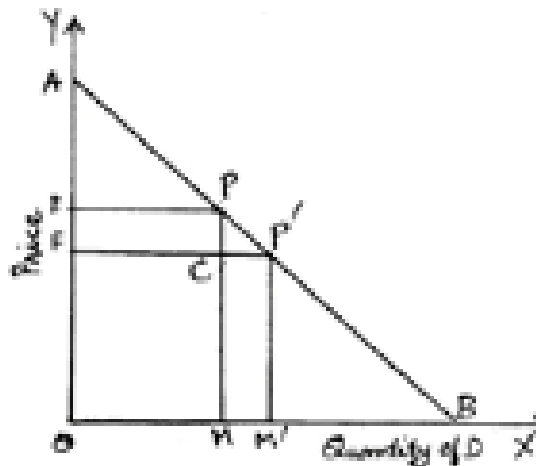


Fig. 2.16 : Point Elasticity of Demand Straight Line Demand Curve

In other words, if the demand curve is a straight line and meets (or is extended to meet) X-axis and Y-axis at points B and A respectively, then elasticity of demand at point P on the demand curve is given by the ratio

$$\frac{\text{segment of demand curve from point P to X-axis}}{\text{segment of demand curve from point P to Y-axis}}$$

It should also be noted that if we consider the foot (M) of the perpendicular drawn upon X-axis from P on the demand curve, the elasticity of demand is also equal to the ratio

$$\frac{(\text{the distance of M from the point where demand curve touches X-axis})}{(\text{the distance of M from the origin O})}$$

that is BM/OM .

When demand curve is curvilinear instead of a straight line, and we want to measure elasticity of demand at a point P on it, we should draw a tangent to it at point P, consider as if the tangent is the demand curve, and use the same approach

as before in measuring elasticity of demand. Thus, in Fig. 2.17, elasticity of demand at point P equals $PB/AP = BM/OM$, while at point P' it is $P'B'/A'P' = B'M'/OM'$.

It is important to note that whether demand curve is a straight line or is curvilinear, in both cases elasticity of demand varies from point to point along the demand curve. This is explained as follows.

We have seen that elasticity of demand is the product of two terms, namely, (i) the slope of demand curve at point P, $(\Delta D/\Delta P)$ and (ii) the ratio of original price to original demand, (P/D) . In the case of a straight line demand curve the first term, namely, $(\Delta D/\Delta P)$ remains unchanged, but the second term (P/D) varies as we move along the demand curve. In contrast, in the case of curvilinear demand curve, both $(\Delta D/\Delta P)$ and (P/D) change as we move along the demand curve.

Keeping in view the above facts, we note that elasticity of demand falls as we move from left to right along the demand curve. In the case of a straight line (Fig. 2.16), elasticity of demand is given by PB/PA . If we want to measure E_d at point A, the denominator is reduced to zero and elasticity tends to infinity. At the other extreme, at point B, the numerator is reduced to zero and E_d becomes zero. If point P happens to be in the middle of AB, elasticity is exactly equal to one. Thus E_d varies from zero to infinity as we move from point B to point A. We reach same conclusions if we consider E_d as $(\Delta D/\Delta P) \times (P/D)$. While $(\Delta D/\Delta P)$ does not change as we move along a straight-line demand curve, P/D decreases when we come closer to point B and it increases when we move towards point A.

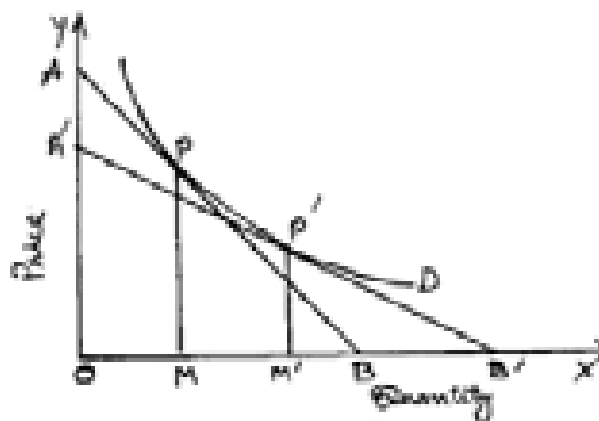


Fig. 2.17 : Elasticity of Demand Curvilinear Demand Curve

Similar conclusions are reached in the case of a curvilinear demand curve also (Fig. 2.17). As we move along the demand curve from left to right, the slope of tangent falls, that is $(\Delta D/\Delta P)$ decreases. At the same time, in the ratio P/D , the numerator falls and denominator increases.

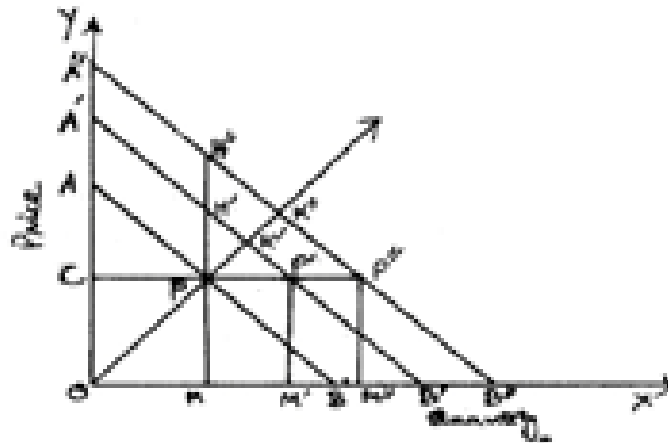


**Fig. 2.18 : Elasticity of Demand at same Price/Same Quantity of Demand
Straight Line Parallel Demand Curves**

Now let us consider some cases of straight line demand curves and E_d .

In Fig. 2.18, we have three straight line demand curves which are parallel to each other. In this case, for any given price, say, OC, E_d falls as we move to a demand curve which is located farther from the origin, that is, as we move from P to P' and P''. This is seen by noting that while $(\Delta D/\Delta P)$ is the same in case of every demand curve, the ratio P/D keeps falling with our rightward movement. Similarly, if we take a given quantity of demand, say OM, the ratio P/D , and therefore E_d , increases as we move from a lower to a higher demand curve (that is, from P to H' and H''). Further, let us remember that the ratio P/D does not change if we move along a ray originating from point O. Since points P, K' and K'' of the successive demand curves lie on the same ray originating from O, E_d does not change at all.

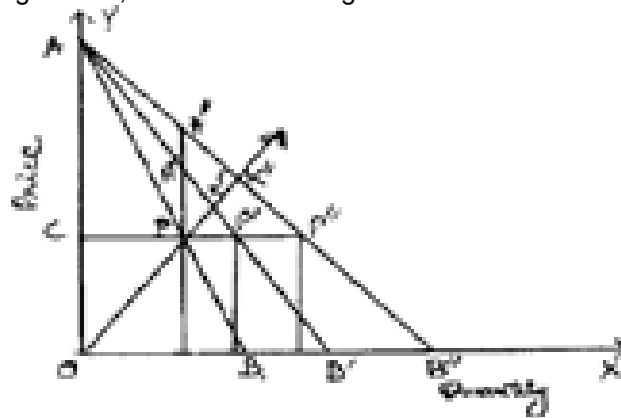


**Fig. 2.19 : Elasticity of Demand at a Given Price or Given Demand Demand
Curves with Different Slopes, but Straight Lines starting from a Common point**

In Fig. 2.19, we have three straight line demand curves. They all start from the same point A on the Y-axis, but have unequal slopes. It is seen that, in this case, if we draw a line parallel to X-axis intersecting the three demand curves at points P, P'

and P'' respectively, Ed is the same at all these points. This is because in a triangle a line parallel to one of its sides divides the remaining two in the same proportion. Note that Ed at point P is less than it is at point H'. It follows that, for a given quantity of demand, Ed increases as we move to demand curve with a smaller slope. By applying similar reasoning, we can also conclude that Ed increases as we shift from point P to K' and from there to point K''.

DETERMINANTS OF PRICE ELASTICITY OF DEMAND

As in most cases, price elasticity of demand is dependent upon a number of factors, of which the most important ones are the following.

Substitutes : Generally speaking, a consumer can choose between several goods for satisfying a given want. Therefore, the demand for a good is affected not only by its own price but also by the prices of its substitutes. If a good has close substitutes, the consumer finds it easier to switch from it to its substitutes and vice versa and its demand tends to be more elastic. It also follows that price elasticity of a good increases if it has a larger number of substitutes.

Number of Uses : If an item has a large number of uses, the consumer finds it easier to adjust its consumption. In case of need, he can re-allocate the good over alternative uses and alter the quantity demanded. Therefore, such goods have higher price elasticity of demand. For instance milk which can be used for direct consumption, for curd, for sweets, for ice-cream etc.

Share in Consumer's Budget : On account of a price rise of a good, a consumer feels more concerned if he is spending a large proportion of his budget on it. The extent of change in demand by the consumer is not significant in the case of those goods which are low priced, or on which the consumer spends a very small proportion of his monthly budget. In the former case elasticity of demand is higher, while in the latter cases, it is low.

Cross Price Elasticity of Demand

The change in the demand of one good (X) in response to a change in the price of another good (Y) is called 'cross elasticity of demand'. Its measure is

(Proportionate Change in Demand for X)/(Proportionate Change in Price of Y)

Symbolically, $(\Delta Dx / \Delta Py) \times (Py / Dx)$

In this context following points should be noted specifically.

- Cross elasticity of demand relates the responsiveness of demand for one good to the price of another good. Therefore, if there are n goods in the market, each of them has (n-1) cross elasticities of demand.
- The value of a cross price elasticity of demand varies from case to case. More specifically, if two goods are totally unrelated, then the cross elasticity would be zero. If the two goods are substitutes of each other, then their cross elasticity will have a positive sign and the value of elasticity will depend upon the degree of substitution between them. It will be higher for closer substitutes and smaller for weaker ones. In contrast, the sign of cross elasticity in the case of complementary goods will be negative and its value

will depend upon the degree of complementarity between the two goods.

Income Elasticity of Demand

Income elasticity of demand for a good (X) refers to the responsiveness of demand for X to a change in the income of the consumer. It is measured by the ratio

$$\frac{(\text{Proportionate Change in Demand for X})}{(\text{Proportionate Change in Income of the Consumer})}$$

Symbolically, it is $= (\Delta D / \Delta Y) / (Y / D)$, where Y denotes income of the consumer. It is noteworthy that sign of income elasticity of demand is associated with the nature of the good in question. If the good is a 'normal' one, the sign of income elasticity is positive. And if the good is an 'inferior' one, the sign of the elasticity is negative.

Determinants of Elasticity of Demand

The leading determinants of elasticity of demand of a good may be mentioned below. It should be noted that they are more or less the same as determinants of the demand itself.

Nature of the Good : A consumer tries to satisfy his wants by starting with the most intensive ones. Accordingly, those goods which are in the nature of necessities have low elasticity of demand, followed by that of comforts and luxuries.

Substitutes : A good which has close substitutes tends to have an elastic demand compared with the one which cannot be substituted. It should be noted that while some goods, considered as a whole (such as cooking oils) may have inelastic demand, a particular good within this category may have a highly elastic demand. For example, consumers may not like to pay extra for a particular brand of mustard oil when its substitutes are available at a lower price.

Multiple Uses : The consumer finds it easier to adjust the quantity demanded of a good when it is to be used for satisfying several wants than if it is confined to a single use. For this reason, a multiple-use good tends to have more elastic demand.

Postponing Consumption : If the consumer finds that it is possible for him to postpone the consumption of a good without undue difficulty, then he postpones his purchase of a good if its price goes up and is expected to fall again. In this case, therefore, the good has an elastic demand.

Share in the Consumer's Budget : Elasticity of demand for a good is also dependent upon the proportion of a consumer's budget spent on it. The consumer does not feel the pinch of price rise if he spends a very small part of his budget on it. He is ready to pay more for it than go without it. As a result, the good has a less elastic demand. Just the opposite is the case when the portion of a consumer's budget spent on it is high.

Time Factor : Normally speaking, a typical consumer finds it difficult to adjust his consumption of a good in the short run. He needs time to adjust to the changed situation. Therefore, demand elasticity of a good tends to increase in the long run.

Price Range : It is generally believed that a good whose price fluctuates over a very wide or a very narrow range, has an inelastic demand.

Income Level of Consumers : The pinch of a price rise is felt less by higher income consumers. They are also less induced to buy more of a good when its price falls. As a result, the demand of a good tends to become less elastic as we move from lower to higher income consumers.

Uses of Elasticity of Demand

Elasticity of demand (and for that purpose, even elasticity of supply) plays an indispensable role in economic decisions of the community. This is because whether an economic decision is beneficial or not to the decision-maker unit depends, to a large extent, upon the elasticity of demand of the good concerned. As a result, all economic decisions (by the government, business firms, investors, and consumers, etc.) take into account the elasticity of demand of the relevant good. This fact is elaborated below with the help of some leading areas in which elasticity of demand is used.

The Government : The concept of elasticity demand is of great use to the government in formulating its revenue-collecting and welfare policies. The government needs resources for financing its own activities and for providing several goods and services which are collectively needed by the society. It raises most of its finance through taxation and supplements it, where the need be, by borrowings. However, while levying and collecting taxes, the government has to keep in mind the response of the market. For example, basic necessities of life have a very low elasticity of demand and the government, by taxing them, can collect a large amount of tax revenue without reducing their demand by the consumers. However, while taxing such goods, it has also to think of the fact that this may lead to an undue burden upon the consumers. They may reduce their consumption of some other (non-taxed or taxed at lower rates) goods which happen to be health-giving and nutritious, such as milk, cereals and vegetables. However, if the good in question is considered a harmful one and has an elastic demand, then the government can deliberately levy a huge tax on it with the objective of reducing its consumption.

Business Sector : It may be assumed that a business firm pursues the objective of profit maximisation. Its profit is the excess of its revenue receipts over its total cost. The former, in turn, is determined by the product of per unit price of the good (P^x) and the quantity of its demand (D^x). When a firm changes P^x , its total revenue changes both on account of the change in P^x and the resultant change in D^x . Therefore, a firm finds that while determining the price of its product, it should take into account its elasticity of demand as well. This point may be further elaborated by noting that elasticity of demand itself differs from one market structure to another. Thus in perfect competition, the firm is a price taker. Its product has perfect elasticity of demand, and it cannot increase its price.

Business firms also realize that they can charge higher prices with a limited reduction in demand only in the short run. If faced with persistent high price, the consumers shift their demand to lower priced substitutes in the long run.

Input Prices : Distribution of national income between individual members and households of the society is an important matter for the economists and social thinkers. It is commonly believed that it has an important role to play in the total welfare of the society. In a modern economy, the income of a household is determined by two factors, namely (i) the productive resources supplied by it to the

market, and (ii) the rates at which they are paid for. And the latter, in turn, depends, to a large extent, upon the respective elasticities of demand for the productive resources.

Rate of Exchange and Balance of Payments : Elasticity of Demand also plays a central role in determining a country's rate of exchange and its balance of payments. Rate of exchange is determined by the demand for and supply of domestic currency in the international markets. And these factors are intimately connected with the exports and imports of the country in which elasticities play a central role. If a country's export goods have a high elasticity of demand in international markets, it finds it easier to increase its exports by reducing their prices. In this case, it can improve its balance of trade without unduly weakening its rate of exchange. But it will be risky for it to raise the export prices if its exports have a low elasticity of demand in the international markets.

ELASTICITY OF SUPPLY

Definition

The price elasticity of supply may be defined as the degree of responsiveness of quantity supplied of a commodity to a change in its price :

$$\epsilon_s = \frac{\% \text{ change in quantity supplied}}{\% \text{ change in price}}$$

Elasticity of Supply : Values, Descriptions and Diagrams

Normally, the elasticity of supply will be positive (i.e., the supply curve is upward sloping). However, it may vary between zero and infinity :

<i>Numerical value of ϵ_s</i>	<i>Economic term</i>
$\epsilon_s = 0$	Perfectly inelastic
$0 < \epsilon_s < 1$	Inelastic
$\epsilon_s = 1$	Unitary elasticity
$1 < \epsilon_s < \infty$	Elastic
$\epsilon_s = \infty$	Perfectly (or infinitely) elastic

The graphical representation of the supply curves of various elasticities would be as under : (See Figure 2.20).

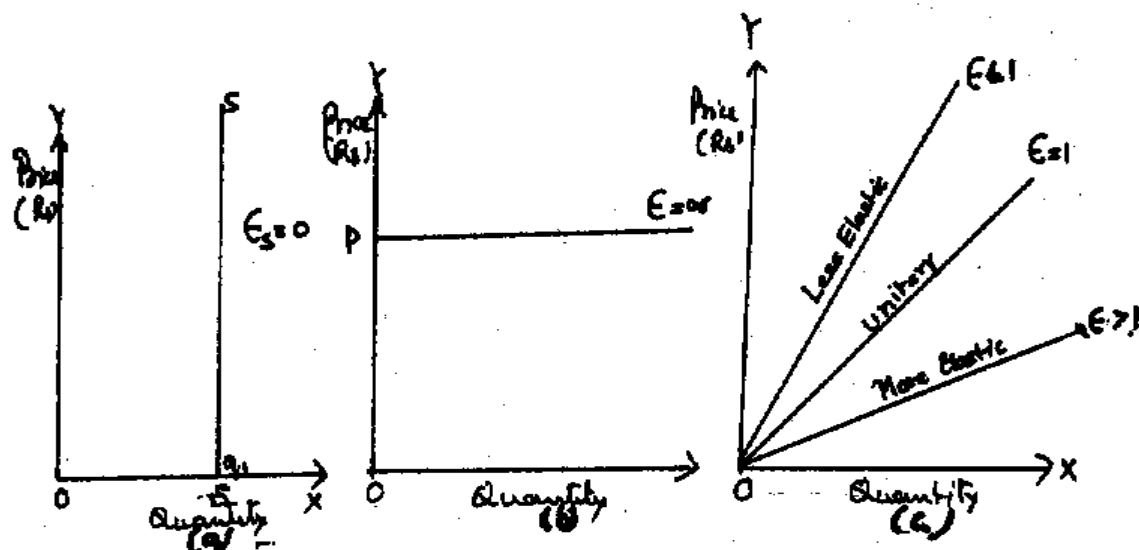


Fig. 2.20 : Supply curves for various elasticities

When E_s is zero (diagram (a)) a given amount of a commodity will be offered for sale (q_1) regardless of the market price, e.g. suppliers might dump a quantity of goods on the market for whatever price it will bring. In diagram (b) the supply is infinitely elastic at price p . Therefore, nothing will be supplied at prices below p , whereas as soon as price is at p an infinitely large amount will be supplied.

Note carefully that any straight line supply curve from the origin will be of unitary elasticity throughout its entire length regardless of its slope [diagram (c)]. Elasticity of supply will be less than elastic to its left and more elastic to its right.

Determinants of Elasticity of Supply

Elasticity of supply measures the ability of firms to change their output in reaction to price changes. The following factors are important in influencing their ability.

- The length of the time period* : In the short run it may be very difficult to expand output in relation to a price rise, whereas in the long run, more inputs are variable and, therefore, output will be more easily expanded.
- Resource constraints*: If the firm unused resources are available, it will be relatively easy for it to increase output. However, then the ease with which the firm is able to increase output will depend upon how readily extra resources may be purchased. For example, with full employment in the economy, supply will be relatively inelastic if the firm does not have "idle" workers of the required skills.
- Levels of stock*: An increase in supply may be met from stock if stock levels are sufficiently high. Stock also gives the firm time in which to expand output (point (a)). Thus, the higher is the level of stock the greater will be the elasticity of supply.

- (d) *Cost relationships:* If costs rise rapidly as output is increased, then any increase in profitability caused by a rise in the price of the good will be consumed by increased costs as supply increases. If this is so, supply will be relatively inelastic. On the other hand, if costs rise slowly as output increases, supply is likely to be relatively elastic.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.

Answers to these questions are not to be submitted for evaluation)

1. Define the concept of utility and distinguish between the concepts of total utility, average utility and marginal utility. Explain these concepts with the help of a numerical illustration and diagrams.
2. What is the relationship between marginal utility of a good and demand for it ? How do you derive an individual consumer's demand curve for a good with the help of the concept of marginal utility ?
3. What do you understand by demand for a good?
4. State and explain the law of demand. What is the reason for the negative slope of a demand curve ?
5. Is the law of demand universally valid ? If not, what are its exceptions? Why do these exceptions occur ?
6. State and explain the law of equi-marginal utility. What are practical limitations of this law ?
7. What are the determinants of demand for a good ? Discuss any three of them?
8. Explain the determination of consumer's equilibrium with the help of utility analysis
9. Discuss the law of supply. Explain any three of its determinants.
10. Explain with the help of diagram change in quantity supplied and shift in supply of a product.
11. Explain market equilibrium for a commodity in the market. What happens if demand for a product if supply remains the same.
12. Define price elasticity of demand for a good. Discuss alternative methods of measuring it.
13. Distinguish between price, income and cross elasticities of demand.
14. Differentiate between total expenditure and proportionate methods of measuring elasticity of demand. Highlight their respective merits and demerits.
15. Highlight the main determinants of elasticity of demand for a good.

16. Distinguish between increase/decrease of demand with expansion/contraction of demand. Why does a demand curve shift its location?
17. What is elasticity of supply ? Discuss its various determinants.

Suggested Readings :

1. *H. L. Bhatia*, Microeconomic Theory.
 2. *Paul A. Samuelson and William D. Nordham*, Economics.
 3. *H. L. Ahuja*, Modern Microeconomics.
 4. *M. L. Seth*, Principles of Economics.
 5. *Misra and Puri*, Modern Microeconomics.
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STUDY III

PRODUCTION, COSTS AND REVENUE ANALYSIS

MEANING

In economics, the term production is not the same as in common language where it is usually taken to mean 'creation' of something, such as agricultural output, manufacture of a good or rendering of a service. In economics, the term production carries a wider meaning. It stands for creation of "value", which can be of two varieties, namely 'use value' and 'exchange value'. Use value is the same thing as utility which enables the consumers to satisfy their wants. It may take the shape of a service, or it may be from a tangible good. Moreover, the use value may be created for self-consumption by a producer, or it may be for sale in the market. In the latter case, the producer creates an exchange value.

It is not necessary that production must take the form of a fresh service or an increase in the tangible quantity of a thing (like the production of an agricultural commodity). Exchange value may be created in several ways, such as, by changing the form of an item or changing its location and bringing it closer to the buyers. Similarly, exchange value of an item can be increased through storage, packing, manufacturing or some other form of processing, and so on.

FACTORS OF PRODUCTION

Production of goods and services needs various inputs which are known as 'factors of production', 'agents of production', 'productive resources' or sometimes even 'productive services'. The level of production depends upon both the quantity of inputs and the efficiency with which they are employed in the process of production. It is also noteworthy that economic growth of a country, in a way, represents its productive capacity which, in turn, depends upon the technology and amounts of productive resources.

Inputs of production are classified into 'factors of production'. Ideally speaking, all the units of a 'factor' are 'homogeneous' so far as their productive capacity is concerned. They are perfect substitutes of each other. Replacing one unit by another does not change the total output. By inference, a unit of one factor cannot be a perfect substitute of a unit of another factor. On this criterion, therefore, a modern economy is bound to have a very large number of 'factors of production', and render analysis of theory of production extremely difficult. Accordingly, in economics this problem is overcome by adopting a simple classification of all inputs into just four factors, namely, 'land', 'labour', 'capital' and 'entrepreneurship'. A further detailed classification is used only if the problem in hand necessitates it. Let us briefly discuss the salient features of each of the four factors of production.

1. *Land* : In ordinary language, the term land represents an area of soil, or earth. But in economics, it has a much wider meaning. We define land as the sum total of those productive resources which are provided 'free of cost' by nature to us, that is to say, those resources on which no human effort has been expended to make them actually usable in a productive process. For this reason, land is considered a 'primary' or 'basic' factor of production without which no production is possible. Some degree of human effort (labour) is essential for free natural resources to impart them use value or exchange value as the case be. The salient features of land are highlighted below.

(1) As stated above, land comprises those productive resources which are provided to us without any expense of human effort on them. Land is not confined to only the soil or agricultural land. It includes a large variety of natural resources including, for example, water, sunlight, climate, water resources, forests, minerals, and so on.

Some of these natural resources are renewable, while others are not. Renewable resources are those which have a tendency to regenerate on their own, such as forests, rain water, sunlight, soil fertility and so on. They tend to get exhausted with use. But it is possible to replenish them with appropriate steps. In contrast, non-renewable resources are those which get exhausted permanently and it is not possible to replenish them. Examples of such resources include minerals.

(2) It has been a tradition with economists to assume that land has a fixed or inelastic supply. But this stand needs a revision which is elaborated below..

- It has been noted above that some of the existing land resources are not renewable and can get exhausted.
- The availability of even renewable resources is not fixed. It declines with use and increases when the resources are replenished. In certain

cases (such as forests), the total availability of a resource may even be enhanced through replenishment.

- The form of certain natural resources can be transformed so as to change their economic value to the economy. For example, swamps and marshy lands may be reclaimed to create tracts of agricultural land. In hilly areas, land fertility may be improved through steps like terracing and bunding. And so on.
- It is possible that some additional natural resources like hydrocarbons and other minerals may be discovered.
- Frequently additional economic uses of already known natural resources are found out.
- It can be argued that a specific natural resource has a given availability for the country as a whole. The country does not have to pay for it. It is just there. However, on account of the fact that a natural resource may be under the system of private property, its availability for an individual economic unit or a group of them can depend upon the price paid for it. Normally, availability of a natural resource to an individual economic unit and its price are inversely related.
- Over time, several components of land have lost their original form. They are inseparably intermixed with several other elements which can be termed capital or the result of human effort. For example, it is nearly impossible to find agricultural land as it was originally given to us by nature.

2. *Labour* : The term labour is used to mean several things and can be a source of great deal of vagueness and imprecise statements. For the sake of clarity, we should note the following:

- The term labour refers to only human effort (or activity), which can be physical, mental or a mixture of the two. It does not include the work performed by animals or machines or nature.
- Only those human activities can be termed as labour which are in the nature of economic activities. That is to say, these activities should aim at production (even when it is for self-consumption).
- The amount of labour is the product of (i) duration of time over which it is performed and (ii) the intensity with which it is performed.
- A labourer (worker) has certain capacity to perform labour. This is known as his labour power.
- Actual labour performed by a labourer can differ from his labour power.
- There are several varieties of human labour for the simple reason that there are several varieties of economic activities.
- Factually, labour power of a worker is a mixture of the working capacity (a) provided to him by nature, and (b) acquired by the worker himself. Normally, it is almost impossible to separate the two. The capacity to work which is

acquired by the worker himself is referred to as human capital and is an important means by which a country can accelerate its economic growth. Addition to human capital is one of the several ways in which capital formation takes place in a country.

Supply of labour in a country refers to

- (i) the total number of workers available for labour,
- (ii) the intensity with which they can work,
- (iii) the duration for which they work ,and
- (iv) their efficiency (or productivity).

Each of these factors, in turn, depends upon a number of factors given below :

Total Number of Workers : There are two sources of labour force of a country, its domestic population and immigration. Ignoring the latter, we may say that the size of labour force of a country depends upon its own population, that is its

- (i) size,
- (ii) age composition, and
- (iii) sex composition.

Important additional factors determining the labour force of a country include the following:

- (i) Health level of its population determines the physical time limits for which the workers can work at a time.
- (ii) The educational and training standards of labour influence the age level at which workers effectively joins the labour force.
- (iii) Every society has certain social and legal norms which guide it in allowing its female members, children, and old-aged persons to work or live on the earnings of others.

It should be noted that the determinants of the size of labour listed above are not exhaustive. And they are also subject to variation over time.

Quality (or Efficiency) of Labour Force : This is as important a determinant of effective supply of labour like its absolute size. Labour productivity is a complex phenomenon and is a result of several physical and psychological causes. To begin with we may mention the 'work culture' of the labour force. Are they happy in performing the tasks assigned to them, or are they work shirkers ? It is noteworthy that their willingness to work also depends upon working conditions, the work-schedule, and similar other factors. On the physical side, division of labour and specialisation add to the productivity of labour. Similarly, labour productivity also increases with the adoption of capital-intensive techniques of production. It is noteworthy that the concepts of division of labour and specialisation extend to geographical areas such that each region tends to specialise in its own particular sphere of production.

It is clear from the above discussion that, for the country as a whole, supply of labour cannot change at a fast rate. An increase in the size of population starts with a growing proportion of babies and children. And it takes years before they are able to join the labour force. Similarly, social and legal norms of a country do not change overnight. Similar observations apply to the efficiency of labour. Its determinants like work culture, working conditions and adoption of capital-intensive technology are time consuming processes. Considering the supply of labour to an individual industry, we note that availability of unskilled labour can vary at a much faster rate than specialised labour and managerial skills. The latter types of labour tend to be industry-specific and it is not possible to change their availability at a short notice.

It is also noteworthy that an individual worker compares the advantages of working longer hours and earning an additional income with the advantages of leisure to be sacrificed in the process. As a result, beyond a level, if the income of the worker goes up, he may opt for shorter hours of work rather than longer ones.

3. *Capital* : Capital is a term with a wide coverage. To an individual economic unit, it denotes the aggregate of purchasing power owned by it which can be used for the purposes of business expenditure. For this reason, the term includes its financial assets also, because they represent generalised purchasing power and claims upon the resources of the society. However, for the economy as a whole, 'internal' financial assets and liabilities do not add to its capital. This is because they are claims of one set of economic units upon the others within the economy. In other words, these financial assets are claims of the economy upon itself. Therefore, for the economy as a whole, capital resources include only its excess of claims over its liabilities to the rest of the world.

Capital is "man-made" productive resources. It is the result of human labour which was performed in the past but the production of which was not used for current consumption. Instead, it was saved in the form of what may be termed 'producer goods', 'intermediate goods', or 'capital goods' etc. Thus, capital is 'concealed labour', 'stored labour', or 'crystallised labour'. It is imbibed in certain natural resources to make them more productive. Viewed this way, capital is a 'non-primary' factor of production, that is, it is possible to produce goods by applying labour directly to land and without the help of capital. However, it is generally advantageous to use labour in first creating capital and then using both labour and capital together with land for final production. The increase in final output through this roundabout process of production far outweighs the loss of output during the creation of capital. It should also be noted that, being man-made, there is upper limit to the stock of capital which an economy may accumulate.

Capital can manifest itself in a variety of forms. To begin with, we should note that past human labour have contributed to the productivity of land and labour. That way, capital stock of the country gets partly intermixed with its land resources and partly assume the form of human capital. In both cases, it is next to impossible to separate the capital component from the original endowment by nature.

Physical form of capital of a country can also assume several forms, such as

structures (buildings, roads, railways, canals, waterways, and so on), and machinery and equipment. Some analysts would prefer to consider technological and other relevant knowledge also as a separate manifestation of capital rather than include it in human capital. Moreover, with the passage of time, the variety of physical forms in which capital of a country manifests itself keeps on increasing.

Savings of the economy are the primary source of addition to its capital stock which may be supplemented by capital inflow from abroad.

4. *Entrepreneurship* : Factors of production do not produce economic goods and services by themselves. They have to be brought together and, in a co-ordinated way, made to pass through a productive process to create output. This job is done by entrepreneurship which, for this reason, is itself considered an independent factor of production. Entrepreneurship is a complex phenomenon and does not have a set list of functions to perform. There is no general agreement among economists regarding the functions of an entrepreneur. Kaldor maintained that entrepreneurship consists of three primary components (or functions), namely,
- co-ordination of all activities of a business firm, including (i) overall policy decisions and (ii) bearing responsibility for the consequences of these decisions;
 - management, that is, implementation of the policy decisions, and working out appropriate details relating thereto;
 - supervision that is, ensuring that the decisions are actually carried out in by workers and all units of the firm.

Kaldor says that, in the final analysis, true entrepreneurship lies only in the first of these three tasks, since the latter two can be delegated and performed by paid employees. It is also possible to have the two latter functions performed, partly or fully, by outside agencies. However, in a stationary economy, by definition, all functions of a firm boil down to routine ones. There is no uncertainty to be faced by the firm either from the shifting market forces or by the policies of the authorities, etc. That way entrepreneurship, in real sense of the term, can exist only in an economy which is uncertain and dynamic and in which the entrepreneur bears the risk of incurring a loss (or making a profit). In a hypothetical economy which is stationary in nature, and in which all business decisions become routine ones, true entrepreneurship vanishes.

Different economists have emphasised selective functions out of a complex variety which entrepreneurs perform. They take steps by which a new business may be started and run as efficiently as possible, and even close them down, if need be. They are the main agents through which the economy decides to allocate its productive resources amongst alternative productive activities. It is they who decide when and how to adopt technical knowledge (that is, adopt innovations), modify quantity and quality of the products of their business concerns, use new sources of inputs, discover new markets for their products, and so on.

In economic analysis, the very concept of entrepreneurship poses several difficult problems. A firm can have only one (or an unified) entrepreneurship while it can have

any number of units of another input. The risk-bearing ability and willingness to bear it differs from one entrepreneur to another. There is no uniformity in their expertise in assessing the changing potential of the market and taking appropriate business decisions. Consequently, the reward earned by entrepreneurs does not vary on account of any single variable. It depends upon all the factors mentioned above and many more. For example, the profit of entrepreneurship tends to vary with the size of the business, the nature of the product and the nature of the market structure. Thus, other things being equal, a monopoly firm can earn greater profit than a competitive one.

The Theory of Production

Theory of production basically consists of how the producer, given the state of technology combines various inputs to produce a definite amount of output in an economically efficient manner. In the production process, firm turns inputs, which are also called factors of production, in to outputs (or products).

The relationship between inputs and output of a good, say X, may be expressed in the form of a production function, which in its general form may be written as :

$$Q_x = f(K, L, \dots)$$

where Q_x stands for the quantity of output of good X per period of time, and K, L,... denote capital, labour and other factors of production.

Two main alternative approaches may be adopted in studying the production theory ie

- (i) Laws of Returns or Laws of Variable Proportions;
- (ii) Laws of Returns to Scale.

LAWS OF RETURNS OR LAW OF VARIABLE PROPORTIONS

Production theory tells us that quantity of output may change (i) when some factors of production are kept constant (fixed), and others are varied; or (ii) when all factors of production are varied.

The law of variable proportions covers the former portion of production theory. It explains the behaviour of a production function when a firm has some fixed factors and can change only the rest. An input, the quantity of which can be varied by the firm, is termed a 'variable' factor, while an input, the quantity of which cannot change, is termed a 'fixed' factor. For this reason the law of variable proportions is a short term phenomenon. Short run is defined as that time period during which a firm cannot vary the quantities of all inputs. It is tied with some 'fixed' inputs like buildings, machines, permanent employees and the like which give it a fixed plant size with a pre-defined range of output.

Given the fixed factors, actual level of output of the firm is determined by the quantities of variable factors employed by it. Alternatively, it is stated that in the short run, a firm has a fixed plant size (or a fixed 'scale' of output). In contrast, the possibility of varying all factors lies only in the "long run". The term "long run" is defined as that time period over which a firm can vary all factors of production and

therefore, can choose between different 'scales' or 'sizes'.

The law of variable proportions relates changes in total output of the firm to only changes in the variable inputs employed by it. It describes shifts in average output or marginal output of only the variable factor. This law evolved in stages to its present state. In the beginning, it did not specify that the decline in the average (and marginal) productivity of a variable factor takes place only after the stage of increasing returns to the variable factor, when marginal product increases. In the beginning the law only stated that, with a given 'fixed' input, an increase in the variable input leads to a reduction in its average (marginal) output. Moreover, it was primarily considered in relation to agriculture. For this reason, its earlier stages of development, this law was popularly known as the law of diminishing returns. For example, Marshall defined the Law by saying,

"An increase in the capital and labour applied in the cultivation of land causes in general a less than proportionate increase in the amount of product raised unless it happens to coincide with an improvement in the arts of agriculture."

It should be noted that Marshall recognises that this law is applicable only in the short run when the technology can be assumed to be given and inputs can be combined only within a given range of combinations.

An Improvement

In due course, the fact that marginal (or average) productivity of a variable factor started declining only after a certain stage was given due recognition. Let us note some of the definitions which subscribe to this view. It should also be noted that these definitions differ only in their wording and not in the contents.

1. Stigler's definition "As equal increments of one input are added, the inputs of other productive services being held constant, beyond a certain point the resulting increments of product will decrease, i.e., the marginal products will diminish."
2. F. Benham, in his famous book Economics, states that "As the proportion of one factor in a combination of factors is increased, after a point, first the marginal and then the average product of that factor will diminish."
3. P. A. Samuelson defines this law in the following words. "An increase in some inputs relative to other fixed inputs will, in a given state of technology, cause output to increase : but after a point the extra output resulting from the same additions of extra inputs will become less and less."

It is seen that these definitions of the law incorporate the following features:

- (i) It is applicable not only in agriculture but in the production of every good.
- (ii) It covers cases where more than one fixed and more than one variable inputs are applied.
- (iii) The application of diminishing returns to the variable factor starts only after a certain stage and not immediately, that is, only after a certain quantity of the variable factor has been used.

These developments resulted in reformulation of this law as the law of variable proportions containing three 'laws' or 'phases', namely,

- (i) law or phase of increasing returns,
- (ii) law or phase of constant returns, and
- (iii) law or phase of diminishing returns.

Assumptions

The law of variable proportions is based upon the following assumptions :

1. The most important assumption of this law is that the set of alternative feasible combinations of inputs is determined by technological conditions. It further states that productive efficiency of factors of production varies from one proportion to the next, that is to say, productive efficiency of inputs depends upon the proportion in which they are combined. It claims that the extent to which a firm can utilise its inputs does not depend upon their absolute quantities. Instead, this depends upon the proportion in which they are combined.

Since the productive efficiency of inputs varies with the proportion in which they are combined, it follows that there will be one combination in which it will be the highest attainable. In all other combinations, the inputs will yield lower productive efficiency. The combination with highest possible productive efficiency of inputs is termed 'ideal' or 'optimum' combination. When a firm selects a proportion of its inputs which is nearer to the optimum combination, the productive efficiency of its inputs improves. The proportionate increase in total output is more than the proportionate increase in the variable factor/s. Just the opposite happens if the firm selects a proportion of its inputs which is farther away from the ideal one.

2. The law assumes a given technology so that inputs can be combined only within a given range of proportions. It should be noted that it is possible to change technology only in the long run. This assumption is necessary because a change in technology may increase the marginal product of the variable input.
3. It is possible to consider more than two inputs and assume that some of them are fixed and the rest are variable. However, for the sake of simplicity, it is assumed that there are only two inputs - one of them is fixed and the other is variable.
4. The law does not consider the cases where the inputs are either perfect substitutes or perfect complementary to each other. The inputs are assumed to be imperfect substitutes of each other. In case of perfect substitutes, the marginal productivity of the variable input in relation to the marginal productivity of the fixed inputs remains constant. And in this case of perfect complements, the inputs can be combined only in a given proportion. In this case, any one input is increased without a corresponding addition of the other, its marginal productivity falls to zero.

To elaborate, let us start with a given quantity of the fixed factor and increase that of the variable one in stages. With each addition of the latter, we move closer to the ideal combination of inputs. As a result, along with the use of variable factor, the utilisation of fixed factor also improves, and output increases more than proportionately. Once the proportion of inputs becomes ideal, each input is utilised in the most efficient manner. However, if the quantity of variable factor is increased still further, it remains underutilised and the output does not increase proportionately.

Let us illustrate the law with the help of a hypothetical example. Let us assume that an agricultural piece of land has 80 acres and the farmer employs alternative number of workers to produce wheat. Let us also assume that the production of wheat does not require any other input. The output of wheat resulting from employing varying numbers of workers is shown in Table 3.1

In Table 3.1 column 1 represents the number of labour units employed on the agricultural farm, column 2 shows the total output of wheat in quintals, and column 3 shows the average output of wheat per unit of labour. Similarly, column 4 shows the marginal output of labour in quintals of wheat. The law of variable proportions has three stages. It should, however, be remembered that it is not always possible to draw clear cut lines of demarcation between these stages in a tabular form because the units of inputs used are in discrete quantities. These stages can be demarcated more clearly in the case of a graphical presentation of the law having smooth curves.

Table 3.1

Agricultural Output with Fixed Land (80 acres) and Variable Units of Labour

(Output in Quintals of Wheat)

<i>Labour Units</i>	<i>Total Output</i>	<i>Average Output</i>	<i>Marginal Output</i>	<i>Stage</i>
(1)	(2)	(3)	(4)	(5)
1	8	8	8	Stage-I
2	20	10	12	
3	36	12	16	
4	48	12	12	Stage-II
5	55	11	7	
6	60	10	5	
7	60	8.6	0	
8	56	7	-4	Stage-III

9	51	5.7	-5	
10	45	4.5	-6	
11	38	3.6	-7	

In Stage I, as the farmer increases the units of labour, total output of wheat increases more than proportionately. This is because with an increase in labour, utilisation of land also increases and adds to total output. Therefore, during this stage, in addition to increase in total output, average output also increases. The end of this stage is reached when average product reaches its maximum. It should be noted that marginal product reaches its maximum before average product does and starts decreasing. Marginal output and average output are equal to each other at the end of this stage.

In Stage II, average output starts declining with use of additional units of labour. During this stage marginal output also declines and becomes smaller than the average. At the end of this stage, marginal output reaches zero and total output stops increasing and reaches its maximum.

In Stage III, marginal output is both negative and declining. The total output, having reached its maximum, also decreases during this stage. In other words, in this stage, all the three measures of output show a reduction with an increase in the employment of variable factor.

All the three stages taken together describe the Law of Variable Proportions. It has three 'laws' or phases.

- (1) The first one is that of increasing returns in which average output of the variable factor is increasing. Correspondingly, while total output increases throughout this phase, marginal output first increases, reaches its highest value and then starts declining till it is equal to the average output.
- (2) The second 'law' or phase is that of constant returns. It is that portion of the law of variable proportions where average output is the highest. Normally, this phase of the law consists of only a point on the average output curve. However, it can also cover a segment of it. In that case this segment of the average product curve will run parallel to X-axis, and its slope will be zero.
- (3) The third 'law' or phase of the law of variable proportions is known as that of diminishing returns. During this phase, average product of the variable factor keeps declining together with marginal output. Eventually, marginal output may even fall to zero and become negative. When that happens, total output also starts declining. It is this phase which was generally enunciated as the law of diminishing returns in economic theory in its initial stage of development.

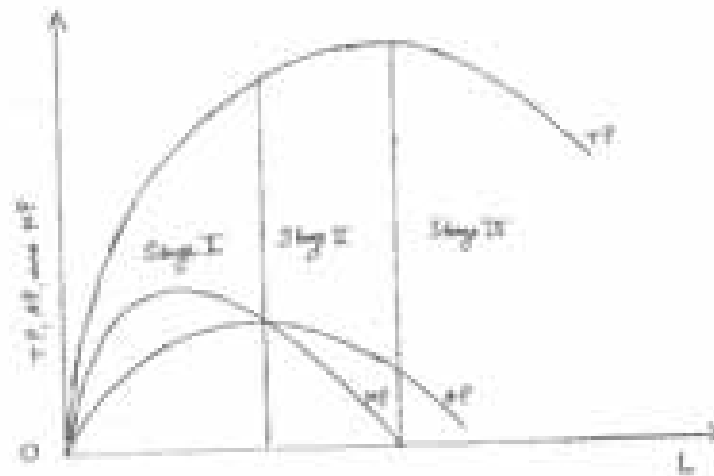


Fig. 3.1 : Law of Variable Proportions

The Law of Variable Proportions is illustrated in Fig. 3.1 It depicts a case of an agricultural farm used for producing wheat. The size of the farm is fixed while the units of labour employed to produce wheat are variable. It is also assumed that no other input is needed to produce wheat. Another assumption is that of perfect divisibility of land and labour so that

- the three curves representing total product, average product and marginal product of labour start from the origin; and
- the three curves are continuous.

In Stage I, with increasing input of labour, there is a more than proportionate increase in total product. This happens because output increases not only because of additional labour, but also on account of increased utilisation of land. This leads to an increase in average product also which reaches its maximum at the end of this stage. This position corresponds to the 'ideal' combination of land and labour and the best possible utilisation of both taken together. As regards marginal output, it first rises, reaches its maximum and then declines and becomes equal to average product at the end of this stage.

In Stage II, total product continues to increase but at a decreasing rate because the rate of increased utilisation of land slows down. At the same time, as size of labour is increased, its utilisation falls below optimum. Total output reaches its maximum level at the end of this stage. For this reason, average product which had reached its maximum at the end of the first stage, continues to fall, but remains positive till the end of this stage. Also, there is a continuous reduction in marginal product of labour. But the rate of fall in it is much faster and it touches zero at the end of this stage.

Throughout stage III, marginal product remains negative. For this reason, total product and average product also decline.

Limitations of Law of Variable Proportion

The Law of variable proportions is based on unrealistic set of assumptions. First, the homogeneous units of variable input (specially labour) is not logical. Every unit of labour or worker is different from each other. Secondly, the assumption of constant input prices and technique of productions also seems unrealistic in the present dynamic world.

RETURNS TO SCALE

In order to understand the concept of 'returns to scale', it is necessary to be first familiar with the terms 'returns' and 'scale' mean.

Scale : If we consider the production plant of a firm, we come across its several dimensions. In the short run, the firm employs a combination of both fixed and variable factors and, by definition, it cannot change the former as it varies its output. This is a short run phenomenon. Under these conditions, the plant of the firm has a certain range of output. It may choose not to produce at all. But if it produces, the output has to be a certain quantity which defines the lower end of the range of its output. Similarly, with given fixed factors, it is not able to produce more than the maximum of the range of the plant. On account of the law of variable proportions, the average cost of production has three phases, namely, that of increasing returns, constant returns, and diminishing returns. The output that corresponds to the constant returns, or better still, the output that corresponds to the least possible average cost of production, is termed the scale of that plant. It is clear that each plant has a scale of its own. And the scale of one may or may not be equal to that of another. The least possible average cost of production of a plant is also known as its optimum cost. The scale of a plant can change when all inputs can change; that by definition can change only in the long run.

Returns : This term refers to the change in average cost of production. Accordingly, when we talk of returns to scale, we are talking about the change in least possible average cost of production when the firm moves from one plant to another, that is, when it shifts from one scale of output to another. If the optimum cost increases with an increase in scale of output, we say that there are diminishing returns to scale. If the optimum cost does not vary with the change in plant scale, then there are constant returns to scale. Similarly, we have increasing returns to scale if the least possible average cost of production falls with an increase in the plant size.

Thus, the concept of returns to scale is a long term one, because it is only in the long run that all factors can be varied and scale of plant can be increased or reduced.

The Classical Stand: The classical economists subscribed to the theory that productive efficiency of inputs depends upon the proportion in which they are combined. Accordingly, as we have seen earlier, with a given plant having some fixed inputs, the average cost of production passes through three phases. It first falls, then remains unchanged, and lastly increases. However, if all factors are increased in the same proportion, so that the original factor proportion is kept constant, then according to this reasoning, total output also increases in the same proportion. Accordingly, there is no change in the average cost of output, and there are constant returns to scale. This is illustrated in Fig 3.2 in which we have several plant curves with their

respective ranges of output as also their respective scales of output. It is seen that in each case, the least possible average cost happens to be the same. There is neither an increase nor a reduction in it. In other words, as we change the scale of output by moving from one plant curve to the other, there is no shift in the least possible average cost. Thus, there are constant returns to scale.

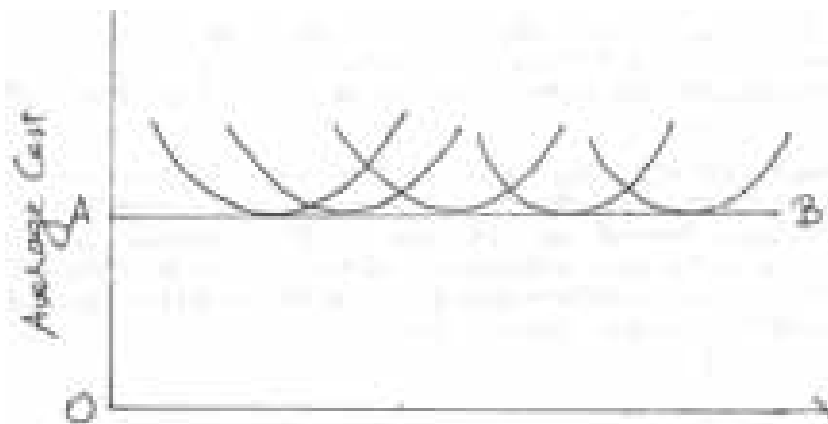


Fig. 3.2 : Constant Returns to Output Scale

The Modern View : Professor Chamberlin and others disagreed with the classical economists that productive efficiency of inputs depends not upon their absolute amounts but upon the proportion in which they are combined. In modern view, productive efficiency of inputs is affected by both their proportion and their absolute quantities. This claim is based upon the following reasoning :

- (i) Unlike the view taken by the classical economists, each input (such as, labour and capital) has several sub-groups or varieties. When the scale is small, the firm is not able to choose between all of them. Its choice is restricted to only a few of them. However, if it decides to go in for a bigger plant size, then its choice of inputs is widened. And this becomes a source of economies (that is saving in cost). The result is a reduction in average cost of production, or economies of scale. However, this source of economies dries up as the scale of output crosses some critical level.
- (ii) Similarly, within each variety of an input (say, machines for manufacturing nails), there are further sub-divisions. A firm finds that its choice of more expensive (but at the same time, comparatively more productive) sub-varieties increases as it expands its scale of output. This also leads to a saving in cost of production. However, as in the earlier case, this source of economies is also not an unlimited one. It dries up beyond a level.
- (iii) Expansion of scale of output does not generate only economies. The very fact that a business is growing in size, brings its own sources of diseconomies or additional expenses. These diseconomies keep increasing with the scale of production. These diseconomies relate to all sorts of problems connected with complexity of management, supervision and

execution of decisions.

As we consider successively increasing scale of production, net economies pass through three phases. In the initial stages, the economies outweigh the diseconomies of scale and the net result is that of economies of scale, or increasing returns to scale. It means that the least average cost of production of successive plant curves decreases as we move from a smaller to a bigger scale. In due course, the economies and diseconomies exactly counterbalance each other and result in constant returns to scale. If the scale of production is increased beyond this, the diseconomies outweigh the economies and the result is that of diminishing returns to scale.

The result is that in the long run, average cost curve of the firm, which is derived with the help of plant curves (that is, short term average cost curves) is U-shaped. With an increase in scale of output, the optimum cost of production passes through three stages. In the first stage, it declines depicting increasing returns to scale. This is followed by the stage of constant returns to scale, while the third and last stage is that of diminishing returns to scale. (See Fig. 3.3)

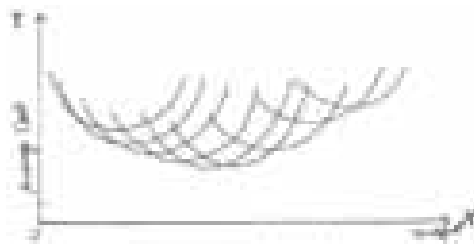


Fig. 3.3 : Returns to Scale: Modern View

COST CONCEPTS

In the process of its decision-making, a firm not only considers the price at which it will be able to sell its output, but also the cost of supplying the product which is determined by the productivity of the inputs which it uses and the prices which it has to pay for them. In this portion of the study lesson, we shall look at some of the basic concepts of cost which a firm has to consider.

Costs of a firm may be analysed in the context of (a) short run, and (b) long run. We shall cover both of these one by one.

Short Run Costs

The term 'short run' does not represent a fixed time period. It is a functional concept and represents that time interval over which the firm is not able to alter every input. It is stuck with some fixed inputs also. It means that irrespective of the volume of output, the firm must incur a fixed amount of expenditure on these factors. These are, therefore, termed fixed costs. Correspondingly, expenditure incurred on variable factors are known as variable costs and they change with the level of output. It is obvious that total cost (TC) is the summation of total fixed costs (TFC) and total variable costs (TVC).

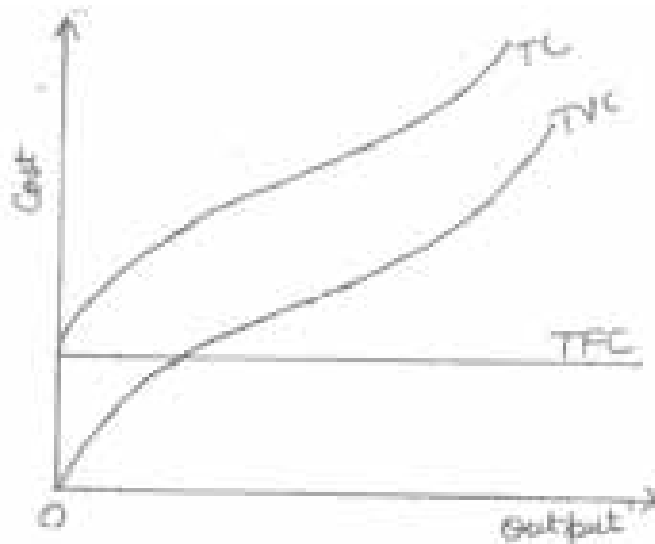


Fig. 3.4 : Concepts of Total Cost of a Firm

Total Cost Curves : Graphically, if quantity of output is measured along X-axis and costs are measured along Y-axis, then the Total Fixed Cost Curve (TFC) runs parallel to X-axis (See Fig. 3.4). In contrast, total variable costs and total output are positively related. They move together. With zero output, the variable costs of the firm are also zero. The total variable cost (TVC) curve, therefore, starts from the point of origin. However, on account of the law of variable proportions, their relative rates of change also undergo a change. In the initial stages, due to the phase of law of increasing returns, total variable costs increase slower than increase in output. It means that during this phase, TVC curve rises but at a decreasing rate. Its slope keeps decreasing. This phase gives place to that of constant returns where the total variable cost increases at the same rate as total output. At this stage, the slope of the TVC curve falls to zero and it becomes parallel to X-axis. This is followed by the phase of diminishing return in which total variable cost starts increasing faster than increase in output. As a result, the slope of the TVC curve increases with each increase in output.

If we add the two curves vertically, we get a corresponding curve which represents total cost (TC). Its starting point on Y-axis coincides with that of TFC curve. The slope-behaviour of the TC curve is the same as that of TVC curve.

Average and Marginal Cost Curves : In addition to the three concepts of total costs and their corresponding curves, we have three concepts of average costs and one concept of marginal cost. These four cost concepts also yield their respective four cost curves. They are illustrated in Fig 3.5 in which quantity of output is measured along X-axis and cost figures are measured along Y-axis.

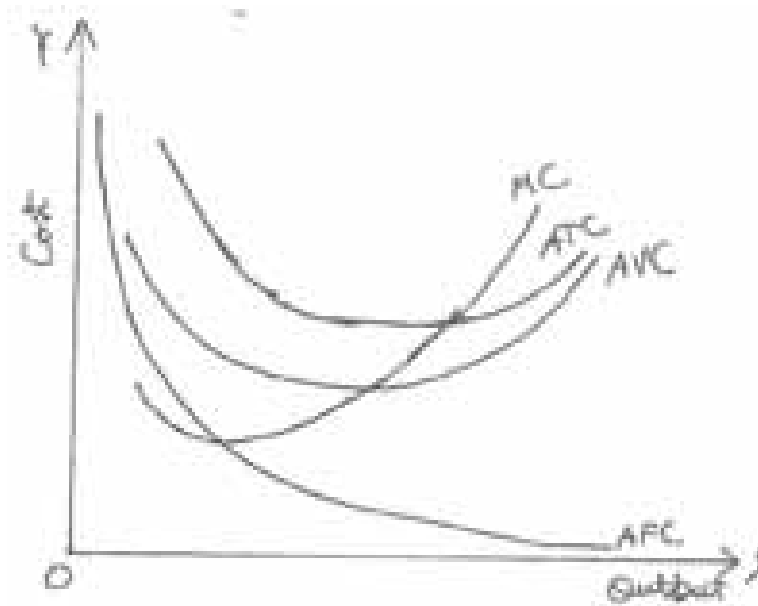


Fig. 3.5 : Average and Marginal Cost of a Firm

1. **Average Fixed Cost (AFC) Curve** : Since total fixed costs do not change with output, therefore, average fixed cost (AFC) declines with increase in the level of output and tends to infinity when output reaches zero. For a single unit of output, AFC equals TFC. And so on. The AFC curve, therefore, is a rectangular hyperbola. If we take any point on it and draw perpendiculars upon the two axes, the rectangle formed by them is always equal to TFC. At one end, this curve approaches Y-axis, without ever touching it, with a reduction in output; and at the other, it approaches X-axis, without ever touching it, with an increase in output.
2. **Average Variable Cost (AVC) Curve** : As we have seen above, with a given plant, returns to variable factors pass through three phases of increasing, constant and diminishing returns. Accordingly, AVC curve is a U-shaped one. In the initial stages, it slopes downwards with an increase in output. However, the reduction in average variable cost slows down till AVC stops declining further and becomes constant. This is followed by the phase in which AVC curve slopes upwards on account of diminishing returns.
3. **Total Average Cost, or just Average Cost (ATC or AC) Curve** : This curve represents the average of all costs incurred by the firm for a given output and is the summation of AFC and AVC. Graphically, it is obtained by vertical addition of the AFC and AVC curves. AC curve lies above AVC curve. At each point, its vertical distance from AVC curve is exactly equal to the distance of AFC curve from X-axis. Therefore, AC curve is (i) U-shaped and with increasing output, its vertical distance from AVC keeps declining.

4. *Marginal Cost (MC) Curve* : Marginal cost is addition to total cost on account of the production of an additional unit. Symbolically, it is $TC_N - TC_{N-1}$. However, it should be noted that in the short run, the firm cannot vary its fixed factors. Therefore, its costs can change only on account of a change in variable costs. Therefore, in the short run, MC gets defined as $VC_n - VC_{n-1}$. For this reason, MC curve is related to only AVC curve. When AVC is decreasing, MC is less than it and MC curve lies below AVC curve. However, when the rate of fall of AVC slows down, MC curve reaches its lowest value and starts increasing and meets AVC curve at the lowest point of the latter. In other words, when AVC is constant, MC is equal to it. In the next phase, when AVC curve slopes upwards, MC curve rises faster than the former and lies above it. It should also be noted that MC curve need not intersect AC curve at the lowest point of the latter. Whether it does so or not would depend upon the rate at which AVC increases compared with the rate at which AFC decreases. MC curve will intersect AC curve at its lowest point only if the rate of increase in AVC equals that of fall in AFC.

Long Run Costs

The term long run is defined as that length of time over which the firm gets an opportunity to vary, if need be, the quantities of all its inputs. In other words, there are no fixed factors in the long run, and therefore, there are no fixed costs. All factors are variable and as a result, all costs are variable. If a firm closes down, its total cost (TC) also falls to zero. Similarly, TC increases with an increase in output, but its rate of increase may not be proportionate to the increase in output.

In classical reasoning, where productive efficiency is determined by proportion of inputs rather than their absolute quantities, total cost of production changes in direct proportion to output. Therefore, TC curve is a straight line with a fixed slope and starts from the origin. Further, in this case, both average cost and marginal cost are throughout equal to each other and remain constant. Their numerical value is equal to the slope of the TC curve. In Fig 3.6, TC curve represents total cost of output of a firm for corresponding quantities of output. Thus, when the output of the firm is OM, total cost is PM, average cost is PM/OM . Marginal cost is also equal to the constant slope of TC curve, that is, PM/OM .

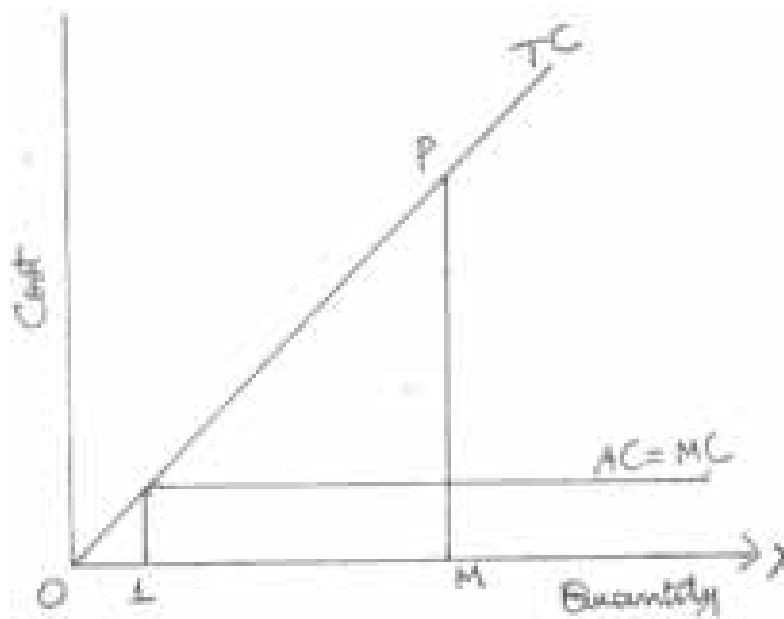


Fig. 3.6 : Long Run Total, Average and Marginal Costs

Constant Returns to Scale

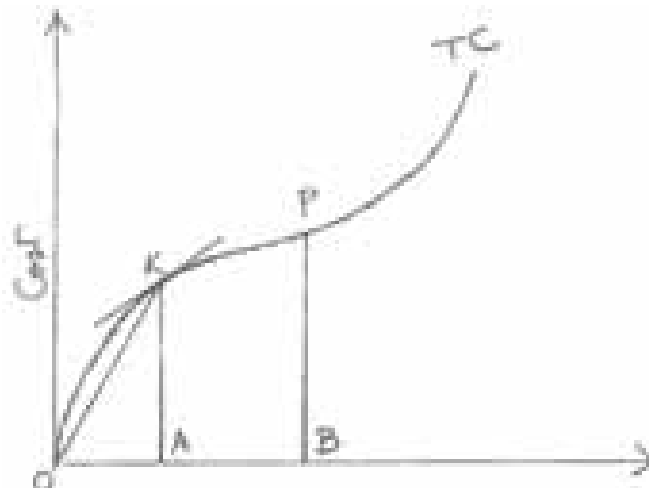


Fig. 3.7 : TC, AC and MC with Varying Returns to Scale

Modern economic theory contends that in the long run, a firm experiences varying returns to scale. With an expansion in the scale, it starts with the benefit of increasing returns. This is followed by constant returns which, in turn, are replaced by diminishing returns. In Fig. 3.7 TC curve starts from point O, rises at a decreasing rate till point P (corresponding to output scale OB). At this output, there are constant returns

to scale. When scale of production exceeds OB, diminishing return set in and total cost curve starts rising at an increasing rate.

If we take a point, say K, on TC curve, then the slope of the line joining it with origin O (that is, the slope of OK) measures AC and the slope of the tangent to the curve at this point measures MC.

CONCEPTS OF REVENUE

Revenue or receipts of a firm are derived from the sale of its output. The basic reasoning related to cost concepts applies here as well. Total revenue (TR) represent total sales proceeds of the firm and are equal to per unit price multiplied by the quantity sold. Average revenue (AR) is, by definition, the per unit price of the product, while marginal revenue (MR) is the addition to total revenue when the quantity sold is increased by one unit. Thus, symbolically, we have the following relationships.

$$TRE_n = \text{Price Per Unit} \times \text{Quantity Sold}$$

$$AR_n = TR_n / \text{Quantity Sold} = \text{Price Per Unit}$$

$$MR_n = TR_n - TR_{n-1}$$

In order to further understand the relationship between AR and MR, we should note the following facts.

- The estimate of total revenue should be the same in case of each of the following two methods, namely (i) the product of AR and Units of the good sold; and (ii) the summation of successive marginal revenues.
- For the first unit sold, $TR = AR = MR$.
- MR pertains to change in TR only on account of the last unit sold, while AR is based upon all the units sold by the firm. Therefore, any change in AR results in a much bigger change in MR. Reduction in MR is far bigger than that in AR; and similarly, an increase in MR is also much bigger than the corresponding increase in AR. The two are equal only when AR is constant.
- The firm will not sell any quantity if TR or AR become zero or negative. However, MR can become negative if the fall in price is big enough.

Graphically, therefore, we have the following relationships.

Since TR, AR and MR equal for the first unit sold, therefore, the three curves start from the same point. TR curve slopes upwards so long as MR is positive. If MR is falling with an increase in the quantity of sale, then TR curve will gain height at a decreasing rate. It reaches its maximum height when MR curve touches X-axis. TR curve slopes downwards when MR curve dips below X-axis.

- A change in AR causes a much bigger change in MR. Therefore, when AR curve has a negative slope, MR curve lies below it and has a greater slope. Similarly, when AR curve has a positive slope, MR curve lies above it and has a greater slope. When AR curve is parallel to X-axis, MR curve coincides with it.

- In case AR is a straight line, MR curve will bisect each perpendicular distance of it from Y-axis. However, if AR curve is parallel to X-axis, then MR curve coincides with it.
- The above graphical relationships between AR and MR are shown in Fig. 3.8 to Fig. 3.11. In Fig. 3.8, AR has a constant value OD. Therefore, AR curve starts from point D and runs parallel to X-axis. Since AR is a constant, MR is always equal to AR and the two curves coincide with each other.

In Fig. 3.9, AR curve starts from point D on Y-axis and is a straight line with a negative slope. It indicates that as quantity of good sold increases, its per unit price falls at a given rate. Accordingly, MR curve also starts from point D and is a straight line. However, it is a locus of all those points which bisect the perpendicular distances between AR curve and Y-axis. For example, $FM = MA$.

In Fig. 3.10, AR curve (DPD') has two segments. The first one starts from point D on Y-axis and is a straight line with a negative slope till point P. The second segment is a straight line (PD') parallel to X-axis. It means that as the quantity of good X is increased, its per unit price falls ; but for all units in excess of quantity OK, the per unit price remains constant. Keeping in view the rules of drawing MR curve, draw a perpendicular PK from point P to X-axis. We find that MR curve starts from point D on Y-axis, and bisects each perpendicular distance from AR curve to Y-axis till point M' on perpendicular PK. However, at this stage, MR curve jumps to P and from there it coincides with AR curve.

In Fig. 3.11, we have the famous case of a 'kinked demand curve'. Here, AR curve is throughout linear but it has two segments with unequal slope. The segment DP starting from Y-axis has a smaller slope, while that from P to D' has a bigger slope. And this causes a kink in the AR curve at point P. Here also let us draw a perpendicular (PK) from P upon X-axis. Then., in terms of the rules of drawing MR curve, we find that it starts from point D, bisects each perpendicular distance from AR curve to Y-axis till it meets PK at point M. From here MR curve jumps to point P and is the locus of all points which bisect the perpendicular distance between segment PP' of AR curve and the perpendicular PK. Thus MR curve takes the peculiar shape of DMPM'.



Fig. 3.8 : Relationship between AR and MR

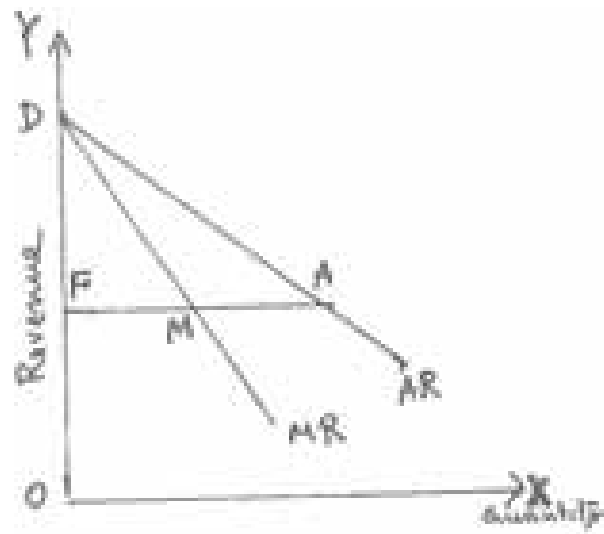


Fig. 3.9 : Relationship between AR and MR

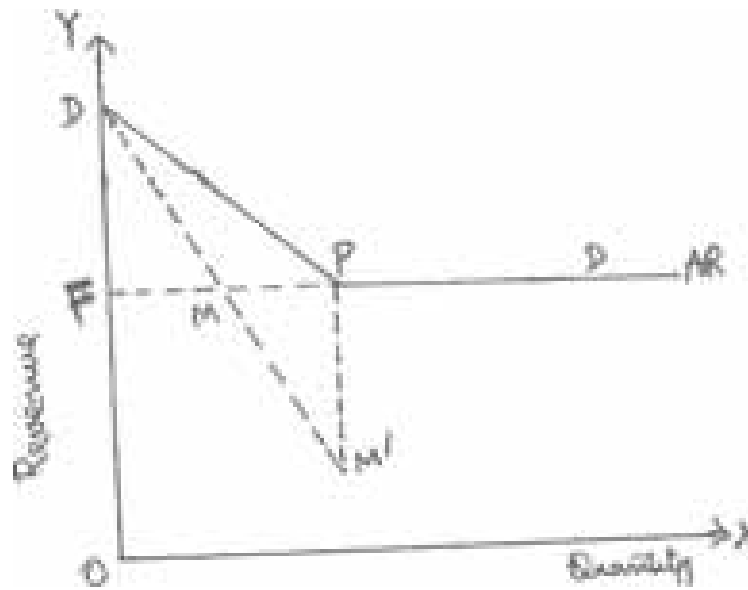


Fig. 3.10 : Relationship between AR and MR

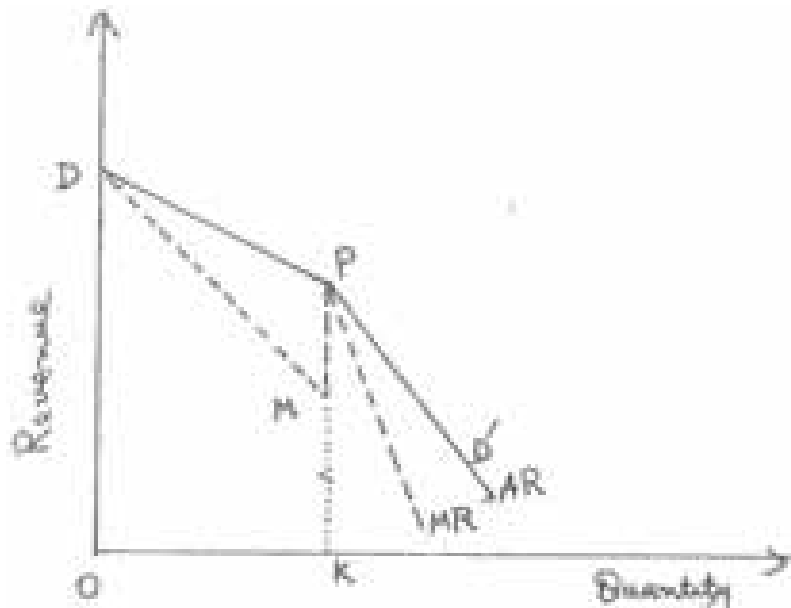


Fig. 3.11 : Relationship between AR and MR

ECONOMIES AND DISECONOMIES OF SCALE

The term economies of scale denotes 'saving' in cost of production with an increase in the scale of output, or the size of the plant. It should be noted that the existence of economies does not mean a reduction in total cost in absolute terms. It only means a reduction in relative terms and manifests itself in a reduction in average cost of output. Similarly, the term 'diseconomies' refers to an increase in average cost of output when the plant size is increased.

We have seen above that average cost of production passes through different phases even when output changes without a change in the plant size (that is without a change in the scale of output). However, those economies and diseconomies are due to variation in the factor proportion and are a phenomenon of short run. In contrast, economies and diseconomies of scale are a long term phenomenon which are associated with a change in the scale or plant size and which occur even when factor proportions do not vary.

Economies and diseconomies of scale are broadly divided into two categories, internal and external. Internal ones are those which occur due to what we term endogenous (or internal) causes. For example, if we are thinking of a firm, then internal economies and diseconomies arise on account of some actions of the firm itself. In contrast, external economies and diseconomies result from some exogenous or external causes, that is, causes which are not directly connected with the activities of the firm itself. It follows that the division between internal and external components of economies and diseconomies depends upon the reference boundary chosen by us. For example, for internal economies of a department within a firm may lead to external economies for the other departments, but they will be internal for the firm as

a whole. Similarly, there can be some economies and diseconomies which are internal to an industry but external to the individual firms, and so on.

The sources of economies and diseconomies are obviously the causes on account of which they come into existence. These sources can be many and are most likely to vary from one situation to another as also from firm to firm and industry to industry. For this reason, it is possible to classify them in a large variety of groups. The description given below is, therefore, only illustrative in nature, and highlights some of the leading probable sources. It confines itself to only the case of a typical firm. Let us start with economies of scale.

Economies of Scale: Internal

By now, it is clear that internal economies are associated with the expansion of the scale of output of the firm itself. They are not derived indirectly as a result of expansion of the industry to which it belongs. Listed below are some of the leading sources of such economies.

Managerial Economies : These economies arise on account of the scope of employing better qualified and trained managers and other employees who are able to take quicker and more profitable decisions. In addition, management experts are exploring new methods of improving the management of the firm and reducing its cost of operations.

Financial Economies : It is a common knowledge that most firms have to depend upon borrowed funds. The lenders, while deciding the rate of interest to be charged on their loans, give due importance to the 'creditworthiness' of the borrower. And other things being equal, bigger firms enjoy greater creditworthiness than the smaller one. Accordingly, they are able to borrow funds at lower interest rates. For the same reason, they have also the option of raising additional sources through equity capital.

Technical Economies : With an increase in the scale of output, the choice of inputs and their varieties becomes wider for the firm. It can go in for those machines and equipment etc. which have a higher marginal productivity as compared with their cost. In other words, it is possible to get a larger output per unit of cost incurred on them.

Bye-products : An increase in the scale of output also generates bigger flows of wastes. When the scale is small, the firm is not able to use these products for additional earnings. However, when the generation of waste crosses a critical limit, it often becomes possible for the firm to produce certain bye-products or sell off the waste to other firms and thus add to its income.

Better Utilisation of Inputs : Various inputs, particularly machines and equipment are lumpy and indivisible. They also require time intervals for 'maintenance' and 'servicing' etc. Any one of them can go out of order and require repairs. If a machine goes out of order, or is otherwise not able to operate, then a firm with a small scale is not able to find its substitute and its production suffers. For example, if a transport company has only one truck and that needs some repair, its employees are left unemployed for the time being, though the firm has to pay them all the while. In contrast, a firm with a bigger scale is able to adjust the availability of its machinery, equipment and employees etc. in such a manner that the 'downtime' of various inputs

is adequately taken care of.

Economies of Inventories : A bigger-size firm is in a better position to adjust its stocks of inputs and finished products etc. in such a manner that the normal discrepancy between flows of production and sales are ironed out.

Marketing Economies : A large firm also reaps the advantages of buying and selling in bulk. As a result, it is able to procure its inputs at concessional prices. Similarly, on account of bulk selling, its average selling costs come down. It can also have separate sales and marketing departments which can undertake the job of marketing its product in a professional manner. In addition, its sheer size imparts it better bargaining strength.

Advertising : When a firm is not operating under conditions of perfect competition, it is obliged to undertake various activities to promote its sales of which advertising happens to be an integral part. It is found that a small firm is not able to afford advertising because it has to be repetitive to be successful. Moreover, with an increase in the advertising budget, a firm is able to diversify its programme so as to cover more effective media and in an optimum proportion. As a result, its per unit advertising expenses come down.

Risk Economies : A large firm can diversify its product lines and thereby reduce the average risk faced by it since all product lines are not likely to generate losses simultaneously. The firm can compensate its losses from some lines with profits from the others. A large firm has also better command over resources compared with a small firm.

Economies of Scale : External

These economies are those which are reaped by a firm not on account of its own efforts and increase in its scale, but on account of the expansion and growth of the industry to which it belongs as also on account of overall development of the economy and markets. Some of the sources of these economies are as under :

Economies of Information : Availability of information is cheaper when we consider the industry as a whole. A firm requires continuous information regarding the prices of inputs and its product, as also likely changes in them on account of shifts in government policies and other developments. If the industry as a whole sets up facilities for providing information through various means of communication, it is much cheaper, than if it is done by the firm alone. As a result, when the authorities or the industry as a whole provides means of information, it becomes economical for the firm to use the same sets up.

Research and Development : The results of research undertaken by the authorities or by the industry as a whole are economical for the firm to use. Also, it is generally commercially viable for a research organisation to undertake research on its own and sell the findings to individual firms on payment basis than for the firms to undertake the same individually.

Economies of Concentration : When an industry is concentrated in a certain locality or region, its firms get incidental saving in costs in the form of cheaper and more reliable services. These services cover, for example, repairs, consultancy,

banking, credit, insurance, financial advice, packing, transport, housing, communication, , training, housing, health care, and so on. An individual firm is able to make use of these services at competitive and economical prices.

Economies of Specialisation : When a number of associated and interlinked industries get located in the neighbourhood, they all provide support to each other and their costs come down. As a result, the individual firms also benefit from this development.

Diseconomies of Scale

In the long run, a number of factors may cause an addition to average cost of a firm. They also happen to be both internal and external.

Internal

These sources of diseconomies are directly or indirectly linked to the inability of the problems of management which not only crop up when a firm is started, but keep increasing with its size Chamberlin terms them 'complexities of management.' Let us note them briefly.

Limits of Entrepreneurship : A firm, by definition, can have only one unit of entrepreneurship though it can have a large number of units of every other input. Moreover, entrepreneurship, in the ultimate analysis, manifests itself in the form of decision-making human beings who have to bear the consequences of their decisions. Therefore, the willingness to take risk varies between individual entrepreneurs and between different situations. Very frequently, wrong or sub-optimal decisions are taken which result in avoidable costs.

Similarly, with an increase in the size of the firm and its activities and departments, the entrepreneurship has to institute a system of delegating responsibility of assessing the ever-changing situation and taking on the spot decisions. It has also to set up an effective monitoring system. All this adds to the operating costs of the firm. In addition, it is found that on account of increase in the size of the firm, a number of additional departments may become necessary (such as a department which maintains leave accounts of the staff). As the administrative set up expands, delays set in and a number of avoidable expenses have to be undertaken.

Managerial Autonomy : With increasing size of the firm, various managerial wings (such as technical, financial, sales, marketing and others) have to be given sufficient autonomy of decision-making. The managers heading these departments, however, do not have a direct personal stake in the success of the firm. In addition, problems of coordination between various departments of the firm have to be tackled. The net result is often diseconomies of scale.

X-inefficiency. It is argued that the traditional theory is wrong in assuming that a firm always uses its resources in the best possible manner. This is because, in practice, most of the ground level decisions are taken by individual managers and other employees of the firm. And their motivation is advancement of their own careers rather than optimising the performance of the firm. Quite frequently, they also lack adequate incentive to do their best. Unless there is a very sound system of 'reward

and punishment' for each employee, their performance is likely to lack necessary motivation.

External

As in the case of external economies, external diseconomies are thrust upon a firm by extraneous forces. They are not directly related to the growth in the size of the firm under consideration.

1. There are several reasons for the prices of inputs to move up or their quality to deteriorate. For example, the authorities may impose a tax on one or more inputs. Or there may be a wage revision in the industry or imposed by the authorities on the economy as a whole.
2. Similarly, it is also possible that prices of some imported inputs may go up because of one or more reasons including for example, customs duties imposed by the domestic government or by the exporting country or increase in cost of production abroad, etc.
3. It is possible that on account of war, strikes, some natural calamity, or quantitative restrictions imposed by domestic country or a foreign country, the availability of an essential input may become costlier or insufficient.

SELF-TEST QUESTIONS

(These are meant for recapitulation only. Answers to these questions are not to be submitted for evaluation)

1. What is the law of variable proportions ? Why does this law come into operation?
2. Discuss the law of variable proportions and its underlying assumptions. Also describe its three stages in detail. Use diagrams.
3. "The laws of increasing, constant and diminishing returns are three parts of one law". Do you agree with this statement? Give reasons for your answer.
4. Why does average variable cost curve have a U-shape both in the short run and long run ?
5. Derive long run average cost curve from the short run plant curves of a firm ? Explain the reasons for its U-shape.
6. Draw short term cost curves of a firm and explain their specific shapes.
7. Why is long term AC curve of a firm U-shaped ? What is the shape of its MC curve ? Use diagrams.
8. Explain the concepts of total revenue, average revenue and marginal revenue of a firm. Illustrate their relationship graphically.
9. Distinguish between returns to scale and returns to a variable factor
10. Define the concept of economies of scale. Classify them into 'internal' and

external' ones and enumerate their sources.

11. What do you understand by economies and diseconomies of scale ? Why do they arise?

Suggested Readings :

1. H. L. Bhatia, Microeconomic Theory.
2. S. K. Agarwala : Economic Systems and Micro-Economic Theory.
3. H. L. Ahuja, Modern Microeconomics.
4. M. L. Seth, Principles of Economics.
5. Misra and Puri, Modern Micro Economic Theory.

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1. Alfred Marshall, Principles of Economics, p.150.
 2. G. J. Stigler, Theory of Price, 1953, p.111.
 3. F. Benham, Economics, p.110.
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STUDY IV

EQUILIBRIUM OF THE FIRM AND INDUSTRY

MARKET FORMS – MEANING AND CHARACTERISTICS

The concept of a market is central to the understanding of the determination of price and quantity of output of a commodity under consideration. This is because, in a modern economy, most of the production does not take place for self-consumption by the producers themselves. It is mainly produced so that it can be sold to its consumers in exchange for some other goods and services. Further, in a modern economy, goods and services are generally not traded against other goods and services in a system of barter. They are sold against money and money, in turn, is used to buy the required goods and services. The net result is that in all these activities, each good is demanded and supplied against money. And this gives rise to an arrangement known as the market.

Thus, when we talk of the market of a good, it should not be taken to mean a place where the buyers and sellers meet each other and conduct sale/purchase transactions. In earlier days, the terms 'a market place' and 'a market' could be used interchangeably because buyers and sellers of a good could contact each other only in a specified place. With the passage of time, however, the necessity of a specified meeting place has become increasingly irrelevant. And now we are left with only the aspect of an arrangement under which potential buyers and sellers can contact each other.

The term market may refer to that of a single good (service) or a group of them. We may, for example, talk of the market for milk and milk products or only one of these items. Analytically, it is more difficult to discuss the determination of output and pricing of a group of items than that of a single one. Therefore, we generally confine this analysis to only a single item.

It follows that it is possible to have a variety of market arrangements. Each market is a set of specific arrangements within which the demand and supply forces operate. The nature of the market, therefore, depends upon several things including the following:

Number of Buyers and Sellers and Competition Between Them

These two factors determine the extent to which an individual buyer or seller can influence the total demand or supply of a good.

Thus, for example, in the case of a monopoly, there is only one seller. And he does not face any competition from other suppliers. He can, therefore, decide to charge any price of his liking for his product. What may deter him to do so, however, is the impact of the price charged on the quantity demanded of his product and the resultant change in the profitability of his firm. In contrast, we can have the other extreme in which the buyers and sellers are in such large numbers that no single individual can perceptibly influence the total demand or supply. In this set of circumstances, each individual buyer and seller is a 'price taker' and has to accept the price of the good as determined by interaction between total demand and supply.

Similarly, it is also possible to visualize several other varieties of market structures. Thus, we can have a market in which a large number of sellers are confronted with a single buyer. This market is known as a monopsony. If a single buyer is confronted with a single seller, we have a market termed a 'bilateral monopoly'. A duopoly stands for a market in which there are two sellers and a large number of buyers. Out of several possible kinds of markets, we shall concentrate upon are :

- (i) Perfect competition,
- (ii) Monopoly, and
- (iii) Monopolistic competition.

These market varieties will be duly described when we come to consider the determination of price and output under them.

Time Factor

It is a common knowledge that demand and supply forces undergo a change with the passage of time. Basically, it is far more difficult to ascertain the manner in which demand for a good may be revised over time. There is no standard theoretical framework available to us by which to specify it. Therefore, demand conditions are mostly assumed to remain unchanged with the passage of time. However, the economists have been able to identify the factors which alter the cost conditions (and therefore supply conditions) of individual firms and industry with the passage of time. The division of markets on the basis of time factor is generally in the categories of

- (i) Day to Day Market Period (or just Market Period),
- (ii) The Short Term Normal Period,
- (iii) The Long Term Normal Period and
- (iv) The Secular Trend.

In the discussion that follows, we shall define and cover the first three of them. The fourth one will be left out because it primarily belongs to the theory of growth economics.

A FIRM

A firm is a business unit engaged in the task of producing/selling of some specified good or service. It is identified by the fact that it has only one unit of entrepreneurship. The entrepreneurship may not be provided by a single individual. It may be exercised jointly by a board or a group of individuals in some defined manner. However, the firm has a unified and coordinated authority of decision-making. In essence, these decisions relate to the objectives (such as, profit maximisation, or sales maximisation, etc.) and other policy decisions (such as, what to produce) of the business unit. Though the entrepreneurship may cover detailed decision-making, it need not necessarily do so. The firm may be organised in such a manner that detailed decisions and their implementation are delegated to paid employees.

The restriction of having only one unit of input applies only to entrepreneurship. A firm can have any number of units of other inputs.

AN INDUSTRY

An industry is a set of firms which are conceptually closely associated in the sense of having some "common" type(s) of activities. A good example of an industry is a set of firms which are producing a certain type of a manufactured good or providing a certain type of service. The good supplied by the firms of the industry may be 'homogenous' in the sense that the buyers believe that products of all firms are perfect substitutes of each other. A consignment of the good, by itself, does not provide the identity of the supplier. The buyers, therefore, are indifferent between the sources of supply. Instead, they select between alternative supplier firms by comparing the prices being asked by them. In contrast, the industry may also comprise those firms which are producing 'differentiated' products. This means that the product of one firm can be distinguished from that of the other. The buyers do not consider the products of different firms as perfect substitutes. However, if the firms are to belong to one industry, then their products must be 'close substitutes' of each other.

There is no pre-determined number of firms which an industry must have. Their number can vary according to the structure of the market. At one extreme, it may have only one firm in which case it is called a monopoly or a 'one-firm industry'. And at the other extreme, an industry may have such a large number of firms that each of them accounts for an extremely small portion of the total supply of the industry and is not able to influence the price of the product. Between these two extremes, there can be several other possibilities.

PERFECT COMPETITION

Before we are able to discuss the determination of output and price determination of a firm and an industry in the context of a perfect competitive market, it is helpful to note the basic features of the this form of market.

(i) *Homogeneous Product*

In a perfect competition, it is not possible to distinguish between the products of individual firms. There are no distinctive features of the product associated with any specific firm. The product, in that sense, is homogeneous and undifferentiated. To the buyer, product supplied by one firm is a perfect substitute of that supplied by another.

(ii) *Large Number of Sellers*

Perfect competition is characterised by a large number of firms. Here, the term 'large' denotes the fact that no individual firm is in a position to significantly influence the total supply of the industry and thereby affect the price of the product. Every firm in the industry is thus a price taker. It can sell any quantity of its own product at the going price. For it, the demand for its product is perfectly elastic. It, of course, must be remembered that the maximum quantity, which this firm can supply, is insignificantly small when viewed in relation to the aggregate supply of the industry as a whole.

(iii) *Large Number of Buyer*

Perfect competition is also characterised by a large number of buyers who are in competition with each other for the available supply. Their number is so large that any single buyer may change the quantity purchased without significantly affecting the total demand in the market and affecting the price of the product. Like an individual firm, an individual buyer is also a price taker. He can buy any quantity of the product he likes at going price. To him, the product has perfect elasticity of supply.

(iv) *Full Knowledge of Market*

It is assumed that in perfect competition, every buyer and seller has full knowledge of the prevailing price of the product, as also the prices being asked by the sellers and being offered by the buyers. This 'perfect knowledge' enables every buyer and seller to make use of any opportunity that may exist to strike a better bargain.

(v) *Economic Rationality*

Economic rationality is another feature of perfect competition. It means that every buyer and seller is motivated by his own economic interest in his decisions to buy or sell. This, coupled with the assumption of perfect knowledge, ensures that a uniform price prevails in the market.

(vi) *No Transportation Cost*

It is assumed that there is no transaction cost to be incurred by buyers and sellers in their activities. The price paid by a buyer is exactly equal to the price received by the seller. There is no resource cost in terms of time or other expenses to be incurred by the transactors in the market. In particular, a seller

have no need to incur any selling expenses (say, in the form of advertisements) because his product is not differentiated from the products supplied by other sellers.

(vii) *Free Entry and Exit*

Perfect competition is also characterised by free entry and exit. Basically, the terms *entry* and *exit* apply to the suppliers, though their coverage can be extended to buyers also. It means that, given enough time, any existing firm can close down and leave the industry or any new firm can enter the industry. There is no legal, institutional, or technical hurdle in doing so. It is only estimated economic benefits or losses that guide the firms in these decisions. Similarly, any existing buyer of the product can increase his purchases, cut them or reduce them to zero. New buyers can also enter the market and offer to buy any quantity they like.

EQUILIBRIUM OF THE FIRM UNDER PERFECT COMPETITION - PRICE AND OUTPUT DETERMINATION

Before we discuss the question of determination of equilibrium of a firm under perfect competition, we should keep in mind the objective for which the firm exists. We must know what it is trying to achieve. In this context, the conventional assumption is that a firm always tries to maximise its profit and takes decisions such that this objective is satisfied to the maximum extent possible. These days, however, several economists have expressed doubts about this assumption. They have suggested that a firm may try to aim at some objective other than profit maximisation. However, we shall subscribe to the conventional view and assume that a firm aims at profit maximisation. This assumption is all the more relevant when the firm is operating under conditions of perfect competition because in such a situation it is a price taker and cannot influence the overall market by its individual actions.

When we think of the equilibrium of a firm, we should remember that under perfect competition it is not able to alter the price of the product by changing the quantity of its own output. It is also confronted with given prices of the inputs and, therefore, given cost conditions. In other words, under perfect competition, it can only decide the quantity of its output. Accordingly, the equilibrium of the firm is analysed in terms of the quantity of output which it decides to produce.

It can also be seen that, given the assumption of profit maximisation by the firm, it will be in equilibrium when there is no scope for either increasing its profit income or reducing its loss by changing the quantity of output. It cannot improve its economic position by changing the output. It is this quantity of output, therefore, that is to be considered as its equilibrium output. Since profit of a firm is defined as its total revenue (total receipts, or TR) minus total expenditure (total costs, or TC), therefore, in equilibrium, the firm maximises this difference (TR - TC).

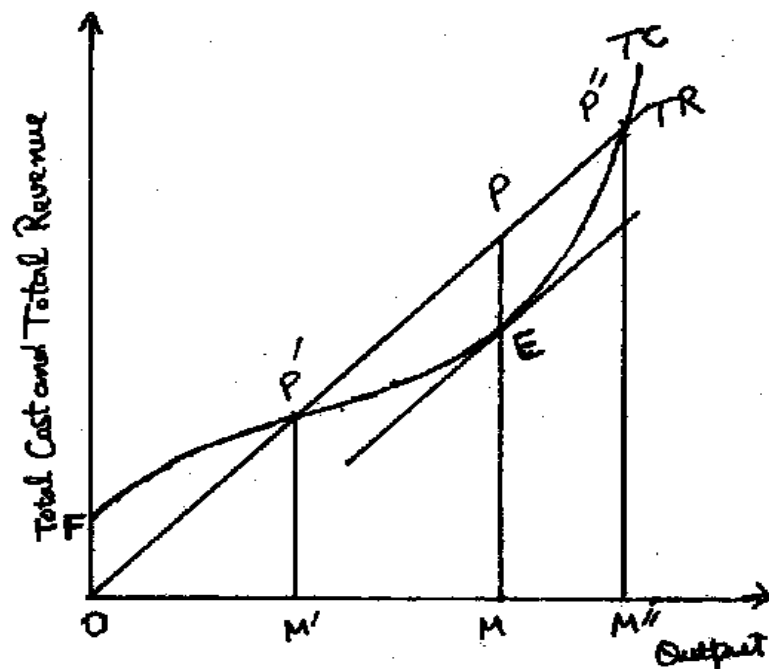


Fig. 4.1 : Equilibrium of a Firm

A general case of this equilibrium of the firm, in the short run and under perfect competition, is illustrated in Fig 4.1. The quantity of output is measured along X-axis while cost and revenue are measured along Y-axis.

In perfect competition, the price of the product is given and does not vary with the quantity produced and supplied by the firm. Accordingly, the curve representing total revenue (TR) is a straight line which starts from the origin O. Its slope is positive and equal to the price of the product (average revenue, AR, of the firm).

In the short run, a firm has to incur both fixed and variable costs. Fixed costs are there even when the output is reduced to zero. As a result, total cost (TC) curve starts from Y-axis at a positive distance from origin O. Assuming that fixed costs are OF, the TC curve starts from point F on the Y-axis. Recalling the application of law of variable proportions, we note that TC curve will not be a straight line. It will correspond to the three phases of the law of variable proportions. To begin with it will rise at a decreasing rate till point P' where the phase of increasing returns gives place to that of constant returns. At this stage, it intersects TR curve and lies below it. However, from point P' onwards, the TC curve rises at an increasing rate on account of the phase of diminishing return. It eventually intersects TR curve from below at point P'' and lies above the latter if output is increased. In between, for output OM the vertical distance between TR and TC curves is the maximum. While TR is PM, TC is EM and the firm makes a total profit of PE. Thus, OM is the equilibrium output of the firm in the short run under perfect competition. At any other output, its total profit is less than PE. It is also noted that if the output is reduced to OM' or increased to OM'', the profit of the firm is reduced to zero. Further, for output less than OM' or greater

than OM", TC exceeds TR and results in a loss for the firm.

The conditions of profit maximisation (or loss minimisation) can be translated into what are known as marginal conditions. Thus profit

$$\pi = TR - TC$$

is maximised if

- (i) its first derivative is zero, and
- (ii) second derivative is negative.

Differentiating $\pi = TR - TC$ with respect to quantity of output, Q, we get

$$\frac{d\pi}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ}$$

so that when $\frac{d\pi}{dQ} = 0$,

$$\frac{dTR}{dQ} - \frac{dTC}{dQ} = 0$$

or $MR = MC$

This is the first marginal condition. Similarly, the second marginal condition is given by :

$$\frac{d^2\pi}{dQ^2} < 0.$$

Graphically, this condition states that for equilibrium of the firm, MC curve should intersect MR curve from below and, after intersection, lie above MR curve. If we translate this condition in ordinary words, it means the following. The firm should keep on adding to its output so long as $MR > MC$ because additional output adds more to its revenue than to its cost and thus its profit income increases. Furthermore, if its MC is equal to MR but the firm finds that by adding to its output, MC becomes smaller than MR (that is, MC curve dips below MR curve), then the firm should decide to increase its output. By doing so, it will add more to its revenue than to its cost and its profit income will increase.

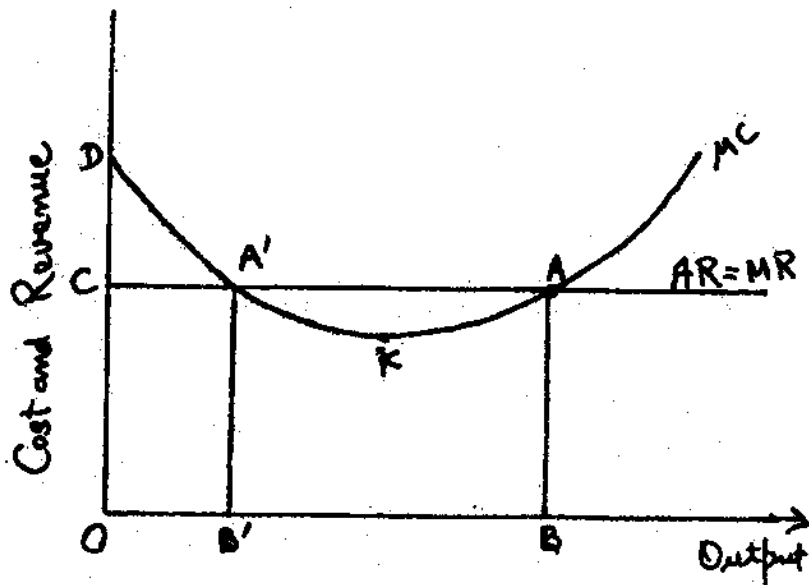


Fig. 4.2 : Equilibrium of a Firm : MC and MR Curves

A graphic illustration of the two marginal conditions for equilibrium of the firm under perfect competition is provided in Fig. 4.2. In this Fig, as before, quantity of output is measured along X-axis and MR and MC are measured along Y-axis. Because of perfect competition, the firm is a price taker. Therefore, the price of the product is not affected by the quantity of output of the firm. The demand curve (which is the same as the AR curve for the firm) runs parallel to X-axis. The non-variability of AR implies that, with changing output, MR also remains constant and is always equal to AR. As a result, MR curve coincides with AR curve throughout its length.

In Fig. 4.2, MC curve is U-shaped because of the fact that AC curve happens to be U-shaped. It starts from point D on Y-axis, slopes downwards till point K and then rises again. In its downward sloping portion, it intersects MR curve at A' and in the upward sloping phase at point A. However, point A' does not describe an equilibrium position of the firm. At this point, the first marginal condition is satisfied but not the second. The firm finds that if it expands its output beyond OB', there is a smaller addition to its total cost than to its total revenue. This is indicated by the fact that, to the right of A', MC curve lies below MR curve. However, if we consider the second point of intersection of MC curve with MR curve, (that is, point A), then second condition of equilibrium is also satisfied. To the right of point A (that is, for output greater than OB), MC curve lies above MR curve. It should also be noted that if the firm produces OB', its total cost would be OCDA'B' as against total revenue of OCA'B', resulting in a net loss of CDA'. In contrast, when the firm produces OB, its total cost is given by ODA'KAB and its total revenue is given by OCA'AB. Assuming that 'normal profit' of the firm is part of its costs, the firm does not earn any abnormal profit or incur any loss when it produces OB.

We shall now consider the equilibrium of the firm under perfect competition in different markets classified on the basis of time periods. *It should be remembered*

that in all these cases, the demand curve (that is, the AR curve) of the firm runs parallel to X-axis and MR curve coincides with it throughout its length.

Day-to-Day Market Period

This time period is also referred to as Day-to-Day Period or simply Market Period. It is that interval of time within which the firm is not able to alter its supply by replenishing it through additional production. It can only sell what it has in stock. In other words, the total supply of the firm is limited by stock held by it. Given the existing stock, of course, it has the choice to sell its entire stock, a part of it, or nothing at all. It bases its decision upon the demand conditions and other relevant factors. Normally, it has a "reserve" price below which it is not ready to sell even a single unit of its product. The quantity offered for sale increases with the price offered by the buyers. And at some 'high enough' price, the firm is ready to sell its entire stock. It need not be emphasised that the firm chooses its reserve price with reference to factors like the perishability of the good, the cost of its storage, its expected price in future and so on.

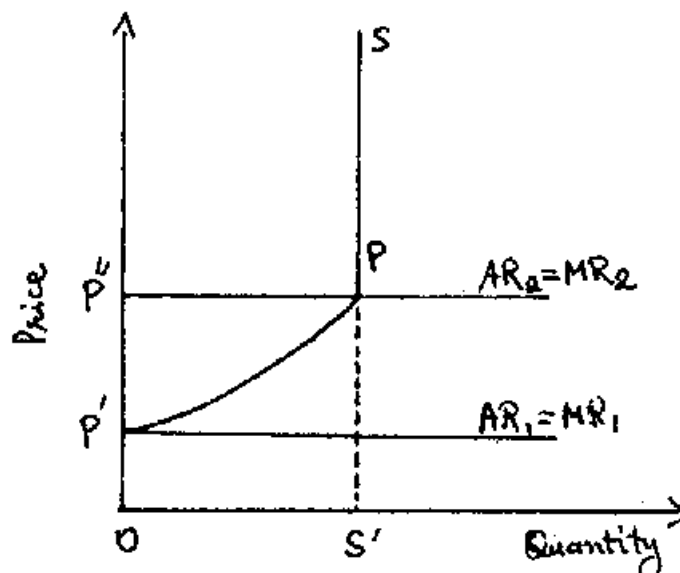


Fig. 4.3 : Perfect Competition, Equilibrium of a Firm in Day-to-Day Market Period

The determination of equilibrium of a firm, producing and selling good G, under day to day market period and under perfect competition is illustrated in Fig. 4.3. The firm has a total stock of OS' so that the quantity of supply offered by it cannot cross the boundary SS' . Further, OP' is the reserve price of the firm and it does not sell any quantity of goods G unless the price is OP' or higher. It is ready to sell its entire stock if the offered price rises to $OP'' (= PS')$. Further, if the price offered exceeds PS' , supply of the firm cannot respond to it. From point P onwards, its supply curve runs parallel to Y-axis. In other words, the firm's supply curve is $P'PS$. Thus, in day to day market period, the supply of the firm can vary between a minimum of zero for a price of OP' , to a maximum of OS' for a price of PS' (or higher). It should also be

remembered that the price of the good G is determined by the interaction between demand and supply forces at the level of the industry as a whole and it is given for the individual firm under consideration.

Short Term Normal Period

This period is defined as that time interval during which the firm is stuck with some fixed inputs. It has a given plant with a given range of output and it can produce and sell only within that range. It can thus vary its supply quantity with the following constraints:

- (i) The firm has the option not to produce any quantity of good G.
- (ii) In case, the firm does produce good G, its minimum quantity is given by the lower end of the output-range of the plant.
- (iii) The output can be increased further, but not beyond the upper end of the output-range.

On account of perfect competition, the demand for the product of the firm is perfectly elastic. The firm can sell all its output at the going price in the market. Accordingly, its demand curve (AR curve) runs parallel to X-axis throughout its length and its MR curve coincides with AR curve.

As regards the supply side, we should recall the set of four cost curves of the firm, namely, the AFC, the AVC, the MC and the ATC. Out of these, the supply curve of the firm is that portion of the MC curve which lies above AVC curve and is upward sloping. The actual equilibrium of the firm is determined by the intersection of its supply and demand curves. An explanation of this phenomenon is provided below.

To begin with we note that, in the short run, the firm cannot avoid fixed costs. They have to be incurred even if production is reduced to zero. However, the variable costs are directly related to the quantity of output. The implication is that, in the short run, the firm cannot avoid losses by not producing. Therefore, it decides to continue production even at a loss, provided the loss does not exceed its fixed costs. It means that the firm would decide to produce if its average price (that is, per unit price of the good) equals or exceeds its AVC.

On account of the law of variable proportions, the average variable cost curve is U-shaped. Let us also recall that marginal cost represents a change in the total cost so that it is related only to the variable costs and not fixed costs. And since AVC curve is U-shaped, MC curve is also U-shaped. It lies below AVC curve when the latter is downward sloping. However, MC curve starts rising when the rate of fall in AVC curves slows down, intersects it at its lowest point, and rises above it.

We have also seen above that a firm attains its best possible position (that is, the position of maximum profit or minimum loss) when its MC curve cuts its MR curve from below. At the same time, price per unit of the product must be able to recover at least the average variable cost. When the price exceeds AVC, the firm is able to recover a part of its fixed costs also with a resultant reduction in its losses. In case the price equals the average of total cost, the firm is able to recover its full costs (including the component of 'normal profit'). And if the price is still higher, it earns an abnormal profit.

Thus, in determination of short term equilibrium of the firm, two conditions should be satisfied :

- (i) MR must equal MC and cut it from below; and
- (ii) AR must equal or exceed AVC.

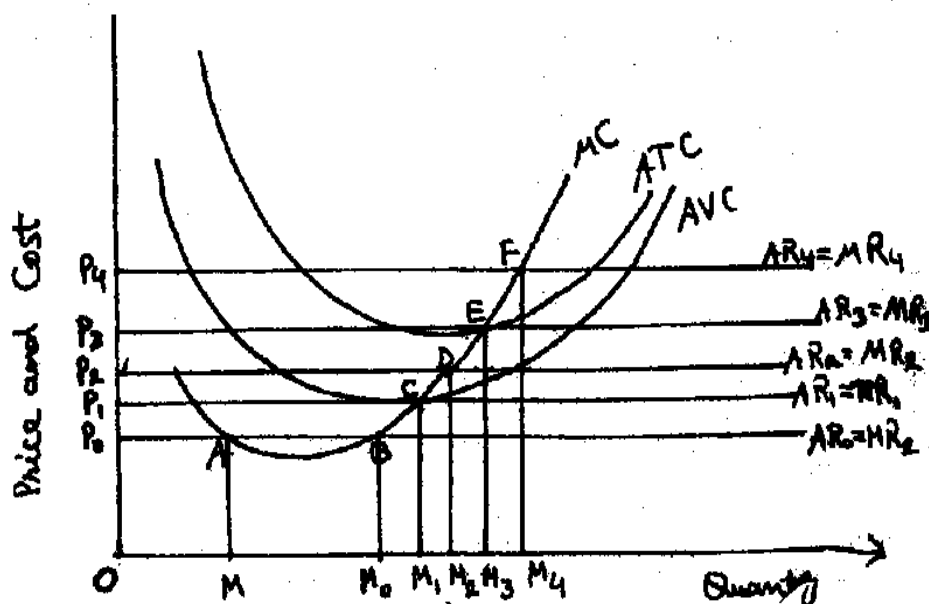


Fig. 4.4 : Perfect Competition, Equilibrium of a Firm in Short Run

In Fig 4.4, we consider five different prices to illustrate the supply behaviour and associated equilibrium of the firm. There is an average revenue curve corresponding to each price. It runs parallel to X-axis and the MR curve also coincides with it.

- (i) When the price is OP_0 , the corresponding MR_0 curve cuts MC curve at two points, A and B. At point A, none of the above-stated two conditions of equilibrium is satisfied. At point B, MC curve cuts MR_0 curve from below but the second condition is not satisfied. AR is still less than AVC. Therefore, the firm incurs a loss greater than its fixed cost if it decides to produce when the price is OP_0 . The firm, therefore, decides to close down but it cannot leave the industry.
- (ii) If the price happens to be higher and equal to OP_1 (that is, equal to the least possible average variable cost), the firm decides to produce. In this case, not only MC curve cuts MR_1 curve from below (a point C), AR_1 is also equal to AVC. Thus, we find that either the firm does not produce at all, or it produces at least equal to OM_1 .
- (iii) In the third case, price (OP_2) exceeds AVC but is still less than ATC. MR_2 and MC curves intersect each other at point D. The firm produces OM_2 . It still

incurs a loss but less than its fixed costs because it is able to recover a portion of the latter.

- (iv) In case the price rises to OP_3 , the firm is able to recover its full cost including fixed costs. Its MC curve cuts MR_3 curve from below at point E and $AR_3 = ATC$. All the conditions of its equilibrium are satisfied. It produces OM_3 .
- (v) If the price rises even further, say, P_4 , the point of intersection of MR_4 and MC curves moves to F. The firm is able to recover not only its total cost but is able to earn an abnormal profit also. It produces OM_4 .

It should be noted that in the short run, existing firms can close down but they cannot leave the industry and new ones cannot enter it. Therefore, when our firm is incurring a loss, it continues production so long its losses do not exceed fixed costs. Similarly, if it earns an abnormal profit, they are not wiped out by new firms entering the industry.

Long Run Normal Period

Long term is defined as that period in which the firm has the opportunity of varying all its inputs. There are no fixed costs and therefore, average fixed cost curve vanishes. The average cost (AC) curve denotes average total cost (ATC) curve. More precisely, in the long run, the firm can decide to go in for any of the alternative plants of different scales. We have seen earlier that in the long run, the average cost (AC or LRAC) curve of the firm formed by its short run average cost curves (that is, plant curves) is also U-shaped. Up to a certain scale, there are increasing returns and LRAC curve slopes downwards. This is followed by the phase of constant returns in which LRAC curve is neither rising nor falling. And the third phase is that of diminishing returns to scale in which LRAC curve slopes upwards. We have also seen that corresponding to the U-shaped LRAC curve, long term marginal cost (LRMC) curve is also U-shaped and that it cuts LRAC from below at the lowest point of the latter.

Since the firm can vary all its inputs in the long run, it follows that it has the option to close down and leave the industry. Similarly, new firms can also enter the industry. This condition, termed 'free entry and exit of firms' has two implications.

- The firm is not compelled to operate when incurring a loss. It can leave the industry.
- No firm is able to earn an abnormal profit (that is, a profit in excess of the 'normal' one). It can only earn 'normal profit' which forms a part of its costs and is incorporated in its LRAC curve. This happens because abnormal profit earned by existing firms attracts new firms. And as they enter the industry, supply increases, price comes down and abnormal profit is wiped out.

At this stage, let us specifically note that two conditions have to be satisfied for the firm to be in long run equilibrium.

- (i) MC curve must intersect MR curve from below.
- (ii) $AR \geq AC$, so that the firm does not incur a loss and close down. In practice, however, on account of free entry and exit of firms, AR cannot exceed AC and is equal to the latter.

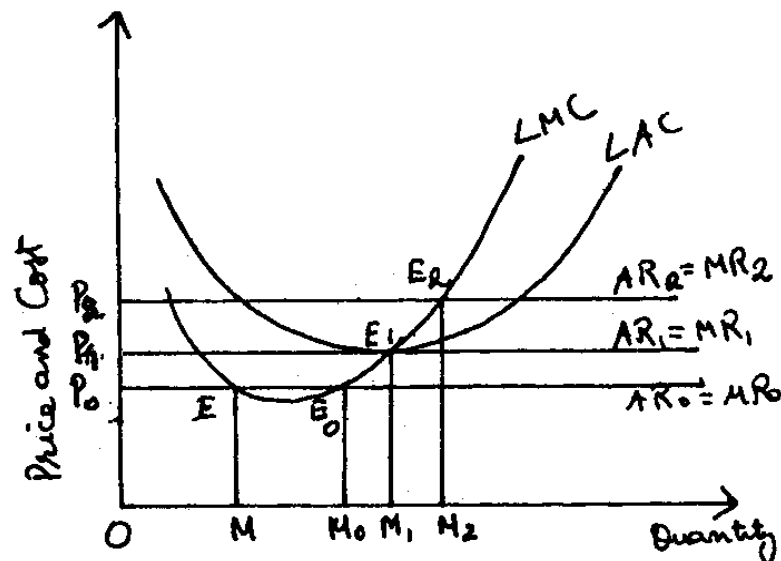


Fig. 4.5 : Perfect Competition. Long Run Equilibrium of a Firm

Determination of long run equilibrium of the firm under perfect competition is explained in Fig. 4.5 in which output is measured along X-axis and costs are measured along Y-axis. The firm is a price taker. For it the price of its product is given and fixed. It can sell any quantity it can produce at the going price. Its AR curve runs parallel to X-axis and MR curve coincides with it.

For the purpose of explaining the determination of firm's equilibrium, we are considering three alternative prices given to the firm by the industry.

- (i) Let us assume that the price in the market is below the optimum cost of the firm, say, OP_0 from which we get corresponding average revenue (AR_0) and marginal revenue (MR_0) curves. Now MR_0 curve cuts LMC curve at two points, E and E_0 , but none of these is a long term equilibrium position of the firm. At point E, LMC curve cuts MR_0 curve from above. At E_0 , LMC curve cuts MR_0 curve from below, but the second condition of equilibrium is not satisfied. $AR_0 < LAC$ and the firm incurs a loss.
- (ii) Similarly, if the price of the firm's product is more than the optimum cost (least possible average cost) of the firm, the firm cannot be in stable equilibrium (even though both conditions of equilibrium are satisfied). Thus, let the price be OP_2 with average revenue curve (AR_2) and marginal revenue curve (MR_2). LMC curve is intersecting MR_2 curve from below at point E_2 and $AR_2 > LAC$. But the firm is not allowed to enjoy the abnormal profit. New firm enter the industry, supply increases and price falls till no firm can earn abnormal profit.
- (iii) Long run stable equilibrium of the firm is attained when price of the product is equal to its optimum cost of production. In Fig. 4.5, this equilibrium price is OP_1 . In this case, marginal revenue curve (MR_1) cuts

LMC curve from below at lowest point of LAC (E_1). At the same time, AR_1 is equal to LAC, so that the firm does not incur a loss or earn an abnormal profit. At this stage, there is no incentive for existing firms to leave the industry or new ones to join it. The corresponding equilibrium output is OM_1 .

In conclusion, we may also note that in long run equilibrium, the firm produces an 'optimum' output at the least possible average cost. It is this position where the firm is operating under 'constant returns' to scale. Consequently, its $MC = AC$. At the same time, $MC = MR$ and $AR = AC$, so that we get

$$AC = AR = MC = MR$$

EQUILIBRIUM OF INDUSTRY UNDER PERFECT COMPETITION

An industry comprises all the firms which are producing goods which the buyers consider substitutes of each other. As such, the determination of price of such a product is the result of interaction between total demand for the output of all the firms taken together and their supply.

On the demand side, the important fact to be noted is that a change in its supply affects the price of the product also. The industry is not a price taker. Though the contribution of an individual firm in total supply is so insignificant that it cannot make any noticeable difference to the price of the product, this is not so with the industry. The change in supply made by the firms taken together alters the aggregate supply to such an extent that it cannot sell more without lowering the price. This results in a downward sloping demand curve for the industry.

The fact of a negatively sloped demand curve for the industry can also be understood as follows. A firm can sell more of its output by attracting customers from its competing firms. In the process, the total sales of the industry need not increase. But an industry can sell more when the existing buyers buy more of its product and/or new buyers enter the market and buy its product. Now it follows that existing buyers are already equating their marginal utility with the price. They would buy more only if price falls. Similarly, for the new buyers, the existing price is higher than the marginal utility of the product. And, therefore, they would also buy more of the good only if the price is reduced. Accordingly, the demand curve for the product of the firm must have a negative slope indicating that more of the product can be sold only by reducing its price.

The exact location and slope of the demand curve varies from product to product and also for the same product from one time interval to the other. There can also be several reasons on account of which its demand curve may shift in its slope and location. However, there is no theoretical basis for predicting these changes. Therefore, even while recognising that demand curve for a product can and often does shift over time, the economists assume that it retains its position when we move from short term to long term. In other words, demand curve for the industry is always drawn with a negative slope without specifically providing for a change in either its exact slope or its exact location.

Short Term Equilibrium of Industry

We have noted above that when an industry changes the quantity of its supply,

there is a corresponding change in the price of its product also. It follows, therefore, that when it is in equilibrium, there is no tendency on its part to change the quantity of its output. We also know that the price of the industry's product is determined by intersection of its demand and supply curves.

Having seen the nature of industry's demand curve, we may look into the nature of its supply curve which is obviously the summation of individual supply curves of the firms constituting it. That is to say, we get the industry's supply curve by adding the quantities which its firms are ready to sell at alternative prices. Since the supply curve of a firm, in the short run, is that upward sloping portion of its marginal cost curve which lies above its average variable cost curve, therefore, the supply curve of the industry also is upward sloping.

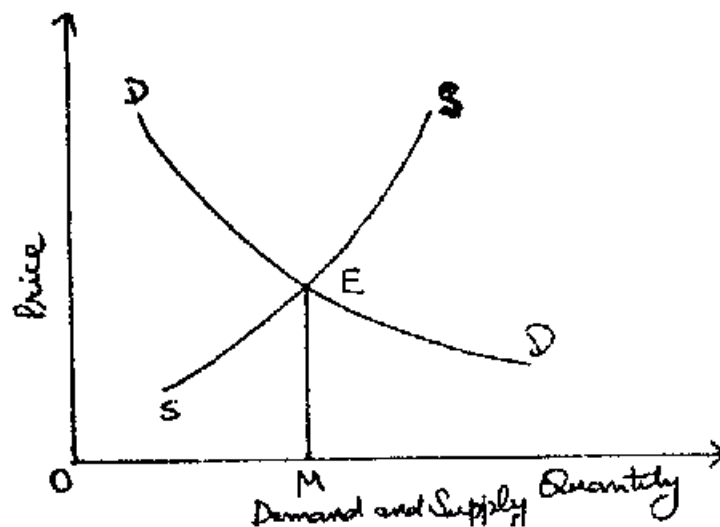


Fig. 4.6 : Perfect Competition : Equilibrium of Industry in the Short Run

Short term equilibrium of the industry, which is determined by the intersection of its demand and supply curves is illustrated in Fig. 4.6., in which quantities demanded and supplied are measured along X-axis and price per unit is measured along Y-axis. While the demand curve is downward sloping, the supply curve has a positive slope. In Fig. 4.6, short term demand and supply curves of the industry intersect at point E. The equilibrium price and output of the industry are, therefore, EM And OM respectively. It is noteworthy that in case the industry happens to be in a non-equilibrium position, it automatically gets adjusted to its equilibrium position This is because, in such a case, there is either an excess of supply or an excess of demand at the existing price. In case of excess supply, the firms are left with unsold stocks which they try to dispose off by reducing price. And in case of excess demand, some customers are not able to buy the quantities they wanted to. They, therefore, bid up price in competition with each other.

Long Term Equilibrium of Industry

The slope of the demand curve of industry remains negative even in the long run,

implying that it can sell more of the product only by reducing the price and vice versa.

However, the long run supply curve of the industry cannot be derived by horizontal summation of the supply curves of the individual firms. The reason is that in the long run, existing firms can leave the industry and new ones can join it. Moreover, it is possible that due to various reasons, the industry may suffer from some internal/external diseconomies or enjoy some economies. These factors can shift the position of the long term supply curve of the industry. Another fact which complicates the derivation of long run supply curve of the industry is that while in the short run, individual firms may incur losses or enjoy abnormal profit income, in the long run, these possibilities tend to be wiped out. When the industry is in equilibrium, its individual firms are also simultaneously in such an equilibrium that they neither make an abnormal profit nor incur a loss.

Thus, long run supply curve of the industry is derived by taking into account all these determining variables. It is not derived by adding those portions of the MC curves of the individual firms which lie above the AC curves of the firms. Instead, it is the locus of the pairs of those points which represent quantities of its output and the least average cost at which its firms can produce it.

Economists believe that the factors at work in the long run may result in one of the three situations, namely, that of diminishing, constant, and increasing returns, indicating the shift in the average cost of its firms. These three cases are explained below.

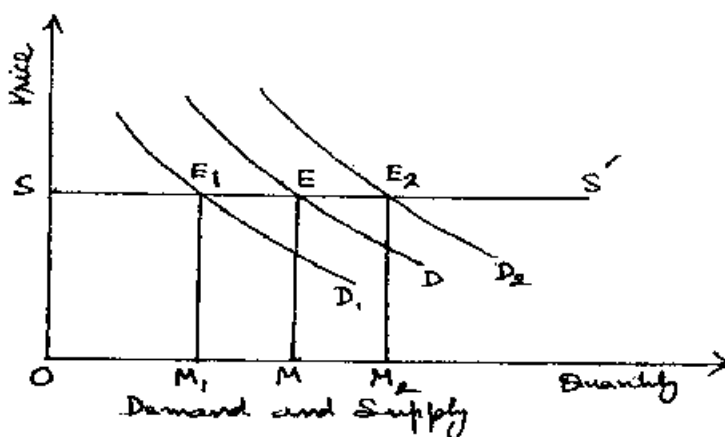


Fig. 4.7 :

Perfect Competition. Long Run Equilibrium of Industry under Constant Returns

Constant Returns

In this case, the expansion of the industry does not lead to net economies or diseconomies. They are either not there or they get neutralised by each other. As a result, the average cost of the industry as a whole remains constant as it expands. Its demand curve is downward sloping and its supply curve is parallel to X-axis. It means that while the quantity demanded responds, to a limited extent, to a change in price of the product, the elasticity of supply is perfect. The industry curtails its supply to zero if the price offered is reduced even by a small margin. On the other hand, at the going

price, it is ready to sell as much as the buyers are ready to buy .

In Fig. 4.7, the supply curve of the industry is SS' and its demand curve is DD_1 . The two intersect at point E_1 with OM_1 and E_1M_1 as equilibrium output and price respectively. At the same time, all the firms of the industry are also at equilibrium such that for each firm, its $MC = MR = AC = AR$ and it operates at the least possible average cost. As a result, there is no incentive for any firm to leave the industry or enter it.

Fig. 4.7 also depicts the alternative equilibrium position if demand curve happens to be differently located. It is seen that shifting of the demand curve does not result in a change in price. It only results in a change in the quantity of supply.

Diminishing Returns

Let us assume that when existing firms of an industry expand their output, their average cost of production increases. Similarly, let us assume that if new firms enter the industry, they also face higher average product cost. This implies that the expansion of the industry generates more diseconomies than economies and the net result is an increase in the average cost of production. The supply curve of the industry, therefore, slopes upwards and implies that the industry will be ready to sell more only if the price offered increases.

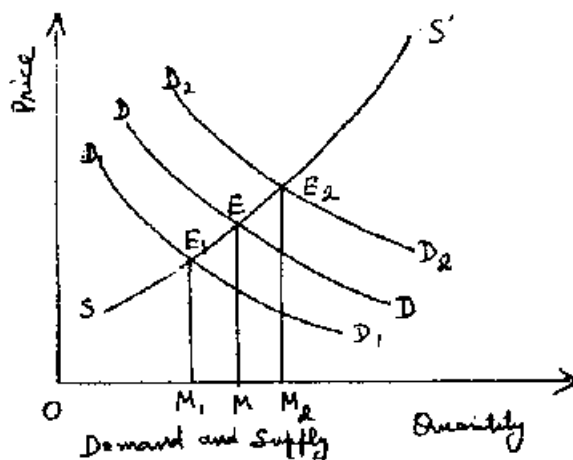


Fig. 4.8 : Perfect Competition. Long Run Equilibrium of Industry under Diminishing Returns

The demand curve of the industry is downward sloping in this case also. And its equilibrium is determined by the intersection of demand and supply curves. Diagrammatic illustration of determination of this equilibrium is given in Fig. 4.8, in which the demand and supply curves intersect at point E . The corresponding equilibrium price and supply happen to be EM and OM respectively. If there is an increase in demand so that the demand curve shifts to the position D_2D_2 , there is an increase in both price and quantity of output. In contrast, if the demand decreases and the demand curve shifts to the position D_1D_1 , there is a reduction in both price and quantity of supply.

Increasing Returns

In this case, the average cost of production of the industry declines with its expansion and its supply curve has a negative slope. Some analysts claim that the very possibility of increasing returns is ruled out in a competitive industry. They say that it is logically contradictory to maintain that an industry can have increasing returns when its firms are facing diminishing returns. The critics point out that individual firms have U-shaped average cost curves even in the long run. As a result, when existing firms expand their output, their average cost is bound to increase, at least beyond a stage. It means that when an industry expands its output beyond a certain quantity, it is bound to face an increase in average cost of production.

Marshall's answer to the critics lies in his distinction between the effect on average cost of production when the expansion takes place in the industry as a whole instead of only in an individual firm. He maintained that it is possible that when a single firm expands it faces diminishing returns, but if all the firms expand simultaneously, there are increasing returns due to several economies that arise on account of their collective expansion. In other words, even when expansion of each individual firm results in an increase in its average cost of production, an expansion by the industry as a whole can still generate a variety of economies which are internal to the industry but external to the individual firms. For example, the expansion of the industry may cause an expansion in the industries supplying its inputs. This may lead to better quality and/or lower prices of certain inputs and other services etc. The industry may also find that, with an expansion in its size, adoption of certain technologies which were hitherto too expensive becomes economical. Several new specialised and technically efficient services (such as those of transport and repair works) may become available. As a result, while an individual firm continues facing diminishing returns, for the industry as a whole average cost may fall with expansion.

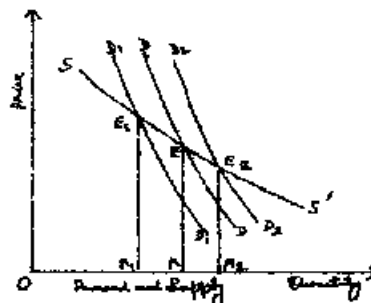


Fig. 4.9 : Perfect Competition. Long Run Equilibrium of Industry under Increasing Returns

In Fig. 4.9, the supply curve of the industry SS' is negatively sloped depicting increasing returns. The demand curve, DD , is also negatively sloped, and the two intersect each other at E . It is noteworthy that for a stable equilibrium, it is necessary that after the point of intersection, demand curve lies below supply curve. It means that though the average cost of production falls with an increase in output, the price at which additional output can be sold falls still faster. In Fig. 4.9, this condition of stable equilibrium is satisfied. The industry produces an output of OM and sells it at a price of EM per unit.

It should be noted that when the industry is operating under increasing returns, an increase in the demand for its product will lead to an increase in quantity supplied but a fall in price. For example, in Fig. 4.9, with an increase in demand, the demand curve shifts from position DD to D_2D_2 . This results in a new equilibrium position represented by point E_2 and a fall in price from EM to E_2M_2). In contrast, if there is a reduction in demand, the buyers will have to pay a higher price for a smaller output. For example, if the decrease in demand shifts the demand curve from DD to D_1D_1 , output will fall from OM to OM_1 and the price will increase from EM to E_1M_1 .

MONOPOLY

The term monopoly means a single seller. In economics, this term refers to a firm the product of which has no close substitute in the market. It is, in that sense, a single-firm industry. Moreover, irrespective of the profit income of the existing producer firm, new firms cannot enter the industry. Hurdles to their entry may be on account of various reasons. There may be legal barriers, or the producer may own a technology or a naturally occurring substance which others cannot avail of. It is also possible that the size of the market may be too small and no new firm may find it economically worthwhile to enter it.

In the absence of a substitute product, the monopolist is free to fix a price of his choice. He can refuse to sell his product for a price below the one decided by him. However, he cannot determine the demand for his product. He cannot force the buyers to buy his product at a price of his choice. A buyer will buy it only if its price does not exceed its marginal utility to him. Therefore, if the monopolist wants to increase his sales, he has to reduce the price of his product so as to induce

- existing buyers to buy more and
- new buyers to enter the market.

Therefore, the demand conditions for his product are not the ones which are associated with a firm under competitive conditions. Instead, the demand conditions faced by him are similar to the ones which are faced by the industry as a whole. In other words, the monopolist faces a negatively sloped demand curve for his product. In the long run, the demand curve can shift both in its slope and location. However, there is no theoretical basis for determining the direction and extent of this shift.

As regards his cost of production, it may be assumed that the monopolist faces a given technology. Moreover, the monopolist faces conditions similar to those faced by a single firm under competitive conditions. He is not the sole buyer of the inputs used by his firm, but only one in the entire market. He has no control over the prices of the inputs used by him.

We have seen earlier that when a firm aims at maximising its profit, it attains its equilibrium when

- its MC curve cuts its MR curve from below; and
- its $AR = AC$.

Short term Equilibrium-Price and Output Determination

In the short run, by definition, the monopolist firm cannot vary all its factors of production. Its short run cost curves are similar to the ones faced by a firm operating in the short run and under perfect competition. It is also noteworthy that, in the short run, the monopolist may incur a loss but it will shut down the plant only if the loss exceeds its fixed costs. On the other hand, if the demand for its product is quite strong, it may make an extra profit.

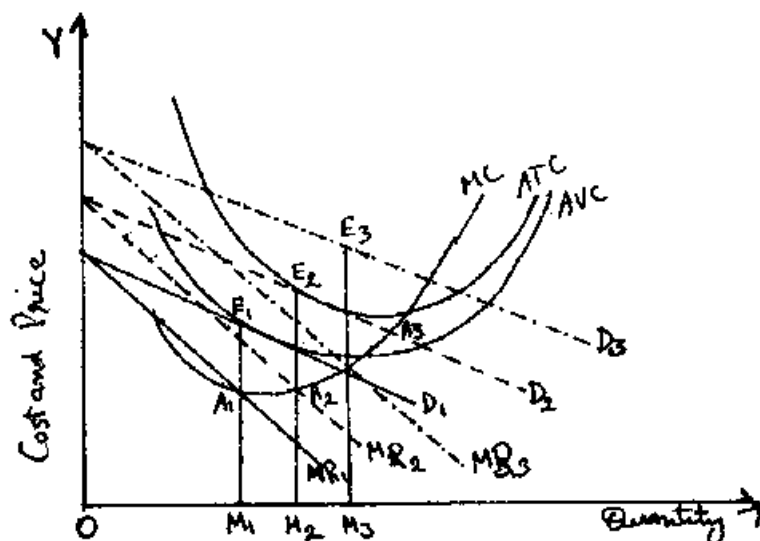


Fig. 4.10 : Short Term Equilibrium of a Monopolist

Determination of short run equilibrium of a monopoly is depicted in Fig. 4.10 with quantity of output measured along X-axis. Correspondingly, price and cost of production are measured along Y-axis. We have drawn three cost curves of the monopoly, namely, average variable cost curve, average total cost curve and marginal cost curve. Similarly, three alternative demand curves have been drawn to explain alternative possible positions of equilibrium.

1. Demand curve labelled D_1 is tangent to AVC curve at point E_1 . Its corresponding marginal cost curve MC intersects MR_1 curve from below at point A_1 . Thus, we note that while the first condition of equilibrium of the firm is satisfied, the monopolist is not able to recover his full cost of production. However, the loss which is equal to fixed costs, cannot be reduced by closing down the plant. In this situation, therefore, the monopolist decides to produce OM_1 quantity of output, sell it at price E_1M_1 and suffer a loss equal to fixed costs. Note that there would be no production if the demand curve lies to the left of its position of D_1 . In that case the monopolist would have added to his losses by operating his plant. Consequently, his best option would have been to close down the plant and minimise the loss to fixed costs.
2. If the demand curve lies to the right of D_1 , the monopolist is able to recover a part of his fixed cost also. He is able to recover his full cost of production if the demand curve happens to be tangent to ATC curve (such as D_2). With D_2 as the demand curve, equilibrium position of the monopolist is given by the

intersection of MC curve with MR_2 curve at A_2 which corresponds to the point of tangency (E_2) of D_2 with ATC curve. In this case not only MC curve cuts MR_2 curve from below but, at the same time, $AR = ATC$. The monopolist makes a normal profit by producing OM_2 and selling it at price E_2M_2 .

3. The monopolist may earn an abnormal profit if the demand curve lies further to the right of D_2 (such as D_3). As before, the equilibrium position of the monopolist is determined with reference to the point of intersection between MC curve and MR_3 curve at A_3 . The monopolist decides to produce OM_3 and is able to sell it at price E_3M_3 .

Long Term Equilibrium-Price and Output Determination

In the long run, by definition, the monopolist can vary all the inputs. Therefore, the determination of equilibrium of the firm can be analysed with the help of only two cost curves, namely, AC and MC. Moreover, the monopolist would not stay in the market if he is to operate at a loss. By implication, therefore, the demand curve must be tangent to the AC curve or must lie to the right and intersect it twice.

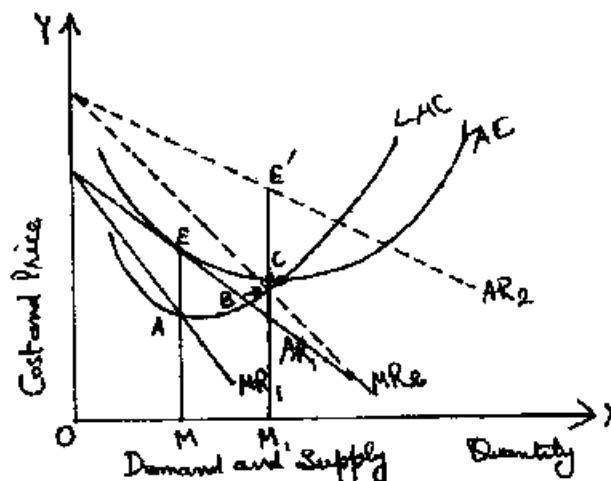


Fig. 4.11 : Long Term Equilibrium of a Monopolist

In Fig. 4.11, long term AC and MC curves of the monopolist are drawn U-shaped. The reasons for their being U-shaped have been discussed earlier. As before, equilibrium of the firm is that its MC curve should cut MR curve from below and its AR should be greater than or equal to AC. In Fig. 4.11, we depict two alternative cases of the determination of equilibrium of the monopolist, namely, (i) with normal profit, and (ii) with abnormal profit. Remember that the monopolist will not operate in the long run if there is a loss.

In the first case, demand curve (AR) of the monopolist is AR_1 and it is tangent to AC or LAC curve at point E. It should be noted that if demand curve lies to the left of AC curve, the monopoly is not able to recover its AC at any output and, therefore, it closes down and leaves the market. However, when AR curve is tangent to AC curve, the monopoly is able to recover its average cost (including normal profit) and is, therefore, ready to stay in the market and produce. Further, it should be noted that,

by the very nature of relationship between MR and AR on the one hand and between MC and AC on the other, (i) the perpendicular drawn from point E to X-axis, (ii) the MC curve and (iii) MR curve are concurrent (at point A). As a result, all the conditions of equilibrium of monopoly are satisfied. Thus, at point A, MC curve of the firm cuts MR curve from below. At the same time, AR is equal to AC at point E. Accordingly, the monopoly produces OM and sells it at a price EM per unit which covers its average cost including normal profit.

In the second case, the monopolist is able to make an abnormal profit. Its marginal revenue curve is MR_2 which cuts its MC curve from below at point B. The corresponding height of its average revenue curve (AR_2) is M'. Accordingly, the monopolist produces OM' and is able to sell it at E'M' per unit with an extra profit of E'C per unit. Moreover, this extra profit is not competed away because there is no substitute good in the market and no new firm can enter the market and produce it.

DISCRIMINATING MONOPOLY

Since a monopolist can fix the price of his product, it is possible that he may find it profitable not to charge a uniform price for his entire output but sell it at varying prices. The term used to denote this phenomenon is 'price discrimination' and the monopoly practising it known as 'discriminating monopoly'. Thus, price discrimination is the absence of a policy of uniform price for the entire output. Instead, the monopolist sells portions of it at two or more prices. And this happens even when the product is homogeneous and one unit of it cannot be distinguished from the other. Professor Pigou mentions three types of price discrimination.

- (i) The monopolist may charge a separate price for each unit sold by him. This is known as the price discrimination of first degree.
- (ii) The monopolist may sell his output in 'batches' or 'lots', charging a separate price for each batch or lot. This is known as price discrimination of second degree.
- (iii) The monopolist may split up the market for his product on the basis of the buyers. He may divide buyers into two or more categories and charge from each category a different price. This is known as price discrimination of third degree.

Reasons for Price Discrimination

There are three main reasons for price discrimination viz.

The monopolist is aware of consumer ignorance for the cost of product due to lack of knowledge and communication of proper information.

In rendering professional services or personal services discriminating price can be charged by a monopolist from different customers. A doctor specialist having monopoly in his professional specialisation can charge higher fee from rich and lesser fee from poor clients. Such discrimination is possible when the service rendered or commodities cannot be resold.

Price discrimination may be practised under the circumstances when cost difference might exist due to distance between one market or another, lower price in poorer market and higher prices in sophisticated market could be charged. Such

price discrimination occurs when firm's different markets are separated by distance or by national frontiers; cheaper commodity in one market may not be resold at dearer markets because of excessive cost of transportation.

Price and Output Determination under Price Discrimination

Profit maximisation is the basic objective before a discriminating monopolist. For this purpose, he would like to avail of every opportunity what is available to any ordinary monopolist. The basic rule according to W.J. Baumol which he has to follow is that marginal revenue in all the markets where he is practising discrimination should be similar. Monopolist can allocate his product in different markets on the basis of available MR from the best combination. The total market shows the aggregate AR and MR and the profit maximising output of OQ. The optimum level of output for the firm is determined at OQ since at this level of output $MR = MC$. The whole output OQ cannot be profitably sold in one market because of the limited size of market. Therefore, the monopolist must allocate output OQ between two markets i.e. X and Y in such proportion that the necessary condition of profit maximisation is satisfied i.e. in both markets i.e. $MC = MR_x = MR_y$. The price and output in each market is determined by the intersection of the aggregate marginal cost curve and the specific marginal revenue curve. In market X the price charged is P_x which is higher than P_y in market Y. P_x is higher because the demand in market X is more inelastic than in market Y. Assuming that the costs are similar for each market, the supplier will make more profit in market X than in market Y. The total output of this monopolist is OQ which equals $OQ_x + OQ_y$. (See figure 4.12 to 4.14).

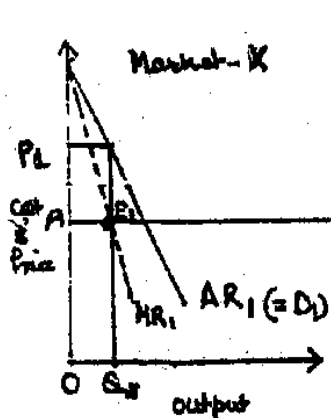


Fig. 4.12

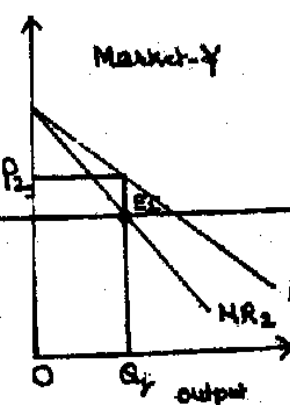


Fig. 4.13

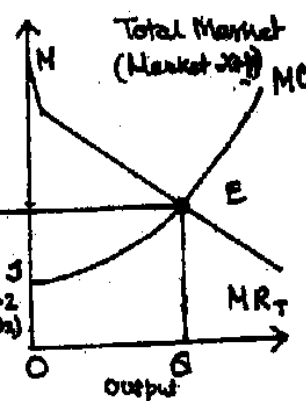


Fig. 4.14

For discriminating monopoly to be successful several conditions are needed to be fulfilled. Some of these conditions include the following :

- (a) at least two distinct markets with no seepage between them so that a higher price can be charged in one of the markets. If there was seepage then enterprising consumers could buy the goods in the lower priced market and then result it in the other market, perhaps undercutting the discriminating monopolist.

- (b) a market imperfection, such as transport costs, which gives the supplier a monopoly and thus keeps out competitors who might undercut him in his high price market.
- (c) different demand elasticities so that the monopolist can gain extra profit from his price discrimination.

MONOPOLISTIC COMPETITION

The types of market under which we discussed the determination of equilibrium of a firm/industry in the foregoing portions do not exist in reality. They are all hypothetical and only help us in analysing the real markets in a logical and systematic manner. The case of a monopolistic competition is one such market which we shall discuss below.

A monopolistic competition is defined as that market structure in which each seller produces a 'differentiated product'. The concept of product differentiation means that the product marketed by one seller can be distinguished from the products marketed by other sellers in some form or other. Some of the important methods of product differentiation include : trade marks, brand names, size, packing, or colour etc. of the item, and technical specifications, etc.

Thus, in this market structure, each seller is a monopolist of his differentiated product. The buyers can get it only from him and from none else. At the same time, however, the products offered by different sellers are close substitutes of each other. The buyers are always comparing the prices of their products together with the perceived 'quality' of each. In other words, there is also an intense competition between suppliers for a share in the market. For this reason, it is a market structure in which there is a competition between a group of firms while each firm is a monopolist of its own product. It is, therefore, termed as monopolistic competition.

However, defining a monopolistic competition in this manner, though very realistic, poses certain problems of its own.

- Since the products supplied by the competing firms are not homogeneous, therefore, we cannot define the concept of a 'market demand for the product' precisely, that is, it is not possible to determine the average revenue curve of the 'industry' as a whole.
- Not only that, it is very difficult to even define an industry in a precise manner for the reason that its constituent firms are not supplying the same product. At the most, we may think of a 'group' of firms selling close substitutes of each other.
- It is not possible to have a satisfactory definition of even a 'group'. This is because the 'product group' (such as scooters, or motor cycles) under consideration is itself in competition with other 'product groups'.

Given these limitations, let us mention some of the salient features of the monopolistic competition.

- (a) The first feature of monopolistic competition, as mentioned above, is product differentiation. A buyer can get a specific type of the 'product' only from one final source (may be, through the dealers and sub-dealers, etc.).
- (b) Product differentiation necessitates incurring of selling expenses on the part

of firms under market structure of monopolistic competition.

- (c) Monopolistic competition is characterised by a large number of sellers. The demand and supply conditions of these sellers are inter-dependent. However, in spite of their large number, no individual seller becomes a price taker. He has the authority to demand a price of his choice, though he also considers the demand conditions for his product while exercising this authority. In other words, in spite of there being a large number of sellers, the demand curve for the product of an individual seller is downward sloping. Its demand is not perfectly elastic.
- (d) The fact that each firm produces a 'differentiated product' implies that it can distinguish it further by varying its 'quality'. An improvement in the 'quality' implies an increase in its average cost of production while a deterioration in quality implies a reduction in average cost of production. Also an improvement in quality is expected to 'increase' the demand for the product so that, for each given quantity, the buyers are ready to pay a higher price.
- (e) The firms under the monopolistic competition face a competitive market as regards the inputs used by them. They also have to operate within a given technological range. The result is that no firm is able to compete out its rival by producing a 'better quality' product at a lower average cost.
- (f) It is assumed that each firm has an accurate knowledge of its demand and cost conditions. This feature implies that the firm is able to estimate the impact of any change in the quantity and/or quality of its product on both its cost of production and average revenue. This knowledge, therefore, enables the firm to maximise its expected profit income.
- (g) Every existing firm can leave the 'group' of firms belonging to the 'product group' (sometimes inaccurately called the industry). Similarly, new firms can enter the group and produce close substitutes of the existing products in the group. This free entry and exit of firms ensures that, in the long run, no firm incurs a loss and no firm is able to earn abnormal profit.
- (h) At the same time, every firm in monopolistic competition is assumed to pursue the goal of profit maximisation. Its aim is not to maximise sales proceeds, or an increase in the market share, etc.
- (i) It is also assumed that in monopolistic competition all firms have identical cost and demand conditions. This simplifying assumption helps us in analysing the determination of group equilibrium. It enables us to analyse the working of an individual firm and use it as the representative of the working of the entire group. In the absence of this assumption, we have to separately work out the determination of output, product quality, and price of each firm within the group.
- (j) Product differentiation necessitates incurring of selling expenses on the part of firm under the monopolistic competition.

Since product differentiation and selling expenses form the foundation of monopolistic competition, let us explain them a little further.

Product Differentiation

The concept of product differentiation covers all those criteria on the basis of which the product of one firm can be distinguished from that of the other. The differentiation may be or may not be real. A real differentiation refers to the technical features of the product, including its technical life and performance, durability, cost of

operation and maintenance, and the like. In contrast, a non-technical or imaginary differentiation may also be there. It may take the form of brand names, trade marks, packing, size, shape, and so on. The non-technical differentiation of a product aims at adding to its subjective appeal to the buyers so that they are induced to 'increase' its demand and are ready to pay more for it. In reality, however, the two forms of differentiation are so mixed up that it becomes nearly impossible to demarcate between the two.

However, irrespective of the nature of product differentiation, it is expected that its adoption by a firm would 'increase' its demand. It provides an opportunity to the firm to tell the buyers that the combination of 'product quality' and price offered by it is better than similar combinations offered by its competing firms. On this account, therefore, a firm under the monopolistic competition is not a price taker. The demand curve for its product develops an inverse relationship with the product price. The firm can raise the price of its product without losing all customers. And it has to lower the price if it wants to sell a larger quantity. In other words, the demand curve of each firm in monopolistic competition corresponds to that for the 'industry' as a whole, with the difference that it is comparatively more elastic. It is downward sloping and not parallel to X-axis.

It must also be recalled that, in monopolistic competition, the products of firms are close substitutes of each other. As a result, they have high positive cross elasticities. The market for the product of one firm is not clearly separated from the market segments occupied by the products of its rival firms. The firm under consideration can gain or lose a market share of its product both by its own price decisions and those of its rivals. In addition to this, the demand conditions for the product of a firm are affected by its own 'selling expenses', as also by the expenses incurred by its rivals.

Selling Expenses

This leads us to the consideration of the other basic feature of monopolistic competition, namely selling expenses. They are to be distinguished from the production expenses in the sense that the latter are incurred so as to 'produce' the product. In contrast, 'selling expenses' are all those outlays which are made in order to create and/or increase its demand. They are aimed at shifting the demand curve of the advertised product to the right so that the buyers should agree to pay more for a given quantity (or are ready to buy more at a given price).

Selling expenses may be incurred in several ways, though in each case, the objective of incurring them is to 'increase' the demand for the product under consideration. They not only include advertisement through different media, show rooms and selling campaigns, but also 'discounts' and 'incentives' to the dealers and customers. Furthermore, selling expenses may be informative and educative in the sense that they try to convince the customers, through 'informing' them of the 'benefits' of using the items being advertised, that they should buy this item in preference to something else. Similarly, some selling expenses are incurred to neutralise the perceived impact being created by the activities of the rival firms (or rival product groups). It is also possible that a firm may decide to adopt an aggressive posture and incur selling expenses to create a market for its product or capture a bigger share of the existing market of the 'product group'.

It should be noted that, under monopolistic competition, a major portion of selling expenses incurred in the economy is likely to be neutralising in its effect or it may

only encourage consumption expenditure at the cost of saving. Since, in the ultimate analysis, all selling expenses imply a resource cost for the economy, it is worth asking whether 'non-educative' competitive selling expenses are desirable.

As noted above, the forms of selling expenses are undergoing continuous changes over time. The options available to the advertisers have rapidly expanded with new media. 'Selling' or 'marketing' has acquired a professional dimension. Repetitive and expensive sales campaigns have become necessary for most firms for survival in the market.

It is generally agreed that the impact of selling expenses on demand for an item follows the law of variable proportions. That is to say, the average selling expenses per unit of sales exhibit the three phases of (i) increasing, (ii) constant, and (iii) diminishing returns in terms of addition of the quantity demanded on account of successive additions to selling expenses. This phenomenon is explained by pointing out that advertisement and other forms of selling expenses gain effectiveness only if they are incurred heavily and repeatedly. Moreover, an addition to the selling budget opens up more effective and wider options to the firm. However, the sources of these benefits tend to get exhausted as the size of selling budget is increased. The average selling cost curve (ASC curve) assumes a U-shape. However, given the selling budget of the firm, the average selling cost curve will be a rectangular hyperbola. It will be similar to the average fixed cost curve of the firm.

EQUILIBRIUM OF A FIRM UNDER MONOPOLISTIC COMPETITION

While analysing the determination of equilibrium of a firm under monopolistic competition, it should be noted that we can have two types of its demand curve. Both will be downward sloping.

- (i) It is assumed that a price revision by our firm is not associated by a retaliatory action by its rival firms. In this case, the demand curve of the firm under consideration will have smaller slope. The elasticity of demand for its product will be more elastic.
- (ii) In case, the rival firms follow the price revision by our firm, then the demand for its product will become less elastic. Our firm will have to resort to a bigger reduction in price to get a given addition in the demand for its product. Similarly, for a given fall in demand, it will be possible to raise the price by a higher amount. Its demand curve will be steeper in this case.

Short Term Equilibrium-Price and Output Determination

At this stage, we need not repeat the conditions of equilibrium of a firm. We may also recall that in the short run, the firm may be able to earn an abnormal profit if the demand for its product is quite strong. The abnormal profit is not competed away because in short run new firms cannot enter the 'group' and enhance the supply of the 'product group'. In other words, it is not possible for additional supplies of close substitutes to enter the market and reduce the absolute share of our firm. Similarly, it is also possible for it to operate at a loss subject to the condition that the loss should not exceed its fixed costs.

As in the case of other market structures, in monopolistic competition also a firm is faced with certain fixed costs in the short run. In addition to some production costs,

they may include some components of firm's selling expenses as well. Similarly, some other components of selling expenses can fall in the category of variable expenses.

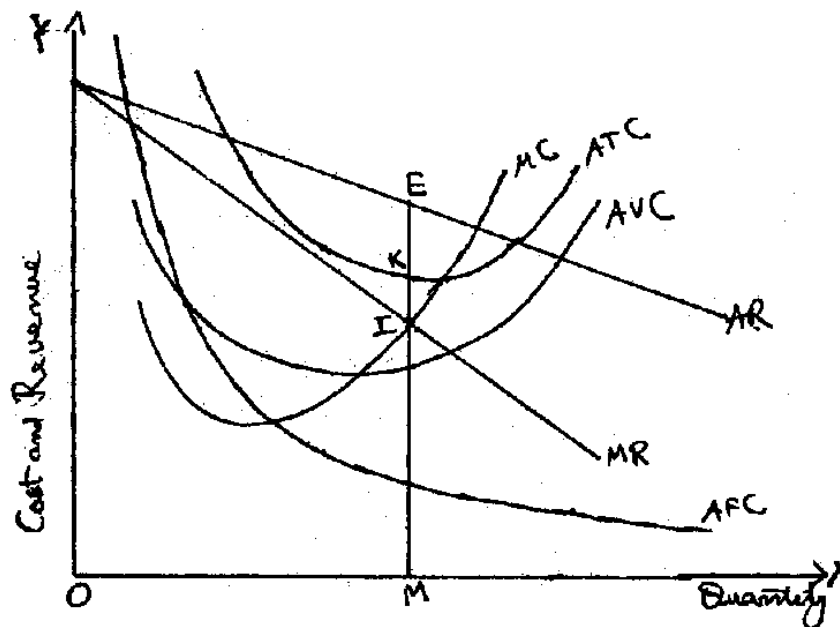


Fig. 4.15 : Monopolistic Competition Short Run Equilibrium

In Fig. 4.15, both AR and MR curve of the firm have negative slopes. AVC curve comprises not only variable production costs but also variable components of selling expenses. Both MC and AVC curves are expectedly U-shaped and the former cuts the latter at its lowest point. ATC curve represents average of the total cost of the firm, including fixed selling expenses.

Equilibrium of the firm is determined with reference to the point I where MC curve of the firm intersects its MR curve from below. The firm decides to produce a quantity of OM while it is able to charge a price of EM per unit. It should be noted that the firm is making an extra profit of EK per unit which is not competed out by the entry of rival firms. However, depending upon the relative location of cost and revenue curves, the firm could also be in equilibrium with

- only normal profit, or
- covering a part of fixed costs and therefore, incurring a loss less than its fixed costs, or
- a loss equal to total fixed costs.
- In the last case, the AR curve would be tangent to AVC curve.

Let us now consider the question of 'group equilibrium', that is, simultaneous equilibrium of all the firms in the group. We notice that the cost and demand

conditions of individual firms differ from each other. Moreover, they produce differentiated products so that it is not possible to derive the supply and demand curves for the group as a whole. Chamberlin overcomes this difficulty by making the 'uniformity assumption'. He assumes that all firms in the group have identical cost and demand conditions. As a result, when in equilibrium, all firms produce same quantities of their respective products and sell them at the same price. It is obvious that this is a highly unrealistic assumption. It was probably better to admit that we cannot talk of the concept of 'group equilibrium' and that we have to consider the determination of equilibrium of each firm individually.

Long Term Equilibrium-Price and Output Determination

In discussing long run equilibrium of a firm under monopolistic competition we should specifically note the following facts.

- In the long run, there are no fixed costs. The firm can not only vary all its inputs, it can also vary its selling costs. Moreover, it is possible for the firm to make a choice between alternative product qualities.
- No firm can be compelled to operate at a loss. It can always leave the industry. Therefore, when loss making firms leave the group, the absolute market shares of the remaining firms increase. Their demand curves shift rightwards and upwards. This process continues till it becomes possible for the remaining firms to produce without incurring a loss.
- Similarly, if the demand is strong so as to bring abnormal profit income to the existing firms, new firms can enter the 'product group', and produce close substitutes of the existing products. This increases the total supply of the 'product group' and with given demand, reduces the demand shares of the existing firms. As a result, the demand curve of an individual firm cannot stay above its long term average cost curve.
- Each firm operating under monopolistic competition is thus able to make a choice between alternative combinations of
 - (i) product quality,
 - (ii) product differentiation, and
 - (iii) selling costs.
- In addition, it must also take note of the fact that any variation of price on its part can lead to a price reaction by its rivals also. Conceptually, therefore, it faces a much steeper demand curve than would be case without price reaction by its rivals.

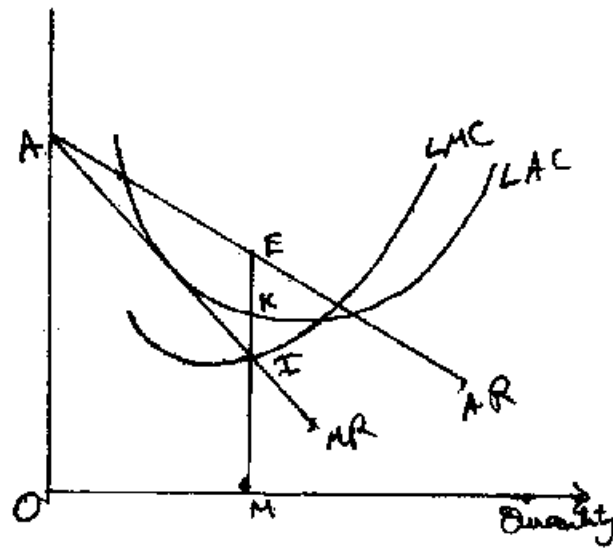


Fig. 4.16 : Monopolistic Competition. Long Run Equilibrium of Firm

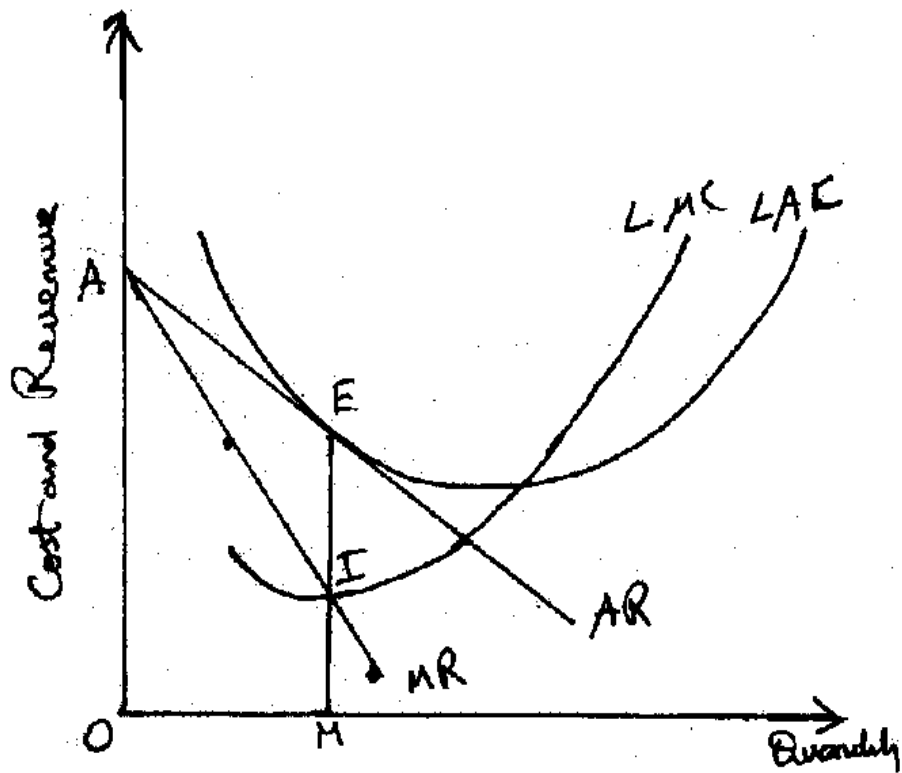


Fig. 4.17 : Monopolistic Competition. Long Run Equilibrium of Firm

It follows from the above that a firm under monopolistic competition is exposed to a continuous interaction with rest of the firms in the group. Its decisions are not independent of what the other firms are doing. It also notes the fact that its demand curve not only depends upon the actions of its rivals but also upon the quality of its own product and the selling expenses incurred by it. Therefore, it considers alternatives combinations of its cost components relating to product quality and selling expenses etc. and estimates the corresponding slope and position of the demand curve.

Let us assume that our firm has selected the product quality and the amount of selling expenses as represented by LAC curve in Fig. 4.16 which has its corresponding long term MC curve (LMC). The latter curve intersects MR curve from below at I. In this case, the firm would decide to produce a quantity OM of its product and sell it at a per unit price of EM which brings it a per unit profit of EK. However, as noted above, in the long run, the firm is not allowed to earn abnormal profit. New firms enter the market and produce close substitutes. This results in a reduction in the market shares of the existing firms including ours. Its AR curve shifts leftwards till it becomes tangent to LAC curve, as at point E in Fig. 4.17. Once this happens, our firm earns only a normal profit. There is no incentive for new firms to enter the market. Similarly, the process of entry of new firms and reduction in market shares of existing firms cannot continue indefinitely. Once the profit income of the existing firms is reduced to normal level, there is no incentive left for new firms to enter the market.

As a result, long term equilibrium of a firm under monopolistic competition is given by the point of tangency between its AR curve with its LAC curve which is point E in Fig. 4.17 in the case of our firm.

Comment

It should be noted that in monopolistic competition, firms earn only normal profit, in the long run as they do under perfect competition. Presence of monopolistic competition does not improve their profitability. Further, on account of

- (i) negatively sloping demand curves,
- (ii) U-shaped long term average cost curves,
- (iii) free exit and entry of firms, and
- (iv) competition among firms.

they all produce below their 'optimum capacity' as the equilibrium is to the left of minimum point of the average cost curve. Some productive capacity of theirs remains unutilised. This increases their average cost of production which they charge from the consumers by adding them to the supply price. The firms operating under monopolistic competition also incur selling expenses which they charge from the consumers.

Similarly, the consumers also suffer in several ways.

- (i) They get a smaller supply compared with what the economy can produce by effectively utilising its productive capacity.
- (ii) The average cost of production is more than the minimum average cost

of optimum level of output and the consumers have to bear it in the form of higher prices.

- (iii) They also pay for the selling expenses incurred by the sellers.
- (iv) In the net, therefore, 'for a given quality of product they pay a higher price, and for a given price they get an inferior product'.

The only possible gain to the consumers is in the form of the 'variety' of products. However, some thinkers believe that the variety does not bring in any addition of utility to the body of consumers taken together because every consumer cannot afford to buy 'better' quality of every product. And those who have a sense of deprivation suffer a loss of utility on that account.

The economy also suffers in the sense that its productive capacity is not utilised fully. Also the firms use up a large amount of productive resources in selling expenses most of which are incurred only to counteract the impact of rivals and have no real benefit for the economy.

EVALUATION OF MONOPOLISTIC COMPETITION

Merits

1. An important merit of monopolistic competition is that it is much closer to reality than several other models of market structure. Firstly, it incorporates the facts of product differentiation and selling costs. Secondly, it can be easily used for the analysis of duopoly and oligopoly.
2. Under monopolistic competition it is possible to see that even when each individual firm produces under conditions of increasing returns, not only the firm under consideration but the entire group of firms can be in equilibrium.
3. Moreover, monopolistic competition is able to show that even when each individual firm is producing under increasing returns, it still earns only normal profit in the long run.

The theory of monopolistic competition helps us in bringing in the concept of market share of an individual firm. This opens up the possibility of considering those situations in which a firm may be pursuing a goal other than profit maximisation.

4. In monopolistic competition we are able to consider the interaction between several interdependent variables on the basis of which a firm takes its decisions.

Demerits

1. The biggest conceptual difficulty with monopolistic competition is the concept of a 'group' of firms. There is no standard theoretical foundation for deciding the boundaries of a group.
2. Related with the concept of a group of firms, we face the difficulty of defining the meaning of a 'close substitute'. We are not told at what values of cross elasticity, two products become close substitutes of each other.

3. The theory of monopolistic competition fails to take into account the fact that the demand by final consumers is largely influenced by the retail dealers because the consumers themselves are not fully aware of the technical qualities of the product.
4. Similarly, the theory fails to fully account for the determination of equilibrium quantities and prices of goods like raw materials and other inputs. To a large extent, their demand is governed by a combination of the technical quality, price, and timely availability rather than by brand name, etc. Given the technical quality of an input, its demand is governed more by its price and availability than its brand name.

SELF-TEST QUESTIONS

(These are meant for recapitulation only. Answers to these questions are not to be submitted for evaluation)

1. What do you understand by equilibrium of a firm ? Explain your answer.
2. What is meant by the term market in economics ? Distinguish between the following market structures (i) perfect competition, (ii) monopoly, and (iii) monopolistic competition.
3. Clarify the statement that a firm is a price taker under perfect competition but not so in monopoly or monopolistic competition. Give reasons for your answer.
4. Explain the concept of optimum output. Under what conditions is it achieved by a firm ?
5. Analyse the determination of short run equilibrium of a firm operating under perfect competition. Can it be in equilibrium while incurring a loss ? Give reasons for your answer.
6. Explain the determination of long term equilibrium of a firm under perfect competition. Show, inter alia, that it will produce at the least possible average cost of production.
7. Is it necessary for a firm to produce optimum level of output under monopoly or monopolistic competition ? Explain with the help of diagrams.
8. Discuss the determination of equilibrium of a perfectly competitive industry under conditions of (a) constant returns, (b) diminishing returns, and (c) increasing returns.
9. Define a monopoly. Define its characteristics as distinguished from those of perfect competition.
10. Do you agree with the statement that a monopoly can attain its long term equilibrium with abnormal profit, but not at a loss ? Give reasons for your answer.
11. It is claimed that price charged by a monopoly is always higher than the competitive price ? Why ?

12. What do you understand by price discrimination by a monopolist ? What are its various kinds ?
 13. Explain the determination of equilibrium output and prices when a monopoly is practising price discrimination.
 14. What do you understand by the concept of monopolistic competition ? What are its salient features ?
 15. What are selling expenses in monopolistic competition ? How are they differentiated from cost of production ? What should they be incurred by a firm operating under monopolistic competition ?
 16. "Under monopolistic competition, consumers pay more for a given product and get an inferior product for a given price". Explain.
 17. Enumerate merits and demerits of monopolistic competition.
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Suggested Readings :

- (1) *H.L. Bhatia*, Microeconomic Theory.
 - (2) *H.L. Ahuja*, Modern Microeconomics.
 - (3) *A. Koutsoyiannis*, Modern Microeconomics.
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STUDY V

BASIC CHARACTERISTICS OF INDIAN ECONOMY

INTRODUCTION

Land, Forests and Water

Geographically, India is one of the large countries of the world, having an area of 32,90,000 sq. km. It is endowed with a wide range of topography, mineral and water resources, climatic zones, a potential for solar, wind, hydro, and nuclear power, as also with cultural and ethnic diversity. The country has vast reserves of coal, manganese, and iron ore. However, there is also a paucity of some essential minerals like oil, coking coal, copper, zinc, lead, nickel, as also of precious metals like gold, silver and platinum.

Unfortunately, India has not been able to derive optimum economic benefit from exploitation of its natural resources nor has it succeeded in rejuvenating and regenerating the renewable ones.

Irrigation

Irrigation is essential for agricultural operations where rainfall is deficient and erratic. It eliminates or at least reduces the dependence of agriculture on the vagaries of rainfall. While some areas of our country have plenty and near-assured rainfall, there are also vast areas with uncertain rainfall, thus spelling out the desirability of a system of assured irrigation. Some of the rain-fed areas of our country undergo periodical droughts or floods. It is also worth noting that some crops like rice, sugarcane and others need a lot of water and timely irrigation. Moreover, assured irrigation provides a scope for two or more crops per year from the same fields and this adds to the income of the farm sector, generate more employment in the rural areas and other benefits to the economy as a whole.

Irrigation system has existed in India since time immemorial. Over time, we developed several means of irrigation including tanks, wells and canals. Post-Independence period saw large scale mushrooming of tube-wells as also a vast extension of the canal network. Unfortunately, this has been accompanied by an avoidable neglect of tanks.

Consequently, today we have the world's largest irrigated area in the world. According to the Economic Survey, 2002-03, country's ultimate irrigation potential (UIP) is estimated at 139.89 million hectares. So far about 68% of UIP has been harnessed. Currently, the pace of net addition to irrigation potential is sought to be accelerated under various schemes. However, our approach to irrigation still suffers from various drawbacks.

- (a) We have a large unexploited potential of irrigation facilities, but their pace of the development is far below the optimum.
- (b) The maintenance of irrigation facilities is extremely poor. As a result, the effective availability of facilities has a tendency to fall into disuse. Moreover, their current use is below the optimum level.

- (c) As a matter of general apathy, several traditional irrigation and water harvesting facilities (like tanks and dug wells) have fallen into disuse.
- (d) There is a need to ensure that water carried by rivers and streams to the sea is utilized to the extent possible for increasing its availability for domestic and industrial uses and for inland waterways. A coherent and effective policy to this end can help our economy in several ways, such as, generation of electricity, checking soil erosion and soil degradation, provision of cheap transport, development of fisheries, and the like. But for various reasons, including non-economic ones, such a coherent and effective policy is not in place.
- (e) As against the limited availability of water, we have promoted the cultivation of some crops like rice and sugarcane, which need large scale water. *Moreover, this has happened in areas having insufficient water availability.* This has led to a shortage of water for irrigating remaining crops.
- (f) As noted above, a major portion of water from rain and melting of snow is allowed to run into the sea. This has the added ill effects of simultaneously causing both floods and drought in different parts of the country.
- (g) In some areas, particularly those which have a moderate rainfall but concentrate on cultivation of rice and sugarcane, indiscriminate mining of groundwater has taken place through tubewells, resulting in a steady lowering the water table in these areas.
- (h) The surface water flow in rivers and streams is getting increasing by polluted by untreated industrial effluents. Consequently, it is becoming increasingly unfit both for drinking and for irrigation.
- (i) There is a vast untapped potential of rainwater harvesting in areas like Rajasthan and Madhya Pradesh. If rainwater is properly harvested in such areas, we can raise the table of groundwater and add to the productivity of land.

Irrigation is one of the components for development of rural infrastructure under 'Bharat Nirman'. The irrigation component of 'Bharat Nirman' aims at creation of irrigation potential of 10 million hectares in four years from 2005-06 to 2008-09. Keeping in view the present status, the target for creation of irrigation potential under 'Bharat Nirman' has been proposed to be met largely through completion of on going major and medium irrigation project. Due emphasis has also been given to enhancing the utilization of completed projects/schemes. Development of new projects of minor irrigation to cater to the requirements of specific areas, particularly to provide benefit to small and marginal farmer and dalits and tribals, has also been included in 'Bharat Nirman'.

Minerals

Like most countries of the world, India is rich in some minerals and very poor in some others. We have huge known coal reserves exceeding 1,30,000 million tonnes. But this huge volume also suffers from certain drawbacks, which can be overcome only at a cost. Firstly, these reserves are not well-spread throughout the country. They are concentrated in West Bengal, Madhya Pradesh, Orissa and Bihar. Secondly, most of our coal is of poor quality and contains a lot of ash. However, in spite of its poor quality, it can be used as a fuel for most industries and, with

appropriate technology, for producing chemical fertilisers and other products. The problem with our coal industry, like many others in our country, is that of its inefficient management, lack of sufficient coal washeries, illegal mining, *inefficient transport, and the like. Lignite reserves, however, are being exploited more effectively.* Figures in Table 5.1 (Key Indicators) show that coal production increased from 32.3 million tonnes in 1950-51 to 413.0 million tonnes in 2004-05 and then fall to 407.04 million tonnes in 2005-06 while the production of lignite increased from 3.39 million tonnes in 1970-71 to 24.81 million tonnes in 2000-01 and 30.06 million tonnes in 2005-06.

As pointed out above, India is highly deficient in a number of essential industrial minerals, like copper, tin, lead, zinc, nickel and cobalt. While the annual consumption of these minerals is within manageable limits, *we continue to be heavily deficient in mineral oil which is a major source of energy for our economy.* In recent years, some significant deposits of mineral oil and gas have been found in our country. But they are insufficient to meet our growing needs. Moreover, international pricing of petroleum products is controlled by some monopolistic forces. Consequently, over years, our import dependence upon oil and gas has increased and is bound to increase further in the foreseeable future. The remedy, if any, lies in the discovery of sufficient fresh deposits of these products within our country or in the tapping of new sources of energy. It needs to be noted that India has a vast and under-tapped potential of generating energy from various unconventional sources like those of water, wind, tidal waves, sunshine, and atomic fuels. Efforts are also being made in the area of bio-diesel. But tapping them economically and adequately is possible only if a well-prepared and coordinated policy is executed for this purpose.

TABLE 5.1

KEY INDICATORS OF INDIAN ECONOMY

	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
1	2	3	4	5	6	7	8	9	10	11	12
Railways (000" Route Km.)	53.6	56.2	59.8	61.2	62.4	63.0	63.1	63.1	63.2	63.5	63.3
Electrified	0.4	0.8	3.7	5.4	10.0	14.9	15.2	16.3	17.5	17.5	17.9
Total Traffic (million tonnes)	93.0	56.2	196.5	220.0	341.4	504.2	521.2	542.7	581.4	NA	682.29
Passengers Originating (million)	1284	1594	2431	3613	3858	4833	5093	4971	5112.0	5416.0	666.42
Length of Roads (000 km)	400.0	524.5	915.0	1485.4	1998.2	2446.7	2483.3	2483.3	NA	NA	NA
Surfaced	157.0	263.0	398.0	684.0	1094.4	1420.5	1420.5	1420.5	NA	NA	NA
Energy Generated (gross) (billion KWH)	6.6	20.1	61.2	119.3	289.4	554.5	573.2	596.5	633.0	680.0	697.3

Hydro + Wind	2.5	7.8	25.2	46.5	71.8	74.5	73.9	64.0	75.2	101.2	99.9
Thermal	2.6	9.1	28.2	61.3	186.5	48.7	422.0	449.3	472.1	490.4	506.0
1	2	3	4	5	6	7	8	9	10	11	12
Nuclear	-	-	2.4	3.0	6.1	16.9	19.3	19.4	17.8	17.0	17.0
Electricity Installed Capacity (Thousand MW)	2.3	5.6	16.3	33.4	74.7	117.0	121.0	126.2	131.4	137.5	143.8
Hydro	0.8	1.9	6.4	11.8	18.8	25.1	26.3	26.8	29.5	33.9	32.3
Thermal	1.1	2.7	7.9	17.6	45.8	73.6	75.9	78.4	80.5	81.7	88.6
Nuclear	-	-	0.4	0.9	1.5	2.9	2.7	2.7	2.7	2.8	3.4
Coal (million tonnes)	32.30	55.23	72.95	113.91	211.73	327.29	N.A.	367.29	389.25	413.0	407.04
Lignite (million tonnes)	NA	NA	3.39	5.11	13.77	24.81	N.A.	26.02	27.96	30.34	30.06
Fertilizers Consumption (NPK)	-	292	2177	5516	12546	16702	17360	16094	16798	18398	20340
Production	-	150	1059	3005	9045	14704	14628	14468	14625	15405	
Irrigated Area (mn hectares)	-	-	38.0	54.1	70.8	81.8	83.6	83.6	NA	NA	
Per Capita Net Availability of (gms p.d) Cereals	334.2	399.7	417.6	417.3	468.5	386.2	N.A.	408.1	427.4	—	390.9
Pulses	60.7	69.0	51.2	37.5	41.6	29.1	N.A.	29.1	35.9	—	31.5
Total	394.9	468.7	468.8	454.8	510.1	416.2	N.A.	437.6	463.3	—	422.4
Index No of yield of pulses (1981-82 = 100)	-	-	114.4	106.6	128.1	120.4	135.0	119.3	161.6	130.6	
Index No of Oilseeds yield	-	-	102.2	96.8	132.1	133.0	146.3	117.6	168.9	157.4	

Source : Govt. of India, Economic Survey – 2006-07.

To re-iterate, a viable solution of the problem of energy supply is possible only through a vigorous policy of increasing our electricity-generating capacity and development of non-conventional sources of energy. However, we are handicapped

by both official apathy and public ignorance of these matters. Our current production of crude oil is in the region of 32 million tonnes (including around 12 million tonnes onshore output). But this domestic output meets only a small part of our needs and we have to import about 90 million tonnes of it per annum. It may be mentioned here that a promising potential source of petroleum products lies in reported huge deposits of shale in North-Eastern parts of our country. Estimates show that if exploited for extraction of mineral oil products, they can last us for centuries. Unfortunately, while the need for exploiting coal and shale reserves is beyond doubt, there is hardly any research activity directed to this end. We should not forget that for us the exploitation of energy potential is an unending process particularly because our demand for mineral oil and gas is bound to increase with the passage of time.

Iron Ore : India has abundant reserves of high quality iron ore not only for its own use but also for exporting, the total known reserves being in the order of 21,000 million tonnes. Currently, we are mining around 75-80 million tonnes of iron ore a year. But strangely enough, our domestic production falls short of our domestic demand. And we are also importing around 1.5 million tonnes of iron and steel from abroad.

ROLE OF AGRICULTURE IN THE INDIAN ECONOMY

In the Indian context, the vital role of agriculture arises out of the position this sector occupies in the overall economy of the country. Agriculture is a large sector of the economic activity and has a crucial role to play in the country's economic development by providing food and raw materials, employment to a large proportion of population, capital for its own development and surpluses for national economic development. Agriculture sector contributes a significantly large share to the national income of India. As a matter of fact, during the fifties it contributed around half of national output. In the sixties and the seventies its contribution, though it did show a fall, has been more than 44 per cent. During eighties and nineties a further fall is indicated. During 2006-07 stood at about 18.5 per cent. This trend of the declining share of agriculture in the national income is an indication of economic progress and structural change that is gradually taking place. It is observed that the rate of change has been rather slow. The agriculture sector still holds the dominant position in the Indian economy. Agriculture has been and is a major source of livelihood in India. Over the years 1921-91, the size of labour force dependent on agriculture had more than doubled and over the next decade is projected to go by more than 25 per cent. This is contrary to the development economists' observation that as country develops the share of labour force dependent upon agriculture as a source of livelihood declines. The occupational structure of the country has shown a lack of flexibility, the large proportion of the increasing labour force, in the absence of any alternative employment opportunities, has been absorbed in agriculture. It is observed that while the share of agriculture in GDP has been declined significantly, its share in the manufacturing sector has gone up. However, corresponding to this structural shift in production, the structure of employment has shown little change.

The increasing labour force in agriculture would only add further to the already low productivity and disguised unemployment, unless steps are taken to raise the level of productivity and create alternative employment opportunities. Indian agriculture plays an important role in the country's international trade. The agricultural commodities are exported primarily, tea, cotton, jute, spices, coffee, sugar, fruits, etc. The important items of import have been cereals, vegetable oils and fats, etc. A large increase in the domestic production of rice, cotton, wheat has

resulted in a decline in the proportion of imports of these commodities. As a result of these developments, the agricultural sector has emerged as a net earner of foreign exchange. Fluctuations in agricultural output levels play a crucial role in the state of the national economy. According to a NCAER Survey, for several consumer durables the rural market is growing much faster than the urban market. There is a direct relationship between agricultural production and income and demand for industrial goods. Similarly, performance in agriculture also influences total demand via Government savings and public investment.

Since agriculture contributes significantly in the National Income, this sector is treated as major source of savings and hence capital formation for the economy. The pace of development is largely conditioned by the rate of capital formation in the economy. Since independence, large investment, both public and private, has been made in agriculture. In areas where agricultural practices are traditional, investment has also been on traditional lines like land and its improvement, tools and implements, farm structures, etc. But the pattern of investment in progressive areas, where modern technology has been adopted, has been predominantly in irrigation, land improvements, farm machinery and other infrastructures. Of course in recent years public investment in agriculture sector has declined. To stimulate growth, substantial capital investments are required for various infrastructure and inputs.

In the process of development, interdependence between agriculture and industry has become stronger. Based on a recent study by Ahluwalia and Rangarajan, those important linkages that have been developed between the agricultural sector and the industrial sector over the last four and a half decades. These are : (i) Production linkages; (ii) Demand linkages; and (iii) Savings and investment linkages. Production linkages arise from the interdependence of agriculture and industry for productive inputs i.e., supply of agricultural commodities viz. cotton, jute, sugarcane, etc. to agro-based industries and supply of fertilizers, machinery and electricity by industry to agriculture. These linkages have got further strengthened with agriculture's dependence on industry increasing at a faster rate than the dependence of industry on agriculture, reflecting the fast moving modernisation of the agricultural sector. There are strong demand linkages between the two sectors. The impact of urban income and industrialization on the demand for food and agricultural raw materials is generally recognized. Equally significant is the impact of rural income on industrial consumption goods i.e., clothing, footwear, edible oils, etc. Equally significant are the savings and investment linkages that have developed between the two sectors. The linkages, however, have been weakening.

Summing up, we conclude that agriculture occupies a central place in the economy. The sector has a razor's edge quality in the development process; good performance encourages many virtuous cycles and poor crops lead to vice like grips of stagnation, maturation and inflation. Its performance sets the pace of growth in the economy as a whole. A strong foundation of agriculture is a necessary condition for rapid economic and social development. Agriculture could contribute substantially to the improvement of the rural as well as the overall economy of the country and has the potential of becoming a leading sector in development. Increasing agricultural productivity makes an important contribution to the programmes of industrialization and general economic development and that is one of the necessary conditions, which must be fulfilled before an economy gets itself ready for a process of self-sustained growth.

Development initiatives through Five Year Plans

The agricultural sector in India was not subjected to the regulations in the same way as, for example, industry. The Government's role in the field of agriculture has been confined largely to investments in infrastructure including research and extension and public procurement and distribution to the extent of about 10 to 15 per cent of output of cereals, in market setting where private traders also operate. First Five Year plan was directed mainly towards increasing agricultural production and strengthening economic infrastructure like irrigation, power and transport. Agriculture was accorded the top most priority sector in the plan. The agricultural plan and programmes were directed to provide adequate food to support the increased population and raw materials needed for growing industrial economy and also to make available larger exportable surpluses of agricultural commodities in the Second Five Year Plan while the Third Five Year Plan was of great significance for the agricultural sector. The new strategy of agricultural production (Green revolution) came to be introduced in this period. A major change occurred with the introduction of the High Yielding Variety (HYV) seeds, which came to be widely adopted by the end of the Third Year Plan. The new agricultural technology was expected to usher in the green revolution and was confined mainly to Punjab, Haryana and Western UP, with the introduction of new HYV varieties of Mexican wheat and dwarf rice from 1967-68. Besides, a new emphasis was placed on the role of agricultural technology as a major input of agricultural production. A policy of support prices for food grains was adopted in the country. In 1965, Agricultural Price Commission (now rechristened as Commission for Agricultural Costs and Prices (CACP) was set up to advise the Government from time to time on appropriate price policies for agricultural commodities. Government's price policy for agriculture produce seems to ensure remunerative prices to the growers for their produce with a view to encourage higher investment and production and to safeguard the interest of consumers. The Government decides on the support price for various agricultural commodities taking into account the recommendations of CACP. The development programmes fell broadly into two categories in the 4th Plan i.e., those which aimed at maximizing production and those which aimed at remedying imbalances. Fifth Five Year Plan sought to modify and correct the weakness evidenced in the strategy of intensive production as also in the various area programmes during the Fourth Plan. The Sixth Five Year Plan has been accorded the highest priority to bridging the gap prevailing between actual and potential farm yields even at current levels of technology through the removal of the constraints responsible for this gap. The Sixth Plan was hailed a great success, production of food grain in 1983-84 reached to 152 million tones while green revolution had spread to eastern states and central states including West Bengal, Madhya Pradesh and Eastern Uttar Pradesh. The central element in the development strategy of the seventh plan was the generation of productive employment opportunities and removal of poverty. This was sought to be achieved through increase in cropping intensity made possible by increased availability of irrigation facility, extension of new agricultural technologies to low productivity regions and to small farmers through measures to make the rural development programmes more effective in the creation of productive assets. The agricultural programmes for production of oilseed, sugar jute and cotton recorded higher than the plan targets whereas, food grains production was 199 million tones as against plan target of 210 million tones in the Eighth Five Year Plan focussed on increasing production using limited resources of land and water. The development strategy during the Ninth Year

plan especially was focused on improving productivity and the quality of the horticulture crops through upgradation of production and farming technologies, supply of quality seeds and planting materials, technology transfer through demonstrations, reducing post harvest losses and improving marketability of produce, developing a strong base for supply of other critical inputs and human resource development. The three pronged strategy envisaged were :

- (i) increase in overall employment and incomes by raising farm productivity and growth of other economic activities in the rural areas;
- (ii) provision of gainful supplementary employment through poverty alleviation; schemes; and
- (iii) distribution of food grains through PDS at subsidised prices to those living below the poverty line.

The Ninth Plan envisaged a growth of 4.5 percent per annum in the agriculture sector. In order to achieve this, a regionally differentiated strategy based on Agro-climatic Regional Planning (ACRP) was envisaged to be implemented. The performance of the agriculture sector during the Ninth Plan had not been as envisaged. The average annual growth rate during the Plan was only 2.06 per cent which was below the targeted growth. The deceleration of growth and stagnation in productivity were matters of concern. There were reports of hunger and malnutrition because of low purchasing capacity of a sizeable portion of households. The Government of India announced National Agriculture Policy (NAP) 2000 which envisaged the following type of growth:

- (i) Growth that is based on efficient use of resources and conserve, our soil, water and bio-diversity;
- (ii) Growth with equity i.e., growth which is widespread across regions and covers all farmers;
- (iii) Growth that is demand driven and caters to domestic markets as well as maximizes benefits from exports of agri-products;
- (iv) Growth that is sustainable technologically, environmentally and economically.

NAP, envisaged a growth rate exceeding four per cent per annum in the agriculture sector. The Tenth Plan envisaged a target of 3.97 per cent growth. The thrust areas in the Tenth Plan envisaged were :

- (a) Regionally differentiated strategy based on agro-climatic conditions and natural resources envisaged for the Ninth Plan for increasing the pace of growth in every region of the country, to be continued during the Tenth Plan.
- (b) Sustainable development of natural resources;
- (c) Crop diversification:--The thrust would be on diversification towards high value/more remunerative crops considering agro-climatic conditions, endowment of land and water resources and market demand both within the country and outside.
- (d) Blending traditional and frontier technologies.

Tenth Plan

Tenth Plan priorities and thrust areas identified for the agriculture includes development of irrigation (micro-irrigation), diversification of high value crops, development of market infrastructure, increasing cropping intensity, rainwater harvesting etc. for the development of rain fed areas, revamping/modernizing extension systems and encouraging private sector increasing farm productivity development of eastern, north eastern regions etc.

Minimum Support Prices (MSPs) Scheme : In order to enable farmers to get remunerative prices for their produce and to encourage crop diversification, Government is implementing this scheme for 25 agriculture commodities.

Credit

The easy and timely availability of institutional credit in a hassle free manner to the farmers at a reduced rate of interest is the key ingredient for meeting their credit needs and encouraging investment for accelerated agricultural growth. In line with this requirement, the Government announced a comprehensive credit policy on 18th June, 2004.

Water Management

Water management holds the key for agricultural growth in the country. About 20 million hectares of additional land can be brought under irrigation by completing the on-going major and medium irrigation projects and by constructing field channels in command areas. In dry land/rain fed areas it is necessary to increase water use efficiency for optimum utilization of available water and to stabilize production for which a new centrally sponsored scheme "Micro irrigation" was approved in December, 2005.

Agriculture Diversification

Agricultural diversification is a major element in the strategy for accelerating agricultural growth. Horticulture has been a priority area for which mission mode has been adopted. National Horticulture Mission was approved for implementation in May, 2005 to give a new impetus for development.

Eleventh Five Year Plan

Approach paper of Eleventh Five Year Plan observes that agriculture lost its growth momentum after mid-1990s and subsequently entered a near crisis situation. One of the major challenges of the Eleventh Five Year Plan will be to reverse the deceleration in agricultural growth from 3.2 per cent observed between 1980 and 1996-97 to a trend average of around two per cent subsequently. This deceleration is the root cause of the problem of rural distress that has surfaced in many parts of the country. Low farm incomes due to inadequate productivity growth have often combined with low prices of output and with lack of credit at a reasonable rate, to push many farmers into crippling debt. The crisis of agriculture is not a purely distributional one that arises out of the special problems of small and marginal farmers and landless labour. In fact, agricultural deceleration is affecting farms of all sizes. To reverse this trend, corrective policies must not only focus on the small and marginal farmers who continue to deserve special attention, but on middle and large

farmers too who suffer from productivity stagnation arising from a variety of constraints. It is vital to increase agricultural incomes as this sector still employs nearly 60 per cent of our labour force. A measure of self-sufficiency is also critical for ensuring food security. A second green revolution is urgently needed to raise the growth rate of agricultural GDP to around 4 per cent. This is not an easy task since actual growth of agricultural GDP, including forestry and fishing, is likely to be below 2 per cent during the Tenth Plan period. The challenge therefore is to at least double the rate of agricultural growth and to do so recognize demographic realities—particularly the increasing role of women.

ROLE OF INDUSTRY IN INDIAN ECONOMY

Industrialization is a process in which there is a sharp increase in the industrial share of GDP and of the labour force. It is thus the process by which the centre of gravity of the economy shifts from agriculture to industry. It is true that the available empirical evidence makes us believe the thesis that no country could have developed and reached its current state of economic development without an easy access to a sound agricultural base. Those countries which had an underdeveloped agricultural sector could afford to make use of agricultural resources of some other dependent country; in all other countries, agriculture served as the “leading sector” of growth. But it is also true at the same time that fast economic development everywhere has been made possible essentially due to rapid industrialization. As a matter of fact, the essential criteria that are being used to distinguish a developed economy from an underdeveloped one relate to proportion of work force engaged in industrial activity, the proportion of national output originating in the industrial sector, etc.

Industrialization involves: (i) adoption of technologically superior techniques of production that help to transform basic raw materials and intermediate goods into manufactured goods and (ii) application of modern techniques of management and organization like economic analysis, accountancy, management technique, etc. The Planning Commission observes two factors favouring rapid industrialization which are: (i) the productivity of labour in industry is much higher than in agriculture, and (ii) in a under developed economy the surpluses created in the industrial sector are likely to be available for investment relatively more easily than surpluses in agricultural sector. The third factor that could be added is industrial sector lends direct stimulus to the setting up of new activities through linkage effects.

As a result of the pursuit of the objective of industrial self-sufficiency during five year plans, industrial structure has become considerably broad based. Further, the industrial sector has established linkages with primary producing sectors e.g., agriculture, the latter is dependent for its own production on a rising flow of inputs from the former.

The share of industry sector (i.e. manufacturing, electricity, mining, construction etc.) in our GDP at factor cost at constant prices registered a substantial increase over the first four decades and then tapered off to a near stagnant level. The share of this sector in GDP reached to 25.5% in 1996-97, and then dipped to 22.2% in 2001-02 while percentage share of this sector was only 13.2% in 1950-51. First four years of Tenth Plan had shown some upward trend. Its share in GDP was 24.1 per cent in 2005-06. The above data, by and large conform the objective of our planning, which has been that, a rapid industrialization of our economy through direct public investment. However, with the introduction of the policy of liberalisation and

globalization, this percentage share has hovered within a narrow margin. Principles of economics state that in a backward and developing economy, the secondary sector, in absolute terms, should be growing much faster than it actually did in our economy. This development could be partly explained by the fact that a rapid industrial growth is possible only if there is an equally rapid growth in infrastructure and other civic amenities. Even now, our economy suffers from a deficiency of essential infrastructure like electricity, transport etc.

The contribution of industry to GDP is an important indicator of a nation's progress in the process of structural transformation from a rural agricultural society to a more urban industrialized one. Further, an increase in per capita income is associated with a rise in the share of industry along with a fall in the share of agriculture in national income. It is significant to note that consumption of manufactured consumer goods is recognized as one of the most widely accepted measures of standard of living and of quality of life. Manufacturing industry provides the driving force for stimulating rapid economic growth. The growth rate of the manufacturing industry normally surpasses that of the agriculture and the service sectors. It is for this reason that industry is considered the backbone of an economy. It is in recognition of this special importance that raising industry's share in GDP is being ranked as the for most objective for this sector in planning process. It is perhaps pertinent to add that traditionally, the political stature of a country has been commensurate with the size and structure of industry.

INDUSTRIAL POLICY

The industrial policy of a country is an important instrument to influence the contribution of industrial sector to the economic development of the country.

The term 'industrial policy' of the government has a very wide scope and forms an integral part of its overall policy. This is more so because in India, the government assumed the responsibility of actively promoting economic development through planning and regulation. Conceptually speaking, industrial policy concerns itself with policies, procedures, regulations, and controls associated with the industrial units of the country and the pattern of industrial set up. In effect, however, industrial policy is also closely connected with rest of the economic policies of the government, including, for example, labour policy, fiscal policy, and tariff policy.

Industrial Policy Resolution, 1948

As stated before, after Independence, the government aimed at rapid industrialisation of the country through systematic planning so as to avoid wasteful employment of scarce productive resources of the economy. It was decided that the government would play an active role in industrial process through public sector undertakings and the role assigned to the private sector would be a complementary one. The process was set in motion right in 1948 itself with the Industrial Policy Resolution which reserved a sphere for the public sector, and had the following main features.

1. The industries were divided into four main categories as follows:

- Some industries were reserved as exclusive monopoly of the Central Government. These included railways, atomic energy, and arms and ammunition.
- In the second category, no new undertakings could be established in the private sector. They could be established only in the public sector. This category included iron and steel, aircraft manufacture, ship-building, manufacture of telephone, telegraphs and wireless apparatus, and mineral oils.
- The third category contained those basic industries which, in the opinion of the Central Government, could need official planning and regulation. This category covered a long list including almost everything of basic importance to the economy, such as salt, automobiles, tractors, prime movers, electric engineering, heavy machinery, machine tools, heavy chemicals, fertilizers, electro-chemical industries, non-ferrous metals, rubber manufactures, power and industrial alcohol, cotton and woollen textiles, cement, sugar, paper and newsprint, air and sea transport, minerals and industries relating to defence.
- The fourth category comprised 'the remainder of the industrial field'.

Thus, almost the entire burden of industrialisation of the country was assumed by the government. Private sector was assumed to be incapable and/or unsuitable for ushering in the industrialisation of the country. Obviously, the success or failure of the public sector was to determine the extent of healthy and efficient industrialisation of the country.

2. The relevance and necessity of foreign capital was recognized. But direct foreign investment was not viewed with favour. The ownership and management of business units were to remain in Indian hands and the persons managing them were to be preferably Indians. In the long run, this amounted to debarring direct foreign investment and, instead, procuring foreign capital in the form of loans.

Industrial Policy Resolution of 1956

With formal introduction of economic planning and specific adoption of the objective of creating a 'socialistic pattern of society', it was thought necessary to modify the industrial policy of 1948. The new resolution had the following features.

1. The division of industries between public and private sectors was re-demarcated as follows.
 - Schedule A contained 17 industries and were made the exclusive responsibility of the government.
 - Schedule B contained 12 industries. These were to be progressively owned by the State. The State would have the main responsibility of setting up new enterprises in it and private sector was expected only to supplement the efforts of the State.
 - Schedule C contained the remaining industries. In their case the private sector was to have the main initiative of development. However, they were to fit within the economic and social priorities and policies of the government and were to be subject to the

provisions of the Industries (Development and Regulation) Act, 1951.

2. The government was to ensure the development of transport and other infrastructure etc. so as to enable the private sector acquire confidence and operate efficiently. The government would also make arrangements for the promotion of appropriate institutions and for the availability of institutional finance. In the event of co-existence of both private and public sector undertakings in a certain field, the government would pursue a non-discriminatory policy between them.
3. The Resolution recognised the importance of village and small-scale industries. To this end, the government was to support them and help them in acquiring competitive strength by protecting them against large-scale enterprises and by supportive differential taxation and subsidies.
4. Removal of regional economic disparities was another component of the Industrial Policy Resolution.
5. The Resolution emphasised that the living and working conditions of the workers were to be improved and their productivity was to be enhanced.
6. The policy regarding foreign capital continued to remain unchanged.

It is seen that, through the Resolution of 1956, the government acquired a right to nationalise any existing industry. In effect, it also made use of this right extensively such as in nationalising the business of life insurance, general insurance, coal mining and banking. The private sector got the message that any industry could be nationalised at the discretion of the government. In actual implementation of the policy, however, a number of weaknesses developed.

Industrial Policy Statement, 1977

The industrial policy was modified in December 1977 by a Statement in the Parliament. It recognised that the existing policy had led to a mixture of some benefits and distortions in the economy, but had also caused serious distortions like an increase in unemployment, widening of rural-urban disparities and stagnation of real investment rate etc. The growth of industrial output had averaged only between 2-4% p.a. Industrial sickness had increased and become widespread. Clearly, there was a need to rectify the distortions. The main elements of the policy were as follows.

1. The main thrust of the new industrial policy was a shift in favour of small-scale sector, which was classified, into three sectors.
 - (i) Cottage and household industries, which were a source of providing large scale self-employment.
 - (ii) Tiny sector which was defined on the basis of a small amount of investment below a specified limit.
 - (iii) Small scale industries which were larger than the first two categories but were still having investment within specified limits.

The policy aimed at simultaneously promoting all types of small-scale and cottage industries. To this end, a number of measures were suggested. These included the following :-

- (a) The existing list of 108 items reserved for the small sector was expanded to cover 807 items by May 1978.
 - (b) A District Industries Centre (DIC) was to be set up in each district for providing all services for helping the entire small sector under a 'single roof'. The Industrial Development Bank of India (IDBI) was to create a separate wing for specifically helping the small sector. Later, this wing grew into a full fledged bank named Small Industries Development Bank of India (SIDBI).
 - (c) The field of activities of the Khadi and Village Industries Commission was enlarged.
 - (d) Steps were to be taken for effective development and use of technology suitable for the small sector so that the productivity of the workers in it could increase.
- 2. The area of operation for the large scale sector was restricted to the following.
 - (a) Basic industries which were needed for providing infrastructure and for development of the small sector, such as steel, cement, refineries and the like.
 - (b) Capital goods industries for meeting the requirements of machinery.
 - (c) Industries which were best operated on a large scale and with advanced technology such as pesticides and fertilizers, etc.
 - (d) Industries producing other non-reserved items.
- 3. The policy clarified the official stand on the growth of large business houses. It was stipulated that, for financing new projects and the expansion of existing businesses, large houses should be required to rely upon their internally generated resources instead of borrowed funds. The funds of public sector financial institutions would be largely going to the small sector.
- 4. The policy clarified that the public sector would be the producer of important and strategic goods of basic nature. It would bear the responsibility of encouraging and developing a wide range of ancillary industries and decentralisation of the industrial production.
- 5. Importing of technology was to be permitted in high priority areas provided the country itself was not in a position to provide the same.
- 6. The policy was rather prohibitive regarding foreign collaborations. It asserted that where foreign technological know-how was needed, existing collaborations would not be renewed. Moreover, as a rule, majority ownership and effective control was to be in Indian hands with possible exceptions in certain cases like those relating to export-oriented units.
- 7. The problem of sick industrial units had assumed alarming proportions. The government decided to have a unit by unit selective approach in keeping them alive.

Industrial Policy of 1980

When Congress Party came into power in 1980, it decided to modify the contents of the Policy adopted in 1977. It reiterated the basic approach contained in the Industrial Policy Resolution of 1956. It re-emphasised the socio-economic goals of the earlier policy with certain clarifications and extensions, namely,

- (i) optimum utilisation of installed capacity,
- (ii) achieving higher productivity and more employment,
- (iii) removal of regional disparities through preferential treatment for industrially backward districts,
- (iv) enlarging the agricultural base of the economy by extending a preferential treatment to agro-related industries,
- (v) faster promotion of export oriented and import substitution industries. The Policy statement of 1980 also recognised the need for improving the management of the public sector undertakings.

The Policy Statement maintained that the division between large and small sectors as enshrined in the preceding Policy Statement was wrong, since the entire industrial sector was internally interdependent and a unified whole. It aimed at the development of big industries with associated ancillary, small and village industries at the periphery. The new policy statement also committed itself to the task of removing regional disparities by setting up industries in industrially backward areas and solving the problem of industrial sickness. An important step taken by it was to simplify the procedure of regulating unauthorised excess capacity installed in the private sector.

At this stage, it would be helpful to note the fact that the implementation of the industrial policy led to the creation of a network of legislative acts, rules, regulations, procedures and so on. Since further changes in industrial policy involved a relaxation in these restrictive measures, we should briefly familiarise ourselves with them to the extent necessary.

In this regard, the first major legislative piece was that of the Industries (Development and Regulation) Act, 1951. It was highly restrictive in nature, a sample of which is given below.

For setting up a new unit or for a substantial expansion of an existing unit, a license was needed from the government. The granting of this license could be subject to the conditions laid down by the government. The government could investigate the working of any undertaking and issue instructions. In case the instructions were not followed, the undertaking could be taken over by the government. Similarly, the government could control prices, methods and volume of production, as also the manner of its sale. Development Councils could be set up for an industry with sweeping powers.

Over years, actual implementation of industrial policy led to several deficiencies, particularly through the misuse of the industrial licensing. The practice led to concentration of industrial power in the hands of a few selected business families. There was hardly any reduction in either regional disparities or in inequalities or incidence of poverty. Moreover, once a license was granted, no monitoring of its use

was there. Similarly, foreign collaboration was permitted in several non-essential and consumer goods.

Steps Initiated in 1984 and 1988

The decade of 1980s is marked with half-hearted and unsure steps at reforming the approach towards industrial licensing. A beginning was made in 1984 by liberalising licensing policy in favour of large business. In particular, they were freed from various provisions of Foreign Exchange Regulation Act (FERA) and Monopolies and Restrictive Trade Practices Act (MRTP). For example, the scheme for renewal of capacity was liberalised and automatic increase of capacity was allowed on the plea that this was needed to reap the economies of scale and technology. In January 1986, the government de-licensed 23 industries by freeing them from the provision of MRTP Act provided they were located in backward areas. The threshold asset limit of becoming an MRTP company was itself raised from erstwhile Rs. 20 crore to Rs. 100 crore. Similarly, the manufacturers were allowed to adjust the mix of their output to suit the needs of the market. This was termed the 'the concept of broad-banding'. Corresponding raising of definitional limits of small scale industries were also adopted in the new approach.

January 3, 1988 saw further liberalisation of industrial licensing system as also some measures for promoting industrialisation of backward areas. Non-FERA and non-MRTP companies were exempted from obtaining licenses under the Industries (Development Regulation) Act provided their investment was below the stated limit and they were located in backward areas. They were also promised various tax benefits. In addition, the government planned to establish 100 growth centres in the next five years.

Industrial Policy of 1990

With the change in government at the Centre, some changes were announced in the industrial policy also, involving a number of details. They included measures for the promotion of small scale and agro-based industries. The investment limits of these industries were increased. A new apex bank SIDBI was established to specifically cater to their financial needs.

The procedures for industrial approvals were simplified and the threshold limits for delicensing were raised. Importing of capital goods, raw materials and components was made easier. Import of technology did not require official permission provided payment of royalty was not more than 5 percent. Foreign equity investment up to 40% was to be allowed on an automatic basis. Setting up of 100% export oriented units, having an investment up to Rs.75 crore, could be set up in export processing zones without license.

In general, we may say that the 1990 policy aimed at the growth of small scale industries while extending liberalisation for the growth of medium and large scale sectors. Subject to certain limitations, it also allowed freedom for foreign collaboration

Policy After 1991

At this stage, the Central Government expressly sought to restructure the economy with a fundamental shift. It was decided that the economy would no longer

be a primarily regulated one. It would be primarily a market-oriented one. The changeover, however, would be in a phased and progressive manner so as to

- (a) minimise any possible disruption,
- (b) allow the Indian enterprises time and opportunity to acquire competitive strength against foreign competitors,
- (c) gain the capacity to absorb foreign capital and technology at an increasing scale, and
- (d) cause minimum dislocation to the employment of labour.

Consequently, the mild pace of liberalisation introduced in mid 1980s was adopted in a full-fledged manner in 1991. It was planned to liberalise the Indian economy from the clutches of the government regulation and control and let it be guided by market forces. Simultaneously, the government decided to integrate the Indian economy with rest of the world. To this end, therefore, a long line of successive measures were initiated. The areas of foreign investment have been successively expanded both in terms of the choice of products, location of business units, use of technology, management practices, and so on. The restrictions on the extent of ownership by Indians have been gradually relaxed with fully owned foreign companies or their subsidiaries coming into existence. At the same time, the licensing requirements have been either abolished or diluted along with simplifying the procedures for getting necessary clearances, if any. Imports have been liberalised to a great extent with a reduction in the number of categories of commodities and a lowering off the customs duties. In the process, we are fast approaching the Asean levels of customs duties.

An important component of the industrial policy since the onset of liberalisation is the encouragement of direct foreign investment and technology. Till the adoption of the New Economic Policy in 1990-91, we did not favour direct foreign investment and put several hurdles in its path. We had a policy of bringing in foreign capital only in the form of loans (and possibly grants). As a result, Indian external debt accumulated over years. Currently, we are one of the top heavily indebted developing countries of the world. This entails a heavy cost of servicing this debt in the form of payment of interest and repayment of the principal amount. Moreover, the burden of external debt increased with depreciation of the exchange rate. Another defect of our policy regarding external capital has been our inability to utilise it in the creation of export potential to the needed extent. This, therefore, compelled us to face balance of payments problems and the weakening of the exchange rate.

With steps in the direction of economic liberalisation and globalisation of the Indian economy, the government also changed its policy regarding inflow of foreign capital. Currently, it prefers its inflow in the form of direct foreign investment. Such a flow is beneficial for the economy in several ways. The investors bring in capital in those areas of investment which are assessed to be commercially viable. They can take home returns on investment only if they are profitable. Consequently, FDI comes only in only those fields which have more or less assured commercial viability. Moreover, inflow of investment tends to bring in improved technology and management techniques. They have also an inherent interest in exploring export

possibilities. Above all, direct foreign investment has the advantage that eventual outflow of resources takes place only if the investment ventures are successful and, for repatriation of profits, the investors have to buy foreign exchange in the open market. At the same time, the public revenue of the government increases in the form of taxes collected from these business enterprises.

As expected, the inflow of direct foreign investment was very small in the beginning; and it is picking up only slowly. However, if the Indian economy continues to grow stronger and the policy of the government continues to be liberalised, the rate of inflow should increase to a substantial level.

Presently, thus main objectives of industrial policy of Government are :

- to maintain a sustained growth in productivity;
- to enhance gainful employment;
- to achieve optimal utilisation of resources;
- to attain international competitiveness; and
- to transform India in to a major player in the global arena.

DECLINING ROLE OF PUBLIC SECTOR

Another leading component of the Government's industrial policy in the liberalised era is to leave those fields in which its competence is believed to be inferior to that of the private sector. In other words, the new policy assigns a greater role to the market mechanism and private sector than to the public sector. The government no longer aims at controlling the commanding heights of the economy and using them for forcing the private sector along pre-selected lines. Instead, in the new policy, the role of the government is limited to -

- (i) providing defence and social services,
- (ii) assuming the primary responsibility of providing infrastructure (which may be supplemented with participation by the private sector),
- (iii) concentrating upon good governance by enforcing the laws and creating a safe and congenial atmosphere for economic growth.

In line with this approach, therefore, the government is pursuing a policy of what is known as phased 'disinvestment' of public sector undertakings and taking steps for rehabilitating the viable weak units, while protecting, to the extent possible, the interests of the workers employed in them. At the same time, the government has been encouraging voluntary retirement by the employees so as to reduce the financial burden on public enterprises. In actual practice, however, the outlines of this policy have not been very sharp and its implementation has been below optimum. In most years, the achievement has been only a fraction of the target set in the budget for the year. The accompanying Table 5.2. provides a brief picture of the progress of disinvestment in public sector undertakings.

Table 5.2
Disinvestment in Public Sector Undertakings

(Rs. crore)

<i>Year</i>	<i>Target</i>	<i>Achievement</i>
1991-92	2500	3038
1992-93	2500	1913
1993-94	3500	NIL
1994-95	4000	4843
1995-96	7000	362
1996-97	5000	380
1997-98	4800	902
1998-99	5000	5371
1999-00	10000	1829
2000-01	10000	1869
<i>Year</i>	<i>Target</i>	<i>Achievement</i>
2001-02	12000	5632
2002-03	12,000	3348
2003-04	14500	15547
2004-05	4000	2765
2005-06	NA	NA

Source : Economic Survey, 2002-03.

Small Scale Industries

Small-scale industry under IDRA, 1951, is one with an investment up to Rs. 1 crore in plant and machinery, excluding land and building. According to Section 7 of Micro, Small, Medium Enterprise Development Act, 2006, enterprises have been classified as a micro enterprise, a small enterprise, a medium enterprise according to quantum of investment made in Plant and Machinery. Section 7 provides for Classification of enterprises as a micro enterprise, a small enterprise, a medium enterprise, as under-

- (i) In the case of the enterprises engaged in the manufacture or production of goods pertaining to any industry specified in the First Schedule to the Industries (Development and Regulation) Act, 1951(65 of 1951) classification is done on the basis of investment in plant and machinery and are classified as "An enterprise is a small enterprise, where the investment in plant and machinery is more than twenty-five lakh rupees but does not exceed five crore rupees"
- (ii) In the case of the enterprises engaged in providing or rendering of services classification is done on the basis of investment in equipment.

— “An enterprise is a **small enterprise**, where the investment in equipment is more than ten lakh rupees but does not exceed two crore rupees”.

Small scale industries has unique place in Indian scheme of planned economic development because of its contribution to countries industrial production, export, employment, and creation of Industrial base. It is evident from the time series data on various economic parameters which are given in the following Table 5.3:

Table 5.3
Number, Production, Employment and Export in Small Scale Sector

Sr. No.	Year	Total SSI units (lakhs)	Fixed investment (Rs. crore)	Production (Rs crore)		Employment (lakh persons)	Exports (Rs. crore)
				Current prices	Constant prices (1993-94)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	1990-01	67.87	93555	78802	84728	158.34	9664
2	1991-92	70.63	100351	80615	87355	165.99	13883
		(4.07)	(7.26)	(2.30)	(3.1)	(4.83)	(43.66)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
3	1992-93	73.51	109623	84413	92246	174.84	17784
		(4.07)	(9.24)	(4.71)	(5.6)	(5.33)	(28.10)
4	1993-94	76.49	115795	98796	98796	182.64	25307
		(4.07)	(5.63)	(17.04)	(7.1)	(4.46)	(42.30)
5	1994-95	79.60	123790	122154	108774	191.40	29068
		(4.07)	(6.9)	(23.64)	(10.1)	(4.79)	(14.86)
6	1995-96	82.84	125750	147712	121175	197.93	36470
		(4.07)	(1.58)	(20.92)	(11.40)	(3.42)	(25.46)
7	1996-97	86.21	130560	167805	134892	205.86	39248
		(4.07)	(3.82)	(13.60)	(11.32)	(4.00)	(7.62)
8	1997-98	89.71	133242	187217	146262.9	213.16	44442
		(4.07)	(2.05)	(11.57)	(8.43)	(3.55)	(13.23)
9	1998-99	93.36	135482	210454	157525.1	220.55	48979
		(4.07)	(1.68)	(12.41)	(7.7)	(3.46)	(10.21)

10	1999-00	97.15	139982	233760	170379.2	229.10	54200
		(4.07)	(3.32)	(11.07)	(8.16)	(3.88)	(10.66)
11	2000-01	101.1	146845	261297	184401.4	238.73	69797
		(4.07)	(4.90)	(11.78)	(8.23)	(4.21)	(28.78)
12	2001-02	105.21	154349	282270	195613	249.33	71244
		(4.07)	(5.11)	(8.03)	(6.06)	(4.44)	(2.07)
13	2002-03	109.49	162317	311952	210636	260.21	86013
		(4.07)	(5.16)	(10.52)	(7.68)	(4.36)	(20.73)
14	2003-04	113.95	170219	357733	228730	271.42	NA
		(4.07)	(4.87)	(14.68)	(8.59)	(4.31)	
15	2004-05	118.59	178699	418263	251511	282.57	NA
		(4.07)	(4.98)	(16.92)	(9.96)	(4.11)	
16	2005-06	123.0	NA	476201	277668	294.91	NA
		(4.10)	-	(13.9)	(10.4)	(4.4)	-

Source : Government of India, Ministry of Small Scale Industries. Annual Report 2005-06

The small-scale sector has maintained a higher rate of growth than the overall industrial sector. The comparative growth rates of production for both the sectors are given in Table 5.4.

Table 5.4

Growth Rate in SSI and Industrial Sectors

Year	Growth rate of SSI sector (%)	Growth rate of overall industrial sector
1993-94	5.7	6.0
1994-95	10.0	9.1
1995-96	11.5	13.0
1996-97	11.3	6.1
1997-98	9.2	6.7
1998-99	7.8	4.1
1999-2000	7.1	6.7
2000-01	8.0	5.0
2001-02	6.1	2.7
2002-03	7.7	5.7
2003-04	8.6	6.9

2004-05	9.96	8.4

Source : Government of India, Ministry of Small Scale Industries. Annual Report 2005-06

The Contribution of SSI to the total Industrial Production and Gross Domestic Product (GDP) are given in Table 5.5:

Table 5.5

SSI Contribution to Industrial Production and GDP

<i>Year</i>	<i>Contribution of SSI (%)</i>	
	<i>Total industrial production</i>	<i>Gross Domestic Product (GDP)</i>
1997-98	39.70	7.02
1998-99	39.94	6.81
1999-00	40.02	6.69
2000-01	39.91	6.86
2001-02	39.63	6.67
2002-03	39.48	6.82
2003-04	39.42	6.71

Source : Government of India, Ministry of Small Scale Industry Annual Reports

Industrial Sickness

The policy of over-regulation of the entire industrial sector, coupled with restrictions on closing a financially sick unit or reducing staff strength, led to a growing menace of industrial sickness, that is, the phenomenon of industry and business units running into a persistent loss and erosion of net worth. Instances also came to light where the entrepreneurs deliberately made a unit financially sick by exploiting it for personal gain. Over years, the growing menace of industrial sickness not only assumed a cancerous form but also endangered the financial institutions which had extended loans to them.

Factually speaking, the incidence of industrial sickness had been on the increase right from the beginning and even the new economic policy initiated in the 1990s was of little help in stemming this tide. The number of non-SSI sick units increased from 1401 in December 1980 to 3,317 in March 2001. Correspondingly, the number of SSI sick units increased from 23,149 to 2,49,630. Such a phenomenal growth in numbers presents a dismal picture of the state of affairs and the mismanagement from which the entire industrial sector suffers. It should be remembered that a leading cause of this disease is the faulty credit and regulatory policies pursued by the authorities. As a result, a number of financial institutions have come to suffer on account of the financial sickness of the units financed by them. For example, the outstanding bank credit to non-SSI sick industrial units increased from Rs 1,520 crore in December

1980 to the phenomenal Rs. 21,270 crore in March 2001. Similarly, the outstanding bank credit to SSI sick units increased from Rs 306 crore in December 1980 to Rs 4,50 crore in March 2001. It is seen that in spite of relatively smaller number, non-SSI units are creating more serious financial problem for our economy.

The phenomenon of industrial sickness has been fed by both fraudulent approach by the owners and the faulty policies pursued by the authorities. The government has been guilty of over-regulating the industrial units to an extent that left little scope for a reasonable return on investment by fair means. At the same time, the government policies also provided an ample scope and temptation for frauds and mismanagement. Frequently, the permitted sales price was insufficient to cover the cost of inputs. The authorities also failed to formulate and implement a labour and wage policy in conformity with the needs of growing industrialization of the economy. The employing units were often forced to bear the wage bills of workers no longer needed by them. In the entire atmosphere of over-regulation, the owners of industrial units found ways of draining out resources to themselves through various means like job contracting, agency work and the like.

Normally, when a business unit turns financially sick, avenues should be explored for restructuring and reviving it. In the process, it may even be given a fresh injection of capital. In case this remedy is not expected to work, it should be allowed to close down. In India, however, the policy of the government has been to keep these units alive through financial support from itself and from the financial institutions with the objective of protecting the jobs of the employees.

In May 1987, the government set up the Bureau of Industrial and Financial Reconstruction (BIFR) for studying the possibility of rehabilitating those sick units which could be revived and suggest measures for doing so, including injection of fresh capital, reduction in staff through voluntary retirement schemes and so on. It started its work on May 15, 1987. However, public sector undertaking were brought under its purview only in December 1991. Till September 2006, as many as 6991 cases were referred to BIFR, including 296 relating to public sector undertakings. These measures, however, touched only a fringe of the problem of industrial sickness. Moreover, the basic causes giving rise to industrial sickness were not removed. As a result, the absolute number of sick units has been increasing with the passage of time.

In 2002, Companies (Second amendment) Act came into existence, providing for the establishment of a National Company Law Tribunal which was assigned the function of BIFR also. With the repeal of Industrial Companies (Special Provisions) Act, the new arrangement is expected to have several advantages over the earlier situation. Under the new system, the definition of industrial sickness has been improved and a fund has been set up for revival and rehabilitation of sick units.

ROLE OF SERVICE SECTOR IN INDIAN ECONOMY

With economic growth and improvement in living standards, the proportionate share of natural products for human consumption registers a downward trend. In contrast, there is an inherent tendency for the share of services sector to register an increase and this prompts a shift in:

- (a) composition of national income by industry of origin; and
- (b) the associated change in occupational pattern of the society.

Empirical analysis reveals that an increase in per capita income is associated with a reduction in the proportion of population engaged in agricultural and other primary activities. Similarly, with further improvement in per capita income, occupational pattern shifts from secondary i.e., (manufacturing, etc.) to tertiary (i.e. services) sector. For example, in countries like USA, UK, Germany and Japan, the proportion of population engaged in agriculture is only between 3 and 6 per cent as compared with a figure of about 60 per cent in India. As already stated, the share of primary sector slowly declined to 18.5 per cent in 2006-07 from 59.1% of GDP in 1950-51. With the economic growth bringing about a decline in the proportionate share of primary sector in national income, there should also be a corresponding reduction in the share of population dependent upon it, as also a reduction in the work force employed in it, though it has not happened in India. A decline in the share of agriculture in national income is inherent in the growth process itself because agriculture cannot grow as fast as other sectors. Normally services sector tended to grow at the fastest rate followed by manufacturing and others. It is generally believed that once economic growth reaches a certain critical level, the growth rate of its services sector comes to overshadow those of primary and secondary sectors. In India, however, this stage appears to have arrived much earlier than expected. In our country, the services sector is already growing faster than both the other two sectors and its share in our GDP is steadily increasing. Considering services sector in totality, it is observed that its share in GDP was only 26.8% in 1950-51. One of the reasons for this proportion being so high even in 1950-51 lies in the fact that this category includes the ever-expanding “public administration” and real estate and ownership of dwellings and business services”. The combined share of the entire service sector registered a steady increase over the years. It reached 32.1% in 1970-71 and increased to 36.6% in 1980-81. By 1990-91 it had reached 40.6%, which further jumped to 49.6% in 2001-02 and subsequently reached 54% in 2005-06. Within the services sector, the sub-sector comprising “transport, communication and trade” has always accounted for the largest (40-45%) proportion. The share of this category in our GDP increased rapidly from 11.9% in 1950-51 to 15.5% in 1970-71, to 18.4% in 1980-81 and to 18.7% in 1990-91. During 1990s and later, it increased much faster and reached 26% in 2005-06. The economic services group covered Banking, Insurance, Real Estate and ownership of Dwelling and Business services.

It is to be noted that “real estate” includes all types of construction e.g. residential and commercial buildings, factories and workshops, roads, bridges and so on. The construction activities generate a variety of services, employment and growth multipliers. However, this category of economic services failed to receive its due place in our growth policy. The share of this group of “services” in GDP was 6.60% in 1950-51. As a result of growth policies it continued to register a very slow pace of growth. Growth rate recorded in 1995-96 and 1999-2000 were 11.4% and 12.7% respectively. The growth rate achieved in 2005-06 was 13.7%. The other sub-category of services sector viz. “Public Administration and Defence and other

services” should be expected to register a downward trend in the percentage share of our GDP especially in the era of economic liberalisation, competition and good governance. The main reason for an absolute increase in this sub-category should be enhanced efficiency of the Government administration and its role in better defence, social security and other welfare services. The share of GDP, which was 9.3% in 1950-51, increased unabated to 12.3% in 1992-93. Thereafter a downward trend witnessed up to in 1996-97 (11.4%). The share of GDP further increased to 14.7% in 2002-03. The growth rate achieved in 2005-06 was 14.2%. In India, however, the growth of this sub-category is mainly attributable to avoidable expansion of the Government administration and its increasing inefficiency. “The services sector is fastest growing sector of the economy, growing at 9% since the mid 1990s. The sector has potential to grow. The scope for expanding construction activity is limited by constraints on land development in many states. The most important of these arise from the urban land Ceiling Act which is still in operation in some states. Non-transparent land use policies, which are almost ubiquitous, also added to the problem. Urban rent control, high stamp duty and other transfer costs also restrict construction. State government and municipal bodies need to undertake a comprehensive review of such policies and amend necessary laws/regulations in line with the requirement of modern city development to formulate their Master Plans and Zonal Plans in a given time frame. State Government need to make their rural/urban land-use conversion processes simpler and quicker. There is considerable scope for FDI in this sector. Investment in the sector can be stimulated if government and SEBI bring about refinements in the financial markets by developing sophisticated financial instruments customized for real-estate sector.

NATIONAL INCOME OF INDIA—CONCEPT, SIGNIFICANCE, MEASUREMENT AND TRENDS

National Income as a Concept

Every economy is characterized by a continuous stream of activities of several varieties. The activities are undertaken by individuals, households, business units, authorities and other economic entities in alternative capacities as consumers, producers, investors, and so on and their overall objective is

- (i) to satisfy, to the extent possible, the wants of the members of the society, and
- (ii) add to the productive capacity of the economy to produce goods and services in the future.

The sum total of goods and services produced during a given period of time, normally a year, is termed its ‘national product’. And since this produce is shared

between members of the society, it is also referred to as 'the national dividend'. In practice, however, we are faced with a number of conceptual and other problems on account of which

- the precise definition of concepts like that of 'national product' undergoes a substantial revision and carries several qualifications, and
- a number of related concepts are also defined so as to cover the relevant analytical and policy issues.

Let us briefly look at the basic fact that economic activities of a country can be simultaneously viewed as follows.

- They result in the production of goods and services, and thereby generate 'national product'.
- The produced goods and services are assigned to (divided between) members of the society. This is done mainly (though not fully) with the help of market mechanism and use of money. This dimension of activities gives rise to the concept of 'national income'.
- The economy also disposes of produced goods and services in alternative ways, such as in the form of consumption, investment and building of stocks or inventories.

It follows, therefore, that the economic system of a country may be looked at in three alternative ways, namely,

- as a system and sum total of productive activities,
- as a system and sum total of income receipts, and
- as a system of exchange activities and a sum total of expenditures incurred.

In other words, the 'national income' of the country may be defined and measured in three alternative ways, that is, from the angles of

- (i) production,
- (ii) generation of income, and
- (iii) expenditure, or final utilisation of the national produce.

It is also logical to assume that the three approaches should yield the same estimates provided we have all the necessary information and there are no conceptual and methodological inconsistencies in our approach. The reason is that all the approaches aim at describing and measuring the same thing from different viewpoints. In a sense they are circular in nature and one gives rise to the other. For example, let us consider the activities of the economic units engaged in production. These production centres bring productive resources like labour and capital together and put them through productive processes. Consequently, the total of goods and services produced during a year measures the 'national product'. However, the

suppliers of productive resources have to be compensated for the productive services supplied by them. Normally, they receive this compensation in the form of money income. Thus, the sum total of incomes received gives us the measure of national product distributed to the factors of production, that is, the national income by factor shares. The incomes received are utilised (spent) variously on consumption goods for household use, on acquiring capital and other physical assets for using them in future for production, or for building up stocks and inventories.

It has been stated above that all the three approaches should give same measure of national produce. This is true when all the theoretical and conceptual conditions are satisfied. In reality, however, in each of the three approaches, several data deficiencies are faced by us, the details of which shall be looked into later. Accordingly, it is generally agreed that all the three approaches should be used simultaneously. This

- ensures that for each component of national income the most suitable method is used;
- errors and omissions are minimised, and
- cross checks can be applied in the estimates.

At this stage, it would be of interest to note a few prominent definitions of national income while keeping in view the fact that they

- tend to highlight alternative approaches,
 - assume the existence of money and market mechanism, and
 - their partial use by the economy (that is, existence of self-consumption, and barter transactions).
- (a) Simon Kuznets says that national income is “ the net output of commodities and services flowing during the year from the country’s productive system into the hands of ultimate consumers or into net addition to the country’s capital goods”.
- (b) V.K.R.V. Rao decided to measure national income in terms of its money value, and accordingly held that “national income may be defined as the money value of the flow of commodities and services, excluding imports becoming available for sale (or capable for being sold) within the period, the value being reckoned at current prices minus the sum of certain specified items.

Measurement of National Income

The National Income of a country can be measured in three alternative ways : (i) as a flow of goods and services; (ii) as a flow of income, and (iii) as a flow of expenditure correspondingly. We have three methods of measuring the national income, viz. (i) the product method;(In terms of National Product) (ii) the income method and (iii) the expenditure method.

National Product — The Product Method

Under the product method, money value of all goods and services produced in an economy during a year are calculated. The money value is calculated at market pricing. The sub total is called the GNP at market prices. Deducting indirect taxes and add to it subsidies, the value of the GNP at factor cost is estimated. If further deduction of depreciation cost is made from the GNP, we get the Net National Product (NNP) at factor cost which is identical with National Income.

National Product is defined as the sum total of all goods and services produced by an economy during a given period of time, normally a year. In addition, this definition conforms to the following conditions.

1. Since national product comprises a variety of goods and services, it is impossible to add them in terms of their physical quantities. The only method by which they can be added up is by converting them into some common denominator. This is done by estimating their 'values' which happen to be (i) either market determined, (ii) or determined by official orders, or (iii) imputed.
2. National product, as seen above, is to include all goods and services produced irrespective of whether they are marketed or are used in self-consumption. In the latter case, they are assigned 'imputed' values. Some important examples of such self-consumption items include parts of agricultural produce and dairy products which the farmers produce for their own use. Similarly, in a country like India, a sizeable proportion of produce gathered from woods is not sold in the market. Several houses are not rented out. The owners themselves occupy and live in them.
3. However, for various reasons, it is not possible to cover all goods and services produced for self-consumption. For example, the services by the housewives to their families are not accounted for in estimates of national product. Similarly, it is not possible to include illegal activities like smuggling, black marketing, and the like.
4. In estimating national product, care is taken to avoid multiple counting of a value. This is done by estimating only the 'value added' at each stage of production. Instead of taking the gross value of output, it is reduced by the values of the inputs (all goods and services) used in the process of production. In other words, a distinction is made between the 'final' and 'intermediate' products and for avoiding multiple counting, only the final products are added up.

In details, actual steps to be taken for estimating 'net value added' have to differ from one specific productive activity to the other. For this purpose, therefore, the whole economy is divided into certain sets of categories of economic activities. For each set, total value of the output is taken and the value of inputs of raw materials and services is subtracted from it. This gives us the 'value added' by the said set of activities without double counting. If the set of activities happens to be that of services, the value added is measured in terms of the total money paid in return for the services received minus the cost of inputs like expenditure on transport, advertisement, and other miscellaneous items.

For example, if we consider an individual firm engaged in production of, say steel, its net value added is the total value of its production minus the intermediate products used.

Income Method

Activities of production lead to the payment of incomes to the suppliers of productive services (also called “productive resources” or “productive inputs”). The net value added available for each unit of production is equal to the amount of income generated by the unit in the process of production. If we consider a given production firm, then the income generated by it is the total value of its produce minus the value of the inputs used. For this reason, the two terms ‘national product’ and ‘national income’ have the same meaning. This value added or income generated takes the form of (i) ‘wages and salaries’ paid to the labour and (ii) the ‘operating surplus’, which itself is a complex concept and is further shared by the suppliers of “non-labour” inputs.

The labour income generated takes the form of wages and salaries including commission, bonus, pensionary benefits (note that these benefits are different from ‘old age pensions’, which are a form of ‘charity’ or ‘social security’). It may also take the form of payment in kind, such as housing accommodation.

For the economy as a whole, the operating surplus is defined as “gross output at producers’ values less the sum of intermediate consumption, consumption of employees (including labour income of self-employed), consumption of fixed capital and indirect taxes reduced by subsidies.” It should be noted that this operating surplus is further distributed as and received as income in various forms, like profit, interest and rent etc. Some portion of the operating surplus remains undistributed and may be used for further investment or building up of reserves. The distributed portion of operating surplus takes the form of dividends, interest and rent. In the Indian context, the concept of rent includes rent on land as also rent on buildings and other structures. In the case of self-employed persons, the income is a mixture of wages, interest, and profit, etc. Accordingly, the national income as expressed in the form of ‘factor incomes’ consists of

- (i) wages and salaries;
- (ii) interest;
- (iii) rent;
- (iv) dividends;
- (v) undistributed profits; and
- (vi) mixed income of self employed.

However, national income is not simply an aggregate of all incomes or receipts. It includes only those incomes which correspond to current production of goods and services and are referred to as factor incomes. Various economic units in the country (both households and others) receive some incomes which do not correspond to the productive services rendered or value added through a production process. These are called **transfer incomes** and include old age pensions, unemployment allowances, education grants, gifts and charities, etc. The transfer receipts are excluded from the calculations of national income.

Expenditure Method

Expenditure approach estimates national income by looking at the manner in which it is disposed or utilised. In a sense, expenditure approach also measures national product by considering expenditure of those who purchase the finished or final goods and services. The national expenditure is the sum total of expenditure incurred by all categories of economic units, namely, the government, households and business sector. In each case, only expenditure on 'final use' is considered so as to avoid duplication, that is, for excluding the network of intermediate sales of all products needed for further production. This utilisation takes the following alternative forms, namely--

- (i) Household consumption expenditure,
- (ii) Government consumption expenditure, and
- (iii) Capital formation comprising (a) fixed capital formation, and (b) stock accumulation.

Let us look at each of them briefly.

Household Consumption Expenditure

It is also known as private final consumption expenditure like that on food, clothing, shelter, services, etc. It covers expenditure by households and non-profit institutions on (i) non-durable consumer goods and services, and (ii) durable goods excluding land and buildings. A durable good is the one which satisfies two conditions, namely,

- its expected life time is considerably longer more than one year; and
- it has a relatively high value.

Examples of consumer durables include motor cars, refrigerators, washing machines, television sets, and so on. However, purchases and construction of residential buildings are not treated as consumer expenditure of the households on consumer durables. Instead, they are included in the gross capital formation. It is the current "residential service" provided by the residential houses which forms part of current final consumption. In the case of residential houses which are let out, the house rent represents the value of this service. In the case of self-occupied houses, imputed rent is included in the final consumption expenditure. We should note that when house rents are regulated by the authorities in some form or other, the rental value of houses fails to capture the true measure of their residential service.

A part of produce, such as in agriculture, is used for self-consumption by the producers. The equivalent market value of such consumption is considered as part of household consumption expenditure.

While estimating household expenditure, there is a big flaw in the treatment of household services. In this regard, a careful note should be made of the following practice. If these services are provided by the members of the household itself, they do not involve any formal payment in money terms. And for this reason, they are not included in the consumption expenditure of the said household. But if same services

are received on payment, they are counted as part of household expenditure and therefore part of national income. For example, when these services are rendered by some households [that is, its members] to other households in their capacities like maid servants, cooks, gardeners, and so on] on a payment basis, then the payments made are included in household expenditure. Obviously, the practice described is logically contradictory, but it is there.

Government Consumption Expenditure

The concept of government consumption expenditure poses some difficult questions. It provides several services to the economy. But generally, they are not 'sold' to the latter. In some cases, the government provides them absolutely free. In some other cases, the "user" charges made have no relationship with the value of the services rendered. Examples of such unpaid or partially charged services include defence, judicial services, health care, and law and order etc. On account of non-payment for their use, their consumption does not appear as the consumption expenditure of households and business sector.

According to one view, these services rendered by the government have an economic value and, and for this reason, they form a part of the final consumption. In other words, holders of this view maintain that the government expenditure on these items should be considered as part of the final consumption expenditure of households and business sectors. The practice is to take the money expenditure incurred by the government on the provision of these services as a measure of the economy's expenditure on these services. Similarly, government expenditure on durable goods used for defence is treated as part of consumption expenditure of the government.

But there are several theoretical and other arguments against this practice. It can be argued that the government expenditure should not be added to consumption expenditure of the economy as such, but should be adjusted and revised before doing so. It is asserted by many that a part of government expenditure does not add to national product in any sense. They say that the government has to spend a huge amount of money for its own maintenance over and above what it has to spend for providing various services to the society. They also argue that government activities are always conducted with less efficiency than is the case with similar activities provided by the private sector. However, the problem is that even when we admit these arguments, it is not possible to split government expenditure into 'nominal value of consumption' and 'true value of consumption', that is between its 'productive' and non-productive' components. Accordingly, the practice is that entire government expenditure except the transfer payments is considered of economic value and taken into account.

The three methods of measurement give us three measures of national income, viz., gross national product, gross national income and gross national expenditure. In other words, any of these three methods could be used to measure national income in a country. The application of a particular method is largely determined by the division of economic activities, economic structure, and above all the state of statistical data. The income method may be most suitable for the developed economies while it may appear inappropriate and unworkable in the under developed economies, which do not possess relevant data while the income would work very successfully in the developed economies in the manufacturing trade and transport sectors but it appears unworkable in the agricultural sector. While it is

logical to assume that the three methods should yield some estimates provided all necessary information are compiled and there are no conceptual and methods logical inconsistencies in the approach. The reason is that all the methods aim at describing and measuring the same thing from different view points. This is true when all the theoretical and conceptual conditions are satisfied

Capital Formation

Gross capital formation consists of the acquisition of fixed assets and accumulation of stocks. Fixed assets are physical productive assets (such as, machinery and equipment, vehicles, residential buildings, factories, civil works and other structures like roads, canals, etc.). The stock accumulation refers to the inventories in the form of changes in stocks of raw materials, fuels, finished goods and semi-finished goods awaiting completion. Thus, gross capital formation is that part of country's total expenditure which is not consumed but is added to the nation's fixed tangible assets and stocks.

National versus Domestic Concept of Income

Most countries have economic contacts with rest of the world on account of which a change takes place in its annual income. A country enters into a variety of economic transactions with others. These transactions include trade, transfers, investments, and other capital flows. In the process, it earns an income for the factor services rendered to the rest of the world and has to pay for the factor services received. The incomes representing factor services include payments for tours and travels, wages for labour, royalties, interest, dividend and profit, and so on. Income earned from abroad less income paid to factor services purchased from rest of the world is known as "net factor from abroad". The "net factor income from abroad" can be a negative figure also.

When net factor from abroad is not taken into account, we get a measure of domestic product. And addition of net factor from abroad makes the measure that of national product. By way of further elaboration, the measure of production arising out of the activities of economic agents within the country is termed its domestic product even if a part of that income accrues to non-residents. In contrast, a measure of national (as against domestic) income is the one which accounts for income attributable to factor services rendered by the normal residents of the country to the rest of the world less factor services rendered to them by the rest of the world. It also includes retained earnings of foreign controlled companies and branches of foreign companies in the domestic territory.

Gross versus Net Value Added

Production activities of the economy result in the consumption (or depreciation) of a part of its fixed capital. There are two aspects to be considered here. Firstly, the fixed capital stock of the economy is the result of its past economic activity and should be included in the national income estimates of the years in which that production took place. Secondly, the consumption of a part of this capital reduces the future productive capacity of the economy. Accordingly, a distinction is made between gross national product and net national product. And the difference between the two is the amount of fixed capital consumption. It measures the replacement value of the part of the capital stock which is used up in the production process during the year. However, unforeseen obsolescence, catastrophes and the depletion

of natural resources are not taken into account.

Factor Cost versus Market Prices

The production and income methods measure the domestic product as the cost paid to the factors of production. As such it is known as domestic product at "factor cost". However, when we come to the expenditure approach, it gives us the measure of expenditure at market prices. Accordingly, the prices paid by the buyers can differ from the "factor cost" of producing them.

The factor cost includes "profit" incomes also, even though this element may be an element of exploitation of the consumers by monopolist forces and other market imperfections. But the market price differs from the 'factor cost' on account of two additional causes as well.

- Firstly, it includes the indirect taxes like excise duties, customs, and sales tax etc.
- And secondly, if a good is subsidized by the government, its market price falls below its factor cost by the amount of the subsidy.

As a result, we find that the two measures, namely, those based upon factor cost and market prices differ from each other and that the market measure is obtained by (i) adding indirect taxes and (ii) subtracting subsidies from the factor cost measure.

Indirect taxes are levied on goods and services in respect of their production, consumption, sales, storage, import, export, transport and entertainment, etc. It is expected that they will be finally borne by the buyers. As a result, they are expected to add to the buyers' expenditure by an equivalent amount. In contrast, a subsidy given on any good or service is expected to reduce its market price by an equivalent amount. The subsidies include all grants on current account.

The difference between the two measures is applicable in all the alternative measures of national income, that is, gross domestic product (GDP), gross national product (GNP), net domestic product (NDP) or net national product (NNP).

The above distinction suffers from one important limitation. It is that the incidence of indirect taxes and subsidies may not exactly reflect in equivalent shift in their market prices and the difference between the two measures of national product may not equal to the net indirect taxation.

Current versus Constant Prices

Regardless of the actual measure of national income and regardless of the approach adopted in its estimate, it may be estimated at current prices or at constant prices. The measure is at current prices when the concept is measured at prices prevailing during the period in question. The measure at current prices, therefore, represents the additive effect of both

- (a) the change in the flow of real output flow, and
- (b) the change in prices at which the output is sold.

The limitation of the measure at current prices is that, when prices are changing, it fails to provide an acceptable estimate of the change in the flow of real output. By

inference, it also fails to provide a measure of economic growth, or that of a shift in real per capita income and economic welfare of the members of the society.

To overcome this and other associated limitations of the measure of national product at current prices, the effect of change in prices is sought to be eliminated. This is done by valuing production (or income or expenditure) flows at the prices prevailing in the base period. National income measured in this manner is termed as national income at constant prices or in real terms. It provides a measure of the growth of the economy. Further, if national income estimates are also available by industry of origin, then they can be used for studying the structural changes in the pattern of production in the country. This information is often vital for detailed analysis of the economy as also for formulating relevant policy steps. Similarly, when real national income estimates are available in terms of shares of factor incomes, they can be used to study the shifts in their respective productivity.

The Concept of Saving

Saving is the excess of current income over current expenditure of various sectors of the economy. It is the balancing item on the income and outlay accounts of the producing enterprises, household, government administration and other final consumers. In the case of a closed economy, its saving equals capital formation during the year. In the case of an open economy, saving equals capital formation plus net capital inflow from abroad during the year.

Gross Capital Formation

It consists of the acquisition of fixed assets and the accumulation of stocks. Fixed assets include physical productive assets like buildings, civil works, machinery and vehicles, etc. In India, gross fixed capital formation consists of net outlays (purchases and own account production) of industries, household and other economic entities on fixed assets. Outlays of government on durable goods for military use are excluded from this measure. Other significant items excluded from this measure are: acquisitions of both reproducible and non-reproducible durable goods (except land, mineral deposits, timber tracts, fisheries and the like) for civilian use, work-in-progress on construction projects; capital repairs, outlays on the improvement of land and on the development and extension of timber tracts, plantations, vineyards, etc. which take considerably more than a year to become productive. Thus fixed capital formation includes

- new assets;
- buildings;
- roads and bridges;
- other construction and works;
- transport equipment, including transport animals;
- machinery and other equipment, including stock, dairy and the like;
- net purchases of second-hand physical assets.

The accumulation in the form of stocks is the changes in stocks of raw materials,

fuels, finished goods and semi-finished goods.

Private Income

It is a measure of the income derived from national income by adding the sum of government transfer payments (grants, subsidies, social security payments, gifts, etc.) and interest on national debt and subtracting from it the property income of government departments and profits of government enterprises. Private income however includes the taxes paid by people to the government.

Personal Income

Personal income measures the actual current income receipts of persons from all sources. It is different from private income in the sense that it excludes the undistributed profits which accrue to the private sector but are not received by the persons. It also excludes the expenditure tax paid to government by the private corporate sector. If we take the measure of private income and subtract from it the savings of the private corporate sector and corporation tax, we get the measure of personal income.

DIFFICULTIES IN ESTIMATING NATIONAL INCOME

Measurement of national income poses several difficulties, which include both conceptual and statistical ones. They are briefly described below.

1. National income consists of not one but innumerable goods and service. And they have to be somehow added up to arrive at a measure of national income. The real difficulty arises from the fact that dissimilar things cannot be added up. They have to be converted into some common denominator before doing so. And the only practical way of doing so is to take their market prices. Now it is widely recognised that market prices do not represent the true social valuation of the goods and services. In the case of officially determined prices, they reflect only what the authorities decide them to be. And in the case of market determined prices, all kinds of market imperfections distort them. The market prices are deeply influenced by--
 - (i) the market structure,
 - (ii) the sales and marketing campaigns of the suppliers,
 - (iii) taxation, subsidies, and other rules, regulations and restrictions of the authorities,
 - (iv) the prices of productive resources and distribution of income and wealth;
 - (v) the role of speculative forces,
 - (vi) shifts in prices of imports and exports, and
 - (vii) several other factors.

In other words, we do not have a reliable method of adding flows of diverse goods and services.

2. The problems of addition increase manifold when we consider the question of

estimating national income in real terms. All the problems faced in the compilation of price index numbers are encountered in this case.

3. There are also serious problems regarding the reliability of information to be used in estimating national income. They include the following :
 - (a) Several pieces of information are available with undue delay and it is not possible to use them in time for formulation of effective policy measures. At the most, this information may be used to revise the past estimates.
 - (b) A modern economy is so complex that it is next to impossible to gather complete information needed for estimates of national income. A number of intelligent guesses have to be made and used for this purpose. These omissions can be quite serious, particularly in the case of developing countries where adequate records are not maintained. Moreover, in the absence of records, most individuals and households are not able to provide correct information of their consumption and investment values.
 - (c) In some cases, relevant information may not be available to the authorities because the households and business units required to provide the information may have reasons to hide the information. In still other cases, they may not have the exact information
4. National income estimates are faulty in terms of their conceptual approach as well. They tend to concentrate on the market pricing of production flows. This in itself is a major limitation of these estimates. The problem is that there is a lack of consistency even in this.
 - (a) Thus, the household services performed by the members of the household are left out of estimates of income generation. But if the same services are performed by others and are paid for in money terms, they are included in national income estimates. The logical inconsistency of this stand comes to the fore when we compare two situations. In situation one, two households perform various household services for themselves and no payment is involved. In situation two, the two households perform same domestic services for each other and pay each other in money terms. Clearly, there is no difference in real national income when we move from one situation to the other. But in national income estimates, this is not so.
 - (b) Take the case of houses, factory buildings and other structures. When they are constructed, there is a corresponding addition to national production. However, they are also taken to add to the national income in later years when they are used for residential purposes or as production centres. Moreover, this methodology is given up when we consider certain other structures like roads. While the construction of roads is taken to contribute to national income in the year of construction and the repairs are taken to add to national income later, the use of roads is not taken to add to national income. However, if there is a road which is owned privately and can be used only on payment, the income received by the road owner is again counted as a part of national income. There are similar contradictions in the case of several other durable goods also. Thus the manufacture of cars is counted as part of national product during the year of manufacture but they are also

taken to add to national income in later years if they are hired out on payment instead of being used by the owners themselves. In reality, however, the consumption service provided in both cases is the same.

- (c) While consumption of fixed capital is considered for arriving at net output of the economy, loss of other productive assets is ignored. Production activities not only lead to a permanent loss of several mineral deposits, but also lead to degradation of many reproducible resources. Examples include degradation of land fertility, forest resources, pollution of water, discharge of harmful chemicals in the air and soil and so on. Some of these activities also lead to a loss of human health. However, all such forms of losses to the economy are ignored while estimating net value produced by the economy.
 - (d) Even if the national income estimates ignore the loss of other productive resources and confine themselves only to the consumption of fixed capital, certain questions are not answered satisfactorily. It can be debated as to whether depreciation should be estimated on the basis of the cost of acquisition and technical life of the capital assets, or it should be estimated on the basis of replacement cost.
5. The national income estimates do not cover illegal activities even though they may be adding to national product. They include smuggling, inland trade activities, production and income generation concealed from the authorities for avoiding tax obligations and prosecution etc.
 6. Several economic activities only add to the disutility of the members of society and entail use of resources (resource cost) which could be used for more productive purposes. But an increase in such activities is taken to add to national income rather than reduce it. For example, let us take the case of a worker who has shifted his residence to a greater distance from his work place. Therefore, compared with the earlier situation, he has to commute a longer distance to his work and has to spend additional time, effort and money for doing so. Though, in reality, both the individual worker and the country are losers on account of the shifting of residence of this worker, national income estimates record the additional resource cost as an addition to national income.
 7. Similarly, economic activities of the country may add to the output of goods and services (like drugs) which adversely affect the health and productivity of their users. But national income estimates do not take this fact into account. So long as a good or service has a market value, its production is added to the national income estimates.
 8. National income estimates include profit of the corporate sector. However, the profit of a business does not reflect the productive contribution of the entrepreneurship. Instead, it varies in relation to several factors like the overall expected or prevailing rate of profit in the economy. This rate itself tends to vary from economy to economy, region to region, industry to industry, and with the passage of time. In this context, mention may also be made of the fact that a large number of public sector undertakings are not run with the motive of earning a profit, while during a period of deficient demand, even private enterprises often fail to earn a profit. As a result, national income estimates can vary simply because of shifts in rate of profit without any corresponding change in real output.

Uses of National Income Estimates

National income estimates suffer from several drawbacks. And this highlights the need to improve their data availability and methods of computation. But even in their present state, they are highly useful in providing an insight into various economic magnitudes and the related issues in addition to providing a basis for policy prescriptions.

1. The first and foremost usefulness of national income estimates lies in the fact that they provide basic information for several analytical and other purposes.
 - While the estimates by themselves reveal the rate at which the economy is growing, the corresponding figures of per capita income show the adequacy or otherwise of economic growth. As it is, just an absolute increase in national income is insufficient unless it also adds to per capita income, because it is the latter which depicts the ability of the members of society to improve their consumption and living standards.
 - The estimates of national income by industry of origin reveal the inter-sectoral growth of the economy. We are able to assess whether the inter-sectoral imbalances are widening or narrowing. It should be noted that the potential rates of growth of different sectors differ from each other. Services have a potential to grow at the fastest rate followed by trade, industry and agriculture. This fact provides a basis for detecting a situation where the growth of the economy is lopsided and needs corrective measures.
 - Combination of occupational pattern of the society with national income estimates by industry of origin enables us to study the relative productivity and income earnings of different occupations. The information is helpful in rectifying the imbalances noticed and accelerating economic growth in a balanced manner.
 - When national income estimates are disaggregated at regional level, they help us in assessing regional economic disparities within the country. Combined with additional detailed information of national income, policy measures can be devised to narrow them down.
2. Every economy needs some form of planning for protecting itself against economic fluctuations and for exploiting its economic potential to the full. The need for such planning is all the more in the case of underdeveloped countries. Detailed national income data provide the basis for such planning exercises.
3. National income estimates help the authorities in quantifying the problem of income and wealth inequalities and take corrective steps.
4. A country is often in need to compare its economic performance with rest of the world. It has to deal with international institutions, particularly for participating in international capital flows. It also wants to compare its own economic performance with that of other countries so as to judge likely repercussion on its trade and balance of payments, and so on.
5. National income estimates provides a framework for national income accounting and social accounting. The former reveals links between various

categories of economic activities like production, consumption, accumulation of capital, government sector and rest of the world. Similarly, social accounting provides a framework both for social and economic analysis. In particular, it helps us in understanding the causes of economic inequalities.

National Income and Welfare

It is often maintained that an increase in national income leads to a corresponding increase in economic welfare of the society. This, however, may or may not be so. It should be remembered that economic welfare of the society depends upon a number of factors and size of national income is only one of them.

- (a) For any given national income, we should expect an increase in economic welfare when a reduction in inequalities takes place. This conclusion is based upon the assumption that richer persons have lower marginal utility of income than the poorer ones. This inference, however, is subject to the qualification that a reduction in inequalities may weaken economic incentives and reduce national income in the years to come.
- (b) An addition to national income may be the result of overworking of the labour force. If that is so, then it may not add to the economic welfare of the society.
- (c) Similarly, production of national income may be accompanied by a resource and environmental degradation of the economy. This may also result in its reduced productive potential.
- (d) As noted above, the so-called increase in national income may only be the result of additional resource use without improving the consumption standards of the people or the quality of their life. The increase in national income may be reflecting (i) an increase in sales and marketing efforts of the sellers, (ii) additional resource expense on commuting to work and back, (iii) increased output of harmful goods and services, and so on.
- (e) An increase in government expenditure on its own maintenance or producing certain public services inefficiently results in an increase in national income estimates, but not in economic welfare of the society.

Important : Conventionally the term National Income stands for Net National Product at factor cost, that is, Net Domestic Product at Factor Cost plus net factor income from abroad.

NATIONAL INCOME ACCOUNTS

These accounts provide statistical relationships between different sectors of the economy and help in studying the economic structure and conditions of the country. By inference, they also provide basis for policy formulation by the authorities. While preparing these accounts, the entire economy is divided into various sectors on the basis of its functions, such as production, consumption, capital formation, government transactions and transactions with rest of the world.

As in the case of private accounts, social accounts are also presented on the basis of double entry. According to the recommendations of the United Nations, matrix approach should be adopted in presenting these accounts, that is, every entry is to appear in a particular row and in a particular column, and for balancing sector accounts a row total must be equal to its corresponding column total.

The main contents of these accounts are mentioned below for illustrative purposes.

1. Production Account

<i>Debit</i>	<i>Credit</i>
1. Payments to Factors of Production	1. Households and Government expenditure on goods and services produced
2. Imputed cost retained by the firm (depreciation, undistributed profit)	2. Sale of items
3. Payment of taxes to the government	3. Net income from abroad
4. Payment to government for acquiring its factor services	
5. Payment for purchases of raw materials, machines, etc.	

2. Household Account

<i>Debit</i>	<i>Credit</i>
1. Payments for purchase of goods and services	1. Income earned through disposal of factor services
2. Taxes paid	2. Transfer payments received from the government both domestic as well as foreign countries
3. Transfer payments made	
4. Individual saving	

3. Government Sector

<i>Debit</i>	<i>Credit</i>
1. Public spending on goods and services of firms	1. Taxes received, revenue from fees, penalties, etc.
2. Government payment to administrative staff	2. Receipt from interest, rent, dividend
3. Subsidies given to producers	3. Foreign aid
4. Debt servicing charges	
5. Transfer payments made to Individuals and abroad	

4. Capital Account

<i>Debit</i>	<i>Credit</i>
1. Savings of Firms	1. Aggregate expenditure on capital

goods assets

2. Household Savings	2. Net changes in stocks (inventories)
3. Government Savings	
4. Net External Borrowings	
-

Usefulness of Social Accounts

1. These accounts provide a handy tool to the analysts in projecting the past behavioural trends of the economy and making forecasts of its future performance.
2. They help us in understanding the macro aggregates of the economy and their inter-linkages.
3. With their aid, we can see the relative contribution of each sector to the national income.
4. The relationship between net national product at factor cost and market prices is easily established with the help of these accounts.
5. These accounts provide a basis for model-building for the economy. This in turn helps the planners and policy makers in estimating the likely effects of alternative policies.

MEASUREMENT OF NATIONAL INCOME IN INDIA

Historical Approach

Before Independence several attempts had been made to estimate India's national income by prominent economists and researchers. The very first estimate was made by Dadabhai Naoroji as early as 1867-68. However, all these estimates were based upon macro-level data and involved a number of assumptions to fill in the gaps in data. As a result, these estimates had a low degree of reliability. But in spite of this limitation, these efforts laid the foundation of improved techniques which the later researchers were able to adopt. The later contributors include Dr. Rao and others who made pioneering contributions in the field national income computation.

With Independence, the subject matter of national income came to receive a concerted attention of the authorities. They realised the usefulness of national income estimates not only for planning but also for all types of economic policies and welfare measures. It was also realised that the estimates of national income should not be restricted to their aggregate level or per capita variations. They should cover adequate details of its composition, origin and other related aspects so as to enhance their practical usefulness. As a result, the Government decided that steps should be taken to have a system of compilation of national income statistics on a detailed and regular basis.

An Expert Committee named "National Income Committee" was set up in 1949 under the chairmanship of Prof. P. C. Mahalanobis. This Committee was to make recommendations regarding the compilation of estimates of national income, the improvement of the statistical data on which the estimates were to be based and the measures for promoting research in this field. The First and Final Reports of the

Committee were brought out in 1951 and 1954 respectively. The Committee recommended that Indian national accounts should be prepared on an annual basis and in due course the task of preparing these accounts was handed over to the Central Statistical Organisation (CSO) with a full-fledged National Income Division (later renamed as National Accounts Division). Over the years, the CSO has been continuously trying to improve the quality and coverage of national income estimates.

In India, Central Statistical Organization (CSO) has been producing annual official estimates of national income of India since 1955 and publishing it annually in National Accounts Statistics (NAS). The methodology of estimation of the National Income in India was originally published by CSO "Brochure of Revised Series of National Product for 1960-61 to 1964-65, later updated in April, 1980 and further revised lately in 1989. The method of estimation adopted is a combination of the product and income approaches. The estimate of National Income for a particular year is obtained by aggregating the contribution to NDP by a number of industrial sectors and then adjusting the total net factor income flows from abroad. For this purpose the Indian economy is divided into 23 broad sectors and they are grouped and three major categories. A further revision in the methodology was adopted in January 1999 with a new base year 1993-94. Several improvements had been made in the coverage of various sectors of our GDP. National income is estimated by employing a combination of the product and income approaches. For the sectors where production approach is followed, the proportions are worked out separately for output and input. These proportions are then combined to work out the proportion for the value added. The task of estimation of national income suffer from deficiencies which could be grouped in two categories i.e., (i) conceptual problems; and (ii) practical problems. Our estimates suffer from all such conceptual problems which are faced by other countries as well. As in the case of other countries, we have not been able to solve the problems relating to consumption of fixed capital, treatment of housing and durable, consumption goods and so on. There are serious limitations in data availability and its reliability. Most of the time a lot of guess work is involved. The monetized sector has not fully developed. The people still follow the barter system of exchange specially in the rural sector of the economy. Therefore, a large proportion of the output remains outside the sphere of national income. In India, statistics are collected on the basis of industrial origin. Accordingly work force is also classified into various occupational categories. This poses problems of its own because a large percentage of work force (particularly in the rural areas) is engaged in more than one occupation.

Till now, we have had five series of national income estimates

First Series : The first national income estimates were published in 1956 both at current prices and at constant prices with the base 1948-49. This series was continued till 1966. This series was termed the Conventional Series. It divided the economy into thirteen sectors. Of these output method was used for six sectors (namely, agriculture, animal husbandry, forestry, fishery, mining and factory establishments). For the remaining seven sectors [namely : (i) small enterprises, (ii) organized banking and insurance, (iii) commerce and transport, (iv) professions, liberal arts and domestic services, (v) public authorities, (vi) house property and (vii) rest of the world], income method was employed. Details for making estimates were worked out for each sector on the basis of its peculiarities, data availability and other considerations.

Second Series : The gradual improvement in the availability of data enabled the CSO to improve its methodology and coverage of national income estimates. Special efforts were also made for a comprehensive review of all available data. The result was that in 1967, the CSO came out with a new basis for national income series with the base 1960-61. At the same time, work was also undertaken for the estimation of related aggregates like “capital formation” and “saving”. The coverage of the national accounts statistics was extended from time to time to incorporate the estimates of private consumption expenditure, saving, capital formation, factor incomes, consolidated accounts of the nation and detailed accounts of the public sector. Later on, special publications were also brought out covering disaggregated tables on output, input, value added, private consumption expenditure, saving and capital formation.

Third Series : The base year was subsequently shifted from 1960-61 to 1970-71 and the corresponding estimates were published with effect from 1978. These estimates used the latest available data from various sources including ad hoc studies, census, sample surveys and the like.

Fourth Series : The CSO released a new series of national accounts with 1980-81 as base year in February 1988. The new series covered not only more comprehensive data but also used a revised methodology. It incorporated a number of revisions arising out of the conceptual and methodological improvements. These included a revision in the method of estimating capital depreciation.

Fifth Series : A further revision in methodology was adopted in January 1999 with a new base year 1993-94. By this time, several improvements had been made in the coverage of various sectors of our GDP.

Recently, CSO has released the new series of National Income estimates assuming 1999-2000 as base year.

Main Features

Some of the main features of our national accounts statistics are as follows:

1. Detailed estimates of macro-economic aggregates accounts of the public sector consolidated accounts of the nation etc., are issued annually in National Accounts Statistics. Their coverage has also been extended from time to time to incorporate the estimates of consumption expenditure, saving, capital formation, transactions of the public sector, consolidated accounts of the nation and detailed disaggregated statements.
2. National income is estimated by employing a combination of the product and income approaches. The contribution to national income by industrial sectors is estimated and added and is then adjusted for net income from abroad. For this purpose the Indian economy is divided into 23 broad sectors and they are grouped into three major categories, as shown below (see Table 5.5).

Table 5.5

Methodology of Income Estimation in India

<i>Sector</i>	<i>Nature of Available Data</i>	<i>Description of the Method of Estimation</i>
(1)	(2)	(3)
Category A:		
Agriculture, Forestry and Logging, Fishing, Mining and Quarrying, Registered Manufacturing, Construction.	Annual figures of commodity-wise output and prices and value of different types of inputs or input-output proportion.	Product approach. Aggregation of commodity-wise price output multiplication figures yield gross value of output from which total value of input is deducted to arrive at the estimates of value added.

Category B :

Electricity, Railways, Air Transport, Organised Road and Water Transport, Communications, Banking and Insurance, Real Estate, Public Administration and Defence.	The actual figures of all types of factor earnings reported in the annual accounts of different companies or undertakings published on a more or less regular basis.	Cost of Sales Approach. The actual figures of employee compensation, interest, rent and operating surplus or profits relating to different enterprises/ organisations in each sector are aggregated to arrive at the estimates of value added.

Category C :

Unregistered Manufacturing; Gas and Water Supply; Unorganised Road and Water Transport; Storage; Trade, Hotels, and Restaurants; Ownership of Dwellings; Other Services..	The estimates of working force derived from the decennial population census data and estimates of average productivity of labour derived from the data shown by periodical sample surveys.	Cost of Sales Approach. Decennial estimates of working force interpolated or extrapolated and the periodical estimates of average productivity are carried forward or backward by using certain indicators. The year-to-year estimates of workers and their average productivity so derived are then multiplied to arrive at the estimates of value added.

- For the sectors where production approach is followed, the proportions are worked out separately for output and input. These proportions are then combined to work out the proportion for the value added. According to the basic reasoning, this formula should be $V = (A_i X_i - B_i Y_i) / (X_i - Y_i)$

Where 'i' represents the sector, V represents the value added based on current data, X represents the output and the input of the sector respectively, and A and B represent the corresponding percentages based on current data.

However, the demerit of this formula is that in it V can be more than 100 due to the fact that X is always greater than V and A is also likely to be much higher than B. Therefore, the formula is modified to

$$V_i = (A_i X_i + B_i Y_i) / (X_i + Y_i)$$

4. The estimates are presented both at current prices and constant prices, and have five Parts.
 - (i) Part I focuses on a long term series for macro-economic analysis. It presents summary statements of macro-economic aggregates and their relationship together with growth rates. They are further related to the performance of the public sector and the nation as a whole.
 - (ii) Part II covers domestic product. It contains estimates of GDP and NDP both by kind of economic activity (and the respective percentage distribution).
 - (iii) Part III covers consumption, saving and capital formation. The estimates of private final consumption expenditure (PFCE) are presented by broad items of expenditure. The estimates of savings, as in the past, are at current prices only and are broken up in terms of the institutions and the industry of use.
 - (iv) Part IV covers public sector transactions. It incorporates several aspects of public sector such as the ratio of GDP/NDP, government final consumption expenditure (GFCE), saving, and capital formation. It also separates accounts for the administrative departments, departmental commercial undertakings and non-departmental commercial undertakings. These accounts also contain separate coverage for railways and communications. There are also purpose-wise details of GFCE.
 - (v) Part V is concerned with disaggregated statements and includes statements at crop/item/category level. These statements include the details of value of output, input and value added for each type of economic activity. For example, the details provided under agriculture relate to the value of output of each of the crops as well as various livestock products and the total inputs used in the sector by items.
5. The CSO uses a mixture of information, which includes commodity-flows, the use of bench-mark weight-proportions for splitting up into components of gross value added into net value added and value of inputs used.
6. The CSO realises the need for a continuous improvement in data availability as also methodology of estimates. For example, estimates of PFCE and capital formation are obtained by commodity-flow method. Therefore, all revisions in the estimates of domestic produce due to the availability of fresh data relating to the flow of commodities also alter the estimates of these aggregates. These aggregates also need revision when there is a revision in the data either on exports/imports or on the trade and transport margins.

Limitations

At present, national income estimates in India suffer from several deficiencies, and include the following :

- (a) Our national income estimates suffer from all the conceptual and index

number problems which are faced by other countries as well. As in the case of other countries, we have not been able to solve the problems related to consumption of fixed capital, treatment of housing and durable consumption goods and so on. In addition, the classification of Indian economy into various sectors needs an improvement.

- (b) There are several limitations connected with the availability and reliability of data. In a number of case, the gaps have to be filled by using intelligent guesses, proxy variables and other devices.
- (c) In India, national income statistics are collected on the basis of industrial origin. And accordingly the work force is also classified into various occupational categories. This poses problems of its own because a large percentage of work force (particularly in the rural areas) is engaged in more than one occupation.
- (d) A major portion of our production is meant for self-consumption by the producers themselves, and some part is transacted in the market on barter basis. This creates problems of imputing them market values.

TREND ANALYSIS

Annual average growth rates

In terms of growth rates, there have been wide variations both in aggregate national income and per capita income. This is clearly indicated by the figures in the accompanying Table 5.6. It is seen that per capita growth rates have been always much smaller than overall growth rates. This is explained by a persistent growth in our population.

GNP and NNP at Factor Cost.

- A. *At Current Prices* : If we take annual average of the Plan periods, one may notice that there was always a positive rate of growth both in GNP and NNP. However, for some individual years in the First Plan, negative rates were also recorded.
- B. *At Constant Prices* : The negative growth rate was experienced more frequently. GNP recorded negative growth in 1957-58, 1965-66, 1972-73, and 1979-80, while NNP recorded negative growth in 1957-58, 1965-66, 1972-73 and 1979-80. Occasional decline in the annual plan-period average of growth was also recorded for both GNP and NNP and in 1979-80, both figures recorded a negative growth. For later years there was positive rate of growth.

Per Capita NNP

- A. *At Current Prices* : In contrast to the totals of GNP and NNP, per capita growth rates of NNP were not only smaller, but also showed negative rates more frequently. This is because, during several years, population grew faster than national income even at current prices. It should also be remembered that NNP measured at current prices includes the effect of inflationary price rise as well. During a period of more than 59 years (from 1951-52 to 2004-05), per capita NNP at current prices recorded a negative growth rate in three years during the First Plan and one year during the Second Plans. This resulted in a decline in the annual average for the entire First Plan also. The annual average rate of growth for the period 2001-02 to 2005-06 was positive, ranges between 6.2 to

12.1%.

- B. *At Constant Prices* : However, at constant prices, negative growth rate was recorded in 12 years (including the Annual Plan, 1979-80). There was also a decline in the average growth rate (compared with that of the preceding average rate) in the Third Plan (1961-66), the Fourth Plan, the Annual Plan of 1979-80, the Annual Plans of 1990-92. It was positive annual rate of growth in rest of the period upto 2005-2006 on revised base year 1999-2000.(See Table 5.6)

TABLE 5.6
ANNUAL AVERAGE GROWTH RATE

(Percent)

<i>Year</i>	<i>GNP at Current Prices</i>	<i>Factor cost 1993-94 Prices</i>	<i>NNP at Current Prices</i>	<i>Factor cost 1993-94 Prices</i>	<i>Per capita Current Prices</i>	<i>NNP 1993-94 Prices</i>
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1951-52	5.7	2.5	5.4	2.4	3.6	0.7
1960-61	9.4	7.0	9.3	7.0	7.2	5.1
1970-71	6.4	5.1	6.1	5.1	3.7	2.8
1980-81	19.7	7.3	19.9	7.5	17.2	5.1
1990-91	16.5	5.5	16.7	5.4	14.3	3.3
1991-92	15.0	1.1	14.3	0.5	12.0	-1.5
1992-93	14.3	5.1	14.1	5.0	12.0	3.1
1993-94	16.3	5.9	16.8	5.8	14.2	3.4
1994-95	17.5	7.2	17.5	7.1	15.2	4.9
1995-96	17.2	7.5	16.9	7.3	14.6	5.2
1996-97	16.1	8.2	16.1	8.2	13.9	6.1
1997-98	11.9	4.9	12.0	4.6	9.9	2.6
1998-99	15.0	6.4	15.5	6.5	13.3	4.4
1999-00	10.3	6.2	10.5	6.2	8.5	4.3
New Series-Base Year 1999-2000						
2000-01	7.3	4.0	7.2	4.0	5.3	2.1
2001-02	8.9	5.9	8.9	6.2	6.9	4.2
2002-03	7.8	3.9	7.9	3.9	6.2	2.2
2003-04 (P)	12.8	8.6	13.2	9.0	11.3	7.2
2004-05 (Q)	11.9	7.6	11.6	7.8	9.8	6.1

2005-06 (A)		13.8	9.0	13.8	9.1	12.1	7.4
ANNUAL AVERAGE GROWTH RATE							
(1)		(2)	(3)	(4)	(5)	(6)	(7)
1st 1951-56	Plan	1.8	3.7	1.5	3.6	-0.3	1.8
2 nd 1956-61	Plan	9.5	4.2	9.4	4.0	7.3	2.0
3 rd 1961-66	Plan	9.6	2.8	9.5	2.5	7.1	0.2
Annual 1966-69	Plans	12.2	3.9	12.2	3.8	9.8	1.5
4 th 1969-74	Plan	11.1	3.4	11.0	3.3	8.5	1.0
5 th 1974-79	Plan	10.7	5.0	10.4	5.0	7.9	2.7
Annual 1979-80	Plan	9.4	-5.0	8.3	-6.0	5.7	-8.3
6 th 1980-85	Plan	15.2	5.5	15.1	5.4	12.7	3.2
7 th 1985-90	Plan	14.4	5.8	14.2	5.8	11.8	3.6
Two Plans	Annual 1990-92	15.7	3.3	15.5	3.0	13.2	0.9
8 th 1992-97	Plan	16.3	6.8	16.3	6.7	14.0	4.6
9 th 1997-2002	Plan	10.7	5.5	10.8	5.5	8.8	3.5

Source : *Economic Survey, 2006-07*, P = Provisional, Q = Quick, A = Advance estimates

National income of India has undergone a large-scale transformation as far as the contribution by various sectors is concerned. This is amply seen from Table 5.7, in which percentage shares of different sectors in GDP at factor cost at constant

prices are shown for selected years. It is seen that, since the beginning of the planning era, the percentage share of primary sector (which covers agriculture, forestry and logging, fishing, mining and quarrying) has been steadily declining. It was as high as 59.1% in 1950-51, but had declined to 47.2% by 1965-66 and 48.1% in 1970-71. After that, the reduction in the share of this sector continued at a little slower rate and by 1993-94 it had dipped to around one-third (at 33.5%). The reduction in the share of this sector in our GDP has continued since then, with an estimate of 26.5% for 2001-02 and 22.97 in 2004-05 at 1998-2000 prices. It should be further noted that the decline is in spite of improved performance of the primary sector, and is explained by the faster growth of the remaining sectors.

The performance of secondary sector (manufacturing, construction, electricity, gas and water supply) has been typically along the lines of expected behaviour. [Actually, for better and more informative analysis, this sector should be sub-divided into relevant portions]. Firstly, the increase in its percentage share has been at a moderate rate. It increased from 13.20% in 1950-51 to only 16.6% by 1960-61 and to 20.2% by 1965-66. This was followed by a marginal decline till 1975-76. The 1980s and early 1990s saw a revival of the upward trend. But the upward trend was quite weak and reached a peak figure of 25.5 in 1995-96 and 1996-97. Since then, it has again declined and was 22.9% in 2001-02, and decreased to 23.80 percent in 2004-05 and at 1999-2000 prices. It increased slightly in 2005-06.

TABLE 5.7

**GDP at Factor Cost by Industry of Origin
(% shares)(Constant prices, 1993-94 = 100)**

	1*	2*	3*	4*	5*	6*
1950-51	59.1	13.2	11.9	6.6	9.3	140466
1955-56	57.1	14.9	12.5	6.5	9.1	167667
1960-61	54.7	16.6	13.6	6.1	9.1	206103
1965-66	47.2	20.2	15.8	6.3	10.6	236306
1970-71	48.1	19.9	15.5	5.9	10.7	296278
1975-76	46.2	19.7	16.9	6.1	11.1	343924
1980-81	41.8	21.6	18.4	6.5	11.7	401128
1985-86	38.6	22.5	19.0	8.0	10.9	513990
1990-91	34.9	24.5	18.7	9.7	12.2	692871
1991-92	34.1	23.9	19.0	10.7	12.3	701863
1992-93	34.2	23.7	19.0	10.8	12.3	737792
1993-94	33.5	23.7	19.3	11.5	12.0	781345
1994-95	32.9	24.4	19.8	11.4	11.5	838031
1995-96	30.6	25.5	20.9	11.4	11.6	899563
1996-97	30.9	25.5	20.9	11.3	11.4	970083

1997-98	29.0	25.2	21.5	12.1	12.2	1016594
	(1)	(2)	(3)	(4)	(5)	(6)
1998-99	28.9	24.6	21.8	12.2	12.6	1082748
1999-00	27.4	24.3	22.3	12.7	13.4	1148367

New Series at 1999-2000 Prices

	(1)	(2)	(3)	(4)	(5)	(6)
1999-00	27.6	23.0	21.5	12.9	14.7	1792292
2000-01	26.5	23.6	22.0	12.9	14.7	1870387
2001-02	26.5	22.9	22.8	13.1	14.5	1978095
2002-03	24.1	23.6	23.9	13.6	14.5	2052586
2003-04 (P)	24.4	24.7	13.1	14.1	14.1	2205041
2004-05 (P)	22.9	23.8	25.4	13.4	14.3	2393671
2005-06(P)	21.74	24.14	26.11	13.76	14.28	2604532

Source : Economic Survey 2006-2007

Notes : With the shifting of base period to 1999-2000 from 1980-81, some of the earlier rows may not total to 100%.

- 1* Agriculture, forestry and logging, fishing, mining and quarrying
- 2* Manufacturing, construction, electricity, gas and water supply
- 3* Transport, communication and trade.
- 4* Banking and insurance, real estate and ownership of dwellings and business services
- 5* Public administration and defence and other services
- 6* GDP at factor cost (in Rs. crore)

The next 'sector', namely, 'transport, communications and trade' is a strange mixture of incongruent components. This is because transport and communication facilitate not only trade but also several other economic activities. In addition, communication has also a place of its own as a means of transferring information. Given these limitations, we note that compared with the sector of 'manufacturing, construction, electricity, gas and water supply' that of 'transport, communication and trade' has recorded a robust growth. From just 11.9% in 1950-51, it shot upto 22.3 per cent (at 1993-94 prices) by the turn of the century and stood at 22.8% in 2001-02 and further increased to 25.4% in 2004-2005 and 26.11 per cent in 2005-06 (at 1999-2000 prices).

The next 'sector', namely, 'Banking and Insurance, Real Estate and Ownership of

Dwellings and Business Services' is also a collection of an extremely heterogeneous group of activities. Table 5.7 shows that this sector continued to be a small and near-stagnant contributor to our GDP till the beginning of 1980s. However, having recorded a phenomenal growth from just 6.5% in 1980-81 to 10.7% in 1991-92, its pace slowed down to only a marginal increase. Its share in our GDP reached 12.7% in 1999-00 and further increased to 13.14% in 2001-02, 13.39% in 2004-05 and 13.76% in 2005-06. Public Administration and Defence and other services. This sector has recorded a moderate long-term growth. This is partly explained mainly by the expansion in government administration and increasing defence needs caused by political uncertainty.

Thus, we may note that the share of services in our GDP is increasing at a fast rate. From around 28% of the GDP in 1950-51, they now account for more than half of it. Analysts think that the share of services in our GDP is likely to increase further in the foreseeable future.

Saving and Investment

When we initiated the process of planned economic growth, our country, like several other developing ones, was suffering from low rates of saving and investment. The relevance of increasing these rates on a long term stable basis was recognised in both academic and official circles. It should be noted that economic growth implies, amongst other things, an increase in per capita real income on a long term basis (also termed sustainable basis) which is possible only if the average productivity of labour goes up. This, in turn, necessitates that workers, on an average, should be assisted with more capital and improved technology. It means to say that capital formation, its judicious investment in most productive employments, and its optimum utilisation become prerequisites of a long term growth process. And all these preconditions correspondingly imply an increase in savings as a proportion of GDP.

Before we proceed further, let us note that the leading sources of capital formation include :

- (a) domestic savings, and
- (b) inflow of foreign capital in the form of (i) loans, (ii) import of technology, capital equipment, essential raw materials, and other inputs, (iii) import of human skill, and so on.

A backward country, by definition, suffers from a low rate of saving and capital formation which are unable to pull it out of a vicious circle of poverty and backwardness. It is also very difficult for it to increase the rate of its saving because of its narrow output base and an intensely urgent need for providing additional consumption to its poor masses. Moreover, when we look at the forms which a backward country's capital accumulation should take place, we find it is not able to convert its domestic saving into the requisite types of capital goods, technology, human skills and the like. By implication, it has to supplement its domestic savings with some form of inflow of capital resources. If it fails to do so, its growth process remains slow and it continues to suffer from economic backwardness for much longer than the need be.

It should be mentioned at the outset that our estimates of both saving and investment rates have been suffering from some serious data and other limitations; they have also been revised frequently.

At the beginning of our plans, our gross domestic rate of saving or GDS [that is, (gross domestic saving / GDP, both measured at current market prices)] was believed to be around 5% (later on, the revised estimates put it was at 10.4% which were again scaled down to around 9%). A major portion of this saving was needed to meet the depreciation of existing fixed capital assets thereby leaving only a fraction of it for net addition to capital stock of the country. There is also another fact which highlights the inadequacy of our GDS in early 1950s. Normally, industrialisation and other segments of economic growth necessitate the use of technology in which capital / output ratio (COR, or the number of units of capital needed to produce one unit of output per annum, both measured in rupees) not only exceeds one but also tends to increase with the adoption of modern technology. The above mentioned factors, coupled with that of rapidly increasing population rendered our low GDS rate totally was insufficient for realising a net increase in our real per capita income. The remedy of this problem, therefore, lay in a multi-fold strategy of

- (a) increasing our domestic rate of saving,
- (b) supplementing it with inflow of foreign capital,
- (c) deploying the available capital in a judicious pattern of investment, and
- (d) checking population growth.

Let us clarify this point with a simple numerical illustration. Suppose, out of gross domestic saving of 10.4% , we are able to make a net addition to our capital stock by only 5% of GDP (the rest going into maintaining the existing capital intact). Further, let us assume that capital-output ratio is 2.5:1 (normally, it is much higher), so that the growth rate of national income is only 2% p.a. Clearly, with such a rate of saving, we are not able to increase our per capita income when population itself is growing faster than 2% p.a.

It should be noted that a developing country like India needs a high rate of capital accumulation which, in turn, necessitates a high rate of saving and its judicious and economical use. History of economic growth of various developing and developed countries bear testimony to this basic fact. It should be further remembered that inflow of foreign capital, though crucial to the nature and pace of economic growth of a developing country, can contribute only a limited portion of total needed capital accumulation. A major portion of capital formation has to come from domestic saving only.

The authorities took a number of steps to promote domestic savings, such as, raising the general level of interest rates. The provision of banking and other financial services enabled small savers to deposit their savings in what they considered safe and liquid bank deposits while bringing in some interest income as well. The growth of financial markets and introduction of new financial instruments also played their role in promoting the rate of saving. These and other measures led to a steady increase in the rate of saving. It recorded an increase from 8.9% in 1950-51 to 14.6%

in 1970-71. By 1980-81, it had increased to 18.9% and, by 1990-91, further to 23.1%. Having touched a high of 25.1% in 1995-96, it declined 21.5% by 1998-99. Later revival placed it at 24.20% in 1999-00. At 1999-2000 prices, it increased from 24.8 per cent in 1999-2000 to 32.4 % in 2005-06.

Sectoral Shares. We may also ask as to who saves in India. A look at the official data reveals that, for this purpose of reporting savings, the economy has been divided into three sectors, namely, the following:

- The Household Sector, which includes individuals, families, and non-incorporated business units.
- The Private Corporate Sector which includes the corporate business enterprises; and
- The Public Sector, which includes Government Administration, official agencies and public sector undertakings.

From 1950-51 till today, the biggest source of our domestic saving has been the household sector. It forms the backbone of the saving activity of our economy, while the contribution by the private corporate and public sectors has been either marginal or negative. In 1950-51, the share of household saving in the total was its share in national savings was around 70%. It was around 6.2% of our GDP. Over the years, domestic saving has recorded a long term upward trend, both in absolute terms and as a proportion of our GDP. Thus, by 1970-71, household saving as a proportion of GDP had risen to 10.1%; and by 1980-81 this figure increased to 13.8%. It increased further to 19.3% by 1990-91; and having declined to 17.0% in 1996-97, it again increased to 20.9% . At 1999-2000 prices, it increased from 21.1 per cent in 1999-2000 to 22.3 % in 2005-06

In contrast, the share of the private corporate sector has tended to fluctuate between 10-20% of the total. As a proportion of our GDP, corporate saving remained below 2% till mid-1980s. Since then, it tended to improve its average performance. The introduction of the era of liberalization and globalization has enabled the corporate sector to increase its saving and currently it is in the region of 8% of our GDP at 1999-2000 prices.

The most dismal performance has been that of the public sector. With a vast network of public sector undertakings and the ownership of almost the entire financial system, public sector was expected to contribute a very proportion of our domestic saving. However, widespread fiscal indiscipline, populist and uneconomical projects and poor performance of public sector undertakings did not let this happen. It is noteworthy that the proportion of GDP saved by the public sector was respectably higher than that of the private corporate sector till mid 1980s. However, since middle of 1980-81, its share registering a long term downtrend and by 1998-99, it had declined to minus 1.0% of GDP. The poor saving performance the public sector has continued even after but it turned out to be positive in 2005-06 at 1999-2000 prices.

Coming to the rate of gross domestic capital formation (GDCF), we may start with the observation that our policy with regard to inflow of foreign capital has been quite restrictive in nature. We were apprehensive that, given the opportunity, foreign business concerns would come to dominate our economy and gain its control.

Therefore, we chose to put all sorts of hurdles in the way of direct foreign investment (FDI) and, instead, sought foreign capital in the form of loans and grants. Moreover, FDI could be expected to flow in only if our economy was sufficiently market-oriented and liberalized. With an all-pervasive planning, and a growing edifice of procedures, rules, and regulations, FDI was, in any case, ruled out.

Gross domestic capital formation comprises (a) gross fixed capital formation and (b) change in stocks. Change in stocks, by its very nature, is a highly erratic item and can vary over a wide range. Between 1950-51 and 2001-02, this item has varied between minus 0.6% to 3.9% of our GDP. Household sector is not supposed to hold stocks; only the private corporate sector and public sector do so. And the change in stocks been erratic in the case of both.

As regards gross fixed capital formation, household sector is not expected to undertake this activity either. It is expected to restrict itself to only financial savings which, through investment by business enterprises and public sector, get translated into physical capital formation. Expectedly, an overwhelmingly large proportion of capital formation has been in the form of gross fixed capital, with a relatively smaller proportion going to change in stocks. As a proportion of GDP, it increased from 8.9% in 1950-51 to around 18.5% in 1980-81, to around 22.9% in 1990-91 and to around 24.4% in 1995-96. Since then, it declined to around 21.8% in 1999-00. At 1999-2000 prices, it increased from 23.4 per cent in 1999-2000 to 28.1 % in 2005-06

Within the component of gross fixed capital formation, the contribution of private corporate sector far exceeded that of the public sector till around 1965-66. During this period, the percentage share of public sector had been increasing. However, since then, the share of public sector has registered an erratic and cyclical behaviour. It has had a secular downtrend in 1990s and later. In 2005-06, its share was 6.9% of GDP as compared with 21.2% of the private corporate sector(1999-2000 Prices).

A similar picture is seen when we consider the relative roles of private corporate and public sectors in gross domestic capital formation. In 1950-51, the share of public sector was only 2.7% as against 7.7% of the private corporate sector. By mid 1960s, however, the share of public sector had increased to match that of the private sector, while the share of the latter had more or less stagnated during this period. However, while the private sector picked up and continued its steady forward march, public sector lagged behind. Since mid 1980s, the share of public sector has been steadily declining while that of the private sector has been increasing. In 2005-06, the share of public sector was only 7.4% of GDP as against 23.6% of the private sector(1999-2000 Prices).

It should be noted, however, that barring an exception here and there, rate of gross domestic formation has always been greater than that of domestic rate of saving. This is explained, as stated above, by the inflow of foreign capital. However, it should be noted that in our case, the inflow of foreign capital has been only a small proportion of the total investment.

In this context, we should also note the following relevant facts.

- The contribution of gross domestic capital formation to economic growth is partly neutralised by the depreciation of existing capital stock. Moreover, with an increase in existing capital stock, a larger proportion of fresh capital accumulation is needed to compensate for this depreciation.

- Over time, improved techniques of production have tended to be capital intensive with a long term increase in capital/output ratio. This is because technological advances mainly taken place in capital-rich and labour-scarce countries. In contrast, very little attention has been paid to research and development in labour-abundant countries like India. The net result is that technological advancement, through an increase in capital/output ratio, has had the effect of retarding the rate of economic growth.
- It can be claimed that our pattern of allocation of capital stock has not been an optimum one. Over years, we have neglected (i) maintenance of existing capital assets, and (ii) building up of additional infrastructure.
- As a result of the above-mentioned factors, the rate of growth expected by the Indian economy has been far below what many other developing economies could achieve.

Mixed Economy

In Indian planning, the concept of mixed economy was adopted so as to avoid elements of both market mechanism and central planning and derive maximum possible benefits from their respective merits. In other words, a mixed economy does not rely exclusively upon either private or public enterprises. Instead, both co-exist in it in a judicious proportion. At the same time, the government assumes a leading role in the sense that while it directly controls and operates public sector undertakings, it also effectively regulates the private sector undertakings.

In India, the structure of our mixed economy may be viewed by dividing it into the following parts.

1. Some segments of the economy are guided by market mechanism. These include (i) agriculture, (ii) tiny, cottage and village industries, and (iii) to a certain extent even the small scale industries. They also include artisans and other self-employed persons, and petty business units. The reasoning is that these segments are able to operate in the most efficient manner if they are left free to respond to demand forces of the market. At the same time, they need to be protected against the possible exploitation by other sectors of the economy on account of their weak bargaining strength. Therefore, the government also pursues an active policy of helping them through various means which include one or more of the following for different categories of economic activities.
 - (a) Provision of concessional, timely and adequate institutional credit from cooperatives, banks and other sources.
 - (b) Provision of adequate and quality raw materials.
 - (c) Help in acquiring skills through education and training etc.
 - (d) Help in marketing the output.
 - (e) Provision of tax concessions and subsidies for improving their competitive strength and making them commercially viable.

To achieve the multiplicity of these objectives, the government instituted a number of commissions, committees, boards and other bodies including those which cover plantation products and their exports.

In some cases, it also adopted a policy of ensuring minimum sales price to the producers. A typical example of this happens to be the set of minimum statutory prices and/or procurement prices for a number of agricultural products. The government also established a chain of agricultural research universities which have done a commendable job of improving seeds, and introduction of new and better varieties of products which give better yield and protection against crop diseases, etc. In the case of some goods like wheat and rice, the government has created and operates buffer stocks so as to (a) protect the farmers from undue fluctuations in market prices, and (b) protect the consumers, particularly those with low income levels.

The government also helps some sectors of the economy through a preferred purchase policy under which it gives preference to certain suppliers.

2. The second segment of the Indian economy covers medium and large scale industries, financial institutions and other business establishments. They are subjected to a wide spectrum of controls and regulations. Till recently, the policy of the government had been to increasingly tighten its grip over them by continuously adding the variety and number of restrictions over them. There was hardly any aspect of their planning and working which was not subject to an intense bureaucratic regulation. This, in turn, created a climate for a parallel economy. These business establishments were also subjected to additional tax burdens.

However, the policy of "self-reliance" and import restrictions through quotas, licenses and high customs duties led to the creation of sheltered markets for the domestic producers. In addition, the domestic tax policy played its role in dampening of research and development. Consequently, over time, Indian products acquired the features of poor quality and high prices. And this, in turn, created a permanent problem of deficit balance of payments. Our external trade grew at much slower rates than did the external trade of rest of the world. As a result, our share in world exports (which was already very low) fell still further to nearly 0.5% of the total.

3. The third segment of the economy comprises public sector. The government extended its business activities indiscriminately into all possible spheres, disregarding the consideration for economic viability, productive efficiency and need for venturing into these areas for the sake of socialist ideas. An absence of a policy of economic incentives and punishment, together with the assurance of job security, led to a steady decline of labour productivity in public sector undertakings. Their inefficiency, in turn, spelt economic disadvantages for the private sector as well. Public sector undertakings, instead of being a source of investment resources for the authorities, became a drag for the economy as a whole. The authorities were forced to increase taxes and borrow heavily from the market and this led to a scarcity of resources for the private sector.

4. The state started acquiring ownership and operating control over the financial sector of the economy right from the beginning and the process was more or less completed by the nationalisation of banks in 1969. The control of the government extended to commercial banking, investment banking, merchant banking and insurance. The typical atmosphere of operational inefficiency seeped into financial sector as well, leading to severe problems of (a) capital inadequacy, (b) non-performing assets, (c) overstaffing, (d) low productivity, (e) persistent losses, and (e) deterioration in customer services. The flow of credit, though guided on paper, failed to meet the requisite targets or stay in designated channels.

The net result of pursuing a policy of mixed economy with the objective of creating a socialist state through planning process was a mixed one. While the economy recorded an overall progress, it also developed ailments all through its body. At the beginning of the 1990s, we even faced a balance of payments crisis. At this time, it was decided to make a shift away from the old pattern. The new restructured economy was envisaged as the one in which the state was to confine itself to only basic functions like governance, defence, and provision of infrastructure and social services. The remaining economic activities were to be progressively handed back to the private sector. The latter was also to be freed, in a phased manner, from the all-pervasive state regulation.

The pursuance of the new policy, therefore, aims at liberalisation of the domestic economy and strengthening its global linkages. In the process, external trade is being freed from both high customs duties and quantitative restrictions. The entire economic structure is being made to move to a competitive set up in which every business unit is to stand on its own by acquiring competitive strength and responding to market forces. Some good results of the new policy are already visible in the form of a higher average rate of growth of the economy, addition to foreign exchange reserves and enhanced inflow of direct foreign investment.

Dualistic Structure

The economy of an underdeveloped country, having a vast size and population, is generally dualistic in character. It means that some segments of economic activity are unevenly developed. In each affected segment, some components are well developed or they are experiencing a high growth rate. They are able to provide means for a high standard of living for the persons engaged in them. In contrast, it also contains some highly backward components. And the persons engaged in those subsets of activities are, on an average, very poor. Moreover, the developed and backward components of the segment of activities are not segregated by geographical boundaries. They coexist side by side.

Viewed from another angle, we notice a simultaneous existence of advanced and backward technologies. On the one hand, some economic activities are highly capital-intensive, and are characterised by (i) speed and availability of information, and processing techniques; (ii) the speed of decision-making and implementation; (iii) high labour productivity; (iv) long gestation periods of the projects; and so on. In contrast, some other economic activities are based upon primitive and old techniques. They are highly labour-intensive, but are characterised by low labour

productivity. Also the activities based upon backward techniques have poor or no industrial organisation. For that reason, they are often termed 'informal sector'. Frequently, even a given type of economic activity is simultaneously undertaken with diverse technologies and production processes ranging from highly labour-intensive to highly capital-intensive ones. A typical example of this phenomenon is provided by the co-existence of means of transport ranging from human-and animal-driven carts to mechanised vehicles and aeroplanes. The advanced components, in this sense, appear like purple spots in the economic map of the country.

It should be noted that dualism is not confined to any one region or a sector. It may be found in several segments of economic activities and in most region of the country. For example, in food items, it may exist from road-side eating places to five-star kitchens. Processed and packed food, including junk items, may be available in the midst of undernourished and starving people. Expensive water may be available in abundance with widespread scarcity of ordinary safe drinking water. Use of computers and sophisticated electronics can be there together with non-availability of basic reading and writing material to the general public.

Dualism also reflects itself in large-scale income disparities. In that sense, a backward economy is a dualistic one both in the rural and urban areas. In rural areas, the advanced components of dualism are found in the form of developed mining, fisheries, plantations, use of agricultural machinery, use of chemical manure, insecticides, assured irrigation, harvesting and storing technology and so on. In contrast, the backward segments are represented by small and fragmented farms, abundance of unskilled and landless agricultural workers, disguised unemployment (where the marginal productivity of labour is zero or even negative), and subsistence farming.

Urban dualism shows itself in the form of posh offices, hotels, restaurants, shopping complexes, entertainment centres, and residential buildings. There is a variety of financial institutions providing financial services. Information services and technology are easily available, economical and of high standard. In contrast, there are urban slums populated by the very poor. They have hardly any civic amenities worth the name. Employment-wise, we have very highly paid executives and others as also those who provide lowly paid menial services.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.

Answers to these questions are not to be submitted for evaluation).

1. Discuss the salient features of Indian Economy. Do they indicate that India is still a backward country.?
2. Discuss the role of agriculture in Indian Economy.
3. Discuss the role of industry in Indian Economy.
4. What is National Income ? Explain various methods to estimate national income.
5. Describe alternative approaches for estimating national income. Do they result in equivalent measures ? If not, why ?
6. Enumerate the difficulties in estimating national income of a country, with particular reference to India.

7. (a) Distinction between the following.
 - (i) GDP and NDP
 - (ii) GDP and GNP(b) Discuss National Income Accounts and their uses.
 8. Distinguish between national income measured at current prices and constant prices. Highlight the use of this distinction and the difficulties encountered in applying it with special reference to the case of a growing economy.
 9. Describe salient trends in Indian national income since 1991.
 10. Discuss the main features of industrial policy statement of 1956
 11. Write short notes on-
 - (a) India as a mixed economy
 - (b) Gross Domestic Capital Formation in India
 - (c) Gross domestic saving in India
 - (d) Dualistic Structure of Indian Economy
 - (e) Public sector in India
 - (f) Small scale Industries in India
 12. Discuss the role of service sector in Indian economy.
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Suggested Readings :

1. C.S.O., Ministry of Planning, GOI - National Income Statistics : Sources and Methods, latest issue.
 2. Government of India - Economic Surveys,
 3. Dutt and Sundharam - Indian Economy, latest edition.
 4. Various Five years Plan Documents.
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SELECT AREAS OF INDIAN ECONOMY

POPULATION—SIZE AND GROWTH

India accounts for 2.4 percent of world surface area but it supports 16.7 percent of the world population. According to the final results for the Census of India 2001, the population of India crossed one billion and was enumerated at 103 billion. Thus, India has become the second country in the world after China to cross one billion mark. The decadal growth of population at 21.53 percent between 1991-2001, was the sharpest decline in the rate of growth of population witnessed since independence with the average exponential growth rate declining from 2.14 percent per annum during the previous decade to 1.93 percent per annum during 1991-2001. The National Population Policy (NPP) 2000 outlines the long term objective of achieving a stable population by 2045, at a level consistent with the requirements of sustainable economic growth and social development.

India is experiencing an explosive growth in its population with all the attendant ill-effects of this phenomenon. At the time of Independence, population of our country was only around 360 million. Since then, it has increased to more than three times that figure. The authorities did not realise the fact that an important by-product of economic growth happens to be a rapid growth in population. Economic growth unleashes several forces which accelerate population growth and tends to neutralise the gains of economic development. Insufficient attention was paid to the need of a vigorous and effective policy for population control. The result was that by 1961, our population had jumped to a figure of 439 million (which was 21.5% above 1951 figure). Even then the authorities remained sluggish in formulating and implementing an effective population policy. Consequently, our population continued to experience an unchecked growth. Having recorded 24.8% and 24.7% growth rates in the next two decades, it touched a figure of 683 million by 1981. The 1991 census put the figure at 844 million and the estimated figure for 2002 (as per *Economic Survey* 2005-06) is around 1090 million. While our death rate has fallen to a very commendable figure of 8.0 per thousand p.a., the corresponding figure for birth rate is still at a high of 24.8 per thousand p.a.. Such a wide divergence between the two rates is adding rapidly to our population growth. In addition, with increasing life expectancy at birth, there is an increase in the proportion of aged persons and economic dependency.

The percentage decadal growth of population in rural and urban areas in the decade 1991-2001 was 18.08 percent and 31.48 percent respectively. Urban population constitutes 27.82 percent of the total population of the country, which is higher by 2.11 percent points as compared to the percentage in 1991. The density of population has increased steadily from 117 persons in 1951 to 325 persons per sq.km. in 2001. However, the sex ratio of country as a whole has improved from 927 females per 1000 males in 1991 to 933 females per 1000 males in 2001. The sex ratio of a country as a whole in the age group 0-6 years was noticed to 927 females per one thousand males. The literacy rate for the country as a whole in 2001, worked out to 64.84 percent for the population aged seven years and above. The corresponding figures for males and females were 75.26 percent and 53.67 percent respectively.

It needs no iteration that a rapid increase in population has been a hurdle in our economic growth in several ways. It has made a tremendous addition to our demand

for consumption goods (especially for the basic necessities like food, housing, clothing, health care, and education, etc.) thereby contributing to the demand for scarce productive resources. In addition, growing population has counterbalanced a sizeable portion of the increase in our national income leading to a slower increase in our per capita income. Faced with certain other drawbacks in our planning and growth strategy, we have also failed in providing adequate *employment opportunities* to our growing work force. As a result, there has been a rapid *increase in unemployment*, both open and disguised. Population growth has also *eroded the effectiveness of our poverty-eradication programmes*. The unfortunate fact is that the population problem remains unsolved even now. Projections show that it would continue to grow rapidly for some more decades.

Some of the major causes of population explosion include the following :

- Since Independence, in spite of inadequate public health care and other medical services we have been able to control many mass-killer diseases. Some of them like small pox have been totally eradicated and some epidemics like plague are well under control. Due to better healthcare of females, there has been a substantial decline in both infant mortality and female mortality during child-bearing. Unfortunately, we have failed in providing safe drinking water to our masses. Had we succeeded in providing this basic necessity, we would have been able to control a large number of additional diseases as well. All these factors have brought down the death rate and added to the reproductive life of our female population. The data given in the Economic Survey 2005-06 show that our death rate fell from around 27.4 per thousand in 1950-51 to around 8.0 per thousand in 2002-03. *This figure is very close to the level of death rate prevalent in the world's most advanced countries.* Correspondingly, the life expectancy at birth (in years) has also recorded a creditable increase from around just 32 in 1950-51 to 63.8 for males and 66.91 for females in 2000-01, and is expected to increase further in the coming years.
- While death rate has declined substantially, and is expected to stay low in the foreseeable future, fall in birth rate has been quite disappointing due to several reasons. It was 39.9 per thousand in 1950-51 and fell to only 25.0 per thousand in 2001-02 and 24.8 per thousand in 2002-03. Leading causes for our failure in achieving the needed decline in birth rate include absence of an effective system of economic incentives and disincentives for promoting small family norms, insufficient availability of medical facilities for restricting family size, absence of social security (because of which children are considered a source of income to aged parents), low average age at marriage, better health and longer reproductive life span of potential mothers, and the like.

AGE COMPOSITION

Age composition is a major factor in determining the overall productivity of a population, because it reflects that proportion of it which is to work and support the rest (namely, the old and the very young). An inevitable consequence of a rapid increase in population caused by the excess of birth rate over death rate (and not by immigration) is a growing proportion of the younger age groups in the total

population. Coupled with an increase in the average life expectancy at birth, the proportion of non-earning consumers in the total population increases and retards the rate of economic growth of the country. It is estimated that currently, more than one-third of our population is in the age-group of 1-14 years, while another 7-8 % is above 60 years. It is noteworthy that some of the advanced Western countries are facing a high dependency ratio on account of increasing proportion of retired and old people. In India, the dependency is high because of a high proportion of persons below the age of 14 years.

DENSITY

The term density of population refers to the average number of persons per square kilometre of area. The density of population which a country can sustain depends upon its level of economic development. India has a vast geographical area but, on account of its economic backwardness, is not able to support its large and rapidly growing population. The density of its population was 363 persons per square km in 2004 and is expected to increase further. This projection highlights an urgent two-fold need to accelerate economic growth on the one hand and stemming the rate of population growth on the other. It should, however, be remembered that the latter cannot be achieved quickly enough. It is a long term phenomenon.

URBANISATION

In India, growing population has also led to increased urbanisation. This is partly explained by the lopsided growth of our economy in which it has become increasingly difficult to find gainful employment in rural areas. The proportion of urban to total population increased from 17.3% in 1951 to 25.7% in 1991 and is expected to have crossed 30 % by the end of the century. As noted above, an important reason for migration from rural to urban areas has been the comparative lack of employment opportunities in the former. In rural areas, agricultural growth has been at a slow pace. The phenomenon of green revolution has remained confined to only some selected regions of the country. Rest of the regions still face a scarcity of assured irrigation facilities, and other inputs. Agricultural reforms have also been uneven in different States. Moreover, agriculturally backward areas suffer from insufficient alternative employment opportunities (such as, in the form of small, village and cottage industries), dairy farming, fisheries and so on. Though some poor surplus workers remain disguisedly employed on their family farms, the rest are compelled to migrate to cities in search of work and income.

It should be noted that urbanisation is a very resource-costly phenomenon for an economy like ours. It necessitates additional consumption of productive resources which have to be diverted from other uses. It requires the provision or augmentation of several collective services which may be avoided or provided only at marginal resource cost in rural areas. Examples of such collective services include the provision of urban transport, additional roads, crossings, traffic management, road lighting, and so on. Similar arrangements have to be made for treatment of drinking water, disposal of sewage and industrial waste, and the like. Urban areas also suffer from atmospheric and noise pollution. For that reason, only well developed economies can afford to have a high percentage of urbanised population.

CLASSIFICATION OF POPULATION BY ECONOMIC ACTIVITY

The final results of 2001 Census reveal that out of total population of 103 crore in the country, 31.30 crore were main workers and 8.92 crore were marginal workers whereas 62.64 crore were non-workers. Thus, main workers constitute about 30.43 percent and marginal workers constitute about 8.67 percent of the total population. Among males 45.12 percent were main workers and 6.56 percent were marginal workers while among females 14.68 percent were main workers and 10.95 percent were marginal workers. Out of the total workers (main + marginal) 31.7 percent were cultivators, 26.5 percent were agricultural labourers, 4.2 percent were engaged in household industries and 37.6 percent were engaged in other economic activities. Thus, about 58.2 percent of working population was engaged in agriculture (i.e. cultivators and agriculture labourers) in 2001.

QUALITY OF POPULATION

Quality of population refers to a combination of the quality of life led by it and the level of its productivity. It is represented by a number of factors, including, (i) the level of health enjoyed by it, (ii) proneness to suffer from ill-health, diseases and epidemics, (iii) life expectancy at birth, (iv) infant mortality, (v) mortality of mothers in child birth, (vi) level of literacy, and (vii) technical skill and productivity of the labour force. Judged by these criteria, we note that the quality of Indian population has steadily improved since Independence, but it is still very poor when compared with the standards achieved in advanced countries. Let us start with the availability of *cereals*. Table 11.1 (Key Indicators) shows that in spite of nearly four-fold increase in the production of food grains, their net per capita availability has not shown noticeable increase since 1970-71. The figure was 334 grams per day in 1950-51 and 418 grams in 1970-71. Having touched 469 grams in 1990-91, it declined back to 427 grams in 2003-04. It is worth noting that this poor performance is not only on account of rapidly increasing population, but also a poor rate of growth registered by pulses. Their per capita per day availability declined from 61 grams in 1950-51 to 29 grams in 2000-01. However, it went up to 35.9 gms. per day in 2003-04. The performance in terms of availability of oilseeds has been equally disappointing.

In contrast, we have been able to control, to a significant extent, the mass killer diseases, and infant and female mortality (even though our infant mortality is still one of the highest in the world). And this has led to an increase in our life expectancy at birth from a low of only 32.1 years in 1950-51 to 60.3 years in 1993-94, and further to 63.87 years for males and 66.91 years for females in 2000-01. Similarly, the literacy rate (in spite of the extremely unrealistic manner of its official definition) has increased from a mere 18.33% in 1950-51 to 65.38% in 2000-01. The dark side of the story is that due to population explosion, the absolute number of illiterate persons in our country is higher than what it was at the time of Independence. Similarly, while we have been to check the wrath of mass killer diseases, we are still unable to provide safe drinking water to the masses or provide even elementary health care.

Thus, the indicators of quality of Indian population provide a mixed picture. Judged by the increase in life expectancy at birth, the quality of life has improved substantially since 1950-51. But as noted above, this achievement is accompanied by a failure along several fronts including, for example, our failure to provide basic necessities like housing, hygienic living conditions, safe drinking water, nutritive food and health care. Food intake of the Indian masses is deficient in certain elements like proteins, vitamins and minerals. Similarly, while we have one of the largest work force

of scientists and technically qualified persons, an average Indian worker is still unskilled and untrained. Average capital intensity in Indian productive activities is quite low and the capital used is often of poor technical standard. In addition, we also suffer from a lack of initiative and work-culture. The general tendency is to look for an opportunity to avoid hard labour.

IMPACT OF POPULATION ON ECONOMIC DEVELOPMENT

The growth of population creates hurdle in economic development of a country in a variety of ways. Some of them are discussed as under:

- (i) *Fall in Per Head Availability of Natural Resources* : Increase in population of a country result decrease in per head availability of natural resources. This shortfall can be made good by building up capital in the process of exploring natural resources by a rising population. In under-developed and low income economies including India, the capital building activity stays at a much lower level because (a) the growing population contributes less to production than it absorbs by way of increase consumption, (b) the quality of labour in under-developed economies also affects capital formation adversely, (c) proportion of workers of productive age to total population is highly adverse, (d) growing population results in diversion of resources not only to consumption expenditure but also to items for social overheads like education, health, housing, etc., so that volume of capital formation suffers.
- (ii) *Adverse Land-man Ratio* : Rising population also distorts the land man ratio. Since the supply of land is inelastic, the rising population pressure on land is resulting in progressive decline in the per capita cultivated land.
- (iii) *Mass Unemployment* : An economy, which is suffering from population explosion generally confronts with mass unemployment. Job opportunities do not widen in such economies as because the labour force is increasing with no commensurate increase in complementary resources to it. Low income and reduced savings, hamper investment and capital formation while increasing job avenues for the rising population are not available. Such economies usually face a backlog of unemployment, which keeps on enlarging because current additions to the labour force are not fully absorbed.
- (iv) *Inadequate Social Overheads* : Growing population is proving to be a menace to the economy in the sense that it requires colossal investment to build up a commensurate social overhead in the form of schools, houses, universities, hospitals, trains and systems of transport and communication, recreation centres etc. This necessitates diverting resources of the community away from economic development. This leaves very less amount of resources for investing in projects, which are productive in nature and lead to improvement in the standard of living of the people. Thus, the economy gets trapped in the Nurkse's vicious circle of poverty i.e. low investment, income and saving etc.
- (v) *Low Per Capita Income* : Population growth results in decline in per capita income and standard of living. Per capita availability of a number of essential goods also declines if real income does not increase at the same pace.

- (vi) *Food Shortage* : With increase in millions, per capita availability of food items also declines. About one million people in the country die every year due to malnutrition. One-third of the people are undernourished and half of them are malnourished.
- (vii) *Energy Crisis* : Population growth has raised energy crisis. More and more energy is needed in future to meet increasing demand of the rising population.
- (viii) *Falling Savings and Investment* : A rising population also influences saving and investment in the country because a large part of income generated in the economy is spent on consumption needs.
- (ix) *Environmental Degradation* : The increasing population growth is also responsible for environmental degradation and pollution thereby causing serious problems in terms of soil erosion, floods, air and water pollution.

INDIA'S POPULATION POLICY

The overriding objective of economic and social development is to improve the quality of lives that people lead, to enhance their well being, and to provide them with opportunities and choices to become productive assets in society.

In 1952, India was the first country in the world to launch a national programme, emphasizing family planning to the extent necessary for reducing birth rates "to stabilize the population at a level consistent with the requirement of national economy". After 1952, sharp declines in death rates were, however, not accompanied by a similar drop in birth rates. The National Health Policy, 1983 stated that replacement levels of total fertility rate (TFR) should be achieved by the year 2000.

Half a century after formulating the national family welfare programme, India has:

- reduced crude birth rate (CBR) from 40.8 (1951) to 26.4 (1998);
- halved the infant mortality rate (IMR) from 146 per 1000 live births (1951) to 72 per 1000 live births (1998);
- quadrupled the couple protection rate (CPR) from 10.4 percent (1971) to 44 percent (1999);
- reduced crude death rate (CDR) from 25 (1951) to 9.0 (1998);
- added 25 years to life expectancy from 37 years to 62 years;
- achieved nearly universal awareness of the need for and methods of family planning, and
- reduced total fertility rate from 6.0 (1951) to 3.3 (1997).

On 11 May, 2000 India was projected to have 1 billion (100 crore) people, i.e. 16 percent of the world's population on 2.4 percent of the globe's land area. If current trends continue, India may overtake China in 2045, to become the most populous country in the world. While global population has increased threefold during this century, from 2 billion to 6 billion, the population of India has increased nearly five times from 238 million (23 crores) to 1 billion in the same period. India's current annual increase in population of 15.5 million is large enough to neutralize efforts to conserve the resource endowment and environment.

Stabilising population is an essential requirement for promoting sustainable development with more equitable distribution. However, it is as much a function of making reproductive health care accessible and affordable for all, as of increasing the provision and outreach of primary and secondary education, extending basic amenities including sanitation, safe drinking water and housing, besides empowering women and enhancing their employment opportunities, and providing transport and communications.

The National Population Policy, 2000 (NPP 2000) affirms the commitment of government towards voluntary and informed choice and consent of citizens while availing of reproductive health care services, and continuation of the target free approach in administering family planning services. The NPP 2000 provides a policy framework for advancing goals and prioritizing strategies during the next decade, to meet the reproductive and child health needs of the people of India, and to achieve net replacement levels (TFR) by 2010. It is based upon the need to simultaneously address issues of child survival, maternal health, and contraception, while increasing outreach and coverage of a comprehensive package of reproductive and child health services by government, industry and the voluntary non-government sector, working in partnership.

In pursuance of these objectives, the following National Socio-Demographic Goals to be achieved in each case by 2010 are formulated:

- Address the unmet needs for basic reproductive and child health services, supplies and infrastructure.
- Make school education up to age 14 free and compulsory, and reduce drop outs at primary and secondary school levels to below 20 percent for both boys and girls.
- Reduce infant mortality rate to below 30 per 1000 live births.
- Reduce maternal mortality ratio to below 100 per 100,000 live births.
- Achieve universal immunization of children against all vaccine preventable diseases.
- Promote delayed marriage for girls, not earlier than age 18 and preferably after 20 years of age.
- Achieve 80 percent institutional deliveries and 100 percent deliveries by trained persons.
- Achieve universal access to information/counseling, and services for fertility regulation and contraception with a wide basket of choices.
- Achieve 100 per cent registration of births, deaths, marriage and pregnancy.
- Contain the spread of Acquired Immunodeficiency Syndrome (AIDS), and promote greater integration between the management of reproductive tract infections (RTI) and sexually transmitted infections (STI) and the National AIDS Control Organisation.
- Prevent and control communicable diseases.
- Integrate Indian Systems of Medicine (ISM) in the provision of reproductive and child health services, and in reaching out to households.
- Promote vigorously the small family norm to achieve replacement levels of TFR.

- Bring about convergence in implementation of related social sector programs so that family welfare becomes a people centred programme.

UNEMPLOYMENT-NATURE AND VARIOUS MEASURES TO REDUCE IT

The nature of unemployment, in India sharply differs from the one that prevails in industrially advanced countries. According to Keynes, unemployment in these countries could be the result of a deficiency of effective demand. It implied that in such economies machines become idle and demand for the products of industry is no longer there. This type of unemployment caused by economic slowdown did arise in India during 1930s. But with the growth of economic activity, it has been possible to mitigate cyclical unemployment. Similarly, after the Second World War, when war-time industries were being closed, there was a good deal of frictional unemployment caused by retrenchment in the defence establishments, etc. These workers were to be absorbed in peacetime industries. Similarly, the process of rationalization which started in India from 1950 also caused displacement of labour. But more serious than cyclical unemployment or frictional unemployment in Indian economy is the prevalence of chronic under-employment or disguised unemployment in the rural areas and the existence of urban unemployment among the educated classes. It may emphasized that unemployment in India is not the result of deficiency of effective demand but a consequence of shortage of capital equipment or other complimentary resources. The committee of experts on unemployment in its report of May, 1973 estimated the likely number of unemployed in 1971 could be 18.7 million including 9 million who were without any job whatsoever and 9.7 million who worked for less than 14 hours per week treated at par with the unemployed. Out of this, 16.1 million unemployed were in the rural areas and 2.6 million in the urban areas. Unemployed as a percentage of total labour force worked out to 10.4 percent for the country as a whole; 10.9 percent for the rural areas and 8.1 percent for the urban areas. It was estimated that 8.5 million persons in rural areas and 1.2 million persons in urban areas were working for less than 14 hours/per week. Besides, this, 23.50 million persons working for less than 28 hours per week were severely under-employed. Similarly, 3.4 million persons working for 15 to 28 hours per week were severely under-employed. Similarly, 3.4 million persons working 15 to 28 hours per week were severely under-employed. This is in all 26.9 million persons were severely underemployed. A person working for 8 hours a day for 273 days of the year is regarded as employed on a standard person year basis. Three estimates of unemployment were generated in the 27th Round of National Sample Survey (NSS) on the basis of the recommendations of the Committee of Experts on unemployment estimates. These are :

- (i) Usual Principal status employment or chronic unemployment, persons who remained unemployed for a major part of the year. This measure is more appropriate to those in search of regular employment who may not accept casual work. This is referred to as “open unemployment”;
- (ii) Weekly status unemployment i.e., persons who did not find even an hour of work during the survey week; and
- (iii) Daily status unemployment i.e. persons who did not find work on a day or some days during the survey week.

The usual status unemployment rate is generally regarded as the measure of open unemployment during the reference year; the current weekly status (CWS)

unemployment rate also measure chronic unemployment, but with reduced reference period of a week. The current daily status (CDS) is a comprehensive measure of unemployment, including chronic unemployment as well as under-employment, on weekly basis. In 1980, nearly 12 million persons fell in the category of usual status or open unemployment. The overall rate of usual status unemployment for India has risen from 4.23 percent in 1977-78 to 4.48% in 1980. On the basis of the NSS Survey, taking all persons under the weekly status criterion, 16 million persons might be considered as unemployed in the beginning of 1990. On the basis of earlier round of NSS, about 12 million persons were estimated to be severely under-employed in the beginning of 1990. The backlog of unemployment for planning process could thus be around 28 per cent at the beginning of the Eighth Plan. The latest and seventh quinquennial NSS survey, namely the 61st round conducted during July 2004-June 2005, constitutes an important source of information on employment and unemployment. The 61st round of NSSO survey reveals a faster increase in employment during 1999-2000 to 2004-05 as compared to 1993-94 to 1999-2000. Survey show that over 47 million persons were provided employment during 2000 to 2005. Annual addition to employment on Usual Principal Status (UPS) basis went up from 5.347 million during 1993-94 to 1999-2000 to 9.58 million during 1999-2000 to 2004-05. Simultaneously, however, according to 61st round estimates, during 1990-2000 to 2004-05, labour force grew even faster at an annual rate of 2.54 percent compared to annual employment growth of 2.48 percent. As a result, despite the faster growth of employment, unemployment (on UPS basis) was higher at 3.06 percent of the labour force in 2004-05 compared to 2.78 in 1990-2000. Incidence of unemployment had come down from 2.88 percent in 1983 to 2.62 percent in 1993-94. The reversal of the declining trend in employment growth from an annual rate of 2.1 per cent in the ten years ending in 1993-94 to 1.6 per cent in the five years ending in 1990-2000 to 2.5 per cent in the five years ending in 2004-05 is an encouraging development. Nevertheless, there is need for faster employment growth for not only absorbing the addition to the labour force, particularly with the ongoing demographic changes, but also for reducing the unemployment rate. The share of agriculture in total employment has come down from 61.67 percent in 1993-94 to 58.54 percent in 1999-2000, and further to 54.19 percent in 2004-05. With the declining share of agriculture in GDP, the scope for absorbing substantial additional labour force in agriculture is limited. While construction and services contributed in maintaining employment growth in the economy, employment growth in manufacturing fell short of potential.

As per suggestions of the Bhagwati Committee Report, 1973 Government of India implemented following schemes to provide employment and alleviate underemployment: (i) Rural Works Programme : Construction of civil works of a permanent nature; (ii) Marginal farmers and Agricultural labourers; families were to be assisted with subsidized credit support for agri and animal husbandry operations; (iii) Small farmers development agencies. To make available to small farmers credit to enable them to make use of the latest technology in farming practices, etc.; (iv) Integrated dry land agricultural development. To undertake permanent works like soil conservation, land development, water harnessing, etc.; (v) Agro-service centres -- Financial assistance to unemployed graduates/diploma holders, graduates in agriculture and sciences. It aimed to help in setting-up workshops, repairing/hiring of machinery and technical services including supply of spare parts; (vi) Area Development Schemes – This relate to the development of infrastructure like road,

market yards, etc. in command areas; and (vii) Crash programme for Rural Employment—The scheme was to generate additional employment through a network of rural projects of various kinds which are labour intensive and productive. The scheme had a two-fold purpose. Firstly, a project in each block was to provide employment to 100 persons on an average continuously over a working season of 10 months in a year. Secondly, each project was to produce works or assets of durable nature in consonance with the local development plan. The various schemes under the Fourth Plan or Crash Plans could not succeed in removing rural unemployment and under-employment because efforts were not made to organize the army of the rural unemployed into appropriate supply camps to be shifted to places of demand at the desired minimum wage. For providing rural employment a number of schemes were taken-up for implementation. These were : (i) Employment Guarantee Schemes, food for work programme, small farmers development agency, drought prone area programme and desert development programme, command area development programme etc. A multiple agencies have been involved in implementing these schemes. The Sixth Plan proposed that such multiplicity of programmes for the rural poor operated through a multiplicity of agencies should be ended and replaced by one single integrated programme operate throughout the country. This programme was named as the Integrated Rural Development Programme (IRDP). The IRDP was initiated in October, 1980 in all the 5011 blocks in the country. The National Rural Employment Programme (NREP) was being implemented from October, 1980 as a centrally sponsored programme with 50 percent central assistance to create additional employment of the order of 300-400 million man days per year for the unemployed and underemployed. Besides this, the NREP aimed to create community assets for strengthening rural infrastructure. The Sixth Plan conceived of these two important programmes. The basic strategy was to promote self-employment of the poor households through IRDP so that with the transfer of productive assets, they may earn incomes that help them to cross the poverty level. The NREP was to provide wage employment to fill in the periods of seasonal and sporadic under employment. It was also intended to enlarge absorptive capacity of labour in rural areas in non-agricultural occupations by creating infrastructure-social and economic which helped to increase the productive capacity of the economy. To supplement NREP, a new Rural Landless Employment Guarantee Programme (RLEGP) was launched on the 15th August, 1983 with 100 per cent central assistance with the objective of generating gainful employment, creating productive assets in rural areas and improving the overall quality of rural life. The Government decided to merge NREP and RLEGP and a new employment programme named Jawahar Rojgar Yojana was launched on 28th April, 1989. Jawahar Rojgar Yojana aimed to reach every single village panchayat and was specially targeted to help people below the poverty line. Preference was to be given to SCs, STs and free bonded labourers. At least 30 per cent of the employment was to be provided to women under Jawahar Rojgar Yojana. Jawahar Rojgar Yojana has been modified from 1993-94 and was implemented in three streams. Wages under Jawahar Rojgar Yojana are paid at the rate notified for the prescribed schedule of employment under the Minimum Wages Act for the relevant works and may be paid partly in food grains and partly in cash. Jawahar Gram Smridhi Yojana (JGSY) was introduced in April 1999 as a successor to Jawahar Rojgar Yojana which was being implemented as a centrally sponsored scheme on a cost sharing ratio of 75:25 between the Centre and the States. Under this programme, all works that can result in the creation of durable assets are taken-up. Swarn Jayanti Gram Swarozgar

Yojana (SGSY) was introduced in April, 1999 as a result of restructuring and combining the IRDP and Million Walls Scheme (MWS) into a single-self employment programme. It aimed at promoting micro-enterprises and helping the rural poor into self help groups. It was being implemented as a centrally sponsored scheme on cost sharing ratio of 75:25 between the centre and the states. The urban self-employment programme and urban wage-employment programmes of the Swarn Jyanti Shahari Yojana (SJSRY), which substituted in December, 1997 various programmes operated earlier for poverty alleviation. SJSRY is also funded on 75:25 basis between the centre and states. The Government of India introduced Employment Assurance Scheme (EAS) with effect from 2nd October, 1993 in rural areas in 1778 blocks of 261 districts. The scheme aimed at providing assured employment of 100 days of unskilled manual work to the rural poor who are in need of employment and seeking it. The scheme was drawn up on the model of Employment Guarantee Scheme of Maharashtra. The assurance of 100 days extends to all men and women over 18 years and below 60 years of age. National Rural Employment Guarantee Scheme (NREGs) Act passed in September, 2005. The NREGS was implemented from February, 2006 in 200 identified districts of the country with the objective of providing 100 days of guaranteed unskilled wage employment to each rural household opting for it. The on-going programmes of SGRY and National Food for Work Programme (NFFWP) have been subsumed under NREGs in these districts. NREGS will cover all districts of the country within five years. The NREGS a demand driven scheme, has its focus on works relating to water conservation, drought proofing, land development, flood control and rural connectivity in terms of all weather roads.

Approach paper for Eleventh Plan observes that : (i) Employment growth accelerated to 2.6% during 1999-2005 outpacing population growth. But the average daily status unemployment rate, which had increased from 6.1% in 1993-94 to 7.3% in 1999-2000, increased further to 8.3% in 2004-05. This was because the working age population grew faster than total population and labour force participation rates increased, particularly among women; (ii) Agriculture employment increased at less than 1% per annum, slower than population growth and much slower than growth in non-agricultural employment; (iii) Non-agricultural employment expanded robustly at an annual rate of 4.7% during 1999-2005 but this growth was entirely in the unorganized sector and mainly in low-productivity self-employment. Employment in the organized sectors actually declined despite fairly healthy GDP growth; (iv) NSS earnings data show negligible growth of average wage rates in non-agricultural employment during 1999-2005. According to the Annual Survey of Industries, real wages stagnated or declined even for workers in organized industry; (v) The wage share in our organized industrial sector has halved after the 1980s and is now among the lowest in the world. One reason for this is increasing capital intensity of the organized sector, another is outsourcing. The approach paper to the Eleventh Plan targets generation of additional employment opportunities in services and manufacturing, in particular, labour intensive manufacturing sectors e.g. food processing, leather products, footwear and textiles and in service sectors tourism and construction. It calls for elimination of distorting fiscal incentives which foster capital intensity; infrastructure investment; removal of distortions that hinder competition, greater emphasis on vocational training and skill development to improve employability of youth. It also calls for redressing the problems faced by village and small scale enterprises (VSSE) units and home based workers particularly women, e.g. non-availability of timely and adequate credit, unreliable power supply, burden of

inspections, etc. Direct employment would be available in social sector like health and education and wage employment programme like NREGS.

FOREIGN TRADE AND BALANCE OF PAYMENTS

Foreign Trade

Foreign trade of a country is believed to be a major contributor to its economic growth. Through it, a country is able to acquire additional capital resources for supplementing its own savings. Foreign trade is the medium through which improved technology can be imported from abroad. The trading partners are able to specialise in their respective fields of advantage and gaining thereby. With foreign trade, the domestic industries are exposed to competition from abroad. This compels them to improve their productivity and efficiency and search for better technology. In fact, a judicious external trade policy coupled with the elements of policy relating to foreign investment etc. can be highly conducive to economic growth.

However, if external trade is to promote domestic economic growth and bring in other economic benefits, a pragmatic set of policies has to be devised by the authorities and pursued with diligence. Use of this channel for economic growth may throw up its own problems like adverse balance of payments and external indebtedness.

For over four decades, the policy of the Indian government with regard to external trade remained a highly conservative one. Its stated objective was that of attaining self-reliance. It was taken to mean that the country should try to produce everything it needs and it should aim at importing only those items which cannot be produced within the domestic economy. In the process, therefore, the policy of 'import substitution' was pursued while disregarding the resource cost of doing so. It also meant not caring about the need to increase international trade. Thus, insufficient attention was paid to the promotion of export capacity of the country and international competitiveness of our industries. Consequently, the domestic industries found that they could sell whatever they produced within the sheltered domestic market.

The result was that, instead of acquiring "self reliance" in the sense of "self sufficiency", India failed to achieve either. It remained in need of importing several essential items like oils and lubricants, technology, defence products, life saving drugs, and for some period, even food and edible oils. Simultaneously, it failed to acquire export competitiveness and had a persistent deficit balance of payments.

The pressure on balance of payments increased on account of another reason as well. The Government did not favour FDI. Instead, it preferred to borrow from abroad. However, it fell into the habit of borrowing even for those projects which did not need any import contents. Moreover, borrowings did not lead to a corresponding creation of export earning capacity. Consequently, along with growing volume of external debt, cost of its servicing kept increasing. This added to our balance of payments difficulties.

Trend analysis - Exports, Imports and Balance of Trade

Table 6.1 shows that right from the beginning, our imports showed a tendency to increase faster than our exports. This was because while our need for imports kept increasing in response to our expanding economy (particularly in the process of industrialisation), we did not make adequate effort in increasing our export capacity.

Moreover, while the growth in exports picked up in mid-seventies and eighties, our imports continued to outpace this increase. Consequently, our balance of trade not only continued to be negative but the deficit also kept widening with the passage of time. Thus, we note that the deficit was only Rs. 2 crore in 1950-51, but in 1966-67 it had increased to Rs.921 crore. The year 1980-81 saw the figure soar to Rs. 5,838 crore, while in the next ten years (that is, in 1990-91) it nearly doubled to Rs. 10,645 crore. The deficit in 2001-02 was Rs.36182 crore and for 2003-2004, it was Rs 65741crore. During 2005-2006(Apr-Dec'06), it increased to Rs. 189893 crore.

The persistent deficit balance of trade is explained by the fact that our official policy of over-regulation of the economy discouraged export promotion. The producers were in a position to sell high-cost and poor-quality produce within the domestic market and had no reason to face international competition. Moreover, controls were by themselves highly costly for the industry. The level of interest rate was also very high and added to production costs. On the other hand, low inflation rate abroad and steady improvement in product quality encouraged imports. We should also note the fact that our exports are primarily those which have a high price elasticity of demand and upon which foreign governments can easily impose quantitative restrictions. In contrast, our imports are crucial to our very survival. It is extremely difficult to reduce them.

It should be noted that the Government of India hardly levies any duties on exports. The customs revenue from exports is quite negligible. In contrast, till recently, rates of import duties have been almost prohibitive. But our demand elasticity for imported goods has been so low that they were not able to check a rapid rise in imports.

TABLE 6.1
INDIA'S BALANCE OF TRADE

(Rs. crore)

<i>Year</i>	<i>Exports</i>	<i>Imports</i>	<i>Balance</i>
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
1950-51	606	608	-2
1955-56	609	774	-165
1960-61	642	1122	-480
1965-66	810	1409	-599
1966-67	1157	2078	-921
1970-71	1535	1634	-99
1973-74	2523	2955	432
1975-76	4036	5265	1229
1980-81	6711	12549	-5838
1985-86	10895	19658	-8763

1	2	3	4
1990-91	32553	43198	-10645
1991-92	44041	47851	-3810
1892-93	53688	6375	-9687
1993-94	69751	73101	-3350
1994-95	82674	89971	-7297
1995-96	106353	122678	-16325
1996-97	118817	138920	-20103
1997-98	130101	154176	-24075
1998-99	130753	178332	-38580
1999-00	162753	215236	-55675
2000-01	203571	230873	-27302
2001-02	213351	268300	-36182
2002-03	255137	2972206	-42069
2003-04	293367	359108	-65741
2004-05	375340	501065	-125725
2005-2006 (April-Dec.)	408394	598287	-189893

Source : Economic Survey.

Since we are signatory to the World Trade Organisation, we are under obligation to open our external trade to international competition. In line with these obligations, the rates of import duties have been successively reduced and quantitative restrictions have been removed, in phases, almost completely. Unless, therefore, Indian economy is able to take advantage of the new atmosphere and withstand competition in international markets, our balance of trade position is bound to worsen.

Composition of Trade

Changing composition of India's external trade reflects the changing nature of its economy. Our country is no longer dependent upon exports of traditional primary products. Currently, it is in a position to be a net exporter of food and other agricultural items as compared to being a net importer of them. Moreover, over time, it has acquired a capacity to export industrial and manufactured goods and they now form the bulk of its exports. As Table 6.2 shows, manufactured goods constitute the maximum proportion (70-77%) of India's total exports. The leading exchange earners in this category happen to be (a) gems and jewellery (around 13-16.6%), (b) readymade garments (around 6.8 to 10%), (c) cotton yarn, and fabrics etc. (3.3-5.3%), (d) handicrafts (around 1.1%), and (e) drugs, pharmaceuticals and fine chemicals (over 4%). Agriculture and allied items account for about 10% of our exports. Here the proportionate shares of traditional items like tea, coffee, cotton,

marine products oil meals, fruits and vegetable have decreased while those of cereals, cashew nuts and spices and unmanufactured tobacco have remained constant. Share of ores and minerals is also quite small; the total, including processed minerals being only around 4-6%. The relatively high proportionate share (5-16% or more) of crude and petroleum products is worth noting. Factually speaking, while we export some varieties of these products, we import much larger quantities of others.

Changing composition of Indian economy is also reflected in the changing composition of its imports. While India was a net importer of cereals and heavily dependent upon these imports for feeding its teeming millions, this item has nearly vanished from the list of its imported items. Their place has been taken by edible oils in which our country has become highly deficient but that is also decreasing. Another significant proportion of the category "food and allied products" is that of processed foods. The biggest share of this category is accounted for by cashewnuts which are partly re-exported.

TABLE 6.2
COMPOSITION OF INDIA'S EXTERNAL TRADE
(% Share)

<i>Commodity Group</i>	<i>2003-04</i>	<i>2004-05</i>	<i>2005-06</i>	<i>2005-06 (Apr.-Oct.)</i>	<i>2006-07 (Apr.- Oct.)</i>
<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(4)</i>	<i>(5)</i>	<i>(6)</i>
Percentage Share of Major Imports					
I. Food and allied products of which					
-- Cereals	4.7	3.5	2.5	3.0	2.3
-- Pulses	0.0	0.0	0.0	0.0	0.0
-- Cashewnuts	0.6	0.4	0.4	0.4	0.4
-- Edible Oils	0.4	0.3	0.4	0.4	0.3
	3.2	2.2	1.4	1.7	1.3
II. Fuels, of which					
-- Coal	28.1	29.6	32.1	32.2	36.2
-- POL	1.8	2.9	2.6	2.6	2.4
	26.3	26.8	29.5	29.6	33.7
III. Fertilizers	0.8	1.1	1.3	1.4	1.8
IV. Paper board, man, and newsprint	0.8	0.7	0.6	0.7	0.7

(1)	(2)	(3)	(4)	(5)	(6)
V. Capital Goods	12.7	13.0	15.8	10.7	12.1
VI. Others, of which	29.9	48.3	43.7	48.2	44.4
(a) Chemicals	7.4	6.2	5.7	6.1	5.5
(b) Pearls, Precious and Semi-precious Stones	9.1	8.4	6.1	7.5	4.1
(c) Gold and Silver	8.8	10.0	7.6	9.0	8.6
VIII. Unclassified Items	23.0	22.6		22.5	
Grand Total (Rs. Crore)	359108 (100.0)	490532 (100.0)	370745 (100.0)	(100.0)	(100.0)
Percentage Share of Principal Exports					
(1)	(2)	(3)	(4)	(5)	(6)
I. Agriculture and allied, of which	12.4	10.5	10.2	9.9	9.9
(a) Marine products	2.1	1.7	1.5	1.5	1.3
(b) Cereals	2.5	0.2	0.1	0.1	0.1
(c) Tea	0.6	0.5	0.4	0.4	0.4
(d) Coffee	0.4	0.5	0.4	0.4	0.4
(e) Oil meals	1.1	0.8	1.1	0.6	0.6
(f) Cashewnuts	0.6	0.7	0.6	0.6	0.5
(g) Spices	0.5	0.5	0.5	0.5	0.5
(h) Unmanufactured tobacco	0.3	0.3	0.2	0.2	0.2
(i) Fruits and vegetables	0.7	0.6	0.6	0.8	0.7
II. Ores and minerals	4.0	5.5	5.2	4.9	4.0

	(1)	(2)	(3)	(4)	(5)	(6)
II. Manufactured goods, of which		76.9	74.3	72.0	73.0	69.0
1. Gems and jewellery		16.6	16.5	15.1	16.7	12.9
2. Cotton, yarn, fabrics, etc.		5.3	4.1	3.8	3.9	3.3
3. Readymade garments		9.8	7.9	8.3	8.2	6.8
4. Drugs, pharma and fine chemicals		5.2	4.8	4.8	4.5	4.0
5. Handicrafts		0.8	1.2	1.2	1.3	1.0
IV. Crude and Petroleum Products		5.6	8.5	11.5	11.0	16.3
V. Others unclassified		1.1	1.2	1.1	1.2	0.7
Grand Total (Rs. Crore)		203571 (100)	361879 (100)	229084 (100)	(100)	(100)

Source : Economic Survey 2006-2007

Indian economy is heavily dependent upon import of fossil fuel and related items. Its dependence upon these imports is increasing rapidly because of growing energy needs and scarcity of deposits of fossil fuels in our country. Depending upon the highly volatile prices of petroleum products, our import bill of these items currently varies between 28 to 36% of the total. We are also importers of high quality coal in which we are deficient (Our huge coal reserves are of relatively inferior quality). Over time, share of fertilizers in our imports has increased to 1.8 %. Paper and related products account for another 0.7 % or so.

Bulks of our imports are related to our industrial activity. Capital goods accounts for around 11-16% of our imports. About half of this category is on account of non-electrical machinery; and electrical machinery and transport equipments account for another 1% each. An important noteworthy sub-category is that of 'project goods'. This sub-category reflects our growing industrial strength.

The changing composition of our economy is also reflected in the fact that around 6-7% of our imports are of chemicals. The imports those of 'pearls, precious and semi-precious stones' has come down to around 4.1 per cent . These imported items are processed and re-exported and happen to be a leading group of exchange earners. Same is the position with regard to gold and silver. These items account for

around 8-10% of our imports. Here also, a substantial portion of these imports is re-exported after processing into jewellery.

Our imports need a further detailed classification. As of now, around 22-23% of our imports are put under 'unclassified items'.

DIRECTION OF TRADE

The government has contributed only marginally in diversifying our export destinations and import sources. Most of the changes witnessed over the last four decades reflect changes in the political and economic scenario of the world. (See Table 6.3)

Let us start with exports. We find that with all the variation, OECD countries continue to account for the bulk of our exports. The share of these countries, as a whole, declined rapidly between 1960-61 and 1980-81 from 66.1% to 46.6%. Having increased subsequently, it declined again at the turn of the century. It was around 49% in 2001-02 and 46.5 in 2004-05. Within OECD, UK registered a phenomenal fall from 26.9% in 1960-61 to just 5.9% in 1980-81; and after some increase, it is again at around 5% of the total exports. In contrast, the share of USA, having first declined from 16.0% in 1960-61 to 11.1% in 1980-81, rose to 22.8% in 1999-00 and again fell to 19.4% in 2001-02 and 18.1% in 2004-05. Japan's share in our exports varied between 5.5% in 1960-61 to 9.3% in 1990-91 and fell drastically after that to just 3.4% in 2001-02 and 2.7% in 2004-05. It is also noteworthy that our export to the Eastern European countries took a nosedive when erstwhile Soviet Union split up into several countries.

From mid 1990s, India has changed its export orientation. It has started actively exploring and promoting non-traditional export markets. For this purpose it is also entering various trade agreements. The net result of all these activities is seen in the growing share of 'Other LDCs' in our exports. Starting from 14.8% in 1960-61, the share of this group of countries increased to 19.2% by 1980-81 and fell to 16.8% by 1990-91. It again increased in the coming years, and stood at 28.0% in 2001-02 and 35.5% in 2004-05.

TABLE 6.3
DIRECTION OF TRADE

(Percentage Shares)

		1960 -61	1970 -71	1980 -81	1990- 91	1995- 96	1999- 00	2000- 01	2001- 02	2004- 05
	1	2	3	4	5	6	7	8	9	10
EXPORTS										
1.	OECD	66.1	50.1	46.6	53.5	55.7	57.3	52.2	49.3	46.5
	(a) EU	36.2	18.4	21.6	27.5	26.5	24.7	22.7	21.8	21.8
	(b) UK	26.9	11.1	5.9	6.5	6.3	5.5	5.2	4.9	4.8
	(c) USA	16.0	13.5	11.1	14.7	17.4	22.8	20.9	19.4	18.1
	(d) Japan	5.5	13.3	8.9	9.3	7.0	4.6	4.0	3.4	2.7
2.	OPEC	4.1	6.4	11.1	5.6	9.7	10.6	10.9	12.0	15.0

	1	2	3	4	5	6	7	8	9	10
3.	Eastern Europe	7.0	21.0	22.1	17.9	3.8	3.1	2.4	2.3	2.4
4.	Other LDCs	14.8	19.8	19.2	16.8	25.7	25.6	26.7	28.0	35.5
5.	Others	8.0	2.6	1.0	6.2	5.1	3.4	7.3	8.4	0.6
IMPORTS										
1.	OECD	78.0	63.8	45.7	54.0	52.4	43.0	39.9	40.1	37.6
	(a) EU	37.1	19.6	21.0	29.4	26.7	21.2	19.8	19.1	18.8
	(b) UK	19.4	7.8	5.8	6.7	5.2	5.5	6.3	5.0	4.1
	(c) USA	29.2	27.7	12.9	12.1	10.5	7.2	6.0	6.1	6.3
	(d) Japan	5.4	5.1	6.0	7.5	6.7	5.1	3.6	4.2	3.4
2.	OPEC	4.6	7.7	27.8	16.3	20.9	22.5	5.4	5.8	7.3
3.	Eastern Europe	3.4	13.5	10.3	7.8	3.4	1.6	1.3	1.4	2.1
4.	Other LDCs	11.8	14.6	15.7	18.4	18.3	20.7	17.5	19.1	26.1
5.	Others	2.2	0.4	0.5	3.5	5.0	12.2	35.9	33.6	27.1

Source : Economic Survey, 2006-07

As regards imports, we find that the share of OECD fell in line with the decline in our exports to that group of countries. The figure which stood at 78.0% in 1960-61, fell to just 45.7% in 1980-81; and having registered some increase in the next decade, again started decreasing. By the turn of the century, the figure had declined to the region of 40%. It further declined to 37.6% in 2004-05. Within this group, EU countries accounted for a major reduction (from 37.1% in 1960-61 to just 18.8% in 2004-05). Strangely enough, the share of our imports from both UK and USA also recorded a phenomenal decline while there was no increase in the share of Japan. Our imports from UK declined from 19.4% in 1960-61 to only 4.1% of the total in 2004-05. The corresponding figures for USA were also phenomenal; namely, 29.2% and 6.3%. The figure for OPEC, having registered a heavy increase on account of repeated petroleum price hikes, fell since mid 1990s on account of our rapidly increasing non-oil imports. The share of imports from Eastern European countries also decreased in 1990s and later with the break up of the Soviet Union. In 2004-05, it was 2.1%.

In contrast, the share of "Other LDCs" and "Others" registered a hefty increase from a mere 14% in 1960-61 to 52.7% in 2001-02 and 53.2% in 2004-05. This reflects the changing map of our import-sources. It shows that we are gradually shifting our imports from the conventional sources to Asean and other ones.

During the first 8 months of the year i.e. 2005-06, the share of Asia and Oceania region comprising South Asian, East Asian, Mid-eastern and Gulf countries accounted for nearly 46.7% of India's total exports. The share of West Europe and America in India's export stood at 24.2% and 21.1% respectively. It is evident that the

share of Asia and Oceania in India's exports during the period has increased while the share of EU has remained unchanged. Asia and Oceania accounted for 33.2% of India's total import during the period followed by West Europe (21.0%) and America (7.8%). Among individual countries the share of USA stood highest at 5.3% followed by Belgium (3.8%), and Germany (3.9%).

During the same period, Africa accounted for the highest growth in India's export at 27.7% followed by Asia & Oceania (15.7%), West Europe (17.0%) and America (12.8%) while the entire East European region registered a decline of 21.2%. On the other hand, India's imports from the Asia and Oceania region was estimated at Rs. 126454 crore which was 20.0% higher than the imports in the corresponding period of the previous year. Substantial imports also took place from regions like the West Europe (Rs. 79869 crore), America (Rs. 29546 crore) and Africa (Rs. 12302 crore).

In terms of export destinations, US continued to be the principal destination accounting for 16.7 percent of India's total export in 2005-06 followed by UAE (8.4 per cent), China 6.5 per cent, Singapore (5.4 per cent) and UK (4.1 per cent). Region wise, Asia and Asian countries have emerged as major export destinations.

In 2005-06, for India's import, Asia and ASEAN continued to be the major and rapidly growing –source accounting for 35.2 per cent of total imports. Country wise imports from China recorded high growth of 51.3 per cent over 75 per cent growth in previous year. Growth of imports from Europe 25 (with a share of 16 per cent) was 19.5 per cent and that from America (with a share of 7.8 per cent) 12.7 per cent. In America USA was the major source of imports; Germany, Belgium and UK were the major import sources in EU25. In South East Asia, import growths from major sources like Singapore and Thailand and in South Asia Growth in imports from Sri Lanka, Bangladesh and Pakistan and even Maldives were high. In April –October 2006 very high growth was registered in the case of imports from Africa, mainly due to dramatic growth rates in five digits in imports from Nigeria (mainly crude oil) which also raised its share in India's imports to 4.4 per cent. Among other regions, growth was high in the case of imports from Latin America, Asia & ASEAN. Imports from major oil exporters like Saudi Arabia, UAE and other countries recorded rapid growth. China the top import source of India with 9.1 per cent share, recorded growth of 58.1 per cent, while imports from US (with 5.7 per cent share) was also buoyant at 30.2 per cent.

India has been recording high growth in export of services during the last few years. Such exports have increased three fold during the last three years. In 2005-06, with a growth of 42 per cent, it reached US\$61.4 billion. Growth has been particularly rapid in the miscellaneous service category, which comprises software services, business services, financial services and communication services. In 2005, while India's share and ranking in world merchandise exports were 1 per cent and 29, respectively, its share and ranking in world commercial services' export was 2.3 per cent and 11 respectively. By growing faster than merchandise exports, services exports constituted almost 60 per cent merchandise exports in 2005-06.

BALANCE OF PAYMENTS

Meaning and Structure

Balance of payments is a record of accounts of a country's economic transactions with the rest of the world over a given period of time (normally, one

year). It is a summary of the transactions pertaining to its buying and selling, borrowing and lending, investments and disinvestments, income from investments, repatriation of profits and dividends, gifts, grants, donations, and so on. The approach is not to record, as such, the quantities or types of goods and services imported and exported, but the categories of payments made and received as also those which become due. Thus recording of transactions is done in terms of the direction of payments which economic transactions entail on both actual and accrual basis. All transactions which typically entail inflow of payments are recorded as credit or plus entries. Actual receipts however need not necessarily be there. Similarly, debit or minus entries are those which typically generate an outflow of payments without necessarily involving actual payments. It follows that balance of payments account incorporates changes in external indebtedness and credit situation of a country.

A balance of payments account of a country need not be drawn with reference to the entire 'rest of the world'. It can also be drawn with reference to one or more of its trading partners, a region or a block of countries and so on. Similarly, if need be, it can also be prepared for a period other than one year, say six monthly.

It is also noteworthy that, because of the double entry system, a balance of payments account necessarily balances in the accounting sense, though this may not be the case in economic sense of the term. Conventionally, balance of payments account is split up into what are known as "revenue account" or better still "current account" and "capital account." By definition, these two components have the same accounting balance but with the opposite signs.

Components of Balance of Payments

The detailed classification of items entering balance of payments account differs from country to country depending upon several factors like the legal framework, the acceptance of international accounting conventions, the availability of data, the economic importance of the items and so on. For example, while it is agreed that trade account should include the transactions relating to the flow of tangible goods, actual classification of the latter has no international standard. Similarly, current account balance includes transactions relating to both tangible goods and rendering of services. The main difference appears in the field of capital flows. A relevant summary classification of items constituting a balance of payments account is given in following Table.

Table
Main Components of a Balance of Payments Account

<i>Credit</i>	<i>Debit</i>
1. Export of Goods	6. Import of Goods
2. Sale of Services to Foreigners	7. Purchase of Services from Foreigners
3. Unrequited Receipts from Abroad	8. Unrequited Payments Abroad

<i>Credit</i>	<i>Debit</i>
4. Capital Receipts	9. Capital Payments
(a) Short Run	(a) Short Run
(b) Long Run	(b) Long Run
5. Export of Gold and Other Precious Metals	10. Import of Gold and Other Precious Metals
	11. Errors and Omissions

Item 1 represents the export of tangible goods and therefore payments on this account appear on the credit side of the account. If some exports are made on credit, then there will be a corresponding entry in item number 9 which will indicate either (a) an improvement in the home country's international credit position, or (b) a reduction in its international indebtedness. This we should note that though item 9 records outflow of capital and appears on the debit side of the balance of payments account, actually it indicates an improvement in financial position. Similarly, Item 6 represents the value of imports of tangible goods. Here also a part may have been bought on credit. If that is so, then it amounts to the foreigners paying some capital to the home country. This part appears on the credit side of the account but indicates either (a) a deterioration in its international credit position, or (b) an increase in its international indebtedness. Conventionally, exports are valued f.o.b. ('free on board'), that is, they do not include freight, insurance, and banking charges etc., but they include export duties and other taxes less subsidies, if any. Similarly, imports are valued c.i.f. (that is, inclusive of cost, insurance, and freight etc.). Therefore, there is an inherent tendency for the imports of a country to be over-valued as compared with its exports.

These two items, namely, 1 and 6, taken together are termed "visible balance of trade" or "balance of tangible trade", or just "balance of trade". If the value of item 1 exceeds that of item 6, the balance of trade is positive; and in the opposite case, the balance is negative. Even in accounting sense, these two positions are also known by alternative pairs of terms, such as, 'surplus', 'active', or 'favourable', and 'deficit', 'passive', or 'unfavourable'. It should be noted, however, that "favourable" trade balance need not be always desirable. Its desirability or otherwise depends upon totality of circumstances.

Items relating to exports and imports of services contain the variety of services sold to tourists. They also include services provided through shipping, transport, insurance, banking, consultancy, remittances of earnings by migrant workers, interest, dividends, and profits, so on. It should be noted that interest, dividend and profit represent the services of capital and entrepreneurship provided by one country to the other. It is for this reason that the payments for these services are included in the 'current account' or 'revenue account' of the transactions. However, on the same reasoning, international movements of capital (including loans and investments) are not included here.

Items 3 and 8 relate to unrequited receipts and payments. The recipient country does not pay anything in exchange for their receipt. They are unilateral transfers like gifts, grants, charity, donations, reparations, indemnities and so on.

Items 4 and 9 record capital flows and may be (a) short term, and (b) long term ones. The economic impact of the two types of capital flows also differs from each other.

- Short term capital movements take place mainly in search of higher rate of return on financial instruments (like deposits, and shares, etc.) and speculative capital gains. These are generally termed “portfolio investment” as against “venture capital” or other terms denoting investment in manufacturing and trading activities etc. Expectations of any balance of payments difficulties or large scale changes in exchange rate can easily trigger these flows.
- In addition to the short term “hot” funds which float around international financial markets in search of “better yield and smaller risk” combinations, trading firms also agree to extend credit to each other. The same may be termed trader’s credit or supplier’s credit. In certain cases, there can be buyers’ credit also, that is, the buyers may lend to the suppliers when the latter have difficulties in arranging finance for their operations or when “firm commitments” are needed from the buyers.

It is important to note that short term capital movements have no direct correlation with the inherent economic strength of a country. Rather they depend upon a number of diverse factors which are not always self-correcting.

Long term capital movements are in the nature of investments of one country into the other. They are basically guided by the perceived economic strength of a country to absorb additional capital and be able to repay the capital through exports out of its enhanced productive and output capability. Viewed this way, therefore, inflow of long term capital is perceived as an indication of the strength of the recipient country.

Items 5 and 10 are somewhat tricky. The conventional approach takes the stand that when a country cannot meet its international payment obligations through exports or raising international loans, then it has to part with its gold stocks. That way, export of gold and other precious metals is indicative of balance of payments weakness of a country. However, we should qualify our conclusion by keeping in view the fact that the country in question should not be a producer of gold (such as South Africa) and should not be exporting it like any other commodity produced by it. Similarly, when a habitual consumer of gold like India imports gold from abroad, it need not indicate its balance of payments strength.. A country like India would try to import gold like any other essential item even when it is facing a huge balance of payments deficit. Illegal transactions, payments and receipts are left out of balance of payments account. To that extent, the account is an incomplete and inaccurate one with a corresponding inability in providing complete data for policy inferences.

Accounting versus Economic Balancing of Payments Account

Balance of payments account is prepared on the basis of double entry system. For this reason, it always balances in accounting sense, provided the following conditions are satisfied.

- All transactions between the home country and the rest of the world are recorded and there are no errors and omissions.

- The problem of timing of the transactions and the accrual or payments has been sorted out, so that the accounts are internally compatible.

In fact, these conditions are never met fully. Thus, as a matter of official policy, illegal transactions are not recorded in balance of payments account. The problem of compatibility of timing is never sorted out fully and there are also undetected and indeterminable amounts of over-invoicing and under-invoicing. The net result is that:

- (a) Several compensatory errors and omissions remain hidden in balance of payments account; and
- (b) some “net” non-compensatory errors and omissions still remain.

To cover these “net non-compensatory errors and omissions”, a balancing item (Item number 11) is added so as to balance the two sides of the account.

However, just as balance sheet of a firm always balances in accounting sense, but can still contain the information regarding its economic strength, similarly, the balance of payments account of a country can reveal its economic strength or weakness. For that kind of inference, however, we have to look at the behaviour of some relevant components of the balance of payments account. And this also leads us to the concept of equilibrium of balance of payments.

Economic Balance

Coming to the concept of economic balance, let us recall that it is different from accounting balance and is to be interpreted in terms of behaviour of relevant components of the payments account. Accordingly, from the balance of payments account of a country, we consider

- (i) Net inflow of gold and other precious metals;
- (ii) Net addition to foreign exchange reserves; and
- (iii) Reduction in short term net international indebtedness.

If during the period under consideration, $(i + ii - iii)$ is positive, the country has a “surplus” or “favourable” balance of payments. And in case, $(i + ii - iii)$ is negative, the balance is negative or unfavourable, or adverse.

It needs reiteration that the above-mentioned criterion should be interpreted carefully. We have seen that (a) gold flow need not truthfully reflect the balance of payments position of a country, and (b) it is often difficult to properly split up capital flows into their short term and long term components.

Equilibrium in Balance of Payments

The concepts of economic balance and equilibrium of balance of payments are closely linked with each other. But they do not have the same meaning. As A. C. L. Day says, the question of balance is related to discovering what lies below the surface of accounting balance. For example, what is happening to the foreign exchange reserves of the country? What is happening to its position as a debtor and creditor vis-a-vis rest of the world? And so on. In contrast, the concept of equilibrium of balance of payments is related to the actual or potential difficulties faced by a country in meeting its international payments obligations.

Equilibrium in balance of payments does not mean that the balance has to be necessarily “neutral” [that is, (i + ii - iii) need not be zero]. In practice, we do not expect that any country can continuously succeed in achieving such a “neutral” balance. Therefore, the concept of equilibrium of balance of payments should be interpreted a bit differently. It should be taken to mean the following two things.

- Balance of payments should not have a persistent surplus or deficit. This is because no country can sustain this situation indefinitely. In case of a persistent deficit, it would continue losing its gold stocks and foreign exchange reserves or would keep accumulating short-term indebtedness. Sooner or later, it would be unable to meet its international payment obligations and there would be a payment crisis. Similarly, a persistent surplus is also economically meaningless for the country concerned and not worth pursuing. What is the use in accumulating gold and foreign exchange reserves unless they are occasionally used to pay for imports ? In other words, it should not be a case only surplus or only deficits. Negative and positive balances should be inter-mixed.
- The size of imbalance should be within “well-tolerable” limits. It should also be noted that it is not possible to lay down the extent of permissible deviations in absolute terms. They would vary from country to country and would depend upon several factors like the national income of the country in question, the size of its balance of payments account, its foreign exchange reserves, its existing international indebtedness, and so on. In the final analysis, therefore, the concept remains a matter of judgement and opinion and not a matter of statistical data.

Causes and Remedies

While discussing the causes of disequilibrium in balance of payments , let us concentrate upon its deficit dimension only. In accounting sense, a surplus (or deficit) in revenue account is always counterbalanced by a deficit (or surplus) on capital account. Therefore, it follows that when there is a deficit in economic sense, the country is not able to export enough and/or get sufficient inflow of long term capital. Assuming a given rate of exchange, there is a structural incompatibility between the economy of the home country and rest of the world. The former does not have enough of competitive strength and export capability. This weakness of the home country may be due to several factors. Let us consider some of them.

When an economy suffers from strong inflationary pressures, its cost-price structure makes it unprofitable for foreigners to import from it. In contrast, there is an inherent incentive for its domestic traders to increase imports. If the home country is not able to adapt its economy and develop competitive strength, it continues to suffer from deficit balance of trade. A country may not be able to meet the changing needs of foreign importers. It may not be undertaking adequate research or development of technology and new goods and so on. In contrast, its own import requirements may be increasing due to its developmental efforts.

A country may be handicapped in production of one or more of its essential needs like food, fuel, or other inputs. To get out of this difficulty, it must develop enough of export capability to pay for its imports.

Similarly, the country may be pursuing a policy of preventing or discouraging direct foreign investment. India followed this policy for a few decades after

Independence. It is also possible that even when foreign investment is allowed, it may be insufficient or it may be into non-export sectors, etc. In addition, a country may have accumulated a huge volume of external debt (India did it) without utilising it for adding to its export capacity. In due course, the cost of servicing the external debt itself becomes an important cause of deficit balance of payments.

A number of measures may be attempted to meet a deficit balance of payments situation in the short run. But there are no fixed long term remedies. To this end, a country must think of all possible sources of the disharmony between its own economy and that of the world. It must aim at improving its competitive strength, lowering cost-price level, checking inflation, investing in research and infrastructure and so on. In other words, everything possible must be done to rectify long term deficit balance of payments.

Therefore, we shall confine ourselves only to short term measures directed at (i) improving balance of trade, and (ii) preventing an outflow of short term capital. For this, the central focus is making the domestic price level competitive with the level prevailing in rest of the world. Let us remember that rate of exchange is the factor by which prices are converted from one currency into the other, that is, home prices multiplied by rate of exchange give us prices in the foreign currency. In order to boost exports and discourage imports, either home prices should decrease or rate of exchange should depreciate.

If it is a regime of fixed exchange rate, a persistent deficit balance of payments implies that there is a “fundamental disequilibrium” between the home economy and rest of the world. Therefore, the entire burden of adjustment has to be effected only through changes in the domestic economy. This means that the country has to follow a deflationary policy of keeping lower prices.

Another drawback of sticking to fixed rate of exchange is that along with imposing contradictory processes upon the economy, the authorities have also to defend the existing rate of exchange through a policy of intervention in the market.

A third difficulty with this remedy is that it can work only if the domestic economy does not suffer from legal, institutional and other rigidities. It should have enough flexibility and ability to transform itself. If this is not so, the deflationary policies may lead to a situation of stagflation, that is, a combination of high costs and prices but poor demand.

Similarly, devaluation cannot succeed unless the elasticities of demand and supply for internationally traded goods are such that a downward shift in export prices and an upward shift in import prices are able to rectify deficit balance of trade.

To overcome the drawback of a fixed exchange rate, some thinkers suggest that the authorities may choose to adopt a policy of “crawling peg”. However, this policy can provide a lasting solution only if it is accompanied by a continuous process of adjustment of the domestic economy.

A frequently recommended remedial measure is that of devaluation. It is a deliberate measure of shifting the exchange rate against the home country. Compared with moving peg, it is a once-over and sizeable lowering of the exchange rate. It is adopted on the assumption that once an appropriate change in exchange rate takes place, market forces will be able to bring about necessary adjustment in balance of trade.

The effect of deflation depends upon a number of factors which determine the elasticities of demand and supply in international markets. Its basic version is known as Marshall-Lerner Condition and states that the direction of effect on trade will depend upon

- whether (elasticity of demand for imports by foreigners plus elasticity of demand for imports by the home country) is greater than equal to, or less than one; and
- the extent of devaluation.

It follows that when the sum of elasticities does not exceed unity, the home country would suffer unnecessarily on account of devaluation. It would be able to earn less of foreign exchange even with more exports and will have to pay more for even less imports. In other words, while its trade balance improves in terms of volume, there is deterioration in terms of value.

A major drawback of devaluation is its assumption that elasticities of all goods are equal to their overall average. Factually, this is never so. Elasticities of both exports and imports are spread over a very wide range. It means that when all export prices are reduced and all import prices are increased in the same proportion, the home country suffers an avoidable loss in the case of all those traded items the demand elasticities of which are less than one. This situation suggests the authorities should avoid an equi-proportionate change in the prices of all goods. Instead, the extent of price revisions should be on a selective basis and vary from item to item.

Another limitation with the method of devaluation is the difficulty in estimating its required extent, particularly when it is to be applied to all internationally traded goods whose elasticities will have to be calculated. Devaluation is also likely to provoke the trading partners of a country to retaliate by competitive devaluation and other measures.

Devaluation raises the prices of all imports including essential inputs. Therefore, it is inflationary in nature, increases production costs and reduces the competitive strength of the devaluing country.

India's Balance of Payments

The above theoretical discussion will help us to understand India's balance of payment situation. Table 6.4 shows India's balance of payments for 1990-91, 1999-2000, 2001-02, 2003-04, 2004-05 and 2005-06. We should note from the table that we have been able to partly make good the trade deficit by a surplus on invisible items. As a result, our current account deficit was not only considerably reduced but, in 2001-02, had become positive. It increased to 63983 crores in 2002-2003 but a negative again i.e. Rs. -12174 in 2004-2005 and further increased to Rs. -40722 in 2005-06. Moreover, since 1996-97, our capital inflow has been so high, that we have been able to add rapidly to our foreign exchange reserves. By March 2004, our reserves had crossed \$110 billion. It further increased to around \$150 billion in 2005-06. Some critics maintain that we should be careful regarding the inflow of short-term funds in the form of commercial borrowings and portfolio investment. Such funds have a high probability of flowing out of country for speculative reasons. If that happens, it can cause a grave disruption to the stability of our economy. The inflow of FDI stands on a different footing and should be encouraged by all means.

TABLE 6.4
BALANCE OF PAYMENTS

(Rs. crore)

		1990-91	1999-00	2001-02	2003-04	2004-05 (R)	2005-06(PR)
	1	2	3	4	6	7	8
1.	Exports	33153	162753	213345	303985	381765	465705
2.	Imports	50086	240112	268300	367301	533550	695131
3.	Trade balance	-16933	-77359	-54955	-63386	-151765	-229426
4.	Invisibles (net)	-435	57028	71381	127369	139591	188704
5.	Current Account (net)	-17368	-20331	16426	63983	-12174	-40722
6.	Capital Account	12898	48101	40167	80010	128081	106618
7.	Overall Balance	-4471	27770	56593	143993	115907	65896
8.	Monetary Trans.	4471	-27770	-56593	-143993	-115907	-65896
	(i) IMF	2178	-1122	—	—	—	---
	(ii) Red. in Res.	2293	-26648	-56593	-143993	-115907	-65896

Source : *Economic Survey 2006-2007*.

The year 2004-05 marked a significant departure in the structural composition of India's balance of payments (BOP) with the current account, after three consecutive years of surplus turning into deficit. This has further increased to Rs. 40,722 crores in 2005-06. The deficit was caused by a burgeoning excess of merchandise imports over exports, which was left uncompensated by the net surplus in invisibles. The Government is initiating various measures time to time such as boost in exports, check in imports, encouraging remittances, mobilizing foreign exchange earnings to overcome the adverse situation in current account of balance of payments..

FISCAL POLICY

Fiscal policy is an important and effective instrument to influence business environment of a firm in a country. It is basically concerned with budgetary policy of the Government in order to achieve certain socio-economic objectives. According to Arthur Simithies, Fiscal policy refers to a policy under which the government uses its expenditure and revenue programmes during a year to produce favourable distributional effects and avoid undesirable effect on national income, production and employment. Fiscal policy has different objectives in developed and developing economies. In developed economies the main objective of fiscal policy is to attain economic stability and full employment which it seeks to do by maintaining a higher level of propensity to consume. As against this, the fiscal policy has to work for accelerating the rate of growth by raising capital formation in the developing economy. Some of the major objectives of fiscal policy in a developing economy are discussed as under:

- (i) *Economic Growth* : It refers to the rate of increase in real income. The fiscal policy helps in achieving this objective by mobilizing resources for

development. These resources are then used for raising infrastructure facilities which give a big push to the process of growth and development in the country. Through various fiscal tools it helps application of saving and investment into priority channels of development.

- (ii) *Equitable distribution of wealth and income* : An important objective of fiscal policy is to achieve income transference from rich to poor. This is achieved on the one hand by highly progressive direct taxes on people in high income brackets and using these resources for the benefit of the common people directly or through provision of social amenities free of cost .

It also tries to put a ceiling on income and wealth by raising the tax rates to draw more than return on wealth so that there is gradual reduction in the concentration of wealth. In the policy of indirect taxes also care is taken to see that bare necessities of life are not taxed while the items of luxury are heavily taxed. The import of consumer items meant for the use of the rich are generally banned and restrictions are placed on export of the items of day-to-day use of the common man.

- (iii) *Full Employment* : The goal of full employment in the case of a developing country is achieved by accelerating the process of growth with employment. This in the case of advanced countries is achieved by designing a fiscal policy which reduces economic fluctuations over the period of an economic cycle. Such a policy of full employment would require a heavy public expenditure. It is necessary to resort to deficit financing during the period of depression, and to resort to a squeeze in public expenditure if there is an investment boom and the signs of prosperity leading to inflationary rise in prices are visible.

- (iv) *Exchange Stability* : Fiscal policy can also help in maintaining the rates of exchanges at even level. By regulating customs duties and if necessary by banning export and import of items which lead to exchange instability fiscal policy helps in maintaining the value of currency in the foreign exchange markets. Exchange control measures are also used in a big way both by the advanced and the developing countries of the world to ensure that foreign exchange which is scarce is conserved for the priority need of the nation. Various types of fiscal restrictions including quota restrictions, bilateral and multilateral trade agreements, regulated movement of capital, regulation of speculation in foreign currencies etc. are some of the measures to maintain, exchange stability.

- (v) *Balanced Regional Development* : Like the underdeveloped countries in the world every country has some underdeveloped regions. Economic policy of all the countries try to achieve a balanced regional development as an essential articles of economic policy. Various fiscal measures are provided for balanced regional development. These include a number of tax concessions including complete exemption of products raised in the backward regions from excise duty, sales tax and octroi and other concessions on profits earned by enterprises in these regions so as to provide conditions for equitable regional development. Direct cash assistance and seed money for starting enterprises also help in starting of industries in these regions. Financial assistance to units set-up in these regions is also provided on a priority basis and at concessional rates. Such facilities are also extended to the existing industries if they shift to these regions.

It also helps to attain other objectives such as rise in rate of saving & investment, check on inflation, price stability, balance of payment equilibrium etc.

The various elements of fiscal policy used for accomplishment of above mentioned objectives are stated below :

- (a) *Taxation* : This is an important source of raising revenues of the State. The taxes may be both in the form of direct and indirect. Since substantial resource mobilization is not possible merely through direct taxes which can be collected only from a very small percentage of total population in the country, a large dose of indirect taxation especially in the form of excise, sale tax etc are resorted to. To achieve the basic policy of equitable distribution of income and wealth it is ensured to maintain progressive character of direct taxation and to exempt essentials of life from direct taxes. Further, to achieve high rate of saving and investment and discourage consumption of certain items tax policy has been made highly discriminatory in a number of cases.
- (b) *Public Expenditure* : Public expenditure both developmental and non-developmental is an important element of fiscal policy. Non-developmental expenditures like expenditure on health, education etc. are equally important from a long-term point of view as developmental expenditure are. Although increase in public expenditure is welcome, there is need for exercising economies.
- (c) *Public Debt* : For mobilization of resources considerable reliance has been placed on public debt and various deposits so as to meet capital expenditure by capital receipts. It is believed that resorting to public borrowing is less inflationary as compared to indirect taxes broadly in a scarcity ridden economy.
- (d) *Deficit Financing* : In India deficit financing means excess government expenditure over revenues from tax and borrowings. Deficit financing is resorted to because of the limitations of resources mobilization through other sources. To determine the extent of safety for an economy to resort to deficit financing is a difficult question.

In recent years, under prevailing liberalized corporate environment and globalization of Indian economy, the government has taken initiative to introduce various fiscal measures in terms simplification of tax structure and laws, stable tax policy, better tax administration and enforcement in order to achieve various socio and economic objectives set under various national plans smoothly.

TAXATION AND SUBSIDIES

Traditional public finance theory maintains that the government should limit its activities to the minimum which is necessary for the protection and benefit of the society and economy. Theoreticians developed a framework of reasoning in which they compared the (i) marginal social utility of government expenditure and (ii) marginal disutility of paying taxes by tax payers to the government. This reasoning was used to develop the principle of maximum social advantage for determining the optimum size of the government budget. This principle reflects the conventional

thinking related to the manner in which the government should formulate its fiscal policy and operations. It was assumed, for example, that there should be no wasteful expenditure of government revenue and that the government should determine its expenditure priorities in line with the maximum possible social advantage to the society. It was also assumed that the government would not plan to borrow for meeting its expenditure needs, and that all its receipts would be in the form of tax revenue. Actually, public debt was considered as a dreadful disease. The government was to borrow, if at all, only in the case of real emergencies like wars and then pay off the debt as soon as possible.

Over time, the theory of public finance has come to incorporate two important features.

1. It is to be generally recognized that every government, irrespective of its political nature and other characteristics, tends to expand its field of activities. And this, coupled with some other features like a continuous price rise, etc. leads to a long term increase in government expenditure.
2. The second development is a basic change in the attitude of modern governments. They have abandoned the policy of laissez-faire and have adopted an active welfare approach. For this reason, fiscal policy is no longer confined to the determination of minimum necessary expenditure and determining the optimum manner of collecting tax revenue for meeting the same. A modern government takes a comprehensive view of the likely effects of all its actions and policies including details of coverage, rates, exemptions and mode of payment etc. Similarly, details of fiscal policy would include the possible impact of the components of government expenditure. And to this end, the government expenditure often includes a variety of subsidies and other transfers.

In India, the field of taxation between the Centre and States is clearly demarcated. The “base” on which a tax may be imposed is defined, and both the Centre and states cannot levy a tax on the same base. There are no overlapping taxation powers between the two layers of the government. Let us note some of the salient features of our tax system.

Our tax system makes a distinction between the levying, collection, sharing and appropriation of a tax. The actual allocation of taxes on these bases has been worked out so as to meet the objectives of (a) uniformity, (b) economy, and (c) efficiency. That is to say, the Constitution has tried to ensure that a tax paying unit does not suffer on account of its residential location or source of income; that the cost of collection should be the minimum possible; and that it should have the least possible ill effects for the economy.

- (a) The first group consists of those taxes which were levied, collected and retained by the Centre. Till recently, they included the corporation tax (that is, tax paid by companies on their incomes), customs duties, and cesses and surcharges specifically levied for the purposes of the Union’s coffer. Currently, however, all taxes levied and collected by the Centre are shared by the Centre with the States, except the cesses and surcharges.
- (b) The second group included those taxes which were levied and collected by the Centre but could be shared with the States. They included Basic Union

Excise Duties. As noted above, now this category of taxes is also compulsorily shared with the States.

- (c) The third group contained those taxes which were levied and collected by the Centre but had to be compulsorily shared with the States. They included income tax collected from non-corporate businesses. The final decision on such sharing was taken after the recommendations of the Finance Commission.
- (d) The fourth group contained those taxes which were levied and collected by the Centre but their entire net proceeds had to be passed on to the States. They included taxes imposed under Article 269. In addition, the States had also given up their right to levy sales tax on certain items so that the Centre could levy Additional Duties of Excise on them. The Centre passed on their entire net proceeds to the States.
- (e) The fifth group was of those taxes which were levied (and are still levied) by the Centre for reasons of uniformity, but are collected and retained by the States, such as stamp duties and excise duties on medicinal and toilet preparations.
- (f) The sixth group contained (and contains) those taxes which were levied, collected and retained by the States, such as, sales tax and land revenue, etc.

Taxation Policy

In India, the authorities have been of the view that tax policy is a powerful tool by which the economy can be effectively regulated and by which effective economic incentives and disincentives can be created. As a result, our tax system has come to acquire the following salient features.

- (a) The system has become extremely complicated with rapidly changing provisions and rates. Often, these provisions have been contradictory to each other and self-defeating in nature.
- (b) The system is laced with a plethora of exemptions, rebates, concessions, penalties and other provisions. In addition, there are notifications, clarifications, procedural details and the like. All this has made the system a highly complex one, and according to one opinion, counter productive.
- (c) The authorities have always recognized the need to simplify the tax system but steps taken to this effect have only added to its complexities.
- (d) The tax-base of our country is a narrow one. Tax payers are practising large scale tax evasion and avoidance. They are helped in this task by highly complicated tax provisions and procedures, as also by the vast discretionary powers enjoyed by the tax officials.
- (e) Frequent voluntary disclosure schemes under which tax evaders are provided an opportunity to pay tax (often on concessional basis) on concealed income and wealth, etc. have also contributed to the phenomenon of tax evasion.
- (f) Indirect taxes comprise a major portion of our tax revenue. Compared with direct taxes, they feed inflationary forces. They are more burdensome and

cause widespread distortions in the allocation of resources. They are known to be highly regressive in their nature. Selective exemption of items from indirect taxes has not been able to reduce their regressive nature because of widespread evasion.

- (g) The authorities have used, on a systematic and selective basis, tax holidays and other concessions
 - for promoting certain industries considered essential for the overall balanced growth of the economy;
 - for promoting and helping small scale industries and self employment activities so as to reduce unemployment and encourage labour-intensive techniques;
 - for encouraging investment in backward areas with the objective of reducing inter-regional economic disparities.

However, a number of concessions are related to the size of capital investment and not the number of persons employed. This has tended to encourage capital-intensive techniques.

- (h) Critics claim that the tax provisions relating to depreciation are based upon the cost of acquiring assets and not the cost of their replacement. This, therefore, discourages capital formation.
- (i) Authorities have tried to encourage exports by
 - levying customs duties on imports;
 - providing income tax and other forms of relief on income from exports.
- (j) Over the years, the government has made a systematic effort to reform indirect taxes by converting the base of excise duties from specific to value added, and by replacing excise duties with VAT.
- (k) Efforts are also being made to bring about a uniformity of indirect tax system throughout the country in the form of a unified VAT. Meanwhile, various intermediate steps are being taken so as to eventually achieve this goal.
- (l) The existence of octroi duty is considered a great hurdle in the development of the domestic market. It is known to cause delays in transport of goods and increase cost of production and marketing activities. Some States have taken steps towards abolishing octroi or replacing it with some other form of indirect taxation, but on the whole not much has been achieved. The problem is that local governments are starved of funds and the States are not in position to give them additional grants or loans. The Centre also finds it difficult to come to their help because funding of local governments comes under the purview of the States.
- (m) It is a common complaint that the States do not exploit their revenue potential to the full. In this context, we should remember that there is a widespread difference of opinion regarding the taxation of agriculture. While one section of thinkers believes that there is a case for taxing agriculture (such as, in the form of tax on agricultural incomes and land revenue) more heavily, others hold the view that agriculture is already being taxed to the extent it can bear its burden.

- (n) The States are in a peculiar situation in so far as taxing alcohol for human consumption is concerned. The States levy excise duty on this item and it is one of their major sources of revenue. At the same time, the Constitution directs the States to pursue a policy of prohibition. However, prohibition policy is highly resource expensive for the State concerned since it not only loses revenue from this item, it has also to incur additional expenditure in enforcing the prohibition.
- (o) The government, both at the Centre and States, has not been able to check the rapid growth in its expenditure. Though, over time, tax revenue of the government has increased very rapidly, public expenditure has increased faster than that. Moreover, public sector undertakings, which should have been a source of additional non-tax revenue, have turned out to be a net drain. Consequently, government budgets of our country are characterised by hefty deficits and cumulative increase in public debt. This phenomenon, in turn, has led to the following results:
 - a heavy increase in the cost of servicing public debt; and
 - a crowding out of private sector from the capital market, that is, making it difficult for the private sector to raise resources from the market;
- (p) The States enjoy a poorer financial health than the Centre. They are heavily dependent upon transfer of resources from the latter, a part of which takes place in the form of loans. Consequently, their indebtedness to the Centre has grown rapidly.

Subsidies

A subsidy is a negative tax. It is an assistance for a specified economic activity or a social purpose. An open subsidy assumes the form of a cash grant or transfer. However, it may also be in a hidden form like a tax concession, a purchase preference, a concessional price, and so on. In India, we have a large variety of both types of subsidies. They have come to account for a substantial portion of public expenditure.

Theoretically speaking, a subsidy is meant to help one section of the economy, or one section of the society, by procuring resources from the remaining sections. Subsidies are expected to help the authorities in achieving one or more goals through their impact on the economy in the following manner:

- Subsidies alter allocation of production and consumption resources as between alternative uses. The resources tend to move from non-subsidised to subsidised uses.
- Subsidies may aim at redistribution of real income and wealth in favour of the targeted sections of the society, such as between urban and rural people, between richer and poorer people, etc.
- Subsidies aim at altering the prices of selected inputs and products, and thereby achieve a shift in investment and production patterns.

Taken one by one, most subsidies can be justified on some ground or the other. The real drawback of having a system of subsidies lies in the fact that they are mostly

not administered well. They fail to achieve the set goals and lead to the emergence of vested interests. Quite often, they become a means by which the beneficiaries are able to hide their economic inefficiency. They develop their own growth process and become an unending burden upon the public budget.

The fact that in India, open subsidies have increased faster than what should normally be the case. It is seen that open subsidies have been increasing in an uninterrupted manner. It is also noteworthy that compared with open subsidies, hidden subsidies constitute a much bigger total. They assume diverse forms such as tax concession, purchase preferences, losses of public sector undertakings, supplying goods at concessional prices and other welfare measures.

Subsidies are an important fiscal policy tool for correcting market failures, particularly under consumption of basic essentials such as food. With direct provisions by the state, major subsidies, mainly on food, fertilizers and petroleum grew from Rs. 40716 crores in 2002-03 to Rs. 43,455 crores in 2003-04. Expenditure on major subsidies remained high at Rs. 45,187 crores in 2004-05 (RE). As a proportion of GDP, subsidies fell from 1.66 percent in 2002-03 to 1.45 per cent in 2004-05 (RE) and was budgeted at Rs. 46,358 crore or 1.31 percent of GDP in 2005-06. However, the apparent declines need to be seen in the context of the measures taken to facilitate liquidation of stocks and drought conditions.

The extent of food subsidy as a fiscal policy tool seeks to serve two separate and potential conflicting objectives of protecting 'producers' interest through payment of remunerative prices and also keeping prices stable/low for consumers.

National Budget

A budget shows, for a given year, the planned expenditures of government programs and the expected revenues from tax systems. In short it (budget) is a quantitative expression of a plan of action and an aid to coordination and implementation. 'Budget' has been used as a tool of economic policy. The Government, through this fiscal instrument channelises the funds collected. The basic objective of a budgetary policy is to achieve growth with stability. A budget may be a balanced one or an unbalanced one. When revenues and expenditure are equal during a given period, it is said to be a balanced budget. According to the traditional view a budget would be balanced. On the other hand the budget deficit is the difference between all receipts and expenditure, both revenue and capital

Under Article 112 of the Constitution of India, a statement of estimated receipts and expenditure of the Government of India has to be laid before Parliament in respect of every financial year which runs from 1st April to 31st March. This statement titled "Annual Financial Statement" is the main Budget document.

The Annual Financial Statement shows the receipts and payments of Government under the three parts in which Government accounts are kept

- (i) Consolidated Fund,
- (ii) Contingency Fund and
- (iii) Public Account.

All revenues received by Government, loans raised by it, and also its receipts from recoveries of loans granted by it, form the Consolidated Fund. All expenditure of

Government is incurred from the Consolidated Fund and no amount can be withdrawn from the Fund without authorisation from Parliament.

Occasions may arise when Government may have to meet urgent unforeseen expenditure pending authorisation from Parliament. The Contingency Fund is an imprest placed at the disposal of the President to incur such expenditure. Parliamentary approval for such expenditure and for withdrawal of an equivalent amount from the Consolidated Fund is subsequently obtained and the amount spent from Contingency Fund is recouped to the Fund. The corpus of the Fund authorised by the Parliament, at present, is Rs.500 crore.

Besides the normal receipts and expenditure of Government which relate to the Consolidated Fund, certain other transactions enter Government accounts, in respect of which, Government acts more as a banker, for example, transactions relating to provident funds, small savings collections, other deposits, etc. The moneys thus received are kept in the Public Account and the connected disbursements are also made there from. Generally speaking, Public Account funds do not belong to Government and have to be paid back some time or the other to the persons and authorities who deposited them. Parliamentary authorisation for payments from the Public Account is, therefore, not required. In a few cases, a part of the revenue of Government is set apart in separate funds for expenditure on specific objects like road development, primary education including mid-day meal scheme, etc. These amounts are withdrawn from the Consolidated Fund with the approval of Parliament and kept in the Public Account for expenditure on the specific objects. The actual expenditure on the specific objects is, however, again submitted for vote of Parliament even though the moneys have already been earmarked by Parliament for transfer to the funds.

A budget contains the following two types of budgets :

- (i) **Revenue Budget** : It consists of the revenue receipts of Government (tax revenues and other revenues) and the expenditure met from these revenues. Tax revenues comprise proceeds of taxes and other duties levied by the Union. The estimates of revenue receipts shown in the Annual Financial Statement take into account the effect of the taxation proposals made in the Finance Bill. Other receipts of Government mainly consist of interest and dividend on investments made by Government, fees, and other receipts for services rendered by Government. Revenue expenditure is for the normal running of Government departments and various services, interest charges on debt incurred by Government, subsidies, etc. Broadly speaking, expenditure which does not result in creation of assets is treated as revenue expenditure. All grants given to State Governments and other parties are also treated as revenue expenditure even though some of the grants may be for creation of assets.
- (ii) **Capital Budget** : It consists of capital receipts and payments. The main items of capital receipts are loans raised by Government from public which are called Market Loans, borrowings by Government from Reserve Bank and other parties through sale of Treasury Bills, loans received from foreign Governments and bodies and recoveries of loans granted by Central Government to State and Union Territory Governments and other parties. Capital payments consist of capital expenditure on acquisition of assets like

land, buildings, machinery, equipment, as also investments in shares, etc., and loans and advances granted by Central Government to State and Union Territory Governments, Government companies, Corporations and other parties. Capital Budget also incorporates transactions in the Public Account.

Union Budget 2007-08

The document Budget at a Glance shows in brief, receipts and disbursements along with broad details of tax revenues and other receipts. This document also exhibits broad break-up of expenditure - Plan and Non-Plan, allocation of Plan outlays by sectors as well as by Ministries/Departments and details of resources transferred by the Central Government to State and Union Territory Governments. This document also shows the revenue deficit, the gross primary deficit and the gross fiscal deficit of the Central Government. The excess of Government's revenue expenditure over revenue receipts constitutes revenue deficit of Government. Government mainly borrows through issue of dated securities, i.e. market borrowings. Apart from this, Government also borrows funds under many schemes which form part of capital receipts. The difference between the total expenditure of Government by way of revenue, capital and loans net of repayments on the one hand and revenue receipts of Government and capital receipts which are not in the nature of borrowing but which finally accrue to Government on the other, constitutes gross fiscal deficit. Gross primary deficit is measured by gross fiscal deficit reduced by gross interest payments. In the Budget documents 'gross fiscal deficit' and 'gross primary deficit' have been referred to in abbreviated form 'fiscal deficit' and 'primary deficit', respectively.

The Budget of the Indian Union Government gives a complete picture of the estimated receipts and expenditure of the government. The Finance Minister presented the Union Budget in the Parliament for the Financial Year 2007-08 on 28th February, 2007. The budget at a glance along with earlier budgets is presented in the following Table 6.5 :

Table 6.5
BUDGET AT A GLANCE

(in crore of Rupees)

	2005-06 <i>Actuals</i>	2006-07 <i>Budget Estimates</i>	2006-07 <i>Revised Estimates</i>	2007-08 <i>Budget Estimates</i>
(1)	(2)	(3)	(4)	(5)
1. Revenue Receipts	347462	403465	423331	486422
2. Tax Revenue (Net to Centre)	270264	327205	345971	403872
3. Non-tax Revenue	77198	76260	77360	82550
4. Capital Receipts (5+6+7)^{\$}	158661	160526	158306	194099
5. Recoveries of Loans	10645	8000	5450	1500

6. Other Receipts	1581	3840	528	41651
7. Borrowings and other liabilities ^{\$}	146435	148686	152328	150948
8. Total Receipts (1+4)^{\$}	506123	563991	581637	680521
9. Non-plan Expenditure	365485	391263	408907	475421
10. On Revenue Account, of which,	327903	344430	362183	383546
11. Interest Payments	132630	139823	146192	158995
12. On Capital Account	37582	46833	46724	91875*
13. Plan Expenditure	140638	172728	172730	205100
14. On Revenue Account	111858	143762	144584	174354
15. On Capital Account	28780	28966	28146	30746
16. Total Expenditure (9+13)	506123	563991	581637	680521
17. Revenue Expenditure (10+14)	439761 66362	488192 75799	506767 74870	557900 122621*
18. Capital Expenditure (12+15)	92299 (2.6)	84727 (2.1)	83436 (2.0)	71478 (1.5)
19. Revenue Deficit (17-1)	146435	148686	152328	150948
20. Fiscal Deficit (16 - 1+5+6)	(4.1)	(3.8)	(3.7)	(3.3)
21. Primary Deficit (20-11)	13805 (0.4)	8863 (0.2)	6136 (0.1)	(-) 8047 -(0.2)

* Based on provisional Actuals for 2005-06

* Includes an amount of Rs. 40,000 crore on account of transactions relating to transfer of RBI's stake in SBI to the Government.

\$ Does not include receipts in respect of Market Stabilisation Scheme, which will remain in the cash balance of the Central Government and will not be used for expenditure.

Source : Website: <http://indiabudget.nic.in>

Notes : The table shows the revenue deficit, the fiscal deficit and the primary deficit. Revenue deficit refers to the excess of revenue expenditure over revenue receipts. Fiscal deficit is the difference between the revenue receipts plus certain non-debt capital receipts and the total expenditure including loans, net of repayments. This indicates the total borrowing requirements of Government from all sources. Primary deficit is measured by fiscal deficit less interest payments.

Preparation of Budget

The major components of receipts and expenditure included in the preparation of Budget of Government of India are listed as under:

RECEIPTS

Revenue

Tax

Corporate tax
Income tax

Wealth tax

Gift Tax

Customs duty

Excise

Non tax

Interest
Dividends

Profit from

PSUs

External

Grants

Capital

Recoveries of loans

Market borrowings
External assistance

Disinvestment of
PSU shares

Receipts in

Provident fund

Small savings.

EXPENDITURE

Revenue

Money spent on items which do not create assets, covers normal activities of departments, services subsidies, interests, staff, pensions, bonus, DA, repayment of interests' non-plan support to PSUs, defence subsidies.

Capital

Money spent on items which create assets financial or otherwise, and repayment of principles.

Stages involved in Preparation of Indian Budget

At the outset there are seven stages at budget preparation.

Stage 1

Ministry of Finance instructs Ministers/Departments to formulate receipts and expenditure for next year and revised estimates for current year. Departments/Ministries prepare estimates which are scrutinized by the financial advisers and then interaction is made with the Department of Expenditure (Finance Ministry).

Stage 2

Estimates of tax revenue-Field Staff report, progress of collections are analyzed by TRU (tax Research Unit) and Boards of Direct Taxes/Excise and Custom. Estimates are prepared through interaction with the Department of Revenue and Economic Affairs based on performance of economy, industrial production, import, foreign exchange reserves.

Stage 3

Public Sector Companies—

Project progress, internal resources, extra budgetary resources, commercial credits, budgetary support needs are discussed with Planning Commission which gives detailed instructions to Central Ministries to prepare estimates of

development plan outlay and ultimately allocations are finalized in consultation with the Ministry of Finance after review of on going schemes.

Stage 4

Interaction with the State—Interaction and interfaces-Deputy Chairman, Planning Commission, Finance Minister as well as Chief Ministers of States.

Stage 5

Industry, trade and professional bodies submit memorandum and discussions are held by Finance Ministry involving economists, scientists, industrialists, farmer lobbies, business associations, IMF and World Bank.

Stage 6

Impact of suggestions are analysed by TRU (Tax Research Unit) and Fiscal unit interaction with all Ministries and final estimates are prepared by the Ministry of Finance (optimistic, realistic and pessimistic).

Stage 7

Budget division works—out revenue expenditure, capital expenditure, gaps, additional taxes, duties, concessions, quick estimates of receipts and expenditure. Interaction with the Cabinet and the Prime Minister through Finance Minister. Discussions are held on reliefs, subsidies, social schemes, internal and external borrowings. Final documents are produced and ultimately budget is presented in the Parliament after introduction of Economy Survey.

FIVE-YEAR PLANS AND ECONOMIC DEVELOPMENT

When India became Independent, it was a highly backward economy. It possessed all the salient characteristics of underdevelopment such as mass poverty, inequalities, regional disparities, a limited extent of industrialisation, poor use of productive resources, insufficient and inefficient infrastructure, dominance of agriculture, widespread unemployment and so on.

Committed to the objective of growth with distributive justice and removal of common ills like poverty and unemployment, the authorities came to the view that we should not commit ourselves to either a full-fledged market economy or a complete negation of it in the form of centralised planning. We chose to have a mixed economy with planning, a complementary role of public and private sectors, and an active role of the state.

The rationale of planning was derived from the reasoning that a poor country like India could not simultaneously pursue a multiplicity of objectives. It had to determine priorities in terms of their social and economic worth, while keeping in view the interlinkages and the need for providing a basis for a rapid self-sustained growth together with a progress towards distributive justice and socialistic pattern of society. Even the Constitution of the country directed the authorities to ensure that all citizens had access to adequate means of livelihood. The directive principles of the Constitution also provided that concentration of economic power was to be prevented. There was, therefore, a need for a systematic restructuring of social and economic institutions. It was recognized that reduction in poverty and improvement in consumption standards was possible only by achieving a faster rate of economic growth through efficient allocation of productive resources. Planning was also needed

to increase gross domestic saving and gross domestic investment together with acquiring improved technology and tackling the balance of payments problem.

If, in our reasoning, we ignore the weakness of human nature and attitudes, it can be established that economic planning can accelerate the growth rate of the economy and achieve other objectives faster while avoiding the ills of a free market mechanism. However, the ground reality is that while government regulation and direction may be recommended for overcoming market failures, planning process itself suffers from government failures. It is not possible to get rid of both types of failures by any means. We tried to achieve this impossible objective through the path of a mixed economy, but failed (as we were bound to). The inherent reason for market failures lies in the fact that in this system, the decision-makers are guided by their self-interest. In contrast, the government failures emanate from the fact that (i) the authorities are unable to judge the precise needs of the economy and the society, (ii) they are unable to implement their plans quickly and efficiently, and (iii) there is a lack of a strong mechanism of economic incentives and disincentives.

In India, the Planning Commission was constituted in March 1950. It was assigned the task of formulating “a plan for most effective and balanced utilisation of the country’s resources”. The institution of planning commission has continued to exist since then and has been supplemented with planning bodies at state and local levels. Some of the main objectives of planning in India happen to be the following.

- *Increase in National Income* : This objective gets translated into an increase in not only the national income, but also in the level of production and real per capita income.
- *Achieving Full Employment* : Unemployment is a curse in any society. It is more so when there is an inadequate social security or its total absence. Employment imparts dignity to human beings and is also an important means of reducing poverty and inequalities. The objective of planning was not to reduce inequalities by lowering the income levels of the richer sections but by raising the income levels of the poorer sections.
- *Reduction in Inequalities of Income and Wealth* : India being an extremely poor country, inequalities of income and wealth translate themselves into absolute poverty and destitution. There can be no difference of opinion regarding the desirability of reducing such inequalities, particularly because they also lead to inequality of economic opportunities.
- *Creation of a Socialist Society* : This was an obvious and generally accepted objective inclusive of there being equal opportunities of economic advancement for all sections of the society.
- *Removal of Bottlenecks* : Removal of Bottlenecks in the way of economic growth such as, low rates of saving and investment, inefficient technology, problems of balance of payments, absence of basic industries and insufficient infrastructure, etc.
- *Industrialisation* : Our plans adopted a strategy of industrialization of the economy with particular emphasis on heavy and basic industries. Though this strategy also assigned a high priority to agricultural growth, in practice, agricultural and rural development received inadequate attention. Some analysts are of the view that India, with its vast agricultural potential should

have first concentrated on the development of agriculture and rural parts of the economy. Such an approach would have generated economic surplus needed for capital formation and investment.

- *Self-reliance* : Our plans also aimed at “self-reliance”. Critics claim that this objective was misinterpreted and led to the adoption of wrong priorities. Our plans and policies took it to mean freedom from the need to import and therefore a policy of “import substitution” regardless of its cost. The critics hold the view that this objective should have been taken to mean “ability to pay for our imports through our export earnings”. Viewed this way, we should have added to our export capacity and competitive strength in international markets.
- *Precedence to Public Sector* : In our planned growth, public sector was assigned a place of precedence over the private sector so as to acquire commanding heights of the economy and be in a position to use it for guiding the private sector along chosen lines. This was done while ignoring the fact that public sector undertakings are inherently less efficient than private ones.

Thus, the basic objectives of India's Five Year Plans are rapid economic growth, full employment, self-reliance and social justice. Apart from these basic objectives, each five-year plan takes into account the new constraints and potential/possibilities during the period and attempts to make the necessary directional changes and emphasis.

The First Five Year Plan emphasized on rapid agricultural development so as to achieve food self-sufficiency in the shortest possible time and control inflation. Simultaneously, the First Plan attempted a process of all-round balanced development, which could ensure a rising national income and a steady improvement in the living standards of the people over a period of time. Agricultural targets fixed in the First Plan had been achieved, price level had registered a fall and, consequently, it was felt that the Indian Economy had reached a stage where agriculture could be assigned a lower priority and a forward thrust be made in the development of heavy and basic industries of the economy for a rapid advancement in future.

The basic philosophy of the Second Plan was therefore, to give a big push to the economy so that it enters the take-off stage. The Second Plan aimed at rapid industrialization with particular emphasis on the development of heavy and basic industries e.g. iron and steel, heavy chemicals fertilizers, heavy engineering and machine building industry. Second Plan programmes could not be implemented fully because of the acute shortage of foreign exchange. Physical targets were revised downwards. At the beginning of the Third Plan (1961-66) it was felt that the Indian Economy had entered the ‘Take-off stage’ and the first two plans had generated an institutional structure needed for rapid economic development. However, during the Second Plan it was witnessed that rate of agricultural growth was the main limiting factor in India's economic development.

The Third Plan accordingly gave top priority to agriculture but it also laid adequate emphasis on the development of basic industries, which were necessary for faster economic development in the country. In view of Indo-China conflicts in 1962 and with Pakistan in 1965, the emphasis of Third Plan was shifted to defence development instead of economic and social development. Indian economy

witnessed severe droughts in two consecutive years, devaluation of rupee and inflationary pressure and recession and had to implement three Annual Plans (1966-69) commonly known as “Plan Holiday”.

The Fourth Plan (1969-74) had two principal objectives viz. growth with stability and progressive achievement of self reliance. It aimed at an average 5.5 per cent rate of growth in the national income and the provision of national minimum for the weaker sections of the community (the latter came to be known as the objectives of “growth with justice” and “Garibi-Hatao. The Fourth Plan experienced three consecutive years of drought (1971-73) and the first oil price shock of 1973.

Fifth Plan (1974-79) was launched at the time when the country was reeling under a veritable economic crisis arising out of a run-away inflation, fuelled by the hike in oil prices since September, 1973 onwards and failure of the Government takeover of the whole-sale trade in wheat. Fifth Plan aimed at achieving the two main objectives viz. removal of poverty and attainment of self-reliance, through promotion of higher rate of growth, better distribution of income and a very significant step-up in the domestic rate of saving. The plan, however, was terminated at the end of the fourth year of the plan in view of change in Government.

The Sixth Plan (1980-85), which was initiated at the fall of Janata Government, aimed at a direct attack on the problem of poverty by creating conditions of an expanding economy. During the plan period Indian economy made all-round progress and most of the targets set by the Government were realized though in the last year (1984-85) of the plan many parts of the country faced famine condition as agricultural output was less than the previous year.

The Seventh Plan sought to emphasise policies and programmes which would accelerate the growth in food grains production, increase employment opportunities and raise productivity – all these three immediate objectives were regarded central to the achievement of long-term goals determined as far back as the First Plan itself. The focus of the Seventh Plan was on food, work and productivity. The Seventh Plan was a great success since the Indian Economy recorded 6 per cent GDP growth during this period as against the targeted 5 per cent. The decade of the 80's witnessed a creditable average annual growth of 5.8 per cent as against the average of 3.5% in the previous five plans.

The Eighth Plan (1992-97) was approved at a time the country was going through a severe economic crisis caused by a balance of payments crisis, a rising debt burden, ever-widening budget deficits, mounting inflation and recession in industry. The Government initiated the process of fiscal reforms as also economic reforms with a view to providing new dynamism to the economy. The Eighth Plan reflected these changes in its attempt to accelerate economic growth and improve the quality of life of the common man. Eighth Plan was launched two years later because of change in Government at the Centre. Eighth Plan witnessed a new take-off of high GDP Growth and industrial revival. During the plan, the country registered the highest annual rate of growth of 6.8 per cent. This growth could be achieved even though the share of the public sector in total investment had declined considerably to about 34 per cent. With the adoption of economic reforms and liberalization, the importance of the private sector and movement towards market oriented economic system were both responsible for the higher rate of economic growth during the Eighth Plan.

The Ninth Plan (1997-2002) was formulated in the context of four important dimensions of state policy viz. quality of life, generation of productive employment, regional balance and self-reliance. The plan focused on accelerated growth, recognizing a special role for agriculture for its stronger poverty reducing and employment generating effects, which would be carried out over a 15 year period. The plan viewed the role of the state and the private sectors as complementary, and both were considered essential. Private sector activity needs properly organized markets and hence the emphasis was on such economic liberalization and decontrol. But market forces may give rise to outcomes which may adversely affect broader national and social perspective. The Ninth Plan, therefore, underlines the need for state intervention in three broad areas to take care of the imperfections of the market forces. These areas were : (i) quality of life of the citizens; (ii) generation of productive employment; and (iii) regional balance. In the Ninth Plan, the targeted growth rate of 6.5 percent of GDP could not be achieved and there was a sharp fall to a level much lower than level attained in the Eight Plan. Since agriculture and manufacturing account for nearly half of the GDP growth, they together pulled down the overall GDP growth to a level of 5.35 per cent. The relatively poor performance in agriculture sector in three out of five years of the Ninth Plan, led to a reduced demand for industrial goods and consequent reduction in growth in the industrial sector apart from lower than expected public investment.

TENTH FIVE YEAR PLAN (2002-2007)

In line with its objective of planned economic growth, India has continued with its planning process even after the adoption of a policy of economic liberalization and globalisation of our economy. This approach has, however, undergone a fundamental transformation. From the earlier approach of over-regulation of almost all economic decisions and activities by the State, the new approach is increasingly relying upon market forces. The State is reverting back to what are recognized as its essential functions and which are expected to help the economy and society in several ways. It should be noted that the earlier system of planning of near-total control and regulation was not abandoned because it was a total failure. It was abandoned because, under changed circumstances, it was believed that the role of the State needed a basic revision.

Factually speaking, the performance of our planned growth was a mixture of both failures and achievements. It was, however, realized that (i) the Indian economy had reached a stage where it could benefit more and accelerate its growth process by shifting from over-regulation to market-orientation; and that (ii) this shift was in line with our commitments to the emerging world economic under the WTO regime. It was also realized that our earlier policy of excessive controls and regulation was a hindrance in achieving our full growth potential. In the process, our planning objective had degenerated from "self-reliance" to that of "self-sufficiency." This had increased the dependence of our economy upon "foreign assistance" which came mainly in the form of loans loaded with their associated demerits. We had failed to retain in the international markets whatever competitive strength we had. In contrast, countries with success stories on economic and social front were those which had relied less on centralized and regulatory planning and more on the market forces.

As noted above, success of the Indian economy during the planning period was a mixed bag. While India had become one of the most industrialized countries of the world, there were also a disconcerting atmosphere of an all-round inefficiency. Such

an inefficiency had prevented our economy from gaining competitiveness in international markets and we were facing a perpetual shortage of foreign exchange. Our planning had also miserably failed in providing adequate and cost-effective infrastructure. We had also failed miserably in providing productive and gainful employment to our growing masses and in promoting social welfare and distributive justice. A major portion of our population lacked the basic necessities of life like safe drinking water, medical and health care, quality education, good housing and so on. Though we had been able to overcome some mass killer diseases, indicators of social development like rates of infant and maternal mortality were still disturbingly high. In contrast with the above-noted failures, our economy had acquired some inputs considered highly helpful in accelerating growth process. Examples of such growth inputs include a growing manpower of skilled and professional workers, and the growth of information and technology.

Our planning had over-relied on various regulatory weapons like direct controls, licenses, quotas and permits. In addition, use was also being made of an increasingly complicated set of fiscal and monetary measures. These measures, it is generally believed, had eroded the efficiency of the economy as a whole. An important hurdle in the growth process was the lack of a system of economic incentives and disincentives, both for labour and management. Equally important was the gross neglect of research and development activities because of the fact that suppliers were able to take advantage of the over-sheltered domestic market suffering from an all-round scarcity of almost everything.

It was contended by some that the need for planning was over once we had re-orientated our official policy from central and regulatory planning to that of relying upon market forces in early 1990s. However, being still an underdeveloped country, India needed State help in several ways. Only the nature of this help was to be modified to suit the new situation. Thus, for example, Indian economy still needed State help in providing infrastructure, basic amenities of life, essential social goods and services, and the like. Consequently, in the new policy framework:

- (1) planning was to become *indicative in nature* for the private sector;
- (2) the State was to withdraw from all those activities which could be better left in the hands of the private sector (like trading, manufacturing, and so on);
- (3) the State was to improve its basic governance and efficiency, including its fiscal and monetary policies; and
- (4) it was to provide essential infrastructure, social goods and services and so on.

The contours of the Tenth Plan should be viewed in the light of these changes.

Objectives and Targets

By the very nature of our economic and social needs, the objectives of Tenth Plan happen to be comprehensive and diversified. *They cover, apart from accelerating the rate of economic growth, strengthening the fundamentals of the system, improving the quality of life and distributive justice, and ensuring enhanced employment opportunities. The objectives of our planning also incorporate helping our economy in acquiring competitive strength in international markets and freedom from the need to borrow externally. The targets of the Tenth Plan were worked out in conformity with achieving these long term objectives.*

In addition to 8% overall rate of growth per annum, the Tenth Plan lays down some specific targets and indicators for human development, including the following.

- (a) Access of all to primary education by the end of Tenth Plan, and increase in literacy rate to 75%.
- (b) A reduction in poverty ratio by 5% by the end of the Plan and by 15% by the end of 2012.
- (c) To provide gainful employment to the labour force expected to be added during the Tenth Plan.
- (d) Access to safe drinking water by every village by 2012.
- (e) Cleaning of all major rivers by 2007.
- (f) Reduction in maternal mortality rate to 2 per thousand live births by 2007 and to 1 per thousand live births by 2012. Correspondingly, reduction in infant mortality rate to 45 per thousand live births by 2007 and further to 28 by 2012.
- (g) Forest cover to be increased to 25% by 2007 and to 33% by 2012.

In addition to the above-mentioned All-India targets, the Tenth Plan also lays down State-wise breakup of growth rates and social development indicators. These targets have been worked out on the basis of the needs and potential of each concerned State. Also sector-wise growth rates have been worked out by taking into account incremental capital output ratio and other determinant factors.

Employment : Ours is an over-populated country suffering from widespread and high rate of unemployment. Successive Plans have not been able to solve this problem of unemployment. This problem has stubbornly resisted all solutions and is now deeply entrenched. Therefore, it is imperative to note the extent to which Tenth Plan aims at providing additional employment opportunities. The Plan estimated a backlog of around 34.85 million unemployed in 2001-02. It also estimated that during 2002-07, there would be an addition of 35.29 million person-years. It means that the backlog of unemployment could be cleared by creating job opportunities totalling 70.14 million person-years during the Tenth Plan. The Plan estimated that the projected economic growth of roughly 8% p.a. would itself generate an additional 29.67 million job opportunities. This figure falls short of even the fresh addition to labour force during the Tenth Plan by 5.62 million. Consequently, the number of unemployed would increase to 40.47 million at the end of the Plan.

As a part solution to this problem, the Tenth Plan talks about the “programme generated additional employment”. The Plan estimates put this part of employment opportunities at 19.35 million, thereby increasing the total job opportunities created during the Tenth Plan to 49 million. This way, the level of unemployment would come down from 9.21% at the beginning of the Tenth Plan to 5.21% at the end of it.

Poverty Alleviation: The wide-spread mass poverty in our country has always been a matter of deep concern to us, and we have not been able to overcome it. Clearly, no developmental plan worth the name can be formulated without incorporating poverty alleviating programmes. The poverty ratio (that is, the proportion of people below poverty line) in 1999-00 was estimated to be 26.1%. The

Tenth Plan aims at reducing this ratio to 19.2% by 2006-07. However, even with this reduced proportion, the number of poor in absolute terms was projected at 21.97 million (at the end of 2006-07). The Plan also estimates that, in 2006-07, about three-fourths of the BPL families would be concentrated in the six poor States, namely, Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan Orissa and Assam. It means to say that, both the absolute number of the poor, and their concentration in a few areas, are matters of a great concern. By implication, the authorities must formulate more effective projects for alleviating mass poverty.

Plan Size and Allocation

As stated before, Tenth Plan is only indicative for the private sector. Therefore, the figures relating to investment and sectoral allocation pertain to only the public sector. The investment by the private sector is in addition to this. The Plan does not lay down that portion of investment. Instead, it only recommends relevant policies for incentives and direction of private sector investment and other activities. The Plan puts allocation for the entire public sector during 2002-07 (at 2001-02 prices) at Rs. 15,25,639 crore, with the following sectoral break up (Rs. crore and % of total allocation).

- (i) Agriculture and Allied Activities : Rs. 58,933 crore (3.9%);
 - (ii) Rural development : Rs. 1,21,928 crore (8.0%);
 - (iii) Special Area Programmes : Rs. 20,879 crore (1.3%);
 - (iv) Irrigation and Flood control : 1,03,315 crore (6.8%);
 - (v) Total of rural-related : Rs. 3,05,055 crore (20.0%);
 - (vi) Energy : Rs. 4,03,927 crore (26.5%);
 - (vii) Industry and Minerals : Rs. 58,939 crore (3.9%);
 - (viii) Transport : Rs. 2,25,977 crore (14.8%);
 - (ix) Communications : Rs. 98,968 crore (6.5%);
 - (x) Science, Technology and Environment : Rs. 30,424 crore (2.0%);
 - (xi) General Economic Services : Rs. 38,630 crore (2.5%);
 - (xii) Social Services : Rs. 3,47,391 crore (22.8%);
 - (xiii) General Services : Rs. 16,332 crore (1.0%);
- Total : Rs. 15,25,639 crore (100.0%).

It is seen that the Tenth Plan covers a wide spectrum of the Indian economy, indicating the seriousness with which the State takes its responsibilities of providing basic support for economic and social development of the country. It is also seen that the emphasis of public sector investment is on the development of agriculture and rural areas, as also on infrastructure like provision of energy and transport. Thus, while rural-related programmes get 20% of total allocation, energy, transport and communications get 47.8% of the total allocation. Equally important is the emphasis given to social services which get 22.8% (higher than even the rural-related programmes).

Resources

The financing of the Tenth Plan public sector allocations is summarized as follows. The Centre is to provide Rs. 4,05,735 crore out of its budgetary resources, and another Rs. 4,87,448 crore are to come from the internal and extra-budgetary resources of the public enterprises, thus bringing the Centre's contribution to Rs. 8,93,183 crore. The remaining amount, namely, Rs. 6,32,456 crore is to be provided by the State Governments as follows: Rs. 5,90,948 crore out of their own resources, and Rs. 41,508 crore out of Central Assistance by the Centre to the States.

Saving and Investment

It is estimated that during the Tenth Plan, the annual average Rate of Investment would be 28.41% of GDP at current market prices, the rate increasing from 24.42% in 2001-02 to 32.26% in 2006-07. As against this, Gross Domestic Rate of Saving (GDS) would be an annual average of 26.84% during the Plan period; it would increase from 23.52% in 2001-02 to 29.41% in 2006-07. The gap (1.57%) would be financed by the current account deficit which would increase from 0.90% in 2001-02 to 2.85% in 2006-07 (that is, a current account deficit of Rs.18,711 crore by 2006-07). The Plan assumed an incremental capital: output ratio (ICOR) of 3.58, with the corresponding estimate of growth rate of 7.93% for the economy. As regards the performance of the external sector, the Tenth Plan assumes that our exports would increase by 12.38% p.a. while the imports would increase at the rate of 17.13% p.a.

It is worth looking at the sources from which domestic saving is expected to be secured during the Tenth Plan. The Government is assumed to be a net consumer (or a negative saver) at the rate of 2.41% of GDP. In contrast, the public enterprises are assumed to save 2.85% of GDP. This means that the public sector as a whole is assumed to save 0.44% of GDP. The private corporate sector is assumed to save 6.10% of GDP, while the household sector is expected to save 20.30% of GDP.

Assessment

It goes without saying that successful implementation of the Tenth Plan programmes depends upon a host of pre-conditions, and there is always the probability of actual outcome being different from the projected one. It should also be noted that the success of the Plan does not depend only upon our domestic circumstances and performance; international developments have an equally important bearing upon the outcome. For example, the performance of our external sector is deeply influenced by the trade policies pursued by our trade partners; the inflow of FDI is conditioned by what the potential investors think and so on. Currently, international economic relations are undergoing a rapid change. Some developments appear to be contradictory in nature, such as deepening globalization on the one hand and increasing number of regional trade agreements on the other. Instances of protectionist and retaliatory actions are also becoming quite frequent. In the light of such developments, it is highly difficult to make a reliable estimate of what would happen.

It is obvious that, irrespective of the technical quality and reliability of Plan projections, the future is bound to remain uncertain, and the final outcome can never be predicted with confidence. In view of this basic reality, various critics have picked up specific components of the Tenth Plan and expressed doubts about the outcome. For example, the very first area of uncertainty relates to the availability of resources

from the government and from our external sector. Critics have also questioned the figure of ICOR used in the Plan and claim that the employment opportunities created by the Plan would not be able to provide employment to the labour force expected to be added during the Plan. We should, however, make note of the fact that economic growth, by itself, stimulates further growth by generating relevant “growth multipliers” including employment opportunities. It is in the light of this fact that the average rate of growth during the Tenth Plan (irrespective of its exact figure) should be expected to be higher than what it was during the Ninth Plan.

Critics, however, insist that reduction in ICOR assumed in the Tenth Plan estimates is not supported by an appropriate policy for this purpose. A reduction in ICOR is possible only if certain preconditions are satisfied like (i) a continuous advancement in technology, (ii) full employment of capital resources, and (iii) no change in sectoral set up of the economy.

It is also claimed by the critics that India is still highly deficient in infrastructure, and lacks resources to remove this deficiency. It, of course, is a fact that an addition to efficient and cost-effective infrastructure greatly adds to the operative efficiency of the economy as a whole. But the critics are afraid that India would not be able to provide the needed additional infrastructure. However, we should take note of the fact that various steps taken by the government are expected to improve the situation relating to infrastructure. Thus, for example, power generation and distribution are being reformed (including privatisation). Similar steps are being taken in the field of transport. A large scale programme has been launched to improve the availability of roads and ports. Financial sector reforms are also being pursued on an ongoing basis.

Similarly, some critics maintain that our government administration and bureaucratic approach to everything come in the way of domestic efficiency and inflow of foreign capital. Unless we are able to streamline our procedures and facilitate inflow of foreign capital, we would not be able to get adequate FDI and accelerate our growth process. Similar observations apply to the assistance needed by our external sector; more so because of the growing protectionist attitude of developed economies. A lot of reforms are also required in our legal and institutional set up. The authorities are taking steps in this direction; but the pace of such reforms needs to be increased.

Mid Term Appraisal

The Mid Term Appraisal presents a detailed assessment of the performance of the economy as a whole as well as an assessment of performance in individual sectors in comparison with the Tenth Plan targets. The picture emerging from the appraisal is mixed. The economy is doing well in many areas and these gains need to be consolidated but there are also important weaknesses, which, if not corrected could undermine even the current performance level.

GDP growth has averaged 6.5 per cent in the first three years, which is below the Tenth Plan target of 8.1 per cent but is commendable nonetheless. Growth in 2005-06 is projected to accelerate to 7.6 per cent and could accelerate further if the corrective steps are implemented speedily. Private corporate sector investment, which had been dormant for several years, appears to have turned around. International perceptions of India are also generally positive creating a favourable climate for foreign direct investment. Inflation had become a serious concern in mid

2004 when there was upward pressure because of the rise in international oil prices, but it has since been brought under control. The external payment position is comfortable with substantial inflows from abroad leading to a more than comfortable build up of foreign exchange reserves.

The Industrial Sector which had a lackluster performance in the first two years of the Tenth Plan period, appears to have turned around in 2004-05 with a growth rate of 8.1 per cent in the first eleven months (April-February 2004-2005). This marks a distinct improvement over the performance in the first two years. Nevertheless, the average for the first three years is unlikely to exceed 7 per cent, which is much better than the average of 4.5 per cent in the Ninth Plan but well short of the Tenth Plan target of 8.9 per cent. A positive feature of recent industrial performance is the evident increase in competitiveness in many sectors. The success in the IT sector is well known but equally important is that many other manufacturing sectors, pharmaceuticals, biotechnology, automobiles, auto components etc. are all showing considerably stronger competitive capability. Fears of Indian industry collapsing under the onslaught of cheap imports have also evaporated and there is much greater confidence in being able to flourish in a more open environment.

These positive features are clearly a source of strength, and the aim of policy should be to consolidate these gains and accelerate growth in the remaining years of the Tenth Plan. However, there are also important signs of weakness which are a cause for concern and call for corrective steps. The corner-stone of the Xth Plan had been a reversal of the declining trend in the growth rate of agriculture to eventually to take it above 4%. The actual performance of agriculture appears to have deteriorated even further and will possibly not exceed 1.5% during the first three years of the Plan.

The slippages that have been recorded in the growth rate of the economy, and especially in agriculture, have wide ranging implications for other important economic variables as well. As we all know, growth of employment and reduction in poverty are both intimately linked to growth performance, specially in agriculture.

Thus, the Tenth Five Year Plan aimed at achieving an average growth rate of GDP of 8 per cent per annum over the period 2002 to 2007. It also sought to create the conditions for a further acceleration in the growth rate over the Eleventh Plan period in order to achieve a doubling of per capita income of the country over the next ten years. Economic growth should not be seen as an end in itself. Its true importance lies in the central role that it plays in realizing the core objectives of all planning and public policy, e.g., providing adequate and decent work opportunities eradicating poverty, reducing disparities and in general, improving the quality of life of the people. To reflect the importance of these dimensions in development planning, the Tenth Plan identified specific and monitorable targets for a few key indicators of human development e.g. reduction of poverty, providing gainful and high quality employment, education for all school children; reduction of gender gap, reduction in decadal growth in population, increase in literacy, reduction of infant mortality rate and maternal mortality rate, enhancement of forest cover, access to potable drinking water, etc. After slowing down to an average growth rate of about 5.5% in the Ninth Plan, it has accelerated significantly in recent years. The average growth rate in the last four years of Tenth Plan period is likely to be a little over 8 per cent, making the growth rate 7.2 per cent for the entire tenth plan period. Though, this is below the Tenth Plan target of 8 percent, it is the highest growth rate achieved in any plan period.

Approach paper of the Eleventh Plan observes that this performance reflects the strength of over economy and the dynamism of the private sector in many areas. Yet, it is also true that the economic growth has failed to be sufficiently inclusive, particularly after the mid-1990s. Agriculture lost its growth momentum and in fact entered in a near crisis situation. Jobs in the organized sector have not increased despite faster growth. The percentage of our population below poverty line is declining but only at a modest pace. Malnutrition levels also appear to be declining, but the magnitude of the problem continues to be very high. For too many people still lack access to basic services e.g. health, education, clear drinking water and sanitation facilities without which they cannot claim their share in the benefits of growth. Women have increased their participation in the labour force as individuals but continue to face discrimination and are subject to increasing violence, one stark example of which is the declining child sex ratio. Despite these problems, most of the ordinary people have tried to cope with their livelihood issues. Many have participated in collective action to try to improve their social and economic conditions. Empowerment of PRIs is ongoing but much remains to be done. Women are participating in PRIs and leading group action for a better life. Further, Approach paper for Eleventh Plan suggests that the plan must aim at putting the economy on a sustainable growth trajectory with a growth rate of approximately 10 per cent by the end of the plan period. It would create productive employment at a faster pace than before, and target robust agricultural growth at 4 per cent per year. It must seek to reduce disparities across regions and communities by ensuring access to basic infrastructure as well as health and educational services to all.

CONCLUSION

Over all, the planning process has been able to create social and economic infrastructure, provide an industrial base by fostering the development of heavy and basic industries and enlarge educational opportunities, it is failed to provide employment to every able bodied person, eliminate poverty and bring about institutional reforms leading to reduction in concentration of income and wealth. Moreover, the benefits from economic development have accrued largely to the relatively affluent and those in urban areas.

From above, we should not come to the conclusion that in today's India, planning has lost its relevance. It does not come in conflict with our new approach of economic liberalization and globalization of the Indian economy. Instead, if pursued properly, planning is a help in the new set up. The reason is that, at this stage of its development, our economy cannot do without active help and support from the State. The State has to play an active role in improving economic and social health of our country. We may say that at this juncture, this need is greater than ever before. Without the active State assistance, we should not expect our economy to get out of the clutches of underdevelopment and mass poverty, and succeed in improving quality of life of the people in general. State help is needed for imparting basic strength and competitiveness to our economy and for making it inherently strong. However, the State help cannot be something random and ad hoc. It has to be properly formulated and implemented with the support of financial resources, legal and institutional restructuring and other form of government action. All these things are possible only if there is a consistent and comprehensive planning so that the efforts and policy measures do not come into conflict with each other.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.

Answers to these questions are not to be submitted for evaluation)

1. Discuss the size and growth of India's population.
2. Discuss the impact of population on economic development of a country.
3. Discuss India's population policy.
4. Discuss the nature of unemployment in India. What measures have been initiated by the government to reduce it?
5. What do you understand by the term composition of trade? Discuss India's composition of trade in recent years.
6. India needs official planning more than ever. Discuss
7. Write an exhaustive note on the changing composition and direction of foreign trade of India.
8. What role do invisibles and capital flows play in our balance of payments? How would you explain our growing foreign exchange reserves as against its scarcity for over four decades ?
9. According to one opinion, urbanization retards economic growth; according to another it helps economic growth. What is your stand and why ?
10. Discuss recent trends in India's balance of payments.
11. What is fiscal policy. Discuss its various objectives.
12. Discuss the instruments of fiscal policy.
13. Write a lucid note on the rationale of subsidies. Have they been misused in India ?
14. Write a note on the salient features of India's tax system. Assess its merits and demerits.
15. Write a comprehensive note on the salient features of the Tenth Plan. Append your assessment regarding the need of planning in India.
16. Write short note on
 - (i) Eleventh Five year plan
 - (ii) Disequilibrium in balance of payments
 - (iii) Methods to correct deficit in balance of payments.
 - (iv) National budget
 - (v) Objectives of five year plans in India

Suggested Readings :

1. Economic Survey, latest issue.
 2. Planning Documents.
 3. Approach Paper to Eleventh Five Year Plan.
 4. India's Population Policy.
 5. Dutt and Sundharam - Indian Economy, latest edition.
 6. A N Aggarwal –Indian Economy.
 7. Regular reading of financial newspapers.
 8. Tenth Five Year Plan, 2002-07.
 9. Budget Documents and Economic Surveys- Ministry of Finance Website.
 10. Dhingra and V K Garg – Economic Development and Planning in India.
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STUDY VII

MONEY AND BANKING

THE CONCEPT AND NATURE OF MONEY

Economists and thinkers have found that it is not easy to define money though we all recognise it without difficulty when we come across it. This is because, over recorded history, a large variety of items have performed the role of money. For this reason, it cannot be defined by referring to its tangible features, such as, the stuff it is made of, its weight, size, shape, colour, chemical composition, and so on. The exact form of money has undergone innumerable changes. These changes have been influenced by the dynamism of the society as a whole including its political, social, and economic institutions and the policies of the government. The evolution of money has proved to be an unending and continuous process which can be seen from the fact that apart from the commodity money and metallic money, we have experienced paper money and a variety of other financial instruments.

It is noteworthy that money is not something which, having come into existence, continues to be in its original form. Money was brought into existence to tide over the difficulties of barter, but in the process it has helped economy in such a manner that its use has become indispensable. It has responded to the ever changing nature of the economy and its growing complexity. In turn, it has helped the economy in acquiring those complex features without which the latter could not develop. At present the position is that a modern economy is associated with a complex financial system woven around the institution of money. With the passage of time, a modern financial system has acquired a huge volume and variety of financial assets supported by financial institutions and markets ; and the evolutionary-cum-developmental process goes on.

Faced with the difficulties of defining money, the economists have come up with some solutions for overcoming them. One such solution is that of identifying the functions of money. In other words, the economists have identified the functions which money is expected to perform and then claim that any item which perform these functions is money. Similarly, if an item does not perform these functions, it is not money. This approach is known as functional approach to defining money. Similarly, another approach is that of defining money in terms of liquidity or generalised purchasing power.

Functional Approach

According to this approach, money is expected to perform four functions, which are explained below:

1. *Medium of Exchange* : The basic idea involved in this concept is that a seller may be accepting, by way of sales proceeds, an item which has no intrinsic value for him, that is, which has no economic use or utility for him. Normally, a seller is expected to accept only that item in payment which he can use either immediately or at a later date. However, if he is ready to accept an item which is of no use to him, then obviously he is doing so for the purpose of disposing it off later. In other words, he accepts it so as to give later to some other seller in exchange for a good/service which is of use to him.

Looked at in this way, the item in question is only a “medium of exchange.”

Note that if a good/service is exchanged with another such that each transacted item has an intrinsic value for each acceptor, then it is termed a barter transaction. In contrast, when a medium of exchange is involved, the same barter transaction is split up into three economic activities comprising (i) two sale/purchase transactions and (ii) one that of storing wealth. Let us illustrate this point as follows.

Let us assume that there are two individuals, A and B. Individual A possesses good X and individual B possesses good M. Further, let us assume that M has an intrinsic value for A and X has intrinsic value for B. Therefore, if X and M are sold against each other, both A and B receive in payment those goods which have intrinsic value for them. It is, therefore, a barter transaction. Now suppose, M has no intrinsic value for A, but he still accepts it from B. In that case, it becomes a monetary transaction and this is first economic activity of A. The second economic activity is that of “holding M” for some time. It means that A comes to own M and remains its owner for some time interval. Of course, there is not fixed time period for which A is to hold M. It can be extremely short or it can be extremely long. The third economic activity of A takes place when he sell M in exchange for some other good or service. It is again a sale/purchase transaction.

Over recorded history, thousands of items have performed the role of money, that is, that of a medium of exchange. These days, money exists in a variety of forms. Of these, legal tender, that is, official currency [both coins and currency notes] happens to be the dominant form of money. However, quantity-wise, non-currency forms of money, cheques, credit cards etc. far exceed the currency-money.

2. *Store of Value* : A seller accepts M even when it has no intrinsic value for him. Why does he do so ? The answer lies in his belief that M possesses purchasing power and that he can find some buyers of M who would be ready to pay him in the form of goods and services which he wants. In other words, A is storing some value in the form of M in preference to storing it in the form of some other asset. Thus, being a store of value becomes the second function of money.
3. *Measure of Value*: In the market, values/prices have to be measured and that requires the choice of a standard unit or unit of account in which to do so. Theoretically, it is possible for an economy to adopt a standard unit in any form it likes. However, the most efficient and convenient choice is that of expressing values in standard monetary unit of the country together with its multiples and fractions. This is because, in each monetary transaction, money is one of the two items exchanged. Being common to all transactions, it has the best claim to be used for expressing prices. For example, in India, the standard monetary unit is called a rupee. It is therefore most convenient and efficient to express all prices in units of a rupee, its multiples and its fractions. Using any other unit of account for this purpose will be highly cumbersome and lead to inefficiency in economic decisions and their implementation.

4. *Standard for Deferred Payments* : When one economic unit borrows from another, it become indebted to the latter. It also becomes indebted when it buys something on credit. The debt may be repayable immediately or after an agreed-upon time period. Conceptually, however, it is a liability of the debtor, which he is to discharge at some future date. The agreement to this effect generally states that the debtor will pay to the creditor a certain value as expressed and measured in terms of standard monetary units of the country. That way, money performs its fourth function, namely, that of being a standard for the deferred payments. It should be noted that, as in the case of third function, money should be assigned this function because it is convenient, efficient and economical to do so. An economy can decide not to use standard monetary unit as a standard for deferred payments. But if it opts for some other measure, it will suffer from economic inefficiency.

The above discussion shows that out of the four functions of money, the last two can be dispensed with while defining money. Though it is desirable that money should be assigned these functions also, it is not essential to do so. Money can exist even when these two functions are performed by some other item or items. These functions can, therefore, be termed highly desirable but still secondary and non-essential for defining money.

In contrast, medium of exchange and store of value are both primary and essential functions of money. The very distinction between barter and monetary transactions is based upon the criterion that one of the transacted items is intended to be a medium of exchange and has no intrinsic value for the acceptor. Similarly, no item can act as a medium of exchange unless it is a store of value also. A seller accepts an item only if it satisfies one the two conditions, namely,

- it has an intrinsic value for him (in which case it becomes a barter transaction);
- or
- it can act as a store of value.

It follows that to be a medium of exchange, an item has to be a store of value also. However, an item can be a store of value without performing the role of a medium of exchange.

In conclusion, therefore, we can define money in terms of a single function, namely, that of a medium of exchange. However, we cannot define money by saying that it is a store of value, because any item can be a store of value without being a medium of exchange. We can say that if an item acts as a medium of exchange, it is money and if it does not act as a medium of exchange, it is not money. The same meaning is conveyed if we say that money is any item which is generally accepted by the creditors in the market in discharge of their claims upon the debtors. . Further, on this basis, while official currency is “full-fledged” or “100%” money, some other items (like bank deposits) may be occasionally rejected by the creditors. They would, for that reason, be termed “part money”. The capacity of such items to act as medium of exchange is less than that of official currency. It also follows that with the passage of time, different items can assume the role of medium of exchange and can be given the title of ‘money’. Further, during any given time interval, more than one items may be acting as money.

Liquidity Approach

This approach of defining money is based upon a conceptual framework similar to that used in the functional approach. Generally acceptability of money by creditors in discharge of their claims, and by sellers as sales proceeds, means that money is a generalised purchasing power. It is a claim upon the resources of the society and can be exercised in a variety of ways. In other words, it can be used to acquire other goods and services. This economic capacity of an item to be readily acceptable in the market is termed its 'liquidity'. It is seen that acceptability and liquidity go together and convey roughly the same meaning.

An item cannot have liquidity unless it is marketable, that is unless it can be sold or exchanged in the market. But given this precondition for the very existence of liquidity, items differ in their liquidity because of the difference in the quality of their marketability or acceptability. An item which is more readily acceptable by the creditors (and has, therefore, better marketability) is more liquid than the other. Cash or official currency, by its very nature, is the most liquid asset. Liquidity-wise, cash is followed by non-currency financial assets while tangible assets (that is, "commodities") are least liquid. Also, within each asset category, liquidity differs from one asset to the other. Liquidity of an asset is deeply influenced by several factors including the following :

- (a) The first factor which determines the liquidity of an asset is the rapidity with which it can be sold or exchanged. Liquidity content of an asset is inversely related with the average time taken to convert it into cash (which is most liquid) in the market.
- (b) Selling an asset is often accompanied with a cost in terms of both money and other resources. A higher marketing cost reduces the liquidity of an asset.
- (c) Liquidity of an asset also depends upon the probability and extent of capital loss/gain associated with its sale. The idea is that the market price of an asset can differ from the price at which it is purchased. Accordingly, the acceptability of an asset declines if its market price is liable to fluctuate. By inference, the liquidity of an asset is inversely related to the probability and extent of its price fluctuation.

Assuming that cash is the most liquid asset, we can count it as full-fledged or 100% liquid. Liquidity of an asset can then be measured in terms of its cash equivalent, that is, by its capacity to displace the holdings of an asset with desired cash balances. If for example, an injection of bank deposits of Rs. 100 is able to reduce the desired cash holdings of the market by Rs. 80, then their liquidity (as estimated in units of their cash equivalent) is 80%. Numerically, the cash displacement capacity of an asset varies with (i) its own quantity, and (ii) the quantity of cash already in existence. Therefore, it is expected that, given other things, the money content of an asset will decline as its own quantity is increased. Accordingly, we may measure its 'degree of liquidity or moneyness at the margin' [or its marginal moneyness] with the technique of elasticity of substitution. The coefficient of elasticity of substitution of money (M) for an asset, A, is estimated by the formula

$$[\Delta(A/M)/(A/M)] / [\Delta MRS_{M,A} / MRS_{M,A}]$$

It should be noted that the liquidity measure of an asset A is not stable. It tends to

change not only on account of the factors mentioned above, but also with a change in the preference pattern of the asset holders in the market.

CREDIT CREATION

THE CONCEPT OF CREDIT

The word credit denotes trust or confidence which one economic unit may place in the other. In the present context, the reference is to the trust which a lender places in the debtor in the latter's capacity and willingness to pay back the loan together with its interest. In a modern monetary economy, money acts as a generalised purchasing power. It is a claim upon the resources of the society which can be exercised by its owner. When a lender gives a loan to the borrower, he transfers a part of his claims upon the resources of the society to the debtor, and in return, is entitled to receive back the claims of a bigger value [because of interest] in future. Simultaneously, he is expressing confidence that his debtor would honour his obligations; he is giving his borrower the credit of ability and willingness to do so. In economics the terms credit, loans and advances have the same meaning.

In a modern economy, it is very common for economic units to extend credit to each other. In addition to the borrowing and lending transactions proper, the sellers are continuously extending credit to their buyers. In this context, however, the financial institutions hold a special position. The very nature of their operations is to provide a bridge between the final lenders and final borrowers. They borrow from the final lenders (or savers) in the market and give loans to the final borrowers. In the process, they "sell" their own financial liabilities and "buy" financial claims upon others. Their operating surplus arises from the difference in the interest paid to their own creditors and interest charged from their borrowers. Interest rate which a borrower has to pay for getting a loan depends, amongst other things, upon the creditworthiness of the borrower. A financial institution is considered to be more creditworthy by the lenders in the market. And, therefore, it is able to borrow at lower interest rates. In contrast, it can charge a higher interest rate from its borrowers because the latter have a lower creditworthiness in the market. In addition, the average term to maturity of the loans taken by the financial institutions is shorter than the average maturity of the loans extended by them. And this also contributes to the interest rate differential.

Within the category of financial institutions, banks occupy a special position. Their peculiarity lies in the fact that they provide the market with more means of payment than they take from the market in the form of cash, and this they do through the process of loan giving and deposit creation. Banks accept a variety of deposit. For us, an interesting variety is that of "cash deposits". However, these deposits do not add to the means of payment available to the market. The market loses a certain amount of its cash holdings to the banks and get, in return, an equivalent amount of "deposit money". However, the story does not end with the creation of these "primary deposits".

The banks find that though depositors are entitled to come and encash their deposits as and when they want to, all of them do not do so very often. Moreover, even those depositors who do so, encash only a part of their deposits. As a result, a bank is left with some surplus cash which it can use for giving loans to others. Thus, a process of giving loans and creation of deposits comes into existence which results

in the “creation of secondary deposits”. It is a form of means of payments which the market acquires. For the market, these means of payment which have been created through the process of loan-giving by the bank are like official money. As a result, this manner of adding to the money supply with the public is termed “credit creation”. We shall study this process in greater detail later in this Unit.

Inverted Pyramid of Credit : All financial claims have their counterparts in the form of financial liabilities. And, depending upon their nature, some of them also circulate in the market as means of payment and effectively add to the money supply. A common feature of these liabilities is that they are all obligations to pay in terms of official currency. Moreover, in a modern money economy, the absolute volume of these liabilities happens to be a big multiple of the quantity of official currency. In other words, the huge superstructure of credit rests upon a very small quantity of official currency circulating in the market. Even within the category of official currency, a major portion happens to that of the currency of the central bank of the country and is itself a ‘promise to pay’ in terms of the government currency. The net result is that the entire superstructure of credit is potentially unstable and can fall in the grip of a crisis. At the same time, the huge volume and variety of credit instruments enable a modern economy to conduct its economic activities in a highly efficient manner. A developed, integrated and sensitive financial system enables a country to go in for projects which have long life and can add to its productive capacity. It is this financial system which provides an efficient means of payments and enables individual economic units to plan and implement their decisions in a cost-effective manner.

CREDIT CREATION BY BANKS

By now it is quite clear that banks add to the aggregate means of payments available to the market. We have seen that the contribution of banks to money supply is in the form of bank deposits. Broadly speaking, these deposits may be divided into two categories, namely cash deposits and credit deposits.

Cash deposits refer to that form of deposits which are created when clients bring cash to a bank and deposit the same with it. In this process, the public finds that there is no net addition to the means of payments possessed by it. There is only a change in their form; that is, some cash is replaced by bank deposits. Cash deposits may also be referred to as primary deposits.

The other category of deposits is more important for our purpose. A bank is a financial firm and has the objective of earning a profit income. Its main source of operating surplus is the difference between interest paid on its liabilities and interest earned from its assets. Cash balances appear on the asset side of its balance sheet. But it cannot earn any interest income from them. It must acquire other income earning assets for this purpose. It finds that the maximum income which it can earn is from the loans and advances given by it to its clients or borrowers. However, loans extended by a bank to its borrowers result in the creation of deposits in favour of the borrowers and thus add to the means of payment with them. . In other words, by giving loans, a bank creates deposit liabilities and thus add to the means of payments (that is, money supply). The loan deposits so created are termed secondary deposits or derived deposits. Numerically, the addition to money supply is equal to excess of its deposit liabilities over its cash holdings. Since this addition takes place via loan-giving activity of the bank, the process is known as that of credit creation.

The fact of credit creation by banks can be verified both with the help of theory and their balance sheets. As stated above, a bank is a financial firm and has the objective of earning a profit income. For this reason, therefore, a bank “borrows short and lends long.” In other words, it contracts liabilities which, on an average, have a shorter duration and it acquires assets which, on the average, have a longer duration. Its assets are dominated by the category of “loans and advances” which bring a high interest income to the bank. Its liabilities are dominated by its deposit liabilities some of which are interest free while the rest of them carry comparatively low interest rates. Therefore, the bank is interested in creating the maximum possible deposit liabilities (preferably of the demand deposit variety).

The fact of credit creation can also be verified by looking at the balance sheet of any bank. It is seen that the cash balances with the bank are always a fraction of its deposit liabilities. As a result, the bank provides the market a much larger amount of means of payment (in the form of bank deposits) than it takes away from it (in the form of cash balances).

The Process of Credit Creation

In order to understand the process of credit creation by a typical bank, we should note two important considerations which guide it. On the one hand, it is interested in maximising the profitability of its operations. To this end, it gives loans to its clients and, in the process, creates deposit liabilities against it. On the other hand, it must be in a position to honour its commitment to pay cash to its depositors as and when the depositors decide to exercise their right to demand cash.

However, a creditor is eager to recover his loan from the debtor if he is in genuine need of money, or if he comes to believe (rightly or wrongly) that the debtor is not able or not willing to repay the loan.

A bank, therefore, takes steps to convince its depositors that it is both willing and able to pay them as and when they demand to be paid. And if it succeeds in earning and retaining this confidence of its depositors, then they will demand encashment of their deposits only to the extent they actually need cash. Further, a bank knows that, during any given time interval, only a fraction of its customers will be in genuine need of encashing their deposits; and the cash needed even by such depositors will be only a fraction of their deposit balances.

The net result is that a bank is able to meet the demand for encashment by its depositors by maintaining cash reserves which are only a fraction of its deposit liabilities. This phenomenon is known as that of “fractional cash reserves”, or “cash deposit ratio” being less than one. This is, however, subject to the condition that the depositors retain their confidence in its ability and willingness in meeting their demand for cash.

In other words, the bank is subject to pulls from two opposite directions. The objective of profitability dictates that the bank should create additional deposits by giving loans to its customers and thus reduce the cash deposit ratio. The objective of liquidity dictates that the bank should be able to meet the demand for cash by its depositors and therefore maintain a very high cash deposit ratio. Accordingly, the bank tries to maintain that cash deposit ratio which is able to meet both requirements in a balanced manner.

Apart from the need to maintain a balance between the objectives of profitability and liquidity, there is another fact which needs to be taken into account. This fact relates to the need for a provision for emergencies and unforeseen contingencies on account of which the bank may face a sudden outflow of cash. The bank, therefore, does not try to have all its non-cash assets in the form of loans and advances only. Instead, it tries to have some assets which are readily marketable and can be converted into cash for meeting such emergencies. Let us elaborate this fact a little further.

Cash reserves of a bank are termed its 'first line of reserves', or 'first line of defence'. When the customers demand cash, it is these reserves which the bank uses up for making payments. At the same time, the bank also keeps acquiring cash in the ordinary course of its activities. So long as the inflow and outflow of cash match other, there is no problem. But the bank must be ready for situations in which cash outflow may suddenly exceed cash inflow. For this purpose, the bank provides as follows.

The bank maintains a part of its assets in the form of what are known as "near money", "till money", "money substitutes", "short term assets" and the like. It is that category of assets which are readily marketable without much risk of capital loss. Examples of these assets includes trade bills, treasury bills, money at call and short notice, promissory notes, commercial paper, and so on. This portion of bank assets is known as its 'second line of reserves', or 'second line of defence'.

The 'third line of defence' or 'third line of reserves' consists of longer term securities and other financial instruments. These are also readily marketable assets and carry a higher average rate of return but are subject to a higher capital risk.

Still another fact to be noted in the process of credit creation by a bank is that all the loans are not given by it in one go. They are sanctioned in 'rounds' or 'instalments' such that in each round, the amount of loans given does not exceed the estimated 'surplus cash' (or free or excess cash) with the bank. This is because the bank management knows that a borrower comes to ask for a loan only he actually needs cash to make payments. Therefore, to sanctions loans in excess of the amount of 'surplus cash' is risky for the bank.

Steps in the Process of Credit Creation

Keeping in view the above discussion, let us discuss the actual process of credit creation by starting with some simplifying assumptions and then gradually removing them to bring the analysis closer to reality.

One Bank : No Cash Leakage

To being with, let us make the following simplifying assumptions.

- There is only one bank, named B, in the market. Therefore, all deposits of cash and cheques are made with this bank only.
- Bank B maintains a fixed cash deposit ratio equal to R%. It means that $(\text{cash reserves/deposit liabilities}) \times 100 = R$. Let us further assume that $R = 10\%$. It means that for financing the circulation of its deposits and meeting the normal outflow of cash (matched by an equivalent inflow of cash) by the depositors, the cash balances with the bank should not be less than R% of its deposit liabilities.

- There is no net cash leakage. It means that the cash withdrawn by depositors is returned to it by the clients in the form of fresh deposits.
- Let us assume that the bank B starts with an initial cash deposit of C (say, Rs. 100).

With the above assumptions, we find that the bank B starts with an deposit liability of Rs. 100 matched by an initial cash balance of Rs. 100. However, once the use of bank deposits by bank clients settles into a routine, the bank finds that, per period of time, there is an outflow of Rs. 10 matched by an equivalent inflow of cash of Rs. 10. As a result, the bank management discovers that it has a surplus of Rs. 90 which can be used for acquiring some income earning asset. Therefore, when borrowers apply for loans, the management is able to lend them Rs. 90. As it does so, it acquires an asset termed 'loans and advances' worth Rs. 90 and simultaneously contracts an additional deposit liability of Rs. 90. This is the second round of deposit creation and first round of credit creation. At the end of the second round of deposit creation, the bank has assets of Rs. 190 (cash Rs. 100 plus loans and advances Rs. 90) matched by liabilities of Rs. 190 (cash deposits Rs. 100 plus loan deposits, or credit creation, of Rs. 90).

When the circulation of deposits of Rs. 190 settles to a routine affair, the bank finds that out of its cash reserves of Rs. 100, only Rs. 19 (Rs. 10 + Rs. 9) are in circulation and it has a spare balance of Rs. 81 left with it. Consequently, the third round of deposit creation (and the second round of credit creation) brings in deposit liabilities of Rs. 81.

In this manner, the bank B keeps creating deposits by giving loans. But it does so in stages and not in one step. When the process of credit creation is completed, the deposit liabilities of the bank stand at Rs. 1000 out of which Rs. 900 are due to the credit creation. It means that by losing Rs. 100 in the form of cash, the market has acquired means of payment, totalling Rs. 1000, in the form of bank deposits. There is a net addition of Rs. 900 to the money supply, or means of payments, in the hands of the market and this corresponds to the loans (Rs. 900) given by the bank in several rounds of deposit creation.

The process of deposit creation can be presented in the form of a geometrical progression

$$\begin{aligned}
 & \text{Rs. } [100 + 100 \times (1 - 0.1) + 100 \times (1 - 0.1)^2 + 100(1 - 0.1)^3 + 100(1 - 0.1)^4 + \dots \text{ so on}] \\
 & = \text{Rs. } 100 / [1 - (1 - 0.1)] \\
 & = \text{Rs. } 100 / 0.1 \\
 & = \text{Rs. } 1000
 \end{aligned}$$

This is the figure of total deposits created by the bank out of which credit creation is sum of second term onwards, that is Rs. 900.

Using the symbols introduced above, we get

$$\begin{aligned}
 \text{Total deposits created} &= C / [1 - (1 - R)] \\
 &= C / R
 \end{aligned}$$

out of which credit creation is $[C (1 - R)] / R$

One Bank with Cash Leakage

Now let us drop the assumption of no net cash leakage, that is, let us admit that some of the cash withdrawn by the depositors leads to a permanent loss of cash by the bank. It follows that such a loss of cash reduces the capacity of the bank to create credit by a multiple of this loss in the same manner as an acquisition of cash adds to its credit creation capacity. It should also be remembered that the loss of cash is exactly equal to the reduction in bank deposits, since every withdrawal from a deposit implies an equivalent payment of cash by the bank to the depositor.

Let us use the symbols introduced above (namely, initial cash deposit, C and cash deposit ratio, R) and add two more symbols, L and K . Let L stand for the deposits created by loans given by the bank, so that total deposits created are $(C + L)$. Similarly, let K stand for the portion of deposits encashed by the depositors, so that cash withdrawn $= K (C + L)$. This means that the deposits left after cash withdrawal equal $(C + L) (1 - K)$, and cash balances left with the bank are equal to $C - K (C + L)$. Now in the end of the process, the cash balances of the bank are to be R proportion of its deposit liabilities. This gives us the following equation.

$$R = [C - K (C + L)] / (C + L) (1 - K)$$

Solving for L , we get

$$L = C(1-R) (1-K) / [R + K(1-R)]$$

In our numerical example, let us put $K = 0.1$. Then L is approximately equal to Rs. 426.3. This means that in addition to the initial cash deposit of Rs. 100, the bank creates loan deposits of Rs. 426.3, thereby creating a total deposit liability of Rs. 526.3. The clients withdraw Rs. 52.64 with the result that the bank is left with a cash reserve of Rs. $(100 - 52.63 = 47.37)$ and a deposit liability of Rs. $(526.3 - 52.64 = 473.66)$ which means that the value of $R = 10\%$. It is this cash deposit ratio which the bank is to maintain on its deposits to sustain their circulation.

A System of Banks : No Cash Leakage

In this case also, the basic process of credit creation remains unchanged. It passes through similar several stages, though with the following differences.

- The process becomes more detailed and credit creation is shared by all the banks put together. When one bank extends loans to its clients and creates deposits in their favour, they pay to others either through cheques or through first drawing cash and then paying them. However, payments made out of the deposits of a bank need not be to the customers of the same bank. Therefore, some withdrawals get deposited with other banks which, in turn, give loans and create deposits.
- If customers are unevenly distributed between the banks, the shares of credit creation of individual banks would also be unequal.
- Total credit created by the banking system as a whole can be different from the case when entire credit was created by a single bank. This happens if the cash deposit ratios maintained by individual banks differ.
- The process of credit creation must be pursued by the entire banking system collectively and evenly. No individual bank can create credit out of step with

others. If it does so, it will lose cash balances to the other banks and will have to stop.

A System of Banks with Cash Leakage

The findings of a single bank with cash leakage apply here as well. Just as a single bank can create less credit when there is a cash leakage, similarly, credit creating capacity of the entire banking system also declines when it faces cash leakage. The process of credit creation remains the same in its essence. Only its arithmetic may change on account of differences between individual banks such as their size, cash deposit ratios, geographical spread, and so on.

It should be noted that cash leakage is a fact and to assume that it is not there is unrealistic. This is because, with an increase in total money supply, the public does not want to hold all its additional money balances in the form of only cash or bank deposits. It wants to divide them into both, though the proportions in which the division takes place may undergo a change.

Cash Deposit Ratio

We have seen that cash deposit ratio plays a crucial role in banking operations. The banks try to fine tune it. They do not want to hold more than necessary cash reserves because in that case they lose some of the profit which they can otherwise earn. Similarly, they cannot afford to have a lower than necessary cash reserve ratio because that can result in their failure to meet their payment obligations. If a bank fails to honour its commitment to pay in time, the customers lose confidence in its ability (or willingness) to pay. As a result, all of them rush to the bank and demand payment. And the bank, by the very nature of its balance sheet, is never able to meet this demand in full. It can go bankrupt. It is, therefore, helpful to note the factors that determine critical cash deposit ratio which a bank tries to maintain.

1. The first factor which determines the cash deposit ratio of a bank is its size and branch network. A big bank is likely to have proportionately larger number of customers also. Consequently, a large proportion of cheques and cash payments is received by its own customers. It, therefore, suffers from a smaller cash leakage and can afford to maintain a lower cash deposit ratio. Similarly, a bank with a large number of branches can transfer cash from one branch to the other and average out demand for cash. As a result, it can afford to have a lower cash deposit ratio on this count as well.
2. The cash deposit ratio which a bank must maintain also depend upon the banking habits of its clients. Normally speaking, when a bank is located in big trade and manufacturing centres, its clients are more likely to make payments to each other through book entries in their bank accounts rather than use hard cash.
3. Apart from the location of the banking offices, the stage of economic development of the country also lays an important role in the determination of cash deposit ratio of the banking system. It is expected that, with economic growth, people develop banking habits and the incidence of cash leakage declines.
4. A significant component of economic growth of a country is the development of its financial system. A large volume and variety of financial instruments are an

integral part of a developed financial system. The markets for financial instruments, including specialised markets for some categories of them, become highly integrated and sensitive to changes in yield rates and the like. This phenomenon is accompanied with the growth of specialised financial institutions also. The net result is that on account of the availability of a larger number of effective substitutes of cash, the need by banks to maintain a high cash deposit ratio is reduced.

5. Legal provisions, such as the measures taken by the central bank of the country, play a crucial role in forcing the banking system to maintain a higher than necessary cash deposit ratio. They, however, may be able to side step these provisions to some extent by resorting to window dressing. Window dressing refers to the practice of the bank in managing their asset portfolio in such a manner that, while normally maintaining a low cash deposit ratio, they have a high ratio at those points of time for which they are to draw their balance sheets. For example, the banks may be required to maintain 8% cash deposit ratio but the market conditions, the strength of the financial system and other factors, may enable a bank to do its business successfully with only 6%. Further suppose, it is to report to the central bank of the country its cash deposit ratio as at the close of every Friday. Then, in that case, it tries to manage its affairs in such a way that it has adequate cash balances at the close of each Friday, but not at other points of time. This it may do by arranging the flow of discounting of bills, money at call and short notice, and the like.
6. Given the overall framework, the cash deposit ratio which a bank is to maintain also depends upon the changing conditions in the market, such as the closeness of festivals and pay days.

While the creation of credit by banking system is regulated by the cash deposit ratio, which it has to maintain, equally important is the extent of cash availability to it. It, therefore, is helpful to consider the factors, which affect the availability of cash to the banks. To begin with, we note that the banks must share the total cash circulating in the economy. Given this constraint, there are also additional factors at work.

- The first factor at work is the ability of the central bank to supply currency and its policy in doing so. For example, under gold and other metallic standards, the central bank cannot increase currency supply beyond the requisite stocks of the precious metal. Under paper standard, however, it enjoys a much wider discretion. And these days, central banks are being increasingly empowered to decide the optimum amount of currency that the market should have. However, in many cases, a central bank is still constrained by two hurdles, namely,
 - (a) the fiscal policy of the government, and
 - (b) changes in its foreign exchange reserves.

If the government borrows from it, or if its foreign reserves increase, there is a corresponding increase in currency supply as well. And if the government reduces its net borrowings from the central bank, or if the latter's foreign exchange reserves decrease, the result is a reduction in currency in circulation.

- The central bank of the country is the authority through which currency (that is, legal tender) is issued. Accordingly, it is the 'lender of the last resort'. It is the final source from which supply of cash to the economy is regulated. As a result, all activities and policies of the central bank have an important bearing upon the availability of cash to the market as a whole and to the banks in particular. Quite often, the central bank does take specific measures directed at regulating the quantity of money and credit circulating in the economy. For example, the central bank may raise the rate at which it is ready to give loans to the banking system. Or it may sell government securities in the market and reduce the availability of cash to the market.
- In some countries, the central bank has the authority to compel the banks in maintaining certain cash balances with it. Normally, these balances are a specified fraction of the deposit liabilities of the banks. The central bank can choose to vary these cash balances.
- Cash availability to banks is also subject to seasonal fluctuations. For example, during festivals and in the first few days of every month, withdrawals from banks increase and the banks lose cash.

Limitations on Credit Creation

Though banks would like to have an unlimited capacity to create credit so as to add to their profit income, in practice they face several hurdles in doing so. These limitations manifest themselves in converting additional credit creation into a non-profitable activity. Thus a bank would keep creating additional credit so long as —

- (i) loans extended by it have only a negligible chance of becoming bad debts; and
- (ii) there is a reasonable difference between the interest which the bank has to pay on its borrowings and deposits, and the interest which it charges from its own borrower. In other words, the limitations of credit creation by banks operate through shifts in their balance between liquidity and profitability.

We may look at the limitations on credit creation by banks by considering

- their capacity to create credit,
- their willingness to create credit, and
- demand for credit in the market.

Capacity to create credit is a matter of (i) the availability of cash to bank; and (ii) the factors that determine their cash deposit ratio. These factors have been discussed above. We have also seen that a bank is willing to create credit so long as it estimates that it will be profitable to do so. As regards the demand for credit, a bank can extend loans only to those who are ready to borrow. It is noteworthy that a bank would not give loan to a borrower who is not considered creditworthy by it. Also, in any case, the amount of the loan would not exceed the paying capacity of the borrower. Similarly, given the interest rate, a genuine borrower would not apply for a loan which exceeds his requirement. Under normal circumstances, the demand for credit gets fully satisfied when expected marginal profitability of new investment declines and becomes equal to rate of interest.

In many situations, due to a policy pursued by the central bank, it is difficult to get fresh loans from the banks and we get the impression that demand for credit is unlimited. But factually it is not so. A persistent excess demand for credit exists only under inflationary conditions. But these conditions cannot last forever because continuous inflationary pressure can disrupt the financial system itself. In other words, the concept of a limitless demand for bank credit is only an illusion and not a reality.

QUANTITY THEORY OF MONEY

Economists have always been interested in answering a two-fold question, namely, what determines the level of prices in general and what causes a variation in it. Quantity Theory of Money tries to answer this question. It makes certain assumptions and states that :

“the level of prices in general is determined by the quantity of money circulating in the economy, and a change in it leads to a change in the price level in the same proportion and in the same direction.”

However, it should be emphasised that this theory is concerned with the purchasing power in terms of goods and services in general and not in terms of any specific category of them. The theory does not try to explain the determination of sector wise price levels.

Quantity theory of money has had a long history. It was very popular till the early parts of the 20th century. This is because people have a general idea of the relationship between quantity of money and prices. They know that, by an large, demand is exercised in the market by offering money to buy goods and services. Accordingly, other things being equal, an increase in the quantity of money is expected to add to the demand flows and prices. However, quantity theory of money is characterised by the fact that it does not limit itself to this type of a qualitative statement. It claims that there is one to one relationship between the quantity of money and level of prices. As a result it states

“A change in the quantity of money leads to a change in the level of prices in general which is an equiproportionate and in the same direction as the change in quantity of money.”

For example, the theory says that if quantity of money is increased by say, 20%, prices would also go up by 20%. Its advocates subscribed to the view that financial and real activities of the economy did not affect each other. Their interaction only resulted in the determination of the level of absolute prices without changing their relative position. They adopted what is known as the dichotomous approach to the working of the economy. The financial flows determined the demand. The quantities of goods and services demanded did not change with the quantity of money which the buyers had to offer. Irrespective of the money balances which they had, they would demand the same quantity of goods and services and offer their entire money balances in payment. This resulted in a price variation which was exactly in proportion to variation in the quantity of money. They treated money only as a medium of exchange and did not use it as a store of value (that is, an asset in the form of which economic units may hold their wealth). In the same way, the suppliers also did not consider the absolute prices of their products while deciding the quantities of their supplies. Price variations did not affect the supply quantities. They

just accepted, by way of sales proceeds, whatever money was offered to them by the buyers (and the buyers, of course, offered to pay all the money they had).

The above description of the quantity theory of money has a variant in which money is treated as a store of value. In other words, the theory has two leading versions, termed the Fisher's Version and the Cambridge Version. We shall discuss each of them turn by turn.

Fisher's Version

This version proceeds with the idea that price level is determined by the demand for and supply of money. It is based upon the following assumptions.

1. Price level is to be measured over a period of time, it being the average of prices of all sale transactions that take place during the said time period.
2. There are no credit sales in the market. All sales/purchase transactions are cash transactions. During a given period of time, no payments are made for purchases done during any earlier period, and nothing is purchased on credit. As a result, total payments made during the said time interval, say a year, are always equal to the money value of the items sold during that period.
3. Money is only a medium of exchange. Therefore, its demand is determined only because it is needed for making current payments. It is not considered one of the alternative forms of assets for holding wealth. Money is accepted by sellers so as to pay for their own purchases.
4. Each unit of money can change hands several times during the said time interval. The average number of time money changes hands is termed its average velocity of circulation (V). Accordingly, total cash payments during the year are always equal to the average quantity of money in circulation (M) multiplied by its velocity (V), that is equal to MV.
5. Similarly, because there are no credit sales, all cash payments received during the year must be equal to the volume of goods and services sold multiplied by their respective prices. If, therefore, T denotes the aggregate volume of all items sold and P stands for their average price, then total sales proceeds received are equal to PT.

Based upon these assumptions, we get the basic equation of the Quantity Theory of Money, namely,

$$MV = PT$$

Given the assumptions of the theory, $MV = PT$ is an identity. Sometimes, the theory is presented by splitting up average quantity of money (M) into two components, namely currency (M_1) and banks money (M_2) and their respective velocities, V_1 and V_2 . This modifies the equation to

$$M_1V_1 + M_2V_2 = PT$$

Furthermore, in order to ensure that the basic statement made by this theory is valid, the theory makes some additional assumptions as follows.

6. It assumes that of the four variables (M, V, P and T) in the equation, only M can change on its own initiative. No other variable can do so.

7. When M changes, V and T do not change in response. The entire adjustment necessary for the equation to hold takes place only in P. As a result, a change in M results in a proportionate change in P in the same direction.
8. The process of adjustment comes to stop with the change in P. There is no repercussive or second-round change in M, T or V.

Given these assumptions, it follows that any change in M results in a proportionate change in P in the same direction.

Evaluation

1. This theory conveys a basic truth that when a change in the quantity of money circulating in the market is not accompanied by a change in any other relevant variable, the result will be a proportionate change in the price level.
2. However, this basic truth does not need any sophisticated theory to prove the point. The real problem arises when the theory makes the claim that the change in price level will be exactly in the same proportion as the change in the quantity of money. It is here that the theory differs from reality. Actual change in price level is the outcome of several causes acting simultaneously and a change in the quantity of money is only one of them. The fact is that prices change on account of several factors. They include speculation, technological changes, shifts in consumer preferences, shifts in supply flows due to cost variations, taxation, and subsidies and so on. The theory is assuming a static economy which only repeats itself year after year in every respect except changes in quantity of money and prices.
3. The theory makes a totally unrealistic assumption that there are no credit sales in the market. The reality is that during any time interval under consideration, some payments are received for sales effected during earlier periods and some sales are effected on credit. As a result, payments made during the current period are seldom equal to the value of the items sold. In that sense, this theory provides an explanation of what Keynes calls a "cash transactions standard".
4. The definition of money supply used in the quantity theory of money is a narrow one. It includes only the currency and bank deposits.
5. The theory suffers from several conceptual problems. How to estimate quantity of money, which is a stock variable, over a period of time? Price level is also a stock variable, but is being measured over a time interval. Similarly, there are problems of estimating aggregate T which comprises dissimilar items and can be added only in terms of their money values. By implication, it is not possible to measure P and T separately, and we always get a measure of their product PT.
6. The theory has a logical flaw in the sense that its basic equation contains a mixture of stock and flow variables.
7. The theory makes the wrong assumptions that V and T remain constant from one period of time to the next. Similarly, it is wrong to assume that nothing changes in response to a change in P. This is in contrast with the fact that the entire economic theory makes use of the basic response of both demand and supply flows to changes in prices.

8. The estimation of price index P is based upon unrealistic weights. Instead of assigning weights to items on the basis of their importance to the consumers, they are assigned on the basis of the frequency with which the items are traded. As a result, less important items like financial assets dominate the calculation of P.
9. Apart from the problem of questionable weights assigned to the items included in the calculation of P, critics point out that it includes all prices. It is a hotch-potch price level which is of no use to anyone. Everyone is interested in some sectional price level. Even the authorities are interested in sectional price levels for formulating their economic policies.

Cambridge Version

This version of quantity theory of money has several variants. In essence, however, it differs from the Fisher's version in the following ways :

1. Cambridge version aims at estimating not the level of prices in general, but the purchasing power of money.
2. It measures purchasing power of money with reference to a point of time instead of over a period of time.
3. It assumes that, like many other assets, money is a store of value and is demanded for that reason.
4. In estimating the purchasing power of money, no use is made of sale purchase transactions.

However, given all these differences in formulation of the theory and its details, Cambridge version also claims that a change in the quantity of money results in a proportionate change in the per unit purchasing power of money but in the opposite direction. This version has had a long tradition and several sub-variants. But it is best presented through the form in which Pigou formulated it.

As stated above, Cambridge version of quantity theory of money concentrates upon the store of value function of money. It claims that wealth holders do not want to hold their wealth in a single asset but in a combination of them including money. Furthermore, they want that their nominal money balances should represent (or contain, or hold) a pre-determined and given value of purchasing power. In other words, they want to hold a given quantity of real money balances [that is, nominal money balances multiplied by per unit purchasing power of money]. Given the fact that the nominal money balances in the market have to be held by the market itself, any change in nominal money balances leads to a corresponding change in purchasing power of money so that the resultant purchasing power of nominal balances remains the same.

Proceeding along these lines, we may explain the Cambridge version of Quantity Theory of Money as follows. Let R stand for the "real resources" of the society and let K stand for that proportion of it which the people want to hold in the form of readily available purchasing power, that is, in the form of money. This gives us the equation

$$P = KR / M$$

Where P stands for the purchasing power of one unit of money, or purchasing power of 'one unit of titles to legal tender'. It should be noted that the quantity of

money, M , is “titles to legal tender”. It stands for “ money supply with the public” and includes both actual cash balances and bank money.

However, Pigou wanted to estimate the purchasing power of “one unit of legal tender” and not that of “one unit of titles to legal tender”. Therefore, if the symbol M is to represent the quantity of actual legal tender, the above equation is modified as follows.

Let the public hold its money balances (that is, titles to legal tender) in two forms (i) actual cash (legal tender) holding, and (ii) bank deposits in proportions of (c) and $(1- c)$. Pigou assumes that ‘ c ’ to be a constant. The public does not change it from one point of time to the other in response to anything. Further, let us note the fact that banks do not hold cash balances (legal tender currency) which are equal to their deposit liabilities. They hold what is known as “fractional reserves”, that is, their cash balances are only a fraction (say, ‘ h ’) of their deposit liabilities. Consequently, against bank deposits of the value of $(1-c)$, banks hold $h(1-c)$ amount of cash balances.

It follows, therefore, that when the market holds $[c+ h(1-c)]$ amount of cash, there is one unit of ‘titles to legal tender’.

With one unit of cash, ‘titles to legal tender’ are $= 1/[c+ h(1-c)]$.

And with M units of legal tender, ‘titles to legal tender’ $= M/[c+ h(1-c)]$.

Now in the equation, $P = KR/M$, the symbol M stands for ‘titles to legal tender’. In the revised form, let M stands for actual legal tender so that titles to legal tender are represented by $M/[c+ h(1-c)]$ and the equation $P = KR/M$ is transformed into —

$$P = KR [c+ h(1-c)] / M$$

In this form also, the equation states that the purchasing power of one unit of legal tender M varies proportionately, but in the reverse direction, to a change in its quantity.

Assumptions

The assumptions of the Cambridge version of quantity theory are very similar to those of the Fisher’s version and most of them have been explicitly mentioned above, together with the main dissimilarities between the two. However, a few of them need specific elaboration.

The symbol R stands for the real “resources” of the society. The meaning of this term is vague and may be interpreted in alternative ways. Should we take R as an estimate of the national income of the society, or its accumulated wealth or some mixture of the two? Equally important is the problem of aggregating resources to arrive at a measure of R . Real resources of the society includes all kinds of dissimilar items and cannot be added. The theory tries to solve this problem by making a self-destructive assumption. Pigou assumes that all prices change in the same proportion and in the same direction. As a result, real resources may be measured in terms of any commodity of our choice, say wheat. But the question that we can ask is this. If every price must change in the same direction and in exactly the same proportion, then why estimate R and K ? It is enough to measure the change in the purchasing power of money by just looking at the price change of any item in the market.

Cambridge version of the quantity theory assumes that the proportions K , ' c ' and ' h ' remain constant over time and same is the case with the value of R . Accordingly when M changes, there is an equivalent change in the value of only P . It also assumes that there is no response to shifts in P by any variable in the market.

Evaluation

1. Pigou himself says that his version should not be considered superior to that of Fisher's. It is only different from that of the latter.
2. However, in certain respects, Pigou's equation is better than that of Fisher. It measures purchasing power of money (which is a stock variable) with reference to a point of time and not over a period of time. It does not mix stock and flow variables in the same equation.
3. Pigou's equation can be modified to cover sectional price levels and made more useful.
4. Having said so, we find that Pigou's equation also suffers from some damaging limitations. It makes stringent assumptions that the proportions K , c and h remain constant from one point of time to the other. Similarly, it wrongly assumes that no variable in the equation, except M , can change on its own, or that when P changes in response to M , there is no response by other variables.
5. There is no explanation of the factors determining the values of K , c and h . For example, the values of these variables are affected by the level of rate of interest in the market, but the theory ignores this and similar explanatory variables.
6. As explained above, the concept of R is vague. In addition, it is measured in such a manner that the very need of having the quantity theory of money vanishes.
7. The theory assumes away any possibility of economic growth and therefore changes in R and other variables in the equation.
8. Another theoretical problem posed by this version is that while money balances represent purchasing power in the hands of individual holders, they do not represent purchasing power in the hands of the economy as a whole.
9. In correspondence with Fisher's version, Pigou's version may be termed a cash balances standard.

THE CONCEPT OF MONEY SUPPLY

Having seen the meaning of money, it is logical to look for the methods of estimating the quantity of money supply in an economy. Ideally, we should be able to measure it by using one of the two definitions discussed by us. Let us see if we can do that.

1. *Measuring money supply with the help of functional definition* : In this case, money is taken to mean a medium of exchange. Any item which performs the role of a medium of exchange is money. Further, different items have unequal capacities to act as money and therefore, we should not add their nominal value. Instead, we should first estimate their money content and then do so. In other words, we should take up each item one by one. Official currency is to be assigned a value of 100%. Medium of exchange equivalent (that is, percentage

cash equivalent) of each non-currency items is be estimated. And its total money content is then measured by multiplying this percentage value with its nominal quantity. In the end, the cash equivalents of all items are added up to arrive at the total supply of money in the economy.

This method may be illustrated by taking a simple hypothetical case. Let us suppose that we consider only two items, cash and bank deposits. Let us assume that their respective nominal quantities are Rs. 200,000 crore and Rs. 600,000 crore. Let us further assume that in terms of our calculation, the capacity of bank deposits to act a medium of exchange is 80% of that of cash. Then, it follows that aggregate money supply in the country is

cash = Rs. 200,000 crore plus

bank deposits = Rs. 600,000 crore x 0.80 = Rs. 480,000 crore

that is, Rs. 680,000 crore.

2. *Measuring money supply with the help of liquidity approach* : In the same way, if we adopt the liquidity approach, we assign a weight of 100% to official currency. Liquidity content (as a percentage of its cash equivalent) is estimated for each non-currency item and multiplied by its nominal quantity. The aggregate of all such products is then the measure of total money supply in the country.

The basic difficulty with these methods is that, in practice, we are not able to measure either the medium of exchange content, nor the liquidity content of a non-currency item. However, in official estimates of money supply, the authorities cannot wait till we are able to estimate the money content of each item in terms of its medium of exchange or its liquidity. They have to take immediate decisions regarding

- items to be included in the measure of money supply; and
- the money content of each of them.

The authorities, for want of a better solution, define and measure the quantity of money supply in the economy as follows :

- Since it is as yet not possible to estimate either the medium of exchange content, or the liquidity content of a non-currency item, the authorities assume that the money content of each item included in the definition of money supply is equal to its nominal value. That way, the official definition and official measure of money supply become equivalent terms.
- Problems of timely availability of reliable and accurate data force them to decide that, in addition to official currency, only a few more financial assets would be included in the official definition of money supply.
- Authorities need an estimate of money supply for use in formulation of several policies. They find that so single definition would serve this purpose. Accordingly, they normally adopt several alternative measures of money supply, each comprising a somewhat different set of items. This practice is common to most leading countries of the world including USA, UK and India.

Measures of Money Supply In India

In India, RBI is the decision-making authority regarding the way supply of money is to be estimated. Currently, RBI provides four alternative measures of money supply and there is a proposal to add some more to the list. RBI makes a distinction between the creators of money and users of money which are termed "the public". All measures of money supply are estimates of "money supply with the public". RBI classifies itself, the Government of India and banks as creators of money and therefore, money balances held by them are excluded from the measures of "money supply with the public"

For a proper understanding of the alternative measures of money supply, we should familiarise ourselves with the "components" used in them.

1. *Currency with the Public (C)* : In India, currency is created by two authorities. The Government of India mints coins of all denominations permitted by law. It can also print currency notes not exceeding the denomination of one rupee. This is known as Government of India currency. It is handed over to RBI and RBI creates corresponding deposit balances in favour of the GOI out of which the latter make payments. All currency notes with denominations exceeding one rupees are printed by RBI. Further, the entire official currency thus created is issued by RBI only. The currency with the public is the total currency issued by RBI and circulating in the economy less the amounts held by RBI itself, the GOI and the banks.
2. *Other Deposits with RBI (OD)* : The Reserve bank of India is the central bank of our country. Ordinarily, it does not undertake banking business except the provision of banking services to GOI and the State governments. However, in the course of its various activities, certain deposits are created with it which, in its judgement, can be encashed by the depositors at their discretion. Therefore, RBI includes them in its measures of money supply with the public. It should be noted, however, that the amount of OD is always negligibly small as compared with other components of money supply.
3. and 4. *Demand Deposit and Time Deposit Liabilities of Banks (DD and TD)* : Deposit liabilities of banks are an important means of payment available to the public. However, while demand deposits can be encashed at the discretion of the deposit holders, withdrawals from time deposits are subject to various conditions including a time notice. The rule of thumb by which total deposit liabilities (D) of banks are divided into DD and TD components is as follows. The portion of a deposit on which the bank allows (that is, pays) an interest is classified as TD and the balance of the deposit is classified as DD. It should be noted that bank deposits are net of inter-bank liabilities.
5. *Deposits with Post Office Saving Bank Organisation* : Deposits are made with post offices in the form of saving and other deposits.

Till March 1977, RBI provided two estimates of money supply with the public. They were as follows.

- A narrower measure of money supply which was equal to $C + DD + OD$.

- A broader measure of money supply which was termed Aggregate Monetary Resources (AMR) and was equal to $C + DD + TD + OD$.

Since April 1977, RBI has been publishing four alternative measures of money supply which are as follows.

1. M1 which is the equivalent of older narrower measure of money supply. It is therefore equal to $C + DD + OD$.
2. M2 which is a wider measure. It includes M1 plus saving deposits with post offices.
3. M3 is an alternative wider measure of money supply. Compared with M2 it excludes saving deposits with post offices and includes TD with banks. Thus, it is equal to $C + DD + TD + OD$. This is the most widely used measure of money supply in India. Unless the context specifies otherwise, the reference is always to this measure. It is also termed 'money stock' by RBI.
4. M4 is the widest measure of money supply. In addition to M3 it includes all deposits with post offices.

As has been pointed out above, none of the four measures can be termed "the best" of all. Had that been the case, RBI would have chosen only that measure and discarded all the rest. Actually, with an ever-changing nature of the economy, the need for revising even the existing measures gathers strength. As of now, the RBI makes use of alternative measures of money supply for different policy purposes.

COMMERCIAL BANKS –ROLE AND FUNCTIONS

A commercial bank is a financial institution authorized to provide a variety of financial services, including consumer and business loans (generally short-term), checking services, credit cards and savings accounts. Earlier commercial banks were limited to accepting deposits of money or valuables for safekeeping and verifying coinage or exchanging one jurisdiction's coins for another's. By the 17th century most of the essentials of modern banking, including [*foreign exchange*](#), the payment of [*interest*](#), and the granting of loans, were in place. It became common for individuals and firms to exchange funds through bankers with a written draft, the precursor to the modern cheque. Because a commercial bank is required to hold only a fraction of its deposits as cash reserves, it can use some of the money deposited by its customers to extend loans. Commercial banks also offer a range of other services, including savings accounts, safe-deposit boxes, and trust services.

Broadly speaking, the functions of commercial banks can be classified in the following two categories:

1. Primary Functions
 2. Secondary Functions.
1. *Primary Functions* : The major activities under this category include —
 - (a) *Accepting Deposits* – The commercial banks accept deposits from public, businessmen and others basically in terms of saving deposits, time deposits and current deposits. Under the saving deposits banks accept small deposits from households or persons in order to encourage savings in the economy. Fixed deposits are accepted for a fixed time period

specified in advance. It carries higher rate of interest as compared to saving deposits. In case of current account, the banks undertake the obligation of paying all cheques against the deposits of the customers subject to adequate fund in the account. Big business houses use this type of deposits. The banks do not pay any interest for the deposits in this account.

(b) *Lending of Fund* : The other important activity covered under the any functions of the bank is lending of the fund to the users in form of Loan. Cash Credit, Overdraft and discounting bills. Loan is like an advance extended by the bank to his customers with or without security for a specified period of time at an agreed rate of interest. In this case, banks credit the loan amount in the customer's account who may withdraw the same as per his needs. Under the Cash credit facility, banks offer his customers to borrow cash up to certain specified limit against the security of goods. Overdraft is like an arrangement offered by the banks where customers are permitted temporarily to overdraw from his current account without security. Banks also deals in discounting and purchasing bills. In both the situations, banks after charging discounts and commissions credit the amount of bills in customer's accounts.

2. *Secondary Functions*: Under this category, banks discharge the following functions:

(a) *Agency Service*: Banks acts as an agents to their customers by rendering the following services:

- (i) Collection of bills, draft, cheques dividends etc. on behalf of customers;
- (ii) Payments of insurance premium, loan installments, rent, bills etc on behalf of customers;
- (iii) Acting as representatives of customers for stock exchange operations such as purchase and sale of securities etc;
- (iv) Acting as an executors, administrators, trustee of an estate of customers;
- (v) Other services such as preparation income tax returns, claiming of tax refunds etc. on the behalf of the customers.

(b) *General Utility Services*: Commercial banks also offers variety of general utility services such as issuing travellers cheques, locker facilities for keeping valuables in safe custody, issue of debit and credit cards, etc. to their customers.

Commercial Banks in India

At the time of independence , the country had a fairly well-developed commercial banking system with 648 banks having 4819 branches. Indian Commercial Banks came under effective regulation of RBI with the passage of the Indian Banking Regulation Act, 1949. The legislation has the powers to monitor the working of the banks, and regulate their working through licensing apart from helping the banks in many ways.

A major structural change occurred when Government announced the nationalization of 14 major commercial banks with effect from 19th July 1969. The objectives of nationalization were "to control the heights of the economy and to meet progressively and serve the need of development of the economy in conformity with national policy and objectives." These banks were given the task of expansion in areas which had no banks or had limited banking facility. This was followed by the introduction of Regional Rural Banks (RRB). The RRBs expanded rapidly and have been able to add to the number of bank offices. Six more big commercial banks have been nationalized in April 1980. However, private and foreign banks have been continuing their operation as well. Since then, however the scope and coverage of public sector banking has considerably widened. From the time of nationalization of banks in 1969 till end June 2006, the total number of public sector bank branches increased to 62704 from 7015 (including 14500 RRBs branches opened during the period). A major share in the expansion of bank branches has been that of RRBs. An important contribution of rapid expansion of banking in the country has been stimulation that it has given to the growth of bank deposits. The net result is a rapid increase in total deposit balances with banks (Rs. 1416125 crore, on 27th Dec, 2002) which was roughly half the national income. However, the banks were facing a number of problems, which have accumulated over time, particularly since 1969. Till recently, the banks were being subjected to (i) an administered set of interest rates on deposits and loans and advances, (ii) compulsory and concessional credit to priority sectors, and (iii) compulsory investment in low-yield government and other approved securities. In addition, banks have been finding it increasingly difficult to recover their loans. Over-staffing and low labour productivity have also been reported in the banking sector. The net result was a decline in their financial health and commercial viability.

The banking system in India has undergone significant changes during last 15 years. Financial sector reforms introduced in the early 1990s as a part of the structural reforms have touched upon almost all aspects of banking operations. For a few decades preceding the onset of reforms, banks in India operated in an environment that was heavily regulated and characterized by sufficient barriers to entry, which protected them against too much competition. While the objectives of the financial sector reforms were to enhance efficiency and productivity, the process of reforms were initiated in a gradual and properly sequenced manner so as to have a reinforcing effect. First phase of reforms was aimed at creating productive and profitable financial institutions operating within the environment of operational flexibility and functional autonomy. The focus of the second phase of financial sector reforms starting from the second-half of 1990s has been on strengthening the financial system consistent with the movement towards global integration of financial services.

The deregulation of interest rates constituted an integral part of financial sector reforms. The interest rate regime has been largely deregulated with a view to achieving better price recovery and efficient resource allocation. Banks have now flexibility to decide their deposit and lending rate structures and manage their assets and liability accordingly. Indian banking system operated for a long time with high reserve requirements both in the form of SLR and CRR. This was mainly to accommodate the high fiscal deficit and its monetization. The efforts in recent periods have been to lower both the SLR and CRR. The SLR and CRR have been reduced from peak levels of 38.5 and 15.0 to 25 percent and 4.5 percent respectively. As a

part of the financial sector reforms, the regulatory norms with respect to capital adequacy, income recognition, asset classification and provisioning have progressively moved towards convergence with international best practices. These measures have enhanced transparency of the balance sheet of the banks and infused accountability in their functioning. Measures to reduce levels of Non performing asset(NPA)s concentrated on improved risk management practices and greater recovery efforts facilitated by the enactment of Securitisation and Reconstruction of Financial Assets and Enforcement of Security Interest(SARFAESI) Act,2002.Several other channels of NPA management have also been instituted. As part of the reform programme, due consideration has been given to diversification of ownership of banking institutions for greater market accountability and improved efficiency. The public sector banks expanded their capital base by accessing the capital market, which diluted the government ownership.It is recognized that the financial strength of a bank depends upon the extent of its risk exposure and its ability to meet any loss arising out of the same. The Bank for International Settlements appointed the Bassle Committee on Banking Regulations and Supervisory Practices which came out with certain recommendations for capital base of the banks. These recommendations were subsequently revised to meet the problems faced by banking industry of the world under changed circumstances.The RBI, in line with the successive recommendations, took steps in ensuring that Indian banking industry comes to world standards, which included norms relating to estimating the risk exposure, capital adequacy and the like. To provide banks with additional options for raising capital funds with a view to the Bassel II, the RBI in January 2006, allowed banks to augment their capital funds by issue of additional instruments. Private Sector is also permitted to operate in banking sector.

RESERVE BANK OF INDIA — ITS FUNCTIONS AND MONETARY POLICY

Set-up in April, 1935, under the Reserve Bank of India act, 1934 as a private shareholders' bank with some subscription from the Government and later nationalized in 1949. The RBI is fully owned by the Government of India. The RBI is the Central Bank of the country. It issues notes, buys and sells Government securities, regulates the volume, direction and cost of credit, manages foreign exchange and supports institutions financing agriculture and industry. According to the preamble to the RBI Act, 1934, the main function of the Bank is to regulate the issue of bank notes and the keeping of reserve with a view to securing monetary stability in India and generally to operate the currency and credit system of the country to its advantage. Although there has not been any explicit legislation for price stability, the twin objectives of monetary policy in India are widely regarded as : (i) price stability and (ii) provision of adequate credit to productive sectors of the economy so as to support aggregate demand and ensure high and sustained growth.

RBI is the apex institution of the Indian Financial System. It keeps track of several measures of money supply with the public and makes an effort to regulate its volume and use according to the changing needs of the country. In addition it has also introduced some additional measures of money supply so as to improve its functioning as a monetary authority. RBI plays an effective role in not only regulating the Indian Financial Institutions, but also guides and helps them to grow along healthy lines. In early 1950, RBI initiated the policy of converting weak banking units into strong ones through mergers, amalgamations and other measures. Its aim was to ensure that all banks should gain enough strength to become scheduled banks.

As a result of this, there is hardly any non-scheduled commercial banks left in the country.

RBI took over the Imperial Bank of India in mid-fifties and converted into the State Bank of India. Overtime, the SBI expanded by : (i) buying out some erstwhile banks of princely states, and (ii) through rapid expansion of branches, particularly in rural and remote areas. In the 60's banking system got the protection against some types of credit extended by it, while the depositors got the protection, in the form of deposit insurance.

Co-operative Credit Institutions represent the earliest official attempts to institutionalize credit to weaker sections of the society both in rural and urban areas. When RBI came into existence in 1935, it assumed the responsibility of helping them. The co-operative credit banking could be divided into two parts : (i) the part specifically meant to help agriculture in its long-term investment, and (ii) the part that extends short-term and medium term credit to not only agriculture but also for other economic activities including marketing, etc. This stream also includes urban co-operative banks.

CONSTITUTION

Central Board

The Reserve Bank's affairs are governed by a Central Board of Directors. The board is appointed by the Government of India in keeping with the RBI Act. Full-time Official Directors including Governor and four Deputy Governors are appointed for four years. Among non-official Directors, 10 Directors from various fields and one Government official are appointed for four years. Among others, four Directors—one each from four local Boards are appointed for four years term. The Central Board provides general superintendence and direction of the Bank's affairs.

Local Boards

Consist of one each the four regions of the country, i.e., Mumbai, Delhi, Kolkata and Channai. Each Board consists of five members each appointed for a five year terms by the Central Government.

The functions of Local Board include : (i) to advise the Central Board on local matters and (ii) to represent territorial and economic interest of local co-operative and indigenous banks; (iii) to perform such other functions as delegated by Central Board from time to time. There are 22 offices of RBI located in various parts of the country.

CENTRAL BANKING

The Central Bank of the Country is the apex institute of the financial system. Correspondingly, the term 'Central banking' refers to the activities of the Central bank. The Central Bank of our country is the Reserve Bank of India (RBI). The best way to define a central bank is to say that it is the apex financial institution of the country and subject to certain legal boundaries is vested with the authority to regulate, guide and help the financial system. It is not guided by profit motive and gives precedence to the economic interests of the country over its gains. Till the end of 19th century, central banking came into existence out of slow evaluation of some existing commercial banks. These banks were mostly in private ownership but through their strength and dominating size, came to acquire certain powers which

were considered there of central banking. However, overtime, their working was bound by codes and ethics of rules and practices. Consequently, central banking developed into a distinct entity of its own. Central banks came into existence in the early 20th century through official legislation. The practice of creating a full-fledged central bank so as to take charge of the existing financial system got an impetus by the recommendations made by the International Financial Conference held at Brussels in 1920s. A large number of Central Banks were established thereafter. As already mentioned, the RBI, which is the central bank of our country, came into existence on 1st April, 1935. Major functions of RBI are discussed below :

Functions of a Central Bank

Central banking functions have evolved gradually over decades. Their evolution has been guided by ever-changing need to find new methods of regulating, guiding and helping the financial system (particularly, the banks). In other words, the evolution of central banking functions has tended to coincide with the evolution of the financial systems of the world economies. Let us recount the leading functions.

1. Note Issue

It is considered one of the primary functions of a central bank. The entire financial system of a country, with ever increasing volume and variety of the financial instruments, institutions and markets, needs a stable supply of legal tender money. This legal tender should tend to vary, both in volume and composition, to the changing requirements of the economy. Accordingly, the central bank of the country is granted the sole right to issue currency (including that of the government of the country) and (ii) a monopoly of issuing bank notes (which are its promises to pay).

The central bank is given monopoly of note issue for two reasons.

- (a) Currency notes issued by a central bank are its liabilities corresponding to which it acquires certain assets which can be a source of income to it.
- (b) Through appropriate legislation or otherwise, it can be ensured that the central bank does not over-issue currency notes.

In the initial stages, central banks were privately owned and were competing with other banks for business. During those days, therefore, they were tempted to over issue notes so as to earn more income. Consequently, the authorities felt that steps should be taken against this misuse of the privilege of monopoly of note issue. The solution of this problem was sought in removing, partially or fully, the temptation to over issue notes, that is, in ensuring that the assets acquired by the central bank against its note issue are not income yielding. The non-income yielding assets for 'backing' the note issue were to be gold bullion and coins. This led to the use of the following concepts in varying combinations.

The concept of *fiduciary* issue, according to which the bank is authorised to issue notes, up to a pre-determined limit, without a 'covering' or 'backing'. In other words, the bank is permitted to have income earning assets corresponding to this amount of note issue. These income earning assets may be government securities, private securities, loans and advances, and the like.

A *maximum limit* of note issue may be prescribed without any reference to its backing in gold. Clearly, this method is highly restrictive. The supply of legal

tender fails to respond to increasing needs of an expanding economy. Revising the limit through legislation can be quite cumbersome and disruptive.

It may be prescribed that the gold backing of note issue must not fall below a prescribed percentage.

The central bank may be trusted for its discretion and allowed to regulate the note issue on its own. It may be expected to decide its course of action on the basis of the needs of the economy rather than its own profitability.

Now let us look at the position in India. To begin with it was prescribed that the assets of the Issue Department of the Reserve Bank of India must consist of gold coins and bullion and foreign exchange securities not less than 40 per cent of the note issue provided further that the value of such assets must not fall below Rs. 40 crore. This provision was modified in 1956. RBI was asked to maintain a minimum reserve of Rs.515 crore with at least Rs. 115 crore worth of gold and the balance in the form of foreign exchange securities. At the same time, the gold holdings of the RBI were revalued. This provision was further modified in 1957 under which it was stipulated that the gold and foreign exchange reserves of the Issue Department should not fall below Rs. 200 crore including a minimum Rs. 115 crore in gold and gold coins. Moreover, RBI was authorised to entirely dispense with its holdings of foreign securities with the prior permission of the government. It means that from 1957 onwards, the RBI has virtually fully discretionary power to decide about the volume of its note issue.

2. Banker's Bank

The second main function of a central bank is that of being a bank of the banks. This function includes the following interrelated sub-functions.

- (i) The first sub-function is its being a custodian of the cash reserves of the commercial banks. The exact form of this function has varied from country to country and in terms of legal provisions. Historically, commercial banks discovered that it was convenient and economical to hold deposit balances with the central bank for making payments to each other. In some countries, however, the banks are compelled by law to hold deposit balances with the central bank and this gives it an additional tool to regulate credit creation by them. The legal provision to this effect was first introduced in USA. Later, it was adopted in India also. RBI has found it a very effective regulatory tool and has used it very extensively. To begin with, bank deposits were categorised into demand deposit liabilities and time deposit liabilities. The minimum cash balances to be maintained with RBI were to be between 2% and 8% of the time deposit liabilities and between 5% and 20% of demand deposit liabilities. The choice of exact percentages and their revision was left to the discretion of the RBI. Later on, the provision relating to minimum cash balances (called 'cash reserve ratio', or CRR) was modified to the effect that now a uniform percentage (between 3% and 15%) is applicable to all bank deposits. Again the choice of exact percentage and its revision is left to the discretion of the RBI.
- (ii) The second sub-function is that of clearance. When individual banks maintain deposit balances with the central bank and use them to make payments to each other, the system of interbank clearance emerges. The

interbank clearance and remittances result in appropriate adjustments in the deposit balances of the banks with the central bank. Actually, the basic motive which induces the commercial banks in maintaining deposit balances with the central bank is the convenience and economy of making payments to each other. This function was first developed by the Bank of England in mid 19th century. Currently, it is one of the primary functions of every central bank of the world.

3. The Central Bank

The central bank is the final source of the supply of legal tender. It is the lender of the last resort. For this reason, it should be able to adjust the availability of currency with the market in line with the changing needs of the latter. When the economy expands and it needs additional money and credit, the central bank can adopt a policy of pumping in additional currency in the market. Similarly, it can try to curtail the supply of available currency when the economy is in a phase of contraction. The central bank adjusts the volume of currency in two ways.

- (i) The banks can approach it for cash loans. It can tighten the terms of issue of such loans (including the rate of interest to be charged) if it wants to restrict the money supply. Alternatively, it can make it easier and cheaper for the banks to borrow if it wants to increase the supply of money and credit.
- (ii) The amount of money needed by the market is also reflected in the bills drawn by the seller upon the buyers and the central bank can take steps to alter the money supply in the market by adjusting the volume of bills discounted/rediscouted by it. For example, when the volume of bills drawn is increasing during an expansionary phase of the economy, the central bank can adopt the policy of discounting more of them and pumping additional currency in the market. Similarly, when the economy is passing through a phase of contraction, the volume of bills drawn decreases. In this case, the central bank can drain the market of excess money supply by collecting the earlier discounted bills and discounting less of fresh bills. In addition, it can also adopt the policy of adjusting its discount rate to encourage or discourage the discounting of bills, as the need be.

4. Banker to the Government

The central bank of the country happens to be a banker to the government. This function normally involves two things: (i) providing ordinary banking services to the government, and (ii) being a public debt agent and underwriter to the government. Let us consider each of these with reference to the Reserve Bank of India.

RBI is an official banker to the Government of India and most of the State Governments. It has a written agreement with each Government to which it is official banker. To illustrate it further, let us consider the relationship between the RBI and the Government of India. RBI provides all kinds of free banking services to the GOI. It is compensated by an interest free deposit by the GOI of an agreed amount. If the outstanding amount to the credit of GOI falls short of the stipulated figure, RBI charges an interest on the shortfall. Similar agreements of RBI exist with other State Governments also. However, the amounts of interest free

deposits vary from State to State. Also the amount of minimum interest free deposit is subject to revision from time to time.

Similarly, RBI is the public debt agent of GOI. It studies the market and advises the GOI regarding the conditions in the market. It also “grooms” the market before GOI floats a new debt in the market, that is, it takes steps so that the response to the GOI loans is favourable. It receives applications for allotment of loans and processes them. It accepts the subscriptions of creditors to GOI loans, maintains records and makes payments to the creditors both of interest and final amounts. In addition, it is also an underwriter of public debt to the GOI. It means that if a portion of a loan floated by the GOI is not picked up by the market, then RBI steps in and subscribes that portion of loan. Over years, therefore, RBI has come to hold a large amount of GOI loans. In addition, RBI also extends several kinds of special loans to GOI. Similarly, RBI is also public debt agent to State Governments and it underwrites their debt floatation as well.

5. Custodian of Foreign Exchange Reserves

Central bank of a country is also a custodian of its official foreign exchange reserves. This arrangement helps the authorities in managing and co-ordinating the monetary matters of the country more effectively. This is because there is a direct association between foreign exchange reserves and quantity of money in the market. The foreign exchange reserves are influenced by international capital movements, international trade credits and so on. Because of the interaction between the domestic money supply, price level, and exchange reserves, the central bank frequently faces several contradictory tendencies which have to be reconciled.

6. Management Regulation of Exchange Rate

A related function which is assigned to the central bank is the Management and regulation and stabilisation of the exchange rate. This task is facilitated when the central bank is also the custodian of official foreign exchange reserves. The need for a stable exchange rate is more in the case of a paper standard than under a metallic standard. In this context, we should specifically note two things : (i) the justification for having a stable exchange rate and avoiding violent and wide fluctuations in it ; and (ii) the need to assign this task to an expert and competent agency.

As regards expertise and competence, central bank of the country is the best agency to which the task of regulating and stabilising exchange rate should be assigned. The central bank happens to be the apex institution of the entire financial system of the country. It is in possession of maximum data and has the expertise of estimating the financial trends and the type of corrective measures needed. Moreover, it possesses several regulatory powers over the financial system. It can contemplate and take the complementary measures needed for ensuring the success of the steps taken in the area of exchange rate.

A stable exchange rate is of great help in promoting external trade and orderly capital flows. The volatility of exchange rate tends to increase if there is complete capital convertibility (that is, capital can flow in and out of the country without specific permission of the authorities). If the central bank is given the authority to regulate the use of foreign exchange (that is, if it has the authority to apply

exchange control to the extent it decides), the task of stabilising exchange rate becomes easier for it.

7. Credit Control

Over the years, credit control has become a leading function of a modern central bank. In earlier days, the term credit control referred to the regulation of only the “volume” of money and credit. Currently, the term is used in a wider meaning and covers not only the “volume” of money and credit, but also its components, its flows, its allocation between alternative uses and borrowers, terms and conditions attached to credit and so on. The need for credit control arises because it is observed that “money cannot manage itself”. Left to unregulated market forces, flows of money and credit have the tendency to accentuate cyclical fluctuations. Moreover, in underdeveloped countries, unregulated credit flows strengthen inter-sectoral imbalances, speculative forces and other distortions.

8. Other Functions

It is believed that an underdeveloped country requires an all-frontal approach in solving its problems of poverty and growth. Though regulation of the volume of money and credit and its other dimensions, the central bank plays a key role in its growth policy, much more is needed to make it really effective. Viewed in this manner, the functions of a central bank come to cover a much wider field than is conventionally considered in the case of central banks of developed countries.

Let us consider the developmental role of a central bank with reference to our own country. At the time of Independence, our entire financial system (including our banking sector) was very weak. Modern banking services were scarcely available in rural and semi-urban areas. The banking system contained several small and weak banks. There was a need to strengthen them through amalgamations and mergers. Similarly, the banking industry was in the grip of some unhealthy practices which risked their own lives and jeopardised the interest of the depositors. They were in need of better regulation and supervision. The Reserve Bank of India undertook a long term programme of

- expanding banking services to every nook and corner of the country ;
- strengthening weak banking units in a variety of ways, including
 - (i) reducing the number of non-schedule banks,
 - (ii) providing protection to the depositors in the form of deposit insurance,
 - (iii) helping the banks through a system credit guarantee,
 - (iv) instituting rules and regulation under which the banks were to prepare their accounts in accordance with prescribed rules and regulations,
 - (v) gathering regular information from the banking sector so as to monitor its state of health and progress.
- guiding the banks in their interest rate structure - a practice which is now being relaxed in stages.

In addition, the banks are subject to supervision and auditing by the RBI. No bank can practice without a license from it. Over years, RBI has taken several measures for the development of the money and capital markets, including the introduction of a number of financial instruments. RBI has taken an active part in promoting specialised institutions for helping specific categories of activities, such as agriculture, trade, industry, export and housing. It has participated in a variety of ways with the financial institutions at both State and All-India level. In addition, it has also extended its area of regulation to non-banking institutions like mutual funds and insurance, and has helped in the promotion of markets for government securities.

INSTRUMENTS OF CREDIT CONTROL

As stated before, the meaning of the term credit control is not confined to only the regulation of the volume of money and credit. That meaning applies only in the case of developed market economies. In developing economies, the term credit control is used in a wider sense of the term which includes the regulation of its use and other dimensions.

It should be noted that every central bank is authorised to use certain measures. Their nature is a matter of several factors including, (i) historical evolution, (ii) expertise of the central bank management and actual use of the measures, (iii) the structure and strength of the financial markets, (iv) the legal framework, and (v) the level of development of the economy.

The choice of measures of credit control and the extent of their use are largely governed by the legal and institutional framework of the economy and the problem in hand. In general, however, the weapons (or instruments) of credit control are divided into two categories, namely, the following :

1. *Selective Credit Control Measures* : These measures are also known as qualitative credit control, though they have also their quantitative impact. By their very nature, these measures are directed at regulating selective segments of the economy. An underdeveloped economy like ours suffers from several rigidities. It does not have a developed market mechanism. It lacks flexibility and ability to adjust quickly and evenly. Some parts of it can suffer from inflationary pressures while others may be suffering from a shortage of demand. There can be inter-sectoral and inter-regional imbalances. It is, therefore, necessary that in such an economy, the central bank should adopt selective regulatory measures so as to encourage or restrict specific categories of economic activities. These measures aim at influencing the allocation of resources.

Selective credit control is exercised through issuing specific instructions to the banks. They can be discriminatory as between banks, between borrowers, between purposes for which credit is extended, and so on. In some cases, the instructions may also cover some additional dimensions of the credit like its maturity and terms and conditions. The central bank may also prescribe credit rationing, that is, absolute limits up to which specified sectors of the economy may be entitled to get credit from the banking system. It need not be emphasised that a developing economy not only needs selective credit control, it is also more effective and useful for it.

2. *General or Quantitative Credit Control Measures* : These measures are non-discriminatory as between banks and as between the uses to which credit may

be given. They aim at regulating only the aggregate volume of money and credit available to the economy. They do not distinguish between the purposes for which borrowers use the loans, or the type of borrowers who are getting the loans. These measures are used on the assumption that there is a free market mechanism in the economy. By implication, any expansion (or contraction) of money supply is expected to spread itself quickly and evenly throughout the economy. The availability or scarcity of credit is experienced throughout the economy and does not remain confined to any segment of it. Therefore, the authorities need not worry about the part of the economy in which they inject additional credit supply, or from which they drain it. It also follows that any effort to selectively influence some parts of the economy is bound to be frustrated. The effect is felt by the entire economy or not at all.

This brings us to the leading instruments associated with general credit control.

Bank Rate

Bank rate is the interest rate at which a central bank provides loans to banks and other borrowers. Corresponding to it is the discount rate, that is, the rate at which the central bank discounts trade bills, and other instruments which are redeemable at par. In practice, the two rates result in the same cost of borrowing from the central bank so that the two terms can be used interchangeably.

The central bank is the lender of the last resort. Therefore, the rate at which it is ready to extend credit has a direct impact upon the level of interest rate in the country. When the market has to pay more for its funds from the central bank, it increases the interest rate charged from the business sector. It is expected that, faced with a demand for increased interest rates, the borrowers curtail their demand for credit and investment activity slows down. Moreover, higher cost of borrowing funds adds to the cost of production and supply, which means that the suppliers must increase prices or bear the extra cost themselves. In the former case, market demand decreases and results in a recession. And in the latter case, there is a dampening effect on fresh investment. In contrast, a reduction in bank rate leads to a fall in the level of interest rate in the market. The cost of borrowing funds comes down resulting in a downward impact on the cost structure of the business sector. Ordinarily, therefore, with an increase in bank rate, the demand for business loans is expected to fall and vice versa.

However, the use of bank rate has its own limitations.

1. The expenditure decisions of the business community are not regulated by the cost of funds alone. It is equally guided by the marginal efficiency of capital that is the expected rate of return on fresh investment expenditure which, in turn, is deeply influenced by inflationary and deflationary expectations. For example, if the economy is passing through a boom period, an increase in bank rate may be more than counterbalanced by an increase in expected rate of return from fresh investment. By implication, depending upon the strength of inflationary expectations, a small increase in bank rate may prove ineffective in reducing demand for credit. In other words, the bank rate will have to be increased substantially enough for successfully counteracting inflationary expectations. Though in theory it is always possible to do so, in practice, it is often difficult to raise the bank rate by more than a small margin.

Going by the same logic, the bank rate is to be reduced when the objective of the central bank is to retrieve the economy from the clutches of a depression and accelerate economic activities. However, if deflationary expectations are very strong, even a substantial reduction in bank rate may fail to revive the economy.

2. The effectiveness of bank rate also depends upon the psychological impact that it may be able to create. Experience shows that it does not succeed because of the time lags involved with time lags. It succeeds only if it has a decisive impact on the market interest rates and related credit conditions.
3. The money markets of the country should be well developed, integrated and very sensitive to even small changes bank rate. If these conditions are not satisfied, bank rate fails in influencing short term rates. If for example, the bill market is underdeveloped, or if there is no market for money on call and short notice, the market will fail to respond to the bank rate changes.
4. Frequently, economic interest of the government of the country clashes with the use of bank rate as an instrument of credit control. Normally, a modern government has a huge amount of outstanding public debt and is in constant need of fresh loans (including short term loans by means of treasury bills, etc.) Since an increase in bank rate means an added budgetary cost for the government, it exerts pressure upon the central bank to avoid raising bank rate.
5. The very success of bank rate in pulling the market rate of interest in the same direction creates its own problems. For example, suppose the central bank increases bank rate with the idea of curtailing the volume of money and credit in the country, and it succeeds in increasing the market interest rates. This will cause an inflow of foreign capital, add to the foreign exchange assets of the central bank, cause an addition to domestic money supply and defeat the very objective of raising the bank rate.
6. The effectiveness of bank rate as a weapon of monetary policy has decreased over time. A variety of financial instruments has come into existence and business sector has learnt to do with more of mutual credit and other means of doing business. As a result, the dependence of the domestic markets over the central bank has decreased.

Open Market Operations (OMO)

When use of bank rate is not effective enough in regulating the volume of money and credit, the central bank can resort to the use of open market operations. This instrument refers to the practice of sale and purchase of commercial paper (like trade and exchange bills) and government securities in the market. These days, even swapping operations (that is, simultaneous buying and selling of securities of different maturities) is also included in OMO. In practice, however, OMO are confined to government securities only. The manner in which this instrument is expected to work is as follows.

When the central bank sells securities, and receives sales proceeds from the buyers, an equivalent reduction takes place in the amount of cash (or balances with the central bank) held by the market. To the extent the commercial banks lose cash balances; the capacity to create credit is reduced by a multiple of this loss. The net

result is that there is a multiple reduction in the amount of money and credit available to the market. Similarly, when the central bank wants to increase the availability of money and credit in the market, it resorts to buying of securities and, in the process, loses cash to the market.

Another effect generated by OMO is that on rate of interest. Other things being equal, when the central bank sells securities, their prices fall. This, by itself, means an increase in the rate of return on securities and a corresponding increase in the market rate of interest. An increase in market rate of interest is also supported by the fact that the sale of securities results in a reduction in the availability of money and credit in the market. Similarly, when the central bank buys securities, other things being the same, an increase in their demand causes an increase in their prices and a corresponding reduction in the rate of return on them. Also, there is an injection of legal tender in the market and that leads to a fall in the interest rate.

The success of OMO depends upon a number of factors including the following:

- (a) The central bank should have a large volume and variety of securities so that it can buy and sell them to the extent needed. A wide maturity range also helps the central bank in reaching larger numbers of potential buyers and sellers. Moreover, with a wide range, it becomes easier for the central bank to influence specific interest rates.
- (b) Success of OMO also depends upon the level of development of the financial markets and their sensitivity or responsiveness to changes in demand and supply of individual instruments. The net impact of OMO tends to remain confined to selected segments of the market if the financial system is not well integrated and developed. Moreover, whatever be the degree of response by the market, its impact tends to be long delayed. For these reasons, therefore, like bank rate, OMO also tend to be less effective in underdeveloped countries.
- (c) Depending upon the manner in which they are used, OMO are expected to be effective in both expansion and contraction of the economy. However, if the banks have already an excess of cash reserves, then restrictive OMO are likely to help the banks in getting rid of the said excess. To the extent that happens, the contractionary effect on the economy gets neutralised. Similarly, a pumping in of cash balances through purchase of securities by the central bank may fail to expand credit if there is an insufficient demand for credit in the market.
- (d) There can be situations in which the banks may be able to partially counteract the variation in their cash balances by adjusting the composition of their remaining assets. For example, they may be able to counteract the contractionary effect of OMO by acquiring additional short term assets.
- (e) There is no fixed or stable quantitative relationship between OMO and their effect on the (i) volume of money and credit, and (ii) rate of interest. The cash deposit ratio maintained by banks varies with time and other circumstances. The inflationary and deflationary expectations also play their role.
- (f) Because of their indiscriminate coverage, OMO are less suitable for use in underdeveloped countries.

Cash Deposit Ratio (CDR)

If the law permits, the central bank may fix a minimum cash deposit ratio which the banks have to maintain. In that case, the banks are prevented from increasing credit creation beyond a certain multiple of their cash reserves. However, this measure has the following qualifications and limitations.

- (i) The ratio applies uniformly to all banks which contradicts the fact that the market conditions permit some banks to maintain lower cash deposit ratios than the others.
- (ii) The cash deposit ratio imposed upon banks is the minimum they have to maintain. The actual ratio maintained by a bank can always exceed it. As a result, it is ineffective when the central bank wants to increase money and credit.
- (iii) It is not easy and practicable to revise the minimum cash deposit ratio very frequently.
- (iv) Depending upon the structure of the financial system, it may be possible for the banks to practise window dressing and create additional credit.

Variable Cash Reserve Requirements

This instrument is also known as “Deposits with the Central Bank”, and “Cash Reserve Ratio or CRR”. It refers to the cash balances which the banks are required to hold as cash deposits with the central bank. The latter has the authority to determine the minimum ratio (within a prescribed range) of the required deposit balances to the deposit liabilities of the individual banks. In addition, it can also revise the ratio as and when it so decides.

The rationale of these compulsory deposits is that the banks are made to lose a part of their cash reserves in the sense that they are not able to use them for backing their credit creation. A higher CRR means a reduction in the capacity of the banks to create credit while a lower CRR has the opposite effect. The central bank finds that CRR is a very powerful instrument. The ratio can be varied as frequently as need be. Moreover, since these balances are not available to the banks for meeting their requirements of cash outflow, therefore, they have to maintain additional cash reserves to finance the circulation of their deposits. To a certain extent, CRR can also be applied in a selective manner by prescribing different ratios for different categories of deposit liabilities.

CRR has the disadvantage that it reduces the profitability of the banking operations. The central bank pays an interest rate on these deposits which is lower than what the banks can get from their market borrowers. In addition, if a bank fails to meet the requirement of maintaining the stipulated minimum balance (which is related to its own deposit liabilities and is therefore a variable amount), it is subjected to some form of a penalty. For this reason, most banks tend to maintain more than necessary deposit balances with the central bank.

Liquidity Ratio

Liquidity ratio is the proportion of assets of bank recognized as “liquid” by the central bank to its total assets. The proportion can be prescribed and revised at the discretion of the central bank within a prescribed range. This instrument can be used

for indirectly forcing the banking system to invest in certain types of financial assets such as the government securities. The central bank has the authority to revise the list of 'liquid' assets from time to time subject to the expectation that some assets like "cash" and "government securities" will always form part of the list. However, an important use of liquidity ratio is that the central bank can counteract some moves of the banking system to restructure its asset portfolio which is not in conformity with the official priorities.

MONETARY POLICY AND ITS FRAMEWORK IN INDIA

Monetary policy

Monetary policy plays an important role in the economic development of a country. It is basically concerned with measures undertaken by the Central Bank of the country to control the money market with a view to influence the working of the economy. H.G. Johnson defines monetary policy as "policy employing Central Bank's control of the supply of money as an instrument for achieving the objectives of general economic policy".

Objectives

In modern world, some of the major objectives of monetary policy include the following :

- (i) Stabilisation of external value of monetary units.
- (ii) Stabilisation of price level.
- (iii) External balance or balance of payments equilibrium.
- (iv) High level of employment.
- (v) High rate of savings and investment.
- (vi) Creation, working and expansion of financial institutions.
- (vii) Debt management.
- (viii) High rate of growth.
- (ix) Correction of cyclical fluctuations in economic activities.
- (x) Higher rate of economic growth.
- (xi) Reduction in income inequalities.

Monetary policy assumes its different role as the economy moves from lower to higher stages of development. Broadly, the objectives of monetary policy in developing country like India is to promote economic growth in environment of reasonable stability whereas in an economy which is characterised by income disparities an important objectives is that of growth with distributive justice. Earlier, the Review Committee set by RBI under Chairmanship of Prof. S. Chakravarty on the working of the monetary system, in its report, has elaborated the objectives of monetary policy as under :

- (i) mobilising the saving of community and enlarging the financial saving pools;
- (ii) promoting efficiency in allocation of savings of the community to relatively more productive purposes in accordance to national economic goals;

- (iii) enabling the resources need of the major entrepreneurship in the country namely, government to be met in adequate measures;
- (iv) promoting price stability; and
- (v) promoting an efficient payment system.

Among these manifold objectives, attaining the price stability and full employment may be considered to constitute the core of monetary policy but not at the cost of growth. The policy mainly has to work under given structural framework of fiscal trade, income and employment. The existence of non-monetary sector and unorganised money market are other factors to put up a check on monetary policy.

Thus, the objective of monetary policy in India has been to speed up economic development in an environment of reasonable price stability. The RBI monetary policy centered around two things

- (i) expansion in supply of money and credit; and
- (ii) ensuring check in rise in prices by use of selective controls

The basic objectives of monetary policy, namely price stability and ensuring credit flow to support growth, have remained unchanged in India, but the underlying operating framework for monetary policy has undergone a significant transformation during the past two decades. The relative emphasis placed on price stability and economic growth is modulated according to the circumstances prevailing at a particular point in time and is clearly spelt out, from time to time, in the policy statements of the Reserve Bank. Of late, considerations of macroeconomic and financial stability have assumed an added importance in view of increasing openness of the Indian economy.

Framework

In India, the broad money (M_3) emerged as the nominal anchor from the mid-1980s based on the premise of a stable relationship between money, output and prices. In the late 1990s, in view of ongoing financial openness and increasing evidence of changes in underlying transmission mechanism with interest rates and exchange rates gaining in importance vis-à-vis quantity variables, it was felt that monetary policy exclusively based on the demand function for money could lack precision. The Reserve Bank, therefore, formally adopted a multiple indicator approach in April 1998 whereby interest rates or rates of return in different financial markets along with data on currency, credit, trade, capital flows, fiscal position, inflation, exchange rate, etc., are juxtaposed with the output data for drawing policy perspectives. Such a shift was gradual and a logical outcome of measures taken over the reform period since the early 1990s. The switchover to a multiple indicator approach provided necessary flexibility to respond to changes in domestic and international economic environment and financial market conditions more effectively. Now, liquidity management in the system is carried out through open market operations (OMO) in the form of outright purchases/sales of government securities and daily reverse repo and repo operations under a Liquidity Adjustment Facility (LAF) and repo and reverse repo rates have emerged as the main instruments for interest rate signalling in the Indian economy.

The armoury of instruments to manage, in the context of large capital flows and sterilisation, has been strengthened with open market operations through Market

Stabilisation Scheme (MSS), which was introduced in April 2004. Under the MSS, the Reserve Bank was allowed to issue government securities as part of liquidity sterilisation operations in the wake of large capital inflows and surplus liquidity conditions. While these issuances do not provide budgetary support, interest costs are borne by the fisc; as far as Government securities market is concerned, these securities are also traded in the secondary market, at par with the other government stock.

While the preferred instruments are indirect, and varied, there is no hesitation in taking recourse to direct instruments also, if circumstances so warrant. In fact, complex situations do warrant dynamics of different combination of direct and indirect instruments, in multiple forms, to suit the conditions affecting transmission mechanism.

There are occasions when the medium-term goals, say reduction in cash reserve ratios for banks, conflict with short-term compulsions of monetary management requiring actions in both directions. Such operations do warrant attention to appropriate articulation to ensure policy credibility. Drawing a distinction between medium term reform goals and flexibility in short-term management is considered something critical in the current Indian policy environment.

Similarly, while there is considerable merit in maintaining a broad distinction between monetary and prudential policies of the central bank, the Reserve Bank did not hesitate, as a complement to monetary tightening, to enhance the provisioning requirements and risk weights for select categories of banking assets, namely real estate, housing and capital market exposures. These measures were needed to specifically address issues of rapidly escalating asset prices and the possible impact on banks' balance sheets in a bank dominated financial sector. This combination, and more important, readiness of the Reserve Bank to use all instruments, has a credible impact, without undue restraint on growth impulses.

Some of the important factors that shaped the changes in monetary policy framework and operating procedures in India during the 1990s were the delinking of budget deficit from its automatic monetization by the Reserve Bank, deregulation of interest rates, and development of the financial markets with reduced segmentation through better linkages and development of appropriate trading, payments and settlement systems along with technological infrastructure. With the enactment of the Fiscal Responsibility and Budget Management Act in 2003, the Reserve Bank has withdrawn from participating in the primary issues of Central Government securities with effect from April 2006. The recent legislative amendments enable a flexible use of the CRR for monetary management, without being constrained by a statutory floor or ceiling on the level of the CRR. The amendments also enable the lowering of the Statutory Liquidity Ratio (SLR) to the levels below the pre-amendment statutory minimum of 25 per cent of net demand and time liabilities of banks – which would further improve the scope for flexible liquidity management.

Institutional Mechanisms

Monetary policy formulation is carried out by the Reserve Bank in a consultative manner. The Monetary Policy Department holds monthly meetings with select major banks and financial institutions, which provide a consultative platform for issues concerning monetary, credit, regulatory and supervisory policies of the Bank. Decisions on day-to-day market operations, including management of liquidity, are

taken by a Financial Markets Committee (FMC), which includes senior officials of the Bank responsible for monetary policy and related operations in money, government securities and foreign exchange markets. The Deputy Governor, Executive Director(s) and heads of four departments in charge of monetary policy and related market operations meet every morning as financial markets open for trading. They also meet more than once during a day, if such a need arises. In addition, a Technical Advisory Committee on Money, Foreign Exchange and Government Securities Markets comprising academics and financial market experts, including those from depositories and credit rating agencies, provides support to the consultative process. The Committee meets once a quarter and discusses proposals on instruments and institutional practices relating to financial markets. Besides FMC meetings, Monetary Policy Strategy Meetings take place regularly. The strategy meetings take a relatively medium-term view of the monetary policy and consider key projections and parameters that can affect the stance of the monetary policy. In pursuance of the objective of further strengthening the consultative process in monetary policy, a Technical Advisory Committee (TAC) on Monetary Policy has been set up with Governor as Chairman and Deputy Governor in charge of monetary policy as Vice Chairman, three Deputy Governors, two Members of the Committee of the Central Board and five specialists drawn from the areas of monetary economics, central banking, financial markets and public finance, as Members. The TAC meets ahead of the Annual Policy and the quarterly reviews of annual policy. The TAC reviews macroeconomic and monetary developments and advises on the stance of monetary policy.

A REVIEW OF INDIAN MONETARY POLICY AND CHALLENGES

The conduct of monetary policy has become more challenging in recent years for a variety of reasons. Many of the challenges the central banks are facing are almost similar which could be summarized as follows:

Challenges with Globalisation

First, globalisation has brought in its train considerable fuzziness in reading underlying macroeconomic and financial developments, obscuring signals from financial prices and clouding the monetary authority's gauge of the performance of the real economy. The growing importance of assets and asset prices in a globally integrated economy complicates the conduct of monetary policy when it is focused on and equipped to address price stability issues.

Second, with the growing integration of financial markets domestically and internationally, there is greater activism in liquidity management with a special focus on the short-end of the market spectrum. There is also a greater sophistication in the conduct of monetary policy and central banks are consistently engaged in refining their technical and managerial skills to deal with the complexities of financial markets. As liquidity management acquires overriding importance, the evolving solvency conditions of financial intermediaries may, on occasions, get obscured in the short run. No doubt, with increasing globalization, there is greater coordination between central banks, fiscal authorities and regulatory bodies governing financial markets.

Third, there is considerable difficulty faced by monetary authorities across the world in detecting and measuring inflation, especially inflation expectations. Recent experience in regard to impact of increases in oil prices, and more recently elevated food prices shows that ignoring the structural or permanent elements of what is

traditionally treated as shocks may slow down appropriate monetary policy response especially if the focus is on "core inflation". Accounting for house rents/prices in inflation measurement has also gained attention in some countries. The central banks are often concerned with the stability/variability of inflation rather than the level of prices. Inflation processes have become highly unclear and central banks are faced with the need to recognise the importance of inflation perceptions and inflation expectations, as distinct from inflation indicators. In this context, credible communication and creative engagement with the market and economic agents have emerged as a critical channel of monetary transmission.

Challenges For Emerging Market Economies

It is essential to recognize that the international financial markets have differing ways of judging macroeconomic developments in industrial and emerging market economies. Hence, the challenges and policy responses do differ.

First, the EMEs are facing the dilemma of grappling with the inherently volatile increasing capital flows relative to domestic absorptive capacity. Consequently, often the impossible trinity of fixed or managed exchange rates, open capital accounts and discretion in monetary policy has to be managed in what could be termed as 'fuzzy' manner rather than satisfactorily resolved - a problem that gets exacerbated due to huge uncertainties in global financial markets and possible consequences in the real sector.

Second, in the emerging scenario of large and uncertain capital flows, the choice of the instruments for sterilization and other policy responses have been constrained by a number of factors such as the openness of the economy, the depth of the domestic bond market, the health of the financial sector, the health of the public finances, the country's inflationary track record and the perception about the credibility and consistency in macroeconomic policies pursued by the country. Further deepening of financial markets may help in absorption of large capital inflows in the medium term, but it may not give immediate succour at the current stage of financial sector development in many EMEs, particularly when speed and magnitude of flows are very high. Some of the EMEs are also subject to adverse current account shocks in view of elevated commodity prices. Going forward, global uncertainties in financial markets are likely to dominate the concerns of all monetary authorities, but, for the EMEs, the consequences of such macro or financial disturbances could be more serious.

Third, the banking sector has been strengthened and non-banking intermediation expanded providing both stability and efficiency to the financial sector in many EMEs. Yet, sometimes, aligning the operations of large financial conglomerates and foreign institutions with local public policy priorities remains a challenge for domestic financial regulators in many EMEs. Further, reaping full benefits of competition in financial sector is somewhat limited in many EMEs. Large players in developed economies compete with each other intensely, while it is possible that a few of them dominate in each of the EME's financial markets. A few of the financial intermediaries could thus wield dominant position in the financial markets of these countries, increasing the concentration risk.

While it is extremely difficult to envision how the current disturbances in financial markets will resolve, the focus of many EMEs will be on considering various scenarios and being in readiness with appropriate policy strategies and contingency

plans. Among the factors that are carefully monitored, currency markets, liquidity conditions, globally dominant financial intermediaries, impact on real sector through credit channel and asset prices are significant, but the list is certainly not exhaustive.

New Issues in the Conduct of Monetary Policy in India

Some of the new issues/challenges faced in the conduct of monetary policy in India include the following:

First, one of the major challenges relates to managing the transition of Indian economy to high growth trajectory accompanied by a low and stable inflation and well anchored inflation expectations. There is growing evidence that the upward shift in growth trajectory in India is of enduring nature as it is supported by high saving and investment rates, improved productivity and vast potential lying by way of demographic dividend. However, it is still important for monetary policy formulation to identify the cyclical and structural components of growth achieved in recent years, despite this task being rendered somewhat difficult in an economy that is undergoing a rapid and deep structural transformation.

Second, a situation in which the aggregate supply is evidently less elastic domestically imposes an additional burden on monetary policy. While open trade has expanded the supply potential of several economies, significant supply in-elasticities do persist domestically, particularly due to infrastructure constraints. Further, persisting impact of supply shocks on prices of commodities and services, to which headline inflation is sensitive, can therefore exert a lasting impact on inflation expectations. Faced with longer-term structural bottlenecks in supply with less than adequate assurance of timely, convincing and demonstrated resolution of these issues, monetary policy needs to respond appropriately.

Third, some categories of interest rates are yet to be fully liberalised in the system, thereby muting at least partly, the impact of monetary policy actions on the structure of interest rates.

Fourth, in the Indian context, it is recognized that monetary policy has to contend with large fiscal deficits and high levels of public debt by international standards. While the recent improvements in the fiscal position of States and significant consolidation in the finances of the Centre provided greater manoeuvrability, monetary policy needs to closely coordinate with cash and debt management of governments in a non-disruptive manner.

Fifth, the operation of monetary policy has to be oriented around the predominantly public sector ownership of most of the banking system which plays a critical role in the transmission of monetary policy to the extent other public policy considerations dominate their overall operations.

Finally, though India is essentially a bank-dominated economy, commercial credit penetration in the Indian economy is still relatively low. Concerns about credit to agriculture and small and medium enterprises usually relate to inadequacy, constraints on timely availability, high cost, neglect of small and marginal farmers, low credit-deposit ratios in several States and continued presence of informal credit markets with high interest rates. It is in this context that the Reserve Bank of India continues to address the need for ensuring financial inclusion of all segments of population, protecting interests of depositors and promoting a conducive credit culture. These considerations invite the attention of the Reserve Bank, even while

monetary policy aims at financial stability by moderating excess volatility in financial markets

In the current environment, monetary policy in India would continue to be vigilant and pro-active in the context of any accentuation of global uncertainties that pose threats to growth and stability in the domestic economy. The domestic outlook continues to be favorable and would dominate the dynamic setting of monetary policy in the period ahead. It is important to design monetary policy such that it promotes growth by contributing to the maintenance of financial and price stability. Accordingly, while the stance of monetary policy would continue to reinforce the emphasis on price stability and well-anchored inflation expectations and thereby sustain the growth momentum, contextually, financial stability assumes greater importance at the current juncture.

Presently, several transitions and structural transformation are taking place in the diverse and large society that is India. These encompass social, political, cultural and of course economic factors. Monetary policy is but one element in the complex web of challenges to public policy and there may be occasions when purely technical responses to monetary policy challenges would be less than appropriate. Public policy, including monetary policy, has to reckon with the complexity of managing these multiple transitions. We are fortunate that we have a supportive and stable political system and well functioning public institutions.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.

Answers to these questions are not to be submitted for evaluation)

1. How would you define money ? What are alternative approaches for doing so?
2. Distinguish between functional and liquidity approaches to defining money. Highlight their similarities and dissimilarities.
3. "Anything which is generally accepted by the creditors in discharge of their claims upon the debtors is money". Elaborate
4. What are the alternative official measures of money supply in India ? Describe them in detail.
5. What is Quantity Theory of Money ? Assess its ability to explain the determination of and variation in the level of prices in general.
6. State, explain and critically discuss the Fisher's version of Quantity Theory of Money.
7. State, explain and critically discuss the Cambridge version of Quantity Theory of Money.
8. Can the banks create unlimited amount of credit ? If not, why ?
9. What is meant by credit creation ? What is its process ? Illustrate your answer with the help of algebraic formulation and numerical examples
10. What are the factors which determine cash deposit ratio of a bank ? What are the sources of cash reserves of the banking system ?

11. Define a central bank and discuss its main functions.
 12. "The central bank of an underdeveloped country has to be more than a conventional central bank. " Elaborate this statement.
 13. What is meant by credit control ? What are its main categories ? Also discuss their suitability for developed and underdeveloped economies.
 14. Discuss in detail the nature and effectiveness of instruments of credit control which can be employed by the central bank.
 15. Discuss the functions of commercial banks.
 16. Write short notes on-
 - (a) RBI
 - (b) Monetary policy
 - (c) Open market Operations
 - (d) Bank rate
 17. Discuss the challenges for Indian monetary policy.
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Suggested Readings :

1. G. Crowther - An Outline of Money.
 2. A. C. L. Day - Outline of Monetary Economics.
 3. M. H. DeKock - Central Banking.
 4. J. L. Hansen - Monetary Theory and Practice.
 5. R. S. Sayers - Modern Banking.
 6. RBI Governor speeches on Monetary Policy.
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STUDY VIII

ECONOMIC REFORMS AND LIBERALISATION

INTRODUCTION

A major crisis had surfaced in Indian economy in early 1991. To overcome the crisis the government, over the past sixteen years has been following a policy of macroeconomic stabilization and structural reforms. To understand the reforms introduced, it would be important to understand what this crisis was and what its origin was.

THE 1991 ECONOMIC CRISIS

The 1991 Economic crisis did not arise in a day, a month, or a year. The origin of the crisis was directly attributable to the imprudent macro management of the economy during the 1980s, which led to large and persistent macroeconomic imbalances. The widening imbalance between the revenue and expenditure resulted in increasing fiscal deficits, which had to be managed through domestic borrowing. The constantly increasing gap between the income and expenditure of the economy as a whole next to large current account deficits in the balance of payments. Loans and borrowings had to be taken from abroad to finance these deficits. Not only living beyond means was causing the problem, the gulf crisis in the late 1990 added fuel to fire. At the same time there was no political stability. The confidence of international community eroded, and India's credit worthiness in the international capital market went down sharply. The economy which could bear many large and sustained oil shocks became too weak to withstand minor oil shock. The sustained mismanagement and the oil crisis ultimately resulted into eruption of a severe macroeconomic crisis in the mismanagement and the oil crisis ultimately resulted into eruption of a severe macroeconomic crisis in the shape of - fiscal deficit, current account deficit and galloping inflation.

THE FISCAL DEFICIT

The fiscal imbalance in 1990 was not a new phenomenon. Throughout 1980s, the situation was deteriorating because of growing non-developmental expenditure. The twin measures to gauge the fiscal imbalance –Revenue Deficit and Gross Fiscal Deficit clearly indicated that throughout the 1980s the fiscal imbalance was on the increase. Revenue deficit showed only a part of the gap in the resources, which was being met by the issue of treasury bills.

The revenue deficit had increased from 0.2 per cent of GDP in 1981-82 to 3.3 per cent in 1990-91. However, it was the Gross Fiscal Deficit which gave the complete picture of fiscal imbalance, as it revealed not only about issuance of treasury bills but also about use of funds from small savings, provident funds and borrowings from market and external sources. The gross fiscal deficit rose steeply from 5.9 per cent of GDP in 1980-81 to 6.6 per cent in 1990-91. Due to rising internal debt the burden of servicing (i.e., interest payment and repayment) for the Central Government increased from 35% of GDP in 1980-81 to 49.8 per cent at the end of 1990-91. The

extent of problem can be gauged from the fact that in 1990-91 interest payments alone amounted to 39.1 per cent of total revenue collections of the Central Government. It was certainly an unsustainable situation.

CURRENT ACCOUNT DEFICIT

The Current Account Deficit which was \$2.1 billion in 1980-81 (1.35 per cent of GDP) rose to \$9.7 billion in 1990-91 (3.69 per cent of GDP), made the balance of payment situation highly fragile. The growing deficit at regular intervals had to be met through external borrowings resulting into rising external debt. The continuously growing external debt meant an increase in debt- service burden from 10% of current account receipts and 15% of export earnings in 1980-81 to 22% and 30% respectively. The strain stretched the Indian economy almost to the breaking point in 1991 because of the gulf crisis. The situation was so alarming on the front of foreign exchange reserves that in late June 1991 these were insufficient to finance imports of even ten days. The default in financing imports and manage debt service obligations was looking imminent. The balance of payments position started appearing grim because of two reasons.

First, due to adverse international perception of the situation it was indeed impossible to stop flight of short-term debt and second, the non-residents Indian deposits outflow also had further gone-up (which was \$1.64 billion between October 1990 to September 1991). The Government of India had to deposit gold stocks with external agencies to get foreign exchange. India had to seek emergency bilateral assistance from donor countries and borrow from IMF under special facilities. These measures, though helped India to avert the crisis of default in meeting payment obligations, pushed the country into a recessionary market situation.

GALLOPING INFLATION

The average rate of inflation during the 1985-90 was 6.7% per annum as measured by the wholesale price index. In 1990-91 it increased to double digit, i.e., 10.3% per annum. The inflation, in terms of consumer price index mounted to 11.2% per annum. The situation was really alarming. The worst part was that the food prices, despite three continuous good monsoons, increased substantially.

REFORMS

In all, the critical situation of 1990-91 forced the Government to introduce economic reforms comprising of macroeconomic stabilization (inflation control, fiscal adjustment and balance of payments) and the structural reforms (trade and capital flows reforms, industrial deregulation, disinvestment and public enterprise reforms and financial sector reforms).

I. *Macroeconomic Stabilization*

Macroeconomic stabilization deals with the demand management to get back to low and stable inflation and a sustainable fiscal and balance of payments position. Introduction of stabilization measures in the short run in conjunction with structural reforms leads to its own problems. To illustrate, trade liberalization may lead to rise

in deficit in the balance of payments and the financial sector reform may result into increasing cost of public borrowing. The conclusion is that stabilization must go along structural reforms and the stabilization policy measures need to be bold and effective to avoid macroeconomic strains. The then Congress government in 1991 led by Narsimha Rao responded to the crisis. The macroeconomic stabilization policy was framed to control the following :

- Inflation;
- Fiscal Imbalance; and
- Adverse Balance of Payments

Control of Inflation

As already stated the rate of inflation during 1990-91 was above 10% per annum. The government decided to bring it down by introducing fiscal and monetary discipline in the economy and improving output and supply position. On both the fronts, the achievements were modest. In 1991-92, due to absence of any increase in output over previous year, increase in money supply by 20.6% due to increase in foreign exchange reserves, the wholesale price index increased sharply by 13.7% in 1992-93, due to increase in agricultural and industrial output, reduction in growth of money supply (14.8%) and decline in fiscal deficit of the Central Government, the rate of inflation came down to 10.1% (though at the beginning of 1993 it was around 7%) in 1992-93. During 1993-94 and 1994-95 the rate of inflation remained over 10% since no effort was made to impose discipline on fiscal and monetary fronts.

Because of slower growth of money supply, better growth of output, a freeze on fuel prices and non-upward revision of administered prices, the rate of inflation came down to single digit, i.e., around 5% during 1995-96. During 1996-97 the rate of inflation remained around 6.4%. 1997-98 saw the rate remaining at 5.3%. Thereafter, the rate has hovered around 5 to 8%. The rate of inflation has been oscillating not only from year to year but also week over week even in one full year. The wholesale price index for the week ended August 18, 2007 was established at 3.94%, less than 4% after a gap of 15 months.

Inflation has been a great worry for the government. It has cut duty on many products besides freezing export of commodities. RBI too has raised rates and allowed the rupee to appreciate in a bid to encourage imports into the economy. The oil prices have not been increased despite sharp increase in international crude prices.

Fiscal Adjustment

To control the problems of high inflation and large deficits in the balance of payments, fiscal adjustment is of great importance. The combined fiscal deficit of the Central, State and Union Territories was less than 6% of GDP in the beginning of 1970s. Thereafter it increased to 8.5% in the beginning of 1980s to 11.2% of GDP in 1990-91 as a result of increasing revenue deficit. Realizing the magnitude of the crisis the Central Government decided to introduce fiscal adjustment. As a result the

fiscal deficit was lowered to 4.7% in 1991-92 as compared to 6.6% of GDP in 1990-91. The Central Government fixed the medium term target for fiscal deficit to be brought down to about 3 to 4% by middle of 1990s. However, the states did not commit to any such limits. Even the Central Government failed to adhere to the limit set by itself. During the year 2005-06 the combined fiscal deficit of the centre and the states was as high as 7.4% of the GDP.

The question is as to why fiscal imbalance? The first answer is the unmindful increase in public expenditure. Plan after plan the Government expenditure as percentage of GDP is on increase. It was 17% of GDP in 1970-71 and rose to 25.9% and 28.5% in 1980-81 and 1990-91 respectively. Prudence demands that it need not go beyond 25%. Thus, the public expenditure must go down. However, it should not mean that necessary expenditure in key infrastructure and social sectors be also curtailed. The second reason appears to be that the government revenues are still 20.5% of the GDP as against the target of around 25% of GDP. Thus, there is scope for mobilization of additional revenues through a mix of broadening of the tax base, rationalization of tax rates and tapping of non-tax revenues. Black money, which is 40% of GDP, can be targeted for the purpose. The public services have no relationship with the cost. The uncovered cost of public services is as low as 86% for the states and 65% for the centre. Not only this, the expenditure on government consumption and subsidies is another burden on fiscal deficit and the government is not serious in taking bold decisions on this front. What the government does is curtailing capital expenditures and social services in real terms. It leads to decline in the rate of capital formation and adverse impact on the human well-being.

The Balance of Payments

India had a foreign exchange reserve only worth \$ 2.2 billion at the end of 1990-91. At the end of 2006-07 it was more than \$ 200 billion. The huge reserve suggests that the Indian economy has reached in a comfort zone after 17 years. The government liberalized imports in 1992-93 finding a relatively better forex (foreign exchange) position. It led the trade deficit to rise from \$ 2.8 billion in 1991-92 to \$ 5.5 billion in 1992-93 and as a result of it the current account deficit as per percentage of GDP rose to 1.7%. The 20.2% increase in exports during 1993-94 brought it down to 0.4% of GDP. The current account deficit was around 1% of GDP despite lower export growth (18.4%) and higher import growth (34.3%) because of improvement in the invisibles account. It was during 2001-02 the current account showed a surplus to the tune of 0.7% of GDP (after a gap of 24 years). But again in 2004-05 there was current account deficit of 0.4% of GDP which rose to 1.1% in 2005-06. To adjust balance of payments, the government used both the stabilization and structural reforms during the last 17 years. But one thing is certain that our exports volume is no where near the imports volume. That is, we still import much greater than exports.

To adjust balance of payments, rupee was devalued by 18 to 19% in July 1991. In 1992-93 India adopted liberalized exchange rate management system (LERMS) under which the exporters had to surrender 40% of forex earnings to the government at the official rate. In the 1993-94, the government took back this condition and the exporters were free to convert 100% of their forex earnings at the market rate. The Reserve Bank of India, except to manage volatile situations, has been following market determined exchange rate system since 1993. This policy of flexibility and pragmatism has stood the test of time. In August 2007 the exchange rate of one US

dollar hovered around Rs.40 to 41.

II. *The Structural Reforms*

To tackle the problems on supply side management since July 1991 the Central Government had undertaken liberalizing Indian economy. The four important measures needing our considerations were:

- Trade and Capital Flows Reform
- Industrial Deregulation
- Public Enterprises Divestment and Reforms
- Financial Sector Reforms.

Trade and Capital Flows Reforms

To integrate (or globalize) the Indian economy with the world economy the Government has come out with the following reforms since July, 1991 :

- Devaluation of Indian Rupee by 18-19% and its subsequent depreciation against other leading currencies.
- Convertibility of the Rupee First on trade account and later on for all the transactions relating to current account.
- Liberalization of import regime. A large number of items of imports and exports were decanalised (earlier these items could be imported or exported only by the Government designated agency like STC, MMTC, NAFED and Others).
- Reduction in Custom Duties—Even before becoming the member of WTO, the Government resorted to reduction in custom tariff rate. The peak rate of import duty was reduced from 200% to 150% in the 1991-92 budget. In the subsequent budgets, these rates have constantly been lowered. In the 2007-08 budgets the peak rate has been brought down to 10%. Not only duties have been lowered but the prevailing duties have been rationalized too.
- Export Promotion Measures were given a new thrust. Establishment of export oriented units, Special Economic Zones (SEZs), Recognition of Export Houses/Trading Houses/Star Trading Houses, Duty Free Imports for exports under the Advance Licensing Scheme and coming to the rescue of exporters as and when required are some of the initiatives made after July 1991. In 2007, the Government has offered a package of Rs.1500 crore to the exporters to mitigate the impact of depreciating rupee.
- As part of package of external sector reforms the Foreign Direct Investment (FDI) flow have been liberalized. In many sectors of the economy the FDI limit has been raised to 74%. It has made our forex reserve quite healthy.

Industrial Deregulation

One of the basic reasons responsible for industrial stagnation during the 40 years since independence has been extensive bureaucratic regulation of the industrial sector. Industrial licensing and 'Inspector Raj' proved to be major obstacles. The economists like Jagdish Bhagwati and Padma Desai, Isher J. Ahluwalia and L K Jha have been highly critical of the then regulatory mechanism lengthy procedures, late decisions, not allowing capacity expansion; price controls and political and bureaucratic corruption were the features of the regulatory system.

As part of economic reforms following policy measures are being executed:

- Limit on the size of industrial units has been scrapped. The industrial firms can grow as they like to optimize their operations.
- Location policy has been simplified and liberalized.
- the requirement of licensing for all sectors (except 5 product categories) has been abolished.
- Reservation of industries for the public sector has been brought down from 17 to 3.

In brief, the Inspector Raj has gone and competition in place of protectionism is the new mantra of industrial development.

Public Enterprises Divestment and Reforms

To begin with, the public enterprises were thought as engine of self sustained growth, to attain commanding heights of the economy and to lead to technological advance. In the process it was not thought of them to generate economic surplus. Due to failure to generate internal resources these proved to be a burden on the public exchequer. As a part of economic reforms they have been granted greater autonomy to work efficiently. As a policy initiative they have to compete with private sector and the government will partly divest equity in them. As per an estimate, by 2005-06, the equity to the tune of Rs.49,214 crores was divested to public financial institutions, private sector companies, mutual funds and general public. In the first round only loss making units were to be divested. But the fact is that to make up budget deficit the Government is even selling shares of even profit making PSUs. The process of divestment has not been free of controversies. There are allegations that Hotel Centaur at Mumbai and BALCO have been offered to private corporates for peanuts. It must also be noted that outright privatization does not find favour of economists and others because of allocative efficiency and lack of effective anti trust laws.

Financial Sector Reforms

To support reforms in the economy an efficient, competitive and a vibrant financial system is a must. With this consideration, the Government set-up two committees under the Chairmanship of Mr. Narismhan namely, the Committee on the Financial System in 1991 and the Banking Sector Reforms in 1998.

During the past years, on the basis of the recommendations of the First

Committee following reforms were introduced in the financial sectors.

- (i) The quantum of statutory liquidity ratio (SLR) and cash reserve ratio (CRR) were steadily increased during 1980s to contain inflationary pressures occurring because of large budgetary deficits. The measure resulted into adverse impact on banks' profitability which pressurized them to levy higher interest rates on commercial advances. The RBI has been using SLR and CRR to check excess liquidity in the economy. In March, 2007, the CRR has raised to 6.5%.
- (ii) The RBI issued new norms for income recognition, classification of assets, provision for bad debts and capital adequacy. The minimum capital adequacy of 8% of the aggregate of the risk weighted assets were prescribed to be followed by March 1996 in accordance with the Basel Committee recommendations. It was increased to 9% to be attained by March 2000. At the end of March 2006 the CRR for nationalized banks stood at 12.3%, for new private sector banks at 12.6% and for foreign banks operating in India at 12.3%.
- (iii) To attain CRR norms the public sector banks received budgetary support amounting to Rs.20,046 crore. This being not sufficient, banks raised debt and went in for Initial Public Offers (IPOs) and Follow on Public Offers (FPOs) in the Capital Market.
- (iv) The Banks were required to prepare their balance sheets and profit and loss accounts in new formats w.e.f .the accounting year 1991-92 so as to reflect true and correct position.
- (v) Freedom to set-up new branches without the RBI approval was linked to attaining capital adequacy norms and adoption of new accounting standards.
- (vi) For setting up banks in the private sector the RBI issued guidelines to see that these banks were financially viable and there was no concentration of Credit and Crossholding with industrial houses. They were also required to adhere to priority sector lendings.
- (vii) The multi interest rates were reduced from 20 in 1989-90 to 2 in 1994-95. The objective behind it was to prevent cross-subsidization. The Banks now have freedom to decide their own interest rates.
- (viii) To strengthen supervision over banks, the RBI has established a new Board for Financial Supervision under the Chairmanship of a Deputy Governor. It looks after the implementation of the regulations with respect to credit management, asset classification, income recognition, provision for bad debts, capital adequacy and treasury operations.
- (ix) The management information system, the internal audit and control mechanisms have been improved, so as to monitor and improve bank's performance.

- (x) To improve debt recovery by the banks and other financial institutions, necessary Act was enacted in 1993. Special Recovery Tribunals have been set-up under the Act for faster recovery of loan arrears.
- (xi) The Banks have now more flexibility in determining permissible bank finance keeping in view the borrowers' needs.

With regard to the Second Committee, Banking Sector Reforms, Committee made the following recommendations :

- (i) The Banking sector to become strong and competitive should consolidate. It is because of this reason many weak banks have merged with the strong banks (IDBI took over United Western Bank; ICICI took over Sangli Bank; State Bank of India has been allowed to merge State Bank of Saurashtra; and Centurion Bank of Punjab to take over Lord Krishna Bank). The developmental financial institutions were permitted to convert into banks (ICICI became ICICI Bank, IDBI became IDBI Bank and even UTI started UTI Bank known as AXIS Bank).
- (ii) It suggested new norms for capital adequacy—10% minimum capital to CRR.
- (iii) For recapitalization the method of Budgetary support be avoided.
- (iv) Legal framework for credit recovery be further strengthened.
- (v) Net Non-Performing Assets (NPA) be brought down to 3% by 2002.
- (vi) There should be rationalization of branches and staff.
- (vii) The banks need to be depoliticised under the supervision of the RBI.
- (viii) The policy of licensing new private sector banks may be continued.
- (ix) Foreign banks may be allowed to set-up subsidiaries and Joint Ventures in India and be given national treatment with regard to branches and directed credit.
- (x) For regulation and supervision there should be one integrated agency named as Board for Financial Regulation and Supervision.

Strengthening the regulation and supervision of banks became particularly important in the aftermath of the South-East Asian crisis of 1996 which led to bank failures. Keeping in view the recommendation of the Committee, the Government undertook many measures :

- CRR was raised from 8% to 9%.
- Accounting norms were strengthened.
- Asset liability Management and Risk Management Guidelines were laid down.

- Enactment of securitization & Reconstruction of Financial Assets and Enforcement of Security Act was passed for efficient recovery of bank credit.

CRITICAL EVALUATION OF ECONOMIC REFORMS

The initiation of economic reforms has completed sixteen years and now it is the right time to critically appraise their impact on Indian economy. A look at the facts relating to inflation and fiscal deficit lead to the conclusion that the objectives behind the reforms have been achieved partially. The rate of inflation often goes out of hand. It is on August 18, 2007 that inflation rate came down below 4% after a gap of 15 months. The fiscal deficit of centre and the states in 2005-06 was as high as 7.4% of GDP. However, on the forex reserve front we are surely comfortable as it crossed \$ 200 billion in April, 2007 and around \$ 250 billion in October, 2007. In fact, our market is overflowing with forex inflows: net investments by FIIs were \$10.16 billion during Jan-Jun 2007 likewise FDI inflows touched \$19.53 billion in 2006-07 a very high increase over last year. Steady inflow of dollars, has naturally led to rupee appreciation subsequently in terms of the dollars.

On the GDP front, after a near stagnation in 1991-92 and 1992-93, the growth has picked up from 5.7% to 9%. In the first quarter of 2007-08 the GDP increased by 9.3% compared to April-June last year. The RBI expects it to be 8.5% in 2007-08 as against Chidambaram's estimate of 9%. Certainly, the industrial production, agricultural production and services, all the sectors have contributed to it. The services sector now contributes half of the GDP. However, the primary sector's growth rate is much below the overall GDP growth rate. The India shining story is on. The savings and investment rates have been modest. In 2006-07, the investment rate (provisional) crossed 35 per cent. A brief review of over all economic performance after 1991 is summarised under the various heads as under:

Economic Environment

India's economic performance has been impressive, averaging over 7% between 2001/02 and 2006/07 (fiscal year, April-March). Growth has been particularly rapid since 2003/04, averaging over 8.5%, with over 9% expected for 2006/07. The Government is aiming to sustain growth at between 8% and 10% per year over the longer term. Rapid economic growth has translated into an improvement in social indicators, including a decline in infant mortality, a reduction in the percentage of the population living below the poverty line and improvements in literacy, sanitation and access to clean water. This impressive performance is largely due to unilateral trade and structural reforms, which have been continued during the period. Growth has been led by the services sector, where liberalization has been most rapid. Manufacturing has also performed well, although further growth may be impeded by infrastructure and other constraints. In contrast, agricultural growth continues to be slow and erratic and dependent on the weather, causing considerable distress, especially among small and marginal farmers.

Recognizing the importance of continuing its economic reform and especially its trade aspects, India has pushed ahead with further reductions in the tariff: the overall applied Most Favoured Nation (MFN) rate fell from 32.3% to 15.8% between 2001/02

and 2006/07. There has also been simplification of the tariff, although it remains complex. The Government is targeting higher export growth in order to sustain India's high levels of economic growth and has put in place a complex set of schemes to reduce the anti-export bias of the trade regime for exporters.

Despite a gradual increase in total tax revenue since the previous Review, India's tax to GDP ratio is relatively low and seemingly insufficient to meet its developmental needs. Further public spending on infrastructure and social services is constrained by the Fiscal Responsibility and Budget Management (FRBM) Act, 2003, which requires India to reduce its fiscal and revenue deficits and to eliminate the revenue deficit by 31 March 2009. Private investment is also deterred by high real rates of interest, while foreign direct investment (FDI) at around 1% of GDP has remained disappointing. In order to meet its FRBM targets, the Government has introduced tax reform to improve collection and increase revenue. Expenditure reductions include further reform of the targeted public distribution system (TPDS) and a partial dismantling of administered pricing for petroleum. However, state-owned enterprises remain a considerable demand on government resources and the recent decision to "pause" privatization will have implications for future government support for these enterprises.

Trade And Investment Policy Framework

There have been no major changes to India's policy framework since its previous Review.

While trade policy making and implementation is the responsibility of the Central Government, through the Department of Commerce in the Ministry of Commerce and Industry, the Constitution gives exclusive or overlapping jurisdiction on a number of related areas to the states. This requires continuous interaction between the Central and state governments and in some cases, such as changes in the structure of indirect taxation and electricity tariffs and provision, has led to delays in reform. The Government also consults with other stakeholders when formulating trade policy, in several cases through a period of public comment for new legislation or policy documents.

Trade policy is articulated for a five-year period, with annual updates, through the Foreign Trade Policy. While the Foreign Trade Policy calls for a simplification of import procedures and reduction of import barriers, a major goal is to increase exports and use trade to generate employment. Export growth is to be facilitated through a range of schemes to "neutralize" duty on imported inputs used in exports; such schemes contribute to the complexity of India's trade regime. Measures to attract foreign investment have also been taken, including by increasing the number of sectors in which FDI is permitted and reducing sectoral restrictions.

While extending at least MFN treatment to all its trading partners, India has also signed a number of regional trade agreements (RTAs) to increase market access for its exports. Thus far, RTAs have been signed only with other developing countries, but India is also examining the possibility of signing economic cooperation agreements with some developed countries. Since its previous Review, India has signed an RTA with Singapore, an "early harvest" arrangement with Thailand and a

preferential agreement with Afghanistan. In addition, previous arrangements, including the Asia Pacific Trade Agreement (APTA), the South Asia Free Trade Area and the Bay of Bengal Initiative for Multi- sectoral, Technical and Economic Cooperation, have been amended or have come into force.

Foreign investment policy continues to be liberalized. Besides the measures noted above, efforts have also been made to streamline the approval and investment process, which was identified in a government report as a possible barrier to investment. Nevertheless, FDI remains far below its potential, at around 1% of GDP, suggesting that policy and infrastructural constraints need to be addressed.

Trade And Trade-Related Reforms

Import duties are among India's main trade instruments as well as an important source of tax revenues, accounting for around 17.5% of Central Government tax revenue. Applied MFN tariffs, especially for non-agricultural products, have continued to fall steadily, with the overall average currently at 15.8%. At 12.1% (14.1% including ad valorem equivalents), the average for non-agricultural products is considerably lower than the average for agricultural products, which is 40.8%. The growing gap between agricultural and non-agricultural tariffs has also raised dispersion in the tariff and the escalation pattern shows increasing de-escalation between unprocessed and semi-processed and in some cases between semi-processed and final products. With the exception of a few applied tariffs, which are at their corresponding bound rates, the difference between the bound and applied tariff rates is considerable. This difference gives the Government considerable scope to raise applied tariffs, scope that was used to raise tariffs for some agricultural products in recent years. Nonetheless, the overall trend in tariff rates continues to be downward; in its 2007/08 Budget, the Government announced a further reduction of the "peak rate" from 12.5% to 10%. Despite gradual reform over the years, the tariff remains complex: tariff changes are announced throughout the year and with numerous exemptions, a number of which are based on industrial use. The policy regarding tariff rate quotas remains unchanged since the previous Review.

India also offers tariff preferences under its regional trade agreement. However, apart from the agreement with Sri Lanka and preferences to LDC members of SAFTA, the preferences do not appear to be significant. The use of import restrictions has declined, with around 3.5% of tariff lines subject to such measures. Another 300 sensitive imports are monitored, while the policy with regard to state trading remains essentially unchanged since the previous Review.

India continues to be a major user of anti-dumping measures, although the number of investigations and measures in force have been in decline. The majority of initiations were targeted at chemicals, plastics, and rubber products; base metals; and textiles and clothing, and were aimed mainly at China, the EC, Chinese Taipei, and Korea. Safeguard measures were taken against one product, in addition to one taken specifically against products from China; no countervailing measures were taken during the review period. Steps are being taken to align national standards increasingly with international norms; currently, some 73% of national standards for which corresponding international standards exist, are aligned with these international norms. In general, national standards are subject to review every

five years to ensure that they keep up with international trends. Sanitary and Phytosanitary (SPS) procedures are also being streamlined, notably with the passage of the Food Safety and Standards Act in 2006 to consolidate 13 separate laws relating to SPS issues; in addition, a risk analysis process has been put in place since 2004. India is not a member of the WTO Agreement on Government Procurement. Its procurement policies have undergone reform, especially at the Central Government level, although preferences continue to be extended to certain items from the small-scale industry and from state-owned enterprises.

While import barriers have been falling, India's export regime continues to be complex. Export prohibitions and restrictions are largely unchanged since India's last Review. However, in order to reduce the anti-export bias inherent in India's import and indirect tax regime, a number of duty remission and exemption schemes are in place to facilitate exports. While a number of these schemes are open to all exporters who use imported inputs, several schemes are targeted at sectors such as electronics (hardware and software), agricultural products and services. Export processing zones, export-oriented units (which are now special economic zones (SEZs)) also offer tax holidays to investors. According to Ministry of Finance estimates, revenue forgone from such schemes was Rs 538 billion in 2006/07, with an additional Rs 21 billion estimated for the SEZs. The cost effectiveness of the schemes in generating incremental investment and employment is open to question. As many of the industries attracted, especially by the SEZs, appear to be capital intensive, it is not clear that this is the most effective way to create employment opportunities, especially for the less-skilled labour force. India also provides export assistance through export insurance and financing schemes by the Export-Import Bank of India.

Other Measures Affecting Trade

Along with trade policy reforms, internal reforms have concentrated on increasing competition and efficiency in the economy. Industrial policy reforms have concentrated on simplifying and reducing restrictions. Thus, the number of industries requiring compulsory industrial licensing for safety, environmental, and strategic reasons has been reduced from six to five, while the number of items reserved for production only by the small-scale sector has declined further, from 799 in 2001 to 326 in May 2006. The number of industries reserved for the public sector is unchanged.

Measures have been taken to simplify the tax structure, especially for indirect taxes, resulting in a substantial increase in revenue collection. Tax reforms have also been pursued to meet the fiscal deficit targets set by the FRBMA and include the introduction of a new value-added tax and an increase in the number of services subject to a service tax. The introduction of the VAT by all but one state opens the way for an eventual goods and services tax. India maintains an "excise" tax (CENVAT), which is a tax on manufacturing, but appears to have elements of a value-added tax as well: currently providing around 25% of Central Government tax revenue, the CENVAT remains the largest source of indirect tax revenue. In the longer run, further streamlining of India's various indirect taxes are planned so that the VAT, the CENVAT, and the services tax will be replaced by a broad-based goods and services tax.

Less progress has been made on reducing direct and indirect assistance to various sectors of the economy. Direct subsidies, it is estimated, accounted for around 1.4% of GDP in 2005/06, although a recent study for the Ministry of Finance suggested that explicit and implicit subsidies accounted for around 4.2% of GDP in 2003/04. The study also suggested that "merit" subsidies, including for education, health care, and research and development, were about 42% of this total. Most central government subsidies are destined for food, while other key subsidies include those for petroleum and fertilizer. The states also provide additional subsidies, especially for basic services such as education and health. Another element of subsidy is contained in price controls, which are basically unchanged since the previous Review, although the removal of the administered price mechanism has reduced the subsidy provided for petroleum products. Current price controls include minimum support prices for 25 major crops, fertilizers, and 74 bulk drugs and related formulations that remain controlled under the Drugs Price Control Order, 1995. Price controls also exist under the targeted public distribution system. In addition, the prices of certain services, such as electricity and water, may be fixed by state governments.

Efforts to increase competition have been aided by the introduction of new legislation to encourage competition and to ease the closure of unviable companies. This includes the passage of a new Competition Law, and a Micro, Small and Medium Enterprises Act, passed in 2006 to encourage the development of these businesses. To tackle the problem of "industrial sickness" especially in the public sector, a Bill, introduced in Parliament in 2003, was passed but not yet implemented due to delays in setting up a National Company Law Tribunal to replace the Board for Industrial and Financial Restructuring (BIFR). Progress has been made in improving corporate governance, notably through improved listing requirements for listed companies and banks; in addition, efforts are under way to amend the Companies Act, 1956, to increase transparency and accountability.

Public sector reform, on the other hand, has been delayed by a decision in July 2006 to keep all decisions on disinvestment in state-owned enterprises on hold pending a review; consequently, the privatization programme has effectively stopped. The policy of the current Government before this decision was to list large profitable SOEs on domestic stock exchanges, while retaining a majority shareholding.

The main changes in protection of intellectual property rights include the passage of new legislation on patents, aimed at bringing Indian legislation in line with the TRIPS Agreement, and the establishment of a new Geographical Indications Registry in 2003. Steps are also continuing to improve enforcement of intellectual property rights including through increased seizures of infringing materials, and fines, although apart from copyright infringement, there are few data available on enforcement.

Sectoral policies

Agriculture

The share of agriculture and allied activities in India's GDP continued to decline during the period under review, from some 23% in 2000/01 to 18% in 2005/06. However, the sector employs around 60% of the working population, suggesting that labour productivity is only around one-sixth of its level in the rest of the economy.

Low productivity is due in part to fragmented landholdings, low mechanization levels, and dependence on rainfall, but also because public investment in infrastructure and research has been inadequate due to crowding out by spending on direct and indirect subsidies to the sector. Food security remains a major concern and a cause for much of the continued government intervention in the sector. This includes minimum support prices for 25 essential commodities, minimum intervention prices for other crops, subsidies for inputs, such as fertilizers, water, electricity, and seeds, and high import tariffs, averaging 40.8%. The Government also ensures distribution of certain foods at subsidized prices to poorer households through the "targeted public distribution system".

Manufacturing

In 2005/06, manufacturing accounted for 16% of GDP. Its share has remained at 15% to 16% since 2000/01. Growth in the sector has been rapid, on average almost 7% per year since 2000/01; this can be attributed, in part, to continued structural reforms and a relaxation in licensing and FDI restrictions. The sector, however, continues to be protected by relatively high tariff barriers, especially in textiles and clothing (22.5), and automobiles (33.6%). In addition, imports of second-hand motor vehicles are subject to licensing requirements. Further growth in manufacturing is hampered also by a lack of infrastructure and labour market rigidities.

Services

Services have been the main engine of growth in recent years. Average annual growth over the last four years has been 9.8%, largely due to greater progress in reform, especially for certain services. Reforms in banking include further relaxation of foreign investment limits and steps to align prudential requirements with international practice. Measures have also been adopted to improve governance in banks and to prepare the sector for implementing the Basel II capital adequacy framework. As a result, there has been a decline in the ratio of non-performing loans (NPLs) for most segments, although rural banks and rural cooperatives continue to suffer from high exposure to NPLs. Efforts to create a well-functioning capital market are being pursued by the Securities and Exchange Board of India, the regulator of the securities market.

Infrastructure remains a major bottleneck. In sectors such as telecommunications, where the market has been exposed to competition, there have been significant benefits to consumers, including through increased penetration, especially of mobile telephony, and a decline in tariffs. Progress has also been made in improving the transport infrastructure, especially road transport, where the network of national highways is being expanded. Although rail transport is one of three activities reserved for the public sector, private-public partnerships are being encouraged in some areas, for example, such as freight transport and railway infrastructure development. Liberalization has also taken place in air transport, resulting in an expansion in the number of airline operators and a decline in prices; foreign investment restrictions have also been relaxed (up to 49% of total equity is permitted), although foreign airlines are forbidden from investing in the sector. In contrast, maritime transport and port services continue to suffer from inefficiencies and constitute a major impediment to trade. Another major constraint on economic activity is the energy sector, where there are frequent shortages of supply and little

progress appears to have been made in tackling the losses of state electricity boards, and transmission and distribution losses.

GLOBALIZATION AND ITS IMPACT ON INDIAN ECONOMY

Globalization has become an expression of common usage. While to some, it represents a brave new world with no barriers, for some others, it spells doom and destruction. It is, therefore, necessary to have a clear understanding of what globalization means and what it stands for, if we have to deal with a phenomenon that is willy-nilly gathering momentum.

Globalization Meaning

Broadly speaking, the term 'globalization' means integration of economies and societies through cross country flows of information, ideas, technologies, goods, services, capital, finance and people. Cross border integration can have several dimensions – cultural, social, political and economic. In fact, some people fear cultural and social integration even more than economic integration. The fear of "cultural hegemony" haunts many. Limiting ourselves to economic integration, one can see this happen through the three channels of (a) trade in goods and services, (b) movement of capital and (c) flow of finance. Besides, there is also the channel through movement of people.

Historical Development

Globalization has been a historical process with ebbs and flows. During the Pre-World War I period of 1870 to 1914, there was rapid integration of the economies in terms of trade flows, movement of capital and migration of people. The growth of globalization was mainly led by the technological forces in the fields of transport and communication. There were less barriers to flow of trade and people across the geographical boundaries. Indeed there were no passports and visa requirements and very few non-tariff barriers and restrictions on fund flows. The pace of globalization, however, decelerated between the First and the Second World War. The inter-war period witnessed the erection of various barriers to restrict free movement of goods and services. Most economies thought that they could thrive better under high protective walls. After World War II, all the leading countries resolved not to repeat the mistakes they had committed previously by opting for isolation. Although after 1945, there was a drive to increased integration, it took a long time to reach the Pre-World War I level. In terms of percentage of exports and imports to total output, the US could reach the pre-World War level of 11 per cent only around 1970. Most of the developing countries which gained Independence from the colonial rule in the immediate Post-World War II period followed an import substitution industrialization regime. The Soviet bloc countries were also shielded from the process of global economic integration. However, times have changed. In the last two decades, the process of globalization has proceeded with greater vigour. The former Soviet bloc countries are getting integrated with the global economy. More and more developing countries are turning towards outward oriented policy of growth. Yet, studies point out that trade and capital markets are no more globalized today than they were at the end of the 19th century. Nevertheless, there are more concerns about globalization now than before because of the nature and speed of transformation. What is striking in the current episode is not only the rapid pace but

also the enormous impact of new information technologies on market integration, efficiency and industrial organization. Globalization of financial markets has far outpaced the integration of product markets.

Gains from Globalization

The gains from globalization can be analyzed in the context of the three types of channels of economic globalization identified earlier.

1. Trade in Goods and Services

According to the standard theory, international trade leads to allocation of resources that is consistent with comparative advantage. This results in specialization which enhances productivity. It is accepted that international trade, in general, is beneficial and that restrictive trade practices impede growth. That is the reason why many of the emerging economies, which originally depended on a growth model of import substitution, have moved over to a policy of outward orientation. However, in relation to trade in goods and services, there is one major concern. Emerging economies will reap the benefits of international trade only if they reach the full potential of their resource availability. This will probably require time. That is why international trade agreements make exceptions by allowing longer time to developing economies in terms of reduction in tariff and non-tariff barriers. "Special and differentiated treatment", as it is very often called has become an accepted principle.

2. Movement of Capital

Capital flows across countries have played an important role in enhancing the production base. This was very much true in 19th and 20th centuries. Capital mobility enables the total savings of the world to be distributed among countries which have the highest investment potential. Under these circumstances, one country's growth is not constrained by its own domestic savings. The inflow of foreign capital has played a significant role in the development in the recent period of the East Asian countries. The current account deficit of some of these countries had exceeded 5 per cent of the GDP in most of the period when growth was rapid. Capital flows can take either the form of foreign direct investment or portfolio investment. For developing countries the preferred alternative is foreign direct investment. Portfolio investment does not directly lead to expansion of productive capacity. It may do so, however, at one step removed. Portfolio investment can be volatile particularly in times of loss of confidence. That is why countries want to put restrictions on portfolio investment. However, in an open system such restrictions cannot work easily.

3. Financial Flows

The rapid development of the capital market has been one of the important features of the current process of globalization. While the growth in capital and foreign exchange markets have facilitated the transfer of resources

across borders, the gross turnover in foreign exchange markets has been extremely large. It is estimated that the gross turnover is around \$ 1.5 trillion per day worldwide (Frankel, 2000). This is of the order of hundred times greater than the volume of trade in goods and services. Currency trade has become an end in itself. The expansion in foreign exchange markets and capital markets is a necessary pre-requisite for international transfer of capital. However, the volatility in the foreign exchange market and the ease with which funds can be withdrawn from countries have created often times panic situations. The most recent example of this was the East Asian crisis. Contagion of financial crises is a worrying phenomenon. When one country faces a crisis, it affects others. It is not as if financial crises are solely caused by foreign exchange traders. What the financial markets tend to do is to exaggerate weaknesses. Herd instinct is not uncommon in financial markets. When an economy becomes more open to capital and financial flows, there is even greater compulsion to ensure that factors relating to macro-economic stability are not ignored. This is a lesson all developing countries have to learn from East Asian crisis. As one commentator aptly said "The trigger was sentiment, but vulnerability was due to fundamentals".

IMPACT OF GLOBALISATION

On the impact of globalization, there are two major concerns. These may be described as even fears. Under each major concern there are many related anxieties. The first major concern is that globalization leads to a more iniquitous distribution of income among countries and within countries. The second fear is that globalization leads to loss of national sovereignty and that countries are finding it increasingly difficult to follow independent domestic policies. These two issues have to be addressed both theoretically and empirically.

The argument that globalization leads to inequality is based on the premise that since globalization emphasizes efficiency, gains will accrue to countries which are favourably endowed with natural and human resources. Advanced countries have had a head start over the other countries by at least three centuries. The technological base of these countries is not only wide but highly sophisticated. While trade benefits all countries, greater gains accrue to the industrially advanced countries. This is the reason why even in the present trade agreements, a case has been built up for special and differential treatment in relation to developing countries. By and large, this treatment provides for longer transition periods in relation to adjustment. However, there are two changes with respect to international trade, which may work to the advantage of the developing countries. First, for a variety of reasons, the industrially advanced countries are vacating certain areas of production. These can be filled in by developing countries. A good example of this is what the East Asian countries did in the 1970s and 1980s. Second, international trade is no longer determined by the distribution of natural resources. With the advent of information technology, the role of human resources has emerged as more important. Specialized human skills will become the determining factor in the coming decades. Productive activities are becoming "knowledge intensive" rather than "resource intensive". While there is a divide between developing and the advanced countries even in this area – some people call it the digital divide - it is a gap which can be bridged. A globalized economy with increased specialization can lead to improved

productivity and faster growth. What will be required is a balancing mechanism to ensure that the handicaps of the developing countries are overcome.

Apart from the possible iniquitous distribution of income among countries, it has also been argued that globalization leads to widening income gaps within the countries as well. This can happen both in the developed and developing economies. The argument is the same as was advanced in relation to iniquitous distribution among countries. Globalization may benefit even within a country those who have the skills and the technology. The higher growth rate achieved by an economy can be at the expense of declining incomes of people who may be rendered redundant. In this context, it has to be noted that while globalization may accelerate the process of technology substitution in developing economies, these countries even without globalization will face the problem associated with moving from lower to higher technology. If the growth rate of the economy accelerates sufficiently, then part of the resources can be diverted by the state to modernize and re-equip people who may be affected by the process of technology up gradation.

The second concern relates to the loss of autonomy in the pursuit of economic policies. In a highly integrated world economy, it is true that one country cannot pursue policies, which are not in consonance with the worldwide trends. Capital and technology are fluid and they will move where the benefits are greater. As the nations come together whether it be in the political, social or economic arena, some sacrifice of sovereignty is inevitable. The constraints of a globalised economic system on the pursuit of domestic policies have to be recognised. However, it need not result in the abdication of domestic objectives.

Another fear associated with globalization is insecurity and volatility. When countries are inter-related strongly, a small spark can start a large conflagration. Panic and fear spread fast. The downside to globalization essentially emphasizes the need to create countervailing forces in the form of institutions and policies at the international level. Global governance cannot be pushed to the periphery, as integration gathers speed.

Empirical evidence on the impact of globalization on inequality is not very clear. The share in aggregate world exports and in world output of the developing countries has been increasing. In aggregate world exports, the share of developing countries increased from 20.6 per cent in 1988-90 to 29.9 per cent in 2000. Similarly the share in aggregate world output of developing countries has increased from 17.9 per cent in 1988-90 to 40.4 per cent in 2000. The growth rate of the developing countries both in terms of GDP and per capita GDP has been higher than those of the industrial countries. These growth rates have been in fact higher in the 1990s than in the 1980s. All these data do not indicate that the developing countries as a group have suffered in the process of globalization. In fact, there have been substantial gains. But within developing countries, Africa has not done well and some of the South Asian countries have done better only in the 1990s. While the growth rate in per capita income of the developing countries in the 1990s is nearly two times higher than that of industrialized countries, in absolute terms the gap in per capita income has widened. As for income distribution within the countries, it is difficult to judge whether globalization is the primary factor responsible for any deterioration in the distribution of income. We have had considerable controversies in our country on what happened to the poverty ratio in the second half of 1990s. Most analysts even

for India would agree that the poverty ratio has declined in the 1990s. Differences may exist as to what rate at which this has fallen. Nevertheless, whether it is in India or any other country, it is very difficult to trace the changes in the distribution of income within the countries directly to globalization.

India's Stance

What should be India's attitude in this environment of growing globalization? At the outset it must be mentioned that opting out of globalization is not a viable choice. There are at present 149 members in the World Trade Organisation (WTO). Some 25 countries are waiting to join the WTO. China has recently been admitted as a member. What is needed is to evolve an appropriate framework to wrest maximum benefits out of international trade and investment. This framework should include making explicit the list of demands that India would like to make on the multilateral trade system, and steps that India should take to realize the full potential from globalization.

Demands on the Trading System

Without being exhaustive, the demands of the developing countries on the multilateral trading system should include

- (1) establishing symmetry as between the movement of capital and natural persons,
- (2) delinking environmental standards and labour related considerations from trade negotiations,
- (3) zero tariffs in industrialized countries on labour intensive exports of developing countries,
- (4) adequate protection to genetic or biological material and traditional knowledge of developing countries,
- (5) prohibition of unilateral trade action and extra territorial application of national laws and regulations, and
- (6) effective restraint on industrialized countries in initiating anti-dumping and countervailing action against exports from developing countries.

The purpose of the new trading system must be to ensure "free and fair" trade among countries. The emphasis so far has been on "free" rather than "fair" trade. It is in this context that the rich industrially advanced countries have an obligation. They have often indulged in "double speak". While requiring developing countries to dismantle barriers and join the main stream of international trade, they have been raising significant tariff and non-tariff barriers on trade from developing countries. Very often, this has been the consequence of heavy lobbying in the advanced countries to protect 'labour'. Although average tariffs in the United States, Canada, European Union and Japan – the so called Quad countries – range from only 4.3 per cent in Japan to 8.3 per cent in Canada, their tariff and trade barriers remain much higher on many products exported by developing countries. Major agricultural food products such as meat, sugar and dairy products attract tariff rates exceeding 100

per cent. Fruits and vegetables such as bananas are hit with a 180 per cent tariff by the European Union, once they exceed quotas. The tariffs collected by the US on \$ 2 billion worth of imports from Bangladesh are higher than those imposed on imports worth \$ 30 billion from France. In fact, these trade barriers impose a serious burden on the developing countries. It is important that if the rich countries want a trading system that is truly fair, they should come forward to reduce the trade barriers and subsidies that prevent the products of developing countries from reaching their markets. Otherwise the pleas of these countries for a competitive system will sound hollow.

To some extent, conflicts among countries on trade matters are endemic. Until recently, agriculture was a major bone of contention between U.S. and E.U. countries. Frictions are also bound to arise among developing countries as well. When import tariffs on edible oil were increased in India, the most severe protest came from Malaysia which was a major exporter of Palm Oil. Entrepreneurs in India complain of cheaper imports from China. In the export of rice, a major competitor of India is Thailand. If development is accepted as the major objective of trade as the Doha declaration proclaimed, it should be possible to work out a trading arrangement that is beneficial to all countries.

There have been protracted negotiations at WTO in reforming the trade system. Admittedly, the tariff and non-tariff barriers are coming down. However, there are apprehensions that the concerns of developing countries are not being addressed adequately. Looked at from this angle, the recent Hong Kong Ministerial is a modest success. Despite reservations, we must acknowledge that it is a step forward. Domestic support to agriculture by developed countries constitutes a major stumbling block to third world trade expansion. However, India's stand in relation to agriculture has been 'defensive'. India is not a major player in the world agricultural market. The impact of what has been accepted in relation to Non-Agricultural Market Access and services will vary from country to country. Despite some contrarian opinion, the gain to India from services can be significant. However, the Hong Kong Ministerial is only a broad statement of intentions. Much will depend upon how these ideas are translated into concrete actions.

The second set of measures that should form part of the action plan must relate to strengthening India's position in international trade. India has many strengths, which several developing countries lack. In that sense, India is different and is in a stronger position to gain from international trade and investment. India's rise to the top of the IT industry in the world is a reflection of the abundance of skilled manpower in our country. It is, therefore, in India's interest to ensure that there is a greater freedom of movement of skilled manpower. At the same time, India should attempt to take all efforts to ensure that we continue to remain a frontline country in the area of skilled manpower. India can attract greater foreign investment, if we can accelerate our growth with stability. Stability, in this context, means reasonable balance on the fiscal and external accounts. We must maintain a competitive environment domestically so that we can take full advantage of wider market access. India must make good use of the extended time given to developing countries to dismantle trade barriers. Wherever legislations are required to protect sectors like agriculture, they need to be enacted quickly. In fact, we had taken a long time to pass the Protection of Plant Varieties and Farmers' Rights Act. We must also be active in ensuring that

our firms make effective use of the new patent rights. South Korea has been able to file in recent years as many as 5000 patent applications in the United States whereas in 1986, the country filed only 162. China has also been very active in this area. We need a truly active agency in India to encourage Indian firms to file patent applications. In effect, we must build the complementary institutions necessary for maximizing the benefits from international trade and investment.

Changes in the foreign trade and foreign investment policies have altered the environment in which Indian industries have to operate. The path of transition is, no doubt, difficult. A greater integration of the Indian economy with the rest of the world is unavoidable. It is important that Indian industry be forward looking and get organized to compete with the rest of the world at levels of tariff comparable to those of other developing countries. Obviously, the Indian Government should be alert to ensure that Indian industries are not the victims of unfair trade practices. The safeguards available in the WTO agreement must be fully utilized to protect the interests of Indian industries.

Indian industry has a right to demand that the macro economic policy environment should be conducive to rapid economic growth. The configuration of policy decisions in the recent period has been attempting to do that. It is, however, time for Indian industrial units to recognize that the challenges of the new century demand greater action at the enterprise level. They have to learn to swim in the tempestuous waters of competition and away from the protected waters of the swimming pools. India is no longer a country producing goods and services for the domestic market alone. Indian firms are becoming and have to become global players. At the minimum, they must be able to meet global competition. The search for identifying new competitive advantages must begin earnestly. India's ascendancy in Information Technology (IT) is only partly by design. However, it must be said to the credit of policy makers that once the potential in this area was discovered, the policy environment became strongly industry friendly.

Over a wide spectrum of activities, India's advantage, actual and that which can be realized in a short span of time must be drawn up. Of course, in a number of cases, it will require building plants on a global scale. But, this need not necessarily be so in all cases. In fact the advent of IT is modifying the industrial structure. The revolution in telecommunications and IT is simultaneously creating a huge single market economy, while making the parts smaller and more powerful. What we need today is a road map for the Indian industry. It must delineate the path different industries must take to achieve productivity and efficiency levels comparable to the best in the world.

Globalization, in a fundamental sense, is not a new phenomenon. Its roots extend farther and deeper than the visible part of the plant. It is as old as history, starting with the great migrations of people across the great landmasses. Only recent developments in computer and communication technologies have accelerated the process of integration, with geographic distances becoming less of a factor. Is this 'end of geography' a boon or a bane? Borders have become porous and the sky is open. With modern technologies which do not recognize geography, it is not possible to hold back ideas either in the political, economic or cultural spheres. Each country

must prepare itself to meet the new challenges so that it is not being bypassed by this huge wave of technological and institutional changes.

Nothing is an unmixed blessing. Globalization in its present form though spurred by far reaching technological changes is not a pure technological phenomenon. It has many dimensions including ideological. To deal with this phenomenon, one must understand the gains and losses, the benefits as well as dangers. To be forewarned, as the saying goes, is to be forearmed. But one should not throw the baby with bath water. One should also resist the temptation to blame globalization for all our failures. Most often, as the poet said, the fault is in ourselves.

Risks of an open economy are well known. We must not, nevertheless, miss the opportunities that the global system can offer. As an eminent critic put it, the world cannot marginalize India. But India, if it chooses, can marginalize itself. We must guard ourselves against this danger. More than many other developing countries, India is in a position to wrest significant gains from globalization. However, we must voice our concerns and in cooperation with other developing countries modify the international trading arrangements to take care of the special needs of such countries. At the same time, we must identify and strengthen our comparative advantages. It is this two-fold approach which will enable us to meet the challenges of globalization which may be the defining characteristic of the new millennium.

The key to India's growth lies in improving productivity and efficiency. This has to permeate all walks of our life. Contrary to the general impression, the natural resources of our country are not large. India accounts for 16.7 per cent of world's population whereas it has only 2.0 per cent of world's land area. While China's population is 30 per cent higher than that of India's, it has a land area which is three times that of India. In fact, from the point of view of long-range sustainability, the need for greater efficiency in the management of natural resources like land, water and minerals has become urgent. In a capital-scarce economy like ours, efficient utilization of our capacity becomes even more critical. For all of these things to happen, we need well-trained and highly skilled people. In the world of today, competition in any field is competition in knowledge. That is why we need to build institutions of excellence.

CONCEPT OF WORLD TRADE ORGANIZATION (WTO)-AN OVERVIEW

Origin of WTO

The WTO came into effect on 1 January 1995, but its trading system is half a century older. Since 1948, the General Agreement on Tariffs and Trade (GATT) had provided the rules for the system.

From 1948 to 1994, the General Agreement on Tariffs and Trade (GATT) provided the rules for much of world trade and presided over periods that saw some of the highest growth rates in international commerce. It seemed well established, but throughout those 47 years, it was a provisional agreement and organization.

The original intention was to create a third institution to deal with handle the trade side of international economic cooperation, joining the two "Bretton Woods" institutions, the World Bank and the International Monetary Fund.

Over 50 countries participated in negotiations to create an International Trade Organization (ITO) as a specialized agency of the United Nations. The draft ITO Charter was ambitious. It extended beyond world trade disciplines, to include rules on employment, commodity agreements, restrictive business practices, international investment, and services. The aim was to create the ITO at a UN Conference on Trade and Employment in Havana, Cuba in 1947.

Meanwhile, 15 countries had begun talks in December 1945 to reduce and bind customs tariffs. With the Second World War only recently ended, they wanted to give an early boost to trade liberalization, and to begin to correct the legacy of protectionist measures which remained in place from the early 1930s.

This first round of negotiations resulted in a package of trade rules and tariff concessions. The group had expanded to 23 by the time the deal was signed on 30 October 1947. The tariff concessions came into effect by 30 June 1948 through a "Protocol of Provisional Application". Hence the new General Agreement on Tariffs and Trade was born, with 23 founding members ("contracting parties").

The Havana conference began on 21 November 1947, less than a month after GATT was signed. The ITO Charter was finally agreed in Havana in March 1948, but ratification in some national legislatures proved impossible.

In the early years, the GATT trade rounds concentrated on further reducing tariffs. Then, the Kennedy Round in the mid-sixties brought about a GATT Anti-Dumping Agreement and a section on development. The Tokyo Round during the seventies was the first major attempt to tackle trade barriers that do not take the form of tariffs, and to improve the system. The eighth, the Uruguay Round of 1986-94, was the last and most extensive of all. It led to the WTO and a new set of agreements.

The seeds of the Uruguay Round were sown in November 1982 at a ministerial meeting of GATT members in Geneva. Although the ministers intended to launch a major new negotiation, the conference stalled on agriculture and was widely regarded as a failure. In fact, the work programme that the ministers agreed formed the basis for what was to become the Uruguay Round negotiating agenda.

Nevertheless, it took four more years of exploring, clarifying issues and painstaking consensus-building, before ministers agreed to launch the new round. They did so in September 1986, in Punta del Este, Uruguay. They eventually accepted a negotiating agenda that covered virtually every outstanding trade policy issue. Two years later, in December 1988, ministers met again in Montreal, Canada. A considerable amount of technical work continued, leading to the first draft of a final legal agreement. This draft "Final Act" was compiled by the then GATT director-general, Arthur Dunkel. It was put on the table in Geneva in December 1991. Presently, there are 149 members of WTO.

The World Trade Organization (WTO) deals with the rules of trade between nations at a global or near-global level. There are a number of ways of looking at the WTO. It may be looked upon as an organization for liberalizing trade; a forum for governments to negotiate trade agreements and settle trade disputes. Above all, it's a negotiating forum. The WTO is essentially a place where member governments try to sort out the trade problems they face with each other.

Rule Based Trading System

WTO is a set of rules and at its heart are the WTO agreements, negotiated and signed by the number of trading nations of the world. These documents provide the legal ground-rules for international commerce. They are essentially contracts, binding governments to keep their trade policies within agreed limits. Although negotiated and signed by governments, the goal of WTO is to help producers of goods and services and exporters to conduct their business, while allowing governments to meet social and environmental objectives.

Objective of WTO

The overriding purpose of WTO is to help trade flow as freely as possible, long as there are no undesirable side-effects, because this is important for economic development and well-being. It also means ensuring that individuals, companies and governments know what the trade rules are around the world, and giving them the confidence that there will be no sudden changes of policy.

WTO also helps trading members to settle disputes. Trade relations often involve conflicting interests. Agreements, including those negotiated in the WTO system, often need interpretation. The most harmonious way to settle these differences is through some neutral procedure based on an agreed legal foundation. The dispute settlement process provided under WTO agreements, meets these parameters.

Principles of WTO Trading System

The WTO agreements are lengthy and complex because they are legal texts covering a wide range of activities. They deal with, agriculture, textiles and clothing, banking, telecommunications, government purchases, industrial standards and product safety, food, sanitation regulations, intellectual property, and much more. But a number of simple, fundamental principles run through all these documents. The principles which are the foundation of the WTO trading system, include :

1. *Most-favoured-nation (MFN)* : Under the WTO agreements, countries cannot normally discriminate between their trading partners. A member of WTO granting someone a special favour (such as lower customs duty rate for one of their products) and such member has to do the same for all other WTO members. This principle is known as most-favoured-nation (MFN) treatment. It is so important that it is the first article of the General Agreement on Tariffs and Trade (GATT), which governs trade in goods. MFN is also a priority in the General Agreement on Trade in Services

(GATS) (Article 2) and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) (Article 4), although in each agreement the principle has been dealt with slightly differently. These three agreements together cover all three main areas of trade dealt with by the WTO.

WTO, however, allows some exceptions to MFN Principle. It allows countries to set up a free trade agreement that applies only to goods traded within the group — discriminating against goods from outside. They can give developing countries special access to their markets or can raise barriers against products that are considered to be traded unfairly from specific countries. In services, countries are allowed, in limited circumstances, to discriminate. The agreements permit these exceptions only under strict conditions. In general, MFN means that every time a country lowers a trade barrier or opens up a market, it has to do so for the same goods or services from all its trading partners, whether rich or poor, weak or strong.

2. *National treatment* : Treating foreigners and locals equally. Imported and locally-produced goods should be treated equally at least after the foreign goods enter the market. The same should apply to foreign and domestic services, and to foreign and local trademarks, copyrights and patents. This principle of "national treatment" (giving others the same treatment as one's own nationals) is also found in all the three main WTO agreements (Article 3 of GATT, Article 17 of GATS and Article 3 of TRIPS), although once again the principle has been dealt with slightly differently in each of these areas.

National treatment only applies once a product, service or item of intellectual property entered the market. Therefore, charging customs duty on an import is not a violation of national treatment even if locally-produced products are not charged an equivalent tax.

3. *Freer Trade* : Lowering trade barriers is one of the most obvious means of encouraging trade. The barriers include customs duties (or tariffs) and measures such as import bans or quotas that restrict quantities selectively. The WTO agreements allow countries to introduce changes gradually, through "progressive liberalization". Developing countries are usually given longer time to fulfil their obligations.
4. *Predictability* : With stability and predictability, investment is encouraged, jobs are created and consumers can fully enjoy the benefits of competition (choice and lower prices). The WTO trading system is an attempt to make the business environment stable and predictable.

In the WTO, when countries agree to open their markets for goods or services, they "bind" their commitments. For goods, these bindings amount to ceilings on customs tariff rates. Sometimes countries tax imports at rates that are lower than the bound rates. A country can change its bindings, but only after negotiating with its trading partners, which could mean compensating them for loss of trade.

The system tries to improve predictability and stability in other ways as well. One way is to discourage the use of quotas and other measures used to set limits on quantities of imports. Another is to make countries' trade rules as clear and public ("transparent") as possible. Many WTO agreements require governments to disclose their policies and practices publicly within the country or by notifying the WTO. The regular surveillance of national trade policies through the Trade Policy Review Mechanism provides a further means of encouraging transparency both domestically and at the multilateral level.

5. *Promoting Fair Competition* : The WTO is sometimes described as a "free trade" institution, but that is not entirely accurate. The system does allow tariffs and, in limited circumstances, other forms of protection. More accurately, it is a system of rules dedicated to open, fair and undistorted competition.

The rules on non-discrimination and national treatment are designed to secure fair conditions of trade. So too are those on dumping (exporting at below cost to gain market share) and subsidies. Since the issues are complex, the WTO rules try to establish what is fair or unfair, and how governments can respond, in particular by charging additional import duties calculated to compensate for damage caused by unfair trade. Many of the other WTO agreements aim to support fair competition. The agreement on government procurement extends competition rules to purchases by thousands of government entities in many countries.

6. *Reciprocity* : It reflects both a desire to limit the scope of free riding that may arise because of the MFN rule, and a desire to obtain better access to foreign markets. A related point is that for a nation to negotiate, it is necessary that the gain from doing so be greater than the gain available from unilateral liberalization; reciprocal concessions intend to ensure that such gains will materialize.
7. *Binding and Enforceable Commitments* : The tariff commitments made by WTO members in a multilateral trade negotiation and on accession are enumerated in a schedules (list) of concessions. These schedules establish "ceiling bindings": a country can change its bindings, but only after negotiating with its trading partners, which could mean compensating them for loss of trade. If satisfaction is not obtained, the complaining country may invoke the WTO dispute settlement procedures.
8. *Transparency* : The WTO members are required to publish their trade regulations, to maintain institutions allowing for the review of administrative decisions affecting trade, to respond to requests for information by other members, and to notify changes in trade policies to the WTO. These internal transparency requirements are supplemented and facilitated by periodic country-specific reports (trade policy reviews) through the Trade Policy Review Mechanism (TPRM). The WTO system tries also to improve predictability and stability, discouraging the use of [quota](#) and other measures used to set limits on quantities of imports.

Governance of WTO

Top Level

The WTO is governed by a Ministerial Conference, which meets every two years; a General Council, which implements the conference's policy decisions and is responsible for day-to-day administration; and a director-general, who is appointed by the Ministerial Conference. The WTO's headquarters are in Geneva, Switzerland. The Ministerial Conference can make decisions on all matters under any of the multilateral trade agreements.

Second Level

The daily work of the ministerial conference is handled by three groups: the General Council, the Dispute Settlement Body, and the Trade Policy Review Body. All three consist of the same membership - representatives of all WTO members - but each meets under different rules.

1. *The General Council* : The General Council is the WTO's highest-level decision-making body in Geneva which meets regularly to carry out the functions of the WTO. It has representatives (usually ambassadors or equivalent) from all member governments and has the authority to act on behalf of the ministerial conference which only meets about every two years. The council acts on behalf on the Ministerial Council on all of the WTO affairs.
2. *The Dispute Settlement Body* : This body is made up of all member governments, usually represented by ambassadors or equivalent.
3. *Trade Policy Review Body* : The WTO General Council meets as the Trade Policy Review Body (TPRB) to undertake trade policy reviews of members under the TRPM. The TPRB is thus open to all WTO Members.

Third Level

The Councils for Trade work under the General Council. There are three Councils- Council for Trade in Goods, Council for Trade-Related Aspects of Intellectual Property Rights, and Council for Trade in Services - each council works in different fields. Apart from these three councils, six other bodies report to the General Council reporting on issues such as trade and development, the environment, regional trading arrangements and administrative issues —

1. *Council for Trade in Goods* — The workings of the General Agreement on Tariff and Trade (GATT) which covers international trade in goods, are the responsibility of the Council for Trade in Goods. It is made up of representatives from all WTO member countries
2. *Council for Trade — related Aspects of Intellectual Property Rights* - It deal with information on intellectual property in the WTO, news and official records of the activities of the TRIPS Council, and details of the WTO's work with other international organizations in the field.
3. *Council for Trade in Services* — The Council for Trade in Services operates under the guidance of the General Council and is responsible for overseeing

the functioning of the General Agreement on Trade in Services (GATS). It is open to all WTO members, and can create subsidiary bodies as required.

Fourth level : Subsidiary Bodies

There are subsidiary bodies under each of the three councils.

1. *The Goods Council – subsidiary* : The Goods Council works under the Council for Trade in Goods. It has 11 committees consisting of all member countries, dealing with specific subjects such as agriculture, market access, subsidies, anti-dumping measures and so on.
2. *The Services Council- subsidiary*: It works under the Council for Trade in Services which deals with financial services, domestic regulations and other specific commitments.
3. *Dispute Settlement panels and Appellate Body*: It is the subsidiary under the Dispute Settlement Body to resolve disputes and the Appellate Body to deal with appeals.

Other committees : There are other Committees also such as Committees on Trade and Environment, Trade and Development (Subcommittee on Least-Developed Countries), Regional Trade Agreements, Balance of Payments Restrictions, Budget, Finance and Administration, Working Parties on Accession, Working groups on, Trade, debt and finance, Trade and technology transfer to deal with different aspects of trade , payments etc.

WTO Working Mechanism

The WTO operates on a *one country, one vote* system, but actual votes have never been taken. Decision making is generally done by consensus, and relative market size is the primary source of bargaining power. The advantage of consensus decision-making is that it encourages efforts to find the most widely acceptable decision. Main disadvantages include large time requirements and many rounds of negotiation to develop a consensus decision, and the tendency for final agreements to use ambiguous language on contentious points that makes future interpretation of treaties difficult.

Dispute Settlement Mechanism

The operation of the WTO dispute settlement process involves the DSB panels, the Appellate Body, the WTO Secretariat, arbitrators, independent experts and several specialized institutions. The General Council discharges its responsibilities under the DSU through the Dispute Settlement Body (DSB). Like the General Council, the DSB is composed of representatives of all WTO Members. The DSB is responsible for administering the DSU, i.e. for overseeing the entire dispute settlement process. If a member state considers that a measure adopted by another member state has deprived it of a benefit accruing to it under one of the covered agreements it may call for consultations with the other member state. If consultations fail to resolve the dispute within 60 days after receipt of the request for consultations,

the complainant state may request the establishment of a panel. It is not possible for the respondent state to prevent or delay the establishment of a panel, unless the DSB by consensus decides otherwise. The panel, normally consisting of three members appointed *ad hoc* by the Secretariat, sits to receive written and oral submissions of the parties, on the basis of which it is expected to make findings and conclusions for presentation to the DSB. The proceedings are confidential, and even when private parties are directly concerned, they are not permitted to attend or make submissions separate from those of the state in question.

India and the World Trade Organization

India is a founder member of the General Agreement on Tariffs and Trade (GATT) 1947 and its successor, the World Trade Organization (WTO), which came into effect on 1.1.95 after the conclusion of the Uruguay Round (UR) of Multilateral Trade Negotiations. India's participation in an increasingly rule based system in the governance of international trade is to ensure more stability and predictability, which ultimately would lead to more trade and prosperity for itself and the other member nations which now comprise the WTO. India also automatically avails of MFN and national treatment for its exports to all WTO Members.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.

Answers to these questions are not to be submitted for evaluation)

1. Discuss briefly the nature of economic crisis in Indian economy in early 1991.
2. Write notes on the following
 - (a) Financial Sector Reforms
 - (b) Industrial Deregulation
 - (c) Trade and Capital Flows Reforms
3. What are macro stabilisation reforms? Discuss.
4. Discuss note on fiscal adjustment as a component of Macro stabilization Reforms.
5. Discuss the critical evaluation of economic reforms in terms of economic Environment.
6. What do you understand by the term "globalization"? Discuss the gains from globalisation.
7. What is WTO ? Discuss its objectives.
8. Explain the principles of WTO trading system.
9. Write short note on –
 - (a) Governance of WTO
 - (b) Dispute settlement mechanism of WTO.

Suggested Readings/References :

1. RBI Annual Reports.
 2. Reports on Currency and Finance.
 3. Dutt and Sundharam - Indian Economy, latest edition.
 4. Globalization- Wikipedia.
 5. WTO-- Wikipedia.
 6. Trade Policy Review Reports. 1998,2002 and 2007
 7. Various Financial Dailies
 8. Rangrajan-Responding to Globalisation : India's answer(2006); Chairman,
Economic Advisory Council to the Prime Minister ,New Delhi
 9. Speeches –RBI Governors and Deputy Governors.
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PART B - STATISTICS

STUDY IX

DESCRIPTIVE STATISTICS

INTROUDCTION

The word 'Statistics' is as old as human society itself. It is regarded in general as a groups of numerical statements of facts relating to certain human experience, put in systematic and logical manner. Perhaps this word of English language had its origin from the Latin word 'Status meaning political state'. Words 'Stato' and 'Statistik' were also used in similar sense in Italian and German languages respectively. In ancient days', the word statistics was used only for facts and figures required by the state for its official use and was known as "the science of king", "the science of state craft" and 'political arithmetic'. At that time, statistics was used to collect information relating to crimes, military strength and wealth for devising military and fiscal policies. It was also used to satisfy the needs of the ruling kings, the needs like number of soldiers, number of objects etc. which helped the state in administration. But today, statistics is not merely a by product of the administrative set up of the state but it embraces all sciences—social, physical and natural and is finding numerical applications in various diversified fields such as agriculture, industry, sociology, psychology, planning, economics, business, management and so on. It is rather impossible to think of any sphere of human activity where statistics has not crept in. The word statistics has acquired a wider meaning over the years. The set of quantitative data relating to phenomena whether concerning state or otherwise are called statistics. The word statistics is used in different senses by different persons. To a layman, statistics has become 'synonymous with figures'. For others, statistics is a discipline. It has grown today as a separate discipline or subject of study like mathematics or economics. Thus, the word '*statistics*' is basically used in two senses i.e. as:

- (i) Statistics Data, and
- (ii) Statistical Method.

Statistics in the sense of numerical data, basically refers to quantitative aspects and is in the form of numerical data. Statistics as statistical method refers to a body of knowledge which contains statistical principles and methods used for collection, analysis and interpretation of data. It is a branch of scientific methods used for dealing with those phenomena which can be described numerically either by measurement or by counting.

To resolve the controversy regarding the meaning of statistics, it is essential to go through various definitions given by experts on the subject from time to time.

DEFINITIONS OF STATISTICS

(a) *Statistics as Numerical Data*

Some of the important and popular definitions of statistics as numerical are presented as under:

"Statistics refers to the classified facts representing the conditions of the people

in the State ... especially those facts which can be stated in numbers or in tables of numbers or in any tabular classified arrangement". —*Webster*

"Statistics are collection of noteworthy facts concerning state both historical and descriptive". —*Gottfried and Achenwall*

"Statistics is an aggregate knowledge brought together for a practical end namely the knowledge of concrete states". —*Wappans*

"Statistics is numerical statement of facts in any development of enquiry placed in relation to each other". —*Bowley*

"By statistics, we mean quantitative data affected to a marked extent by multiplicity of causes". —*Kendal*

All the above mentioned definitions are narrow in scope. These definitions restrict their scope of statistics to facts relating to state only. According to modern thinkers, the scope of the science of statistics is considerably wide today and is applicable to almost anything worth mentioning such as biology, demography, economics, commerce etc. In a sense, above definitions are incomplete because of their poor coverage.

Prof. Horace Secrist has given most acceptable, popular and comprehensive definition of statistics in the sense of numerical data. According to him, "By statistics we mean aggregate of facts affected to marked extent by multiplicity of causes, numerically expressed, enumerated or estimated according to a reasonable standard of accuracy, collected in a systematic manner for a pre-determined purpose and placed in relation to each other".

According to this definition, the numerical data should possess the following major characteristics in order to be known as statistics.

(i) *Aggregate of Facts*

Statistics must relate to aggregate of facts. A single figure even though numerically expressed cannot be called statistics because such figures are unrelated and cannot be compared. Hence, we cannot draw any conclusions out of it. For instance, a single figure relating to the height of the student or marks of the student in the class is meaningless and irrelevant unless we are provided the complete data about all the students of the class in a school. It makes the comparison among students possible. Thus, we can say, that it is not the datum but the data which is the subject matter of statistics.

(ii) *Affected to marked extent by multiplicity of causes*

Generally speaking, statistical facts are not traceable to single factor. Since statistics are commonly used in social science, it is affected by multiple factors at the same time. For example, the prices of particular commodity are affected by number of factors such as supply, demand, import, export, income distribution, money in circulation, taste, etc. In natural sciences, like physics and chemistry, it is possible to isolate the effect of various factors on a particular item but it is very difficult to do so in social science.

However, the science of statistics has provided the novel technique such as multiple correlation to study the joint effects of a number of factors on a single item.

(iii) *Numerically expressed*

It is only the numerical data which constitute statistics. Any qualitative expression such as rich, poor, good, bad, intelligent, young, old do not constitute statistics, and this is outside the scope of study of statistics unless a numerical equivalent value is assigned to each expression. For example, intelligence is not statistics but intelligence quotient designed by Dr. Freud could be accepted as statistics of attributes. Thus, in statistics facts are expressed in numbers and not words but it does not mean that all numerical statements are statistics.

(iv) *Enumerated or Estimated*

Statistical data relating to any subject could be collected either by actual counting or measurement or by estimation. In case, where the scope of enquiry is very large, enumeration is not advisable because it involves high costs and is also time consuming too. In such cases, data are estimated by using the powerful techniques of sampling and estimation. On the other hand, if number of units are less, they are actually counted or measured. For example to find out the number of students appearing in an examination in a particular class we have to actually count, but to find out the number of persons attending a particular public meeting, we rely on estimates.

(v) *Reasonable degree of Accuracy*

Statistical data are collected only with a reasonable degree of accuracy. The data which are collected by enumeration are supposed to be accurate and precise but it is not so in the case of estimation. The degree of accuracy of estimated value largely depends on the nature and purpose of the enquiry. There cannot be a uniform standard of accuracy for all type of enquiries. For example, if the height of the students of a class are being measured, it is all right if measurement is correct to a centimeter but if we are measuring distance between two places say Delhi and Calcutta, the difference of a few kilometers may be ignored. Thus, in many statistical studies mathematical accuracy cannot be maintained but it is important that reasonable standards of accuracy must be maintained for drawing meaningful conclusions.

(vi) *Systematic manner*

The collection of data must be in a careful and systematic manner because data collected in haphazard and unsystematic manner may lead to erroneous, misleading fallacious conclusions. It requires careful planning of data collection approach in order to attain reasonable degree of accuracy.

(vii) *Pre-determined purpose*

It is essential that one must be clear in advance about the objectives and purpose of enquiry or data to be collected before actually going for it. If

data are not collected with some objective, the whole effort in term of money and result would be waste. For example, if the, purpose of enquiry is to measure level of education in labour strata, it would not serve any purpose unless data are collected from the area dominated by labour strata.

(viii) *Placed in relation to each other*

The comparability is one of the important attributes for the numerical facts to be known as statistics. The numerical data may be compared period-wise or region-wise. For example, per capita income of India may be compared at a point of time to that of Pakistan, China, Brazil, Mexico, provided the data are homogeneous. They are related to same phenomena.

(b) Statistics as Statistical Method

Statistics has developed as a fullfledged discipline over a period of time. Basically, it is the science which provides tools for analysis and interpretation of huge amount of data collected for the purpose of decision-making in various fields of scientific enquiry. Some of the popular definitions of statistics as statistical methods are given below for examination:

"Statistics may be called as the science of counting." —A.L. Bowley

"Statistics may be rightly called the science of averages". —A.L. Bowley

"The science of statistics is the method of judging collective, natural or social phenomenon from the results obtained by the analysis of an enumeration or collection of estimates." — King

"Statistics is the science which deals with classification and tabulation of numerical facts as the basis for explanation, description and comparison of phenomenon." — Lovin

"Statistics is the science which deals with the method of collecting, classifying, presenting comparing and interpreting numerical data collected to throw some light on any sphere of enquiry." —Selligman

"Modern statistics refers to a body of methods and principles that have been developed to handle the collection, description, summarisation and analysis of numerical data. Its primary objective is to assist the researcher in making decision or generalisation about the nature and characteristics of all the potential observations under consideration of which the collected data form only a small part." —Lincon L. Chao

"Statistics may be defined as the science of collection, presentation, analysis and interpretation of numerical data." —Croxtan & Cowden

Earlier definitions of statistics given by Prof. A.L. Bowley are inadequate and defective because they restrict the scope of statistics to counting and average. Prof. King's definition is comprehensive but it focuses on collection of data, treating other methods of secondary importance. This is not a correct approach. Lovin's definition is fairly satisfactory because it indicates simple and scientific exposition of statistical

methods.

Croxton and Cowdon has given more satisfactory and acceptable definition. This definition brings into its fold various stages of statistical enquiry i.e., collection, presentation, analysis and interpretation of numerical data.

Thus, on examining above mentioned definitions, statistics may be defined as a discipline which is concerned with collection, organisation, presentation, analysis and interpretation of numerical data. According to this definition, a brief detail of various stages of statistical enquiry are given below:

Collection of data

Collection of statistical data constitutes one of the important aspects of statistical inquiry. During this stage, the relevant data are collected from various sources. The sources of data may be primary or secondary. In the case of primary data, data are originally collected by an investigator or agency, on the other hand, the data published or unpublished which have already been collected and processed by some agency or person and taken over from there and used by any other agency for their statistical work are termed as secondary. It may be observed that the distinction between primary and secondary data is matter of degree only.

Organisation and presentation of numerical data : Organisation and presentation of data is the second important stage of statistical enquiry. Generally, secondary data are available in organised form but primary data collected through survey in raw form needs their organisation. Some of the important components of organisation of data are editing, classification and tabulation of data. Editing of data removes omission, inaccuracies and inconsistencies whereas in classification, general items which have common characteristics are brought together before the tabulation. Subsequently, they are presented in table and finally the data is given the shape of a diagram, chart and graph wherever necessary.

Analysis of numerical data : In this phase of statistical enquiry, the numerical data after collection, organisation and presentation is analysed, in order to have deep understanding of the subject matter. In the process of analysing numerical data, some of the popular measures, such as averages or measures of central tendency, dispersion, skewness and variations, correlation, regression, association and attributes, interpolation and extrapolations are used. Probability and distribution, sampling, analysis of variance, index number and time series are also used if required to simplify the data.

Interpretation of numerical data : The interpretation of data refers to drawing inferences and conclusions from the given data. The interpretation of data is most sensitive and difficult task which requires higher degree of skill, experience and common sense and balance judgement on the part of the investigator. If the data is misinterpreted, it may lead to misleading conclusions which results in wastage of time and resources and thus the object of enquiry may be defeated.

Importance and Functions of Statistics

Statistics is a useful science. There is hardly any area in social science or natural science where statistical methods are not effectively used. In fact, to a very striking

degree, the modern culture has become a statistical culture and there is no ground for misgivings regarding the practical realisation of the dream of H.G. Wells "statistical thinking one day be as necessary for effective citizenship as the ability to read and write." The science of statistics has gained an enormous importance and popularity because of various functions performed by it.

(i) *Preciseness and Definiteness*

Statistics presents the facts in a precise and definite form. It is generally agreed that facts which are presented in numerical form are more precise and convincing. Statistics, in a sense, leaves, no scope for vagueness. For example, the statement that total population of India has increased during 1981 to 1991. This statement does not give any idea about increase in population. But if we say that total population of India has increased to 856 millions during 1981-1991. This statement is more precise and conclusive.

(ii) *Simplification of Large Volume and Complex Data in Understandable Form*

Statistics presents the large volume of complex data in meaningful and understandable form. In the words of W. King's, it is for the purpose of simplifying these unwieldy masses of facts that statistical science is useful. It reduces them to numerical totals or average which may be abstractly handled like any other number. It draws pictures and diagrams to illustrate general tendencies and thus in many ways adopts these group of ideas to the capacity of our intellects.

(iii) *Comparison*

Comparison is also one of the important functions of statistics. It enables us to understand the behaviour of data over a time period or at a point of time and has certain reasons for it. Averages, standard deviations, trends, time series, Index number, correlation, graphs, diagrams are some of the statistical techniques which make the comparison of particular phenomenon possible.

(iv) *Enlarge Individual Knowledge and Experience*

Statistics is a science which provides opportunities to individuals to enrich their knowledge and experience. It is well established fact that statistics with the help of noble techniques and sound methodology has opened new vistas of knowledge which was closed to mankind otherwise. In a sense, statistics has provided such a master key to mankind that we can use it anywhere and can study any problem and on right terms.

(v) *Formulation of Policies*

Statistics also helps in the formulation of various economic, business and other policies at state, national or global level. For example, framing of government policies on education, taxation, pollution, law and order need a sound statistical support. Poor statistical base and network in the economy may prove a handicap in designing sound policy and achieving expected results thereafter. Business organisations also make use of statistics to design their policies in areas of finance, marketing and personnel. They

collect relevant information on various parameters, analyse it and draw inferences and then in the light of conclusions derived from or gathered information design their policies.

(vi) *Business Forecasting*

Forecasting means formal process of predicting future events that will significantly affect the functioning of enterprise. Government and business units needs forecasting for designing better plans and policies and sound decision-making in order to use existing man and material resources optimally. To achieve this end, statistics offers various forecasting techniques such as time series, extrapolation in order to make reliable predictions on future.

About statistical forecast, Prof. Bowley rightly observed that "A statistical estimate may be good or bad, accounts for the reverse, but almost in all cases it is likely to be more accurate than a casual observers' impression".

(vii) *Framing and Testing Hypothesis*

Statistics also helps to formulate hypothesis and to test its validity and subsequently for developing sound theories. The hypothesis may be about any phenomena on political, social or economical. In the words of Lord J.M. Keynes, it is rightly pointed out that the function of statistics is first to suggest empirical laws which may or may not be capable of subsequent deductive reasoning by checking its results and submitting them to the test of experience".

Laws of Statistics

There are two important laws of statistics on which whole theory of sampling is based. These two laws are:

- (a) The Law of Statistical Regularity; and
- (b) The Law of Intertia of a large numbers.

(a) *The Law of Statistical Regularity*

This law provides the basis of theory of probability in statistics. According to this law, if a large sample is taken from a population in a random way, it is bound to be fairly representative of the population. Prof. W.I. King has rightly observed in this regard. "The law of statistical regularity formulated in a mathematical theory of probability lays down that a moderately large number of items chosen at random from a very large group are almost sure on the average to have the characteristics of the large group".

This law holds good if it meets the following two conditions.

- (i) random sample is taken; and
- (ii) the size of sample is large.

(b) *Law of Intertia of a Large Numbers*

This law is corollary of the law of statistical regularity. This law states that the larger the size of sample more accurate the results are likely to be. It is because large numbers have greater stability, steadiness, consistency as compared to small numbers.

Scope of Statistics

It is very difficult to mark the scope of statistics because there is hardly any sphere of human activity where statistics does not creep-up. All disciplines whether social sciences or natural sciences or management, they are using statistics in one form or another. Broadly, the scope of statistics can be confined to the following two main aspects i.e.,

1. Divisions or classifications of statistics.
2. Applications of statistics.

1. DIVISIONS OR CLASSIFICATION OF STATISTICS

Broadly speaking, statistics may be classified into four major categories which are discussed below:

(i) Descriptive Statistics

Descriptive statistics deals with the numerical data. These data represents observations obtained either through counting or through some measurement process. They may define an entire population or universe and be derived through some sampling procedure. In other event, they represent the raw material of any subsequent statistical processing and may in some cases be sufficient by themselves to answer particular question or problem.

Descriptive statistics include the techniques such as collection and tabulation of data averages or measures of central tendency trends, index number, dispersion, skewness, which help in summarising and describing the main features of data. It also focuses its attention on characteristics of data which on account of its huge size would have escaped the attention of user.

(ii) Applied Statistics

This division of statistics is concerned with the application of statistical methods and techniques to the specific problems and facts of real life situations as they exist. Some of the important techniques which constitute the applied statistics are sample survey, quality control, quantitative analysis for business decisions, index numbers etc. For example, for the purpose of business forecasting such as demand of a particular product in the market, we have to make use of methods like extrapolation or least square which form the contents of applied statistics.

(iii) Inferential Statistics

It covers those methods and techniques of statistics which are used to draw conclusions and statistical inferences about the parameters of population on the basis of estimates derived from a sample. Similarly, the hypothesis in regard to the characteristics of sample are tested on the basis of population

parameters. There are several significance tests which are designed for this purpose. These tests lay down the possibility of being true in individual cases. The statistical inferences or conclusions drawn from given data are not merely guesses but they are backed by prior exercise of logical thought and are based on fundamental theories of science of mathematics.

(iv) *Inductive Statistics*

Inductive statistics refers to those methods and techniques of statistics which help in estimating a particular phenomenon on the basis of random observation. For example, business forecasting is done with the help of inductive statistics.

(v) *Mathematical Statistics*

It is that branch of statistics which is concerned with the application of various mathematical theories and techniques such as theory of measures and integration, differentiation, algebra, trigonometry, matrix theory, etc. to develop various statistical theories and techniques. It is basically concerned with mathematical aspects of statistics. In the words of Corner, "statistics is a branch of applied mathematics which specialises in data".

(vi) *Analytical Statistics*

It consists of those methods which are used in establishing functional relationship between variables. It is attempted through comparison, between two sets of data at a point of time in cross-section data or between two points of time otherwise. Important techniques form the part of analytical statistics include association of attributes, correlation and regression, etc.

2. APPLICATIONS OF STATISTICS

Statistics has developed wide areas of its applications in the modern age of information technology. Some of the important areas of statistical applications are discussed as under:

(a) *State*

Statistics is indispensable for functioning of the State. State authorities need different type of facts and figures on various matters to frame policies and guidelines in order to perform its functions smoothly. In earlier days, when statistics was science of statecraft, the object was to collect data relating to manpower, crimes, income, wealth etc. for formulating suitable military and fiscal policies. Presently, with the change in the nature of functions of the State i.e. from maintenance of law and order to promoting human welfare, the scope of application of statistics to State affairs has changed drastically. Today, State authorities collect statistics through their own agencies on multiple aspects i.e., population, national income, defence, science, mineral resources, oceanography, space research, etc. Almost all ministries at Central or State level, depend heavily on statistical information for their smooth functioning. The availability of statistical information helps the government to frame suitable policies and guidelines to improve the overall working of the system.

(b) Economics

Economics is concerned with the allocation of limited resources among unlimited ends in the most optimal manners. Statistics, provides statistical information to answer the basic questions in the economics i.e. what to produce, how to produce and for whom to produce. Statistical information basically helps to understand the economic problems and the formulation of economic policies. Earlier, in olden days, the applications of statistics to economics was limited because (i) at that time economic theories and principles were based on deductive logic; (ii) the statistical techniques were not developed for its applications in other disciplines. But in the present age of computers, statistical data and advanced techniques of statistical analysis have proved immensely useful. In economics, now the scholars have shifted their stand from deductive logic to inductive logic to explain any economic proposition. The inductive logic of reasoning requires observation of economic behaviour of large number of units. Thus, it requires a sound statistical support in the form of data as well as techniques.

The use of statistics and statistical techniques can be better examined in the following term:

(i) Test and Verification of Economic Theories/Principles/Hypothesis

Over the years economists have developed multiple theories and principles based on deductive reasoning in the areas of consumption, production, exchange, distribution, investment, business cycles and taxation etc. All these theories are merely for academic interests only unless they are put to empirical test or verification. Statistics serves this purpose and enables us to compare the theories in real life situations.

(ii) Understanding and Study of Economic Problems

Statistics helps to understand the various economic problems with clarity and precision and also enables to frame suitable policies in relevant areas for better results. For example, income and wealth statistics are helpful to frame policies reducing disparities of income whereas price statistics helps to understand the problem of inflation and cost of living in the economy.

(iii) Economic Planning

Economic planning is an important aspect of economic policies of a country. An effective economic planning requires sound information base for different components of economy so that planner should be able to face future smoothly. Here, statistics helps to provide data and also tools to analyse for optimal results. Time series analysis, index numbers, forecasting techniques are some of the powerful techniques, which are immensely useful for the analysis of data in economic planning. Statistical techniques are also helping in framing planning models. In India economic models of different five year plans have extensively used the tools of statistics.

(iv) Measurement of National Income and Components

Statistics also enables to study and measure various national income components and their compilations. It collects information on income, saving, investment, expenditure etc. and also establishes relations among them.

(c) Business Management and Industry

In modern world, management of business organisation has become a complicated exercise as a result of change in size, technical know-how, quantum of production, number of personnel's employed, capital employed, workers and increasing level of competition. Management while planning, organising, controlling and communicating is confronted with alternative courses of action. In the face of uncertainty, management cannot adopt trial and error method. It is here that statistical data and powerful statistical techniques of probability, expectations, sampling, test of significance, estimation theory, forecasting and so on play an indispensable role. In the words of Chao "Statistics is a method of decision-making in the face of uncertainty on the basis of numerical data and calculated risks". Statistics provides information to the business units which help in deciding location and size of business, demand forecasting, production planning, quality control, marketing decisions and personnel administration. In Industry, statistics is extensively used in 'Quality Control'.

(d) Social Sciences and Natural Science

Statistics has its vast applications in social sciences. In social science, particularly sociology, the most important application is in the field of demography for studying mortality, fertility, marriage, population and growth. In education and psychology, it is used to determine the intelligent quotient (IQ).

Biology and Medicine : Statistical tools for collection, presentation and analysis of observed data relating to the causes and incidence of diseases are of paramount importance in biology and medical sciences. For instance, the statistical pulse rate, body temperature, blood pressure, heart beats, weight, etc. of the patient greatly help the physician for proper diagnosis of disease. The most important application of statistics in medical science lies in using the test of significance for testing the efficacy of manufacturing drugs or injections or medicines for controlling/curbing specific diseases.

Research: Statistics is also extensively used to conduct research in new areas and to open new vistas of knowledge to mankind. Experiments include impact of fertilizer on crops, soil etc.

Limitations of Statistics

Statistics inspite of its immense use has certain limitations. Some of the important limitations are listed as under:

(i) Deals in Quantitative Data

Statistics deals with quantitative data only and not the qualitative and descriptive facts such as honesty, efficiency, intelligence, blindness, etc.

(ii) *Study of Groups and not Individuals*

Statistics deals with groups and not with individuals. This is a serious limitation of statistics. For example, income of an individual or profit of a particular business unit do not constitute the statistics because those figures are unrelated and uncomparable whereas aggregate of figures relating to prices and consumption of various commodities, over different period of time will be statistics.

(iii) *In-exact Science*

Statistical laws are not exact. Their results are true only on averages. They are valid only under certain set of assumptions. It is because of this, the science of statistics is less exact than natural sciences i.e., physics, chemistry, etc.

(iv) *Misuse*

Statistics deal with figures which are innocent by themselves and do not bear on their face the level of their quality and can be easily distorted, manipulated by dishonest politicians or unscrupulous people for their selfish motives. It is a delicate subject and dangerous tool in the hands of non-experts. The user of statistical methods should not only have sound knowledge of the subject but also have self-control of an artist. In the words of W.I. King, "Statistics are like clay from which you can make a God or a devil as you please". At another place he opined "science of statistics is the useful servant but only of great values to those who understand its proper use".

Distrust of Statistics

Distrust literally means lack of confidence or belief. The statistical statement or science of statistics is always subject to doubt and suspicion to the public because of its misuse by unscrupulous elements for their selfish motive. The common beliefs about statistics are as follows:

- (i) An ounce of truth will produce tonnes of statistics.
- (ii) It can prove anything.
- (iii) It can prove nothing.
- (iv) Figures do not lie liars figure.
- (v) Figures are innocent and easily believable.
- (vi) There are three type of lies—lies, damn lies and statistics.
- (vii) Figure though accurate, might be manipulated by selfish persons to conceal the truth and present a misleading and distorted picture of the facts to general public.

Here, it may be clarified that statistics is only a tool which if rightly used may prove extremely useful and if misused, might be disastrous. Statistics neither

approves nor disapproves anything. There is a need for utmost care and precaution in the interpretation of statistical data in all of its manifestations. "Statistics should not be used as a blind man uses a lamp post for support instead of illumination".

SELF-TEST QUESTIONS

*(These are meant for recapitulations only
Answer to these questions are not to be submitted for evaluation.)*

1. Define 'Statistics'. What are its various functions and limitations?
2. What are the major characteristics of statistics when we consider it as numerical data?
3. "By statistics we mean aggregate of facts affected to a marked extent by multiplicity causes, numerically expressed, enumerated or estimated according to a reasonable standard of accuracy, collected in a systematic manner for a predetermined purpose and placed in relation to each other". In the light of above statement discuss the characteristics of statistics as numerical data.
4. "Statistics are like clay from which you can make a God or devil as you please". In the light of this statement, discuss the uses and limitations of statistics.
5. Comment briefly on the following statement:
 - (a) "Statistics can prove anything".
 - (b) "All Statistics are numerical statements but all numerical statements are not statistics".
6. "Statistics may be defined as a discipline which is concerned with the collection, organisation, presentation, analysis and interpretation of numerical data". Elucidate the statement.
7. Write short notes on the following :
 - (a) Laws of statistics
 - (b) Distrust of statistics
 - (c) Application of statistics.
8. Discuss the scope of statistics.
9. "Statistics should not be used, as a blindman uses a lamp post for support instead for illumination". Comment.
10. "Statistics widens the field of knowledge". Elucidate the above statement.

Suggested Readings/References :

- (1) Statistical Methods — S.P. Gupta.
- (2) Fundamentals of Statistics — A.K. Aggarwal & Sahib Singh.

(3) Fundamentals of Statistics — *S.C. Gupta*.

(4) Business Statistics — *R.S. Bhardwaj*.

STUDY X

COLLECTION AND PRESENTATION OF STATISTICAL DATA

COLLECTION OF STATISTICAL DATA

INTRODUCTION AND MEANING

Collection of facts and figures about a phenomenon is one of the most important functions of statistics. For any statistical enquiry whether it is related to business, management, economics or natural sciences, the basic issue is to collect the facts and figures relating to a particular phenomenon.

Collection of data refers to systematic recording of results either by counting or by enumeration. The collected data should be quantitative i.e. numerical in nature so that we can apply statistical methods in presentation, analysis and interpretation of the same. The entire structure of statistical analysis for any enquiry is based on systematic collection of data.

Once statistician is clear about the objectives and scope of enquiry, statistical units to be used, the degree of accuracy aimed in the final results, the next step in data collection is to decide about the sources of data and type of data to be used.

Broadly speaking, there are two types of data —

- (1) Primary
- (2) Secondary

Primary Data

It is the data, which is collected for the first time by investigators or enumerators working under his supervision to serve a particular purpose. Such a data is of original nature. The sources from where these data can be collected are known as primary sources. In India, the organisations such as Central Statistical Organisation (CSO), Census of India, National Sample Survey (NSS), Reserve Bank of India (RBI) are the organizations, which collect and publish the primary data and so they are primary sources of data.

Secondary Data

Secondary data refers to the data which is originally collected and published by the authorities other than who require it. Such data is already available in some government publications, research study, journals or newspapers. Main sources of secondary data may be classified in the following two categories:

- (a) *Published Sources* : Published sources of secondary data basically refers to various national/international organisations/agencies which collect and publish the statistical data relating to business, trade, labour, price, consumption, production, investment, savings etc. These publications offer very useful sources of secondary data. Some of the important sources of secondary data in this category include the following:
 - (i) Publications of the Central and State Governments, of Foreign Governments and international bodies like IBRD, IMF, ADB, ILO, UNO,

WTO, WHO etc.

- (ii) Publications of Semi-Government organisation e.g. Reserve Bank of India Bulletin, Reports on Currency and Finance.
 - (iii) Publications of CSO and NSS and other research bodies (ICAR & IARI, Delhi).
 - (iv) Publications of various Chambers of Commerce, Trade Associations and Co-operative Societies.
 - (v) Reports of various Committees and Commissions appointed by the Government.
- (b) *Unpublished Sources* : It covers all those sources of secondary data where records are maintained by private agencies or business firms for their own use and are restrictedly available for use of general public. Data collected by research institutions are also included in the category of unpublished sources of secondary data.

Distinction between Primary and Secondary Data

It is very difficult to distinguish between primary and secondary data. The difference is merely of degree of detachment of original source. The data which is primary for one may be secondary to other. Some of the major points of distinction between the two types of data are listed as under:

- (i) Primary data is first hand original in nature whereas secondary data is in the form of compilation of existing data or already published data.
- (ii) The collection of primary data involves huge resources in terms of money and time, finance and energy whereas secondary data is relatively less costly.
- (iii) Primary data is usually collected by keeping in mind the purpose for which it is collected so its suitability will be more, but secondary data may or may not suit the purpose.
- (iv) Primary data may be used as it is but the use of secondary data requires lot of care.
- (v) Primary data are more reliable, accurate and adequate where as secondary data are not always, reliable, accurate and adequate.

Choice of Data

A proper choice of type of data needed for any statistical investigation basically depends on consideration of various factors such as nature, objective and scope of enquiry, availability of financial resources, time, degree of accuracy expected and the status of agency.

It is observed that presently in large number of statistical investigations, secondary data are generally used because of the availability of large amount of reliable published data from government sources (Central or State), Government agencies, international institutions and organisations, private organisations and research institutions, journals and magazines, etc. But primary data are usually collected for those situations where secondary data suitable for enquiry under study is either not available or it is not directly suitable for the purpose.

Precautions in the Use of Secondary Data

Secondary data needs utmost precautions in their use because they are collected for different purpose and by different agencies. Prof. Bowley rightly stated in this regard — "It is never safe to take the published statistics at their face value without knowing their meaning and limitations." So, it is essential for the users of secondary data to ensure the reliability, adequacy and suitability of data to the given problem under investigation. Some of the major precautions in this regard include the following:

I. Suitability of data

It is expected that the user of the secondary data should ensure that the data are suitable for the purpose of enquiry. The suitability of data can be judged in the light of the nature and scope of investigation, terms and units defined, etc.

II. Reliability of data

The reliability of secondary data is another precaution, which needs special attention of the users. The users should take note of following points regarding reliability of secondary data:

- (a) the reliability, integrity and experience of the collecting organisation;
- (b) the reliability of the source of information;
- (c) the methods used for collection and analysis of data;
- (d) the degree of accuracy desired by the company.

In case the data were collected on the basis of sample, the users should satisfy themselves regarding:

- adequacy of sample;
- use of proper sampling technique;
- collection of data by trained, experienced and unbiased investigator under the supervision of competent officer;
- use of proper estimation techniques to estimate the population parameters.

III. Adequacy of data

Even if the available secondary data are suitable and reliable from the users point of view, it may not be adequate enough for the purpose of the given enquiry. Adequacy of data is to be judged in the light of the requirements of the survey and the geographical area covered by the available data. Adequacy of the available data is also considered in the light of time period.

Hence, in order to arrive at conclusions free from limitations and inaccuracies, the secondary data must be subjected to thorough scrutiny and editing before they are accepted for use.

Methods of Collecting Primary Data

Primary data may be collected by any one of the following method:

- (a) Direct personal interview.
- (b) Indirect oral interview.
- (c) Information received from local agencies or correspondents.
- (d) Mailed questionnaire method.
- (e) Schedule sent through enumerators.
- (f) Telephonic survey.

(a) Direct Personal Interview

Under this method, investigators personally visit the respondents, ask them questions pertaining to the enquiry and collect the desired information. The information or data so collected from such type of interviews is an original one in nature.

Advantages

- (1) It proves highly accurate and reliable data.
- (2) It makes available to investigators supplementary information which helps them in the interpretation of results.

Limitations

- (i) It is a costly and time consuming method.
- (ii) The data collected under this method may be influenced by subjective attitude of investigators.
- (iii) The success of this method depends on the capability of the interviewer and the manner in which he conducts the interview to gather the required information or data.

Suitability

This type of method is suitable only in those cases where scope of enquiry is confined to single locality, area or region and there is no constraint on the utilisation of resources like money and time.

(b) Indirect Oral Investigation

Under this method, investigators collect data by contracting third-party or informants who are supposed to possess the information on the problem under investigation. For example, the information on the gambling, drinking, or smoking habits of an individual can best be obtained by interviewing his personal friends, relatives, neighbours who know him thoroughly well. Usually under this method, a small list of questions are prepared and these questions are put to different informants in the environments and then their answers are recorded. This type of procedure to collect actual data may be adopted by enquiry committee or commissions of enquiry.

Merits

- (i) It allows to extract information from the parties about the person who is reluctant to supply any information about the subject matter of enquiry if approached directly;
- (ii) It consumes time and money.

Demerits

- (i) The information collected under this method is sometimes not reliable.
- (ii) The success of this method is directly dependent on several factors, such as knowledge and representative character of informants, biasedness of witness about the matter and ability and sincerity of interviewer to extract information.

(c) Information Received from Local Agencies or Correspondents

According to this method, the correspondents or local agencies in different regions collect the required information in their own way and subsequently submit their reports or transmit the information to the Central Office where data are processed and finally analysed. This method is usually adopted by newspaper agencies, who require periodical information in areas like sports, economic trends, share markets, law and order, etc.

Merits

- (i) This method is economical and expeditious.
- (ii) It is ideal method for the situation where data is required on a continuous basis.

Demerits

- (i) The quality of data collected through this method is highly unreliable because of biasedness of local agents and the different techniques of data collection adopted by them.
- (ii) It is not useful for extensive study of a problem.

(d) Mailed Questionnaire Method

Under this method, a well designed questionnaire is mailed to the informants with a request to fill it up and return the same within the specific time schedule. It is pointed out in the covering letter to the respondents that information supplied by them in the questionnaire will be kept strictly confidential. The investigators, send questionnaire along with self-addressed envelope to respondents for quick and better response. In the prevalent knowledge based environment, an investigator may e-mail the questionnaire to target group of respondent and can mobilize the desired information subject to certain conditions. This type of method is very popular among research workers, private agencies, etc.

Merits

- (i) It is most economical method in terms of time, money and manpower.
- (ii) It may be used more effectively in cases where scope of enquiry is very wide and extensive.
- (iii) Direct information from respondents, leave less scope for personal bias.

Demerits

- (i) This method does not work where majority of respondents are literate.
- (ii) There is low degree of reliability of the information supplied by informants.
- (iii) This method is not flexible

The success of this method is based on the ability to design the questionnaire, knowledge of the respondents and their response to questionnaires.

(e) Schedule or Questionnaire sent through Enumerators

Under this method of enquiry, the trained enumerators personally visit the informants and explain the objectives of enquiry, ask questions and record their replies.

This method is commonly used by big business houses, research institutions and large public undertakings.

Merits

- (i) It enables to extract information from all type of respondents literate and illiterate.
- (ii) The information collected by this method is more accurate and reliable.
- (iii) This method is ideal for extensive surveys.
- (iv) In the case of poor response, the enumerators can personally persuade the informants to supply information.

Demerit

- (i) It is the most expensive method because the enumerators who collect information are paid workers.
- (ii) It is time consuming.
- (iii) It is hectic and tiring.
- (iv) The success of this method depends on skill of enumerators, object of enquiry, etc.

(f) Telephonic Survey

Under this method investigator instead of presenting himself before the informants contact them on telephone and collect the desired information. This method is more convenient and less time consuming but subjective in nature.

Merit

It is convenient and less time consuming.

Demerits

It is subjective in nature.

CENSUS AND SAMPLE INVESTIGATION

Census and Sample Investigation are the two popular approaches used by the statistician to collect the primary data. Under the census or complete enumeration method, data are collected for each and every unit of the population or universe

which is a complete set of items which are of interest in any particular situation. For example, if the marks obtained by all the students of B.A. (Hons.) Economics of Delhi University are recorded for analysis, it will be called a census investigation. This method is generally recommended in those cases where area of investigation is limited and requires intensive examination or study of the population.

Merits of Census Investigation

The technique of census investigation is advocated by its users because of its various merits including the following:

- (i) *Intensive study* : Under census investigation, data are obtained from each and every unit of population. It enables to study more than one aspect of each item of population. For example, in the census of India study which is conducted after every 10 years, data are collected regarding population size, males and females, education levels, handicap member in the family, source of income, etc.
- (ii) *Reliable Data* : The data collected under this method is likely to be more reliable, representative and accurate because in census every item is observed personally.
- (iii) *Suitable choice* : The census method is a suitable choice in the situations when different items of population are not homogeneous.
- (iv) *Basis of various surveys* : Data of complete enumeration or census can also be used as a basis of various surveys.

Demerits of Census Investigation

Despite various merits discussed above, the census techniques has certain demerits also. Some of these demerits include the following:

- (i) *Costly Method* : Census is very costly method of investigation since the data are collected by observing each and every item of population. This method is usually adopted by the government organization to collect detailed data such as population census or agricultural census, etc.
- (ii) *Time Consuming* : This method is time consuming and requires more manpower to collect the original data.
- (iii) *Possibilities of Errors*: There are large number of possibilities of errors in this method due to non-response, measurement, lack of preciseness of the definition of statistical units or personal bias of the investigators.

Sample Investigation

On the other hand, sample investigation refers to the process of learning about population on the basis of sample drawn from it. To be more precise, in sampling technique instead of every items of the universe only a part of the universe is studied and conclusions are drawn on the same basis for the entire universe. The basic objectives of collection and analysis of sample investigation is to reveal certain characteristics of population—

- (a) To estimate parameters of population, i.e. means, median and mode etc.;

- (b) To test certain validity of statement about a population;
- (c) To investigate the changes in population over time.

Basically, the sampling process involves mainly following three elements:

- (i) selecting the sample
- (ii) collecting the information
- (iii) making an inferences about population.

Essentials of Sampling or Sample Investigation

Some of the important essentials of sample investigation include the following:

- (i) *Representativeness* : A sample is selected in such a way that it should in true sense represents the universe otherwise the results obtained from it may be misleading.
- (ii) *Adequacy* : The size of the sample should be adequate enough to represent the parametric characteristics of the population.
- (iii) *Independence* : There should be independent and at random selection of all the items covered under sample.
- (iv) *Homogeneity* : Homogeneity is another essential element of sample investigation. According to this, there is no basic difference in the nature of units of universe and that of sample.

Merits of Sample Investigation

Some of the important merits of sample investigation include the following:

- (a) *Less costly* : Data collection through sample investigation is less costly because in this case the task of data collection is confined only to a fraction of population.
- (b) *Less time consuming* : Sample investigation is less time consuming because it takes less time in collection, analysis and interpretation of data.
- (c) *Reliability* : Data collected under sample investigation are more accurate and reliable because of use of services of well trained investigators/experts.
- (d) *Detailed information*: Since the sample investigation saves both time and money, it is always possible to collect detailed information in sample survey.
- (e) *Flexibility* : The data collected thorough sample investigation have greater scope of flexibility.

Demerits of Sample Investigation

Despite all the above mentioned merits, sample investigation has various demerits also including the following :

- (i) It is impossible to attain cent percent accuracy because the conclusions drawn about characteristics of population are based on the results obtained from the selected sample.
- (ii) It creates the new source of error, i.e. 'random error' or 'sampling error'.
- (iii) The results of sampling investigation are not satisfactory unless it uses the

services of experts.

- (iv) The sample may not be the representative of population because it depends on the mind set and attitude of the investigators.
- (v) It is not possible to use sample investigation method when the population possesses the heterogeneous character.

Distinction between census and sample

Some of the major points of distinction between the census and sample method of investigation are presented as under:

S.No.	Attributes	Census Investigation	Sample Investigation
1.	Type and nature of Enquiry	Comprehensive	Selective
2.	Time required	More	Less
3.	Accuracy & Reliability	As high as 100%	Less than 100%
4.	Types of errors	Non sampling	Both
5.	Suitability	For small surveys where the coverage of every item is necessary	For large coverage
6.	Organisational work	Difficult	Easier
7.	Cost	High	Low

PRESENTATION OF DATA

The presentation of statistical data generated from various sources is highly cumbersome and complicated exercise. It is an essential step after data collection to make the data really useful. It broadly covers following aspects—

1. Classification of data
2. Tabulation of data
3. Frequency distribution of data
4. Diagrammatic presentations of data
5. Graphic representation of data.

1. CLASSIFICATION OF DATA

Introduction

The data collected is usually very voluminous and large in quantity and as such they are not fit for analysis and interpretation. Hence the first step after collecting data is to classify it.

Classification of data means grouping of related facts into classes. According to Secrist, classification of data, "is the process of arranging data into sequences according to their common characteristics or separating them into different but related parts". In the words of AM Tuttle, "a classification is a scheme for breaking a category into a set of parts, called classes, according to some precisely defined, differing characteristics possessed by all the elements of the category". Both the definitions focus on arrangement of data on the basis of certain characteristics or criteria. In simplified words, it is similar to sorting of letters received in the post office into different lots on the basis of geographical areas.

For example the students registered for Company Secretaryship course during a financial year may be classified on the basis of any of the following criterias:

- (i) Sex
- (ii) Level of qualifications
- (iii) Regions
- (iv) Legal/Non-Legal qualifications
- (v) Professional qualifications
- (vi) Others.

Thus, the same data can be classified in different ways based on different criteria, depending upon the requirements of the users. This process can be compared to sorting of letters in the postoffice.

Advantages of Classification

Some of the advantages of classification of data are listed as under:

- (i) It arranges and presents huge volume of unwieldy raw data in condensed and meaningful form so that it is easily understandable to the users.
- (ii) It facilitates meaningful comparison of data.
- (iii) It help us to understand the relationship among variables which are classified on the basis of different criteria.
- (iv) It highlights significant features of the data at a glance.
- (v) It makes the statistical treatment of the data easier because of its arrangement in relatively homogeneous groups based on certain criteria.

Principles of Classification

However, there are no hard and fast rule to classify raw data. It depends on the nature of data and the objectives of the study for which data are needed. The following principles may prove useful for sound technical classification of data.

Ambiguity

There should not be any ambiguity and confusion regarding placing any observation/variable in the given arrangement or classification. It means that each and every item in the data must belong to one of the classes. A good and ideal classification is one which is free from residue class i.e. 'all others' or the rest because such class do not reveal the characteristics of data completely.

Mutually Exclusiveness

Each item of the data should be mutually exclusive or non-overlapping that is an observed value belongs to one and only one of the classes.

Stability

The classification of data should follow the principle of stability throughout the period of analysis in order to enable the user to properly carry out the analysis and comparison of data. For example, if the sales of refrigerators are classified by regions then advertising expenditure incurred for promoting the sale should also be classified regions wise.

Conformity to Objectives

The data should be classified in such a way that it conforms to the objectives of the enquiry. For example, if we are interested in studying the relationship between company secretary qualification and sex then it is meaningless to classify the students registered for Company Secretaryship course according to age and region because it will not serve any purpose.

Flexibility

Flexibility is an essential attribute for ideal classification so that it should be adjustable to new and changing conditions/circumstances. No classification is permanent to be used forever

Basis of Classification

Classification of data depends upon characteristics of data, and objectives of the enquiry. Broadly speaking, the data may be classified on the following four bases:

- (a) Geographical i.e. in relation to place, area or region;
- (b) Chronological i.e. on the basis of time.
- (c) Qualitative i.e. on the basis of some character or attribute.
- (d) Quantitative i.e. in terms of numerical values or magnitudes.

Geographical Classification: It is the classification where data are classified according to geographical or locational differences i.e., areawise, zonewise, regionwise, statewise or countrywise. For example, registration of students for company secretaryship course during the month of May 1991 and 1992 are given in the following tables.

Students Registration for CS Course

<i>Region</i>	<i>May 1991</i>	<i>May 1992</i>
Eastern	355	319
Northern	418	438
Southern	522	403
Western	318	222
Foreign	2	1
Total	1615	1383

This type of classification is generally listed in alphabetical order or in some other form depending upon the size or values as the case may be.

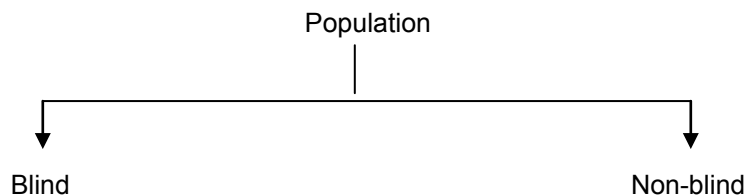
Chronological Classification: Under this type, data are classified on the basis of differences in time. For example, we may present the growth of population in India over different years as under:

<i>Year</i>	<i>Population (Crores)</i>
1891	23.6
1901	23.6
1911	25.2
1921	25.1
1931	27.9
1941	31.9
1951	36.1
1961	43.9
1971	54.8
1981	68.3
1991	84.4
2001	110.0

This type of classification is widely used in understanding the economic and business problems and to analyse their trend values over a period of time.

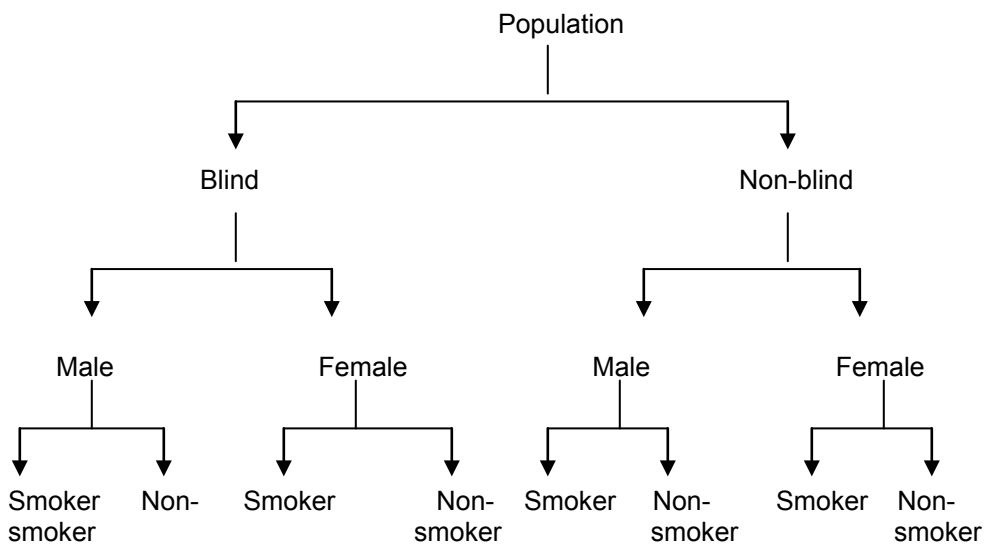
Qualitative classification : In this type of classification, data are classified on the basis of certain qualitative/descriptive characteristics or presence and absence of attributes, such as intelligence, beauty, honesty, occupation and sex, etc. This type of classification may be simple or multiple. In simple classification, the data are classified into two categories i.e., presence and absence of attributes. This form of

simple classification would be as follows:



However, in multifold classification the given data are classified into more than two categories.

For example, the problem of blindness among students is being studied on the basis of sex and their smoking habits. The classification of data in such a case would be as under:



Quantitative Classification

It refers to the classification where data are classified on the basis of figures or criteria which are capable of quantitative measurement such as height, age, weight, income, expenditure, number of marks obtained by students etc. For example, marks obtained by 100 B.Com. (Hons.) students in the statistics paper may be classified as under:

<i>Marks in statistics</i>	<i>No. of students</i>
0-20	15
20-40	15

40-60	45
60-80	20
80-100	5

In the above mentioned table, the marks of the students are the variable and number of students are the frequency. Variable means a characteristic which varies. A variable may be discrete or continuous. A discrete variable is one which does not assume fractional values within the range of numbers whereas continuous variable is one which is capable of manifesting every conceivable fractional value within the range of fractional possibilities

2. TABULATION OF DATA

Introduction

Tabulation refers to systematic and logical arrangement of data in columns and rows in accordance with some salient features and characteristics. According to A.M. Tulte, 'A statistical table is the logical listing of related quantitative data in vertical columns and horizontal rows of numbers with sufficient explanatory and qualifying words, phrases and statements in the forms of titles, heading and explanatory notes to make clear the full meaning of data and their origin. In the words of Secrist, "Table are means of recording in permanent form the analysis that is made through classification and by placing in just opposition things that are similar and should be compared".

Thus, it is clear from above two definitions that tabulation is a systematic and logical presentation of data such that it is easily understandable and comparable. It attempts to furnish the maximum information in the minimum possible space without sacrificing the quality and usefulness of data. The basic objectives of tabulation is to summarize the information in such a fashion that it can be easily analysed, compared and interpreted.

Significance of Tabulation of Data

Some of the major points of significance of Tabulation of data are discussed as under:

(i) *Presentation of complex data in systematic and simplified form*

Tabulation presents the complex raw data in systematic and simplified form so that it is easily understandable to a common man without wasting much time.

(ii) *Comparison*

Tabulation facilitates meaningful comparison of data because of division of table into parts, sub-parts, columns and rows.

(iii) *Identification of Data*

Tabulation enables easy identification of data as source of reference because data are arranged in tables with specific titles and numbers.

(iv) *Economy in Space and Time*

Tabulation, also eliminates unnecessary and irrelevant details and presents the meaningful information only. In this way it saves time and space both.

(v) *Discloses Trend and Pattern of Data*

Tabulation discloses the trend and pattern of data which cannot be otherwise understood if the presentation is descriptive.

(vi) *Facilitates Statistical Analysis*

Tabulation facilitates statistical analysis easier because of systematic presentation of data. It enable to make use of various statistical techniques such as averages, dispersion, correlation or time series, when data are tabulated in systematic fashion.

Essential Parts of a Table

Before going into details of the techniques of tabulation, it is useful to discuss about the essentials of a table. A table consists of statistical data systematically arranged in rows and columns. The actual form and structure of a table depends upon the nature of data tabulated and the purpose of study under investigation.

However, a table should contain the following parts:

- (i) Table Number
- (ii) Title of the Table
- (iii) Sub-title or Head Note
- (iv) Captions and stub
- (v) Body
- (vi) Footnotes
- (vii) Source Note

(i) *Table Number*

Each and every table should be serially numbered so that it becomes easier for reference purposes in future. The number of a table may be either in the centre at the top of title or in the side of title at the top or in the bottom of the table at left hand side.

(ii) *Title of the Table*

It is a must for every table to have a suitable title which usually appears at the top of table. The title should be brief, precise, clear and self-explanatory so that the reader or user gets clear idea about the contents of table at a glance. Title should be written in phrases and in bold letters.

(iii) *Sub-title or Head Note*

A Sub-title or head notes refers to brief or short statement for explaining any point or points not included in the heading. It is placed below the title centered and is enclosed in brackets. The head notes are applicable for entire tables. For example, unit of measurements are always expressed as head notes such as 'rupees in

thousands' or 'area in hectares' or 'quantity in litres' or in 'tonnes' etc.

(iv) Captions and Stubs

Captions and stubs are heading for the vertical columns and horizontal rows in a table respectively. They should be brief, concise and self-explanatory. Captions are written in the centre of the columns in small letters to economise the space whereas stub are written at the extreme left of the row. The stubs are kept as narrow as possible without losing precision and clarity of statements.

(v) Body of the Table

The body constitutes an important part of the table. It contains the numerical information which is presented to the users. The information is shown in columns and rows arranged according to captions and stubs.

(vi) Footnotes

Footnotes are used to clarify anything which is not otherwise clear by the heading, title, captions, stub etc. Footnote is given at the bottom of a table. The footnotes basically supply information on any of the following points:

- (i) to point out any specific detail of data;
- (ii) the sources in the case of secondary data;
- (iii) limitation of data if any.

Footnotes may be identified by members say 1, 2, 3 ... or letters i.e. a, b or symbols *, **/! etc.

(vii) Source Note

Below the footnotes or below the table, the source note of the data may be mentioned for the verification of the reader. The source note is required if the secondary data is used. In case data are taken from a research journal or periodical, then source note should contains the details such as name of the journal/periodical, date of its publication, volume number, table number if any, page number etc. It may help the users to satisfy himself about the accuracy of data.

A specimen table, containing all parts are given as under, in order to understand it clearly.

Table

TITLE

<i>Head note if any</i>		
<i>Stub Heading</i>	<i>Captions Column Headings</i>	<i>Total</i>
Stub		
Entries	Body	Row Total

Total	Column Total	Grand Total

Footnotes

Classification of Table

Tabulation of data may be classified on different basis depending upon the objectives, nature and the coverage of enquiry. But broadly, speaking, it may be classified into following ways:

(i) Simple and Complex Table

Simple Tabulation of data refers to the table where data are classified on the basis of single characteristics. It is also known as one way table whereas in the case of complex table manifold table data are classified and presented with respect to two or more characteristics simultaneously. The Table 1 & 2 respectively will illustrate both the types of tables.

Table 1
India's Gross National Product at Factor Cost

(Rupees thousand crores)

<i>Year</i>	<i>Gross National Product (at current price)</i>
1990-91	503.5
1994-95	903.9
1995-96	1059.8
1996-97	1230.5
1997-98	1376.8
1998-99	1601.1
1999-2000@	1771.0

@ Quick Estimates

Source : Economic Survey 2000-2001.

The above table is a simple one, because it furnishes the data about one single characteristics of Indian economy i.e. Gross National Product. Table 2 is an example of the complex table which reflects two or more than two characteristics. In this case, it shows, India's export, import and trade balance over the years, i.e. from 1990-91 to

2000-2001.

Here, it may be clarified that as the order of the table increases, the table becomes more and more confusing and complicated.

Table 2
India's Export & Import and Trade Balance

(Rs. Crore)			
Year	Exports (including re-export)	Imports	Trade Balance
1990-91	32553	43198	-10645
1991-92	44041	47851	-3810
1992-93	53688	63375	-9687
1993-94	69751	73101	-3350
1994-95	82674	89971	-7297
1995-96	106353	122678	-16325
1996-97	118817	138920	-20103
1997-98	130101	154176	-24075
1998-99	139753	178332	-38580
1999-2000	162925	204583	-41658
2000-2001 (P)	129460	157256	-27796
(April-November)			

P = Provisional;

Source : Economic Survey, 2000-2001

(ii) *General Purpose or Reference Table and Specific Table*

General purpose tables are those tables, which serve general purpose and provide reference to the users. The basic purpose of this type of table is to present the data in such a fashion that individual item may be found readily by a reader. In this type of tables, we include the tables published by government or government agencies such as tables included in Economic Survey, Statistical Abstract of India, RBI Bulletin etc. On the other hand, specific purpose tables are those tables which are of analytical nature and prepared with the idea of making comparative studies and studying the relationship and significance of the figures provided by the data. Such type of tables uses interpretative figures such as ratio, percentage, in order to facilitate comparison. These tables are called derivative tables since they are derived from the general tables.

General Guidelines and Rules of Tabulation

There is no hard and fast rule to prepare a table. Basically, it depends on the nature of data and the objectives of the enquiry, and the skill and common sense on the part of investigator. According to Prof. A.L. Bowely, "In construction and tabulation common sense is the chief requisite and experience is the chief teacher". Tabulation of data is basically an art of presenting the data in a meaningful manner. Some of the general rules which may be followed in the construction of tables are given as follows:

- (i) The table should be compact, easily understandable and free from confusions;
- (ii) The table should be designed keeping in view the size of paper to be used;
- (iii) There should be logical placement of items in the table to avoid confusion;
- (iv) All items should be clearly stated;
- (v) The table should be complete and self-explanatory;
- (vi) Avoid the use of Detto marks ("");
- (vii) Proper care should be taken for ruling and spacing between different rows and columns;
- (viii) The unit of measurement should be clearly stated in the form of head note.

Requisite of a Good Statistical Table

A good statistical table should possess the following requisites:

- (i) A statistical table should aim at simplicity. Too much of detail and complexities should be avoided. But at the same time, it should be complete in itself and give explanation wherever necessary;
- (ii) It should have a clear, comprehensive and explanatory title. If necessary, there may be sub-title also.
- (iii) The stub and caption should be clear and concise and should be arranged in a way so that the objectives, whether a general purpose table, special purpose table, are fully achieved. The rows and columns can be lettered or numbered to facilitate reference;
- (iv) The head note should be clear and should indicate the units;
- (v) Totals and sub-totals should be shown in the table to indicate the overall total and sub-totals of various columns as also to indicate that all items have been accounted for;
- (vi) The reference if any should be noted clearly at the bottom of the table;
- (vii) Whenever necessary the derived statistics should be shown in the table;
- (viii) A table should have balanced length and breadth;
- (ix) Use of abbreviation should be avoided;
- (x) Greater clarity can be achieved by the use of variations in column width, width of lines, and faces of types (bold, italics etc.);
- (xi) There should be consistency in ruling.
- (xii) Zero should not be used to indicate the information that is not available.

This can be well indicated by not available.

The following illustrations explain the above points.

Illustration 1 : Present the following information regarding the employees of a factory in a suitable tabular form:

In 1985 out of a total of 3,500 workers of a factory 2,400 were members of a trade union.

The number of women employed was 400 of which 350 did not belong to a trade union. In 1990 the number of union workers increased to 3,160 of which 2,580 were men. On the other hand, the number of non-union workers fell down to 416 of which 360 were men.

In 1995 there were 3,600 employees who belonged to a trade union and 100 who did not belong to a trade union. Of all the employees in 1995, 600 were women, of whom only 16 did not belong to trade union.

Solution

Table showing the Sex-wise Distribution of Union and Non-Union Members in a Factory in 1985, 1990 and 1995

Category	1985			1990			1995		
	M	F	Total	M	F	Total	M	F	Total
Members	2350	50	2400	2580	580	3160	3016	584	3600
Non Members	750	350	1100	360	56	416	84	16	100
Total	3100	400	3500	2940	636	3576	3100	600	3700

M — Males,

F — Females

Illustration 2 : In a trip organised by a Local College of Delhi University, there were 80 persons, each of whom paid Rs. 150 on an average. There were 60 students each of whom paid Rs. 160. Members of the teaching staff were charged at a higher rate. The number of servants was 8 (all males) and they were not charged anything. The number of ladies was 30% of the total of which two was lady staff member.

Tabulate the above information.

Solution

Table showing the Type of Participants, according to Sex and Contribution Made

Type of	Sex	Contribution	Total

<i>Participants</i>	<i>Males</i>	<i>Females</i>	<i>Total</i>	<i>per member (Rs.)</i>	<i>Contribution (Rs.)</i>
Students	38	22	60	160	9,600
Teaching Staff	10	2	12	200	2,400
Servants	8	—	8	—	—
Total	56	24	80	—	12,000

Notes : 1. Total contribution = Average contribution X No. of persons who joined the trip.

$$= 150 \times 80 = \text{Rs. } 12,000$$

2. Contribution of the staff per head has been obtained by deducting the contribution of students from the total and dividing the difference by the number of teaching staff, i.e.

$$= \frac{(12,000) - (60 \times 160)}{12} = \frac{12,000 - 9,600}{12} = \frac{2,400}{12} = \text{Rs. } 200$$

Illustration 3 : In 1990 out of total 2400 students in a college in a metropolitan city, 1800 were for graduation and the rest for post graduation. Out of 1800 graduate students 600 were girls. However, in all there were 800 girls in the college. In 1995, the number of graduate students increased to 2000 out of which 700 were girls but the number of PG students falls to 500 of which only 400 were boys. In 2005, out of 1000 girls, 800 were for graduation where as total number of graduates were 2500. The number of boys and girls in PG classes were equal.

You are required to present the above information in Tabular Form and calculate the percentage increase in number of graduate students in 2005 as compared to 1990.

Solution

<i>Year</i>	<i>Graduate Students</i>		<i>PG Students</i>		<i>Total</i>
	<i>Boys</i>	<i>Girls</i>	<i>Boys</i>	<i>Girls</i>	
1990	1200	600	400	200	2400
1995	1300	700	400	100	2500
2005	1700	800	200	200	2900

Percentage Increase in Graduate students in 2005 as compared to 1990

$$= 700/1800 \times 100 = 38.8\%$$

3. FREQUENCY DISTRIBUTION OF DATA

Introduction

A tabular arrangement of data with corresponding frequency is known as frequency distribution. In other words, it is a specification of the ways in which the frequencies of the different elements of the population are distributed according to the size of variables under consideration. To be more precise, in the words of Croxton and Cowdon, "Frequency distribution is a statistical table which shows the set of all distinct values of the variables arranged in the order of their magnitude, either individually or in groups with their corresponding frequencies side by side". Thus, a frequency distribution consists of two parts, one part shows magnitude of values whereas other part shows number of times a value or group of values has repeated.

Classification of Frequency Distribution

Broadly speaking, a frequency distribution may be classified into the following two categories:

1. Ungrouped frequency distribution of discrete frequency distribution.
2. Grouped continuous frequency distribution or continuous frequency distribution.

(i) *Ungrouped or Discrete Frequency Distribution*

Under discrete frequency distribution, we count the number of times each value of a variable is repeated and the number (technically known as tally) is placed alongside the value to which it corresponds. The following illustration would make it clear:

Illustration 4 : From the given information of number of rooms in house in a locality, construct the discrete frequency distribution.

1	3	2	2	2	2	1	2	1	1	1	3
2	2	3	3	3	3	3	3	2	3	4	1
3	2	6	2	1	6	2	1	5	1	5	2
1	5	2	3	4	2	7	4	2	3	3	4
4	3	4	4	2	3	1	4	3	2	2	1

In this case, the variable is the number of rooms in each house and since it assumes only integer value so it is a discrete variable. The above information can be

condensed in the form of discrete frequency distribution as under:

<i>No. of rooms in the house (x)</i>	<i>Tally Bars</i>	<i>Frequency (f)</i>
1	//// //	12
2	//// ////	18
3	//// //// /	16
4	//// ///	8
5	///	3
6	//	2
7	/	1
		60

In the above table X shows the number of rooms and (f) the frequency i.e. availability of rooms in the house. Literally bar is used to count the frequency.

The above distribution is discrete frequency distribution because every X value is associated with corresponding (f) values i.e. $X_1 = 1, f_1 = 12$; $X_2 = 2, f_2 = 18$, $X_3 = 3$ and $f_3 = 16$, $X_4 = 4, f_4 = 8$, $X_5 = 5, f_5 = 3$, $X_6 = 6, f_6 = 2$, $X_7 = 7, f_7 = 1$.

(ii) Grouped Frequency Distribution

It is the distribution where the frequency refers to group of values. It is a tabular arrangement of data by classes together with the corresponding frequencies. This type of distribution is prepared when some variable assumes any fractional values particularly height and weight of the students. The following table on frequency distribution of weight of 100 male students at Delhi University will help to understand the above point more clearly:

Table
Weights of 100 Male students at Delhi University

<i>Weights (kg.)</i>	<i>Tally</i>	<i>No. of students</i>
40-50	////	5
50-60	/// ////	18
60-70	//// //// //// //// //// //// //// //	42
70-80	//// //// //// //// //// //	27
80-90	//// //	8
		100

Basic Terminology Used in the Construction of Grouped Frequency Distribution

The basic terminology which is frequently used in the construction of grouped frequency distribution includes the following aspects.

Class limit : The end numbers or the highest and lowest values that can be included in a class interval are known as the class limits of that class. For example, in above table 40-50 and 80-100 are the lower and upper class limits.

Class interval : It is the difference between the upper limit and lower limit of the same class. The lower limit of a class is usually represented by symbol l_1 and upper limit by l_2 .

$$\text{Class mid point} = \frac{\text{Upper limit} + \text{Lower limit}}{2}$$

Class frequency : The number of observations included in a particular class is known as the frequency of that class.

Exclusive classification: Exclusive classification is the one whose class intervals are so determined that upper limit of one class is the lower limit of the next class. Example of this type of classification is as below:

<i>Wages of workers (Rs.)</i>	<i>Workers</i>
500-600	35
600-700	30
700-800	20
800-900	10
900-1000	5
	100

The basic point of confusion in this type of classification is on placing the variable having upper unit value. For example, a worker getting Rs. 600 would be placed in the class of Rs. 500-600 or Rs. 600-700. The normal convention in this case is to include the value equal to upper limit in the next class. A more precise way to present the data is as under:

<i>Wages (Rs.)</i>	<i>Workers (Frequency)</i>
500 and above but below 600	35
600 and above but below 700	30
700 and above but below 800	20
800 and above but below 900	10
900 and above but below 1000	5
	100

Inclusive Classification

It refers to that classification where both the class limits are included in the class itself while determining the class intervals. The following example will illustrate this

type of classification:

<i>Marks</i>	<i>Students</i>
1-10	4
11-20	5
21-30	6
31-40	10
41-50	5
	30

In this case, both the class limits lower as well as upper are included in the class interval. For example, marks 1 and 10 both are included in the class interval 1-10.

Class Boundaries

Under a situation where group frequency distribution is having a gap between upper limit of one class and lower limit of the next class, there arises a need of obtaining class boundaries. These class boundaries are obtained as under:

Lower class boundary = Lower class limit - $1/2.d$

Upper class boundary = Upper class limit + $1/2.d$

where d is known as the correction factor and it is the difference between upper class limit of any class interval and lower class limit of next class interval.

The following table illustrate this point clearly:

<i>Class limit (Wages)</i>	<i>Class boundaries</i>	<i>Workers</i>
6-10	5.5 - 10.5	4
11-20	10.5 - 20.5	5
21-30	20.5 - 30.5	6
31-40	30.5 - 40.5	10
41-50	40.5 - 50.5	5
		30

It may be noticed in the above table that upper boundary of one class is the same as the lower boundary of the next class. Basically, it is the process of making the distribution continuous.

Un-equal Class Intervals

In this type of cases, Class intervals for different classes are different. Following example illustrates this type of case:

<i>Marks</i>	<i>Students</i>
1-10	4
10-15	4
15-25	12

25-40	5
40-50	5
	30

Open End Classes

Open end classes refers to those situations where the last class has no upper limit and the first class has no lower limit. The necessity of open end classes arises when there are few very high values or low values which are far apart from the majority of observation. The following example illustrates the case of open end classes.

<i>Marks</i>	<i>Frequency</i>
Less than 50	9
50-100	4
100-150	3
150-200	2
200-above	2
	20

However, the use of open end classes creates difficulties in finding mid-values while analysing grouped frequency distribution. The best way to overcome this type of problem is to avoid the use of open end classes as far as possible.

Class Width or Size of Class Interval

It is the difference between the lower and upper class boundaries. If all class interval or frequency distribution have equal width then the width is denoted by C. It is generally preferable to have classes of equal width. Unequal width is resorted when some classes are over crowded and some have practically no frequency.

Frequency Density - It refers to the frequency of a class per unit of width and indicates concentration of frequency in the class.

$$FD = \frac{\text{Class Frequency}}{\text{Width of the Class}}$$

General Rules for Constructing a Frequency Distribution

- (i) Determine the largest and smallest numbers in raw data and thus find the range (difference between largest and smallest numbers).
- (ii) Divide the range into a convenient number of class interval having the different sizes or open end classes. The number of class interval depends on the number of items to be classified, magnitude of data and the level of accuracy. Class intervals are chosen in such a way that class marks or mid-points coincide with actually observed data. This tends to reduce the so called grouping error involved in further mathematical analysis. However, class boundaries should not coincide with actually observed data.
- (iii) Determine the number of observations into each class intervals i.e. find the

class frequencies. This is best done by using tally marks.

Determination of Number of Classes and Class Intervals

- (a) *Determination of Number of Classes* : In a group frequency distribution the determination of number of classes/class interval is very tedious task. Generally, there is no hard and fast rule to decide the number of classes. Practically, the number of classes should be neither large nor too small. If the number of classes are large, some of the groups may have very small or no frequencies. This might give irregular pattern of frequencies in different class thus making the frequency distribution irregular. On the other hand, if the number of classes is small, large number of frequencies may get concentrated in small number of groups. This obscures some of the important features and characteristics of data, and thus results in loss of information. The number of class basically depends upon the total frequency, the nature of data, accuracy desired and ease of computation. However, there is need to keep a balance between these two factors i.e. irregularity of frequency distribution and loss of information in order to arrive at the optimum number of classes. The number of classes is inversely proportional to magnitude of class interval.

Prof. Sturges has suggested a rule (formula) in order to decide the approximate number of classes. The rule is as under:

$$K = 1 + 3.322 \log_{10} N$$

where K = Number of class intervals.

N = Total Number of observations in data.

The value obtained by the above formula is rounded to the next higher figure. For example

if $N = 10$

$$\begin{aligned} \text{then } K &= 1 + 3.322 \log_{10} 10 \\ &= 1 + 3.322 \times 1 \\ &= 1 + 3.322 = 4.322 \simeq 4 \end{aligned}$$

If $N = 100$

$$\begin{aligned} \text{then } K &= 1 + 3.322 \log_{10} 100 \\ &= 1 + 3.322 \times 2 \\ &= 1 + 6.644 = 7.644 \simeq 8 \end{aligned}$$

Sturges Rules very ingeniously restrict the number of classes 4 and 20 which is fairly reasonable number from practical point of a view. This rule does not work if the number of observations are very large or small.

- (b) *Determination of Size of class*: Like the number of classes, the magnitude of

class intervals should be optimal and reasonable. Since the number of classes are inversely proportional to the magnitude of class intervals in a given distribution, the approximate value of the magnitude (width) of the class interval can be obtained by using Struges rules as under:

$$\text{Magnitude of class (i)} = \frac{\text{Range}}{\text{Number of class}}$$

where, range = $X_{\text{max}} - X_{\text{min}}$

= Highest value in distribution — Lowest value in distribution
(H) (L)

$$i = \frac{H - L}{1 + 3.322 \log_{10} N}$$

It may be pointed out, from practical point of view that it is desirable to take class interval of equal or uniform magnitude, throughout the frequency distribution. This will facilitate the computation of various statistical measures and also result in meaningful comparison between different classes and different frequency distribution.

4. DIAGRAMATIC PRESENTATION OF DATA

Diagrams are another important method to represent the statistical data. They are nothing but geometrical figures such as lines, bars, squares, rectangles, circles, cubes, etc.

Diagramatic presentation of data provides an easier method of understanding.

Advantages of Diagramatic Presentation

Some of the advantages of diagrammatic presentation include the following:

- (i) Data presented in the form of diagram can be understood even by a common man. Due to their attractive and impressive character, the diagrams are very frequently used by various newspapers and magazines for the 'explanation of certain phenomena'. Diagrams are also useful in modern advertising campaign.
- (ii) Diagrams are used to represent a huge mass of complex data in a simplified and intelligible form.
- (iii) A diagrammatic presentation may bring out certain hidden facts and relations which may not be revealed from classification and tabulation of data.
- (iv) The data, when presented in the form of diagrams, require less time to understand it.
- (v) The data, when presented in the form of diagrams, are easy to compare.
- (vi) The diagrams have universal applicability. These are used almost in every field of study like economics, business, administration, social institutions etc.

Limitations

In spite of the above advantages of diagrams, their usefulness is somewhat limited. One has to be very careful while drawing conclusions from diagrams. The main limitations are as under :

- (i) Diagrams give only a vague idea of the problem which may be useful for a common man but not for an expert who wishes to have an exact idea of the problem.
- (ii) The information given by diagrams vis-a-vis classification and tabulation is limited.
- (iii) The level of precision of values indicated by diagrams is very low.
- (iv) Diagrams do not lead to any further analysis of data.
- (v) Diagrams can portray only limited number of characteristics. Larger the number of characteristics, the more difficult is to understand them using diagrams.
- (vi) Diagrams are liable to be misused for presenting an illusory picture of the problem.
- (vii) Diagrams do not give a meaningful look when various measurements have wide variation.
- (viii) Diagrams drawn on a false base line should be analysed very carefully.

General Principles of a Diagrammatic Presentation

A diagrammatic presentation is a simple and effective method of presenting the information contained in statistical data. The construction of a diagram is an art, which can be acquired only through practice. However, the following rules should be observed in their construction, to make them more effective and useful tool of understanding a given problem:

- (i) Every diagram must have a suitable title written at its top to convey the subject matter in brief and unambiguous manner. The details about the titles, if necessary, should be provided below the diagram in the form of a footnote.
- (ii) A diagram should be constructed in a manner that it has an immediate impact on the viewer. It should be neatly drawn and an appropriate balance should be maintained between its length and breadth. A diagram should neither be too small or too large. Various aspects of the problem may be emphasised by using different shades or colours.
- (iii) Diagrams should be drawn accurately by using proper scales of measurements. Accuracy should not be compromised to attractiveness.
- (iv) The selection of an appropriate diagram should be carefully done keeping in view the nature of data and the objective of investigation.

- (v) When a diagram depicts various characteristics distinguished by various shades and colours, in index explaining these should be given for clear identification and understanding.
- (vi) The source of data must also be indicated particularly when it has been from a secondary source.
- (vii) As far as possible, the constructed diagram should be simple so that even a layman can understand them without any difficulty.

Types of Diagrams

There are a number of diagrams which can be used for the presentation of data. The selection of a particular diagram depends upon the nature of data, objective of presentation and the ability and experience of the person doing this task. Some popular types of diagrams are discussed below.

1. Line Diagram

In case of a line diagram, different values are represented by the length of the lines, drawn vertically or horizontally. The gap between successive lines is kept uniform. Although the comparison is easy, the diagram is not very attractive. This diagram is used when the number of items is very large.

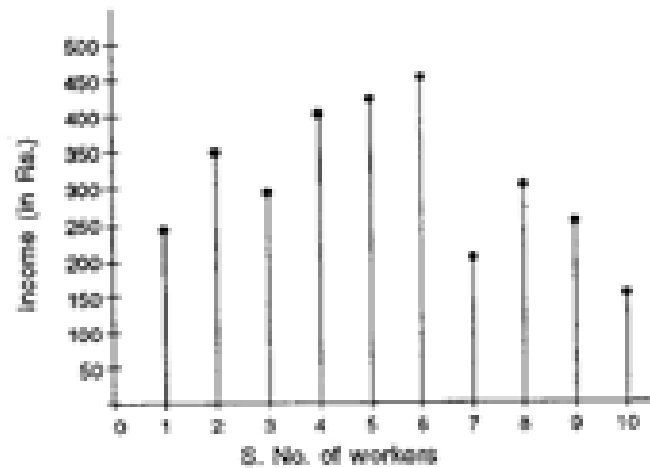
Illustration 5

The income of 10 workers in a particular week was recorded as given below. Represent the data by a line diagram.

S.No. of workers	1	2	3	4	5	6	7	8	9	10
Income (in Rs.)	240	350	290	400	420	450	200	300	250	200

Solution :

Line Diagram of Income of 10 workers :



2. Simple Bar Diagram

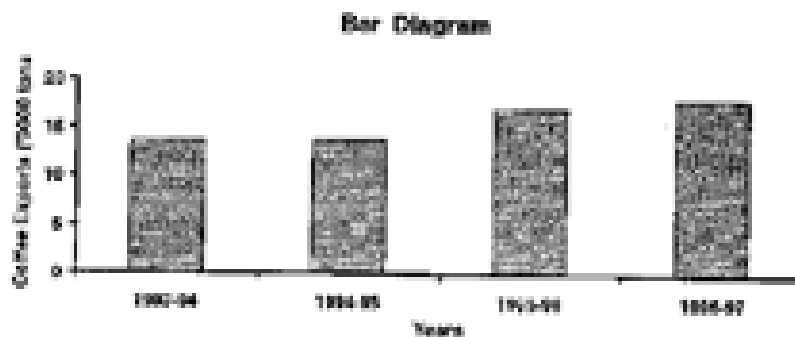
In case of a simple bar diagram, the vertical or horizontal bars, with height proportional to the value of the item, are constructed. The width of a bar is chosen arbitrarily and is kept constant for every bar. The gaps between successive bars is also kept same. Bar diagrams are particularly suitable for representing individual time series or spatial services.

Illustration 5 :

Represent the following data by a bar diagram :

Years :	1993-94	1994-95	1995-96	1996-97
Coffee Exports ('0000 tons) :	13.67	13.73	17.06	18.12

Solution :



Source : Ministry of Commerce, Government of India.

3. Multiple Bar Diagram:

This diagram is also known as *compound bar diagram*. It is used when we want to show comparisons between two or more sets of data. A set of bars for a period or related phenomena are drawn side by side without gaps while various sets of bars are separated by some arbitrarily chosen constant gap. Different bars are distinguished by different shades or colours.

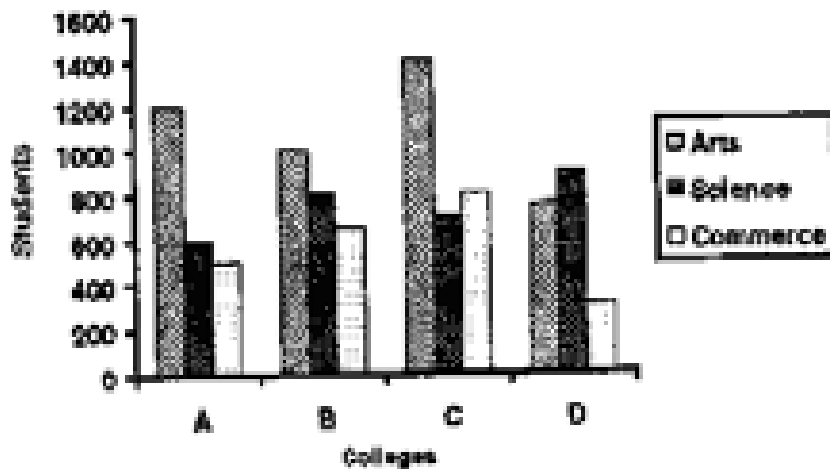
Illustration 6 :

Represent the following data on faculty-wise distribution of students by a multiple bar diagram :

College	Students		
	Arts	Science	Commerce
A	1200	600	500
B	1000	800	650
C	1400	700	800
D	750	900	300

Solution :

Multiple Bar Diagram of the Faculty-wise Distribution of students:



4. Sub-divided or Component Bar Diagram

In this diagram, the bar corresponding to each phenomenon is divided into various components. The portion of the bar occupied by each component denotes its share in the total. The sub-divisions of different bars should always be done in the same order and these should be distinguished from each other by using different shades or colours.

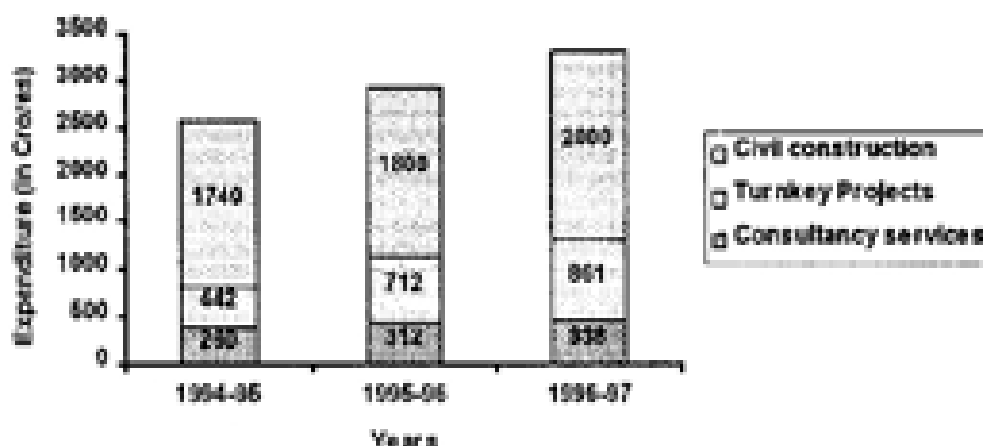
A sub-divided bar diagram is useful when it is desired to represent the comparative values of different components of a phenomenon.

Illustration 7

The following table gives the value of (Rs. in Crores) of contracts secured from abroad, in respect of Civil Construction, industrial turnkey projects and software consultancy in three financial years. Construct a component bar diagram to denote the share of an activity in total export earnings from the three projects.

Years	1994-95	1995-96	1996-97
Civil construction	260	312	338
Turnkey Projects	442	712	861
Consultancy services	1740	1800	2000
Total	2442	2824	3199

Solution :



5. Circular or Pie Chart

Pie chart is an alternative to a component bar diagrams. A pie chart basically consists of a circle divided into sector by radii in such a way that areas of the sectors are proportional to the values of the component items under investigation. The whole circle, of course, representing the whole of data under investigation. It is also known as circular chart or percentage chart diagram.

Steps to draw Pie Chart

- Express the different components of the given data in percentages of the whole.
- Multiply the each percentage components to 3.6 (since the total angle at the centre being 360 degree, it will represent the whole i.e. 100%).
- Draw a circle with convenient radius.

- (iv) Divide the circle into different sectors with those central angles.
- (v) Shade different sector differently.

Use of Pie Chart

The use of pie chart is quite popular as the circle provides a visual concept of the whole (100%). Pie charts are also one of the most commonly used charts because they are simple to use. Despite its popularity, pie charts should be used sparingly for two reasons:

- (i) They are best used for displaying statistical information when there are no more than six components only, otherwise, the resulting picture will be too complex to understand.
- (ii) Pie charts are not useful when the values of each components are similar because it is difficult to see the differences between slice sizes.

Illustration 8 : Represent the following data, on India's exports (Rs. in Crores) by regions during April to February, 1997.

Region:	Europe	Asia	America	Africa
Exports:	32699	42516	23495	5133

Solution:

Total exports = 32699 + 42516 + 23495 + 5133 = Rs. 10,3843 crore

The angles for different regions are :

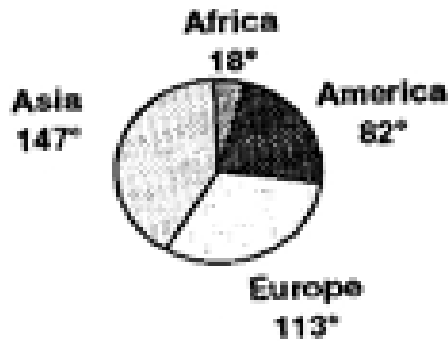
$$(i) \text{ Europe} = \frac{32699 \times 360}{103843} = 113^\circ$$

$$(ii) \text{ Asia} = \frac{42516 \times 360}{103843} = 147^\circ$$

$$(iii) \text{ America} = \frac{23495 \times 360}{103843} = 82^\circ$$

$$(iv) \text{ Africa} = \frac{5133 \times 360}{103843} = 18^\circ$$

Pie Chart

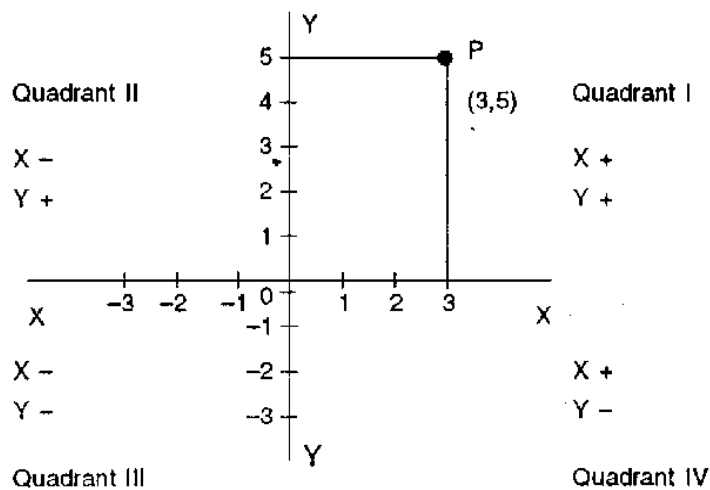


5. GRAPHIC PRESENTATION

Graphic presentation is another way of presentation of data. Graphs are commonly used for the presentation of time series and frequency distributions. Graphic presentation of data, like diagrammatic presentation, also provides a quick and easier way of understanding broad features and to facilitate the process of comparison of two or more situations. In addition to this, it can also be used as a tool of analysis e.g. we can find median, mode etc. by means of graph.

Construction of a Graph

A point in a plane can be located with reference to two mutually perpendicular lines. The horizontal line is called the X-axis and the vertical line the Y-axis. Their point of intersection is termed as origin. The position of a point in a place is located in terms of its distances from the two axes. If a point P is 3 units away from Y-axis and 5 units away from X-axis, its location will be as shown in the figure :



It should be noted here that the distance of the point from Y-axis is measured along X-axis and its distance from X-axis is measured along Y-axis. To measure 3 units from Y-axis, we move 3 units along X-axis and erect a perpendicular at this point. Similarly, to measure 5 units from X-axis, we move 5 units along Y-axis and erect a perpendicular. The point of intersection of these two perpendiculars is the required point. The position of the point is denoted by the pair of numbers (3, 5). These numbers are respectively termed as abscissa and ordinates of the point. Jointly they are termed as the coordinates of a point. The coordinates of a point, in general form, are written as (X, Y).

The four parts of the plane are called quadrants. It may be noted that X and Y are both positive in first, X is negative and Y is positive in second, X and Y are both negative in third and X is positive and Y is negative in fourth quadrant.

Different points can be plotted for a different pair of values e.g. for data on demand of a commodity at different prices, we can locate a point for each pair of quantity and price. These points are then joined by a line or a curve to get the required graph.

General Rules for a Graphic Presentation

For an attractive and effective graphic presentation, statistical data requires certain rules, principles and guidelines. Some of the major principles in this regard are discussed as under :

- (i) *Suitable title* : It is essential for a graph to have a suitable title. It indicates clearly the subject for which the facts or data are presented in the graph.
- (ii) *Unit of measurement* : The unit of measurement of a variable should be clearly stated below the title.
- (iii) *Suitable scale* : There should be suitable scale so that the whole data may be represented in accurate manner. The respective sizes of the scale of X axis and Y axis cannot be rigidly laid down. About choice of scale, Bowley has rightly pointed out, "It is difficult to lay down rules for the proper choice of scales by which the figures should be plotted out. It is only the ratio between the horizontal and vertical scales that need to be considered. The figure must be sufficiently small for the whole for it to be visible at once: if the figure is complicated, related to long series of years and varying numbers, minute accuracy must be sacrificed for this consideration. Supposing the horizontal scale is decided, the vertical scale must be chosen so that the part of the line which shows the greatest rate of increase is well inclined to the vertical which can be managed by making the scale sufficiently small and on the other hand all important fluctuations must be clearly visible for which the scale may need to be decreased. Any scale which satisfies both these conditions will fulfill its purpose".
- (iv) *Index* : A brief index explaining various types of shades, colours, lines and designs used in the construction of the graph along with scale of interpretation should be given for clear understanding.
- (vi) *Sources of Data* : The sources of information wherever possible should be given at the bottom of the graph.
- (vii) *Simplicity* : The Graph should be as simple as possible so that they are easily understood even by an ordinary person who does not have any exposure in the areas of statistics or mathematics.

- (viii) *Neatness* : Since the graphs is visual aids for presentation of statistical data, it is therefore, imperative that they are made neat, clean and very attractive by proper size and lettering, and use of appropriate devices like different colours, dashes, dark lines broken lines etc.

Merits of a Graph

The technique of graph offers numerous advantages to the users. Some of the major advantages are listed as under :

- (i) The graph presents the data in such a fashion, that it is easier for the user to understand.
- (ii) It gives attractive presentation to statistical data as compared to tables. By looking at the graph, it is easier to notice the main features of data at a glance in trends and fluctuations.
- (iii) It is time saving device.
- (iv) It facilitates comparison of data relating to two different periods of time or two different regions.
- (v) It does not require knowledge of mathematics on the part of the users to understand the message of graph.
- (vi) It is helpful to locate the median, mode and mean values of the data.
- (vii) It is helpful in forecasting, interpolation and extrapolation of data.

Limitations of a Graph

Although the technique of graph is a useful one, but it is not free from limitations. Some of its major limitations are as under :

- (i) It lacks complete accuracy about facts.
- (ii) It depicts only few characteristics of data.
- (iii) The graph cannot be used in support of some statement.
- (iv) The graph is not a substitute for tabulation in all circumstances and for all purposes.
- (v) It is not easy to a layman to understand and interpret the graph.
- (vi) It shows only the unreasonable tendency of the data and actual values are not always clear from the graph.

Types of Graphs

Basically, the graphs are broadly divided into two categories:

- (i) Graph time series or time series graph.
- (ii) Graph of frequency distribution.

Time Series Graph

A time series graph also known as historigram refers to a graph which depicts the value of a variable over a different point of time. In time series graph, time is the most important factor and the variable is related to time which may be either year, month, week, day, hour or even minutes and second. It is the most helpful device to understand and analyse the changes in a variable at different point of time. These types of graphs are widely used by economists, businessmen and statistician because:

- (i) it is easy to understand;
- (ii) it enables to present more information of complicated nature in very simple and precise way.

Steps involved in Construction of Graph

The construction of this type of graph is very simple and does not require any technical skill on the part of users. Some of the major steps involved in the construction of time series graph are given as under:

- (a) Represent time on horizontal or X axis and value of variable on vertical or Y axis. Ensure that the unit of time and value of variable should be clearly stated.
- (b) Start Y value with zero and devise a suitable scale to present the value of a variable so that the whole data can be accommodated within given space. For instance, 1 centimeter on the vertical scale may be equal to 100 units, 500 units or 1000 units. Like wise, it may be equal to year; month or days on horizontal axis.
- (c) Plot the values of variable corresponding to the true factor and join different points by drawing a straight line.
- (d) If there are more than one variable, then these values may be plotted on the graph by different types of lines.

A brief details of various types of graph are given as under:

1. Line Graph

A line graph is a way to summarise how two pieces of information are related and how they vary depending on one another.

In graph, the successive plotted points are joined with the help of a straight line.

Advantages

- It can compare multiple continuous data sets easily.
- Interim data can be inferred from graph line

Disadvantages:

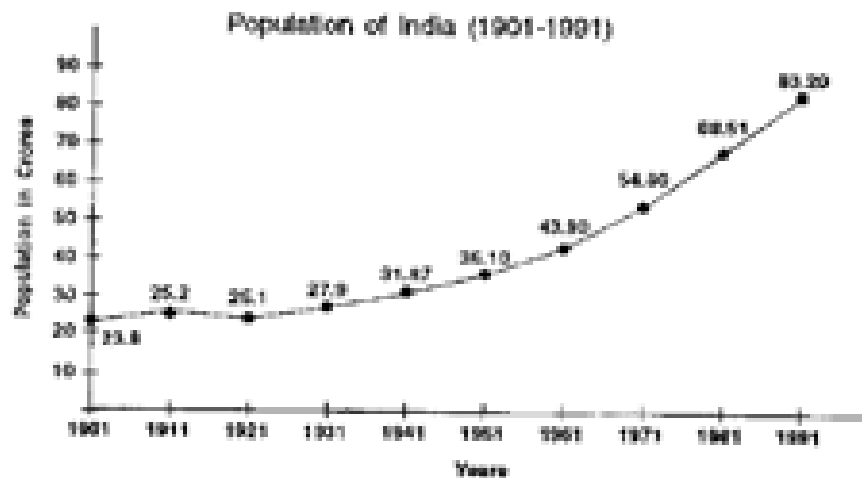
- It is used only with continuous data.

The method of construction is illustrated by means of following illustration.

Illustration 9 : Represent the following population of India data by a suitable graph:

<i>Year :</i>	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991
<i>Population (crores):</i>	23.8	25.2	25.1	27.9	31.87	36.10	43.90	54.80	68.51	83.70

Solution:



Use of False base Line: The basic principle of drawing a time series graph is that vertical line must start from zero. If the fluctuations in the values of the dependent variable (to be presented on Y axis) are very small relative to their magnitude and if the minimum of these values is very distant (far greater) from zero, the point of origin, then for an effective portrayal of these fluctuations, the vertical scale is stretched by using false base line. In such a situation the vertical line is broken and the space between the origin 0 and minimum value (or some convenient value near that) of dependent variable is omitted by drawing two zig-zag horizontal line above the base line. The scale along Y axis is framed accordingly. The false base line graph technique is useful from two point of views.

- (i) To magnify the minor fluctuation in time series data.
- (ii) To economise the space.

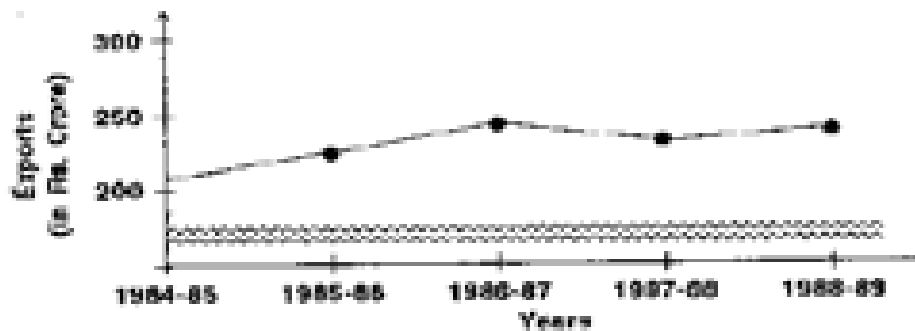
The following illustration will provide clarity to the technique of false base line.

Illustration 10 : The yearly exports (Rs. in Crores) of coffee are given below. Represent the data by a line graph.

Year	1984-85	1985-86	1986-87	1987-88	1988-89
Exports (in Rs Crores)	210	265	297	262	294

Solution :

Since the fluctuations in values are small in relation to their size, the graph will be drawn by the use of false base line, as shown below:



2. Net Balance Graph

When the net balance of, say, income and expenditure or revenue and cost or exports and imports etc. are to be shown, then net balance graph is used. Different shades are used for positive and negative differences.

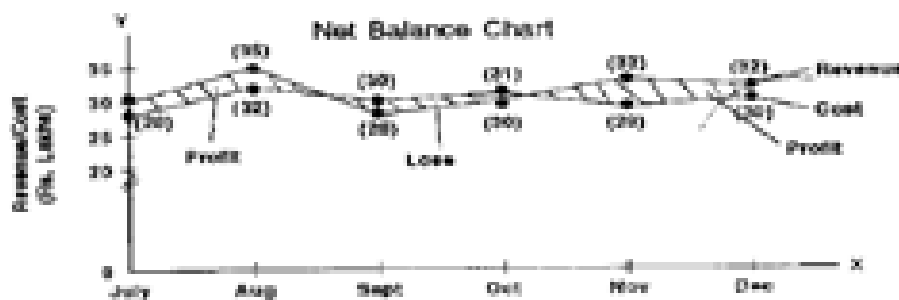
Illustration 11

Represent the following data on revenue and cost, of a company during July 1997 to December 1997, by a net balance graph.

Months (1997)	July	Aug.	Sep.	Oct.	Nov.	Dec.
Revenue (Rs. in Lakhs)	30	35	28	30	33	32
Cost (Rs. in Lakhs)	28	32	30	31	29	30

Solution :

We draw line graphs of revenue and cost separately. The gap between them will be either profit (when revenue is greater than cost) or loss. The distinction between profit and loss is made by shading the respective gaps in different styles, as shown in the following graph



(1997)

Alternatively, we can draw a line diagram of the profit (or loss) values of various months.

Graphs of a Frequency Distribution

A frequency distribution can also be represented by means of a graph. The most

common forms of graphs are discussed below.

1. Histogram

A histogram is a graph of a grouped frequency distribution in which class intervals are plotted on X-axis and their respective frequencies on Y-axis. On each class interval, a rectangle is created with height proportional to the frequency density of the class.

The histogram is a popular graphing tool. It is used to summarize discrete or continuous data that are measured on an interval scale. It is often used to illustrate the major features of the distribution of the data in a convenient form. A histogram divides up the range of possible values in a data set into classes or groups. For each group, a rectangle is constructed with a base length equal to the range of values in that specific group, and an area proportional to the number of observations falling into that group. This means that the rectangles will be drawn of non-uniform height. A histogram has an appearance similar to a vertical bar graph, but when the variables are continuous, there are no gaps between the bars. When the variables are discrete, however, gaps should be left between the bars.

Generally, a histogram will have bars of equal width, although this is not the case when class intervals vary in size. Choosing the appropriate width of the bars for a histogram is very important. Thus, the histogram consists simply of a set of vertical bars. Values of the variable being studied are measured on an arithmetic scale along the horizontal x-axis. The bars are of equal width and correspond to the equal class intervals, while the height of each bar corresponds to the frequency of the class it represents.

(a) Construction of a Histogram when class Intervals are equal

When class intervals are equal, then there is no need of computing frequency density. We can take the height of each rectangle to be equal to the frequency of the class.

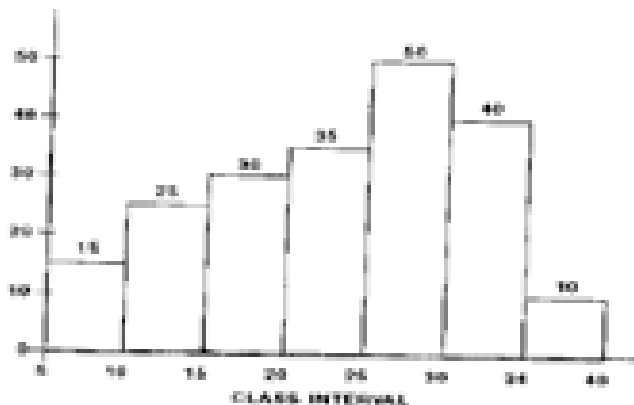
Illustration 12 :

Draw a histogram for the following frequency distribution :

Class Intervals	5-10	10-15	15-20	20-25	25-30	30-35	35-40
Frequency	15	25	30	35	50	40	10

Solution:

Histogram



(b) Construction of a Histogram when Class Intervals are not equal

When different class intervals of a frequency distribution are not of equal width, we compute frequency density (= frequency ÷ class interval) of each class. The product of shortest class interval and the frequency density of a class is taken as the height of the corresponding rectangle. Thus, we can write the height of the rectangle of a class as under:

$$= \frac{\text{Frequency of the class} \times \text{Width of the Shortest Class Interval}}{\text{Width of the class interval}}$$

$$\text{OR} = \frac{\text{Frequency of the class}}{\text{Adjustment factor}}$$

$$\text{Where Adjustment Factor (AF)} = \frac{\text{Width of the Shortest Class Interval}}{\text{Width of the class interval}}$$

Illustration 13:

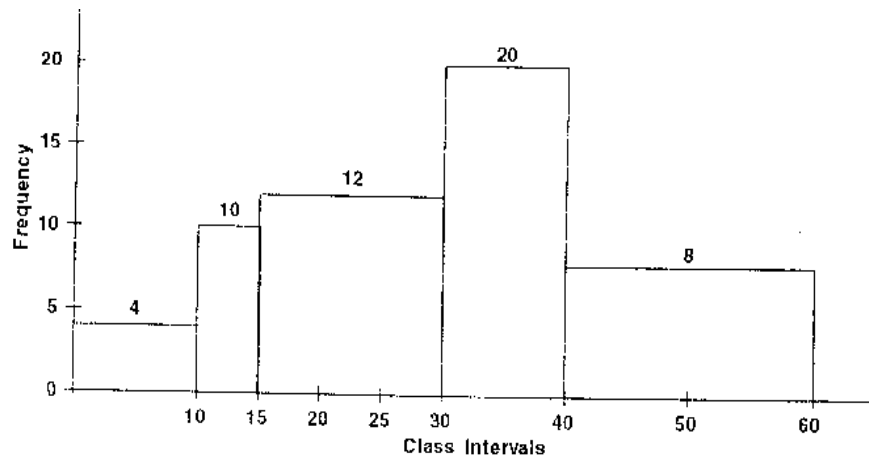
Represent the following frequency distribution by a histogram :

<i>Class Intervals</i>	0-10	10-15	15-30	30-40	40-60
<i>Frequency</i>	8	10	36	40	32

Solution:

<i>Class Intervals</i>	<i>Frequency (f)</i>	<i>Adjustment Factor (AF)</i>	<i>Adjusted Frequency = $\frac{f}{AF}$</i>
0-10	8	2	4
10-15	10	1	10
15-30	36	3	12
30-40	40	2	20
40-60	32	4	8

Histogram



Use of Histogram

The histogram is used for variable whose values are numerical and measured on an interval scale. It is generally used when dealing with large data sets (greater than 100 observations). A histogram can also help detect any unusual observations (outliers) or any gaps in the data.

2. Frequency Polygon or Histogram

A frequency polygon or Histogram is another method of representing a frequency distribution on a graph.

A frequency polygon is drawn by joining the mid-points of the upper widths of adjacent rectangles of the histogram, with straight lines. Two hypothetical class intervals, in the beginning and at the end of the distribution, are created. The ends of the polygon are extended upto base line by joining them with the mid-points of the hypothetical classes. This step is required to make area under the polygon equal to the area under histogram. Frequency polygon can also be constructed without making rectangles. The points of frequency polygon are obtained by plotting mid-points of classes against heights of various rectangles, which are equal to the frequencies if all the classes are of equal width. A histogram smoothes out the abrupt changes that may appear in histogram and is useful for demonstrating continuity of the variable being studied.

Illustration 14:

The daily profits (in Rs.) of 100 shops are distributed as follows :

<i>Profit/Shop:</i>	0-100	100-200	200-300	300-400	400-500	500-600
<i>No. of Shops:</i>	12	18	27	20	17	6

Construct a frequency polygon of the above distribution.

Solution:

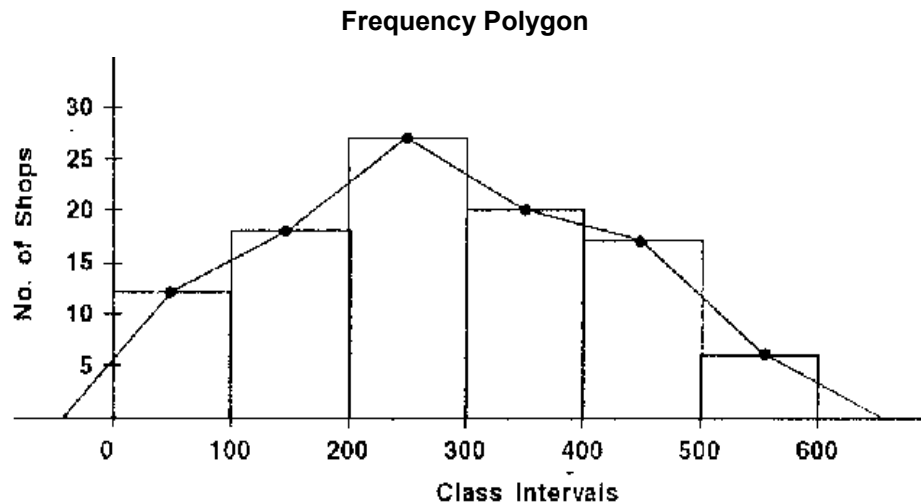


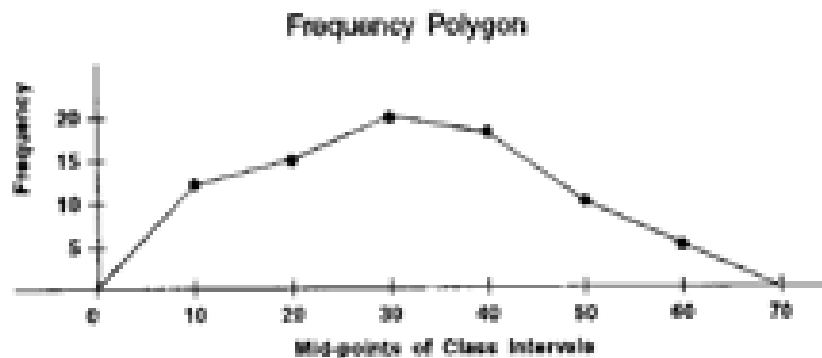
Illustration 15:

Represent the following data by a frequency polygon.

<i>Class Intervals:</i>	5-15	15-25	25-35	35-45	45-55	55-65
<i>Frequency:</i>	12	15	20	18	10	5

Solution:

We shall construct the frequency polygon without making the histogram.



3. Frequency curve

When the verticals of a frequency polygon are joined by a smooth curve, the resulting figure is known as a frequency curve. As the number of observations increases, there is need of accommodating more and more classes to accommodate them and hence the width of each class becomes smaller and smaller. In such a situation the variable under consideration tend to become continuous and the frequency polygon of the data tends to acquire the shape of a frequency curve. Thus, a frequency curve may be regarded as a limiting form of frequency polygon as the number of observations tend to become large.

The construction of a frequency curve should be done very carefully by avoiding, as far as possible, sharp and sudden turns. Smoothing should be done so that the area under the curve is approximately equal to the area under histogram or frequency polygon. The dotted curve represents the frequency curve of the data in illustration 15, as shown above.

4. Cumulative Frequency Curve or Ogive

The graphical representation of a cumulative frequency distribution is termed as a cumulative frequency curve or ogive. Since, a cumulative frequency distribution can be of 'less than' or more than type, accordingly, there are two types of ogives; 'less than ogive' and 'more than ogives'. The ogives can be better understood with the help of following illustration :

Illustration 16

Draw 'less than' and 'more than' ogives for the following distribution of weekly wages of 100 workers.

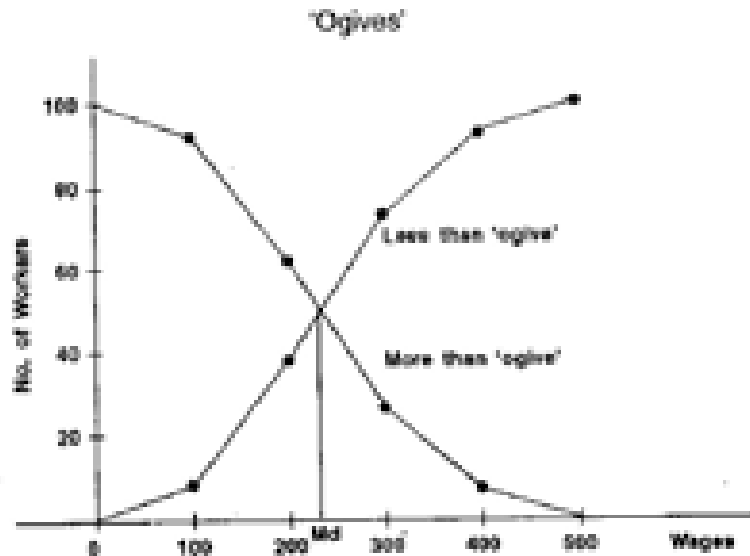
<i>Weekly Wages (Rs.)</i>	0-100	100-200	200-300	300-400	400-500
<i>No. of Workers</i>	8	30	35	20	7

Solution:

First we construct the 'less than' and 'more than' type cumulative frequency distributions.

<i>Wages less than (Rs.)</i>	<i>Cumulative Frequency (Workers)</i>	<i>Wages Cumulative More than (Rs.)</i>	<i>Cumulative Frequency (Workers)</i>
100	8	0	100
200	38	100	92
300	73	200	62
400	93	300	27
500	100	400	7

Note that the two ogives intersect at median



Note that the two Ogives intersect at median.

An ogive can be used to determine positional averages like median, quartiles, deciles, percentiles etc. We can also determine the percentage of cases lying between certain limits. Various frequency distributions can be compared on the basis of their ogives.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.)

Answer to these questions are not to be submitted for evaluation.)

1. Distinguish between primary and secondary data and discuss various methods of collecting primary data.
2. Define classification of data. What are its various objectives? Also discuss various methods of classification.
3. What is tabulation? Discuss its importance to the users.
4. Explain the requirements of a good statistical table.
5. Distinguish between following :
 - (a) Continuous and discrete variable
 - (b) Exclusive and inclusive class intervals
 - (c) 'More than' and 'less than' frequency tables.
6. What are the components of a table. Explain the main precaution you would take into account while tabulating your data.
7. Tabulate the following information about the Tea Habits of persons in Two cities of India i.e. A & B.

CITY A — 70% people are male

- 50% are tea drinkers
- 40% are male Tea drinkers

CITY B — 60% people are male

- 40% are Tea drinkers
- 30% are male Tea drinkers

8. From the following marks out of 100 in statistics for the 50 students, you are required to draw group frequency distribution along with their tally marks :

70	55	51	42	57
45	60	47	63	53
33	65	39	82	55
64	58	61	65	42
50	52	53	45	45
25	36	59	63	39
65	45	49	54	64
75	42	41	52	35
30	35	15	48	26
20	40	55	46	18

9. Describes with suitable examples the following types of diagrams:

- (i) Bar Diagram
- (ii) Multiple Bar Diagram
- (iii) Component Bar Diagram
- (iv) Pie Diagram

- 10 Distinguish between a histogram and histogram. Explain their construction with the help of suitable examples.

11. From the following data, construct :

- (a) Frequency Histogram
- (b) Frequency Polygon

<i>Wages Groups (Rs.)</i>	<i>No. of Workers</i>
0-10	2
10-20	4
20-30	11
30-40	15

40-50	25
50-60	18
60-70	15
70-80	4
80-90	3

12. Following is the distribution of marks in statistics obtained by 50 students in a college :

<i>Marks (More than)</i>	<i>No. of Students</i>
0	50
10	46
20	40
30	20
40	10
50	3

You are required to draw an ogive curve.

13. Explain the following :

- (a) Class limits and Class interval
- (b) Frequency Density
- (c) Class Boundaries
- (d) Cumulative Frequency Distribution
- (e) Histogram
- (f) Ogive.

14. Distinguish between

- (a) Tabulation and classification;
- (b) Simple table and complex table;
- (c) Simple and Cumulative frequencies.

Suggested Readings / References :

- 1. Business Statistics - *R.S. Bhardwaj*, Excel Books, A-45, Naraina Phase I, New Delhi-110028.
- 2. Elements of Statistics — *S.P. Gupta*.

3. Fundamentals of Statistics — *S. P. Gupta.*
 4. Statistics — Theory, Method and Applications — *D.C. Sancheti & V.K. Kapoor.*
 5. Fundamental of Statistics — *A.K. Aggarwal & Sahib Singh.*
-

STUDY XI

MEASURES OF CENTRAL TENDENCY

INTRODUCTION

A measure of Central Tendency or an average of a distribution is a single figure which can be regarded as a representative of the whole distribution. Different authors have defined the average of a distribution in different ways. Some of the important definitions of an average are given as under:

- (i) "An average is an attempt to find one single figure to describe the whole of figures". — *Clark and Sekkade*.
- (ii) "An average is a value which is typical or representative of a set of data". — *Murry R. Spiegel*
- (iii) "An average is a single value within the range of data that is used to represent all values in the series. Since an average is somewhere within the range of the data, it is also called a measure of Central Value". — *Croxtan and Cowden*
- (iv) "A measure of central tendency is a typical value around which other figures congregate". — *Simpson and Kafka*

Thus, it is clear from the above definitions that an average is a single figure that represents the frequency distribution of the large number of items.

OBJECTIVES AND SIGNIFICANCE

Some of the important objectives and significance of statistical averages are discussed as under :

- (i) *To present huge mass of data in a summarised form*

It is very difficult for human mind to grasp a large body of numerical figures. A measure of average is used to summarise such data into a single figure which is easier to understand and remember.

- (ii) *To facilitate comparison*

Different sets of data can be compared by comparing their averages. For example, the level of wages of workers in two firms can be compared by mean (or average) wages of workers in each of them.

- (iii) *To help in decision making*

Most of the decisions to be taken in research planning etc. are based on the average values of certain variables. For example, if the average monthly sales of a company are falling, the sales manager may have to take certain decisions to improve it.

- (iv) *To establish Precise relationship*

It also focuses and establish precise relationships among variables.

Requisites of a Good Statistical Average

An average is a single value representing a group of values and hence it should possess the following characteristics:

(a) It should be firmly defined

That is, it should not be flexible or that there would be no confusion with regard to its meaning and connotation. If an average is left to the estimation of an observer and if it is not rigid, it cannot be a representative of a series. The bias of the investigator in such cases would affect the value of the average considerably.

(b) Easy to understand and simple to compute

An average should be readily understood, otherwise its use is bound to be very limited. The properties of the average should be such that they can be easily understood by persons of ordinary intelligence. It should also be simple to compute so that it can be used widely. But ease of computation should not be sought at the expense of other advantages. For instance, a difficult average may be desirable so as to ensure greater accuracy.

(c) It should be based on all the items

The average should depend upon each and every item of the series. If some of the items are not taken into account the average cannot be said to be a representative one. Further, the average itself is altered if any of the items is dropped. For example, the arithmetic mean of 35, 43, 25, 70, 60, 85 is 53. If one item is dropped say 43, the arithmetic mean would become 55.

(d) It should be capable of further algebraic treatment

An average could be used for further statistical computations so that its utility gets enhanced. For example, if we are given the data about the average heights of boys and girls in a class and their numbers separately, then we should be able to work out the combined average.

(e) It should not be affected by extreme observations

The average obtained in a particular field from two independent sample studies should not materially differ from each other. If one or two items unduly affect the averages i.e. either increases its value or reduces its value the average cannot be really typical of the entire series.

(f) It should possess sampling stability

An average should be least affected by sampling fluctuations, i.e., if we take independent random samples of the same size say 35 different groups from a given population and compute the average of each group, it is expected to get approximately the same value. The value so obtained from different samples should not vary much from one another. There may be some difference but these samples in which this difference is less are considerable better than those in which this difference is more.

(g) Capable of Calculation in case of distributions containing open and class-interval

Sometimes, we are bound to use open and class interval for classification. Even in such situations, an average can be calculated very easily without making any

assumptions regarding such open end class interval.

Types of Average

Various measures of average can be classified into two broad categories.

- (a) *Mathematical averages*: Arithmetic mean or mean, geometric mean and Harmonic mean. Further, each of these averages can be simple or weighted.
- (b) *Positional averages*: Median, Mode, Quartiles, Deciles and Percentiles etc.

ARITHMETIC MEAN

Arithmetic mean is defined as the sum of observations divided by the number of observations.

If there are n individual observations $X_1, X_2 \dots X_n$, and then their arithmetic mean, denoted by $\bar{X}$, is given by

$$\bar{X} = \frac{X_1 + X_2 + \dots + X_n}{N} = \frac{\sum X_i}{N}$$

Where

$\bar{X}$ = Arithmetic Mean

$\sum X_i$ = Sum of the Values of the Variable X

N = Number of items.

Further, if the frequency of observations X_i is f_i ($i = 1, 2, \dots, n$),

Then

$$\bar{X} = \frac{f_1 X_1 + f_2 X_2 + \dots + f_n X_n}{f_1 + f_2 + \dots + f_n} = \frac{\sum f_i X_i}{\sum f}$$

In the frequency distribution is grouped, then mid-points of the class intervals are taken as X_i values.

Illustration 1

Compute the arithmetic mean of the following frequency distribution:

<i>Class Intervals:</i>	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
<i>Frequency:</i>	8	10	12	15	18	14	11	5

Solution

<i>Class Intervals</i>	<i>Mid-values</i> (X)	<i>Frequency</i> (f)	<i>fX</i>
0-10	5	8	40
10-20	15	10	150
20-30	25	12	300
30-40	35	15	525
40-50	45	18	810
50-60	55	14	770
60-70	65	11	715
70-80	75	5	375
Total :		$\sum f = 93$	$\sum fX = 3685$

$$\bar{X} = \frac{\sum fX}{\sum f} = 39.6$$

$$\text{or } \bar{X} = \frac{3685}{93} = 39.6$$

Short-cut Method

This method is used when the magnitude of X_i values is large. The use of short-cut method is helpful in the simplification of calculation work.

Let A be the assumed mean, We can write

$$d_i = X_i - A$$

$$\text{or } \sum f_i d_i = \sum f_i (X_i - A) = \sum f_i X_i - A \sum f_i$$

Dividing both sides by N ($=\sum f_i$), we get

$$\frac{\sum f_i d_i}{N} = \frac{\sum f_i X_i}{N} - A$$

$$\text{Or } \bar{X} = \frac{\sum f_i X_i}{N} = A + \frac{\sum f_i d_i}{N}$$

Illustration 2

The following is the distribution of weekly wages of workers in a factory. Calculate the arithmetic mean of the distribution.

<i>Weekly Wages (Rs.) :</i>	240-269	270-299	300-329	330-359	360-389	390-419	420-449

No. of Workers:	7	19	27	15	12	12	8

Solution

Note that the given class intervals are inclusive. However, for the computation of mean, they need not be converted into exclusive intervals.

Weekly Wages (Rs.)	Mid-value (X)	Frequency (f)	$d=X-344.5$	$f_i d_i$
240-269	254.5	7	-90	-630
270-299	284.5	19	-60	-1140
300-329	314.5	27	-30	-810
330-359	344.5	15	0	0
360-389	374.5	12	30	360
390-419	404.5	12	60	720
420-449	434.5	8	90	720
Total		$\Sigma f_i = 100$		$\Sigma f_i d_i = -780$

$$\therefore \bar{X} = A + \frac{\Sigma f_i d_i}{N = \Sigma f_i} = 344.5 - \frac{(-780)}{100} = 336.7$$

Step Deviation or Coding Method

In a frequency distribution, if the X_i values are equally spaced, the computation work can be further reduced by using step-deviation method

We can define $U_i = \frac{X_i - A}{h}$ where h is the difference of any two successive observations. Multiplying both the sides by f_i and taking sum of all observations, we get —

$$\Sigma f_i U_i = \frac{\Sigma f_i (X_i - A)}{h} = 1/h \{ \Sigma f_i X_i - NA \}$$

$$\text{or } \Sigma f_i X_i - NA = h \Sigma f_i U_i$$

Dividing both the sides by N , we get

$$\bar{X} = \frac{\Sigma f_i X_i}{N} = A + h \frac{\Sigma f_i U_i}{N}$$

Using this formula, we can find the mean of the above illustration as given below:

$U = \frac{X - 344.5}{30}$	-3	-2	-1	0	1	2	3	Total
f_i	7	19	27	15	12	12	8	100
$f_i U_i$	-21	-38	-27	0	12	24	24	-26

$$\begin{aligned}\therefore \bar{X} &= 344.5 + \left(\frac{30 \times -26}{100} \right) \\ &= 344.5 - 7.8 \\ &= 336.7\end{aligned}$$

Weighted Arithmetic Mean

In the computation of simple arithmetic mean, it is assumed that all the items (or observations) of the distribution are of equal importance. However, if all the items are not of equal importance, then simple arithmetic mean will not be a good representative of the distribution. Hence, the weighing of different items become necessary and weight are assigned in proportion to the importance of the item in the group i.e. more important item is assigned more weight.

Let $W_1, W_2 \dots W_n$ be the respective weights of $X_1, X_2 \dots X_n$

Then, the weighted arithmetic mean $\bar{X}_w = \frac{\sum W_i X_i}{W}$

Illustration 3

Ram purchases 20 kgs. of Wheat, 10 kgs. of rice and 2 kgs. of ghee every month. If the price of wheat is Rs. 10 per kg., price of rice is Rs. 14 per kg. and price of ghee is Rs. 120 per kg. find the average price per kg. per month.

Solution

The simple average of the prices $\bar{P} = \frac{10 + 14 + 120}{3} = \frac{144}{3} = \text{Rs. } 48$

Thus, the average is not representative of all observations because it is highly affected by the price of ghee, which is not very important in the group, since its consumption in a month is only 2 kg.

In such a situation, the weighted arithmetic mean will be appropriate. The importance to various items can be based on its quantity consumed.

Thus $\bar{P}_w = \frac{20 \times 10 + 10 \times 14 + 2 \times 120}{20 + 10 + 2} = \text{Rs. } 18.125$

Properties of Arithmetic Mean

Arithmetic mean possesses the following important properties :

- (1) The sum of deviations of values is zero when these deviations are taken from their arithmetic mean. The deviation of a value X_i from its mean is written as $X_i - \bar{X}$. Then sum of deviations is written as $\sum (X_i - \bar{X})$. The above property implies that

$$\sum (X_i - \bar{X}) = 0$$

- (2) The sum of square of deviations is minimum when the deviations are taken

from their arithmetic mean.

This property implies that

$$\sum f_i (X_i - \bar{X})^2 \leq \sum f_i (X_i - A)^2 \text{ Where } A \text{ is any arbitrary origin...}$$

- (3) Arithmetic mean is capable of being treated algebraically.

This property implies that if any two of the three values, $\bar{X}$, $\sum f_i X_i$ and N , are known, the third can be computed easily.

- (4) If N_1 and $\bar{X}_1$ are the number of observations and mean of a series and N_2 and $\bar{X}_2$ are the respective values of another series, then mean $\bar{X}_{12}$ of the series may be obtained by combining the two series i.e.

$$\bar{X}_{12} = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}$$

- (5) If a constant A is added (or subtracted) from every value of the series, then the mean of the series also gets added (or subtracted) by it.

According to this property if we write $X_1 + A$, $X_2 + A$, ... then the mean of the changed series = $\bar{X} + A$, where $\bar{X}$ is mean of the $X_1, X_2, \dots, X_n$ series.

- (6) If every value of a series is divided (or multiplied) by a constant h , then the mean of the series also gets divided (or multiplied) by it.

According to this property if we write $\frac{X_1}{h}, \frac{X_2}{h}, \dots$ then the mean of the changed series = $\bar{X} / h$

Illustration 4

The average rainfall for a week, excluding Sunday, was 10 cms. Due to heavy rainfall on Sunday, the average for the week rose to 15 cms. How much rainfall was on Sunday?

Solution

A week can be treated as composed of two groups. First group consisting of 6 days, excluding Sunday for which $n_1 = 6$ and $\bar{X}_1 = 10$. The second group consisting of only Sunday for which $n_2 = 1$. Note that the mean of this group is equal to the observation itself that we want to find. Let this be $\bar{X}_2$. We are also given $\bar{X}_{12}$ (Combined mean) = 15.

$$\therefore 15 = \frac{6 \times 10 + \bar{X}_2}{7} \quad \sigma \quad 60 + \bar{X}_2 = 105 \quad \sigma \quad \bar{X}_2 = 45 \text{ cms.}$$

Illustration 5

The mean weight of 20 employees in a company is 65 kgs. And the mean weight of 8 employee is 70 kgs. And another 7 is 55 kgs. You are required to find out the mean weight of reminder.

Solution

Mean weight of 20 employees in a company = 65 kgs.

Total weight of 20 employees = $65 \times 20 = 1300$ kgs.

Total weight of 8 employees whose mean weight is 70 kgs. = 560 kgs.

Total weight of 7 employees whose mean weight is 55 kgs. = 385 kgs.

Total weight of remaining 5 employees = $1300 - (560 + 385) = 355$ kgs.

Mean weight of these 5 employees = $355/5 = 71$ kgs.

Illustration 6

Two groups of students reported mean weights of 160 kg. and 150 kg. respectively. Find out, when the mean weight of both the groups together be 155 kg?

Solution

Let N_1 be the number of students reported in the first group and N_2 be the number of students reported in second group, then:

	Group-I	Group-II
Number of students	N_1	N_2
Mean (kg.) ($\bar{X}$)	160	150

Combined Mean Weight = 155 kg.

$$\bar{X}_{12} = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}$$

$$155 = \frac{160N_1 + 150N_2}{N_1 + N_2}$$

$$155N_1 + 155N_2 = 160N_1 + 150N_2$$

$$\Rightarrow 5N_2 = 5N_1 \Rightarrow N_1 = N_2$$

Thus, the combined mean weight of both the groups together will be 155 kg when $N_1 = N_2$.

Illustration 7

The mean weight of 150 students in certain class in a co-educational college in Delhi University is 60 kg. The mean weight of boys in the Class is 70 kg. and that of girls is 50 kg. Find the number of boys and the number of girls in the Class.

Solution

Let N_1 and N_2 stand for number of boys and girls in the class respectively.

$\bar{X}_1$ = Mean weight of boys in the class

$\bar{X}_2$ = Mean weight of girls in the class

$\bar{X}_{12}$ = Combined mean weight of boys and girls in the class

$$\bar{X}_{12} = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}$$

$$60(N_1 + N_2) = 70N_1 + 50N_2$$

$$60 \times 150 = 70N_1 + 50N_2$$

$$9000 = 70N_1 + 50N_2 \quad \dots(i)$$

$$150 = N_1 + N_2 \quad \dots(ii)$$

Solving (i) and (ii) we may get:

$$9000 = 70N_1 + 50N_2$$

$$\begin{aligned}
 10500 &= 70N_1 + 70N_2 \\
 \pm \\
 -1500 &= -20N_2 \\
 20N_2 &= 1500 \\
 N_2 &= 1500/20 = 75 \\
 N_1 + N_2 &= 150 \\
 N_1 + 75 &= 150 \\
 N_1 &= 150 - 75 = 75
 \end{aligned}$$

Hence,

$$N_1 = 75$$

$$N_2 = 75$$

Illustration 8

The mean of a certain number of observations is 40. If two or more items with values 50 and 64 are added to this data, the mean rises to 42. Find the number of items in the original data.

Solution

Let 'n' be the number of observations whose mean $\bar{x} = 40$.

$$\bar{x} = \frac{\sum x_i}{n} \therefore \sum x_i = n(40) = 40n \text{ total of } n \text{ values.}$$

Two more items of values 50 and 64 are added therefore, total of (n+2) values:

$$= \sum x_i + 50 + 64$$

$$= 40n + 50 + 64$$

$$= 40n + 114$$

Now new mean is 42.

$$\therefore \text{New } \bar{x} = \frac{\text{New total of } (n+2) \text{ values}}{n+2}$$

$$\therefore 42 = \frac{40n + 114}{n + 2}$$

$$\therefore 42n + 84 = 40n + 114$$

$$\therefore 2n = 30$$

$$\therefore n = 15$$

Therefore, the number of items in the original data = 15.

Illustration 9

The mean weight of 98 students is found to be 50 lbs. It is later discovered that the frequency of the class interval (30-40) was wrongly taken as 8 instead of 10. Calculate the correct mean.

Solution

Incorrect mean ($\bar{x}$) = 50 kg and $\sum f_i = 98$

$$\therefore \text{Incorrect } \bar{x} = \frac{\text{Incorrect } \sum f_i x_i}{\sum f_i}$$

$$50 = \frac{\text{Incorrect } \sum f_i x_i}{98}$$

Therefore, Incorrect $\sum f_i x_i = 98 \times 50 = 4900$

Now correct

$$\sum f_i x_i = \text{Incorrect } \sum f_i x_i - (8 \times 35) + (10 \times 35)$$

Note that the class-mark of class interval (30 – 40) is 35 and for the calculation of the mean we consider class marks.

$$\text{The correct } \sum f_i x_i = 4900 - 280 + 350 = 4970$$

$$\text{Also the correct } \sum f_i = 98 + 2 = 100$$

Therefore, the correct mean

$$\bar{x} = \frac{\text{Correct } \sum f_i x_i}{\text{Correct } \sum f_i} = \frac{4970}{100}$$

$$\bar{x} = 49.70 \text{ lb}$$

Illustration 10

The average marks of three batches of students having 70, 50 and 30 students respectively are 50, 55 and 45. Find the average marks of all the 150 students, taken together.

Solution

Let $\bar{x}$ be the average marks of all 150 students taken together.

	Batch-I	Batch-II	Batch-III
	$\bar{x}_1$	$\bar{x}_2$	$\bar{x}_3$
Marks	= 50	= 55	= 45
No. of students	$n_1 = 70$	$n_2 = 50$	$n_3 = 30$

$$\bar{x} = \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2 + n_3 \bar{x}_3}{n_1 + n_2 + n_3} = \frac{70 \times 50 + 50 \times 55 + 30 \times 45}{70 + 50 + 30} = \frac{7600}{150}$$

$$\bar{x} = 50.67 \text{ marks}$$

Illustration 11

The mean salary paid per week to 1000 employees of an establishment was found to be Rs. 900. Later on, it was discovered that the salaries of two employees were wrongly recorded as Rs. 750 and 365 instead of 570 and 635. Find the corrected mean salary.

Solution

We first find the corrected sum of observation.

Corrected sum of observations = uncorrected sum of observation – sum of incorrect observations + Sum of correct observations = $900 \times 1,000 - 1,115 + 1,205$

= 9,00,090

∴ Correct mean = $9,00,090/1,000 = \text{Rs. } 900.09$

Merits and Demerits of Arithmetic Mean

Merits

Out of all averages, arithmetic mean is the most popular average. It is widely used because of its following merits:

1. It is easy to understand and easy to calculate.
2. It is a rigidly defined average.
3. It is based on all the observations and hence can be regarded as representative of the data.
4. It is capable of being treated mathematically and hence is widely used in statistical analysis.
5. It can be computed even if detailed distribution is not known but sum of observations and number of observations are known.
6. It provides a good basis for the comparison of two or more distributions.

Demerits (Limitations)

Although arithmetic mean satisfies most of the characteristics of a good statistical average, yet it has certain limitations also. Some of these limitations are given below:

1. It can neither be determined by inspection nor by graphical location.
2. It cannot be computed for a qualitative data because qualitative data are not measurable like number of males and females in a family etc.
3. It is unduly affected by extreme observations and hence is not a good representative of data having some extreme observations.
4. The value of arithmetic mean of a data may not be an observation of the data and as such it is called a fictitious average.
5. It cannot be computed for a distribution with open ends.
6. In the absence of complete distribution of observations, the arithmetic mean may lead to fallacious conclusions. For example, there may be two different distributions with same arithmetic means.
7. Simple arithmetic mean gives lesser importance to smaller items and *vice-versa*.

Uses

1. In spite of the above limitations of arithmetic mean, it is widely used in the statistical analysis of problems relating to social sciences, economic and business problems.
2. It is also a suitable average for averaging rates, like price, speed etc. under appropriate conditions. This use is illustrated later along with the uses of harmonic mean.

MEDIAN

Median of a distribution is that value of the variate which divides it into two equal parts. In terms of the frequency curve, the ordinate drawn at median divides the area under the curve into two equal parts. Median is a positional average because its value depends upon the position and not on magnitude of the items.

Determination of Median

(a) When individual observations are given

The given observations are arranged in either ascending or descending order of magnitude. If n is the number of observations, then median is given by (i) the size of $\frac{(N+1)^{\text{th}}}{2}$ observation if n is odd or (ii) the mean of $n/2^{\text{th}}$ and $(n/2 + 1)^{\text{th}}$ observation if N is even.

Illustration 12

Find median of the observations in each of the following two cases :

- (i) 25, 14, 28, 30, 25, 15, 32
- (ii) 35, 20, 55, 27, 15, 40

Solution

- (i) Arranging the given observations in ascending order of magnitude, we have

14, 15, 25, 25, 28, 30, 32

Here, n is 7, therefore median is the size of $(7 + 1/2)^{\text{th}}$ i.e. 4^{th} item. Hence, median is 25.

- (ii) Arranging the observations in ascending order, we may get

15, 20, 27, 35, 40, 55

Thus, the median is mean of 3^{rd} and 4^{th} observation = $(27 + 35/2) = 31$.

Note that the same value of median is obtained if the observations are arranged in the descending order.

Alternative Definition of Median

We have defined median as a value so that half (i.e. 50%) of the observations lie below it and half of the observations lie above it. However, the median = 25, obtained in illustration 12(i) is such that only two (i.e. 28.6%) observations are below it and three (i.e. 42.9%) observations are above it. This indicates that the definition of median, given above, is somewhat ambiguous. To avoid this ambiguity, the median of a distribution is often defined as that value of the variate *such that at least half of the observations are less than or equal to it and at least half of the observations are greater than or equal to it*.

(b) When grouped frequency distribution is given (interpolation formula)

For a continuous or grouped frequency distribution, median is that value of the variate such that the ordinate at it divides the area under the histogram into two equal parts.

The following steps are involved in the computation of median.

- (i) Locate the median class i.e. the class in which median lies. If $N (= \sum f_i)$ is the number of observation, then median class is the class in which $n/2^{\text{th}}$ observation lies.
- (ii) The median is given by the following interpolation formula :

$$M_d = L_m + \frac{\frac{N}{2} - C}{f_m} \times h,$$

where

L_m = lower limit of the median class

f_m = frequency of the median class

h = width of the median class

C = less than cumulative frequency of class preceding the median class.

Important Mathematical Property of Median

It may be noted that the sum of deviations of the variables from their median, ignoring signs, is always the minimum. For example the median of 2, 4, 6, 8, 10 is 6. The deviations from 6 ignoring signs are 4, 2, 0, 2, 4, is 12. This total is smaller than the one obtained if deviations are calculated from any other value. Thus, if deviations are taken from 8, the deviation ignoring signs would be 6, 4, 2, 0, 2 and the total is 14.

Illustration 13

The following table gives the marks obtained by 300 students of a management course. Find the median of the distribution.

<i>Marks obtained</i>	0-15	15-30	30-45	45-60	60-75	75-90	90-100
<i>No. of students</i>	26	34	64	76	60	30	10

Solution

Computation of Median

<i>Marks obtained</i>	<i>Frequency (f)</i>	<i>Cumulative Frequency (C)</i>

0-15	26	26
15-30	34	60
30-45	64	124
45-60	76	200
60-75	60	260
75-90	30	290
90-100	10	300

Since $N/2 = 150$, therefore, 45-60 is the median class.

Further, $L_m = 45$, $f_m = 76$, $h = 60-45 = 15$ and $C = 124$

$$\therefore M_d = 45 + \frac{(150 - 124) \times 15}{76} = 50.13 \text{ marks}$$

Remarks:

- (1) Since the variable in a grouped frequency distribution is continuous, we always take exact value of $N/2$, including figures after decimals, when N is odd.
- (2) The above formula is also applicable when classes are of unequal width.
- (3) When class intervals are of inclusive type, then these should be changed to exclusive type before the computation of median.
- (4) Median can be computed even if class intervals are with open ends.

Illustration 14

Find median of the following data

<i>Age greater than (in yrs.)</i>	0	10	20	30	40	50	60	70
<i>No. of Persons</i>	230	218	200	165	123	73	28	8

Solution

Note that it is a greater than type cumulative frequency distribution. First we convert it into a less than type form.

Persons

<i>Class intervals of age (in yrs.)</i>	<i>Greater than (c.f.)</i>	<i>Frequency</i>	<i>Less than (c.f.)</i>

0-10	230	12	12
10-20	218	18	30
20-30	200	35	65
30-40	165	42	107
40-50	123	50	157
50-60	73	45	202
60-70	28	20	222
70 and above	8	8	230

$N/2 = 230/2 = 115$, therefore median class is 40-50

Also $L_m = 40$, $f_m = 50$, $h = 10$, $C = 107$

$$\therefore M_d = 40 + \frac{115 - 107}{50} \times 10 = 41.6 \text{ years}$$

Illustration 15

The following table gives the distribution of daily wages of 900 workers. However, the frequencies of the two classes 40-50 and 60-70 are missing. If the median of the distribution is Rs. 59.25, find the missing frequencies.

<i>Wages (Rs.)</i>	30-40	40-50	50-60	60-70	70-80
<i>No. of Workers</i>	120	?	200	?	185

Solution

Let f_1 and f_2 be the missing frequencies of the classes 40-45 and 60-70 respectively. We can write the given distribution in the following tabular form :

<i>Class Intervals Wages (Rs.)</i>	<i>Frequency (f)</i>	<i>Cumulative Frequency (c)</i>
30-40	120	120
40-50	f_1	$120+f_1$
50-60	200	$320+f_1$
60-70	f_2	$320+f_1+f_2$
70-80	185	900

Since median is given to be 59.25, the median class is 50-60. Thus, we can write

$$59.25 = 50 + \frac{450 - (120 + f_1)}{200} \times 10 = 50 + \frac{330 - f_1}{20}$$

Solving this for f_1 , we get $f_1 = 145$

Further, $f_2 = 900 - (120 + 145 + 200 + 185) = 250$.

Other Partition or Positional Values

Similar to median, where a distribution is divided into two equal parts, it is also possible to divide a distribution into more than two equal parts. The values dividing a distribution into equal parts are known as partition values or fractiles. Important partition values are quartiles, deciles and percentiles.

Quartiles

Quartiles are the values of a variable that divides a distribution into four equal parts. For a discrete distribution, the first quartile Q_1 is the value such that at least 25% of the observations are less than or equal to it and at least 75% of the observations are greater than or equal to it. The second quartile Q_2 is equal to median and the third quartile Q_3 is a value such that at least 75% of the observations are less than or equal to it and at least 25% of the observations are greater than or equal to it.

For a grouped frequency distribution, Q_1 is that value of the variate that the area under the histogram to the left of the ordinate at Q_1 is 25% and the area to its right is Q_3 . The formula for Q_1 can be written by making suitable changes in the formula of median.

After locating the first quartile class, the formula for Q_1 can be written as under :

$$Q_1 = L_{Q_1} + \frac{N/4 - C}{f_{Q_1}} \times h$$

Where

L_{Q_1} is the lower limit of the first quartile class,

f_{Q_1} is the frequency of the first quartile class.

h is the width of the first quartile class and

C is the cumulative frequency of classes preceding the first quartile class.

Similarly, we can write

$$Q_3 = L_{Q_3} + \frac{3N/4 - C}{f_{Q_3}} \times h$$

Deciles :

Deciles of a distribution divide a series of observations into 10 equal parts and there are, in all, 9 deciles.

For a discrete distribution the i th Decile D_i is that value of the variate such that at least $(10i)\%$ of the observations are less than or equal to it and at least $(100-10i)\%$ of the observations are greater than or equal to it ($i = 1, 2, \dots, 9$).

For a grouped frequency distribution, D_i is that value of the variable such that area under the histogram to the left of the ordinate at D_i is $(10i)\%$ and the area to its right is $(100-10i)\%$. The formula for the i th decile can be written as :

We may note that $D_5 = M_d$ (Median)

Illustration 16

(a) Find D_1 , D_3 , D_5 and D_8

$X:$	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0
$F:$	1	2	4	5	15	30	60	95	82	75	44	25	15	4

(b) Find D_3 and D_7 from the following distribution

<i>Class Intervals</i>	19-21	22-24	25-27	28-30	31-33	34-36	37-39
<i>Frequency</i>	6	13	19	23	18	12	9

Solution

(a) Calculation of Decile

X	f	<i>Cumulative frequency</i>
4.5	1	1
5.0	2	3
5.5	4	7
6.0	5	12
6.5	15	27
7.0	30	57
7.5	60	117
8.0	95	212
8.5	82	294
9.0	75	369

9.5	44	413
10.0	25	438
10.5	15	453
11.0	4	457

Determination of D_1

10% of total frequency is 45.7. From the above table, we note that 7.0 is a value such that at least 10% (i.e. $57/457 \times 100 = 12.5\%$) of the observations are less than or equal to it and at least 90% of the observations are greater than equal to it. Therefore, $D_1 = 7.0$.

Similarly, we find that $D_3 = 8.0$, $D_5 = 8.5$ and $D_8 = 9.0$.

(b) Calculation of Deciles

<i>Class Intervals</i>	<i>Class Boundaries</i>	<i>Frequency (f)</i>	<i>Cumulative Frequency (c)</i>
19-21	18.5-21.5	6	6
22-24	21.5-24.5	13	19
25-27	24.5-27.5	19	38
28-30	27.5-30.5	23	61
31-33	30.5-33.5	18	79
34-36	33.5-36.5	12	91
37-39	36.5-39.5	9	100

Note : The given class intervals are inclusive. It is necessary to make them exclusive for the computation of any partition value.

(i) Computation of D_3

We have $3N/10 = 3 \times 100/10 = 30$, therefore 3rd decile class is 24.5 — 27.5

Thus, $L_{D_3} = 24.5$, $f_{D_3} = 19$, $h = 3$, $C = 19$

$$\therefore D_3 = 24.5 + (30-19/19) \times 3 = 26.23$$

(ii) Computation of D_7

We have $7N/10 = 70$, therefore 7th decile class is 30.5 — 33.5.

Thus $L_{D7} = 30.5$, $f_{D7} = 18$, $h = 3$, $C = 61$

$$\therefore D7 = 30.5 + 70 - 61/18 \times 3 = 32.0$$

Percentiles

Percentiles of a distribution divide a series of observations into 100 equal parts and there are, in all, 99 percentiles.

For a discrete distribution, the K^{th} percentile P_K is that value of the variable such that at least $K\%$ of the observations are less than or equal to it and at least $(100-K)\%$ of the observations are greater than or equal to it.

For a grouped frequency distribution, P_K is that value of the variable such that the area under the histogram to the left of the ordinate at P_K is $K\%$ and the area to its right is $(100-K\%)$. The formula for the K^{th} percentile can be written as:

$$P_K = L_{PK} + \frac{\frac{KN}{100} - C}{F_{PK}} \times h$$

(K = 1, 2, ... 99)

We may note that —

$$P_{25} = Q_1$$

$$P_{50} = Q_2$$

$$P_{75} = Q_3$$

Illustration 17

The following is the distribution of weekly wages of workers

Wages (Rs.) :	50-100	100-150	150-200	200-250	250-300
No. of Workers:	25	42	63	50	20

Determine —

- (i) M_d , Q_1 , Q_3 , P_{40} and P_{70}
- (iii) Percentage of workers getting weekly wages between Rs. 125 and 260.

Solution

Calculation of Median, Quartiles and Percentiles

Wages (Rs.)	No. of workers(Frequency)	Cumulative Frequency
50-100	25	25
100-150	42	67

150-200	63	130
200-250	50	180
250-300	20	200

(i) *Median* : $N/2 = 100$, $L_m = 150$, $f_m = 63$, $h = 50$, $C = 67$

$$M_d = 150 + \frac{100 - 67}{63} \times 50 = 176.19$$

Quartile

First Quartile (Q_1) : $N/4 = 50$, $L_{Q1} = 100$, $f_{Q1} = 42$, $h = 50$, $C = 25$

$$Q_1 = 100 + \frac{50 - 25}{42} \times 50 = 129.76$$

Third Quartile (Q_3) : $3N/4 = 150$, $L_{Q3} = 200$, $f_{Q3} = 50$, $h = 50$, $C = 130$

$$Q_3 = 200 + \frac{150 - 130}{50} \times 50 = 220$$

Percentiles

40th Percentile P_{40} : $40N/100 = 80$, $LP_{40} = 150$, $f_{P40} = 63$, $h = 50$, $C = 67$

$$P_{40} = 150 + \frac{80 - 67}{63} \times 50 = 160.32$$

70th Percentile P_{70} : $70N/100 = 140$, $LP_{70} = 200$, $f_{P70} = 50$, $h = 50$, $C = 130$

$$P_{70} = 200 + \frac{140 - 130}{50} \times 50 = 210$$

(ii) The number of workers getting wages between 125 and 260 is

$$\frac{150 - 125}{50} \times 42 + 63 + 50 + \frac{260 - 250}{50} \times 20 = 138$$

Therefore, the percentage of workers $138 \times 100/200 = 69\%$

Illustration 18

From the following table, showing the income distribution of workers, find—

- the range of incomes earned by middle 50% of the workers,
- the range of incomes earned by middle 80% of the workers, and
- the percentage of workers earning between Rs. 550 and 880

<i>Monthly Income (Rs.)</i>	<i>No. of Workers</i>
0-200	150
0-400	250
0-600	330
0-800	380
0-1000	400

Solution

Note that the distribution in the above table is of less than type.

Calculation Table

<i>Monthly Income (Rs.) (less than)</i>	<i>Cumulative Frequency</i>	<i>Frequency (No. of workers) (f)</i>
0 - 200	150	150
200 - 400	250	100
400 - 600	330	80
600 - 800	380	50
800 - 1000	400	20

- (i) The range of incomes earned by middle 50% of the workers is given by $Q_3 - Q_1$

$$Q_1 = 0 + \frac{100 - 0}{150} \times 200 = 133.33$$

$$Q_3 = 400 + \frac{300 - 250}{80} \times 200 = 525$$

$$\therefore Q_3 - Q_1 = 525 - 133.33 = \text{Rs. } 391.67$$

- (ii) The range of middle 80% of the workers is given by $P_{90} - P_{10}$.

$$P_{10} = 0 + \frac{40 - 0}{150} \times 200 = 53.33$$

$$P_{90} = 600 + \frac{360 - 330}{50} \times 200 = 720$$

$$\therefore P_{90} - P_{10} = 720 - 53.33 = \text{Rs. } 666.67.$$

(iii) The number of workers getting income between Rs. 550 and 880 is

$$\frac{600 - 550}{200} \times 80 + 50 + \frac{880 - 800}{200} \times 20 = 78$$

$$\therefore \text{Percentage of workers} = 78 \times 100/400 = 19.5\%$$

Merits and Demerits of Median

Merits

1. It is easy to understand and easy to compute. In case of individual observations or ungrouped data, it can be located even by inspection.
2. It is rigidly defined.
3. It is not much affected by extreme values
4. It can be determined even if the given distribution has open ends.
5. It can also be located graphically.
6. It can be computed for a qualitative data where ranking of items, according to the intensity of characteristics, is possible.

Demerits

1. When the number of observations is large, the location of median requires their arrangement in ascending or descending order which is a very cumbersome process.
2. It is a positional average and hence is not capable of being treated mathematically.
3. For a grouped frequency distribution, the median is only estimated but not located.
4. It is not based on all the observations and therefore cannot be regarded their good representative.
5. Since weighted median, like weighted arithmetic mean, is not defined, it is not a suitable average when all the items are not of equal importance.

Uses of Median

- (1) It is an appropriate measure of central tendency when the characteristics is not measurable but different items can be ranked according to its intensity.
- (2) Median is used to convey the idea of a typical observation of the given data.
- (3) It is most suitable measure of average for a skewed frequency distribution.
- (4) When the given data has class intervals with open ends, median is preferred since it is not possible to compute the mean.

MODE

It is that value of the variate which occurs maximum number of times in a distribution and around which other observations are densely distributed. In the words of A.M. Tuttle, "*Mode is the value which has the greatest frequency density in its immediate neighbourhood*".

If the frequency distribution is fairly regular, then mode is given by the value corresponding to maximum frequency. A frequency distribution is said to be regular in which the frequencies first increase in a gradual manner, reach a peak value and finally decline gradually in, approximately, the same manner as the values of the variable increase (or decrease).

The concept of mode as a measure of average is preferable to mean and median when it is desired to know the most typical size e.g. the most common size of shoes, the most common size of a garment etc.

Determination of Mode

(i) By Inspection

When a frequency distribution is regular then mode can be determined just by inspection.

Illustration 19

Compute mode of the following distribution

<i>X</i> :	1	2	3	4	5	6	7	8	9	10
<i>f</i> :	4	6	8	12	17	11	7	6	5	3

Solution

Since the distribution is fairly regular, therefore, mode of the above distribution is = 5.

(ii) By method of grouping

This method is used when the distribution is not regular. This method is explained through the following illustration.

Illustration 20

Determine mode of the following distribution :

<i>X</i> :	10	11	12	13	14	15	16	17	18	19
<i>f</i> :	8	15	20	100	98	95	90	75	50	30

Solution

The above distribution is not regular because there is a sudden increase in frequency from 20 to 100. Therefore, mode cannot be located by inspection. To obtain mode, we write the following grouping table

Determination of Mode

X	(1)	(2)	(3)	(4)	(5)	(6)
10	8					
11	15	23		43		
12	29		36		135	
13	154	120	109			218
14	98	183	205	205		
15	85		185		283	
16	90	165				260
17	75		125	215		
18	50				155	
19	30	60				

The highest frequency total in each of the six columns of the above table is identified and analyzed in the following table.

Variables										
Columns	10	11	12	13	14	15	16	17	18	19
1				1						
2					1	1				
3				1	1					
4				1	1	1				
5					1	1	1			
6						1				
Total	0	0	0	3	4	4	2	1	0	0

Since the values 14 and 15 are both repeated maximum number of times, therefore the mode is ill defined. In this case, we can find the value of mode by the use of the formula. Mode = 3 Median — 2 Mean, to be discussed later in this Chapter.

We note that for the given distribution Mean = 15.09 and Median = 15. Therefore, Mode = $3 \times 15 - 2 \times 15.09 = 14.82$

Note : If the most repeated values in the above analysis table were not adjacent, the distribution would have been bi-modal.

(iii) *By interpolation formula* :

For a grouped frequency distribution, we can determine modal class either by inspection or by method of grouping. The exact location of mode is then determined by the use of the following interpolation formula :

Where L_m = is the Lower

$$\text{Mode} = \frac{\Delta_1}{\Delta_1 + \Delta_2} \times h \quad \text{limit of Modal Class}$$

Δ_1 = is the difference of frequencies of modal class and the preceding class,

Δ_2 = is the difference of frequencies of modal class and the following class, and

h = is the width of the modal class.

Illustration 21

The frequency distribution of marks obtained by 60 students of a class is given below:

<i>Marks :</i>	30-34	35-39	40-44	45-49	50-54	55-59	60-64
<i>Frequency:</i>	3	5	12	18	14	6	2

Find mode of the distribution.

Solution

The given class intervals should be converted into class boundaries. Since the distribution is regular, the modal class, by inspection, is 44.5 — 49.5

Further $L_m = 44.5$, $\Delta_1 = 18 - 12 = 6$, $\Delta_2 = 18 - 14 = 4$, $h = 5$

$$\therefore \text{Mode} = 44.5 + \frac{6}{6 + 4} \times 5 = 47.5 \text{ marks}$$

Merits and Demerits of Mode

Merits

1. It is easy to understand and easy to calculate. Very often, it is located by just inspection.
2. It can be located even when the variable is not measurable but categorization or ranking of observations is possible.
3. It is not affected by extreme observations.
4. It can be determined even for a distribution with open ends.
5. Model value is a value around which there is a concentration of observations and therefore regarded as best representative of the observations.
6. It can also be located graphically.

Demerits

1. It is not based on all the observations.
2. It is not capable of further mathematical treatment.

3. In certain cases, mode may not be rigidly defined and hence the important requisite of a good measure of central tendency is not satisfied.
4. It is not easy to calculate unless the number of observations is sufficiently large and reveal a marked tendency of concentration around a particular value.
5. It is not suitable when different items of the data are of unequal importance.
6. The mode of a distribution depends upon the choice of class width and hence is an unstable average.

Uses

The concept of mode is very useful in business and industry. A shoe company or a manufacturer of readymade garments etc. are often interested in modal size, and manufacture them in large quantities.

Comparative Merits and Demerits of Mean, Median and Mode

- (1) All the three measures of averages are easy to understand and easy to compute. In certain situations, median and mode can be located just by inspection.
- (2) Mean is highly affected while median is slightly affected by extreme observations. Mode is not affected by extreme observations.
- (3) Mean is based on the magnitude of all the observations as opposed to median and mode.
- (4) Only Mean is capable of algebraic treatment.
- (5) If a distribution has open ends, we can compute median and mode but not mean.
- (6) If a distribution has unequal class intervals; we can compute mean and median but not mode.
- (7) All the three averages can be computed if the characteristics is measurable; median and mode can be computed if the characteristics is not measurable but items can be arranged in the order of its intensity, only mode can be computed if the characteristics is neither measurable nor can be arranged in order of intensity.
- (8) Mean and median are rigidly defined while mode may not be rigidly defined in all situation.
- (9) Like weighted arithmetic mean, weighted median, or weighted mode is not defined.

Relation Between Mean, Median and Mode

A frequency distribution is said to be symmetrical about an ordinate (AB) if its frequency curve is divided into two parts, by this ordinate, such that one part is mirror image of the other. For a symmetrical distribution, we have Mean = Median = Mode,

as shown in figure :

If a distribution is not symmetrical, it is termed as skewed. Empirically, it has been found that, for a moderately skewed distribution, we have

$$\bar{X} - Mo = 3 (\bar{X} - M_d) \text{ or } Mo = 3M_d - 2\bar{X}$$

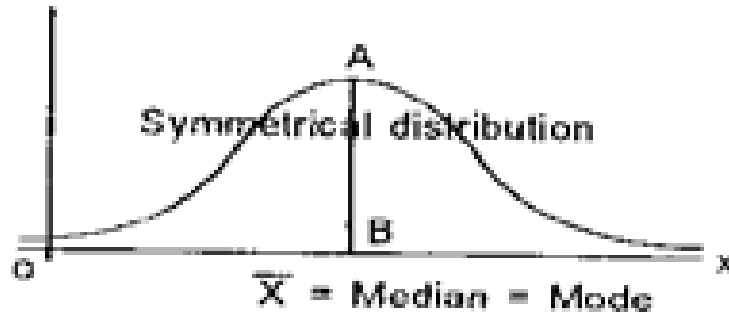


Illustration 22

In a moderately a symmetrical distribution—

- (a) The mode and median are 75 and 60 respectively, find mean.
- (b) The mean and mode are 50 and 37.5 respectively, find median.

Solution

- (a) Using the empirical relation between mean, median and mode, we can write

$$\bar{X} - Mo = 3 (\bar{X} - M_d)$$

$$\text{or } 2\bar{X} = 3M_d - Mo$$

$$\text{or } \bar{X} = \frac{3M_d - Mo}{2} = \frac{3 \times 60 - 75}{2} = 52.5$$

$$(b) \text{ Also } M_d = \frac{2\bar{X} + Mo}{3} = \frac{2 \times 50 + 37.5}{3} = 45.83$$

Choice of a Suitable Average

The Choice of a suitable average depends upon the following three broad considerations :

- (a) *Considerations based on the suitability of data for an average*

The nature of the given data may itself indicate the type of average that could be used. For example, if the characteristics is not measurable, it is not possible to compute mean. Similarly, if the distribution is skewed, median may represent the data more appropriately because mean is highly affected by extreme observations and

mode is not affected at all.

Further, if the class intervals are of unequal width, mean and median can be satisfactorily calculated. However, an approximate value of mode can be computed by making class intervals of equal width under the assumption that observations in a class are uniformly distributed. The accuracy of the mode will depend upon the validity of this assumption.

If a distribution has open ends, we can compute mode and median. An approximate value of mean can be computed only under the assumption that the width of first class is equal to the width of second class and the width of last class is equal to the width of last but one class.

(b) Considerations based on the purpose of investigation

If the purpose of investigation is to compute an average value (e.g. average income), then computation of mean is more appropriate. However, if we want to study the pattern of the distribution, e.g. number of persons having income between two values, the computation of median, quartiles, deciles and percentiles etc. might be more appropriate. In contrast to this, mode is computed when we want to determine the most common or modal size of the distribution.

(c) Considerations based on the merits of an average

The presence or absence of various characteristics of an average may also affect its selection in a given situation.

If the requirement is that the average should be rigidly defined, then mean or median should be chosen in preference to mode. Similarly, if it is desired to compute an average based on all the observations, we select mean. Further, if the requirement is that an average should not be affected by extreme observations, then mode is most appropriate etc.

GEOMETRIC MEAN

The geometric mean of a series of n positive observations is defined as the n th root their product.

Computation of Geometric Mean

(a) Individual Series

If there are n observations $X_1, X_2, \dots, X_n$ such that $X_i > 0$

For all i , their geometric mean G is defined as

$$G = (X_1 \cdot X_2 \cdot \dots \cdot X_n)^{1/n} = \left(\prod_{i=1}^n X_i \right)^{1/n}$$

To evaluate G , we use logarithms, we can write.

$$\log G = 1/n [\log X_1 + \log X_2 + \dots + \log X_n] = 1/n \sum \log X_i$$

Alternatively, geometric mean can be defined as the antilog of the arithmetic mean of logarithms of observations.

(b) For a grouped or ungrouped frequency distribution, we can write

$$\begin{aligned}
 G &= [X_1^{f_1}, X_2^{f_2} \dots X_n^{f_n}]^{1/n} \\
 \log G &= \frac{1}{n} [\log X_1^{f_1} + \log X_2^{f_2} + \dots + \log X_n^{f_n}] \\
 &= \frac{1}{n} [f_1 \log X_1 + f_2 \log X_2 + \dots + f_n \log X_n] = \sum f_i \log X_i \\
 \Rightarrow \text{GM} &= \text{Antilog} \frac{1}{n} \left[\sum_{i=1}^n f_i \log X_i \right]
 \end{aligned}$$

Weighted Geometric Mean

If the observations $X_1, X_2, \dots, X_n$ are not of equal importance, weighted G.M. is computed. If $W_1, W_2, \dots, W_n$ are the respective weights of the observations, the weighted G.M. is given by

$$\text{G.M.} = \text{Antilog} \frac{\sum W_i \log X_i}{\sum W_i}$$

Illustration 23

Calculate geometric mean of the following data

5, 30, 90, 800, 6500

Solution

$$\begin{aligned}
 G &= \left[\frac{\text{Antilog} (\log 5 + \log 30 + \log 90 + \log 800 + \log 6500)}{5} \right] \\
 &= \left[\frac{\text{Antilog} (0.6990 + 1.4771 + 1.9542 + 2.9031 + 3.8129)}{5} \right] \\
 &= \text{Antilog} (10.8463/5) = \text{Antilog} 2.1693 = 147.7
 \end{aligned}$$

Illustration 24

Calculate Geometric mean of the following distribution :

<i>Wages (Rs.) :</i>	100-110	110-120	120-130	130-140	140-150	150-160
<i>No. of Workers:</i>	20	32	33	17	18	2

Solution

Calculation of G.M.

<i>Wages (Rs.)</i>	<i>Mid Values X</i>	<i>Frequency (f)</i>	<i>Log X</i>	<i>F log X</i>
100 – 110	105	20	2.0212	40.424
110 – 120	115	32	2.0607	65.942
120 – 130	125	33	2.0969	69.198
130 – 140	135	17	2.1303	36.215
140 – 150	145	8	2.1614	17.291
150 – 160	155	2	2.1903	4.381
Total		112		233.451

$$\therefore \text{GM} = \text{AL} \frac{(233.451)}{112} = 121.44$$

Illustration 25

The weighted geometric mean of the four numbers 20, 62.5, 42.5 and 75 is 38.25. If the weights of the first three numbers are 12.5, 7.5 and 10; find the weight of the fourth item.

Solution

<i>(A)</i>	<i>W</i>	<i>Log A</i>	<i>W log A</i>
20	12.5	1.3010	16.2625
62.5	7.5	1.7959	13.4693
42.5	10.0	1.6284	16.2840
75	W_1	1.8751	$1.8751 W_1$
$30 + W_1$		$46.0158 + 1.8751 W_1$	

$$\log 38.25 = \frac{46.0158 + 1.8751 W_1}{30 + W_1}$$

$$1.5826 (30 + W_1) = 46.0158 + 1.8751 W_1$$

$$47.478 + 1.5826 W_1 = 46.0158 + 1.8751 W_1$$

$$1.4622 = 0.2925 W_1$$

$$W_1 = 4.99 \text{ or } 5$$

The weight of the fourth item is 5

Merits and Demerits of Geometric Mean

Merits

1. It is based on all the observations.
2. It is rigidly defined.
3. It is capable of further algebraic treatment.
4. In contrast to arithmetic mean, it is less affected by extreme observations.
5. It gives more weights to smaller observations and vice-versa.

Demerits

1. It is difficult to understand and difficult to calculate.
2. It cannot be calculated if one or more observations are zero or negative.

Uses of Geometric Mean

Geometric mean is the most suitable average in the following two circumstances:

(i) For average ratios

Let a variable x takes two values 40 and 20 and another variable y takes values as 60 and 80. Their ratio x/y will take two values as 40/60 and 20/80 or 2/3 and 1/4.

Arithmetic mean of these values = $\frac{2/3 + 1/4}{2} = 11/24$ and

The geometric mean = $\sqrt{2/3 \times 1/4} = \frac{1}{\sqrt{6}}$

Similarly, the arithmetic mean of y/n values = $\frac{3/2 + 4}{2} = 11/4 = 11/4$ and the

geometric mean = $3/2 \times 4 = \sqrt{6}$

Note that the product of the two geometric means is unity while the product of the two arithmetic means is not equal to one.

Since it is desirable that a method of average should be independent of the manner in which a ratio is expressed, it seems reasonable to regard the geometric mean as more appropriate than arithmetic mean while averaging ratios.

(ii) For averaging compound or exponential rates of growth

Let Rs. P be invested at 100 $r_1\%$ rate of interest in first year, the amount after one year is invested at 100 $r_2\%$ in second year and so on the amount at the end of (K-1)th year is invested at 100 $r_k\%$ in kth year. The amount A at the end of K years is given by

$$A = P (1 + r_1) (1 + r_2) \dots (1 + r_{1k}) \dots (1)$$

Here, a sum of money is invested at different rates of interest in different years and we want to find the average (or compound uniform) rate of interest per year. Let

this rate of 100 r% per year is such that Rs. P become equal to Rs. A at the end of K years.

$$\text{Thus, we can write } A = P (1 + r)^k \quad \dots (2)$$

Using (1) and (2), we can write

$$(1 + r)^k = [(1 + r_1) (1 + r_2) \dots (1 + r_k)]$$

$$\text{or } (1 + r) = [(1 + r_1) (1 + r_2) \dots (1 + r_k)]^{1/k}$$

This shows that $(1 + r)$ is geometric mean of $(1 + r_1) (1 + r_2) \dots (1 + r_k)$

From the above, the average rate of interest is

$$100r = \{[(1 + r_1) (1 + r_2) \dots (1 + r_k)]^{1/k} - 1\} 100$$

Note :

- (i) $r_1, r_2 \dots r_k$ etc. are the rates of interest on a rupee.
- (ii) We have taken the example of growth of money in the above illustration. However, the above formulae are applicable to compound (or exponential) rates of growth in other situations like price changes, population changes, growth of capital etc.
- (iii) If P_o is the sum (or population) at the beginning of a period and P_n is the sum (or population) at the end of n years, then the rate of growth per year is given by

$$100r = \left[\frac{P_n}{P_o} - 1 \right]$$

Illustration 26

Price of a commodity went up by 6%, 10% and 15% respectively, in the last three years. What is the annual average change of price?

Solution

The per unit rise of price are $r_1 = 6/100 = 0.06$, $r_2 = 0.10$ and $r_3 = 0.15$. If the average change in price per year be 100 r%, then we can write

$$1 + r = [(1 + 0.06) (1 + 0.10) (1 + 0.15)]^{1/3}$$

$$= (1.06 \times 1.10 \times 1.15)^{1/3}$$

$$\text{or } \log (1 + r) = 1/3 [\log 1.06 + \log 1.10 + \log 1.15]$$

$$= \text{Antilog } 1/3 [0.0253 + 0.414 + 0.0607] = \text{Antilog } \left[\frac{0.1274}{3} \right] = \text{Antilog } 0.0425$$

$$\therefore 1 + r = 1.103 \text{ or } r = 10.3\%$$

Illustration 27

The number of literates has increased from 42 million in 1980 to 69 million in

1993, in India. Find the annual growth rate in literacy.

Solution

Here $P_0 = 42$, $P_n = 69$, $n = 13$

$$\therefore (1+r) = \left(\frac{69}{42}\right)^{1/3}$$

$$\text{or } \log(1+r) = 1/13 (\log 69 - \log 42) = 1/13 [1.8388 - 1.6232]$$

$$= \frac{0.2156}{13} = \text{Antilog } 0.0165$$

$$\therefore 1+r = 1.039 \text{ or } r = 3.9\%$$

HARMONIC MEAN

The harmonic mean of n numbers, none of which is zero, is defined as the reciprocal of the arithmetic mean of their reciprocals.

Computation of Harmonic Mean

(a) Individual Series

For n observations $X_1, X_2, \dots, X_n$, their harmonic mean H is defined as

$$H = \frac{n}{\frac{1}{X_1} + \frac{1}{X_2} + \dots + \frac{1}{X_n}} = \frac{n}{\sum_{i=1}^n \frac{1}{X_i}}$$

(b) For a grouped or ungrouped frequency distribution, we can write :

$$H = \frac{N}{\sum_{i=1}^n \frac{f_i}{X_i}}$$

Weighted Harmonic Mean

The weighted harmonic mean of $X_1, X_2, \dots, X_n$ with respective weights $W_1, W_2, \dots, W_n$ is defined as :

$$H_w = \frac{\sum W_i}{\sum \frac{W_i}{X_i}}$$

Illustration 26

Find harmonic mean of the following distribution :

Age (Yrs.)	18	22	28	30	35	38	40
No. of Persons	6	3	10	2	9	5	8

Solution

<i>Age yrs.(x)</i>	<i>No. of Persons (f)</i>	<i>1/x</i>	<i>f/x</i>
18	6	0.0556	0.3336
22	3	0.0455	0.1365
28	10	0.0357	0.3570
30	2	0.0333	0.0666
35	9	0.0286	0.2574
38	5	0.0263	0.1315
40	8	0.0250	0.2000
Total	43		1.4826

$$H = \frac{43}{1.4826} = 29$$

Merits and Demerits of Harmonic Mean*Merits*

1. It is based on all the observations.
2. It is rigidly defined average.
3. It gives less weight to large items and vice-versa.
4. It is capable of further algebraic treatment.
5. It is suitable for a distribution with wide dispersion.

Demerits

1. It is difficult to understand and compute the harmonic mean of a distribution.
2. It cannot be calculated if one or more observation of a distribution is zero.
3. It may not be representative of a distribution if small observations are given correspondingly small weights.

Uses

It is a suitable average for computing average rate under certain conditions.

Choice between Harmonic Mean and Arithmetic Mean

Both, the harmonic mean and arithmetic mean are used to average rates like price per unit, Kms per hour, work done per hour etc. The choice of an average depends upon the condition that is given along with various rates to be averaged.

This condition is either in terms of the numerator or denominator of the rate. For example, if we want to find average of Prices, say, P_1 , P_2 and P_3 , then the associated condition can be in terms of either money spent (which appear in the numerator of Price = Money/Quantity) or quantity purchased.

It can be shown that if the associated condition is in terms of numerator of the rate, then use harmonic mean and if the condition is in terms of denominator, use arithmetic mean. On the basis of the above, we can write :

- (i) In averaging of price (Money/Quantity) in different situations, use arithmetic mean if the conditions are given in terms of quantities purchased and harmonic mean other wise.
- (ii) In averaging of speed (Distance/Time), use harmonic mean if the conditions are given in terms of distance etc.

Further if the conditions are same in all the situations, use simple arithmetic (or harmonic) mean and if the situations are different use weighted arithmetic (or harmonic mean).

Illustration 29

During a period of decline in stock market prices, a stock sold at Rs. 50 per share on one day, Rs. 40 on the next day and Rs. 25 on the third.

- (i) If an investor bought 100, 120 and 180 shares on the respective three days, find the average price paid per share.
- (ii) If an investor bought Rs. 1000 worth of shares on each of the three days, find average price paid per share.

Solution

Note that we are given average price, which is then ratio of money to quantity.

- (i) In this case the condition is given in terms of quantity and further the quantities are different at different prices, weighted arithmetic mean is appropriate.

$$\text{Thus, the average price} = \frac{50 \times 100 + 40 \times 120 + 25 \times 180}{100 + 120 + 180} = \text{Rs. } 35.75$$

- (ii) On the basis of similar logic, simple harmonic mean is appropriate.

$$H = \frac{3}{\frac{1}{50} + \frac{1}{40} + \frac{1}{25}} = \text{Rs. } 35.29$$

Illustration 30

An aeroplane flies around a square field, the side of which measure 100 kms each. The aeroplane covers at a speed of 100 kms per hour the first side, at 200 kms per hour the second side, at 300 kms per hour the third side and 400 km per hour the fourth side. Use the correct mean to find out the average speed round the square.

Solution

Here, in the above situation, HM is the appropriate mean.

Let required average speed be H kms per hour, then

$$H = \frac{4}{\frac{1}{100} + \frac{1}{200} + \frac{1}{300} + \frac{1}{400}} = \frac{4}{\frac{12+6+4+3}{1200}}$$

$$H = \frac{4 \times 1200}{25} = 192 \text{ km / hr} .$$

Illustration 31

A man travels from Lucknow to Kanpur, a distance of 80 Kms, at a speed of 45 Kms/hr. From Kanpur, he goes to Etawah, a distance of 165 Kms, at a speed of 65 Kms/hr, and from Etawah he comes back to Lucknow, along the same route, at a speed of 60 Kms./hr. What is his average speed for the entire journey?

Solution

The average speed is given by the weighted harmonic mean of the three speeds:

$$\text{Average Speed} = \frac{80 + 165 + 25}{\frac{80}{45} + \frac{165}{65} + \frac{25}{60}} = 58.34 \text{ kms. hr.}$$

Illustration 32

Four typists take 15, 10, 8, 7 minutes respectively to type a letter. Determine the average time required to type a letter if —

- (a) Four letters are to be typed by each typist
- (b) Each typist works for two hours.

Solution

- (a) Since condition is given in terms of denominator of the rate and each typist has to type equal number of letters, simple arithmetic mean of the typing speeds is the required answer.

$$\therefore = \frac{15 \times 4 + 10 \times 4 + 8 \times 4 + 7 \times 4}{4 + 4 + 4 + 4} = \frac{160}{16} = 10 = 10 \text{ minutes/letter}$$

- (b) The correct average is harmonic mean

$$= \frac{120 + 120 + 120 + 120}{\frac{120}{15} + \frac{120}{10} + \frac{120}{8} + \frac{120}{7}} = \frac{480}{52} \text{ minutes/letter}$$

Relationship between Arithmetic Mean, Geometric Mean & Harmonic Mean

Generally, the relationship between the three average i.e. Arithmetic Mean, Geometric Mean and Harmonic Mean of a series of observation are expressed as under:

$$AM \geq GM \geq HM$$

The sign of equality will hold good if and only if all the n observations are equal or same.

SELF TEST QUESTIONS

*(These are meant for recapitulations only.
Answer to these questions are not to be submitted for evaluation).*

1. Do you agree with the following statements :
 - (i) Arithmetic mean can be calculated for a distribution with open ends.
 - (ii) Median is not affected by extreme observations.
 - (iii) The class limits should be exclusive for the determination of Median and mode.
 - (iv) Mode can be calculated if class intervals are of unequal width.
 - (v) Mean is based on all the observations.
 - (vi) Mode is the value with maximum frequency in the data.
 - (vii) Geometric mean is used to average exponential rates of change.
2. (a) Calculate mean, mode and median from the following information:

<i>Age (yrs.)</i>	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60
<i>Frequency</i>	50	70	100	180	150	120	70	60

- (b) The average marks in English obtained by 400 students is 50. If the average marks of first and last 100 students are 75 and 25 respectively, then calculate the average marks.
3. (a) Define Median. What are its merits and demerits?
 - (b) The following is the distribution of weekly wages of workers:

<i>Wages (Rs.)</i>	50-100	100-150	150-200	200-250	250-300
<i>No. of Workers</i>	25	42	63	50	20

Determine—

- (i) Median (M_d) and Quantiles (Q_1 and Q_3); and
 - (ii) Percentage of workers getting weekly wages between Rs.130 to Rs.280.
4. If the mode of the following distribution is 24, find out the missing frequency corresponding to the class 20----30:

<i>Exp (.Rs)</i>	0-10	10-20	20-30	30-40	40-50
<i>No of Families</i>	14	23	?	21	15

5. Ram appeared in three tests of 20, 50 and 30 marks respectively. He obtained 75% marks in the first and 60% marks in the second test. What should be his percentage of marks in the third test in order that his aggregate is 60%?
6. The monthly expenditure of 250 families of a locality was found to be as given below :

<i>Expenditure (Rs.)</i>	<i>No. of Families</i>	<i>Expenditure (Rs.)</i>	<i>No. of Families</i>
0-500	50	2000-2500	25
500-1000	80	2500-3000	15
1000-1500	40	3000-3500	10
1500-2000	25	3500-4000	5

Find the limits of expenditure of middle 50% of the families.

7. The Gross national product (GNP) of a country was Rs. 20,000 crores before 5 years. If it is Rs. 30,000 crores now, find the annual rate of growth of GNP.
8. The interest paid on each of the three different sums of money yielding 10%, 12% and 15% simple interest per annum is the same. What is the average yield per cent on the total sum invested?
9. Typist A can type a letter in five minutes, B in ten minutes and C in fifteen minutes. What is the average number of letters typed per hour per typist?
10. Write short note on-
 - (a) Requisites of a good average
 - (b) Properties of Arithmetic mean
 - (c) Ogive
 - (d) Merits and demerits of mode
 - (e) Geometric Mean
 - (f) Harmonic Mean.

Suggested Readings/References :

1. Statistical Methods — *S.P. Gupta*; Sultan Chand & Sons; 23, Daryaganj, New Delhi-110 002.
2. Business Statistics — *R.S. Bhardwaj*, Excel Books, A-45, Naraina, Phase-I,

New Delhi-110 028.

3. Statistics, Theory, Methods & Applications — *D.C. Sanchetti & V.K. Kapoor*, Sultan chand & Sons, New Delhi-110 002.
 4. Fundamentals of Statistics — *S.C. Gupta*; Himalya Publishing House, 4-B, Murari Lal Street, Ansari Road, Daryaganj, New Delhi-110 002.
 5. Fundamental of Statistics — *A.K. Aggarwal and Sahab Singh*, Franksons; G-2/16, Top Floor, Ansari Road, Daryaganj, New Delhi-110 002.
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STUDY XII

MEASURES OF DISPERSION

INTRODUCTION

Statistical average or the measures of central tendency gives us an idea of the concentration of the observations about the Central parts of the distribution but it does not tell us the full story. It is hardly representative of mass unless we know the manner in which the individual items scatters around it. For instance, if we are given only the averages of a series of observations, we cannot form complete idea about the distribution since there may exist a number of distributions whose averages are same but which may differ widely from each other in number of ways. Thus, it is necessary that the measures of statistical averages must be supported and supplemented by some additional summary measures to describe a distribution. One such measure is dispersion or a measure of variability of observations.

MEANING AND DEFINITION OF DISPERSION

Dispersion means the variation or scattering or deviation of the different values of a variable from their average. In other words, it is the extent of scatteredness of items around a measure of central tendency. It indicates the extent to which the values vary among themselves. Some of the important definitions of dispersion given by different experts are as under:

- (i) "Dispersion is the measure of variations of items". — *A.L. Bowley*
- (ii) "Dispersion is the measure of extent to which individual items vary".
— *L.R. Connor*
- (iii) "The measure of the scatteredness of the mass of figures in a series about an average is called the measure of variation or dispersion".
— *Simpson and Kafka*
- (iv) "The degree to which numerical data tend to spread about an average value is called variation or dispersion of the data". — *Spiegel*

OBJECTIVES AND SIGNIFICANCE OF DISPERSION

Some of the important objectives of dispersion along with their significance are:

- (i) *To test the reliability of an average*

The reliability of a average depends upon the extent of dispersion in the data. A low value of dispersion implies greater degree of homogeneity among the observations and hence more reliable average.

- (ii) *To compare the extent of variability in two or more distributions*

Using a measure of dispersion, we can compare the degree of homogeneity of observations in different distributions. A distribution having lower value of dispersion is said to be more uniform or consistent.

- (iii) *To facilitate the computation of other statistical measures*

Various measures of dispersions are used in the computations of important statistical measures like correlation, regression, test statistics, confidence

intervals, control limits etc.

(iv) *To serve as a basis for control of variations*

The knowledge about the dispersion may be utilised to control variations in various areas of medicines, industry, incomes etc.

Characteristics of Good Measure of Dispersion

A good measure of dispersion should possess the following characteristics:

- (i) It should be easy to calculate and easy to understand.
- (ii) It should be rigidly defined.
- (iii) It should be based on all the observations.
- (iv) It should be capable of further mathematical treatment.
- (v) It should not be unduly affected by extreme observations.
- (vi) It should not be much affected by the fluctuations of sampling.

TYPES OF DISPERSION

Various measures of dispersion can be classified into two broad categories:

- (a) The measures which express the variations in observations in terms of differences between certain selected observations e.g. range, interquartile range, interpercentile range etc.
- (b) The measures which express the variations in observations in terms of average of deviations from a central value e.g. mean deviation, standard deviation etc.

Both categories of measures can be further divided into absolute and relative measures of dispersion. An absolute measure is expressed in terms of the unit of measurement of the variable. A disadvantage of this measure is that it cannot be used to compare dispersions of two or more distributions expressed in different units. As opposed to this, a relative measure of dispersion, popularly known as coefficient of dispersion, is expressed as a pure number, independent of units of measurement of the variable. Relative measures are often used for comparisons of dispersions of various distributions.

Methods of Dispersion

The following are some of the important methods measures of dispersions :

- (i) Range
- (ii) Inter-quartile range
- (iii) Mean Deviation
- (iv) Standard deviation
- (v) Lorenz Curve.

RANGE

The range of distribution is the difference between its two extreme observations i.e. the different between the largest and the smallest observations. Symbolically, $R = L - S$, where R denotes range, L and S denote the longest and the smallest observations respectively.

R is an absolute measure of range. The relative measure of range, known as co-efficient of range

$$= \frac{L - S}{L + S}$$

Illustration 1

Find range and the co-efficient of range for each of the following distributions.

(a) 220, 350, 320, 205, 215, 245, 150, 200

(b) <i>Class Intervals</i>	: 10-20	20-30	30-40	40-50
<i>Frequency</i>	: 15	19	14	6

Solution

(a) $R = 350 - 150 = 200$

Co-efficient of range = $200/500 = 2/5$

(b) $R = 50 - 10 = 40$

Co-efficient of range = $40/60 = 2/3$

Merits and Demerits of Range

Merits

1. It is easy to understand and easy to compute.
2. It gives a crude but quick measure of variability.

Demerits

1. It is not based on all the observations.
2. It is not a reliable measure of dispersion as it is very much affected by the extreme observations.
3. It gives only rough idea of dispersion of observations.
4. It does not give any idea about the pattern of a distribution. It is possible to have two distributions with same range but different patterns of distribution.
5. It is not capable of being treated mathematically.
6. It cannot be computed for a distribution with open ends.

Uses

In spite of its many serious limitations, the measure of range is useful in the following situations:

1. It is used by the industries for the preparation of control charts for controlling the quality manufactured items.
2. It is used in the study of fluctuations of, say, price of a commodity, price of a share of a company, temperature of a patient, amount of rainfall in a period etc.

INTER-QUARTILE RANGE

Range of a distribution is highly affected by extreme observations. To avoid this difficulty, inter-quartile range as a measure of dispersion is suggested.

$$\text{Inter-quartile Range} = Q_3 - Q_1$$

Inter-quartile range is the range of middle 50% of the observations. If the observations of a distribution are densely concentrated around median, then the inter-quartile range will be less than half of the range. On the other hand, in the absence of such concentration, the inter-quartile range will be approximately equal to half the range.

The difficulty of extreme observations can also be tackled by the use of inter-percentile range.

$$\text{Inter-percentile range} = P(100-i) - P_i \quad (i < 50)$$

This measure excludes $i\%$ of the observations at each end of the distribution i.e. it is the range of middle $(100 - 2i)\%$ of the observations.

Use of Inter-percentile range

Inter-percentile range is used in describing the pattern of a distribution. For example, the answers to questions like : what is the maximum income of the lowest 30% of population, what are the lowest and highest incomes of the middle 80% of population etc.?

Quartile Deviation (Q.D.)

Half of the inter-quartile range is called quartile deviation. Symbolically

$$Q.D. = \frac{Q_3 - Q_1}{2}$$

The value of Q.D gives the average magnitude by which the two quartiles differs from median. A low value of Q.D indicates a high concentration of middle 50% of the observations.

$$\text{Co-efficient of Q.D.} = \frac{\frac{Q_3 - Q_1}{2}}{\frac{Q_3 + Q_1}{2}} = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

In a similar manner, we can define percentile deviation and co-efficient of percentile deviation as:

$$\frac{P_{(100-i)} - P_i}{2} \text{ and } \frac{P_{(100-i)} - P_i}{P_{(100-i)} + P_i} \text{ respectively}$$

Illustration 2

For the given distribution find—

- The inter-quartile range and co-efficient of quartile deviation.
- The inter-percentile range of the middle 80% of the observations and the co-efficient of percentile deviation

<i>Class Intervals :</i>	11 -13	13- 15	15 -17	17 -19	19- 21	21- 23	23- 25
<i>Frequency :</i>	8	10	15	20	12	11	4

Solution

<i>Class Intervals</i>	<i>Frequency(f)</i>	<i>Cumulative Frequency(c)</i>
11-13	8	8
13-15	10	18
15-17	15	33
17-19	20	53
19-21	12	65
21-23	11	76
23-25	4	80
Total	80	

From the above table, we can find:

- Since the first Quartile item = $\frac{N}{4} = \frac{80}{4} = 20$, it lies in the class range of 15 – 17.

$$\text{Thus, } Q_1 = 15 + \frac{20 - 18}{15} \times 2 = 15.27$$

- Since the third Quartile item = $\frac{3N}{4} = \frac{3 \times 80}{4} = 60$, it lies in the class range of

$$19 - 21. \text{ Thus, } Q_3 = 19 + \frac{60 - 53}{12} \times 2 = 20.17$$

$$\therefore \text{ Inter-quartile range} = 20.17 - 15.27 = 4.90$$

$$\text{Co-efficient of Q.D} = \frac{4.90}{35.44} = 0.138$$

- Since the percentile 10 i.e. (P_{10}) = $\frac{10 \times N}{100} = \frac{10 \times 80}{100} = 8$. It lies in the range of

$$11 - 13. \text{ Thus, } P_{10} = 11 + \frac{8 - 0}{8} \times 2 = 13$$

$$\text{Since the percentile 90 i.e. } (P_{90}) = \frac{90 \times N}{100} = \frac{90 \times 80}{100} = 72. \text{ It lies in the class}$$

$$\text{range of 21 – 23. Thus, } P_{20} = 21 + \frac{72 - 65}{11} \times 2 = 22.27$$

$$\therefore \text{ Inter-percentile range} = 22.27 - 13 = 9.27$$

$$\text{Co-efficient of P.D} = 9.27/35.27 = 0.263$$

Merits and Demerits of Quartile Deviation

Merits

1. It is easy to understand and easy to compute.
2. It is rigidly defined.
3. It is not affected by extreme observations and therefore a suitable measure of dispersion for a highly skewed distribution.
4. It can be computed even for a distribution with open ends.

Demerits

1. It ignores 25% of the items at each end and hence not a reliable measure of dispersion.
2. It is not capable of being treated mathematically.
3. It is a crude measure of dispersion.

MEAN OR AVERAGE DEVIATION

An important requirement of a measure of dispersion is that it should be based on all the observations. Mean deviation is a measure of dispersion based on all the observations. It is defined as the arithmetic mean of the absolute values of deviations of observations from a central value viz. mean, median and mode.

If $X_1, X_2 \dots X_n$ are n observations with frequencies $f_1, f_2 \dots f_n$ respectively, then we can define mean deviation (M.D) as

$$(i) \text{ M.D from } \bar{X} = 1/N \sum f_i |X_i - \bar{X}|, \text{ where } N = \sum f_i$$

$$(ii) \text{ M.D from } M_d = 1/N \sum f_i (X_i - M_d)$$

$$(iii) \text{ M.D from } M_o = 1/n \sum f_i (X_i - M_o)$$

Note : Mean deviation is minimum when deviations are taken from median.

Co-efficient of Mean Deviation

The above formulae for mean deviation give an absolute measure of dispersion. The relative measures, also known as the co-efficient of mean deviation are:

$$(iv) \text{ Co-efficient of M.D from } \bar{X} = \text{M.D from } \bar{X} / \text{Mean}$$

$$(v) \text{ Co-efficient of M.D from } M_d = \text{M.D. from } M_d / \text{Median}$$

$$(vi) \text{ Co-efficient of M.D from Mode} = \text{M.D. from } M_o / \text{Mode}$$

Steps for Computing Mean Deviation

(a) Individual Series

- (i) Calculate the mean/median/mode of observations.
- (ii) Calculate the deviations from mean/median/mode.
- (iii) Sum up all the deviations (say $\sum |x - \bar{x}|$ or $\sum |x - \text{Median}|$ or $\sum |x - \text{Mode}|$ Calculated under step (ii).
- (iv) Divide the total deviations by total number of items.

(b) Group Frequency Distribution (Discrete)

- (i) Calculate the mean/median/mode from which mean deviation is measured.
- (ii) Calculate the mean deviation from selected measure of central tendency.
- (iii) Multiply the frequency of each class with their respective deviation i.e. $\sum f|x - \bar{x}|$
- (iv) Sum up all the products as obtained in step (iii)
- (v) Divide $\sum f|x - \bar{x}|$ by the total number of observations or frequencies.

(c) Group Frequency Distribution (Continuous)

- (i) Calculate the mean/median/mode from which mean deviation is measured.
- (ii) Determine the mid-point of each class interval.
- (iii) Determine the deviation of each class interval (mid-value) from the selected measure of central tendency.
- (iv) Multiply the frequency of each class by the deviation of its class i.e. $f|x - \bar{x}|$
- (v) Sum-up all the products as obtained in step (iv) i.e. $\sum f|x - \bar{x}|$
- (vi) Divide $\sum f|x - \bar{x}|$ by N or total number of frequencies.

Illustration 3

Calculate the mean deviation from the following:

Value (X) :	10	11	12	13
Frequency (f) :	3	12	18	12

Solution

Calculation of Mean Deviation

Value	Frequency (f)	fX	(X - $\bar{X}$)	f(X - $\bar{X}$)

10	3	30	1.87	5.61
11	12	132	0.87	10.44
12	18	216	0.13	2.34
13	12	156	1.13	13.56
$\Sigma f = 45$		$\Sigma fX = 534$	$\Sigma f(X - \bar{X}) = 31.95$	

$$\bar{X} = \frac{534}{45} = 11.87$$

$$\begin{aligned} \text{Mean Deviation about AM} &= \frac{1}{n} \Sigma f(X - \bar{X}) = \frac{31.95}{45} \\ &= 0.71 \end{aligned}$$

Illustration 4

Calculate the mean deviation from mean and median from the following distribution:

<i>Age in Years</i>	<i>No. of Persons</i>
0-10	20
10-20	25
20-30	32
30-40	40
40-50	42
50-60	35
60-70	10
70-80	8

Solution

Calculation of Mean Deviation from Mean and Median

<i>Age</i>	<i>Mid-values (X)</i>	<i>Frequency (f)</i>	<i>fX</i>	<i>(X - $\bar{X}$)</i>	<i>f(X - $\bar{X}$)</i>	<i>Cf</i>	<i>(X - Md)</i>	<i>f(X - Md)</i>
0-10	5	20	100	31.5	630.0	20	32.25	645.00
10-20	15	25	375	21.5	537.5	45	22.25	556.25
20-30	25	32	800	11.5	368.0	77	12.25	392.00
30-40	35	40	1400	1.5	60.0	117	2.25	90.00
40-50	45	42	1890	8.5	357.0	159	7.75	325.00

50-60	55	35	1925	18.5	647.5	9	17.75	621.25
60-70	65	10	650	28.5	285.0	4	27.75	277.50
70-80	75	8	600	38.5	308.0	4	37.75	302.00
						21		
						2		
Total	212	7740			3193.0			3209.50

(i) Calculation of Mean deviation from Mean

$$\bar{X} = 7740/212 = 36.6$$

$$\text{M.D from } \bar{X} = \frac{\sum f |X - \bar{X}|}{\sum f} = 3193.0/212 = 15.06$$

(ii) Calculation of mean deviation from median

$$N/2 = 212/2 = 106; \text{ median class is } 30-40$$

$$M_d = 30 + \frac{106 - 77}{40} \times 10 = 37.25$$

$$\text{Mean Deviation} = \frac{\sum f |X - M_d|}{\sum f}$$

$$\text{M.D from } M_d = \frac{3209.5}{212} = 15.14$$

Illustration 5

Calculate the mean deviation and its co-efficient from median for the following data:

<i>Class Intervals:</i>	20-25	25-30	30-40	40-45	45-50	50-55	55-60	60-70	70-80
<i>Frequency:</i>	6	12	17	30	10	10	8	5	2

Solution

<i>Class Intervals</i>	<i>Frequency (f)</i>	<i>c.f.</i>	<i>Mid-values X</i>	<i>X - M_d</i>	<i>f (X - M_d)</i>
20-25	6	6	22.5	20.0	120.0
25-30	12	18	27.5	15.0	180.0
30-40	17	35	35.0	7.5	127.5
40-45	30	65	42.5	0	0
45-50	10	75	47.5	5.0	50.0
50-55	10	85	52.5	10.0	100.0
55-60	8	93	57.5	15.0	120.0
60-70	5	98	65.0	22.5	112.5
70-80	2	100	75.0	32.5	65.0
Total	100				875.0

In the above table, $\frac{n}{2} = \frac{100}{2} = 50$ It lies in the class interval of 40-50

$$M_d = \text{Median} = 40 + \frac{50 - 35}{30} \times 5 = 42.5$$

$$\text{M.D from median} = 875/100 = 8.75$$

$$\text{Co-efficient of M.D.} = \frac{\text{Mean Deviation}}{\text{Median}}$$

$$\text{Co-efficient of M.D} = 8.75/42.5 = 0.206.$$

Merits and Demerits of Mean Deviation

Merits

- (i) It is easy to understand and easy to compute.
- (ii) It is based on all the observations.
- (iii) It is rigidly defined.
- (iv) It is less affected by extreme observations.
- (v) It is flexible measure of dispersion because it can be computed from either mean or median or mode.

Demerits

- 1. It is not capable to be treated mathematically. Since mean deviation uses absolute values of deviations, it is not very convenient to be handled.
- 2. According to some critics, it is not a well defined measure because the central tendency, from which deviations are to be taken, is not specified.

Uses of Mean deviation

It is a very useful measure of dispersion when sample size is small and no elaborate analysis of data is needed. Since the standard deviation (to be discussed later) gives more importance to extreme observations, the use of mean deviation is preferred in statistical analysis of certain economic, business and social phenomena.

STANDARD DEVIATION

Since mean deviation is the arithmetic mean of the absolute values of deviations, it is not very convenient to be algebraically manipulated. This necessitates a search for a measure of dispersion which is capable of being subjected to further mathematical treatment. One such measure is standard deviation or root-mean square deviation. *Standard deviation may be defined as the positive square root of arithmetic mean of the squares of all the deviations of the values from their arithmetic mean. In brief, it refers to the square root of the mean of the squares of deviation from mean.*

The standard deviation is usually denoted by Greek letter σ , is given by

$$\sigma = \sqrt{1/N \sum (X_i - \bar{X})^2}$$

for n individual observations and

$$\sigma = \sqrt{1/N \sum f_i (X_i - \bar{X})^2}$$

for a frequency distribution.

Note : We consider only positive square root of the above expression as standard deviation.

Square of the standard deviation is known as variance of the distribution.

The above formulae are appropriate if X is a whole number. If X is not a whole number, the standard deviation is conveniently computed by using transformed form of the above formula, given below:

$$\begin{aligned}\sigma^2 &= \frac{1}{n} \sum (X_i - \bar{X})^2 = \frac{1}{n} \sum (X_i - \bar{X})(X_i - \bar{X}) \\ &= \frac{1}{n} \sum (X_i^2 - \bar{X}X_i) - \frac{\bar{X}}{n} \sum (X_i - \bar{X})\end{aligned}$$

Here in above equation, the second term is sum of deviations from $\bar{X}$ which is equal to zero.

$$= \frac{1}{n} \sum X_i^2 - \bar{X}^2 \text{ or } \frac{1}{n} \sum X_i^2 - \left(\frac{\sum X_i}{n} \right)^2$$

= Mean of Squares - Square of the mean.

Similarly, for a frequency distribution, we can write —

$$\sigma^2 = \left[\frac{\sum f_i X_i^2}{\sum f_i} - \left(\frac{\sum f_i X_i}{\sum f_i} \right)^2 \right]$$

Illustration 6

Calculate standard deviation of the following data

X :	10	11	12	13	14	15	16	17	18
f :	2	7	10	12	15	11	10	6	3

Solution

X	f	fX	X-X-	f (X- $\bar{X}$) ²
10	2	20	-4	32
11	7	77	-3	63
12	10	120	-2	40
13	12	156	-1	12
14	15	210	0	0
15	11	165	1	11
16	10	160	2	40
17	6	102	3	54
18	3	54	4	48
Total	76	$\sum f = 1064$		$\sum f (X - \bar{X}) = 300$

$$\bar{X} = 1064/76 = 14$$

$$\sigma = 300/76 = 3.95 \text{ or } \sigma = 3.95 = 1.99$$

Short-cut Method

This method is based on an important property of variance (or standard

deviation), given below:

The variance of a distribution is independent of the change of origin but not of change of scale.

Change of Origin

If a constant value, say, A is subtracted from each observation $X_1, X_2, \dots, X_n$, then resulting observation $X_1 - A, X_2 - A, \dots, X_n - A$ are said to be measured from A. This operation is termed as shifting of origin at A because $X_i - A = 0$ when $X_i = A$ ($i = 1, 2, \dots, n$).

Note : That the origin of X_i values is at 0

In this case $\sigma_x^2 = \sigma_d^2$ when $d = (X - A)$

Change of Scale

To make change of scale, we can divide (or multiply) every observation by a suitable constant. For example, if X_i are measured in inches, then $Y_i = \frac{X_i}{12}$ ($i = 1, 2, \dots, n$) will be in feet.

It is possible to make simultaneous change of origin and scale by making the Transformation $dx_i = \frac{X_i - A}{h}$

($i = 1, 2, \dots, n$) where A refers to change of origin and h refers to change of scale. It can be shown that:

$$\begin{aligned}\sigma_x^2 &= h^2 \sigma_{dx_i}^2 \\ &= \left(\frac{\sum (f_i dx_i)^2}{N} \right) - \left(\frac{\sum (f_i dx_i)}{N} \right)^2 \times h^2 \\ \text{or } \sigma_x &= \sqrt{\left\{ \frac{\sum (f_i dx_i)^2}{N} \right\} - \left(\frac{\sum (f_i dx_i)}{N = \sum f_i} \right)^2} \times h\end{aligned}$$

Illustration 7

Calculate standard deviation of the following data:

<i>Marks:</i>	0-10	10-20	20-30	30-40	40-50
<i>Frequency:</i>	10	8	15	8	4

Solution

Calculation of Standard Deviation

Marks	Mid-values (m)	f	$dx_i = X - 25/10$	fdx_i	fdx_i^2
0-10	5	10	-2	-20	40
10-20	15	8	-1	-8	8
20-30	25	15	0	0	0
30-40	35	8	1	8	8
40-50	45	4	2	8	16
Total		45		-12	72

$$\sigma^x = \sqrt{\frac{72}{45} - \frac{144}{45 \times 45}} \times 10 = 12.36$$

Illustration 8

Find the mean and standard deviation of the following observations :

$$X = 2, 5, 7, 8, 13$$

Transform the above observations such that :

- The mean of the transformed series become 10, while the standard deviation remaining unchanged;
- $\bar{X}$ the mean of the transformed series becomes 10 and the standard deviation becomes double the standard deviation of the given series.

Solution

$$\bar{X} = \frac{2 + 5 + 7 + 8 + 13}{5} = 7$$

$$\sigma = \sqrt{\frac{4 + 25 + 49 + 64 + 169}{5} - 49} = 3.63$$

- Since the standard deviation is not affected by change of origin, the transformed series with mean 10 and s.d. 3.63 is obtained by adding 3 to each observation. Thus, the required series is 5, 8, 10, 11, 16.
- If every observation of the series is multiplied by 2, the mean and s.d. of the new series would be 14 and 7.26. Then, the required series is obtained by subtracting 4 from each observations. Thus, the required series is 0, 6, 10, 12, 22.

Illustration 9

The mean and standard deviation of 10 observations are 35 and 2 respectively. Find the changed mean and standard deviation if—

- each observation is increased by 4, and
- each observation is multiplied by 5.

Solution

- (i) When each observation is increased by 4, the mean of the changed observations will also increase and it will become equal to $35 + 4 = 39$.

Since the increasing of all observations by a constant is change of origin, the standard deviation shall not change.

Thus, the mean and standard deviation when each observation is increased by 4 would be 39 and 2 respectively.

- (ii) When each observation is multiplied by 5, the mean of the new observations will be $35 \times 5 = 175$ and their standard deviation will be $2 \times 5 = 10$.

Illustration 10

In a series of 5 observations, the values of mean and variance are 4.4 and 8.24. If three observations are 1, 2 and 6, find the other two.

Solution

$$\bar{X} = \frac{\sum X_i}{N} \Rightarrow \sum X_i = N\bar{X}$$

$$\text{Here } N = 5, \bar{X} = 4.4; \sum X_i = 5 \times 4.4 = 22$$

Let the two missing items be X_1 and X_2

$$\therefore 1 + 2 + 6 + X_1 + X_2 = 22$$

$$\Rightarrow X_1 + X_2 = 22 - 9$$

$$\Rightarrow X_1 + X_2 = 13$$

$$\sigma^2 = \frac{\sum X^2}{N} - \left(\frac{\sum X}{N} \right)^2$$

$$\Rightarrow 8.24 = \frac{\sum X^2}{5} - (4.4)^2$$

$$41.20 = \sum X^2 - 5 \times 19.36$$

$$\sum X^2 = 41.20 + 96.80 = 138$$

$$\sum X^2 = X_1^2 + X_2^2 + X_3^2 + X_4^2 + X_5^2$$

$$= X_1^2 + X_2^2 + 41$$

$$138 = X_1^2 + X_2^2 + 41$$

$$\Rightarrow X_1^2 + X_2^2 = 138 - 41 = 97$$

$$(X_1 + X_2)^2 = X_1^2 + X_2^2 + 2X_1 X_2$$

$$(13)^2 = X_1^2 + X_2^2 + 2X_1 X_2$$

$$169 = 97 + 2X_1 X_2$$

$$2X_1 X_2 = 169 - 97 = 72$$

$$X_1 X_2 = 72/2 = 36$$

$$(X_1 + X_2) = 13$$

$$(X_1 - X_2)^2 = X_1^2 + X_2^2 - 2X_1 X_2 = 97 - 2 \times 36 = 97 - 72 = 25$$

$$X_1 - X_2 = 5 \quad \dots(i)$$

$$X_1 + X_2 = 13 \quad \dots(ii)$$

By adding two equation we may get

$$2X_1 = 18$$

$$\Rightarrow X_1 = 9$$

Putting the value of X_1

$$9 + X_2 = 13$$

$$\text{or } X_2 = 13 - 9 = 4$$

Hence, the two missing observations are 9 and 4.

Illustration 11

40 Passengers were found ticket less on a bus. The sum of squares and the standard deviation of the amount found in their pockets were Rs. 4000 and Rs. 6 respectively. If the total fine imposed on these passengers is equal to the total amount recovered from them and fine imposed is uniform, what is the amount each one of them has to pay as fine? What difficulties do you visualize if such a system of penalty is imposed?

Solution

$$\sigma = \sqrt{\frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2}$$

$$6 = \sqrt{\frac{4000}{40} - \left(\frac{\sum X}{40}\right)^2}$$

$$36 = 100 - \left(\frac{\sum X}{40}\right)^2$$

$$\Rightarrow \left(\frac{\sum X}{40}\right)^2 = 64$$

$$\Rightarrow \frac{\sum X}{40} = 8^*$$

i.e. each passenger will have to pay Rs. 8 as fine. In such a system, the person having more money in their pocket may object.

Co-efficient of Variation (CV)

The standard deviation is an absolute measure of dispersion. A relative measure, known as co-efficient of dispersion or variation, is given by

$$C.V = \frac{\sigma}{\bar{X}} \times 100$$

This measure is used to compare variability or homogeneity or stability or uniformity or consistency of two or more sets of data. The data having a higher value of the co-efficient of variation is said to be more dispersed or less uniform etc.

Note : The dispersion of two or more distributions can be compared on the basis of their standard deviations only if their means are equal and the units of measurements are same.

Illustration 12

The mean and standard deviations of two brands of light bulbs are given below:

	<i>Brand I</i>	<i>Brand II</i>
Mean	800 hours	770 hours
Standard deviation	100 hours	60 hours

Which brand of bulbs is more reliable ?

Solution

Since means of the two brands are different, their reliability can be compared by computing the co-efficient of variations.

$$C.V \text{ of brand I} = 100 \times 100/800 = 12.5\%$$

$$C.V \text{ of brand II} = 60 \times 100/700 = 7.79\%$$

Since C.V of brand II is less, therefore mean life of brand II is more reliable than the mean life of brand I.

* The fine imposed on the passenger is uniform simply implies that each of the passenger has to pay the same amount as fine. Since the total fine imposed = Total amount recovered, the fine imposed on each passenger is equal to Arithmetic Mean of the amount available with all the passengers.

Correction of Values

The method of correcting the value of standard deviation computed from a set of observations consisting of one or more incorrect observations is explained through the following illustration.

Illustration 13

The mean and standard deviation of a sample of 100 observations were found to be 40 and 5.1 respectively by a student who wrongly recorded an observation as 50. Recalculate the mean and standard deviation if—

- (i) The wrong observation is deleted.
- (ii) The wrong observation 50 is replaced by the correct observation 40.

Solution

- (i) The sum of 100 observations = $40 \times 100 = 4000$

The sum of 99 observations when the incorrect observation is deleted = $4000 - 50 = 3950$.

$\therefore$ Mean (corrected) = $3950/99 = 39.9$

To correct s.d., we find $\sum X_i^2$ which is given by $n(\sigma^2 + \bar{X}^2)$

$$\sum X_i^2 = 100 (5.1^2 + 40^2) = 162601$$

$$\text{The corrected } \sum X_i^2 = 162601 - (50)^2 = 160101$$

$$\therefore \sigma \text{ (corrected)} = \sqrt{\frac{160101}{99} - (39.9)^2} = 5.02$$

- (ii) $\sum X_i$ (corrected) = $3950 + 40 = 3990$

$$\therefore \text{Mean} = 3990/100 = 39.9$$

$$\sum X_i^2 \text{ (corrected)} = 160101 - (50)^2 + (40)^2 = 161701$$

$$\sigma = \sqrt{\frac{161701}{100} - (39.9)^2} = 5$$

Combined Variance

Let $\bar{X}_1, \bar{X}_2$ be the arithmetic means, σ_1^2, σ_2^2 be the variances and n_1, n_2 be the number of observations in group I and II respectively then:

$$\text{Combined mean } \bar{X}_{12} = \frac{n_1 \bar{X}_1 + n_2 \bar{X}_2}{n_1 + n_2}$$

$$\text{and combined variance } \sigma_{12}^2 = \frac{n_1 \sigma_1^2 + n_2 \sigma_2^2}{n_1 + n_2} + \frac{n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2}$$

Where $d_1 = (\bar{X}_1 - \bar{X}_{12})$ and $d_2 = (\bar{X}_2 - \bar{X}_{12})$

$$\text{Or } \sigma_{12}^2 = \frac{n_1 \sigma_1^2 + n_2 \sigma_2^2 + n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2}$$

$$\sigma_{12} = \sqrt{\frac{n_1\sigma_1^2 + n_2\sigma_2^2}{n_1 + n_2} + \frac{n_1d_1^2 + n_2d_2^2}{n_1 + n_2}}$$

If there are K data sets with means $\bar{X}_1, \bar{X}_2, \dots, \bar{X}_K$ and number of observations $n_1, n_2, \dots, n_K$, Then the combined mean

$$\text{is given by } \bar{X}_{12\dots K} = \frac{n_1\bar{X}_1 + n_2\bar{X}_2 + \dots + n_K\bar{X}_K}{n_1 + n_2 + \dots + n_K}$$

Similarly, we can find the combined standard deviations of two or more data sets whose standard deviations are known.

Illustration 14

For a group of 30 male workers, the mean and standard deviation of weekly overtime work (number of hours) are 10 and 4 respectively. For another group 20 female workers, the mean and standard deviation of weekly overtime work are 5 and 3 respectively.

- Calculate the mean and standard deviation for the two groups taken together.
- Is the overtime work more variable for the male group than for female group? Explain.

Solution

- Let $n_1, \bar{X}_1$ and σ_1 be the number of observations, mean and standard deviations, respectively, of the first group (male workers) and $n_2, \bar{X}_2$ and σ_2 for the second group (female workers).

Thus, we can write

$$n_1 = 30, \bar{X}_1 = 10, \sigma_1 = 4$$

$$n_2 = 20, \bar{X}_2 = 5, \sigma_2 = 3$$

If $\bar{X}_{12}$ be the mean of the combined group, then

$$\bar{X}_{12} = \frac{n_1\bar{X}_1 + n_2\bar{X}_2}{n_1 + n_2} = \frac{30 \times 10 + 20 \times 5}{30 + 20} = \frac{400}{50} = 8$$

To find combined standard deviation, denoted by σ_{12} we write

$$d_1 = \bar{X}_1 - \bar{X}_{12} = 10 - 8 = 2 \text{ and } d_2 = \bar{X}_2 - \bar{X}_{12} = 5 - 8 = (-3)$$

$$\sigma_{12} = \sqrt{\frac{n_1\sigma_1^2 + n_2\sigma_2^2}{n_1 + n_2} + \frac{n_1d_1^2 + n_2d_2^2}{n_1 + n_2}}$$

$$= \sqrt{\frac{30 \times 16 + 20 \times 9}{50} + \frac{30 \times 4 + 20 \times 9}{50}}$$

$$= \sqrt{\frac{660}{50} + \frac{300}{50}} = \sqrt{\frac{960}{50}} = \sqrt{\frac{96}{5}} = 4.38$$

(ii) To answer this, we compute the co-efficient of variations for each group.

$$\text{C.V (Males)} = \sigma_1 / \bar{X}_1 \times 100 = 4/10 \times 100 = 40\%$$

$$\text{C.V (Females)} = \sigma_2 / \bar{X}_2 \times 100 = 3/15 \times 100 = 60\%$$

Since C.V (Males) < C.V (Females), it is not correct to say that overtime work for males is more variable than females.

Illustration 15

Initially there were 9 workers, all being paid a uniform wage. Later 10th worker is added whose wage rate is 20 less than for the others. Compute—

- (i) The effect on mean wage.
- (ii) The standard deviation of wages for the group of 10 workers.

Solution

- (i) Let Rs. X be the wage of each of the nine workers, then wage of 10th worker will be X – 20.

$$\text{Thus, the mean wage for the group of 10 workers} = \frac{9X + X - 20}{10} = X - 2$$

Note that the average wage of 9 workers is X.

Thus, the mean wage decreases by Rs. 2.

- (ii) Regarding 9 workers as one group, we can write $n_1 = 9$, Mean = X and $\sigma_1 = 0$ and 10th worker as another group, we can write $n_2 = 1$ mean = X – 20.

$$\text{Also } d_1 = X - X + 2 = 2 \text{ and } d_2 = X - 20 - X + 2 = -18.$$

$$\therefore \sigma^2 = \frac{9 \times 4 + 1 \times 18^2}{10} = \frac{36 + 324}{10} = 36$$

$$\sigma = 6$$

Illustration 13

The following is the distribution of daily wages of workers :

<i>Wages :</i>	25-35	35-45	45-55	55-65	65-75	75-85	85-95	95-105
<i>No. of Workers:</i>	3	5	9	14	13	11	6	4

Calculate the percentage of workers lying between the range (i) $\bar{X} \pm \sigma$ (ii) $\bar{X} \pm 2\sigma$

Solution

Calculation of $\bar{X}$ and σ

Class	Mid-value	f	$\mu = \frac{X - 60}{10}$	fu	fu^2
Intervals	(X)				
25-35	30	3	-3	-9	27
35-45	40	5	-2	-10	20
45-55	50	9	-1	-9	9
55-65	60	14	0	0	0
65-75	70	13	1	13	13
75-85	80	11	2	22	44
85-95	90	6	3	18	54
95-105	100	4	4	16	64
Total		65	$\Sigma fu = 41$		$\Sigma fu^2 = 231$

$$\bar{X} = 60 + \frac{41}{65} \times 10 = 66.31$$

$$\sigma = 10 \sqrt{\frac{231}{65} - \left(\frac{41}{65}\right)^2} = 17.76$$

- (i) $\bar{X} - \sigma = (66.31 - 17.76) = 48.55$, and $\bar{X} + \sigma = (66.31 + 17.76) = 84.07$. The percentage of workers lying between 48.55 and 84.07 is

$$\left[\frac{55 - 48.55}{10} \times 9 + 14 + 13 + \frac{84.07 - 75}{10} \times 11 \right] \times \frac{100}{65} = 65.82$$

- (ii) $\bar{X} - 2\sigma = (66.31 - 35.52) = 30.79$ and $\bar{X} + 2\sigma = (66.31 + 35.52) = 101.83$. The percentage of workers lying between 30.79 and 101.83 is

$$\left[\frac{35 - 30.79}{10} \times 3 + 5 + 9 + 14 + 13 + 11 + 6 + \frac{101.83 - 95}{10} \times 4 \right] \times 100/65 = 95.38$$

Properties of Standard Deviation

Some of the important properties of standard deviation are as under :

1. The standard deviation is independent of change of origin but not of change of scale.
2. The standard deviation of a distribution is not greater than any other root mean square deviation i.e.

$$\sqrt{1/n \Sigma (X_i - \bar{X})^2} \leq \sqrt{1/n \Sigma (X_i - A)^2}$$

3. In an approximately normal distribution $\bar{X} + \sigma$ covers about 68% of the distribution, $\bar{X} + 2\sigma$ covers about 95% of the distribution and $\bar{X} + 3\sigma$ covers 99% i.e. almost whole of the distribution. This rule is helpful in determining whether the deviation of a particular value from mean of the distribution is

unusual or not. The deviations of more than 2σ are regarded as unusual and warrants some remedial action. In addition to this, all observations with deviations of more than 3σ from mean are regarded as not belonging to the given data set. (See Figure 1)

Normal Curve

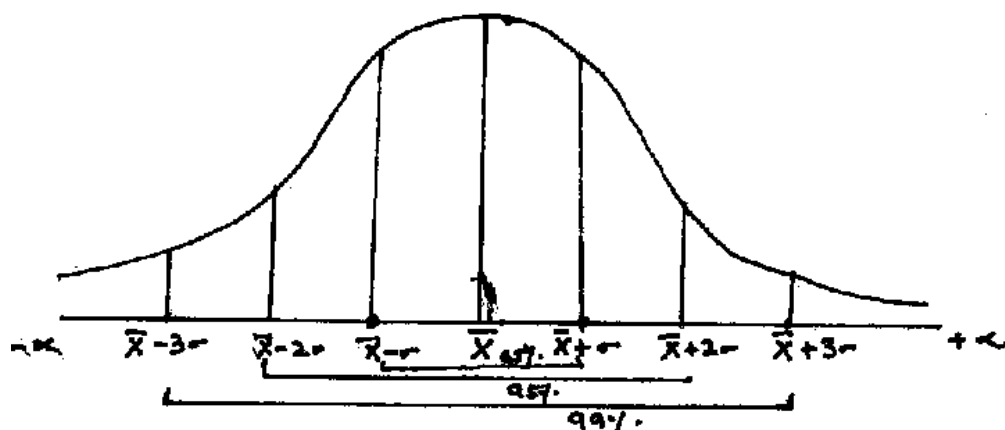


Figure 1

Relationships among Quartile Deviation, Mean Deviation and Standard Deviation

Measure of variation	% of items covered with in a given range of Mean ($\bar{X}$)			Size of Measure of variations to standard deviation
	$\pm 1\sigma$	$\pm 2\sigma$	$\pm 3\sigma$	
1. Quartile Deviation	50.0	82.3	95.7	0.6748
2. Mean Deviation	57.5	88.9	98.3	0.7949
3. Standard Deviation	68.27	95.45	99.73	1.000

Merits and Demerits of Standard Deviation

Merits

1. It is a rigidly defined measure of dispersion.
2. It is based on all the observations.
3. It is capable of being treated mathematically.

Demerits

1. As compared to Range and Quartile Deviation etc., it is difficult to understand.
2. It is difficult to compute.
3. It is highly affected by extreme observations.
4. Since the unit of standard deviation is same as the unit of observations, it cannot be used to compare the dispersions of the distributions expressed in indifferent units.

Uses of Standard Deviation

1. It can be used to compare the dispersions of two or more distributions when their units of measurements and arithmetic means are same.
2. It is used to test the reliability of mean. A mean with less standard deviation is said to be more reliable.

LORENZ CURVE

It was developed by Max O Lorenz in 1905 as a graphical representation of income distribution. It portrays observed income distribution and compares this to state of perfect income equality. It is cumulative percentage curve in which percentage of items (or frequencies) are shown with corresponding percentage of factors like income, wealth, profits etc.

Lorenz Curve method is a graphical method of measuring dispersion of a distribution. This method is often used to measure the inequalities of income or wealth in a society.

In this method, the cumulative percentages of income or wealth are plotted against the cumulative percentages of persons. The curve, thus, obtained is called the *Lorenz Curve*. The curve shows the actual relationship between the percentage of income recipients and percentage of income they did in fact actually receive. The 45° degree line shows the situation when there is even distribution of income i.e. 20% of the population earns 20% of the income and 50% of household earn 50% of the income and so on. This is known as the line of absolute equality.

Steps required in drawing Lorenz Curve —

- (i) Reduce various groups of each variable into percentages.
- (ii) Determine cumulative percentage of two set of percentages calculated in step (i).
- (iii) Plot cumulative percentages of these two variable along the X axis and Y axis.
- (iv) The points 100, 100 along the axis of Y and point (0, 0) along the axis of X should be joined by a straight line. The line so obtained is called the line of equal distribution and serves as the basis for the determination of the extent to which the actual distribution deviates from the ideal distribution given by this line. The actual data map drawn on this graph in the ordinary manner and the plotted points may be connected by means of a curve. Farther is the curve obtained from the line of equal distribution, the greater is deviation and closer is the curve from the line of equal distribution, more equal is the distribution of income.

A point $P(100, 100)$ is plotted on a plane in which X-axis represents cumulative percentage of persons and Y = axis represents cumulative percentage of income or wealth as shown in Figure 2.

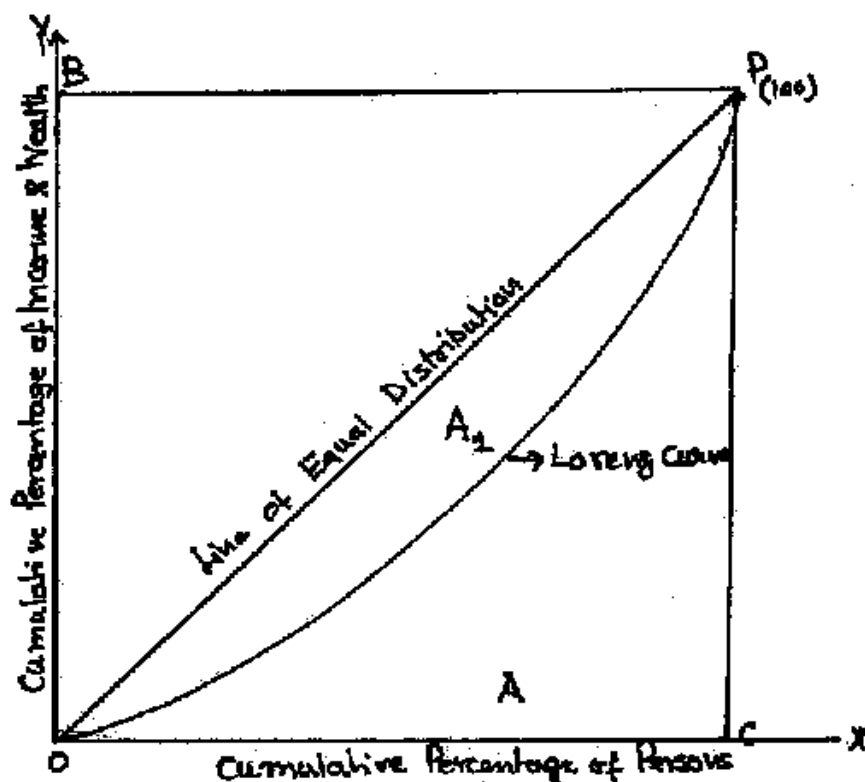


Figure 2

Then we drop perpendiculars PB and PC on Y and X axis respectively. The line joining OP represents the *line of equal distribution*. Any departure from this line denotes the extent of inequality. For example, the extent of inequalities, in the figure, are given by the area A_1 between the Lorenz curve and the line of equal distribution is OP.

Co-efficient of Inequality (Gini co-efficient)

The Gini co-efficient is a measure of inequality developed by Italian statistician Corrado Gini. It is usually used to measure income inequality, but can be used to measure any form of uneven distribution. The Gini co-efficient is a number between 0 and 1 where 0 corresponds with perfect equality (where everyone has the same income) and 1 corresponds with perfect inequality (where one person has all the income, and every one else has zero income). The Gini Index is the Gini co-efficient expressed in percentage form.

Gini co-efficient – Area between the Lorenz curve of the distribution and the uniform distribution line (Numerator)/Area under the uniform distribution line

(Denominator). A low Gini co-efficient indicates more equal income or wealth distribution while a high Gini co-efficient indicates more unequal distribution. Zero corresponds to perfect equality (everyone has the same income) and one corresponds to perfect inequality (one person has all the income while every one else has zero income).

While the Gini Co-efficient is mostly used to measure income inequality, it can also be used to measure wealth inequality. This use requires that no one has a negative wealth.

Let the area of the triangle POC be denoted by A_1 (See Fig. 2). The coefficient of inequality is defined by the ratio A_1/A , which is popularly known as *the Gini Co-efficient*.

If the above figure is drawn by taking cumulative fractions, rather than percentages, on both the axes, the co-ordinate of P would become (1, 1). Thus, the area of triangle POC would be equal to $\frac{1}{2}$ and hence, the Gini Co-efficient becomes equal to $2A_1$.

Illustration 17

Use Lorenz Curves to compare the extent of inequalities of income distribution in the following two groups :

Monthly Income (Rs.)	No. of Persons	
	Group A	Group B
1200-1400	800	4800
1400-1600	960	6400
1600-1800	1040	9600
1800-2000	600	3600
2000-2200	480	8000
2200-2400	120	4000

Solution

Monthly Income Rs.	Mid Values	Cumulative Income	Cum. %	Group-A			Group-B		
				No. of Persons	Cum. Total	Cum. %	No. of Persons	Cum. Total	Cum. %
1200-1400	1300	1300	12	800	800	20	4800	4800	13
1400-1600	1500	2800	26	960	1760	44	6400	11200	31
1600-1800	1700	4500	42	1040	2800	70	9600	20800	57
1800-2000	1900	6400	59	600	3400	85	3600	24400	67

2000-2200	2100	8500	79	480	3880	97	8000	32400	89
2200-2400	2300	10800	100	120	4000	100	4000	36400	100

Note : The cumulative percentages are approximated to the nearest whole number.

Lorenz Curve

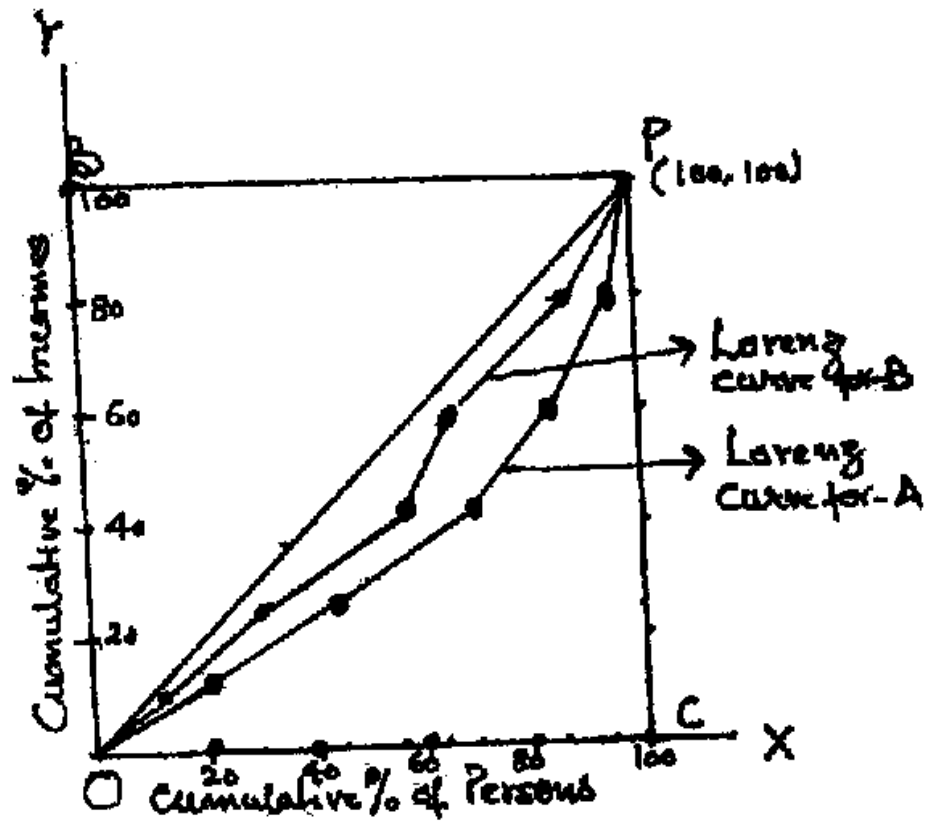


Figure 3

From the above figure 3, we find that inequalities of income are more in group A than in group B.

Choice of a suitable Measure of Dispersion

The choice of a suitable measure of dispersion depends upon:

- The nature of data available,
- the objective of measuring dispersion, and
- the characteristics of the measure.

If a distribution has open ends, we can calculate, quartile deviation, percentile deviation etc. On the other hand, if the objective is to know the extent of variations in observations in a given time or situation, the calculation of range may be more appropriate e.g. maximum or minimum rainfall in a season, maximum and minimum temperature on a particular day, maximum and minimum marks obtained by the students in an examination, maximum and minimum price of the share of a company is a month etc.

Further, if one is interested in obtaining the magnitude of deviations from a central value, the use of standard deviation is preferred to mean deviation because the later is inconvenient to handle mathematically.

SELF-TEST QUESTIONS

(These are meant for recapitulations only.

Answer to these questions are not to be submitted for evaluation).

1. Do you agree with the following statements?
 - (i) The standard deviation of a set of values can be positive or negative.
 - (ii) Quartile deviation takes into account the middle 50% of the observation.
 - (iii) Standard deviation is independent of Change of origin but not of change of scale.
 - (iv) If X_1 and X_2 are the means of two series, then the mean of the combined series will always lie between them.
 - (v) If s_1 and s_2 are the variance of the two series, then the variance of the combined series will lie between them.
 - (vi) The standard deviation can never exceed the range of a distribution.
2. Calculate the range and its coefficient from the following data :
 - a. 159, 165, 140, 125, 110, 170, 132, 150
 - b.

<i>Weights :</i>	110-120	120-130	130-140	140-150	150-160
<i>Frequency :</i>	6	7	9	5	2

3. Find out the quartile deviation and its coefficient from the following data :

<i>Class :</i>	0-4	5-9	10-14	15-19	20-24	25-29
<i>Frequency :</i>	15	26	12	5	4	3

4. Calculate the coefficient of mean deviation from mean and median from the following data :

<i>Marks :</i>	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90
<i>No. of students :</i>	2	6	12	18	25	20	10	7

5. Calculate the standard deviation from the following data :

<i>Age (less than) :</i>	10	20	30	40	50	60	70	80
<i>No. of Persons :</i>	15	30	53	75	100	110	115	125

6. The salaries paid to the managers of a company had a mean of Rs. 20,000 with a standard deviation of Rs. 3000. What will be the mean and standard deviation if all the salaries are increased by (i) 10%, (ii) 10% of the existing mean?
- Which policy would you recommend if the management does not want to have increased disparities in wages?
7. There are 60 male and 40 female workers in a factory. The standard deviation of their wages (per hour) were computed as Rs. 8 and 11 respectively. The mean wages of the two groups were found to be equal. Compute the combined standard deviation of the Wages of all the workers.
8. The mean, standard deviation and range of a symmetrical distribution of weights of a group of 20 boys are 40, 5 and 6 Kgs. respectively. Find the mean and standard deviation of the group if the lightest and the heaviest boys are excluded.

Suggested Readings/References :

1. Statistical Methods — *S.P. Gupta*; Sultan Chand & Sons; 23, Daryaganj, New Delhi-110 002.
2. Business Statistics — *R.S. Bhardwaj*, Excel Books, A-45, Naraina, Phase-I, New Delhi-110 028.
3. Statistics, Theory, Methods & Applications — *D.C. Sanchetti & V.K. Kapoor*, Sultan chand & Sons, New Delhi-110 002.
4. Fundamentals of Statistics — *S.C. Gupta*; Himalya Publishing House, 4-B, Murari Lal Street, Ansari Road, Daryaganj, New Delhi-110 002.
5. Fundamental of Statistics — *A. K. Aggarwal and Sahab Singh*, Franksons ;

G-2/16, Top Floor, Ansari Road, Daryaganj, New Delhi-110 002.

6. Statistics — *RSN Pillai & V. Bhagrathi*, S. Chand & Company Ltd., Ram Nagar,
New Delhi.
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STUDY XIII

CORRELATION ANALYSIS

INTRODUCTION

Correlation and regression are the important statistical tools widely used by the business analysts, economists, policy makers, scientists, sociologists, management experts and others to measure the amount of similarities and variation i.e. the degree of association between series of pairs or sets of observations of two or more variables. This tool is useful to ascertain how much a variable changes corresponding to the average amount of change in other variable in the data.

When various individuals or items are observed simultaneously with regard two characteristics, we get *bivariate data*. For example, the collection of data on income and expenditure of house holds in a city. For such data, we can compute mean, variance etc. for each of the characteristics. In addition to this, in a *bivariate* study, we are often interested to know whether there exists any association between the two characteristics.

The knowledge of such association is useful for predicting the value of one characteristics given the value of the other, which is very helpful in understanding and analysis of various economic and business problems.

The study of association between two characteristic can be divided into two broad categories:

- (i) To determine whether there exists some association between the two characteristics. If so, what is the degree of association or the magnitude of correlation between them.
- (ii) To estimate a suitable form of relationship between the two characteristics given that they are associated.

The first category relates to the study of correlation and the second relates to the study of regression. Here ,we are concerned with the study of correlation only.

MEANING OF CORRELATION

Correlation is a statistical tool which measures the degree of relationship between two and more variables. Here, by term relationship, we mean the tendency of variable to move together. In a sense, it denotes interdependence amongst variables. The movement of variables may be in positive or negative direction.

Definitions of Correlation

Different statistical experts have defined the concept of correlation as under :-

- (i) "Correlation analysis deals with association between two or more variables."
— *Simpson & Kafka*
- (ii) "Correlation analysis attempts to determine the degree of relationship between variables."
— *Ya Lun Chou*
- (iii) "Correlation is analysis of covariation between two or more variables."

— A.M. Tuttle

- (iv) "If two or more quantities vary in sympathy so that movement in one tend to be accompanied by movement in others, then they are said to be correlated."

— L.R. Croner

- (v) "The relationship of quantitative nature, the appropriate statistical tool for discovering and measuring the relationship and expressing it in brief formula is known as correlation."

— Croxton & Cowdon

Thus, it may be noted from above mentioned definitions that correlation is a statistical tool which measures and analyses the degree of the extent to which two or more variables fluctuate with reference to one another.

Co-efficient of Correlation

It is a numerical measure of degree of association between two or more variables. It ranges between +1 and –1. The direction of change is indicated by + or – sign. The positive sign refers to sympathetic movement in the same direction where as minus sign refers to movement in negative direction. The following table indicates various degrees of correlation.

<i>Degree</i>	<i>Positive Sign</i>	<i>Negative Sign</i>
(i) Perfect	+1	–1
(ii) Highly Significant	+ 0.75 to 1	– 0.75 to – 1
(iii) Moderate	+ 0.50 to 0.75	– 0.50 to – 0.75
(iv) Slightly Significant	+ 0.25 to 0.50	– 0.25 to – 0.50
(v) Insignificant	0 + 0.25	0 to – 0.25
(vi) Absent	0	0

SIGNIFICANCE OF CORRELATION

The significance of correlation can be better understood in following terms :

- (i) It is very useful tool in the hands of economists and business analysts to study the relation between variables and frame the business policies accordingly.
- (ii) It helps to estimates costs, sales, price and other related variable given the required information.
- (iii) It contributes in understanding the economic behaviour of a phenomena and locating the critical variables.
- (iv) It is the basis for concept of regression and ratio of variation.
- (v) The relation between variables can be verified and tested for significance. The effect of correlation is to reduce the range of uncertainty of our prediction.

CORRELATION AND CASUATION

Correlation analysis enables us to have an idea about the degree and direction of the relationship between the two variables under study but it fails to reflect upon cause and effect relationship between the variables. In a bivariate distribution, if the variables have the cause and effect relationship, they are bound to vary in sympathy with each other and therefore, there is bound to be a high degree of correlation between them. In other words, causation always implies correlation but converse is not true. Even a fairly high degree of correlation between the two variables need not imply a cause and effect relationship between them. The high degree of correlation between the variables may be due to mutual dependence, pure chance factors etc.

Types of Correlation

Correlation is broadly classified into following three categories :-

- (i) Positive or Negative Correlation;
- (ii) Simple, partial and multiple correlation; and
- (iii) Linear and non-linear correlation.

(i) *Positive or Negative Correlation*

Positive or negative correlation between the variable depends upon the direction of change. If both the variables are varying in the same direction i.e. if one variable is increasing then the other on an average is also increasing, or if one variable is decreasing then the other, on an average is also decreasing, the correlation is said to be positive.

Some of the examples of positive correlation include the following :

- Height and weight of students in a class;
- Price and supply of a commodity;
- Price of News prints and Newspaper;
- Family income and expenditure on luxurious items;

On the other hand, correlation is said to be negative or inverse if the variables are varying or moving in the opposite direction i.e. as one variable is increasing the other is decreasing or *vice versa*.

Some examples of negative correlation include the following: -

- Price and demand of a Commodity.
- Degree of temperature in summer and sale of room-coolers.

(ii) *Simple, Partial and Multiple Correlation*

- (a) Simple correlation refers to study of relationship between two variables.
- (b) Partial correlation refers to study of relationship of more than two variables, between the dependent variable and one independent variable keeping the effect of other variable as constant.

- (c) Multiple correlation measure the degree of relationship or effect of so many variables on a given variable.

(iii) Linear and Non-linear Correlation

- (a) *Linear correlation* : It refer to a situation if the ratio of change between the variables is same. For example, consider the following

X	10	20	30	40
Y	8	16	24	32

In above case, the ratio of change between the variables is the same i.e. 1.25. If we plot the above information on graph, we get a simple straight line.

- (b) *Non-linear Curvilinear* : Non-linear correlation refers to the situation when amount of change in one variable does not bear a constant ratio to the amount of change in the other variables.

METHODS OF STUDYING CORRELATION

There are different methods of studying correlation between the variables. Some of the popular methods in use are discussed as under :

- (i) Scattered Diagram or Dotogram Method
- (ii) Two way frequency table method
- (iii) Karl Pearson or co-variance method
- (iv) Spearman's rank correlation method

(i) Scattered Diagram or Dotogram Method

It is the simplest method to study the correlation in two variables. Basically, it is concerned with diagrammatic representation of bivariate data. Under this method, given data are plotted on a graph paper in the forms of data i.e. for each pair of X and Y values, we put dots and thus obtain as many points as the number of observations. By observing the diagram of various points, we can form an idea as to whether the variables are related or not. The more the plotted points scattered over a chart, the less relationship there is between the two variables. The more the points coming to falling on a line, the higher is the degree of relationship. The Figures 1 to 6 at page ___ and ___ of the scattered data depict the different form of correlation.

Merits

- (i) It is the most simple and easy method of studying correlation between the variables. Under this method, merely by looking at diagram, the person may have the idea whether the variable are related or not or there exist positive or negative correlation.
- (ii) It is not influenced by extreme items.
- (iii) Being a non-mathematical method, it is easy to understand.

- (iv) Drawing a scattered diagram is the first step to find out the relationship between two variables.

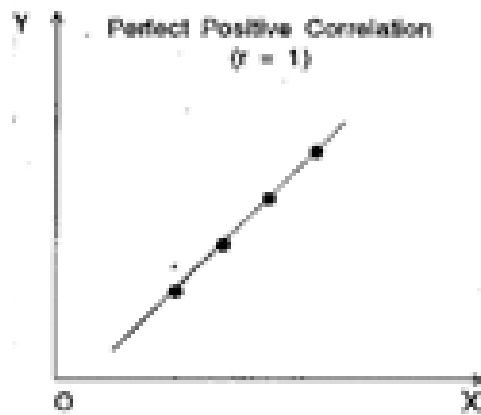


Fig. 1

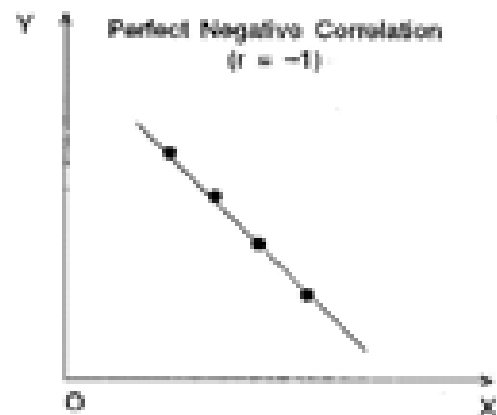


Fig. 2

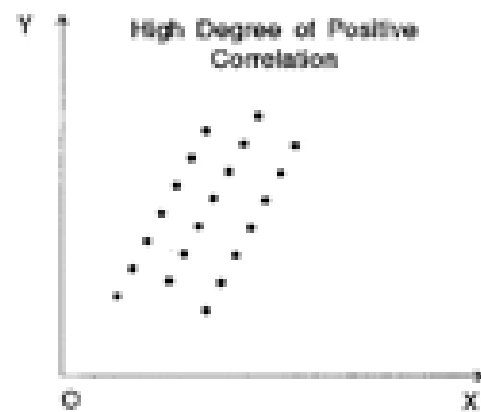


Fig. 1

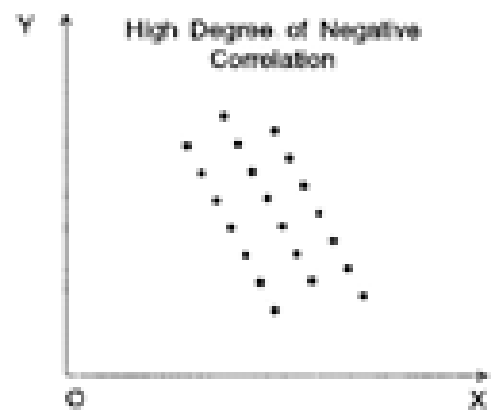


Fig. 2

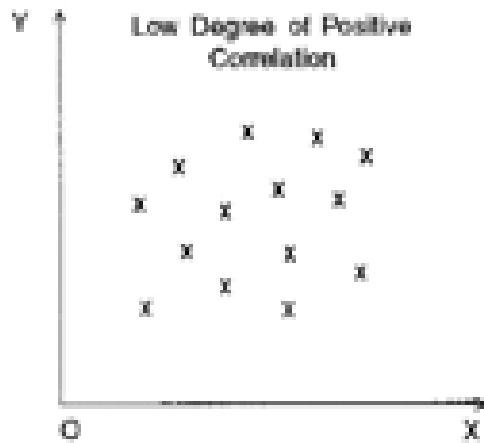


Fig. 1

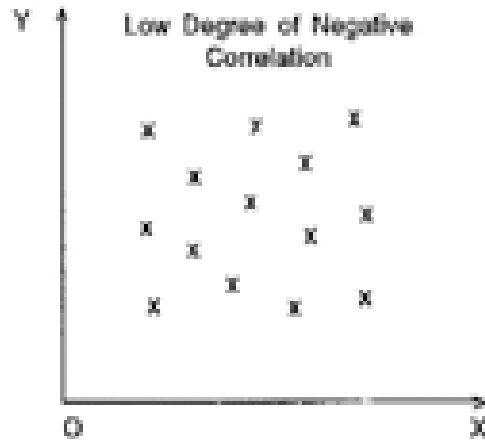
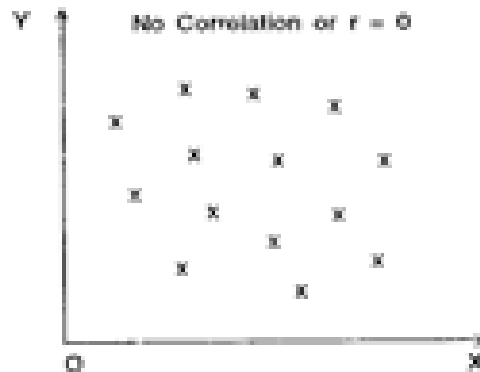


Fig. 2



Demerits

This method helps us to form an idea whether the relationship between the variables is high or low, positive or negative but we can't define or get the exact degree or correlation between two variables.

(ii) **Two way Frequency Table Method**

It is another simple method to study the correlation between the two variables. Under this method, a two way frequency table can be prepared by taking one variable in the rows and other variable in the columns. The frequencies are shown in the respective squares (cells) of the table. The concentration of frequencies in various squares shows the amount of positive or negative correlation. With the help from the following table, we can have only a rough idea about the correlation, but again we cannot ascertain the degree of correlation. The marks in mathematics and physics of BSc students are shown in the tabular form as under:

Marks in Physics	0-20	20-40	40-60	60-80	80-100

**Marks in
Mathematics**

0-20	12	16				28
20-40		12	20			32
40-60			12	8		20
60-80				6	6	12
80-100				6	2	8
	12	28	32	20	8	100

It may be noted from the above that scattered values from the top left to bottom right indicates that lower marks in mathematics are associated with lower marks in Physics.

(iii) Karl Pearson Method or Covariance Method

The degree of linear association between the two variables X and Y is measured by the Karl Pearsons Coefficient of correlation or the product moment correlation coefficient or simply the coefficient of correlation between them. The coefficient of correlation between X and Y will be denoted by r_{xy} . Various expressions for r_{xy} are given below :-

$$r_{xy} = \frac{\text{Cov}(xy)}{\sigma_x \sigma_y} \quad (1)$$

where

σ_x = standard deviation for X

σ_y = standard deviation for Y

n = number of observations.

$$r_{xy} = \frac{\frac{1}{n} \sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\frac{1}{n} \sum (X_i - \bar{X})^2} \sqrt{\frac{1}{n} \sum (Y_i - \bar{Y})^2}} \quad (2)$$

By canceling $\frac{1}{n}$ both from numerator and denominator, we may get

$$\text{or } r_{xy} = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2} \sqrt{\sum (Y_i - \bar{Y})^2}} \quad (3)$$

$$\text{or } r_{xy}^* = \frac{\sum (X_i Y_i - n\bar{X}\bar{Y})}{\sqrt{\sum (X_i - n\bar{X})^2} \sqrt{\sum Y_i^2 - n\bar{Y}^2}} \quad (4)$$

$$\text{or } r_{xy} = \frac{n\sum X_i Y_i - \sum X_i \sum Y_i}{\sqrt{n\sum X_i^2 - (\sum X_i)^2} \sqrt{n\sum Y_i^2 - (\sum Y_i)^2}} \quad (5)$$

If we assume $x_i = (X_i - \bar{X})$ and $y_i = (Y_i - \bar{Y})$ then equation 2 can be written as

$$r_{xy} = \frac{\frac{1}{n} \sum x_i y_i}{\sqrt{\frac{1}{n} \sum x_i^2} \times \sqrt{\frac{1}{n} \sum y_i^2}}$$

$$\text{or } r_{xy} = \frac{\sum x_i y_i}{\sqrt{\sum x_i^2} \times \sqrt{\sum y_i^2}}$$

It is known as direct method of calculating correlation.

$$*r_{xy} = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2} \times \sqrt{\sum (Y_i - \bar{Y})^2}}$$

$$\begin{aligned} \sum (X_i - \bar{X})(Y_i - \bar{Y}) &= \sum (X_i - \bar{X})Y_i - \bar{Y} \sum (X_i - \bar{X}) \\ &= \sum X_i Y_i - \bar{X} \sum Y_i - \bar{Y} \sum X_i + n\bar{X}\bar{Y} \\ &= \sum X_i Y_i - n\bar{X}\bar{Y} - n\bar{X}\bar{Y} + n\bar{X}\bar{Y} = \sum X_i Y_i - n\bar{X}\bar{Y} \end{aligned}$$

$$r_{xy} = \frac{\sum X_i Y_i - n\bar{X}\bar{Y}}{\sqrt{\sum X_i^2 - n\bar{X}^2} \sqrt{\sum Y_i^2 - n\bar{Y}^2}}$$

Case 1 : When deviation are not taken at all

Illustration 1

Calculate the Karl Person's Coefficient of correlation from the following data :

Advertising Expenses (Rs) :	39	65	62	90	82	75	25	98	36	78
Sales (Rs) :	47	53	58	86	62	68	60	91	51	84

Solution : Let X denote the advertising expenses and Y denote sales.

X	Y	XY	X ²	Y ²
39	47	1833	1521	2209
65	53	3445	4225	2809
62	58	3596	3844	3364
90	86	7740	8100	7396
82	62	5084	6724	3844
75	68	5100	5625	4624
25	60	1500	625	3600
98	91	8918	9604	8281
36	51	1836	1296	2601
78	84	6552	6084	7056
650	660	45604	47648	45784

$$r_{xy} = \frac{N \sum X_i Y_i - \sum_{i=1}^n X_i \sum Y_i}{\sqrt{N \sum X_i^2 - (\sum X_i)^2} \times \sqrt{N \sum Y_i^2 - (\sum Y_i)^2}}$$

Here N = 10 (no. of pairs of observations)

$$\therefore r_{xy} = \frac{10 \times 45604 - 650 \times 660}{\sqrt{10 \times 47648 - (650)^2} \sqrt{10 \times 45784 - (660)^2}} = \frac{27040}{34647} = 0.78$$

Case 2 : When deviations are taken from Arithmetic Mean

Illustration 2

Find the Karl Pearson co-efficient of correlation between the height and weight of the students of a class in the college on the basis of given information :

<i>Heights in Inches</i>	<i>Weights in lbs.</i>
57	113
59	117
62	126
63	126
64	130
65	129
55	119
58	116
57	112

Solution :

Formula to calculate co-efficient of correlation

$$r_{xy} = \frac{\sum xy}{N \sigma_x \sigma_y}$$

Computation of Co-efficient of Correlation

<i>X Series</i>			<i>Y Series</i>			
<i>Height in Inches</i>	<i>Deviation from Mean $\bar{X} = 60$</i>	<i>Square of deviations</i>	<i>Weight in lbs</i>	<i>Deviation from Mean $\bar{Y} = 120$</i>	<i>Square of Deviations</i>	<i>Product of deviations of xy</i>
<i>X</i>	<i>(X - $\bar{X}$) = x</i>	<i>(x²)</i>	<i>Y</i>	<i>i.e. (Y - $\bar{Y}$) = y</i>	<i>(y²)</i>	
57	-3	9	113	-7	49	21
59	-1	1	117	-3	9	3
62	+2	4	126	+6	36	12
63	+3	9	126	+6	36	18
64	+4	16	130	+10	100	40

65	+5	25	129	+9	81	45
55	-5	25	111	-9	81	45
58	-2	4	116	-4	16	8
57	-3	9	112	-8	64	24
$\Sigma X=540$	$\Sigma x_i=0$	$\Sigma x_i^2=102$	$\Sigma Y_i=1080$	$\Sigma y_i=0$	$\Sigma y_i^2= 472$	$\Sigma xy=216$
$N = 9$						

Calculations of X series

$$\bar{X} = \frac{\Sigma X_i}{N} = \frac{540}{9} = 60$$

(σ_x) Standard Deviation of x series

$$\Sigma x^2 = 102, \quad \sigma_x = \sqrt{\frac{\Sigma x^2}{N}}$$

$$\sigma_x = \sqrt{\frac{102}{9}}$$

$$= 3.36$$

Calculations of Y series

$$\bar{Y} = \frac{\Sigma Y_i}{N} = \frac{1080}{9} = 120$$

σ_y Standard Deviation of Y Series

$$\sigma_y = \sqrt{\frac{\Sigma y^2}{N}}$$

$$\sigma_y = \sqrt{\frac{472}{9}}$$

$$\sigma = \sqrt{52.44} = 7.241$$

$$r_{xy} = \frac{216}{9 \times 3.36 \times 7.241}$$

$$= + 0.98$$

Use of Simplified Formula – Alternate Method

Illustration No. 4

Making use of summarised data given below, calculate the correlation co-efficient between X_1 and X_2

Case	X_1	X_2
A	10	9
B	6	4
C	9	6
D	10	9
E	12	11
F	13	13
G	11	8
H	9	4

Solution : Calculation of Co-efficient of Correlation

Case	X_1	X_2	$(X_1 - \bar{X}_1)$ $= x_1$	$(X_2 - \bar{X}_2)$ $= x_2$	x_1^2	x_2^2	$x_1 x_2$
A	10	9	0	+1	0	1	0
B	6	4	-4	-4	16	16	16
C	9	6	-1	-2	1	4	2
D	10	9	0	+1	0	1	0
E	12	11	+2	+3	4	9	6
F	13	13	+3	+5	9	25	15
G	11	8	+1	0	1	0	0
H	9	4	-1	-4	1	16	4
$N = 8$ $\Sigma X_1 = 80$ $\Sigma X_2 = 64$ $\Sigma x_1 = 0$ $\Sigma x_2 = 0$ $\Sigma x_1^2 = 32$ $\Sigma x_2^2 = 72$ $\Sigma x_1 x_2 = 43$							

$$r_{xy} = \frac{\Sigma x_1 x_2}{\sqrt{\Sigma x_1^2} \times \sqrt{\Sigma x_2^2}}$$

$$\bar{X}_1 = \frac{\Sigma X_{1i}}{N} = \frac{80}{8} = 10$$

$$\bar{X}_2 = \frac{\Sigma X_{2i}}{N} = \frac{64}{8} = 8$$

$$\Sigma x_1 x_2 = 43, \Sigma x_1^2 = 32, \Sigma x_2^2 = 72$$

By putting the calculated values in the formulas, we may get

$$r_{x_1 x_2} = \frac{43}{\sqrt{32 \times 72}} = \frac{43}{\sqrt{2304}} = \frac{43}{48} = 0.896$$

Case 3 : Method of Calculating Co-efficient of correlation by using Assumed Mean

At times, the calculation becomes very complicated and tedious if one use actual mean to take deviations from the variable say when actual mean is in fraction or decimal. In such a situation, the use of assumed mean for taking deviations simplify the calculations. Given two variations, x, y, in such situations, r_{xy} may be calculated by using the following formula.

$$r_{xy} = \frac{\sum d_x d_y - \frac{(\sum d_x)(\sum d_y)}{N}}{\sqrt{N\sum d_x^2 - (\sum d_x)^2} \times \sqrt{N\sum d_y^2 - (\sum d_y)^2}}$$

Where

$X = (X - \text{Assumed Mean})$

$Y = (Y - \text{Assumed Mean})$

$\sum d_x$ = Sum of deviations of X series from its assumed mean.

$\sum d_y$ = Sum of deviations of Y series from its assumed mean.

$\sum d_x^2$ = Sum of squares of deviations of X series from an assumed mean.

$\sum d_y^2$ = Sum of squares of deviations of Y series from an assumed mean.

$\sum d_x d_y$ = Sum of the product of deviations of X and Y series from an assumed mean.

Illustration 4

Find the co-efficient of correlation between the marks obtained by 11 students in the class in the paper of Economics and Statistics out of 100 from the following data.

<i>Marks in Economics</i>	<i>Marks in Statistics</i>
80	82
45	56
55	50
56	48
58	60
60	62
65	64
68	65
70	70

75

74

85

90

Solution : Calculation of Co-efficient of Correlation

Marks in Economics (X)	Marks in Statistics (Y)	Deviation from X=60 (X-60)=d _x	Deviation from Y=65 (Y-65)=d _y	Square of deviation x = d _x ²	Square of deviation y = d _y ²	Product of deviation d _x d _y
80	82	20	17	400	289	340
45	56	-15	-9	225	81	135
55	50	-5	-15	25	225	75
56	48	-4	-17	16	289	68
58	60	-2	-5	4	25	10
60	62	0	-3	0	9	0
65	64	+5	-1	25	1	-5
68	65	+8	0	64	0	0
70	70	+10	5	100	25	50
75	74	+15	9	225	81	135
85	90	+25	25	625	625	625
N=11		Σd _x =57	Σd _y = 6	Σd _x ² = 1709	Σd _y ² =1650	Σd _x d _y =1433

$$r = \frac{N \Sigma d_x d_y - \Sigma d_x \Sigma d_y}{\sqrt{N \Sigma d_x^2 - (\Sigma d_x)^2} \times \sqrt{N \Sigma d_y^2 - (\Sigma d_y)^2}}$$

Putting the calculated values in the above formula, we may get

$$r_{xy} = \frac{11 \times 1433 - 57 \times 6}{\sqrt{11 \times 1709 - (57)^2} \times \sqrt{11 \times 1650 - (6)^2}}$$

$$r_{xy} = \frac{15763 - 342}{\sqrt{18799 - 3249} \times \sqrt{18150 - 36}}$$

$$= \frac{15421}{\sqrt{15550 \times 18114}}$$

$$= \frac{15421}{124.699 \times 134.588}$$

$$= \frac{15421}{16783}$$

$$= 0.918$$

Hence, it is clear from above that there is high degree of positive correlation between the marks of two subjects i.e. economics and statistics.

Case 4 : Calculation of Co-efficient of Correlation in case of Change of Origin and Scale

The value of r is independent of origin of reference and units of measurement. It implies that the value of r remains unaffected by the addition (or subtraction) of a constant to, and/or by multiplication (or division) by a constant, of the values of either or both variables. In practice, it means that if we subtract any number from X values and any number from Y values and divide the resulting quantities by any number, then find or calculate r for resulting new set of observations, the value of r , remains unchanged.

Illustration 5

Calculate co-efficient of correlation between X and Y from the following information

X	Y
100	30
200	50
300	60
400	80
500	100
600	110
700	130

Solution : To simplify the calculation, let every value of X be divided by 100 and every value of Y be divided by 10 and denote these series by X' and Y'

Calculation of Co-efficient of Correlation

X	$X'=X/100$	$(X'-\bar{X})=x$	x^2	Y	$Y'/10=Y'$	$(Y'-\bar{Y})=y$	y^2	xy
100	1	-3	9	30	3	-5	25	15
200	2	-2	4	50	5	-3	9	6
300	3	-1	1	60	6	-2	4	2
400	4	0	0	80	8	0	0	0

500	5	1	1	100	10	2	4	2
600	6	2	4	110	11	3	9	6
700	7	3	9	130	13	5	25	15
$\Sigma X = 2800$	$\Sigma X' = 28$	$\Sigma x = 0$	$\Sigma x^2 = 28$	$\Sigma Y_i = 560$	$\Sigma Y' = 56$	$\Sigma y = 0$	$\Sigma y^2 = 76$	$\Sigma xy = 46$

$$\text{Here } \bar{X} = \frac{\Sigma X_i}{N} = \frac{2800}{7} = 400$$

$$\text{Or } \bar{X} = \frac{\Sigma X_i}{N} = \frac{28}{7} = 4 \quad (\text{After change in Scale})$$

$$\text{Here } \bar{Y} = \frac{\Sigma Y_i}{N} = \frac{560}{7} = 80$$

$$\text{Or } \bar{Y} = \frac{\Sigma Y_i}{N} = \frac{56}{7} = 8 \quad (\text{After change in Scale})$$

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2} \sqrt{\Sigma y^2}}$$

$$x = (x' - \bar{x})$$

$$y = (y' - \bar{y})$$

$$r = \frac{46}{\sqrt{28} \times \sqrt{76}}$$

$$= \frac{46}{\sqrt{28 \times 76}}$$

$$= \frac{46}{\sqrt{2148}} = \frac{46}{46.13}$$

$$r = +0.997$$

PROPERTIES OF CORRELATION CO-EFFICIENT

Some of the important properties of correlation co-efficient include the following :

- (i) The co-efficient of correlation is independent of change of origin and scale of measurement.
- (ii) The correlation co-efficient lies between -1 and $+1$.
- (iii) If x and y are independent, then $r_{xy} = 0$ but the reverse is not true.

Assumptions of Karl Pearsonian Correlation Co-efficient

The calculation of correlation co-efficient by using Person Method is based on certain set of assumptions. Important assumptions include the following :

- (i) *Linear relationship* : It is assumed that there is linear relationship between the two series under study. In other words, the scattered diagram of data will give a straight line.
- (ii) *Normality* : Each of the variables in a series is being affected by a large number of independent contributory causes of such a nature which form a normal distribution.
- (iii) *Casual Relationship* : Correlation is meaningful if there is cause and effect relationship between the forces affecting the distribution of items in the two series. It is meaningless if there is no correlation ship.
- (iv) *Error of Measurement* : It is assumed that if the error of measurement is reduced to minimum, the co-efficient of correlation will be more reliable.

Merits of Karl Pearson Method of Correlation

Important merits of Karl Pearson method of calculating co-efficient of correlation include the following :

- (i) This co-efficient measures both the direction and degree of correlation between the two variables.
- (ii) This is amenable to further algebraic treatment.
- (iii) It is the most popular mathematical method for measuring the degree of relationship.

LIMITATIONS OF CORRELATION CO-EFFICIENT

The Karl Pearson's coefficient is very popular method of expressing the degree and direction of linear association between two variables. This measure, however, suffers from the following limitations :

- (i) The co-efficient of correlation does not give any idea about the existence of a cause and effect type of relationship between the variables. It is possible to obtain a high value of r although none of them seem to be directly affecting the other. A correlation between such variables, e.g. height and intelligence, is termed as spurious or non-sense correlation. In view of this limitation, any interpretation of correlation should be done very carefully.
- (ii) The coefficient of correlation is only a measure of the degree of linear association between two variables. If the association is not linear, the value of correlation does not have any meaning.

Rank Correlation

The method of computation of rank correlation was given by Spearman. This is a method of computing correlation between two characteristics that are either measurable or capable of being ranked. When the characteristics are measurable, we can get a crude idea about the association between them by considering their ranks and not actual magnitudes.

Let R_{xi} be the rank of i th individual according to the characteristics X and R_{yi} be its rank according to characteristics Y. Note that both R_{xi} and R_{yi} takes integral values in the close interval (1, n) where n denotes the number of observations. Let us define $d_i = R_{xi} - R_{yi}$ ($i = 1, 2, \dots, n$).

The formula for rank correlation is

$$\ell = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Illustration 6

The following table gives marks obtained by 10 students in accounting and statistics. Compute the rank correlation between the marks in two subjects.

Marks in Accounting :	39	31	30	36	28	33	23	29	27	35
Statistics :	30	23	25	32	26	29	18	20	22	28

Solution

Let us denote the marks in accounting by X and the marks in statistics by Y. We shall denote rank 1 to the highest value for each of the variables and so on. Note that the problem can also be attempted by assigning rank 1 to the lowest value. It is important to follow the same method of ranking for the two variables.

X	Y	R_x	R_y	d_i	d_i^2
39	30	1	2	-1	1
31	23	5	7	-2	4
30	25	6	6	0	0
36	32	2	1	1	1
28	26	8	5	3	9
33	29	4	3	1	1
23	18	10	10	0	0
29	20	7	9	-2	4
27	22	9	8	1	1
35	28	3	4	-1	1
Total					22

Here $n = 10$

$$\therefore \ell = 1 - \frac{6 \times 22}{10(100 - 1)} = 0.87$$

Illustration 7

Twelve entries in a painting competition were ranked by two judges as shown below. Find the rank correlation and interpret the value.

Entry :	A	B	C	D	E	F	G	H	I	J	K	L
Judge I :	5	2	3	4	1	6	8	7	10	9	12	11

Judge II : 4 5 2 1 6 7 10 9 11 12 3 8

Solution :

The d_i values are :

1 -3 1 3 -5 -1 -2 -2 -1 -3 9 3

$$\therefore \sum d_i^2 = 1 + 9 + 1 + 9 + 25 + 1 + 4 + 4 + 1 + 9 + 81 + 9 = 154$$

$$\therefore \ell = 1 - \frac{6 \times 154}{12 \times 143} = 0.46$$

Tied Ranks

In case of a tie i.e. when two or more individuals have the same rank, each individual is assigned a rank equal to the mean of the ranks that would have been assigned to them in the event of their being slight differences in their values. Let us consider the series 20, 21, 21, 24, 25, 25, 25, 26, 27. Here, the value 21 is repeated two times and 25 is repeated three times. The values 21 and 21 could have been assigned rank 2 and 3 if these were slightly different from each other. Thus, each value is assigned a rank of 2.5 which is mean of 2 and 3. Similarly each value 25 will be assigned a rank 6 which is mean of 5, 6 and 7. For each tie, we add a term $m(m^2-1)$ to $\sum d_i^2$, where m is the number of observations tied to a particular rank. In our example, we shall have to add

$$\frac{2(4-1)}{12} + \frac{3(9-1)}{12} \text{ to } \sum d_i^2$$

Illustration 8

Calculate the coefficient of rank correlation from the following data :

X :	48	33	40	9	16	16	65	24	16	57
Y :	13	13	24	6	15	4	20	9	6	19

Solution : Calculation of Rank Correlation Co-efficient

X	Y	R_x	R_y	d_i	d_i^2
48	13	8	5.5	2.5	6.25
33	13	6	5.5	0.5	0.25
40	24	7	10	-3	9.00
9	6	1	2.5	-1.5	2.25
16	15	3	7	-4	16.00
16	4	3	1	2	4.00
65	20	10	9	1	1.00
24	9	5	4	1	1.00
16	6	3	2.5	0.5	0.25
57	19	9	8	1	1.00

Total	41.00

$$\begin{aligned}
 P &= 1 - \frac{6 \sum d^2 + \frac{1}{12} (m^3 - m) + \frac{1}{12} (m^3 - m)}{n(n^2 - 1)} \\
 &= 1 - \frac{6 [41 + \frac{1}{12} (3^3 - 3) + \frac{1}{12} (2^3 - 2) + \frac{1}{12} (2^3 - 2)]}{10 \times 99} \\
 &= 1 - \frac{6 (41 + 2 + 0.5 + 0.5)}{990} \\
 \ell &= 1 - \frac{264}{990} \\
 &= \frac{990 - 264}{990} \\
 &= 0.733
 \end{aligned}$$

Merits of Rank Correlation

- (i) It is simpler to understand and easy to calculate.
- (ii) It is more appropriate method to use where the data are of a qualitative nature.
- (iii) It is the only method which can be used where we are given the rank and not the actual data.

Limitations

This method can not be used for finding out group correlation in group frequency distribution.

Probable Error and Co-efficient of Correlation

Probable error is an old measure for testing the reliability of an observed correlation co-efficient. According to Secrist, "The probable error of the correlation coefficient is an amount which if added to and subtracted from the mean correlation co-efficient, gives limits within which chances are even that a co-efficient of correlation from a series selected at random will fall".

It is calculated by using the following formula :

$$\text{Probable Error (P.E.)} = 0.6745 \times \frac{1 - r^2}{\sqrt{n}}$$

Where n is the number of pair of items

The reason for taking the factor 0.6745 is that in a normal distribution, the range of ± 0.6745 covers 50% of the total area.

Rule

- (i) If $r < 6 \text{ PE}(r)$ correlation is not significant at all or insignificant.
- (ii) If $r > 6 \text{ PE}(r)$, the correlation is significant.
- (iii) In other situations, nothing can be concluded with certainty.

Situations/Conditions for use of Probable Error

Probable error, generally, can be used by the experts in the following situations :

- (i) The data must have been drawn from a normal population.
- (ii) There should prevail the condition of random sampling in selected sample observations.
- (iii) The sample must have been selected in an unbiased manner and individual items must be independent.

Illustration 9

If $r = 0.7$ and $n = 81$, calculate the probable error of the co-efficient of correlation and determine the limits for the population.

$$\text{Solution : P.E.}(r) = 0.6745 \frac{1-r^2}{\sqrt{n}}$$

$$r = 0.7, \text{ and } n = 81$$

$$\text{P.E.}(r) = 0.6745 \frac{1-0.49}{9}$$

$$= \frac{0.6745 \times 0.51}{9}$$

$$= \frac{0.343995}{9}$$

$$= 0.038$$

Limit of population correlation

$$= 0.7 \pm 0.38$$

$$= 0.662 \text{ to } 0.738$$

Illustration 10

In a correlation analysis, the values of Karl Pearson's co-efficient of correlation and its probable error were found to be 0.80 and 0.04 respectively. Find the value of n .

Solution

Given $r = 0.80$ $PE(r) = 0.04$

As per formula,

$$PE(r) = 0.6475 \times \frac{1-r^2}{\sqrt{n}}$$

$$0.04 = 0.6475 \times \frac{1-0.64}{\sqrt{n}}$$

$$\sqrt{n} = \frac{0.6475 \times 0.36}{4}$$

$$\sqrt{n} = \frac{23.31}{4}$$

$$= 5.8275$$

$$n = 33.95 \text{ or } 34$$

Co-efficient of Determination (r^2)

The co-efficient of determination (r^2) is basically the square of co-efficient of correlation (r). But it is a much more precise measure of strength of the relationship between the two variables and is subject to more precise interpretation because it can be presented as a proportion or as an percentage.

To be more precise, the co-efficient of determination may be defined as the proportion of the variation in the dependent variable Y that is explained by the independent variable X in the regression model. In other words,

$$r^2 = \frac{\text{Explained variation}}{\text{Total variation}}$$

$$= \frac{\sum (Y_c - \bar{Y})^2}{\sum (Y - \bar{Y})^2}$$

Where Y_c = computed or estimated value of Y

$\bar{Y}$ = Mean value of Y .

For example if $r = 0.8$ then $r^2 = 0.64$ or 64%. It indicates that 64% of the variance is explained by the given independent variable or variables and rest 36% are unexplained and may be due to chance factors. (see fig. below)

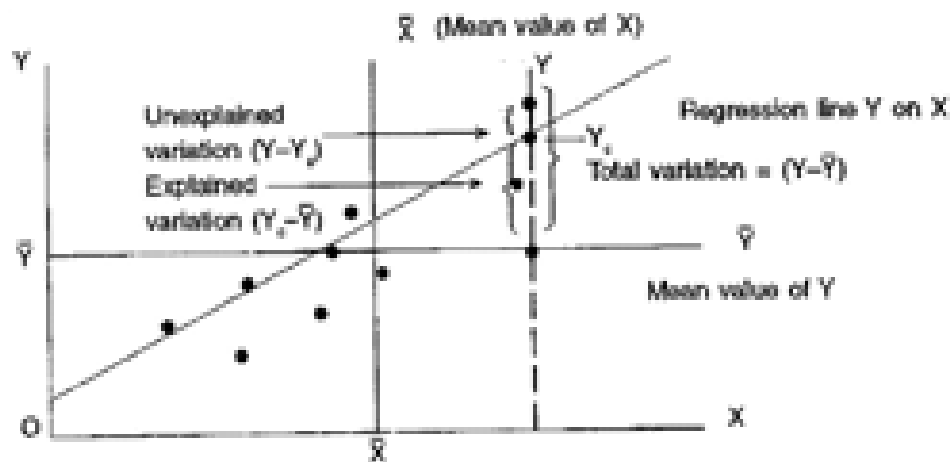


Fig. showing total, explained, and unexplained variation

Co-efficient of Non-Determination

It may be defined as the ratio of the unexplained variation to total variation ie

$$\begin{aligned}
 K^2 &= \frac{\text{Unexplained Variance}}{\text{Total Variance}} \\
 &= 1 - \frac{\text{Explained Variation}}{\text{Total Variation}} \\
 &= 1 - r^2
 \end{aligned}$$

The root of $\sqrt{1-r^2}$ is called co-efficient of alienation and mostly used in determining standard error.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.

Answer to these questions are not be submitted for evalution.)

1. Do you agree with the following statements?
 - (i) The coefficient of correlation between two variables depends upon their units of measurement.
 - (ii) If two variables are uncorrelated, they are independent.
 - (iii) The coefficient of correlation is a measure of the degree of linear association between two variables.
 - (iv) Correlation and causation convey the same meaning.
 - (v) Simple correlation is one in which only three variables are to be studied.
 - (vi) If the value of correlation coefficient lies between + .75 and + .99 ,it is the

case of moderate degree of correlation.

2. Define correlation. What is significance ?
3. Discuss in brief different degree and types of correlation.
4. Write short note on-
 - (a) Partial correlation
 - (b) Standard error
 - (c) Spurious correlation
 - (d) Multiple correlation.

5. Calculate Karl Pearson's coefficient of correlation for the following data:

Price (Rs.) : 10 11 12 13 14 15 16 17 18 19
Demand (kgs.) : 420 410 400 310 280 260 240 210 210 200

6. Calculate the coefficient of correlation from the following data :

- (i) Sum of deviations of X values = 5
- (ii) Sum of deviations of Y values = 4
- (iii) Sum of squares of deviations of X values = 40
- (iv) Sum of squares of deviation of Y values = 50
- (v) Sum of the product of deviations of X and Y values = 32
- (vi) No. of pairs of observations = 10.

7. Ten competitors in a beauty contest are ranked by three judges in the following order :

Competitors :	A	B	C	D	E	F	G	H	I	J
First Judge :	1	6	5	10	3	2	4	9	7	8
Second Judge :	3	5	8	4	7	10	2	1	6	9
Third Judge :	6	4	9	8	1	2	3	10	5	7

Which pair of Judges have the nearest approach to common task in beauty.

8. Comment on the following :
 - (i) The correlation coefficient between the number of railway accidents and the number of babies born per year was found to be 0.75.
 - (ii) A correlation co-efficient $r=0.8$ between X and Y implies a relationship twice as close as $r = 0.4$.
9. Write a short notes on the following:
 - (a) Positive and negative correlation
 - (b) Scattered Diagram

(c) Limitation of correlation Coefficient.

10. If s_x & s_y are the standard deviation of two variables X & Y:

- (i) Find standard error in estimating y from x if $r_{xy} = 0$
- (ii) By how much this error is reduced if r_{xy} is increased to 0.6?
- (iii) What will be the standard error if $r = \pm 1$.

Suggested Readings/References :

- 1. Statistical Methods — *S.P. Gupta*; Sultan Chand & Sons; 23, Daryaganj, New Delhi-110 002.
 - 2. Business Statistics — *R.S. Bhardwaj*, Excel Books, A-45, Naraina, Phase-I, New Delhi-110 028.
 - 3. Statistics, Theory, Methods & Applications — *D.C. Sanchetti & V.K. Kapoor*, Sultan chand & Sons, New Delhi-110 002.
 - 4. Fundamentals of Statistics — *S.C. Gupta*; Himalya Publishing House, 4-B, Murari Lal Street, Ansari Road, Daryaganj, New Delhi-110 002.
 - 5. Fundamental of Statistics — *A.K. Aggarwal and Sahab Singh*, Franksons; G-2/16, Top Floor, Ansari Road, Daryaganj, New Delhi-110 002.
 - 6. Statistics — *RSN Pillai & V. Bhagrathi*, S. Chand & Company Ltd., Ram Nagar, New Delhi.
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STUDY XIV

TIME SERIES AND INDEX NUMBERS ANALYSIS

TIME SERIES

INTRODUCTION

A series of observations observed or recorded at successive intervals of time is called a time series. The successive intervals are usually equal time intervals, e.g., it can be a year, quarter, month, etc. familiar examples of time series data are national incomes, industrial production (yearly data), population figures (10 years data), etc.

MEANING AND DEFINITION OF TIME SERIES

Time series is a set of numeric observation of the dependent variables, measured at specific points of time in chronological order, usually at equal intervals in order to determine the relationship of time to such variables.

Some of the important definitions of time series given by different experts are as under :

“A time series may be defined as a sequence of repeated measurement of a variables made periodically through time” — *Cecil H. Mayers*

“A time series may be defined as a collection of readings belonging to different time period of same economic variable or composite of variables” — *Yu-lun Chao*

“A time series consist of statistical data which are collected, recorded over successive increments” — *Patterson*

“A time series is a set of observations taken at specified times, usually at ‘equally intervals’. Mathematically, a time series is defined by the values $Y_1, \dots, Y_2, \dots$ of a variable Y (temperature, closing price of share etc.) at time $t_1, t_2, \dots$. Thus, Y is a function of t symbolised by $Y = f(t)$ ” — *Spiegel*

Thus, it is clear from above definitions that time series consists of data which are arranged chronologically. It establishes a relationship between two variables in which one of the variable is independent variable i.e. the time and other variable Y is the dependent variable whose value changes with regards to time variable. e.g. total agricultural production in different years.

OBJECTIVE OF TIME SERIES ANALYSIS

By the analysis of time series, we mean the decomposition of Y_t in to various components that affect this value in a given period. There are two main objectives of analysis of any time series:—

- (a) to study of past behaviour of data
- (b) to forecast for future

SIGNIFICANCE OF TIME SERIES ANALYSIS

Time series is an important statistical technique which is widely used by business executives, financial analysts, economists, scientists, sociologists, research workers, policy administrators in the government etc. because of following reasons :

- (i) It helps to understand the past behaviour of data and enables the users to forecast the future behaviour.
- (ii) It enables the users to compare the actual performance with the expected performance and analyse the different causes of variation.
- (iii) It is helpful in planning the future operations.
- (iv) It enables to evaluate the current accomplishments or performances and ascertain the causes in case of poor performance.
- (v) It is useful in planning, state administration, business, social and other areas of human knowledge.

COMPONENTS OF A TIME SERIES

A observed value of a time series Y_t is the net effect of many types of influences such as changes in population, techniques of production, seasons, level of business activity, tastes and habits, incidence of fire, floods, etc. It may be noted that different types of time series variables may be affected by different types of factors, e.g., factors affecting agricultural output may be entirely different from the factors affecting industrial output. However, for the purpose of time series analysis, various factors can be classified into the following three general categories applicable to any time series variable.

- (a) Secular Trend or Simple Trend
- (b) Periodic or Oscillatory Variations
 - (i) Seasons Variations
 - (ii) Cyclical Variations
- (c) Random or Irregular Variations

(a) *Secular Trend*

Secular trend is the tendency of data to increase or decrease or stagnate over a long period of time. Most of the business or economic time series would reveal a tendency to increase or decrease over a long period of time. The long-term changes are often caused by factors like population change, technology change, changes in government policies, changes in consumers' tastes and habits etc.

Trend Analysis fulfills the following purposes :

- (i) Behaviour pattern of the variables can be visualised;
- (ii) The impact of residential forces of change, seasonal, cyclical and irregular can be ascertained;
- (iii) Forecasting;
- (iv) To make comparative analysis of two or more series over a period of time.

(b) *Periodic Variations*

These variations are of regular nature and repeat themselves after a fixed interval of time. This time interval is known as period of these variations.

- (i) If the period of these variations is less than one year, then these are known as *Seasonal Variations*. For example, sale of sweets during Diwali, sale of woollen garments in the month of November, etc. occur every year because of seasonal effects.

If the period of variations is more than one year, then the variations are termed as cyclical variations. These variations, like boom, depression, etc. are revealed by most of the business and economic time series.

A time series data, where the interval between successive observations is less than one year, e.g. monthly, quarterly, etc., may have the effects of both the seasonal and cyclical variations. However, the seasonal variations are absent if the time interval between successive observations is greater than or equal to one year.

- (ii) *Random or Irregular Variations*

As the name suggests, these variations do not reveal any regular pattern of movements. These variations are caused by random factors such as strikes, floods, fire, war, famines, etc.

Analysis of Time Series

As mentioned earlier, the purpose of analysis of a time series is to decompose Y_t into various components. However, before doing this, we have to make certain assumptions regarding the manner in which these components have combined themselves to give the value Y^t .

(a) Additive Model

This model assumes that Y_t is the sum of four components, i.e.,

$Y_t = T_t + C_t + S_t + R_t$ where T_t , C_t , S_t and R_t are the values of trend, cyclical, seasonal and random components respectively at point of time t .

(b) Multiplicative Model

Here we assume that $Y_t = T_t \times C_t \times S_t \times R_t$

If various components are believed to be independent, then additive model is appropriate.

Measurement of Model

The following methods are used for the measurement of trend :

- (i) Graphic Methods
- (ii) Method of Semi-Averages
- (iii) Method of Moving Averages

(iv) Method of Least Squares

(i) *Graphic Methods*

In this method, we plot the time series data on a graph by taking time on X-axis and output on Y_t on Y-axis. A smooth line or curve is drawn through the plotted points which represents the trend of given data. The main drawback of the method is that it is a subjective method.

(ii) *Method of Semi-Averages*

Under this method, the given time series data are divided into two equal segments and the arithmetic mean of the values of each segment is computed. These are plotted as two points and joined with a straight line to get trend. The main limitation of the method is that we can get only linear trend.

Illustration 1

Fit a trend by the method of semi-averages to the following data :-

Years	1990	1991	1992	1993	1994	1995	1996
Output (000 tons)	45	50	64	50	60	65	67

Solution

Since the number of observations is 7, the two groups are obtained by leaving the middle observation, i.e., the observation corresponding to 1993

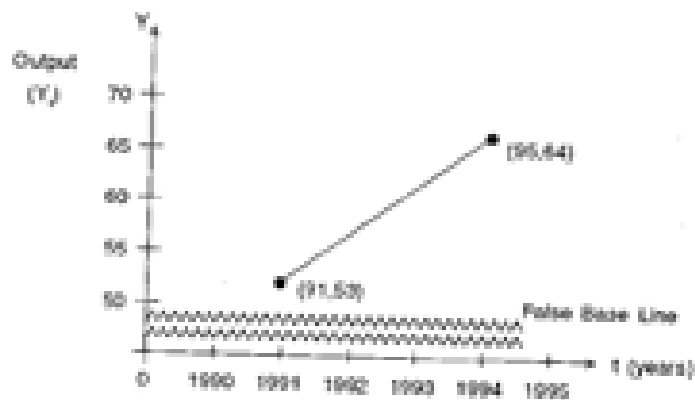
$$\text{Mean of the 1st group of } \bar{Y}_1 = \frac{45 + 50 + 64}{3} = \frac{159}{3} = 53$$

$$\text{Also } \bar{t}_1 = \frac{1990 + 1991 + 1992}{3} = 1991$$

$$\text{Similarly } \bar{Y}_2 = \frac{60 + 65 + 67}{3} = \frac{192}{3} = 64$$

$$\bar{t}_2 = 1995$$

The trend is shown in the following figure :



(iii) Method of Moving Average

This method is based upon the principle that the total effect of periodic variations at different points of time in its cycle get completely neutralised, i.e. $\sum C_t = 0$ in one year and $\sum C_t = 0$ in the period of cyclical variations.

In the method of moving average, successive arithmetic averages are computed from overlapping groups of successive values of a time series. If the time series values are $Y_1, Y_2, Y_3, Y_4, Y_5, \dots$, then the successive three year moving averages are

$$\frac{Y_1 + Y_2 + Y_3}{3}, \frac{Y_2 + Y_3 + Y_4}{3}, \text{ etc.}$$

It can be shown that if the trend is approximately linear, then moving averages with period equal to the period of cyclical or seasonal variations would eliminate these variations and reduce the effect of random variations.

Note that an annual time series consists of only trend, cyclical variations and random component. Thus, a moving average with a suitable period will eliminate cyclical variations and reduce the effect of random variations. Thus, the resulting figures can be regarded as trend values.

Illustration 2

Determine trend by taking (i) 3-yearly and (ii) 4-yearly moving averages.

Year	Sales (Rs. '00)	Year	Sales (Rs. '00)
1983	440	1988	405
1984	318	1989	515
1985	392	1990	723
1986	402	1991	432

1987	403	1992	417

Solution				
3-Year Moving Average				
<i>Year</i>	<i>Sales</i>	<i>3-Year moving totals</i>	<i>3-Year moving average</i>	
1983	440			
1984	318	1150		383.33
1985	392	1112		370.67
1986	402	1197		399.00
1987	403	1210		403.33
1988	405	1323		441.00
1989	515	1643		547.67
1990	723	1670		556.67
1991	432	1572		524.00
1992	417			

4-Year Moving Average				
<i>(Rs. 00)</i>				
<i>Year</i>	<i>Sales</i>	<i>4-Year moving totals</i>	<i>Centred Totals</i>	<i>4-Year moving average</i>
1983	440			
1984	318			
		→ 1552		
1985	392		→ 3067	383.38
		→ 1515		
1986	402		→ 3117	389.63
		→ 1602		
1987	403		→ 3327	415.88
		→ 1725		
1988	405		→ 3771	471.38
		→ 2046		
1989	515		→ 4121	515.13
		→ 2075		
1990	723		→ 4162	520.25

→ 2087

1991	432
1992	417

(iv) Method of Least Squares

This method is used to fit a mathematical trend. A mathematical trend can be linear, exponential, parabolic, etc.

(a) Linear Trend

The general form of a linear trend is $Y = a + bt$, where a and b are constants.

The constant a is interpreted as the trend value in the year of origin (i.e. when $t = 0$) and b is the absolute rate of change of Y . For example if $b = 5$, and t denotes year, then the successive values of Y change by 5 units every year.

(b) Exponential Trend

As opposed to Linear trend, the values of Y in this case change by a constant percentage. For example, if the successive values of Y change by 5%, we can write $Y_t = a(1.05)^t$. In general, we write an exponential trend by $Y_t = a.b^t$.

(c) Parabolic Trend

When the absolute changes in Y values in successive years are not constant, then we can use a non-linear trend. A parabolic trend is a popular linear trend written as $Y_t = a + bt + ct^2$.

Fitting of a Linear Trend

The fitting of a linear trend $Y^t = a + bt$ to the given data (t, Y^t) , for n periods, implies the determination of the values of two constants a and b . By using the method of least squares, it can be shown that these values are obtained by solving the following equations simultaneously.

$$\sum Y = na + b \sum t$$

$$\sum tY = a \sum t + b \sum t^2$$

To simplify computations, we can write $X = t - A$ such that $\sum X = 0$. Thus, the above equations become

$$\sum Y = na \text{ or } a = \frac{\sum Y}{n}$$

$$\sum XY = b \sum t^2 \text{ or } b = \frac{\sum XY}{\sum t^2}$$

Illustration 3 (when n is odd)

Fit a trend line to the following data by the method of least squares.

Calculate the trend values and predict the value for the year 2008.

Year	1995	1996	1997	1998	1999
Production (tons)	82	94	96	107	100

Solution

Year (t)	Production (Y)	$X=t-1997$	XY	X^2	Trend Values (Y_t)
1995	82	-2	-164	4	86.0
1996	94	-1	-94	1	90.9
1997	96	0	0	0	95.8
1998	107	1	107	1	100.7
1999	100	2	200	4	105.6
Total	$\Sigma Y=479$	$\Sigma X = 0$	$\Sigma XY=49$	$\Sigma X^2=10$	

Trend Equation = $Y_t = a + bX$

For calculating the values of a and b, we may use the following two normal equations —

$$\Sigma Y = na + b\Sigma X \quad (i)$$

$$\Sigma XY = a\Sigma X + b\Sigma X^2 \quad (ii)$$

substituting the available information in above two equations, we may get

$$479 = 5a,$$

$$49 = 10b \text{ or}$$

$$a = \frac{479}{5} = 95.8$$

$$b = \frac{49}{10} = 4.9$$

$Y_t = 95.8 + 4.9 X$ is the trend equation.

$Y_t = 95.8$ (for 1997 when $X = 0$)

To obtain the trend values, we substitute the corresponding values of X in the above equation.

To predict the value for 2008, we substitute $X = 11$, in the above equation.

Thus, the trend for the 2000 is $Y_t = 149.7$ tons

Illustration — 4 (when n is even)

Obtain a straight line trend of sales by the method of least squares from the following data. Predict the level of sales for 1992.

Years	1985	1986	1987	1988	1989	1990
Sales (Rs. 000)	40	42	50	46	54	58

Solution

Years (t)	Sales (Y)	$X=t-$	XY	X^2

	(Rs. 000)	1987.5)		
1985	40	- 5	- 200	25
1986	42	- 3	- 126	9
1987	50	-1	- 50	1
1988	46	1	46	1
1989	54	3	162	9
1990	58	5	290	25
Total	$\sum Y = 290$	$\sum X = 0$	$\sum XY = 122$	$\sum X^2 = 70$

$$Y_t = a + bX$$

Two normal equations

$$\sum Y = na + b\sum X$$

$$\sum Y = a\sum X + b\sum X^2$$

substituting the available information in above two equations, we may get

$$290 = 6a,$$

$$122 = 70X^2$$

$$\text{or } a = \frac{290}{6} = 48.33$$

$$b = \frac{122}{70} = 1.74$$

$\therefore Y_t = 48.33 + 1.74X$ is the trend equation with year of origin at 1st January 1988, and the unit of $X = 6$ months.

For sales of 1992, we put $X = 9$ in the above equation.

$$Y_t = 48.33 + 1.74 \times 9 = 63.99$$

Conversion of an annual trend equation into quarterly (or monthly) equation

If $Y_t = a + bX$ denotes an annual trend equation,

then $Y_t = \frac{a}{4} + \frac{b}{4} X$ denotes a quarterly average equation and

$$Y_t = \frac{a}{4} + \frac{b}{16} X \text{ (or } Y_t = \frac{a}{4} + \frac{b}{8} X)$$

denotes a quarterly equation when units of X is one (or half) year.

$$\text{Similarly, } Y_t = \frac{a}{12} + \frac{b}{144} X \text{ (or } Y_t = \frac{a}{12} + \frac{b}{72} X)$$

denotes a monthly equation.*

Illustration 5

- (i) The equation of trend is $Y_t = 84 + 28.8X$ with 1st July 1995 as origin. Determine the monthly trend equation.
- (ii) A quarterly equation is $Y_t = 350 + 3X$, with origin at I quarter of 1992. Find the annual equation.

Solution

- (i) The monthly trend equation is

$$Y_t = \frac{84}{12} + \frac{28.8}{144} X = 7 + 0.2X \text{ with origin at 1st July 1995.}$$

Note that the origin of a monthly equation must be at the middle of the month. To convert the origin at 15th July 1995, we replace X by $X + 0.5$.

$$\therefore Y_t = 7 + 0.2 (X + 0.5) = 7.1 + 0.2X \text{ is the required equation.}$$

- (ii) To convert this into an annual equation, we must shift the origin at the middle of the year. This is obtained by replacing X by $X + 1.5$.

$$\therefore Y_t = 350 + 3 (X + 1.5) = 354.5 + 3X \text{ is quarterly equation with origin at 1st July 1992.}$$

$$\begin{aligned} \text{Thus, annual equation is } Y_t &= 354.5 \times 4 + 3 \times 16X \\ &= 1418 + 48X \text{ is the required equation.} \end{aligned}$$

Measurement of Seasonal Variations

These are periodic variations that recur after one year. These variations are present in time series that are recorded on monthly, quarterly, etc. basis. The main objectives of measuring seasonal variations are :

- (i) To understand their pattern
- (ii) To use them for short-term forecasting or planning
- (iii) To compare the pattern of Seasonal Variations of two or more time series.
- (iv) To eliminate the seasonal variations from data. This process is also known as deseasonalisation of data.

* The justification of dividing a and b by 12 and 144 is that data are sum of 12 months hence a and b must be divided by 12 and b is again divided by 12 so that the time units(X 's) will be in month as well i.e. ' b ' would give monthly increments.

Methods of Measuring Seasonal Variations

(a) Method of Simple averages

This method is used when the time series variables consists of only seasonal and random components. The effect of taking average of data corresponding to the same period (e.g. first quarter of each year) is to eliminate the effect of random variable and thus leaving only seasonal component. These averages are then used to compute seasonal indices.

Illustration 6

Obtain the seasonal indices from the following time series data by the method of simple averages

QUARTERS				
Years	I	II	III	IV
1980	65	58	56	61
1981	68	63	53	67
1982	70	59	56	52
1983	60	55	51	58

Solution

QUARTERS				
Years	I	II	III	IV
1980	65	58	56	61
1981	68	63	53	67
1982	70	59	56	52
1983	60	55	51	58
Total	263	235	216	238
Average	65.75	58.75	54.00	59.5
Seasonal Index	110.5	98.7	90.8	100.0

$$\text{Grand Average} = \frac{65.75 + 58.75 + 54.00 + 59.5}{4} = 59.5$$

$$\text{Seasonal Index (S}_i\text{)} = \frac{\text{Average of } i\text{th quarter}}{\text{Grand Average}} \times 100$$

where (i = 1, 2, 3, 4)

Note that the sum of seasonal indices of quarters is 400 and of monthly indices is 1200. If this is not so, then the seasonal indices have to be adjusted in the following manner.

Let $S_1 + S_2 + S_3 + S_4 = 402$. Then, the adjusted seasonal index for i th quarter

$$\text{will be } S_i = \frac{S_i}{402} \times 400$$

(b) Ratio of Trend Method

This method assumes the presence of trend, seasonal and random components, i.e., $Y = \text{TSR}$.

Here, we first compute trend values by the method of least squares and then find ratio to trend i.e. $\frac{X}{T}$ values.

These values consists of seasonal and random components. Random component is then eliminated by the method of simple averages.

Illustration 7

Calculate the seasonal indices by the ratio to trend method for the following data. Assume that the trend is linear.

Years	Ist Qtr.	II Qtr.	III Qtr.	IV Qtr.
1995	15	20	18	17
1996	17	26	25	22
1997	20	29	34	31
1999	40	46	43	41

Solution

To determine trend, we fit Linear Trend to the annual data as under :

Years (T)	Annual Output (Y)	$X=t-1997$	XY	X^2	Trend values
1995	70	- 2	- 140	4	64
1996	90	- 1	- 90	1	88
1997	100	0	0	0	112
1998	130	1	130	1	136
1999	170	2	340	4	160
560		$\sum X = 0$	$\sum XY = 240$	$\sum X^2 = 10$	

Trend Equation

$$Y_t = a + bX$$

Two normal Equations are

$$\sum Y = na + b\sum X$$

$$\sum XY = a\sum X + b\sum X^2$$

Substitute the available information in above equations, we may get —

$$560 = 5a,$$

$$240 = 10b$$

$$a = \frac{560}{5} = 112, \text{ and } b = \frac{240}{10} = 24$$

The trend line is $Y_t = 112 + 24X$ with 1st July 1997 as origin, unit of $X = 1$ year

The quarterly equation is

$$Y_t = \frac{112}{4} + \frac{24}{16}X$$

$$= 28 + 1.5X \text{ with origin at 1st July 1997.}$$

$$= 28 + 1.5(X + 0.5) \text{ with 3rd quarter of 1997 as origin}$$

$$= 28.75 + 1.5X$$

Table for quarterly trend values

Years	Ist Qtr.	II Qtr.	III Qtr.	IV Qtr.
1995	13.75	15.25	16.75	18.25
1996	19.75	21.25	22.75	24.25

1997	25.75	27.25	28.75	30.25
1998	31.75	33.25	34.75	36.25
1999	37.75	39.25	40.75	42.25

Table of ratio of Quarterly Values to trend values ($\frac{Y}{T} \times 100$)

<i>Years</i>	<i>Ist Qtr.</i>	<i>II Qtr.</i>	<i>III Qtr.</i>	<i>IV Qtr.</i>
1995	109.09	131.15	107.46	93.15
1996	86.08	122.35	109.89	90.72
1997	77.67	106.42	93.91	79.34
1998	85.04	114.29	97.84	85.52
1999	105.96	117.20	105.52	97.04
Total	463.84	591.41	514.63	445.77
Average	92.77	118.28	102.93	89.15
S.I.	92.05	117.37	102.12	88.46

Note : Grand Average = 100.78

(c) *Ratio to Moving Average Method*

This method assumes the presence of all the components in the time series data, i.e., $Y = TCSR$

The moving average of Y values with period equal to the period of seasonal variations, will consist of trend, cyclical and random components, i.e., $M = TCR'$

Ratio to moving average is $\frac{Y}{M} = \frac{TCSR}{TCR'} = SR''$

Finally, we apply method of simple averages to eliminate random components.

Illustration 8

Find seasonal indices from the following data by ratio to moving average method.

<i>Years</i>	<i>Ist Qtr.</i>	<i>II Qtr.</i>	<i>III Qtr.</i>	<i>IV Qtr.</i>
1990	25	28	30	18
1991	26	30	32	17
1992	24	32	35	16
1993	22	34	40	19
1994	25	35	45	20

Solution

<i>Year/ Quarter</i>	<i>Y</i>	<i>4 period Moving Total</i>	<i>Centered Totals</i>	<i>4 Period Moving Average</i>

1990				
I	25			
II	28			
	→	101		
III	30	→	203	25.38
	→	102		
IV	18	→	206	25.75
1991				
	→	104		
I	26	→	210	26.25
	→	106		
II	30	→	211	26.38
	→	105		
III	32	→	208	26.00
	→	103		
IV	17	→	208	26.00
1992				
	→	105		
I	24		213	26.63
	→	108		
II	32	→	215	26.88
	→	107		
III	35	→	212	26.50
	→	105		
IV	16	→	212	26.50
1993				
	→	107		
I	22	→	219	27.38
	→	112		
II	34	→	227	28.38
	→	115		
III	40	→	233	29.13
	→	118		
IV	19	→	237	29.63
1994				
	→	119		
I	25	→	243	30.38

	→	124		
II	35	→	249	31.13
	→	125		
III	45			
	→			
IV	20			

Ratio to Moving Average Table $\left(\frac{X}{m} \times 100\right)$

Years	Ist Qtr.	II Qtr.	III Qtr.	IV Qtr.
1990	—	—	118.23	69.90
1991	99.05	113.74	123.08	65.38
1992	90.14	119.07	132.08	60.38
1993	80.37	119.82	137.34	64.14
1994	82.30	112.45	—	—
Total	351.86	465.08	510.73	259.80
Average	87.96	116.27	127.68	64.95
S.I.	88.66	117.19	128.69	65.46

Note : Grand Average = 99.22

Deseasonalisation of Data

The deseasonalisation of data implies the removal of the effect of seasonal variations. Deseasonalisation is done under the assumption that the pattern of seasonal variations remain the same over various years.

$$\text{The deseasonalised Value} = \frac{Y}{\text{Seasonal Index}} \times 100$$

Illustration 9

Deseasonalise the following sales data of various quarters :

Quarters	I	II	III	IV
Sales ('000 Rs.)	33.5	48.2	45.4	62.8
Seasonal Index	70	105	95	130

Solution

$$\begin{array}{c} \text{Quarters} \qquad \qquad \qquad \text{I} \qquad \qquad \qquad \text{II} \qquad \qquad \qquad \text{III} \qquad \qquad \qquad \text{IV} \\ \text{Deseasonalised} = \frac{33.5 \times 100}{70} = 47.86, \frac{48.2 \times 100}{105} = 45.91, \frac{45.4 \times 100}{95} = 47.79, \frac{62.8 \times 100}{130} = 48.31 \end{array}$$

Illustration 10

The seasonal indices of the sales of a popular brand of colour television by a company in Delhi are given below :

Quarters :	I	II	III	IV
Seasonal Indices :	125	95	80	100

If the total sales of the first quarter of the year 2000 were Rs. 9,00,000 estimate the worth of sales in the remaining quarters.

Solution

$$\text{The worth of sales in 2}^{\text{nd}} \text{ quarter} = \frac{9,00,000}{125} \times 95 = \text{Rs. } 6,84,000$$

$$\text{The worth of sales in 3}^{\text{rd}} \text{ quarter} = \frac{9,00,000}{125} \times 80 = \text{Rs. } 5,76,000$$

$$\text{The worth of sales in 4}^{\text{th}} \text{ quarter} = \frac{9,00,000}{125} \times 100 = \text{Rs. } 7,20,000$$

Forecasting

Forecasting is a prediction or estimation of future values of a variable like sales, demand, price, profits, cost, investment, output, inventory, exports, imports, etc. for a firm, industry or the economy as a whole. The basic motive of forecasting is to assist the management to devise plan of action in respect of diverse fields viz. production, purchase, sales, inventory control, personnel, finance, etc. It must be noted that the purpose of forecasting is not to provide future data with perfect precision. The purpose is just to bring out range of possibilities regarding future under a given set of assumptions. Such forecasts do not eliminate but only help to reduce the degree of risk and the uncertainties of future.

Methods of Forecasting

Broadly speaking, there are two approaches to forecasting :

1. To forecast on the basis of collection of data or obtaining opinion of the experts. These methods are known as opinion polling or survey methods.
2. To forecast on the basis of past data. These methods are known as trend projection or extrapolation methods.

Opinion Polling or Survey Methods

These methods are often used for forecasting demand or sales of a product. Various methods under this category are described below :

(i) Complete Enumeration

Under this method, a survey of all the individuals is undertaken to obtain the data. The forecasts are then made on the basis of collected information.

The main advantage of the method is that it is free from the bias of the investigator. This method, however, is cumbersome and costly particularly when the population is very large.

(ii) Sample Survey

A sample survey is often undertaken when the population is very large. Here, information is collected by contacting a fraction or a sample of individuals. The

forecasting is then done by applying sampling techniques to the collected information.

There are several variants of the sample survey method. Some of these are described below :

- (a) *Test Marketing* : Test Marketing is often useful for forecasting the sales of a new product or the potential of the existing product in new geographical areas. In this method, we select a test area which is suppose to be the representative of the whole market. The product is introduced in test market area. If it is successful, the forecast is made regarding its success in the total market. Although this method has the advantage of having real life experience, it is very costly.
- (b) *Experts' Opinion Poll* : In this method, the opinion of the experts are obtained. The simple or weighted average of these opinions can be regarded as the forecast value. The results of this method are highly of subjective nature.
- (c) *Delphi Technique* : In this method, the experts are asked to give their opinions by post. These opinions are supplied to all the experts and their revised opinions, based on feed back, are obtained. This process is repeated unless divergent views of the experts are narrowed down and the final range of outcomes can be regarded as probabilistic forecasts.

Trend Projection Methods

These methods are based upon the analysis of past time series data. The basic assumption of these methods is that future events are a continuation of the past. These methods are cheaper than surveys because the necessary data is available from the past records as time series data.

Fitting of Trend (Time Series Data)

We can fit a mathematical trend to the given data and use this to make forecasts. This method we have already discussed in the analysis of time series. The results of these methods are fairly accurate so long as the trend has a persistant tendency to move in the same direction. The analysis is more reliable for short-term forecasts.

Smoothing Method

Alternatively, we can determine trend by smoothing out the fluctuations due to other components. Two main smoothing methods are : (i) Method of Moving Average, discussed earlier and (ii) Method of Exponential Smoothing.

Method of Exponential Smoothing

This method is very popular for short term forecasting. In this method, the value for a period is computed by an exponentially weighted system where weights to a value reflect the degree of its importance. More recent values are often assigned a higher weight as these are more relevant to the forecasting. The sum of assigned weights is equal to unity.

Let Y_t be the observed value at time t and S_{t-1} be the smoothened value at time $t - 1$. Let W ($0 < W < 1$) be the weight assigned to Y_t . Then, the smoothened value for time t , denoted by S_t is given by

$$S_t = WY_t + (1 - W) S_{t-1}$$

This is the basic equation of exponential smoothing.

Replacing S_{t-1} by $WY_{t-1} + (1 - W) S_{t-2}$, the above equation can be written as

$$S_t = WY_t + W(1 - W)Y_{t-1} + (1 - W)^2 S_{t-2}$$

Proceeding in this way, we can write S_t the smoothened value of current period, as a weighted average of the observed value of current period and all previous periods. The weighing system changes exponentially as the smoothing process moves forward.

Barometric Technique or Lead or Lag Technique

This technique is based upon the idea that it is possible to predict future from certain currently occurring or already occurred events. To apply this technique, we find a time series variable X, known leading indicator, which has a close association with the forecast variable Y.

Using statistical techniques, we can estimate a relationship (Linear, Quadratic, exponential) between X and Y by considering various time lags. A relation with maximum value of co-efficient of determination can be used for prediction.

INDEX NUMBERS

INTRODUCTION AND MEANING

An index number is a statistical measure used to compare the average level of magnitude of a group of distinct, but related, items in two or more situations. For example, the average change in prices of a group of items of food, called price index. Similarly, we can find quantity index, value index etc.

An important feature of the index number is that it is an average change of various magnitudes expressed in different units. It should also be noted that index numbers are specialised type of averages that are used to measure a characteristics that is not capable of being measured directly. For example, it is not possible to measure the change in price level or the business activity level in a direct way.

Index numbers are often known as *the barometers of economic activity* as they help to get an idea of the present day situation with regard to changes in production, consumption, exports and imports, national income, business level, cost of living etc.

DEFINITIONS OF INDEX NUMBERS

Some of the important definitions of index numbers are given as under :

- (i) "An index number is a special type of average that provides a measurement of relative changes from time to time or from place to place"
— *Wessell, Wilett and Simone.*
- (ii) "Index number shows by its variations the changes in a magnitude which is not susceptible either of accurate measurement in itself or of direct valuation in practice."
— *Edgeworth.*
- (iii) "An index number is a device for comparing the general level of magnitude of a group of distinct, but related, variables in two or more situations"

— *Karmal and Pollasek.*

- (iv) “In its simplest form, an index number is the ratio of two index numbers expressed as a percent. An index number is a statistical measure — a measure designed to show changes in one variable or in group of related variable over time or with respect of geographic location or other characteristics” — *Patterson*

- (v) “An index number is a statistical measure designed to show changes in variable or a group of related variables with respect of time, geographical locations or other characteristic” — *Spiegel*

Thus, it is apparent from above definitions that an index number is a statistical device which measures the extent to which a group of related variable changes over a period of time. Index number in fact relates a variable or group of variables in a given period to the same group of variables in some other period.

Some of the important characteristics of index numbers include the following —

- (i) Index numbers are the specialised averages.
- (ii) Index numbers record the net changes in a group of related variables over a period of time.
- (iii) Index numbers are expressed in percentages.

SIGNIFICANCE OR USES OF INDEX NUMBERS

Index numbers are the most powerful tool in the hands of management executives, government officials and individuals to analyse the business and economic situations of a country. Some of the important uses or significance of index numbers to its users are listed as under :

- (i) Index Numbers are used to measure level of economic and business activities in a country.
- (ii) They are helpful in planning and formulation of various policies.
- (iii) Index Numbers help social scientists to study trends and tendencies of important social, economic and business variables over a period of time i.e., population, agricultural production, import and exports, crime etc
- (iv) Index Numbers are also useful in deflation. In other words, they are used for adjusting the original data for price changes.
- (v) They also help to measure purchasing power of money.

TYPES OF INDEX NUMBERS

Broadly speaking, index numbers are classified in the following categories :

- (a) *Price Index Number* : Price index numbers are most frequently used by different experts such as statistician, businessman, policy makers or researchers. These index numbers measure the general changes in the price level from one period to another. Index numbers are further divided into the following two categories.
 - (i) *Wholesale price index numbers* : It reflect the changes in general price level of the country such as wholesale price index number prepared by government.
 - (ii) *Retail Price Index Numbers* : These index numbers show general

changes in retail prices of various commodities such as consumption goods, stock and shares, bank deposits, consumer price index etc.

- (b) *Quantity Index Numbers* : These index numbers study the changes in the volume of goods produced, consumed, distributed like the indices of industrial production, agricultural production, exports and imports etc. over a period. These types of indices are useful for measuring the changes in level of physical output in an economy during some period, compared with other period.
- (c) *Value Index Numbers* : It covers all those index numbers which measures the changes in total money worth during some period compared with other period.

Precautions in Construction of Index Numbers

Index numbers are very powerful and effective tools but its computation and construction require utmost care. In construction of index numbers, the following points need special attention :

(i) Purpose of Index Numbers

It is essential to be very clear about the purpose for which the index number is used. Every index number has its own particular uses. If it is used for measuring consumers' price, there is no need of including wholesale prices. Similarly, if it is employed for studying cost of living, there is no need of including the price of capital goods.

(ii) Selection of Base Period

Base period is the period against which comparisons are made. One has to be very careful in selecting a base period. It may be a year, month or a day. Before selecting a base period the following points should be kept in mind:

- (a) The base period should be a normal one i.e., it should not get affected by extra-ordinary events like war, earthquakes, famines, booms, etc.
- (b) It should be relatively current i.e., it should not be too distant in the past because we are interested in the changes relating to the present period only.
- (c) The base may be fixed, chain or average depending upon the purpose of constructing the index.

(iii) Selection of Number of Items

This depends on the purpose of index. For example, in a general price index a larger number of commodities may be included, on the other hand, in a specific purpose index, relatively a small number of items would be included.

(iv) Choice of an Average

Arithmetic mean and geometric mean are used in its construction. Averages play a vital role in arriving at a single index number summarising a large volume of information. But theoretically, the geometric mean is preferred because it is less susceptible to variation; it gives equal weightage to equal ratio of change.

(v) Selection of Weights

'Weights' imply the relative importance of the difference variables. Due consideration should be given to the relative importance of each variable. It is essential to adopt a suitable method of weighting to avoid arbitrary and haphazard weights. For instance, in the computation of cost of living index, wheat should be given more importance compared to sugar.

METHODS OF CONSTRUCTION OF PRICE INDEX NUMBERS

To illustrate the construction of an index number, we consider the group of 5 good items : wheat, rice, milk, eggs and sugar.

Their prices in 1995 and 1998 are given in the following table.

	<i>Item</i>	<i>1995 Price (Rs.)</i>	<i>1998 Price (Rs.)</i>
1.	Wheat	800/quintal	1000/quintal
2.	Rice	15/Kg.	19/Kg
3.	Milk	12/Litre	15/Litre
4.	Eggs	10/Dozen	12/dozen
5.	Sugar	14/Kg.	18/Kg.

We want to find the average change in price level for the group in 1998 as compared with 1995. Here, 1998 is termed as the current year and 1995 is the base year.

Current Year : It is the year for which we want to construct the index number.

Base Year : It is the year from which we want to compare the current year magnitudes of various items.

In the above table, the comparison of price of an item, say wheat, in 1998 with its price in 1995 can be done in following two ways :

- By taking the difference of prices in two years i.e. $1000 - 800 = 200$, one can say that the price of wheat has gone up by Rs.200 per quintal in 1998 as compared with its price in 1995.
- By taking the ratio of the two prices i.e. $1000/800 = 1.25$, one can say that if the price of wheat in 1995 is taken to be equal to 1, then it has become 1.25 in 1998. A more convenient way of expressing this change as a percentage i.e. $1000 \times 100/800 = 125$, which is known as *Price Relative* of the item. Price relative of wheat equal to 125 shows that the price of wheat in 1998 is 125 when its price in 1995 is taken as 100. Further, the change in price of wheat in current year as compared with base year is $125 - 100 = 25\%$.

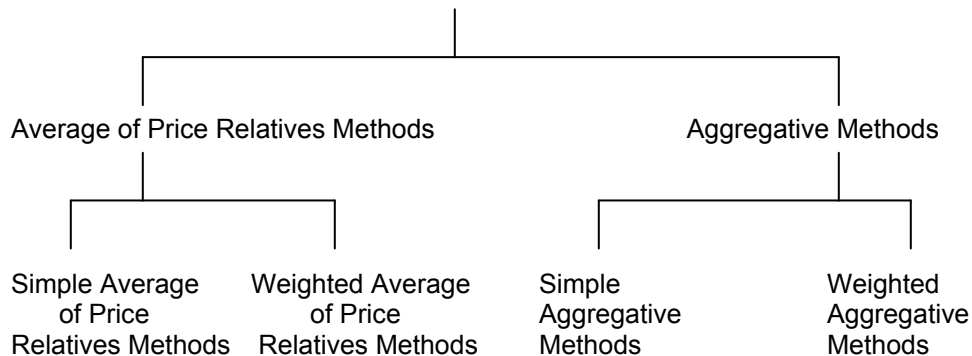
Out of the above two methods, we shall adopt the second method of comparison because it is independent of the units in which prices are quoted. Further, it is easier to grasp the percentage change rather than absolute change.

To construct an index number, we have to obtain average price change for the group in 1998. This can be done in following two ways :

- (i) By taking suitable average of the price relative of different items. The methods of index number construction based on this procedure are termed as Average of Price Relatives Methods.
- (ii) By taking ratio of averages of the prices of different items in current and base years. These methods are known as aggregative methods.

Since average in each of the above methods can be simple or weighted, the index numbers can be further divided as simple or weighted.

Methods of Index Number Construction



In addition to the above, a particular method would depend upon the type of average used. Although, geometric mean is more suitable for averaging ratios, arithmetic mean is often preferred because of its simplicity with regard to computations and interpretation.

Price Index Numbers

Let $p_{01}, p_{02}, \dots, p_{0n}$ be the prices of items in base year and their respective price in current year be $p_{11}, p_{12}, \dots, p_{1n}$.

(1) Simple Average of price relatives

- (a) *When we take arithmetic mean of prices relatives.* The index number formula for current year, denoted by 1, as compared with base year, denoted by 0, is given by

$$P_{01} = \frac{\sum P_i}{n}, \text{ where } P_i = \frac{P_{1i}}{P_{0i}} \times 100$$

- (b) *When we take geometric mean of price relatives.*

$$P_{01} = (P_1 \times P_2 \times P_n)^{1/n}$$

$$= \text{Antilog} \left[\frac{\sum \log P_i}{n} \right]$$

Illustration 11

From the following data, construct index number by simple average of price relatives using (a) arithmetic mean and (b) geometric mean.

Commodity	1995	1998

<i>Commodity</i>	<i>Price (Rs.)</i>	<i>Price (Rs.)</i>
1. Wheat	800/quintal	1000/quintal
2. Rice	15/Kg.	19/Kg
3. Milk	12/Litre	15/Litre
4. Eggs	10/Dozen	12/Dozen
5. Sugar	14/kg.	18/Kg.

Solution :

<i>Commodity</i>	<i>P₁</i>	<i>P₂</i>	<i>P(Price relative)</i>	<i>log P</i>
1. Wheat	800	1000	$1000 \times 100 / 800 = 125$	2.0969
2. Rice	15	19	$19 \times 100 / 15 = 126.67$	2.1027
3. Milk	12	15	$15 \times 100 / 12 = 125$	2.0969
4. Eggs	10	12	$12 \times 100 / 10 = 120$	2.0792
5. Sugar	14	18	$18 \times 100 / 14 = 128.57$	2.1091
				625.24 10.4848

(a) Using simple Arithmetic Mean

$$P_{01} = \frac{625.04}{5} = 125.05$$

(b) Using simple Geometric Mean

$$P_{01} = \text{Antilog} \left(\frac{10.4848}{5} \right) = \text{Antilog} (2.097) = 125.02$$

Weighted average of Price Relatives

Let w_i be the weight assigned to the i th item, then

$$P_{01} = \frac{\sum P_i W_i}{\sum W_i} \text{ (using arithmetic mean)}$$

$$\text{and } P_{01} = \text{Antilog} \left[\frac{\sum W_i \log P_i}{\sum W_i} \right] \text{ (using geometric mean)}$$

Nature of Weights

While taking weighted average of price relatives, values are often taken as weights. These weights can be values of base year quantities valued at base year prices i.e. $p^0 q^0$ or current year quantities values at current year prices i.e. $p_1 q_1$ etc.

Illustration 12

Calculate the index number of 1992 with 1990 as base from the following data by using (i) weighted arithmetic mean and (ii) weighted geometric mean of price

relatives.

Commodity	Weights	Prices	
		1990	1992
A	22	250	620
B	48	330	440
C	17	625	1275
D	13	65	90

Solution :

Calculation of Price Index Number							
Commo- dities	1990 (Rs.) (P ^o)	Price 1992 (Rs.) (P ^o)	Price Relatives (P ₁ /P ^o =P)	Weights	PW	logP (W)	WlogP
A	250	620	248.00	22	5456.00	2.3945	52.6779
B	330	440	133.33	48	6400.00	2.1249	101.9971
C	625	1275	204.00	17	3468.00	2.3096	39.2637
D	65	90	138.46	13	1800.00	2.1413	27.8373
Total				100	17,124.00		221.7760

(i) *Weighted Arithmetic Mean of Price Relatives*

$$P_{01} = \frac{17124.00}{100} = 171.24 \text{ (using A.M.)}$$

(ii) *Weighted Geometric Mean of Price Relatives*

$$P_{01} = \text{Antilog } (221.776/100) = \text{Antilog } (2.21776) = 165.1 \text{ (using G.M.)}$$

(iii) *Simple Aggregative Method*

Here, we take the ratio of the sample arithmetic means of the prices in current year to base year.

$$P_{01} = \frac{\sum P_{i0}/N}{\sum P_{0i}/N} \times 100 = \frac{\sum P_i}{\sum P_{0i}} \times 100$$

Illustration 13

Calculate the price index for 1995 and 1996 using 1990 as base from the following data by using the simple aggregative method.

Commodity	Prices (Rs. per unit)		
	1990	1995	1996
A	8	9	7
B	10	13	10
C	11	15	9
D	50	47	36
E	150	200	180

Solution :

Calculation of Price Index Numbers

Commodity	1990	Prices	
		1995	1996
A	8	9	7
B	10	13	10
C	11	15	9
D	50	47	36
E	150	200	180
Total	229	284	242

$$P_{1990, 1995} = 284 \times 100/229 = 133.3$$

$$P_{1990, 1996} = 242 \times 100/229 = 120.0$$

Weighted Aggregative Method

Here, the index number is defined as the ratio of weighted arithmetic mean of current year prices to base year prices.

$$P_{01} = \frac{\frac{\sum P_{1i} W_i}{\sum W_i}}{\frac{\sum P_{0i} W_i}{\sum W_i}} \times 100 = \frac{\sum P_{1i} W_i}{\sum P_{0i} W_i} \times 100$$

Omitting the subscript i, we can also write

$$P_{01} = \frac{\sum P_1 W}{\sum P_0 W} \times 100$$

Nature of Weights

Under weighted aggregative price index numbers, quantities are often taken as weights. These quantities can be the quantities purchased in base year or in current year or an average of base year and current year quantities or any other quantity. Depending upon the choice of weights, some of the popular formulae for weighted aggregative index numbers can be written as follows :

(i) *Laspeyre's index*

This index uses base year quantities as weights.

$$P_{01}^{La} = \frac{\sum p_1 q_1}{\sum p_0 q_0} \times 100$$

(ii) *Paasche's Index*

Here, we use current year quantities as weights

$$P_{01}^{Pa} = \frac{\sum p_1 q_1}{\sum p_0 q_1} \times 100$$

(iii) *Fisher's Ideal Index*

It is the Geometric Mean of Laspeyres' and Paasche's index numbers

$$P_{01}^{Fi} = \sqrt{L \times P} \text{ where } L = P_{01}^{La} \text{ and } P = P_{01}^{Pa} \text{ or } P_{01}^{Fi} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \times 100$$

(iv) *Dorbish and Bowley's Index*

It is the A.M. of Laspeyres' and Paasche's Index numbers

$$P_{01}^{DB} = 1/2 (L + P)$$

$$= 1/2 \left[\frac{\sum p_1 q_0}{\sum p_0 q_0} + \frac{\sum p_1 q_1}{\sum p_0 q_1} \right] \times 100$$

(v) *Marshall - Edgeworth index*

This index uses arithmetic mean of base and current year quantities.

$$P_{01} = \frac{\sum p_1 \frac{(q_0 + q_1)}{2}}{\sum p_0 \frac{(q_0 + q_1)}{2}} \times 100 = \frac{\sum p_1 q_0 + \sum p_1 q_1}{\sum p_0 q_0 + \sum p_0 q_1} \times 100$$

(vi) *Walshe's Index*

This index uses G.M. of q_0 and q_1

$$P_{01}^w = \frac{\sum p_1 \sqrt{q_0 q_1}}{\sum p_0 \sqrt{q_0 q_1}} \times 100$$

(vii) *Kelly's Index*

This is also known as fixed weight index. Here, the quantities can be any quantity other than q_0 and q_1 .

$$P_{01}^{Ke} = \frac{\sum p_1 q}{\sum p_0 q} \times 100$$

Out of the various formulae discussed so far, the laspeyres' and Paasche's

formulae are generally preferred for the construction of index numbers. The main reason for this is that the values of these index numbers have simple interpretation.

For example, the ratio $\frac{\sum p_1 q_0}{\sum p_0 q_0}$, in Laspeyres' formulae, gives the change in the cost

of purchasing the bundle q_0 . Similarly, the ratio $\frac{\sum p_1 q_1}{\sum p_0 q_1}$ in Paasche's formula reflects

the change in cost of purchasing the bundle q_1 . However, Out of these two formula, the Laspeyres's index is preferred because weights do not change over different periods and hence the index numbers of various periods remain comparable. Because of fixed weights, it is easier to compute than Paasche's Index. The main disadvantage of the Laspeyres's index is that with passage of time, the relative importance of various items may change and, therefore, base year weights may become outdated.

Illustration 14

From the following data, construct the Laspeyres's, Paasche's and Fisher's indices of prices

Item	Base Year		Current Year	
	p_0	q_0	p_1	q_1
A	4	20	10	15
B	8	4	16	5
C	2	10	4	12
D	10	5	20	6

Solution : Calculation of Price Index Numbers

Items	Base Year		Current Year		$p_0 q_0$	$p_1 q_0$	$p_0 q_1$	$p_1 q_1$
	p_0	q_0	p_1	q_1				
A	4	20	10	15	80	200	60	150
B	8	4	16	5	32	64	40	80
C	2	10	4	12	20	40	24	48
D	10	5	20	6	50	100	60	120
Total					$\sum p_0 q_0 = 182$	$\sum p_1 q_0 = 404$	$\sum p_0 q_1 = 184$	$\sum p_1 q_1 = 398$

$$P_{01}^L = 404/182 \times 100 = 221.98$$

$$P_{01}^P = 398/184 \times 100 = 216.30$$

$$P_{01}^{Fi} = \sqrt{221.98 \times 216.3} \times 100 = 219.12$$

Illustration 15

From the following data, calculate the price index numbers for 1992 with 1982 as base by—

(a) Laspeyre's method

- (b) Paasche's method
- (c) Bowley method
- (d) Marshall — Edgeworth method
- (e) Fisher's ideal method.

Item	1990		2000	
	Price (Rs.)	Quantity (unit)	Price (Rs.)	Quantity (unit)
Maize	70	28	140	21.0
Millet	175	35	210	17.5
Sugar	140	52.5	175	52.5
Coconut	70	70.0	70	87.5

Solution :

Calculation of Price Index Numbers

Items	p_0	q_0	p_1	q_1	p_1q_0	p_0q_0	p_1q_1	p_0q_1
Maize	70	28	140	21.0	3920	1960	2940	1470
Millet	175	35	210	17.5	7350	6125	3675	3062.5
Sugar	140	52.5	175	52.5	9187.5	7350	9187.5	7350
Coco	70	70	70	87.5	4900	4900	6125	6125
					25357.5	20335	21927.5	18007.5

$$(a) \text{ Laspeyres's Method: } P_{01}^{La} = \frac{\sum p_1q_0}{\sum p_0q_0} \times 100 = \frac{25357.5}{20335} \times 100 = 124.70$$

$$(b) \text{ Paasche's Method: } P_{01}^{Pa} = \frac{\sum p_1q_1}{\sum p_0q_1} \times 100 = \frac{21927.5}{18007.5} \times 100 = 121.77$$

$$(c) \text{ Bowley Method: } P_{01}^B = \frac{L + P}{2} = \frac{124.70 + 121.77}{2} = 123.27$$

$$(d) \text{ Marshall Edgeworth Method: } P_{01}^{ME} = \frac{\sum p_1q_0 + \sum p_1q_1}{\sum p_0q_0 + \sum p_0q_1} \times 100$$

$$= \frac{25357.5 + 21927.5}{20335 + 18007.5} \times 100 = 123.32$$

$$(e) \text{ Fisher's Method: } P_{01}^F = \sqrt{L \times P} \times 100$$

$$= \sqrt{124.70 \times 121.77} \times 100 = 123.23$$

Illustration 16

Calculate Fisher's Ideal Index number from the following information:

Commodities	2000		2004	
	Price	Total Exp.	Price	Total Exp.

	<i>per Unit (Rs.)</i>	<i>(Rs.)</i>	<i>per Unit (Rs.)</i>	<i>(Rs.)</i>
X	5	250	8	360
Y	10	100	15	180
Z	2	60	3	120
D	3	72	5	150

Solution:

Determination of Quantity for different commodities given the price and total expenditure in the year 2000.

$$A = 250/5 = 50 \text{ units}$$

$$B = 100/10 = 10 \text{ units}$$

$$C = 60/2 = 30 \text{ units}$$

$$D = 72/3 = 24 \text{ units}$$

Similarly determination of Quantity in the Year 2004

$$A = 360/6 = 60 \text{ units}$$

$$B = 180/15 = 12 \text{ units}$$

$$C = 120/3 = 40 \text{ units}$$

$$D = 150/5 = 30 \text{ units}$$

Calculation of Fisher's Ideal Index Number

<i>Commo- dities</i>	<i>Year 2000</i>		<i>Year 2001</i>		p_0q_0	p_1q_1	p_0q_1	p_1q_0
	<i>Price/ Unit (Rs.) p_0</i>	<i>Quan- tity q_0</i>	<i>Price/ Unit p_1</i>	<i>Quan- tity q_1</i>				
A	5	50	6	60	250	360	300	300
B	10	10	15	12	100	180	120	150
C	2	30	3	40	60	120	80	90
D	3	24	5	30	72	150	90	120
				Σ	482	810	590	660

$$F_{p01} = \sqrt{\frac{\Sigma p_1q_0}{\Sigma p_0q_0} \times \frac{\Sigma p_1q_1}{\Sigma p_0q_1}} \times 100$$

$$F_{p01} = \sqrt{\frac{660}{482} \times \frac{810}{590}} \times 100$$

$$F_{p01} = \sqrt{1.369 \times 1.3728} \times 100$$

$$= \sqrt{1.88} \times 100 = 1.37.1 \times 100 = 137.1$$

Cost of Living Index Number

This Index is also known as the consumer price index number. It measures the average change in prices paid by the consumer for a specified list of goods and services consumed by them. It can be computed by using either of the following two methods:

(a) Aggregate Expenditure method

$$P_{01} = \frac{\sum p_1 q}{\sum p_0 q} \times 100$$

(b) Family budget method

$$P_{01} = \frac{\sum pw}{\sum w} \text{ where } P = \frac{P_1}{P_0} \times 100$$

Illustration 17

Compute the cost of living index from the following data :

Commodity	Quantity (q)	Prices in Base Year (P_0)	Prices in Current Year (P_1)
Wheat	400 Kgs.	3.50	4.00
Rice	200 Kgs.	5.80	7.00
Gram	100 Kgs.	7.40	9.50
Pulses	200 Kgs.	9.80	12.00
Ghee	50 Kgs.	70.00	85.00
Sugar	50 Kgs.	8.00	11.00
Fuel and lighting	5 units	50.00	60.00

Solution :

Calculation of Cost of Living Index Number

Commodity	Quantity (q) (kgs)	p_0	p_1	$p_0 q$	$p_1 q$
Wheat	400	3.50	4.00	1400	1600
Rice	200	5.80	7.00	1160	1400
Gram	100	7.40	9.50	740	950
Pulses	200	9.80	12.00	1960	2400
Ghee	50	70.00	85.00	3500	4250
Sugar	50	8.00	11.00	400	550

Fuel and Lighting (units)	5	50.00	60.00	250	300
Total				9410	11450

$$P_{01} = \frac{\sum p_{1q}}{\sum p_{0q}} \times 100 = \frac{11450}{9410} \times 100 = 121.68$$

Quantity Index Numbers

A quantity index number is a statistical device which measures changes in quantities in current year as compared to base year. The formulae for calculating the quantity index numbers can be directly written from price index numbers simply by interchanging the role of price and quantity.

Laspeyres, Paasche's and Fisher's formula of calculating quantity index numbers may be written as under —

$$Q_{01}^{LA} = \frac{\sum q_1 p_0}{\sum q_0 p_0} \times 100$$

$$Q_{01}^{PA} = \frac{\sum q_1 p_1}{\sum q_0 p_1} \times 100$$

$$Q_{01}^{FI} = \sqrt{\frac{q_1 p_0}{q_0 p_0} \times \frac{q_1 p_1}{q_0 p_1}} \times 100$$

Illustration 18

Compute quantity index numbers from the following data by using Laspeyer's formula —

Commodity	p_0	q_0	p_1	q_1
A	15	30	26	18
B	12	40	30	14
C	25	25	23	27
D	18	100	80	20

Solution :

Calculation of Quantity Index Number

Commodity	p_0	q_0	q_1	$q_0 p_0$	$q_1 p_0$
A	15	30	26	450	390
B	12	40	30	480	360
C	25	25	23	625	575
D	18	100	80	1800	1440
Total				3355	2765

$$Q_{01}^{LA} = \frac{\sum q_1 p_0}{\sum q_0 p_0} \times 100 = \frac{2765}{3355} \times 100 = 82.41$$

Value Index Numbers

A value index numbers measures the change of value in current year as compared with base year.

The value index number based on the information given in illustration 18 can be calculated as under :

$$\text{Value Index number } V_{01} = \frac{\sum p_1 q_1^*}{\sum p_0 q_0} \times 100 = 3109/3355 \times 100 = 92.67$$

Tests of Adequacy of Index Numbers Formulae

A number of formulae have been developed for the construction of index numbers. However, each one of them, suffers from one or the other type of drawbacks. It was, therefore, suggested that a satisfactory index number formula should satisfy certain mathematical criteria. These criteria are known as tests of adequacy of index numbers.

* Value of $p_1 q_1$ can be calculated by multiplying the various quantitive under q_1 with corresponding prices under p_1 .

(i) Unit Test

This test requires that an index number formulae should be independent of the units measurement of the prices and quantities. This test is satisfied by all the index number except simple aggregative formulae.

(ii) Time Reversal Test

This test requires that the formulae for calculating an index number should give consistent results in both the directions, i.e. forward and backward. Or in other words, the index of period 1 with period 0 base should be reciprocal of the index of period 0 with period 1 as base i.e. $P_{01} = 1/P_{10}$ or $P_{01} \times P_{10} = 1$.

This test is satisfied by the Fisher's Ideal Index.

We can write

$$P_{01}^F = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}} \quad (\text{dropping } 100)$$

$$P_{10} = \sqrt{\frac{\sum p_0 q_1}{\sum p_1 q_1} \times \frac{\sum p_0 q_0}{\sum p_1 q_0}}$$

$$\therefore P_{01}^F \times P_{10}^F = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1} \times \frac{\sum p_0 q_1}{\sum p_1 q_1} \times \frac{\sum p_0 q_0}{\sum p_1 q_0}} = \sqrt{1} = 1$$

(iii) Factor Reversal Test

This test requires that the product of price index and the corresponding quantity index numbers should be equal to the value index number i.e. $P_{01} \times Q_{01} = V_{01}$

This test is also satisfied by the Fisher's ideal index.

We can write

$$P_{01}^{Fi} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1}}$$

$$\text{and } Q_{01}^{Fi} = \sqrt{\frac{\sum q_1 p_0}{\sum q_0 p_0} \times \frac{\sum q_1 p_1}{\sum q_0 p_1}}$$

$$\therefore P_{01}^{Fi} \times Q_{10}^{Fi} = \sqrt{\frac{\sum p_1 q_0}{\sum p_0 q_0} \times \frac{\sum p_1 q_1}{\sum p_0 q_1} \times \frac{\sum q_1 p_0}{\sum q_0 p_0} \times \frac{\sum q_1 p_1}{\sum q_0 p_1}} = \sqrt{\left(\frac{\sum p_1 q_1}{\sum p_0 q_0}\right)^2} = \frac{\sum p_1 q_1}{\sum p_0 q_0} = V_{01}$$

(iv) Circular Test

This test is an extension of time reversal test to the case of more than two periods.

We can write $P_{01} \times P_{12} \times P_{23} \dots P_{n-1,n} \times P_{n0} = 1$

Or $P_{0n} = P_{01} \times P_{12} \times P_{23} \dots \times P_{n-1,n} (\because P_{n0} = 1/P_{0n})$

This test is satisfied by (a) simple aggregative index, weighted aggregative index with fixed weights (Kelly's index) and (c) simple geometric mean of price relatives index.

It may be pointed out here that both the Laspeyres's and Paasche's index numbers do not satisfy time reversal, factor reversal and circular tests. In spite of this, these formulae are generally used by the majority because of their unambiguous interpretation.

Fixed Base Index Numbers

When the comparison of (prices or quantities etc.) various periods are done with reference to a particular or fixed period, we get an index number series with fixed base.

Chain Base Index Number

The main problem with a fixed base series arises when the current year becomes too far off from the base year. In such a situation, it may happen that the commodities which used to be very important in the base year are no longer so in current year. Furthermore, certain new commodities might be in use while some old commodities are dropped in current year. This problem is often solved by constructing Chain Base Index Numbers. A chain base index number is an index number with previous year as base. For example, we construct chain base index of 1991 with 1990 as base. Chain base index of 1992 with 1991 as base, Chain base of 1999 with 1998 as base as so on. These indices are multiplied to get chained index of 1999 with 1990 as base. This multiplication is based on the application of circular test.

$$P_{90,99}^{\text{Chained}} = P_{90,91}^{\text{Chain}} \times P_{91,92}^{\text{Chain}} \dots \times P_{98,99}^{\text{Chain}}$$

Illustration 19

The price index of cosmetics was 110 in 1956 with base as 1950 and 120 in 1957 with 1956 as base. It further increased by 30% in 1958 in relation to the price index of 1957 and decreased by 10% in 1959 as compared to its level in 1958. Find the index for 1959 with 1950 as base.

Solution :

It is given that $P_{50,56} = 110$, $P_{56,57} = 120$, $P_{57,58} = 130$, $P_{58,59} = 90$.

$$\therefore P_{50, 59} = 1.10 \times 1.20 \times 1.30 \times 0.90 \times 100 = 154.4$$

Illustration 20

Shift the base of the following series to 1987.

Year	:	1985	1986	1987	1988	1989	1990
Index No.	:	125	155	185	220	265	320

Solution :

To shift the base at 1987, we multiply every index number by 100/185.

Year	:	1985	1986	1987	1988	1989	1990
Index No.	:	67.6	83.8	100	118.9	143.2	173.0

Illustration 21

Between 1980 and 1990 the price of a commodity increased by 60% while the production decreased by 30%. By what percentage did the value index of production of commodity change in 1990 with respect to its value in 1980.

Solution :

Note that on the basis of factor reversal test we can write

$$P_{01} \times Q_{01} = V_{01}$$

$$\text{Or } 1.60 \times 0.70 \times 100 = 112$$

Thus, the value index increased by 12%.

Use of Price Index Numbers in Deflating

The following formulae is used for conversion of money wages into real wages.

$$\text{Real Wage} = \frac{\text{Money Wage}}{\text{Price Index}} \times 100$$

Similarly, we can write

$$\text{Output at constant prices} = \frac{\text{Output at Current Prices}}{\text{Price Index}} \times 100$$

The concept of deflating can also be used to determine the purchasing power or real value of a rupee.

$$\frac{100}{\text{Price Index}}$$

Illustration 22

The consumer price index was 120 in 1994 and it increased to 215 in 1998. If a worker's wages were Rs. 2400 in 1994, determine the dearness allowance payable to the worker in 1998.

Solution :

Here, we first find money wage.

$$\begin{aligned} \text{Money Wage} &= \frac{\text{Real Wage} \times \text{Price Index}}{120} \\ &= \frac{2400 \times 215}{120} = \text{Rs. 4300} \end{aligned}$$

Note that price index here is = $\frac{215}{120} \times 100$

∴ Dearness allowance payable = Rs. 4300 – Rs. 2400 = Rs. 1900.

Illustration 23

The consumer price index for a group of workers was 250 in 1994 with 1980 as base.

- (i) Compute the purchasing power of a rupee in 1994 as compared to 1980.

Solution :

Purchasing power of a rupee = $100/250 = 0.40$

This implies that a rupee in 1994 is worth 40 paise of 1980.

Limitations of Index Number

1. The construction of an index number is based on sample which may not be a true representative of population.
2. An index number does not take into account the quality of items.
3. Index number is an average and as such it suffers from all the limitations of an average.
4. There is no unique index number that is acceptable to all.
5. The index number can be manipulated by choice of base year and weighing system and thus are likely to be misused.

SELF-TEST QUESTIONS

(These are meant for recapitulation only.

Answer to these questions are not be submitted for evalution.)

1. Explain various components of a time series. What do you understand by the analysis of a time series?
2. With which component would you associate each of the following statement and why ?
 - (i) Constantly rising population of India
 - (ii) An era of prosperity
 - (iii) Heavy sales on the occasion of Diwali
 - (iv) Chechenia-war
 - (v) Depressed business environment
3. Determine the trend values by the method of moving average if the observations, given below, are known to have a business cycle of 4 years.

Years	:	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
		1991	1992	1993							
Value	:	41	61	55	48	53	67	62	60	67	73

4. Given below are the figures of production of a sugar factory in thousand tons.

Years	1999	2000	2001	2002	2003	2004	2005
Production	77	88	94	85	91	98	90

- Fit a straight line trend by the method of least squares.
 - Calculate trend values and plot them on a graph paper.
 - Predict the production for 2008 and 2009.
5. The trend equation for annual sales of a product is
- $$Y = 120 + 36X \text{ with } 1^{\text{st}} \text{ January, 1990 as origin}$$
- Determine the monthly trend equation with 1st July 1992 as the origin
 - Compute the trend values of sales in August 1991 and October 1994.
6. Using the ratio to moving average method, compute seasonal indices

Quarters	1985	1986	1987	1988	1989	1990
I	35	35	35	40	41	42
II	39	41	39	46	44	46
III	34	37	37	38	42	43
IV	36	40	42	45	45	47

7. The seasonal indices of a firm are as given below :

Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
106	105	101	104	98	96	93	89	92	102	106	108

If the firm is expecting total sales of Rs. 42,00,000 during 1998, estimate the sales for the individual months of 1998.

8. The linear trend of the quarterly sales (in Rs. 000) of a company is estimated as $Y_t = 200 + 8X$, with 15th May, 1992 as the origin and unit of X being a quarter. If the seasonal variations in the sales of company are 115, 95, 80 and 110 for 1st, 2nd, 3rd and 4th quarters respectively, estimate the sales for each quarters of 1993.
9. Define Index Number. How is it prepared?
10. Explain different methods of construction of index numbers.
11. Prices paid and quantities consumed of three commodities during two time periods are :

<i>Commodity</i>	<i>Time Period I</i>		<i>Time period II</i>	
	P_1	q_1	P_2	q_2
A	10	2	15	1
B	15	3	10	3
C	25	4	15	4

- Keeping the quantity mix of period I as weights, what percentage change in price has occurred between the two periods?
- What is the percentage change in prices if quantity mix of periods II is used as weights?
- What is the percentage change in quantities between two periods when prices of period I are taken as weights?
- What percentage change in the value of consumption has occurred?

12. An enquiry into the family budgets of middle class families gave the following informations :

	<i>Food</i>	<i>Clothing</i>	<i>Fuel</i>	<i>Rent</i>	<i>Misc.</i>
Percentage of Expenditure :	35	15	10	20	20
Prices in 1990 :	70	45	20	80	40
Prices in 1995 :	90	50	25	70	30

A weighted price index for 1995 with base 1990 is to be computed.

- Which index number formulae is appropriate, why?
- Compute the index.
- If a person was getting Rs. 2400 in 1990 and Rs. 4300 in 1995, how much he ought to have received as extra allowance to maintain his former standard of living?

13. The prices paid and quantities purchased by a house hold in base and current years are given below. Calculate the additional dearness allowance to be given to the household so as to fully compensate it for the price rise, using both the Laspeyres's and Paasche's index numbers.

<i>Commodity</i>	<i>Base Period</i>		<i>Current Period</i>	
	<i>Price</i>	<i>Quantity</i>	<i>Price</i>	<i>Quantity</i>
A	30	10	40	8
B	12	20	15	18

14. Convert the following fixed base index numbers into chain base index numbers.

Year : 1980 1981 1982 1983 1984

Fixed Base Index : 100 125 130 145 160

F.B.I. of current year

Hint : Chainbase of current year = _____ x 100

F.B.I. of previous year

14. Given the following information on the Gross Domestic Product (in Rs. crores) at constant prices (1980-81) and current prices for five years, Calculate the series of price index numbers and of quantity index numbers for each of the five years with 1980-81 as base year.

<i>(1980-81)</i>	<i>G.D.P. at Constant Prices</i>	<i>G.D.P. at Current Prices</i>
1980-81	200	200
1981-82	150	240
1982-83	125	350
1983-84	120	360
1984-85	160	400

15. The following table shows the average wage in rupees per week of a group of industrial workers during 1980-87. The consumer price indices for these years with 1980 as base are also shown :

<i>Year</i>	<i>Average Wage (Rs.)</i>	<i>Consumer Price Index</i>
1980	119	100
1981	133	107.6
1982	133	106.6
1983	157	107.6
1984	175	116.2
1985	184	118.9
1986	189	119.8
1987	194	120.2

- (i) Determine the real wages of workers during the years 1981-87 as compared with their wage in 1980.
- (ii) Determine the purchasing power of a rupee in 1987 as compared to (a) 1980 (b) 1985.

Suggested Readings/References :

1. Statistical Methods — *S.P. Gupta*; Sultan Chand & Sons; 23, Daryaganj, New Delhi-110 002.
 2. Business Statistics — *R.S. Bhardwaj*, Excel Books, A-45, Naraina, Phase-I, New Delhi-110 028.
 3. Statistics, Theory, Methods & Applications — *D.C. Sanchetti & V.K. Kapoor*, Sultan chand & Sons, New Delhi-110 002.
 4. Fundamentals of Statistics — *S.C. Gupta*; Himalya Publishing House, 4-B, Murari Lal Street, Ansari Road, Daryaganj, New Delhi-110 002.
 5. Fundamental of Statistics — *A.K. Aggarwal and Sahab Singh*, Franksons; G-2/16, Top Floor, Ansari Road, Daryaganj, New Delhi-110 002.
 6. Statistics — *RSN Pillai & V. Bhagrathi*, S. Chand & Company Ltd., Ram Nagar, New Delhi.
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FOUNDATION PROGRAMME
ECONOMICS AND STATISTICS

QUESTION PAPERS OF PREVIOUS SESSIONS

Question papers of immediate past two examinations of Economics and Statistics paper are appended to this study material for reference of the students to familiarize with the pattern and its structure. Students may please note that answers to these questions should not be sent to the Institute for evaluation.

JUNE 2010

Time allowed : 3 hours

Maximum marks : 100

PART A

*(Answer Question No.1 which is COMPULSORY and
ANY TWO of the rest from this part.)*

1. (a) State, with reasons in brief, whether the following statements are correct or incorrect :
 - (i) Positive economics and normative economics are synonyms to each other.
 - (ii) There is normally a direct relationship between price and quantity in supply of a commodity.
 - (iii) The agriculture sector holds the dominant position in the Indian economy in terms of contribution to India's Gross Domestic Product (GDP).
 - (iv) National income is the aggregate money value of all goods and services produced in the country over a period of time, usually one year.
 - (v) A surplus in balance of trade necessarily implies a surplus in the current account of balance of payments of an economy.

(2 marks each)
- (b) Choose the most appropriate answer from the given options in respect of the following :
 - (i) Elasticity of demand for a necessity like salt is normally —
 - (a) Equal to 1
 - (b) Less than 1
 - (c) Greater than 1

- (d) Infinite.
- (ii) The demand curve of a firm under perfect competition is —
 - (a) Vertical
 - (b) Horizontal
 - (c) Negatively sloped
 - (d) Positively sloped.
- (iii) If all factors of production are increased by 100% and the output increases by 90%, it is a case of —
 - (a) Increasing returns to scale
 - (b) Decreasing returns to scale
 - (c) Constant returns to scale
 - (d) None of the above.
- (iv) In the case of a free good, the level of consumption where marginal utility is zero and the total utility is maximum, it is called —
 - (a) Consumers equilibrium
 - (b) Consumers dissatisfaction
 - (c) Negative utility
 - (d) Equi-marginal utility.
- (v) According to Fisher, total supply of money is —
 - (a) $MV + M_1V_1$
 - (b) $MV_1 + M_1V$
 - (c)
 - (d) None of the above.
- (vi) The average revenue curve of a firm is also known as its —
 - (a) Profit curve
 - (b) Demand curve
 - (c) Income curve
 - (d) None of the above.
- (vii) Which one of the following is not a function of RBI —
 - (a) To issue currency notes
 - (b) To regulate supply of credit
 - (c) To act as banker to the government
 - (d) To regulate foreign trade.
- (viii) Point out the odd one out of the following —
 - (a) Delhi Transport Corporation
 - (b) Indian Railways
 - (c) Hindustan Aeronautics Ltd.
 - (d) Reliance Industries Ltd.
- (ix) Product differentiation is the basic feature of —

- (a) Monopoly
 - (b) Monopolistic competition
 - (c) Perfect competition
 - (d) All of the above.
- (x) Who is the ex-officio Chairman of the Planning Commission of India—
- (a) The Prime Minister
 - (b) The Finance Minister
 - (c) The Planning Minister
 - (d) The President of India. (1 mark each)
2. (a) Distinguish between **any three** of the following :
- (i) 'Increase in demand' and 'expansion in demand'.
 - (ii) 'Market economy' and 'planned economy'
 - (iii) 'Revenue deficit' and 'fiscal deficit'.
 - (iv) 'Inferior goods' and 'Giffen goods'. (3 marks each)
- (b) Re-write the following sentences after filling-in the blank spaces with appropriate word(s)/figure(s) :
- (i) Internal economies accrue to a firm when it _____ its operation.
 - (ii) Alfred Marshall's definition of economics is concerned with _____ welfare.
 - (iii) _____ is additional total cost when an additional unit of production is produced.
 - (iv) Government policy relating to public revenue, expenditure and borrowings is called _____.
 - (v) The average number of persons per square kilometre of area is called _____.
 - (vi) All factors of production are variable in _____ run. (1 mark each)
3. Comment on **any three** of the following :
- (i) Under perfect competition, the problem before a firm is to determine output only.
 - (ii) The Industrial Policy, 1991 redefined the role of public sector.
 - (iii) The welfare of people increases with increase in Gross National Product (GNP).
 - (iv) Selective credit controls regulate the flow of credit in particular directions. (5 marks each)
4. Attempt **any three** of the following :
- (i) "Quantity demanded of a commodity bears an inverse relationship to its price." Elaborate the statement with the help of a diagram.
 - (ii) What do you mean by 'economies of scale' ? What are its different sources ?
 - (iii) Name the methods of computing national income. Describe in detail the product method.

- (iv) What do you mean by 'monetary policy' ? Discuss its various objectives.
(5 marks each)

PART B

*(Answer Question No.5 which is COMPULSORY and
ANY TWO of the rest from this part.)*

5. (a) State, with reasons in brief, whether the following statements are correct or incorrect :
- (i) Statistical results are true only on an average.
 - (ii) Geometric mean gives higher weight to large items and less weight to small items.
 - (iii) Same weight is given to all commodities in a weighted index number.
 - (iv) Lorenz curve furnishes a quantitative measure of dispersion.
 - (v) There is an inverse relationship between the size of the sample and accuracy of the result. (2 marks each)
- (b) Choose the most appropriate answer from the given options in respect of the following :
- (i) The arranging of related facts into classes is called —
 - (a) Diagram
 - (b) Graph
 - (c) Classification
 - (d) Tabulation.
 - (ii) Ogive curve is drawn with the help of —
 - (a) Tallies
 - (b) Median
 - (c) Cumulative frequency distribution
 - (d) None of the above.
 - (iii) The index number which adopts base year quantities as weights is a method of —
 - (a) Laspeyre
 - (b) Bowley
 - (c) Fisher
 - (d) Paasche.
 - (iv) Co-efficient of variation is a —
 - (a) Absolute measure
 - (b) Relative measure
 - (c) Both (a) and (b)
 - (d) Neither (a) nor (b).
 - (v) Which of the following averages would be more suitable for ascertaining average size of shoes —
 - (a) Arithmetic mean

- (b) Mode
- (c) Geometric mean
- (d) Median.
- (vi) Which average is affected most by extreme observations —
 - (a) Mode
 - (b) Median
 - (c) Geometric mean
 - (d) Arithmetic mean.
- (vii) While drawing a scatter diagram, if all the points appear to form a straight line going downward from left to right, then it is inferred that there is a —
 - (a) Perfect positive correlation
 - (b) Simple positive correlation
 - (c) Perfect negative correlation
 - (d) No correlation.
- (viii) Which graphical representation is suitable for determining mode —
 - (a) Histogram
 - (b) Ogive curve
 - (c) Frequency curve
 - (d) Z-curve.
- (ix) A distribution in which the values of mean, mode and median coincide is known as —
 - (a) Asymmetrical distribution
 - (b) Skewed distribution
 - (c) Symmetrical distribution
 - (d) Non-normal distribution.
- (x) The square root of co-efficient of non-determination is called —
 - (a) Co-efficient of alienation
 - (b) Co-efficient of determination
 - (c) Co-efficient of correlation
 - (d) Co-efficient of regression. (1 mark each)

6. (a) Distinguish between **any three** of the following :

- (i) 'Primary data' and 'secondary data'.
- (ii) 'Mean deviation' and 'standard deviation'.
- (iii) 'Karl Pearson's co-efficient' and 'rank correlation co-efficient'.
- (iv) 'Wholesale price index number' and 'cost of living index number'.

(3 marks each)

(b) Re-write the following sentences after filling-in the blank spaces with appropriate word(s)/figure(s) :

- (i) The law of inertia of large numbers is _____ of the law of statistical regularity.

- (ii) Co-efficient of variation is usually expressed in _____.
- (iii) 'r' is significant if it is _____ of probable error.
- (iv) _____ is the ratio of explained variation to the total variation.
- (v) _____ requires that the product of price index and the corresponding quantity index numbers should be equal to the value index number.
- (vi) 'Trend line' obtained by method of least squares is called _____.

(1 mark each)

7. (a) State the characteristics which the numerical data should possess to be known as statistics. (5 marks)
- (b) Explain laws of statistics. (5 marks)
- (c) Explain the 'census investigation method'. What are its merits? (5 marks)

OR

Calculate Karl Pearson's co-efficient of correlation for the data given below :

Roll No.	1	2	3	4	5
Marks 1	48	35	17	23	47
Marks 2	45	20	40	25	45

(5 marks)

8. (a) Compute mean and median from the following data :

Age (Years)	10-20	20-30	30-40	40-50	50-60
No. of Workers	15	18	30	20	17

(5 marks)

- (b) Calculate Fisher's index number for the year 2008 from the data given below :

Item	2007		2008	
	Price (Rs.)	Quantity (Kgs.)	Price (Rs.)	Quantity (Kgs.)
A	5	10	4	12
B	8	6	7	7
C	6	3	5	4

(5 marks)

- (c) Compute standard deviation and co-efficient of variation from the following data :

Size	1	2	3	4	5	6	7
Frequency	6	12	18	26	16	10	8

(5 marks)

DECEMBER 2010

Time allowed : 3 hours

Maximum marks : 100

PART A

(Answer Question No.1 which is **COMPULSORY** and
ANY TWO of the rest from this part.)

1. (a) State, with reasons in brief, whether the following statements are true or false :
 - (i) In a capitalist economy, all means of production are exclusively owned by the government.
 - (ii) A straight line demand curve has the same elasticity at each point on the curve.
 - (iii) Transfer incomes are excluded from the calculation of national income.
 - (iv) In the short-run, a firm that is operating at its shutdown point is earning no profit or no loss.
 - (v) Depreciation of a currency makes the exports costlier and hence proves inflationary. (2 marks each)
- (b) Choose the most appropriate answer from the given options in respect of the following :
 - (i) A consumer will continue to purchase a good until its —
 - (a) Marginal utility falls to zero
 - (b) Total utility falls to the level of price
 - (c) Marginal utility falls to the level of its price
 - (d) Total utility falls to zero.
 - (ii) Quantity theory of money explains the relationship between quantity of money and —
 - (a) Level of employment
 - (b) National income
 - (c) General price level
 - (d) Quantity of investment.
 - (iii) Which one of the following curves is not 'U' shaped —
 - (a) Average variable cost curve
 - (b) Average cost curve
 - (c) Average fixed cost curve
 - (d) Marginal cost curve.
 - (iv) Which one of the following was not the immediate cause of the 1991 economic crisis —
 - (a) Rapid growth of population
 - (b) Severe inflation
 - (c) Expanding fiscal deficits

- (d) Rising current account deficit.
- (v) Which one of the following is not a function of the central bank —
- Monopoly of note issue
 - Custodian of foreign exchange reserves
 - Lender of the last resort
 - Conduct of fiscal policy. *(1 mark each)*
- (c) What is meant by 'credit creation' by the commercial banks ? Illustrate its process. *(5 marks)*
2. (a) Distinguish between **any three** of the following :
- 'Value in use' and 'value in exchange'.
 - 'Revenue budget' and 'capital budget'.
 - 'A firm' and 'an industry'.
 - 'Quantitative credit control measures' and 'qualitative credit control measures'. *(3 marks each)*
- (b) Re-write the following sentences after filling-in the blank spaces with appropriate word(s)/figure(s) :
- The _____ is defined as that time period over which a firm can vary all factors of production.
 - In the modern economy, most of the production does not take place for _____.
 - An important reason for migration of population from rural to urban areas has been the comparative lack of _____ in the rural areas.
 - _____ came into existence to overcome the difficulties of the barter system.
 - The _____ is essentially a place where member governments try to sort out trade problems they face with each other.
 - National income estimates do not cover _____ even though they may be adding to national product. *(1 mark each)*
3. (a) Define 'market mechanism'. How does it help us to deal with the problem of allocation of resources ? *(5 marks)*
- (b) What do you mean by the term 'revenue' ? Examine the relationship between average revenue and marginal revenue when a firm is faced with a linear downward sloping demand curve. *(5 marks)*
- (c) Discuss the structure of the Indian economy as a mixed economy. *(5 marks)*
4. Attempt **any three** of the following :
- Explain the income effect and substitution effect of a change in the price of a good.
 - "Product differentiation and selling expenses form the foundation of monopolistic competition." Explain.
 - Discuss the major objectives of Five Year Plans in India.
 - Define 'liquidity'. Discuss the factors which influence liquidity of an asset.

- (v) Discuss briefly the measures taken by the government to bring in structural reforms in Indian economy. (5 marks each)

PART B

(Answer Question No.5 which is **COMPULSORY** and **ANY TWO** of the rest from this part.)

5. (a) State, with reasons in brief, whether the following statements are true or false :
- (i) Statistical laws are not exact.
 - (ii) Arithmetic mean is very much affected by extreme observations.
 - (iii) A distribution having higher value of dispersion is said to be more uniform or consistent.
 - (iv) The coefficient of correlation is not independent of origin and scale of measurement.
 - (v) Index numbers are the specialised averages. (2 marks each)
- (b) Choose the most appropriate answer from the given options in respect of the following :
- (i) In ancient times, statistics was known as —
 - (a) The science of kings
 - (b) The science of Statecraft
 - (c) Political arithmetic
 - (d) All of the above.
 - (ii) Statistical data are of two types. These are —
 - (a) Primary data and technical data
 - (b) Primary data and secondary data
 - (c) Primary data and personal data
 - (d) None of the above.
 - (iii) If the population is shown for each of the States in India, then we have data which are classified —
 - (a) Chronologically
 - (b) Geographically
 - (c) Quantitatively
 - (d) Qualitatively.
 - (iv) The difference between the maximum and minimum values in a given set of data is called —
 - (a) Class interval
 - (b) Frequency
 - (c) Cumulative frequency

- (d) Range.
- (v) In any pie-chart, the sum of central angle is —
 - (a) 90°
 - (b) 180°
 - (c) 270°
 - (d) 360° .
- (vi) The value of the variable which occurs most frequently is called —
 - (a) Mode
 - (b) Mean
 - (c) Median
 - (d) Weighted mean.
- (vii) Equation $Y_t = a.b^t$ represents —
 - (a) Linear trend
 - (b) Exponential trend
 - (c) Parabolic trend
 - (d) None of the above.
- (viii) Which one of the following measures of central tendency can be used for further mathematical treatment —
 - (a) Median
 - (b) Arithmetic mean
 - (c) Mode
 - (d) None of the above.
- (ix) Seasonal variations are absent if the time interval between successive observations is —
 - (a) Less than or equal to one year
 - (b) Equal to one year
 - (c) More than one year
 - (d) None of the above.
- (x) The index number that uses base year quantities as weights is known as —
 - (a) Laspeyre's index
 - (b) Paasche's index
 - (c) Marshall-Edgeworth index
 - (d) Walsch's index. (1 mark each)

6. (a) Distinguish between **any three** of the following :

- (i) 'More than cumulative frequency table' and 'less than cumulative

frequency table'.

(ii) 'Simple bar diagram' and 'multiple bar diagram'.

(iii) 'Linear correlation' and 'non-linear correlation'.

(iv) 'Time reversal test' and 'factor reversal test'. (3 marks each)

(b) Re-write the following sentences after filling-in the blank spaces with appropriate word(s)/figure(s) :

(i) _____ is indispensable for functioning of the State.

(ii) _____ the size of sample, more accurate results are likely to be.

(iii) Graphical representation of a time series is known as _____.

(iv) The difference between upper and lower limits of a class gives _____ of the class.

(v) The sum of deviations of the variables from their median, ignoring '+' and '-' sign, is always _____.

(vi) _____ is always computed from arithmetic mean.

(1 mark each)

7. Attempt **any three** of the following:

(i) Define 'statistics' and discuss its importance in business and management. (5 marks)

(ii) Define 'geometric mean'. Point out its merits and demerits. (5 marks)

(iii) From the following distribution of marks obtained by students in a certain examination, find the median marks :

Marks Obtained	0-20	21-30	31-40	41-50	51-60	61-70	71-80
No. of Students	38	42	120	72	60	36	32

(5 marks)

(iv) What is 'Lorenz curve' ? What are its uses ? (5 marks)

8. Attempt **any three** of the following :

(i) Following information relate to payment of weekly wages to workers in two firms. Firm-A and Firm-B:

	Firm-A	Firm-B
No. of workers	160	150
Average weekly wages (Rs.)	560	575
Standard deviation of wages (Rs.)	20	25

Find out — (i) Which firm's weekly wage bill is higher; and (ii) in which firm payment of wages is more uniform. (5 marks)

(ii) "Correlation fails to explain cause and effect relationship between the variables." Comment. (5 marks)

(iii) From the following information, calculate correlation coefficient between x and y:

$$\Sigma x = 36$$

$$\Sigma y = 60$$

$$n = 6$$

$$\Sigma (x - \bar{x})^2 = 50$$

$$\Sigma (y - \bar{y})^2 = 106$$

$$\Sigma (x - \bar{x})(y - \bar{y}) = -67$$

(5 marks)

(iv) Calculate the trend values by the method of moving averages, assuming 4-yearly cycle from the following data :

Year	Production (In Lakh Tons)	Year	Production (In Lakh Tons)
2000	242	2006	251
2001	250	2007	257
2002	252	2008	260
2003	249	2009	265
2004	253	2010	262
2005	255		

(5 marks)

FOUNDATION PROGRAMME

ECONOMICS AND STATISTICS

FPES/2007

TEST PAPERS

This Test Paper set contains Two Test Papers i.e . Test Paper 1/2007 and 2/2007. The maximum time allowed to attempt each Test Paper is 3 hours.

Students are required to attempt any one Test Paper, i.e either Test Paper 1/2007 or Test Paper 2/2007 and send the response sheet to the Institute for evaluation. They can also attempt both the test papers, if they so desire, in order to improve their knowledge and practice but it is optional. While writing answers, students should take care not to copy verbatim from the study material, text books or other publications. Instances of deliberate copying from any source will be viewed very seriously.

W A R N I N G

It is brought to the notice of all the students pursuing Company Secretaryship Course that they should follow strict discipline while writing response sheets to various Test Papers appended at the end of this Study Material. Any attempt of unfair means by students in completing the postal coaching by way of submitting response sheets in different handwritings or by way of copying from the study material/suggested answers supplied by the Institute or from the answers of the students who have already completed the course successfully, etc., will be viewed seriously by the Institute. Students are, therefore, advised to write their response sheets in their own handwriting without copying from any original source.

Students may note that use of any malpractice while undergoing postal or oral coaching is a misconduct as per certain provisions of Company Secretaries Regulations and accordingly the registration of such students is liable to be cancelled or terminated.

FOUNDATION PROGRAMME
ECONOMICS AND STATISTICS

TEST PAPER 1/2007

(Based on All Study Lessons)

Time allowed: 3 hours

Maximum marks: 100

NOTE : Answer Question No. 1 which is **COMPULSORY** and **ANY TWO** of the rest from this part)

1. (a) Fill in the blanks (Attempt all question in this part)
 - (i) A capitalistic system is guided in its working by the _____
 - (a) Planning Authority
 - (b) Market mechanism
 - (c) Intuition
 - (d) All the above.
 - (ii) _____ define economics as under :

“Economics is the study of how people and society end up choosing, with or without the use of money, to employ scarce productive resources that could have alternative uses, to produce various commodities and distribute them for consumption now or in future, among various persons and groups in society .It analyses the costs and benefits of improving pattern of resource allocations”

 - (a) T. Scitvosoky
 - (b) P.A. Samuelson
 - (c) L. Robbins
 - (d) Alfred Marshall.
 - (iii) Total utility derived from the consumption of a commodity by a consumer will be _____ when it marginal utility is zero.
 - (a) Minimum
 - (b) Maximum
 - (c) Zero
 - (d) None of the Above.
 - (iv) Price elasticity of demand for a commodity is the change in quantity demanded for a commodity with response to _____
 - (a) Income of the consumer

- (b) Price of the related goods
 - (c) Price of commodity in the question
 - (d) None of the above.
- (v) Under the Total outlay method of measuring elasticity, price elasticity of a commodity will be _____ when there is increase in expenditure with increase in price of a commodity
- (a) Less than one
 - (b) Equal to one
 - (c) Greater than one
 - (d) Zero.
- (vi) The physical relationship between inputs and output is known as _____
- (a) Demand function
 - (b) Supply Function
 - (c) Production Function
 - (d) None of the above.
- (vii) In production theory, MC curve cuts AC curve from below at point when AC is _____
- (a) Minimum
 - (b) Maximum
 - (c) Zero
 - (d) None of the Above
- (viii) A firm is a price maker under the -----form of market situation
- (a) Perfect Market
 - (b) Monopsony
 - (c) Duopoly
 - (d) Monopoly.
- (ix) Under the Fisher quantity theory of money, a change in the quantity of money leads to a change in the level of prices in general which is _____ and in the same direction as the change in quantity of money.
- (a) Less than proportionate
 - (b) More than proportionate
 - (c) Equi –proportionate
 - (d) None of the Above
- (x) India is heavily deficient in _____

- (a) Coal
 - (b) Iron
 - (c) Mineral Oil
 - (d) Zinc
- (xi) Density of population refers to average number of persons
- (a) per 10 square kilometer of area
 - (b) per 100 square kilometer of area
 - (c) per 500 square kilometer of area
 - (d) per square kilometer of area.
- (xii) Composition of foreign trade refers to types of goods included in
- (a) internal trade of the country
 - (b) regional trade with in the country
 - (c) foreign trade of the country
 - (d) district level trade of the country
- (xiii) Fiscal policy is the _____
- (a) monetary policy of the country
 - (b) budgetary policy of the country
 - (c) Wage policy of the country
 - (d) Income policy of the country
- (xiv) Originally Quantity theory of money propounded by _____
- (a) Milton Friedman
 - (b) J R Hicks
 - (c) A. Marshall
 - (d) I. Fisher
- (xv) Open market operation is the instrument of _____
- (a) Fiscal policy
 - (b) Price policy
 - (c) Wage policy
 - (d) Monetary policy.

(1 mark each)

(b) State with reasons, whether the following statements are **TRUE or FALSE**:

- (i) Macroeconomics deals with aggregates of an economy and their relationship with one another.

- (ii) Changes in the quantity demanded of a good as a result of changes in price of that goods are represented by shift in the entire demand curve.
 - (iii) Under monopoly the price is determined at higher level and output at lower level as compared to perfect competition.
 - (iv) National income is an important but not a perfect measure of a country's economic well-being.
 - (v) Globalisation and liberalization of economy convey the same meaning. (1 mark each)
2. Distinguish between **any three** of the following:
- (i) Price elasticity and income elasticity
 - (ii) Balance of trade and balance of payments
 - (iii) Perfect competition and monopolistic competition
 - (iv) Product method and income method of estimating national income. (5 marks each)
3. (i) Firm under the perfect competition is price taker and not the price maker. Discuss. (6 marks)
- (ii) Explain the uses of national income estimates. (3 marks)
- (iii) Discuss the functions of Reserve Bank of India. (6 marks)
4. (a) What is price discrimination? Discuss various forms of price Discrimination. (7 marks)
- (b) Critically examine the Fisher's version of Quantity Theory of Money. (8 marks)

OR

Write short note on **any three** of the following:

- (a) Role of agriculture in Indian economy
- (b) Industrial policy 1990 and after
- (c) India's population policy
- (d) National Budget
- (e) India's 1991 economic crisis. (5 marks each)

PART-B

(Answer question no. 1 which is **COMPULSARY** and **ANY TWO** of the rest from this part)

5. (a)(i) Statistics in singular sense means _____
- (a) statistical data
 - (b) statistical method

- (c) inductive statistics
 - (d) descriptive statistics
- (ii) Distrust of statistics is due to _____
- (a) misuse of statistics
 - (b) limited Scope of Statistics
 - (c) insufficient statistical method
 - (d) None of the above
- (iii) Primary data is preferred to secondary data where-----
- (a) accuracy is important
 - (b) time available is very short
 - (c) fund is inadequate
 - (d) much accuracy is not required.
- (iv) Ogive is _____
- (a) frequency curve
 - (b) frequency polygon
 - (c) cumulative frequency curve
 - (d) None of the above.
- (v) Tabulation of data is done _____
- (a) before classification
 - (b) after classification
 - (c) no restriction
 - (d) None of the above
- (vi) Histogram is used to find out _____ graphically.
- (a) Arithmetic mean
 - (b) Median
 - (c) Mode
 - (d) Harmonic mean.
- (vii) A diagram having two dimension is known as _____
- (a) linear diagram
 - (b) volume diagram
 - (c) area diagram
 - (d) None of the above.
- (viii) Dispersion measures are indicator of reliability of _____

- (a) of an average
 - (b) median
 - (c) mode
 - (d) None
- (ix) Mode of a series ie 2, 4, 6, 6, 7, 8, 9 is _____
- (a) 7
 - (b) 6
 - (c) 8
 - (d) 9
- (x) The sum of deviations of values in a series is zero when these deviations are taken from _____
- (a) median
 - (b) mode
 - (c) arithmetic mean
 - (d) none of the above.
- (xi) The value of coefficient of correlation between the variables is always _____
- (a) greater than one
 - (b) less than one
 - (c) equal to zero
 - (d) in the range of minus one and plus one.
- (xii) Secular trend or simply trend in the time series is the general tendency of data to _____ over a long period of time.
- (a) increase
 - (b) decrease
 - (c) stagnate
 - (d) all the above.
- (xiii) The geometric mean of Laspeyre's and Paasche's is _____
- (a) Marshall and Edgeworth's index
 - (b) Bowley's index
 - (c) Paasche's index
 - (d) Fishers's index
- (xiv) The weight used in Laspeyer's price index is
- (a) q_1
 - (b) p_1

(c) q_0

(d) q_1

(xv) _____ is not a time series component of a time series.

(a) Secular trend

(b) Seasonal variation

(c) Cyclical variation

(d) Regulatory variation.

(1 mark each)

(b) State with reasons whether the following statements are correct or incorrect (Attempt any five):

(a) Primary data is expensive and time consuming.

(b) Pie diagram is a circle divided in to sectors with area equal to the corresponding component.

(c) The sum of absolute deviation of observations in a series from the median is maximum.

(d) The variance of the observation in a series is equal to square of deviation.

(e) The correlation coefficient is not independent of change of origin and change of scale.

(f) Forecasting is not the prediction of future values of a variable.

(g) Based year should be an abnormal year while calculating the index number.

(1 mark each)

6. (a) Find the mean, median and mode from the following data:

<i>Mid value</i>	150	250	350	450	550
<i>Frequency</i>	15	18	30	20	17

(6 marks)

(b) Calculate the standard deviation and its coefficient of variation from the data given below:

<i>Marks</i>	<i>No of students</i>
0 -- 50	4
50 -- 100	6
100 -- 150	10
150 -- 200	16

200 -- 250	12	
250 -- 300	8	
300 -- 350	4	(9 marks)

7. (a) Mean and standard deviation of 100 items are found to be 40 and 10. If at the time of calculation two items are wrongly taken as 30 and 70 instead of 3 and 27, find the correct mean and standard deviation. (6 marks)

- (b) Calculate Karl Pearson's coefficient of correlation from the following data :

- (i) Sum of deviations of $x = 5$
- (ii) Sum of deviations of $y = 4$
- (iii) Sum of squares of deviations of $x = 40$
- (iv) Sum of squares of deviations of $y = 50$
- (v) Sum of the product of deviations of x and $y = 32$
- (vi) No. of pairs of observations = 10

(6 marks)

- (c) What is time series? List out its uses.

(3 marks)

8. (a) Calculate Laspeyres's, Paasche's and Fisher's index numbers for the following data:

Items	Base Period		Current Period	
	Qty.	Price	Qty.	Price
A	12	10	15	12
B	15	7	20	5
C	24	5	20	9
D	5	16	5	14

(7 marks)

- (b) Fit a straight line trend by the method of least squares to the following data .

Year	2000	2001	2002	2003	2004	2005	2006	2007
Production (Tonnes)	380	400	650	720	690	600	870	950

Also predict the production for 2010 if the same trend continues. (8 marks)

TEST PAPER 2/2007

(Based on All Study Lessons)

Time allowed: 3 hours

Maximum marks: 100

PART - A

(Answer Question No. 1 which is COMPULSORY and ANY TWO of the rest from this part.)

1. (a) Fill in the blanks (Attempt all question in this part)
 - (i) Positive statements in economics concern what is; normative statements concerns _____
 - (a) What Was ?
 - (b) What is the normal situation ?
 - (c) What will be ?
 - (d) What ought to be ?
 - (ii) Socialist economies discard the use of market mechanism and replace it with some form of _____
 - (a) intuition
 - (b) profit
 - (c) regulatory mechanism
 - (d) none of the above.
 - (iii) Marginal utility derived from the consumption of a commodity may be defined as _____
 - (a) TU/Q
 - (b) $TU \times Q$
 - (c) $TU_n - TU_{n-1}$
 - (d) None of the above.
 - (iv) A consumer move on the same demand curve when change in quantity demanded of a commodity depend upon _____
 - (a) price of related goods
 - (b) consumer income
 - (c) price of commodity itself
 - (d) none of the above.
 - (v) Ceteris paribus means-
 - (a) Consumer income is constant
 - (b) Price of related goods remains constant

- (c) Other things remains constant
 - (d) None of the above.
- (vi) Cross elasticity of demand is percentage change in amount demanded of one commodity X with response to percentage change in _____
- (a) consumer income
 - (b) price of X
 - (c) Price of other commodity Y
 - (d) None of the above,
- (vii) Given a straight line downward sloping demand curve ,the price elasticity in the middle of demand curve will be _____
- (a) infinity
 - (b) zero
 - (c) unity
 - (d) inelastic
- (viii) An increase in the supply of commodity means _____
- (a) the creation of surplus or glut
 - (b) an increase in the consumer demand to purchase more
 - (c) an increase in willingness of firms to produce more for reasons other than price of the commodity.
 - (d) All the above.
- (ix) Production function is the physical relation ship between _____
- (a) input and input
 - (b) input and price
 - (c) output and price
 - (d) input and output.
- (x) Selling cost and product differentiation are the two important aspects of _____
- (a) perfect competition
 - (b) monopsony
 - (c) monopoly
 - (d) monopolistic competition.
- (xi) Role of public sector in Indian economy since 1990 is _____
- (a) increasing
 - (b) stationary

- (c) declining
- (d) none of the above.
- (xii) Since 1990, the contribution of agriculture to India's GDP is _____
 - (a) increasing
 - (b) declining
 - (c) constant
 - (d) none of the above
- (xiii) Deficit financing is an important instrument of _____
 - (a) monetary policy
 - (b) wage policy
 - (c) price policy
 - (d) fiscal or budgetary policy.
- (xiv) The First Five Year Plan focussed on
 - (a) Industry
 - (b) Infrastructure
 - (c) Agriculture
 - (d) All the above.
- (xv) As a result of reforms, India's economic performance in recent years has been _____
 - (a) impressive
 - (b) disappointing
 - (c) static
 - (d) none of the above.

(1 mark each)

(b) State with reasons, whether the following statements are **Correct or Incorrect**.

- (i) Microeconomics and macroeconomics convey the same meaning.
- (ii) Return to scale describes the change in output in response to an equi-proportionate change in one input.
- (iii) GNP_{MP} and GNP_{FC} convey the same meaning.
- (iv) An increase in cash reserve ratio for banks can increase their capacity of credit creation.
- (v) WTO facilitate international trade among nations.

(1 mark each)

2. (a) State the facts on which Lionel Robbins definition is based. *(3 marks)*
- (b) Distinguish between return to scale and return to a factor. *(3 marks)*

- (c) Explain with the help of a diagram short runs average and marginal cost curves. (3 marks)
- (d) Explain and illustrate price output equilibrium under the monopoly in the short run. (6 marks)
- 3. (a) Discuss the salient features of Indian economy. (6 marks)
- (b) Write short note on any three of the following :
 - (i) Recent trends in India's national income.
 - (ii) Unemployment in India
 - (iii) Financial Sector reform
 - (iv) Urbanisation in India
 - (v) India's balance of Payments. (9 marks)
- 4. (a) What is WTO? Discuss its objectives.
- (b) Discuss impact of globalisation on Indian economy.
- (c) What is money? What are its various functions ? (5 marks each)

PART – B

(Answer Question No. 1 which is COMPULSARY and ANY TWO of the rest from this part)

- 5. (a) (i) Statistics is a discipline which deals in analysis of :
 - (a) qualitative data
 - (b) quantitative data
 - (c) all types of data
 - (d) only simple facts
- (ii) Distrust of statistics occurs due to :
 - (a) insufficient statistical methods
 - (b) limited scope of statistics
 - (c) mistrust of statistics
 - (d) none of the above.
- (iii) Secondary data is preferred in cases where –
 - (a) much accuracy is not required
 - (b) adequate fund is available
 - (c) adequate time is available
 - (d) much precision is required.

- (iv) _____ is a class in which either the lower limit or upper limit is missing.
- (a) exclusive class
 - (b) inclusive class
 - (c) open-end class
 - (d) none of the above.
- (v) A circle divided in to component sectors with areas proportional to the size of the corresponding component is known as _____
- (a) bar diagram
 - (b) pie diagram
 - (c) pictogram
 - (d) none of the above.
- (vi) A method in which an investigator personally visits the respondents, ask questions pertaining to the enquiry and collect the desired information is known as _____
- (a) Indirect oral interview method
 - (b) Direct personal interview method
 - (c) Mailed questionnaire method
 - (d) None of the above.
- (vii) An approach in which data are collected for each and every unit of the universe is known as -----
- (a) sample investigation
 - (b) census investigation
 - (c) random sampling
 - (d) none of the above.
- (viii) Sample investigation is preferred over census investigation because it is _____
- (a) less costly
 - (b) less time consuming
 - (c) reliable
 - (d) all the above.
- (ix) The sum of square of deviation is minimum when the deviations are taken from _____
- (a) Median
 - (b) Mode

- (c) Arithmetic Mean
 - (d) Harmonic Mean
- (x) In a symmetrical distribution,
- (a) Mean, median and mode are unequal to one another;
 - (b) Mean, median and mode are equal to one another;
 - (c) Mean is greater than median
 - (d) None of the above.
- (xi) Coefficient of determination is defined as
- (a) r^4
 - (b) r^3
 - (c) r^2
 - (d) none of the above.
- (xii) Standard deviation is always computed from _____
- (a) Arithmetic mean
 - (b) Median
 - (c) Mode
 - (d) Geometric mean.
- (xiii) For ascertaining the degree of agreement about taste of beauty between three judges in a beauty contest, we use _____
- (a) Coefficient of correlation
 - (b) Rank correlation
 - (c) Scattered diagram
 - (d) All the above.
- (xiv) Weighted aggregative index formula using the average base year and current year's quantities as weights is known as _____
- (a) Bowley's price index
 - (b) Laspeyre's price index
 - (c) Fisher's price index
 - (d) Marshall-Edge worth price index.
- (xv) The patterns with in a year of change that tends to be repeated from year to year known as _____
- (a) secular trend
 - (b) cyclical variation

(c) irregular variation

(d) seasonal variation.

(1 mark each)

(b) State with reasons whether the following statements are correct or incorrect (Attempt any five):

(i) Applied statistics and inferential statistics are the same .

(ii) Census and sample convey the same meaning.

(iii) Diagrammatic presentation is a tabular form of classified data.

(iv) All positional averages are mathematical averages.

(v) Variance and coefficient of variation are the same.

(vi) Positive correlation means both the variables are moving in the same direction.

(vii) Method of least squares is used to fit a mathematical trend.

(1 mark each)

6. (a) Distinguish between primary data and secondary data.

(b) If the price of any commodity double in five years, you are required to find out the average percentage increase per annum.

(c) Find the missing frequency in the following table if the mode is 44 :

Marks :	10-20	20-30	30-40	40-50	50-60	60- 70	70-80
No. of Students :	5	8	20	30	?	12	5

(5 marks each)

7. (a) From the following data, draw the pie chart :

Distribution of Rupee Spent on Khadi

Head	Paise
Farmer	19
Carder and Spinner	35
Weaver	28
Washer man,Dyer and Printer	8
Administrative Agency	10
Total :	100

(5 marks)

(b) State interrelationship between mean, median and mode.

(5 marks)

(c) Calculate coefficient of correlation between X and Y series from the following data:

	<i>X Series</i>	<i>Y Series</i>
No. of Observations	15	15
Arithmetic Mean	25	18
Standard Deviation	5	5
$\Sigma (X-25)(Y-18)=125$		

(5 marks)

8. (a) Discuss the various tests of adequacy of index number formulae. Also explain which index number formula meets all the tests. (7 marks)
- (b) Fit a straight line trend by the method of least squares from the following data and predict the sales for the year 2009.

<i>Year :</i>	1999	2000	2001	2002	2003	2004	2005
<i>Sales in (000 units) :</i>	100	105	109	96	102	108	112

(8 marks)
