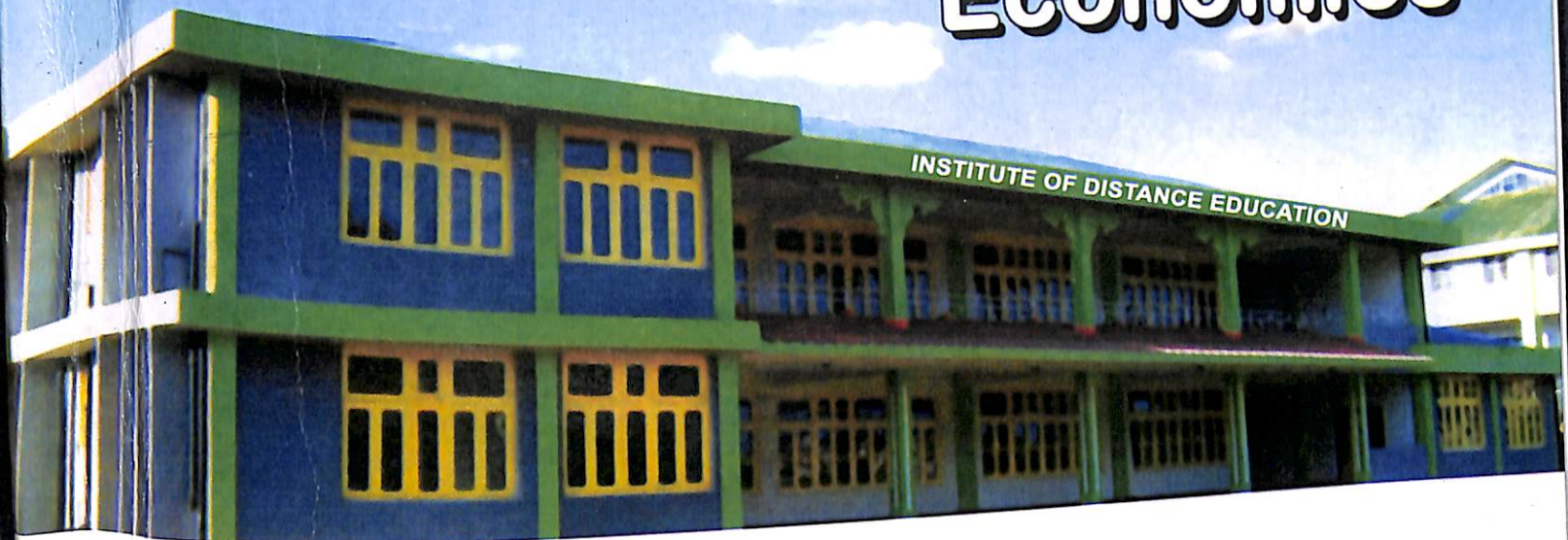


Economics



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**B.A. COURSE
THIRD YEAR
PAPER - IV
PUBLIC FINANCE AND
ELEMENTARY STATISTICS**

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INTRODUCTION

Generally, an economy reflects the way of organizing and performing economic activities such as production, consumption and distribution. The differences in organization and operation of these activities give us different economic systems. Accordingly, we have national economy, regional economy or state economy if we consider the economic activities on the basis of a geographical or political boundary. Similarly, we have capitalist, socialist, and mixed economy on the basis of the significance of ownership of means of production while organising these activities. These economies also differ in their peculiarities from one nation to the other. For example the socialist economy of China is different from the socialist economy of the former Soviet Union. While the economy of China has agricultural base, the economy of Soviet Union had industrial base. An understanding of, say a socialist economy, may not capture the ground realities which exist in different countries. It is therefore necessary to discuss the economy of a nation or a region for a meaningful understanding. It is in this context that the course entitled, Indian Economy and the Economy of Arunachal Pradesh bear significance. The course has two sections, namely Indian economy consisting of six units and the economy of Arunachal Pradesh consisting of two units.

Unit-I discusses the nature and structure of Indian economy. Besides, it includes discussion on National Income and contribution of different sectors to its growth over the years.

In the process of development of a nation its population has a greater bearing. Development is meant for the people and people are the agents of development. That is why the study of population with its associated components such as literacy, sex ratio, occupational distribution are very important. This is the subject matter of Unit-II which also discusses the population policy adopted in India over the years.

India is an agricultural country; agricultures share in National Income is quite sizable. Hence the role of agriculture in Indian economy is very important. Unit-III discusses the nature and status of Indian agriculture and measures like land reforms and green revolution to raise agricultural productivity and thereby developing agriculture.

In the process of transformation of economy, Industries follow agriculture and foreign trade follows industries. Unit-IV discusses the industrial development of India after independence. It has described the pattern of industrialization as a result of different industrial policies. Besides, it has specially focused on the cottage and small scale industries in the economic development of India.

Unit-V discusses the foreign trade, its composition and nature. An important instrument in foreign trade, that is Balance of Payments has also been discussed in details. As international trade is directed by World Trade Organisation, the unit also discusses India's emerging role as a member country in World Trade Organisation.

India has adopted planned approach to development. As a matter of fact, India formulates plans for economic growth and social justice. Unit-VI discusses various five year plans and critically evaluates its performance. Consequent upon globalisation, India has also embarked upon economic reforms. The unit has made an appraisal of economic reforms in the process of economic development in India.

Unit-VII and Unit-VIII discuss the economy of Arunachal Pradesh with reference to the State Domestic Product, population, agriculture and industry. Unit-VII discusses domestic product, contribution of different sectors to it and the population along with its characteristic. Unit-VIII has discusses development of agriculture and industry with reference to traditional practices in these two sectors.

The course explains the economic behaviour of a nation and a state. In the process of explanation both theoretical and empirical explanations have been blend to present the systems objectively.

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Unit – I
PUBLIC FINANCE: INTRODUCTION

Structure

- 1.0 Objectives
- 1.1 Introduction
- 1.2 Meaning and Definitions of Public Finance
- 1.3 Nature of Public Finance
- 1.4 Public Finance and Private Finance
- 1.5 Role and Significance of Public Finance
 - 1.5.1 Private Goods
 - 1.5.2 Social Goods or Public Goods
 - 1.5.3 Merit Goods
- 1.6 Principles of Maximum Social Advantage
 - 1.6.1 The Theory
 - 1.6.2 Different Criterion to Judge Social Advantage
- 1.7 Let Us Sum Up
- 1.8 Check Your Learning
- 1.9 Key Words
- 1.10 Suggested Readings
- 1.11 Hints/Answers to Questions in Check Your Progress

1.0 Objectives

After going through this Unit you should be able to:

- know the meaning of public finance;
- distinguish between public finance and private finance;
- understand importance of public finance in an economy; and
- learn the principles of maximum social advantage which guide the taxation and expenditure activities of the government.

1.1 Introduction

As our society is committed to a rapid economic growth along with economic justice, there is an undercurrent of *optimum growth* and *public welfare* considerations in the spectrum of economics. In recent years there has been a tremendous increase in the role and functions of government across the globe. Pigou in his 'Economics of Welfare' has shown how there is a divergence between private interest and social interest under capitalist system. Thus, the role of government has been conceived to reduce this gap and ensure maximum welfare to the society. Obviously, the activities of the government have been increased because of its welfare role. When the government performs some activities, it is but natural to think of the income and expenditure of the government. Hence, the main activity of the state is to bring about changes in financial flows including debts, revenues and expenditures to carry out its activities. This is precisely what the public finance deals with. The subject of public finance has been following the developments in the state activities and the corresponding economic philosophy. Therefore, it has become an important branch in economics discipline.

1.2 Meaning and Definition of Public Finance

'Public finance deals with identification and appraisal of the income and expenditure policies of the government. It is a combination of two words 'public and finance'. Public means the individuals living in an administrative territory and signifies public. Mainly it is used to signify the Government or the State. Finance means the process of generation of income and expenditure. Thus, public finance is related to the financing of the State- Central, State and Local-activities. The finance of the government includes the raising and disbursement of government funds.

Many economists have given their respective definitions of 'Public finance'. The definitions as given by the leading economists are as follows:

Prof Dalton: "Public finance is one of those subjects which are on the borderline between economics and politics. It is concerned with income and expenditure of public authorities and with the adjustment with each others".

Prof Ursula K. Hicks: "The main concept of public finance consists of the examination and appraisal of the methods by which governing bodies provide for the collective satisfaction of wants and secure the necessary funds to carry out their purpose".

Prof Findlay Shirras: "Public finance is the study of the principles underlining the spending and raising of funds by public authority".

Prof Lutz: "Public finance deals with the provision custody and disbursement of resources needed to conduct public or Government function"

Thus public finance deals with the revenue generation process and the expenditure incurred by the government to provide different services to the people. Thus the subject matter of public finance broadly consists of the following five components:

- (i) **Public Revenue:** This component deals with the sources from which the state might derive its income. It includes the study of the method and extent of raising public revenue by various means like tax, non-tax revenue, debt etc.
- (ii) **Public Expenditure:** It deals with the principles through which the public revenue should be spent. Public expenditure is a major tool in the hands of authorities for implementing various welfare measures meant for public.
- (iii) **Stability of the Economy:** It studies the effect of revenue and expenditure on the national income, employment, prices etc.
- (iv) **Financial administration:** It relates to the public budget, its preparation and passing, implementation and auditing. All financial activities are related to financial administration.
- (v) **Federal Finance:** In Indian Federal Structure, multi-layer system of government necessitates division of resources between different layers-centre and state precisely. Issues and problems relating to Inter-Governmental Financial Flows are referred as Federal Finance. This has assumed a great significance in the study of Public Finance.

1.3 Nature of Public Finance

Different economists have defined the concept of the nature of public finance. Seligman and others have talked about pure theory of public finance, which deals with the problems of government income and expenditure ignoring the welfare of the people. The other group of economists led by Wagner, Pigou and others advocated the socio-political theory of public finance, where they advocated for the maximization of social welfare of the people.

Functional Finance is a new concept of public finance (Advocated by J.M Keynes) deals with the stabilization function of the government to maintain stabilities in price, income, employment.

1.4 Public Finance and Private Finance

Long ago Abraham Lincoln the President of United States of America defined Government as "By the people, of the people, for the people". Thus the government is made by the people and the functions of the government are to be decided by the people for their own betterment. Thus the main objective of public finance lies with the betterment of the people in particular and the societies in general.

On the other hand 'Private' means something which is purely personal in nature and does not have anything to do with the society as a whole. Private finance thus basically studies the income generation and expenditure process of the private individuals. Public Finance and Private Finance are separate from each other and operate with the limited resources. However, there are clear differences between these two which are discussed as under:

PUBLIC FINANCE	PRIVATE FINANCE
1. Given the resources the aim of public finance is to maximize the satisfaction of social wants	1. Given the resources the aim of Private Finance is to maximize the satisfaction of private wants.
2. Public finance aims at generation of revenues through imposition of tax and generation of non-tax revenue through imposition of fees, fines etc.	2. Private finance generates revenues only through selling of goods and services to the people.
3. When revenue is less than the expenditure, Public finance resorts to other means like borrowing from public agencies and private agencies to fill up the gap. In some situations, the government can borrow from its central bank, which is known as deficit financing.	3. In private finance the income-expenditure gap is filled up through borrowing from the other private and public agencies.
4. Deficit or surplus budget in public finance is dependent on the nature and characteristics of the economy. During the time of unemployment the government resorts to deficit financing. Surplus budget in public finance means taxation is greater than public expenditure, which is not desirable by the societies and is always discouraged.	4. In private finance the deficit finance is always discouraged. Deficit financing means income is less than the expenditure and hence, a situation of loss which is always discouraged. On the other hand a situation of surplus budget that is income greater than expenditure is preferred because it is a case of profit.

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5. Public finance is open in nature as it is determined by the government which is formed by the people.	5. Private finance is very secretive in nature as the private individuals do not want to leak out to others anything about their financial position.
6. Public finance is based on the principles of the equimarginal utilities derived by the society as a whole and not by the individuals.	6. Private finance is based on law of equimarginal utilities; in other words the maximization of utilities is achieved by equalising the marginal utilities derived from expenditure in different activities.
7. Public finance is based on the motive of long run return.	7. Private finance is generally based on the motive of maximisation of short run return.

Check Your Progress -I

- Q1 What is Public finance?
 Q2 Write True (T) or False (F).
 a) Military expenditure is related with private finance.
 b) Public finance deals with the expenditure and income of your family
 c) Construction of your village school building comes under the preview of private finance.
 d) The income tax paid by the individual is a subject matter of public finance.
 e) The income earned by you is the subject matter of private finance.
 Q3 What is deficit budget? How is it different from Surplus budget?
 Q4 What is deficit financing?
 Q5 What is federal finance?
 Q6 What is financial administration?
 Q7 What is meant by budget?

1.5 Role and Significance of Public Finance

While discussing the previous section we pointed out that both public and private finance deals with the satisfaction of human wants. Satisfaction of social wants comes under the domain of public finance and satisfaction of private wants. Therefore we must know the characteristics of social wants and private wants comes under the domain of private finance. Further we must note that the goods which satisfy social wants are public goods and the goods which satisfy private wants are known as private goods. The nature and characteristics of private and social goods are as follows:

1.5.1 Private Goods

We consume many goods. For example we consume food, we use pens, telephones, mobiles etc. They satisfy our private wants. Whenever we want to consume them we need to pay a price for them. If we do not want to pay a price for them, we are simply excluded from the market. The price is determined by the market principle of demand and supply. Thus, the private goods are divisible in the sense that those who do not want to pay the price are excluded from its consumption and those who want to pay the price are supposed to consume it.

1.5.2 Social Goods or Public Goods

The goods or services which are collectively consumed are known as social or public goods. The best example of social or public goods is 'defence' and 'police'. The goods called 'defence' which is produced by the government is collectively consumed by the society as a whole. There are certain distinct characteristic of social goods which are given as follows:

- (i) **Indivisibility:** The goods which cannot be divided for consumption are indivisible goods. In other words, when there are two persons in a society the consumption of the first person of the good is equal to the consumption of the second person which is also equal to the total supply. Therefore it is also said that social goods or public goods are supplies to satisfy the collective wants.
- (ii) **Principle of Exclusion:** No body in the society can be excluded from the consumption of social goods. Suppose an individual in the society is not interested to consume social goods. On principle it is not possible. Example is 'defence'. This is a distinct characteristic of social goods as compared to the private goods. In case of private goods if a person does not want to consume, s/he can exclude him/herself from the consumption. As such, the public goods are produced by the government and each and every individual in the society is the beneficiary of the goods.
- (iii) **Non Applicability of the Pricing Principles:** The price of public goods is not determined by the principle of demand and supply. The point number two above states that, no individual in the society can exclude himself from the consumption of public goods. Therefore, lots of externalities are associated in the supply of public goods. Hence the traditional pricing principles are not applicable. In order to finance the supply of public goods the principle of public finance plays a crucial role.

1.5.3 Merit Goods

There are certain social goods which are known as 'merit goods'. The best example is primary education. These types of goods are called merit goods because they command overwhelming importance in the attainment of social welfare. The important characteristics of the merit goods are:

- i) Merit goods have some similarities with that of private goods in that if a person does not want to consume the goods, s/he can exclude him/herself from its consumption. Example is primary education. If someone does not want to have primary education s/he can exclude himself. But the importance of primary education is very high and no society wants to continue with mass illiteracy. Therefore, 'Primary education' as a good is a merit good and the government supplies the goods.
- ii) The main difference between private good and merit goods is that merit good calls for interference in consumer's sovereignty. Suppose a good (Primary education) is supplied as a private goods. In this case the poor people cannot afford to purchase primary education for their children and they became illiterate. This is the reason why the government supplies primary education as a merit good along with the private supplies which is nothing but some kind of interference with the consumer's sovereignty.

Because of the above characteristics of the social and merit goods the role of the government becomes very crucial and provisioning and financing of these goods are the important ingredients of the subject matters of public finance.

1.6 Principles of Maximum Social Advantage

Introduction

We have argued in the previous section that the responsibility of the government should lie with the provisioning of social and merit goods, because of their distinct characteristics.

The price mechanism does not work in the provisioning of social and merit goods. Therefore, in order to finance these goods the government should impose the taxes on the societies. When tax is imposed on the society, the society receives some disutility. When there is public expenditure in the form of supply of public goods, the society receives some utility. Because of these utility and disutility generated through the government interventions, a sound principle is necessary to guide the activities of the government. Many economists have contributed significantly to the principles of public finance which is known as the principles of maximum social advantage.

Principles of Maximum Social Advantage

Two basic branches of public finance are taxation and expenditure. Thus, the government collects revenue by imposing taxes and spends the collected amount which is known as expenditure. J.B. Say, the famous French economist, believed that the very best of all plans of finance is to spend little and the best of all taxes is that which is least in amount. Adam Smith the famous classical economist developed the theories of public finance on the basis of the following principles.

- (i) The activities of the governments should be minimum and should restrict itself to maintenance of law and order and external security.
- (ii) All public expenditure does not contribute to economic welfare of the country.
- (iii) All private expenditures are productive.

Thus, on the basis of the above three principles the classical economist believed that "every tax is an evil" and the maintenance of internal and external security. In believing to the classical economist have forgotten certain positive impact of taxation.

For example, when tax is imposed on liquor it increases the price, as a result the demand falls. The ultimate result is reduction of liquor, which is good to promote a healthier society. Another example may be given when income tax is imposed people work harder and harder in order to maintain their income. The outcome is that the national output increases. Thus the impact of tax is not necessarily evil and imposition of tax enhances the quality of life and national income.

On the similar line of argument we may disprove the fact that all public expenditure are non productive. For example the public expenditure of Arunachal Pradesh has gone up from Rs.500 crores in 1987-88 to Rs.1,300 crores in 2003-05 and that of central government has gone up from Rs.1,14,483 crores in 1991-92 to

Rs.438726 crore in 2002-03. The responsibility of the central government ranges from defence to many things like education, health, public transport, railways, atomic energy, etc.

In the year 2002-2003, the developmental expenditure of central government was 44.50 percent and that of non-developmental expenditure was 55.50 percent. The defence expenditure is kept in non-developmental expenditure. Thus if we view the classical arguments that public expenditure is non-productive then a question arises, why did the central government spend 44.5 percent as developmental expenditure and 55.5 percent as non-developmental expenditure?

The answer to the above question is given as follows:

- (i) Defence, police, maintenance of the government is necessary because protection of the country is a must.
- (ii) The developmental expenditure are not unproductive for example expenditure on education, health, water etc promote the quality of life in a society since no society is better off when people are illiterate, plagued with diseases. Thus public expenditure in these activities indirectly enhances the productive capacity of the society which further enhances economic growth.

But, there are certain public expenditures, which are necessary evils. For example, using public money, when big parties are arranged. These types of public expenditure should be curtailed. Keeping in view the above ideas, many economists have given famous guidelines of public finance on the basis of which should be imposed and expenditure should be incurred. This guideline is known as the principle of maximum social advantage.

1.6.1 The Theory

When tax is imposed it creates some sort of disutility to the person on whom the tax is imposed. Similarly, a person receives some utility out of public expenditure incurred by the government. This analogy is true for the society as a whole and the society receives utility out of public expenditure of the government and some pain (disutility) is inflicted upon it when a tax is imposed. Example is imposition of income tax generates disutility and expenditure on education by the government gives utility to the society. Therefore, there should be a basis or a principle on which tax should be imposed and public expenditure should be incurred. This principle is known as the principle of maximum social advantage. In other words, the principle of public finance should be such that the societies as a whole receive the maximum social benefit out of public finance.

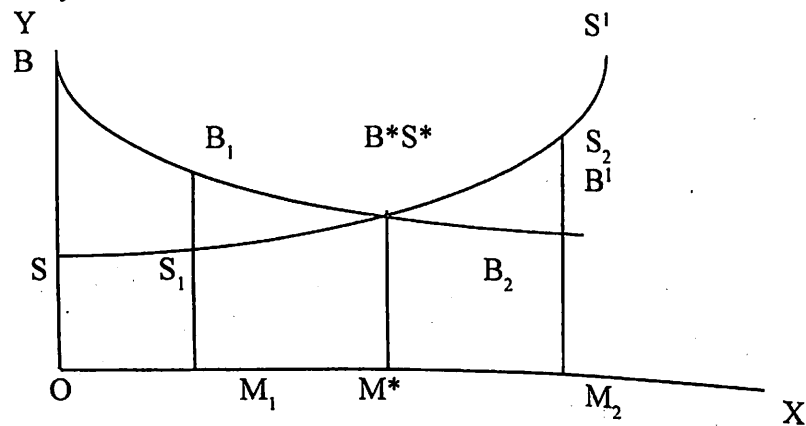
There are two fundamental principles which are known as principles of maximum social advantage. The principles of maximum social advantage are as follows:

- (i) The public expenditure should be such that when it is spent for different purposes (i.e. education, health, defence, etc.) such that the marginal benefit or utility received from each and every purpose should be equal.
- (ii) The public expenditure should be moved to that point in such a way that the marginal social benefit of the last rupee spent is equal to the marginal sacrifice of the last rupee raised by taxation.

The two principles mentioned above according to Prof. Dalton are known as principle of maximum social advantage and according to Prof. Pigou the principle of Maximum aggregate welfare.

Diagrammatic Representation of the Principle

The principle of Maximum Social Advantage or aggregate welfare can be explained diagrammatically as follows;



Amount of Money spent and raised by taxation.

The X-axis (horizontal) of the diagram shows the amount of money spent as public expenditure and amount of money raised by taxation. The Y-axis (vertical) represents the amount of utility received by the society due to public expenditure. The fundamental assumption of the diagram is that the budget of the government is a balanced one, where amount raised by way of taxation is equal to amount spent as public expenditure. Therefore, revenue raised through tax is equal to expenditure.

BB' represents the Marginal Benefit curve when the government spends the money as public expenditure. The curve is downward sloping as marginal benefit declines with increase in public expenditure. the marginal sacrifice incurred by the society as the society pays more and more as tax. The curve is upward rising thereby showing that with additional tax the disutility from sacrificing the amount goes on increasing. Thus, marginal sacrifice increases and marginal benefit declines with increase in the size of the budget.

When the size of the budget is OM_1 , the marginal benefit is M_1B_1 and marginal sacrifice = M_1S_1 . At OM_1 , the amount of tax is equal to the amount of expenditure incurred. Here M_1B_1 is greater than M_1S_1 , implying that the benefit derived from public expenditure is more than the sacrifice created due to taxation. Marginal benefit is greater by S_1B_1 at this point. When the marginal benefit is greater than the marginal sacrifice the society will not mind paying more in terms of tax, when the size of the budget is increased. Therefore, it is wise for the government to increase the size of the budget.

When the size of the budget is OM_2 the marginal benefit = M_2B_2 . It is less than the marginal sacrifice M_2S_2 . Here, the amount of pain inflicted on the society is greater than the amount of benefit it receives. The disutility to the society is shown by S_2B_2 , the difference between M_2S_2 and M_2B_2 . Thus, the budget is not optimum and it is desirable on the part of the government to reduce the size of the budget. Thus, the optimum size of the

budget is arrived at that point where the marginal benefit curve intersects with the marginal sacrifice curve. In the diagram the optimum budget is achieved when the size of the budget is OM^* , where the marginal sacrifice M^*S^* = Marginal Benefit M^*B^* . Thus, when the size of the budget is OM^* the society receives the maximum social advantage and the budget becomes optimum.

1.6.2 Different Criterion to Judge Social Advantage

It is not possible to quantify social cost or social benefit at the aggregate level when taxes are collected and expenditures made. Maximum social advantage can, therefore be taken as a broad guideline to understand the revenue and expenditure policies of the government. The economic test of maximum social advantage may be stated as (i) increase in economic welfare by increasing production and (ii) make the distribution of what is produced efficient. It is only then that public finance may be considered to secure the maximum social advantage from the operations which it conducts. Many economists, however, have given different criteria to judge whether the principles of maximum social advantage is achieved or not.

The criteria are:

- Preservation of the community:** The fundamental goal of the government is to protect the society from external aggression, maintenance of equality in the society. When these things are maintained of public expenditure, then the society will not mind paying the taxes to meet the expenditure. Thus preservation of the community is the first test of social advantage.
- Increase in national income:** The basic principle of social advantage is satisfied when the national income is increased due to the operation of public finance. For example tax on people, companies reduce their willingness to produce more and save similarly excessive subsidy may reduce the willingness of the people to work hard, which indirectly reduce the national income. On the other hand reduced public expenditure on road, telecommunication or infrastructure in general reduces the production of the economy. Thus, tax and expenditure should be in such, a way that it does not hinder production and national income.
- Maintenance of equality:** The primary aim of the government is to promote equality in the society. When tax is imposed on the rich, it reduces the income of the rich and when the amount collected is spent on the poor, for example as old age pension, education of the poor, indirectly income is redistributed in the society. Thus equality is being achieved by the operation of public finance and the society is placed at an advantageous position.
- Economic stability:** Economic stability means maintenance of full employment with price stability. During the time of recession, unemployment increases. Inflation, that is rise in price, affects the poor section of the society adversely. Thus during the time of recession excessive public expenditure is necessary and the society adversely. Thus during the time of recession a controlled public expenditure is a must. Thus the maintenance of economic stability through public finance is one of the basic tests of social advantage.
- Sustainable development:** The term sustainable development refers to betterment of the present generation without hurting the interest of the future generation. Thus the aim of the government through public finance is to maintain a balance between the two. For example excessive borrowing is necessary

for faster economic development but when we are borrowing today the repayment had to be done by the future generation such that they are not hurt in repaying. This is another test of social advantage.

Thus taxation, tax and public expenditure are not bad if they satisfy the different tests of maximization social advantage. Therefore, the principle of maximum social advantage is the basic guidelines on which the principles of public finance are derived.

Therefore, Public Finance be used with judicious and thoughtful planning. The purpose should be to design the policy and operations of public finance so as to achieve the maximum possible social welfare or advantage in the nation state.

Check Your Progress-II

1. What is balanced budget?
2. What are the main differences between public and private finance?
3. What is (a) Public goods (b) Merit goods (c) Private goods
4. Discuss the principles of Maximum social advantage.
5. What is economic stability?

1.7 Let Us Sum Up

Public finance is that branch of economics which deals with principles behind income and expenditure of the government. It differs from private finance in the sense that it aims at maximization of social welfare taking all visible and non-visible welfare. Private finance on the other hand maximization of the individual's interest. Public finance deals with the provisions of public goods which has certain distinct characteristics like indivisibility, non-excludability and non-applicability of pricing principles (example police and defence). It deals with the provision of merit goods, which is a different type of goods having the characteristics of both public and private goods (example primary education). To meet the expenditure, the government resorts to certain type of taxes. Thus, due to operation of public finance both utility and disutility is generated. Therefore, the principle of maximum social advantage is the guiding principle to have a harmonious balance between taxation and public expenditure.

1.8 Check Your Learning

1. What are the tests of Maximum social Advantage? Discuss.
2. Discuss public welfare activities of the Central Government.
3. Discuss the role and significance of Public Finance in modern times.
4. Define Public Finance and distinguish it from Private Finance.

1.9 Key Words

- Public finance:** Public finance deals with identification and appraisal of the income and expenditure policies of the government
- Private finance:** Private finance means the income generation and expenditure process of the private individuals
- Stability of the economy:** It signifies stability in national income, employment, prices, etc.

Public revenue: It includes the income of the government generated by various means like tax, fees, fines, debt etc.

Public expenditure: It deals with the principles through which the public revenue should be spent.

Private goods: Goods which satisfy private wants are known as private goods.

Public goods: Goods which satisfy public wants are known as public goods.

Merit goods: The goods that command overwhelming importance in the attainment of social welfare.

Indivisibility: When the consumption of the one person is equal to the consumption of the each and every person of the society, which is also equal to the total supply, in that case the good is called indivisible.

Non-excludability: No body in the society can be excluded from the consumption of the good. In that case it is said that the good is a public good.

Marginal Benefit: Additional benefit received by the society from a unit increase in public expenditure.

Financial Finance: It deals with activity of the government to stabilize price, income and employment in the country

Deficit Financing: Borrowed by the government from central bank to finance the public expenditure (when revenue is less than expenditure)

Marginal sacrifice: Additional sacrifice made by the society due to unit increase in tax.

Maximum social advantage: The guiding principles behind the optimum size of the tax and public expenditure which maximize the social advantage.

National Income : It is regarded either as money value of total volume of production of goods and services, or the total of all incomes derived from economic activity during a specified period, generally one year.

1.10 Suggested Readings

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1.11 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. Public finance is concerned with identification and appraisal of the income and expenditure policies of the government. It is related to financing of State activities.
2. (a) F; (b) F; (c) F; (d) T; (e) T.
3. When expenditures are more than revenue in the annual budget, it is called as deficit budget. It is different from the surplus budget because in surplus budget revenue is more than expenditure.
4. Borrowings made by the government to finance the deficit budget are known as deficit financing. The government borrows from central bank and other sources.
5. Inter-governmental financial flows are referred as federal finance. Sharing of financial resources is made between central and state governments on the basis of federal finance structure.

Check Your Progress-II

1. When expenditure equals revenue.
2. Public finance relates to the finance of the government with a view to increase the welfare of the people in particular and the society in general. Private finance, on the other hand, relates to the income and expenditure process of private individuals to maximize the satisfaction of private wants.
3. **Public goods:** The goods or services which are collectively consumed by the society as a whole are known as social or public goods. Example: 'defence' and 'police'.
Merit goods: Some goods which command overwhelming importance in the attainment of social welfare, provided through the public budget, but accessed through a price, are called merit goods. Example: primary education.
Private goods: Goods which satisfy private wants and for whose consumption a price is paid are called private goods. Example: food, pens, telephones, mobiles, scooter, etc.
4. A tax imposed by the government is a sacrifice and thus creates disutility, whereas an expenditure incurred creates utility. The tax and expenditure should be managed in such a way that it creates maximum public welfare or advantage in the process of raising revenue and making expenditure for the society as a whole. This is known as principle of maximum social advantage.
5. Economic stability means maintaining full employment with price stability. It is one of the basic tests of social advantage.

Unit-II

PUBLIC EXPENDITURE

Structure

- 2.0 Objectives
- 2.1 Introduction
- 2.2 Meaning of Public Expenditure
- 2.3 Scope of Public Expenditure
- 2.4 Theories of Increasing Public Expenditure
- 2.5 Objectives of Public Expenditure
- 2.6 Reasons of Growth of Public Expenditure
- 2.7 Let Us Sum Up
- 2.8 Key Words
- 2.9 Check Your Learning
- 2.10 Suggested Readings
- 2.11 Hints/Answers to Questions in Check Your Progress

2.0 Objectives

After reading this Unit you should be able to:

- understand the meaning, scope and objectives of public expenditure;
- identify the factors responsible for the growth of public expenditure; and
- appreciate the significance of public expenditure especially in developing countries.

2.1 Introduction

The policies and programmes of the government are welfare-directed, because the state is conceived as a welfare-state. In our economy, the large-scale governmental action is welfare oriented. The goals of a welfare state include a minimum living standard for all citizens, production of social goods and services, control of business cycle, etc. To promote welfare activities, the role of public expenditure is beyond any doubt.

In the previous unit the role of the government was pointed out. The objectives of the government are mainly:

- (i) provisions of public goods;
- (ii) maintenance of stability in the economy;
- (iii) preservation of the community;
- (iv) maintenance of equality; and
- (v) sustainable development.

Thus, to achieve these objectives the government needs to spend. For spending, the government needs resources. The resources required to be spent on achieving the objectives are collected from the society through taxes. With the change in time and increase in the role of government the public expenditure has increased manifold.

2.2 Meaning of Public Expenditures

Public expenditure refers to the expenses which the government incurs for its own maintenance as well as the society and the economy as a whole. The government incurs expenditure for the general well being of the

society by provisioning public and merit goods. In Indian economy private economy private economy plays an important role in production and distribution of goods and services. But private spending does not ensure provisioning of public goods, for private activities are motivated by maximisation rule. The rationale of private expenditure either on consumption or on investment is the pursuit of maximisation of an objective. So the government has to intervene and need to spend for the public welfare. However, public finance depends on both private and public savings which in terms influence production and distribution. In the era of welfare-dominated policies the public expenditure remains vital for the overall progress of humankind apart from the economic betterment. As such, public expenditure is incurred for the benefit of society and economy. The public expenditure is incurred in areas of defence, rural development, sanitation, urbanization, transportation and communication, exploitation of natural resources etc.

2.3 Scope of Public expenditure

The government takes steps to maintain economic stability, promote social justice and furnish a variety of public services which the private economy cannot properly and adequately provide. The increasing role of government in providing public amenities, literacy programmes, rural upliftment programmes, concentration on enhancing living standard of citizens indeed describes the nature and scope of public expenditure. The increasing population has contributed for further study of public expenditure. In reality, the problems of labour exploitation, economic and social injustice have assumed serious proportions in the subject matter of public expenditure. It is worthwhile to note that public finance in general and public expenditure in particular continues to be popular among teachers, students, policy makers and planners as well. There are certain expenditures which the market economy cannot sustain and in that case the role of government is indispensable. Such areas are defence, rural development programmes, mass education, etc. Basically public expenditure is a part and parcel of the economy and its scope is widened day by day due to societal needs and emerging economic diversifications.

2.4 Theories of Increasing Public Expenditure

The theory of public expenditure is more or less related to employment, prices etc. However, various further studies have been made in the field of public expenditure. There are two well known theories of increasing public expenditure. They are Wagner's law and Wiseman-peacock Hypothesis.

Wagner's law :- Adolph Wagner, a German economist, propounded a law known as law of increasing expansion of public, and particularly State, activities on the basis of historical facts. His law states that there are inherent tendencies for the activities of different layers of government to increase both intensively and extensively. The law seeks to establish that there exists a functional relationship between the rate of growth of an economy and the expenditure of the government. The law however, states that the government sector activities increase more rapidly than the economy. This is, as Wagner argues, because of 'social progress' which necessitates more public sector activities. A few examples of such a growth are as follows:

- (i) expansion of traditional functions of government viz, defence administration, justice, etc.;
- (ii) increase in coverage activities of the government like welfare measures;
- (iii) progressive role of government for the general benefit;
- (iv) increasing complexities in modern life;
- (v) going up of secular tendency; and
- (vi) recognition of growing expansion of public goods.

Empirical Evidence

The growth of public expenditure can be visualized by taking the example of India. Table 2.1 gives the total development and non-development expenditure of central and state government in India over the period of time.

Table No.2.1

Year	Total expenditure (Development + Non Development) Rupees in crores	GDP (Rupees in crores)	Total expenditure (as a % of GDP)
1980-81	37879	130176	29.09
1985-86	78627	249547	31.50
1990-91	163240	510954	31.9
1995-96	303582	1073271	28.28
2000-01	595595	1902999	31.29
2004-05	946132	2830465	33.42

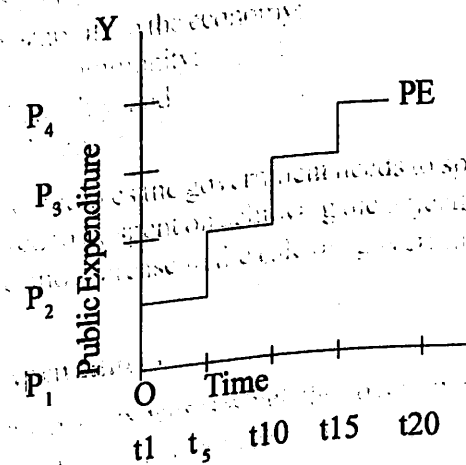
The table of reference shows that between the period 1980-81 and 2004-05 in India public expenditure increased around 25 times and in contrast to increase in GDP of only 21 times. Total expenditure as a percentage of GDP increased from 29.09 % in 1980-81 to 33.42 percent in 2004-05. Thus, it is revealed that the public expenditure in India is growing faster than the national income. Thus, Wagner's law is proved in case of India which states that government sector grows faster than the economy.

Wiseman-Peacock Hypothesis :- The second theory was put forth by Wiseman and Peacock in their study of public expenditure in United Kingdom (UK) for the period between 1890 and 1955. They established that the relative growth of the public sector expenditure in that country occurred on a step-like pattern rather than a continuous growth pattern. They observed that public expenditure enhanced consequent upon social and other disturbances. Their study says that there is insufficient pressure on public expenditure and there is also a constraint of public revenue which restrains an expansion of public activities and also on account of an increase in their intensity and quality.

A hypothesis of Wiseman and Peacock is also important to understand the process of rise in public expenditure of a country. The hypothesis states, as has been mentioned, that public expenditure does not increase in a smooth and continuous manner but in jerks and step-like fashion. Diagram 2.1 reveals the process.

The X-axis of the diagram shows the time and Y-axis shows public expenditure. At the time one the level of public expenditure is OP1 and the level remains constant up to the time period t5. Due to some external events, for example war, public expenditure increases suddenly to OP2. Then, between the time t5 and t10, public expenditure remains at the level of OP2. Again due to some other happening it suddenly increases to OP3. Thus, public expenditure does not increase in a continuous growth pattern. It increases in a step wise manner and the sudden jerk in increase comes from some major disturbance like war, flood, etc.

Diagram 2.1



2.5 Objectives of Public Expenditure

The main aim of a government is to prove itself that it is carrying out activities of a welfare-state. So, it believes in allocating more to the basket of Public Expenditure. The allocation is more in the sphere of social justice, maintaining social equality, upgrading living standard of people and rural people as well, to finance the urbanisation effect, to guard the national boundary and internal policing, etc. In every activity of expenditure it is guided by the pre-determined objectives. It has to see how welfare-state is maximized, citizens derive maximum utility, etc. An additional force which is pushing up for the new and emerging objective of public expenditure is globalization. The gap between rich and poor has been widened. So it is the business of public authority how to tackle the complexities in social and economic administration. That is why one talks about Sarva Shikshya Abhiyan (SSA), old age pension, rural electrification, rural sanitation, technology mission, rural telecommunication, etc. The main target has to have efficient administration to administer public expenditure for achieving the cited objectives. The public consciousness has further pushed up the objectivity and attainment of public expenditures. In the days of right to information we are more vigilant to the public expenditure, its utility and effectiveness.

2.6 Reasons for the Growth of Public Expenditure

- (i) **Increase in the activities of the state:** With the increase in the activities of the government over time gets diversified. For instance, with the increase need of education and health, the government needs to set up school and hospital. For instance, at the time of independence Arunachal Pradesh had only 3(three) schools and now it has about 2000 schools and one University.
- (ii) **Increase in population:** Population of a country plays an important role in the rapid growth of public expenditure. For instance, in 1981, the population of India was 81 crores which has increased to more than 100 crores in 2001. Thus the rise in population forces the government to increase more supply of public goods, as a result public expenditure increases rapidly.
- (iii) **Urbanisation:** Rapid urbanization process compels the government to increase expenditure in the fields of water supply, electricity, roads and communications, etc.
- (iv) **Rising prices:** Inflation also compels the government to increase public expenditure because due to price rise value of money declines. Therefore, to maintain the real level of expenditure the government has to increase expenditure.
- (v) **Political reasons:** Political reasons force the government to increase expenditure. For instance, due to large scale prevalence of poverty the government has to give food subsidy, support to the farmers in the form of fertilizer subsidies, etc. These subsidies may not have economic rationale. But they are important because the political parties are dependent on the vote banks, where farmers constitute a major chunk. Thus, due to political reasons the government has to increase public expenditure in order to continue to be in power.
- (vi) **Defence factor:** Defence expenditure is a must for each and every country. In India it is a major item of expenditure constituting around 20 per cent of budget of the central government. With the rise in militarization of the neighbouring countries like Pakistan and China, India has to equip itself with better military hardware and technology in order to protect itself from its neighbour. The defence is a major reason why public expenditure of a country increase over time.
- (vii) **Welfare state:** The main aim of a government is to prove itself that it is a welfare state. That is why it has to increase expenditure in terms of old age pension, unemployment allowances, free education, child welfare, etc. As a result the public expenditure increases overtime.

Check Your Progress-I

1. What is meant by public expenditure?
2. Discuss the main reasons behind the increase in public expenditure.
3. Explain Wagner's law.
4. Explain Wiseman - Peacock hypothesis.
5. What is welfare state?
6. Discuss the role of Public authority in globalised era.

2.7 Let Us Sum Up

Public expenditure is the main activities of the government to achieve different objectives like growth and stability of the economy, equity, preservation of the society, sustainable development, etc. In order to achieve these objective public expenditure increases rapidly. Wagner's law postulates that government expenditure grows faster than the growth of national income mainly due to increase in its responsibility. Apart from this, due to other reasons like population growth, urbanisation, welfare state, inflation, political reasons, public expenditure increases rapidly.

Wiseman-Peacock hypothesis explains the stepwise growth of public expenditure. They argue that sudden increase in public expenditure takes place due to extraneous reasons like war, flood, etc. Then the level of expenditure remains stagnant for some time. But due to some disturbances expenditure of the government increases in a jerk and step-like fashion.

2.8 Key Words

Public expenditure	:	Expenditure incurred for well being of public and maintenance of government
Wagner's Law	:	It states that there is a functional relationship between the growth of an economy and relative growth of public expenditure.
Wiseman- Peacock hypothesis:	:	It states that public expenditure increases in a step-like pattern.
Globalisation	:	Opening up economy to multinational companies.
Welfare-State	:	The state that is more concerned with the welfare of its citizens. A welfare state differs from a police state in which the major concern of the government is to maintain law and order.

2.9

Check Your Learning

1. What is meant by public expenditure?
2. Discuss the main reasons behind increase in public expenditure.
3. Explain Wagner's law.
4. Explain Wiseman - Peacock hypothesis.
5. What is a welfare state? Why public expenditure is important in a welfare state?
6. Discuss the role of public expenditure in a developing economy.

2.10 Suggested Readings

- Bhatia, H.L. : Public Finance, 1998, Vikas Publishing House Pvt. Ltd, New Delhi.
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2.11 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. Public expenditure is incurred by the government for 'social progress' and to correct irregularities of market economy. The important public expenditure areas are defence, rural development, urbanization, transportation and communication etc.
2. Day to day public expenditure is increasing due to urbanization, increasing gap between rich and poor, rise in population, defence, modernization, increasing concern to rural development.
3. Wagner's law is related to increasing state activities which lead to rise in public expenditures. His law states that there are inherent tendencies for the activities of central and state governments. All these activities lead to rise in public spending.
4. Wiseman-Peacock Hypothesis is a study on public expenditure conducted in UK for the period between 1890 and 1955. This hypothesis tells that public expenditure is enhancing due to social and other disturbances. The revenue constraints limit the public spending. However, government spending increases due to immediate expansion of government activities.
5. In a welfare state, the government's primary duty is to take care of public welfare. In our country large scale government activities are welfare oriented in areas of preservation of society, sanitation, drinking water, child and woman welfare, welfare of rural and weaker sections of society, etc.
6. The role of public authority is more important in the era of globalization. The government has to take up policy measures in the areas of rural development, labour issues (blue collar workers), creating employment and self employment opportunities. The government has to take care of indigenous communities, small scale industries, farmers, small and marginal investors etc. in the globalised economy.

Unit-III TAXATION

Structure

- 3.0 Objectives
- 3.1 Introduction
- 3.2 Sources of Public Revenue
- 3.3 Canons of Taxation
- 3.4 Direct and Indirect Taxes
- 3.5 Characteristics of Good Tax System
- 3.6 The Benefit and Ability-to-Pay Approach.
- 3.7 The Shifting and Incidence of Tax
- 3.8 Let Us Sum Up
- 3.9 Key Words
- 3.10 Check Your Learning
- 3.11 Suggested Readings
- 3.12 Hints/Answers to Questions in Check Your Progress

3.0 Objectives

The objective of the Unit is to introduce you to the income of the government. You have learned that income and expenditure of government are two sides of the public finance. After knowing the different heads of expenditure incurred by the government it is now essential to learn about the different sources of the government income, that is, public revenue. Here you will learn about the followings:

- the different sources of public revenue;
- principles of taxation;
- classification of taxes;
- the benefit and ability to pay principle of taxation; and
- sharing of tax burden between the buyers and sellers.

3.1 Introduction

Public expenditure and public revenue are the subject matter of public finance. To meet the public expenditure government has to raise its revenue. The government may earn its income from various sources. These sources are of two types: tax and non-tax sources. In raising revenue government must follow certain principles or canons because a tax may affect the people in various ways. However, the impact of a tax depends upon the nature of the tax. A tax may be direct or indirect. Direct tax like income tax is different from the indirect tax such as custom duties. Whatever may be the kind of a tax, a principle has to be followed in collecting it. There are two principles- Benefit Principle and Ability-to Pay Principle of taxation. According to the benefit principle, a tax -payer should pay the tax equal to the benefit s/he receives from the government. While ability to pay principle states that, the amount of tax should be in proportion to the ability to pay of the taxpayer. The burden of a tax is generally shared among the buyers and sellers depending upon the elasticity of demand and supply.

3.2 Sources of Public Revenue- Tax and Non-Tax Revenue

There are a number of sources from which a modern state collects its revenue. Broadly speaking, the government revenues can be classified as (1) Tax Revenue and (2) Non-Tax Revenue.

Tax revenue is derived from various taxes: (a) Direct taxes, e.g. income tax, wealth tax, gift tax, expenditure tax, etc. (b) Indirect taxes, e.g., custom duties, excise duties, sales tax, etc.

Non-tax revenue is obtained from public undertakings called prices and other miscellaneous receipts. The major sources of Government revenue are taxes and prices. The minor sources are fees, special assessment, fines, forfeitures and escheats, gifts and grants.

Tax

Taxes are compulsory levies on private individuals and organizations made by Government to raise revenue in order to defray the expenses incurred in conferring common benefits upon the residents of the state. Thus, the essence of a tax is (a) that it is a compulsory levy under certain conditions, and (b) it is meant for the general purposes of the state. The individual can not expect that the state should render him a specific service or benefit in return to the tax paid by him. The taxes are intended to meet the general expenses of the government which confer a common benefit.

Price

In modern times, public sector occupies a very important place in the economy. The government has to launch public enterprises when private sector is either unwilling or unable to enter certain fields because the return is either uncertain or it takes a long time to mature, such as multi purpose projects, railways, hydroelectric works, water works, huge iron and steel works. Government does not supply these services or goods manufactured in state undertakings free but charge a price like private enterprise. When public authority sells a commodity or renders a service, the charge made on the consumer, who avails of the service or buys a commodity, is called a price. Though public sector, at present, has been transforming under new economic policy regime, incomes from public enterprises constitute a substantial source of public revenue.

Fee

It is also a compulsory payment made by those obtain a definite service in return. The fee is intended to cover a part of the cost of the service rendered by the government keeping in view some public purpose. A good example is of the educational fees. In short, a fee is charged for a specific service which is rendered primarily in public interest. A license fee, however, is much more the cost of service, and there is not much of a positive service in return.

The difference between a fee and a price is that in a fee public interest is prominent, whereas a price is a payment for a service of business character. e.g., charges for traveling on state railways. One can escape the price by not purchasing a service. Price also differs from a tax. A tax is paid for a common benefit, whereas both fees and prices are paid for specific benefits.

Special Assessment

A tax imposed for a special purpose is called special assessment. Suppose government builds a road or makes suitable drainage arrangements in a town, as a result all the property in the neighbourhood will appreciate in value. In such a case government can impose a special tax on property in the neighbourhood which will appreciate and this special tax is known as special assessment.

Special assessment is compulsory like a tax. Thus the essence of a special assessment: (a) there is the element of special purpose; (b) the special benefit is measurable; (c) these assessments are proportional to benefit received; (d) they are for specific local improvements; and (e) they are intended to extend or improve the present service. Unlike a fee, there is an element of coercion in special assessment.

Rates

Rates are levied by local bodies, i.e., municipalities and district boards, for local purposes. They are generally levied on immovable property of the residents but not necessarily for any special improvements effected or special benefits conferred. The rates generally vary from locality to locality.

Fines

Fines are imposed as a penalty for breaking the law. A fine is compulsory like a tax but it is imposed more as a deterrent than as a source of revenue.

Forfeitures

By rule a sum of specified amount of money is deposited in Government's fold for certain purposes. For example, if an under trial jumps a bail or a party to contract fails to carry his part of the contract, the money deposited to the Government is forfeited.

Escheat

When a person dies heirless or without a successor or leaves no will behind his property or assets will go to the state. This claim of the state to a deceased's assets is called escheat.

Grants and Gifts

Grants are given by a government at a higher level to that at the lower level, e.g. from the Central Government to the State Government. These are given for a specific purpose, e.g. for economic development or some public work or for public health or education.

Gifts are received either from governments or some private bodies or individuals. Gifts are sometimes received from foreign government for relief in natural calamities like earthquake, floods, drought, cyclones, etc. Donations are given by individuals for specific purposes such as building a hospital or relief fund.

Check Your Progress- I

1. What is Tax?
2. Distinguish between tax and price.
3. What do you mean by fee?
4. Distinguish between price and fee.
5. Compare tax and special assessment.
6. What is escheat?
7. Define forfeitures.

3.3

Canons of Taxation

A good tax system must fulfill certain principles if it is to raise adequate revenue and to accomplish certain social objectives. Adam Smith had explained four canons or principles of taxation which he thought a good tax must fulfill. These four canons are (1) Equity, (2) Certainty, (3) Convenience, and (4) Economy.

However, since Adam Smith activities and functions of modern Government have increased enormously. Now, the governments are expected to maintain economic stability at full employment level, they are to reduce inequalities in the income distribution, and they are also to perform the function of the welfare state. Above all, they are to promote economic growth and development, especially in the developing countries, not only through encouraging private enterprise, but to undertake the task of production in some strategic industries. Keeping in view these functions of the government, the modern economists have added other principles which taxation system of a country must satisfy if the objectives of the Governments are to be achieved. The additional canons are (5) Productivity, (6) Elasticity, (7) Flexibility, (8) Simplicity, (9) Diversity, and (10) Taxation as achievement of social and economic objectives. The canons of taxation are discussed below.

1. Canon of Equality

According to the canon of equality, every person should pay to the Government according to his ability to pay, that is in proportion of the income or revenue which he enjoys under the protection of the state. Thus under the tax system based on equality principle the richer persons in the society will pay more than the poor. This is the most important canon of taxation as it embodies the principle of equity or justice. What this canon really means is the equality of sacrifice. The amount of tax paid is to be proportional to the respective abilities to the tax payers. This clearly points to progressive taxation.

2. Canon of Certainty

This is another principle of good tax system.

According to this canon the tax which each individual is bound to pay ought to be certain and not arbitrary. The time of payment, the manner of payment, the quantity to be paid ought all to be clear and plain to the contributor and to every other person. Uncertainty in taxation, according to Adam Smith, encourages corruption. The canon of certainty demands that there should be no element of arbitrariness in a tax. It is not to be left to the caprice or the sweet will of the tax department.

Certainty is needed not only from the point of view of the tax-payer but also from that of the state. The Government should be able to estimate roughly the proceeds of the various taxes proposed to be levied and the time when they are expected to flow in. Only then the Government can follow its financial programme.

3. Canon of Convenience

The canon of certainty says that the time and manner of payment should be certain whereas the canon of convenience requires that the time of payment and the manner of payment should be convenient to the contributors. If a tax on land or house is collected at a time when rent is expected to be paid and acceptable by cheque, the manner is convenient, but not so if it is to be paid personally to the existing authority. In the latter case, there will be a lot of inconveniences and harassment.

Taxes imposed on consumers for purchases are very convenient. The consumer pays them when he makes purchase and at a time when he can afford to pay because the purchaser chooses his own time for purchasing. The manner is also very convenient for he has to make no special arrangement for paying a tax. He pays it when he buys the commodity. The tax is wrapped up in the price of the commodity. Also the Indian land revenue conforms to the canon of convenient, because it is paid in installment and after the harvesting.

4. Canon of Economy

The government has to spend money on collecting taxes levied by it. Since collection costs of taxes add nothing to the national product, they should be minimized as far as possible. If the collection cost of a tax is more than the total revenue yielded by it, it is not worthwhile to levy. More complicated a tax system, more elaborate

administrative machinery will be employed to collect it and consequently collection costs will be relatively higher. Therefore, even for achieving economy in the tax collection, the taxes should be as simple as possible.

In broader sense, a tax is economical if it does not hamper in any manner the economic progress of the country. It would infringe the canon of economy, if it retarded the development of trade and industry in any manner. If income is subjected to a heavy tax, saving may be discouraged, capital will not accumulate and the productive capacity of the community will be seriously impaired. This would obviously be uneconomical.

5. Canon of Productivity

An important principle of a good tax system for a developing country is that it should yield adequate amount of resources for the Government so that it should be able to perform its increasing welfare and development activities. If the tax system fails to yield enough resources, the government will resort to deficit financing. An excessive dose of deficit financing is bound to raise prices which are harmful for the society. To make the tax system productive it should be broad based and both direct and indirect taxes find place in it. At the same time Government should avoid to raise more revenue by a tax system that may impair the productive capacity of the community and hence the development.

6. Canon of Elasticity

According to the concept of elasticity of taxation system, as national income increases as a result of economic growth, the Government revenue from taxes should also increase. The other aspect of this canon is that the Government should be in a position to augment its financial resources to meet an emergency or a period of stress and strain. Some of the taxes should be capable of yielding more if need be. Income tax is a very good example of an elastic tax. By raising the rate a bit or by levying a surcharge, the yield from income-tax can be considerably increased.

7. Canon of Flexibility

The canon of flexibility looks like that of elasticity but there is a difference between the two. Flexibility means that there should be no rigidity in the tax system. So that it can be quickly adjusted to new conditions, and elasticity means that the revenue can be increased. Unless the system is flexible, the revenue can not be increased. Thus, presence of flexibility is a condition for elasticity. If a tax system can't be altered at the time of emergency, it lacks flexibility.

8. Canon of Simplicity

According to this canon a tax system should be simple, plain, and intelligible to the common understanding. This canon is essential if corruption or oppression is to be avoided. If a tax is complicated so that the tax payer can not understand, a great power will pass into the hands of the tax collectors.

9. Canon of Diversity

A good tax system should follow the principle of diversity. This implies that there should not be a single or a few taxes from which government seeks to raise large revenue. This is because if a government tries to get large revenue from a single tax or few taxes, it will have to raise the rates of taxation too high which will not only adversely affect the incentives to work, save and invest but also encourage evasion of taxes. Therefore, a tax system should be a multiple tax system with a large variety of taxes so that all those who can contribute to the public revenue should be made to do so. This calls for a mix of various direct and indirect taxes. With the diverse tax system, the principles of fiscal adequacy and equity will also be better satisfied.

10. Taxation as Achievement of Social and Economic Objectives

Another important principle of good taxation is that of achieving the social and economic objectives that the community has placed before itself. In the world of today, taxation is not just a means of raising revenue for the limited functions of the state. Tax system today has to play a more positive role. It is intended to bring about rapid economic growth, reduce inequalities of incomes, promotes stability and to achieve other socio-economic objectives of the government.

Check Your Progress -II

1. What do you mean by canons of taxation?
2. Explain the concept of progressive taxation.

3.4 Direct and Indirect Taxes

Taxes are classified as direct or indirect depending upon the shifting of tax burden. Direct taxes are those which are levied directly on the individuals and firms and their burden is borne by those on whom they are levied. Personal income tax, corporate income tax, wealth tax, expenditure tax, gift taxes are some examples of direct taxes. On the other hand, indirect taxes are levied on production and sale of commodities and services. A part or whole of the burden of an indirect tax is passed on to the consumers. Some of the examples of the indirect tax are excise duties on the production of commodities, sales tax, service tax, tax on railway or bus fare. Both types of tax system have some merits and demerits, which are explained below.

3.4.1 Merits of Direct Taxes

- i. Equitable:** Direct taxes are more equitable as progression can be applied to them. The rate of the tax is varied to make the tax conform to the ability to pay.
- ii. Economical:** They are economical as the cost of collection is small as there is no intermediary between the tax-payer and the state.
- iii. Certain:** The yield of direct taxes can be calculated with a fair degree of precision. The tax payer is also certain of the amount that he has to pay.
- iv. Elastic:** Direct taxes have a high degree of elasticity. Income tax has remarkably responded to the enormously enhanced needs of the state of defence and development.
- v. Civic consciousness:** Direct taxes create a civic consciousness among the tax payers. A man who pays direct tax feels that he is contributing towards the state expenditure.
- vi. Reduction of inequalities:** Progressive direct taxes are used as an instrument for the reduction of economic inequalities. The rich persons are called upon to pay taxes at a higher rate so that the gulf between the rich and the poor is narrowed down.

3.4.2 Demerits of Direct Taxes

- i. Inconvenient** : Direct taxes are very inconvenient to pay. Every tax-payer feels the pinch. The tax has to be paid in a lump sum; the filling of returns is a complicated affair; and there is a lot of harassment.
- ii. Unpopular** : Direct taxes are very unpopular. Nobody likes to pay them because there is no direct relation between tax payment and benefits.

- iii. Evasion** : They can be easily evaded and the state defrauded of its due.
- iv. Arbitrary** : The direct taxes are arbitrary in the sense that the rates of taxes are fixed arbitrarily by the government as the rates are not determined on any scientific principle but political consideration.

3.4.3 Merits of Indirect Taxes

- i. Convenient** : An indirect tax is convenient. We pay the tax when we buy a commodity, and at a time when we can afford it. It is paid in small trickles rather than in a lump sum. The tax-payer does not feel that he is paying it. The tax is wrapped in the price of the commodity he buys.
- ii. No Evasion** : It is very difficult to evade an indirect tax, because it is mixed up with the price of the commodity one purchases.
- iii. Equitable** : Indirect taxes can be made more equitable by being imposed on articles generally consumed by the rich. That is why luxury goods are generally taxed at a higher rate.
- iv. Elastic** : When imposed on necessities of life or articles for which the demand is inelastic, indirect taxes are also fairly elastic. They can, therefore, be varied according to the needs of state.
- v. Beneficial Social Effects:** indirect taxes have a beneficial social effect in that the consumption of harmful drugs and intoxicants can be discouraged by means of such taxes.
- vi. Capital Formation** : Indirect taxes are levied on the consumption of commodities. In this way, consumption is reduced. The savings so made can be invested in some productive employment.
- vii. Wide Coverage** : Indirect taxes can be levied on a large number of commodities. In this way, larger sections of consuming public can be made to contribute to the public exchequer.
- viii. Productive** : Since they can be given a wide coverage, indirect taxes can be very productive. It is the Indian experience that Union excise duties and sales tax have yielded very substantial revenue and have become the mainstay of the respective governments.

3.4.4 Demerits of Indirect Taxes

- i. Uncertain** : Indirect taxes are uncertain. It is not always possible to anticipate the various repercussions of a tax imposed on a commodity. It is difficult to calculate precisely the estimated yield of a tax.
- ii. Regressive** : They are regressive. Every consumer of the taxed commodity, rich or poor, pays the tax at the same rate. Therefore, the real burden on the poor is greater than on the rich as higher proportion of the income of poorer section is spent in buying the necessities than that of the rich.

- iii. No Civic Consciousness: Indirect taxes do not develop any civic consciousness in the tax-payer, because nobody feels that he is paying tax as it is concealed in price.
- iv. Uneconomical : Many indirect taxes are uneconomical because collection expenses are very high.
- v. Inflationary : The indirect taxes have one serious danger especially in developing countries, viz., the contribution to the inflationary pressures in the economy because they raise the prices.
- vi. Evasion : Certain of the indirect taxes are easily evaded. For example if a tax is levied on the farm product, the portion consumed by the grower escapes taxation.

Check Your Progress-III

1. What is direct tax?
2. Why income tax is a direct tax?
3. Explain the term equality.
4. What is indirect tax?
5. What is custom duties? What types of tax is this?

3.5 Characteristics of Good Tax System

A good tax system should be composed of taxes which conform to the canons of taxation discussed earlier. The following are the basic characteristics of a good tax system.

- i. The tax system should be capable of yielding adequate revenue.
- ii. The distribution of tax burden should be equitable. Everyone should be made to pay his fair share of the tax burden.
- iii. The incidence of the tax must be certain and progressive.
- iv. Such taxes should be chosen that interfere least with economic decisions. In other words, the taxes levied impose minimum excess burden.
- v. The good tax system facilitates the use of fiscal policy for stabilization and growth objectives.
- vi. The tax system should permit fair and non-arbitrary administration and it should be understandable to the tax payer.
- vii. Administrative and compliance costs should be as low as is compatible with other objectives.

3.6 The Benefit and Ability-To-Pay Approach

An important question widely discussed in the subject of public finance is what kind of tax system is fair, just or equitable. We have seen that equity is the most important canon of taxation. It is ethically desirable that taxes should be equitable. Equitable distribution of tax burden is defined as equity. It means that each tax payer should contribute his "fair share" to meet the cost of government.

Equity is generally classified into (i) horizontal equity and (ii) vertical equity. By horizontal equity is meant the equal treatment of equals. Vertical equity refers to unequal treatment of unequals. Both constitute part of the

same principle of equal treatment. There are two approaches put forward to devise a fair and equitable tax system. They are (1) the benefit principle and (2) the ability-to-pay principle.

3.6.1 The Benefit Principle

According to this theory of taxation, citizens should be asked to pay taxes in proportion to the benefits they receive from the services rendered by the Government. This theory is based on the assumption that there is an exchange relationship between the tax payer and Government. The government confers some benefits on the tax payers by performing various services or providing them what are called social goods. In exchange of these benefits individuals should pay taxes to the government. Further, according to this theory, equity or fairness in taxation demands that an individual should be asked to pay a tax in proportion to the benefits he received from the services rendered by the Government.

But the crucial problem of this theory is that it is very difficult to measure the benefits received by an individual from the services provided by the Government. Secondly, most of the government expenditure is incurred on common indivisible benefits so that the division of benefits of government expenditure is not possible.

However, the benefit principle is applicable only in cases where the beneficiaries can be clearly identified. Thus benefit principle is applied to the collection of road tax from vehicle owners. This is also applied when local bodies collect special levies for the services such as construction of sewers and roads they render to the people of their locality. To conclude, therefore, "at best the benefit principle can provide a partial solution to the problem of fairness in taxation."

3.6.2 The Ability-To-Pay Principle

Ability-to-pay principle states that individuals should be asked to pay taxes according to their ability to pay. The rich have greater ability to pay; therefore they should pay more tax to the Government than the poor. Essentially, the ability to pay approach to fairness in taxation requires that burden of tax falling on the various persons should be the same. The two concepts of equity-horizontal equity and vertical equity are based on the principle of ability to pay. According to the concept of horizontal equity, equals should be treated equally, that is, persons with the same ability to pay should be made to bear the same amount of tax burden. According to the vertical equity, unequals should be treated unequally, that is, how the tax burden among people with different abilities to pay be divided. However, the question is; what is the measure of a person's ability to pay?

One measure of ability to pay is the sacrifice made by a tax payer when pays tax to the Government. In paying a tax, a person feels a pinch or suffers from some disutility. This pinch or disutility felt by a tax payer is the sacrifice made by him. Here tax burden is measured in terms of sacrifice of utility made by the tax payers. The following three principles of sacrifice have been put forward.

1. The Principle of Equal Absolute Sacrifice;
2. The Principle of Equal Proportional Sacrifice; and
3. The Principle of Equal Marginal Sacrifice (or Minimum Aggregate Sacrifice)

Equal Absolute Sacrifice

The Principle of equal absolute sacrifice implies that the tax burden in terms of utility sacrificed should be the same for all tax payers. Mathematically, equal absolute requires $U(Y) - U(Y-T)$ equal for all persons. Where U stands for total utility, Y stands for income and T is the amount of tax paid.

Then the term $U(Y)$ implies the total utility of a given income Y and $U(Y-T)$ implies the total utility of the post-tax income $(Y-T)$. If the equal absolute sacrifice principle is applied, everybody will pay same amount of tax. Equal absolute sacrifice principle will suggest progressive/proportional income tax, if the fall in marginal utility of income is greater/equal than the rate of increase in income.

Equal Proportional Sacrifice

This principle requires that every person should be made to pay so much tax that the sacrifice of utility as a proportion of his income is the same for all tax payers. This implies that

$$\frac{U(Y) - U(Y-T)}{U(Y)}$$

If a person enjoys higher income is to bear same proportion of sacrifice, then given the falling marginal utility of income, he will have to pay income tax at a higher rate. This means equal proportional sacrifice ensures progressive income tax.

Equal Marginal Sacrifice

According to this principle, tax burden should be so apportioned among various individuals that marginal sacrifice of utility of each person paying the tax should be the same. This approach seeks to minimize the aggregate sacrifice of the society as a whole. In terms of notations it can be expressed as

$$\frac{dU(Y-T)}{d(Y-T)}$$

where d stands for change.

So, $dU(Y-T)$ is the change in utility arising from $(Y-T)$. When all persons pay so much tax that their marginal sacrifice of utility is the same, the loss of total utility by the society will be minimum. Thus, the principle of equal marginal sacrifice looks at the problem of dividing the tax burden from the point of view of welfare of the whole society. The equal marginal sacrifice rule leads clearly to progressive taxation.

Check Your Progress-IV

1. Explain horizontal equity.
2. What do you understand by vertical equity?
3. Define equal absolute sacrifice.
4. Explain equal proportional sacrifice.
5. Examine equal marginal sacrifice.

3.7 Shifting And Incidence of Tax

When a tax is imposed it is important to know who bears the money burden of the tax and in what proportion. The incidence of taxation refers to this question of who and in what proportion bears the final burden of the tax. That is, incidence means the final resting place of a tax. The concept of incidence arises because taxes are not always borne by the people who pay them in the first instance. This is because a tax can be shifted or transfer to others. In this context it is necessary to distinguish between impact and incidence of a tax. The impact of a tax is said to be resting on the person or firm who pays the amount of the tax and thus receives the initial burden, the incidence of a tax rests on the person or firms who ultimately bears the money burden of the tax. If a person or a firm who pays the tax to the Government is also one who ultimately bears it, then the impact and incidence of the tax rests on the same person or firm. In such a case, there is no shifting. For example, if an excise

duty is imposed on sugar, it is paid in the first instance by the sugar manufacturer; the impact is on him. But the firm can add duty to the price of the sugar, which, through a series of transfers, will ultimately fall on the consumers of sugar. The incidence is, therefore, on the consumers of sugar. If it fails to add duty, the sugar firm will have to bear both the impact and incidence of the tax.

Shifting of tax burden

The burden of the tax can be transferred to others through a process of shifting. Thus, shifting is a process through which a tax payer escapes the burden of a tax. Whether shifting is possible, or if it does so how much tax burden can be shifted depends on a number of factors such as the nature of tax, market conditions, costs condition (increasing, decreasing, or constant), and elasticity.

Elasticity and Division of Tax Burden

The question of tax shifting specially arises in the case of indirect taxes, that is, taxes on the production and sale of goods such as excise duties and sale taxes. In this regard, whether and to what extent a tax on commodity can be shifted depends on the price elasticity of demand for and supply of a commodity. In other words, price elasticity (both demand and supply) determines the share of tax burden because these elasticities determine the bargaining strengths of the buyers and sellers of the taxed commodity. Sellers can shift the tax burden to the buyers if they are able to reduce the supply of the commodity and thereby raise its price. Thus, the power to shift the tax depends on the elasticity of supply of the taxed commodity. The greater the elasticity of supply, the smaller is the extent to which the tax will be shifted to them. Under condition of perfect completion the incidence of a commodity tax is shared between the sellers and buyers in the ratio of the elasticity of demand and supply. This is explained with the help of the following diagram:

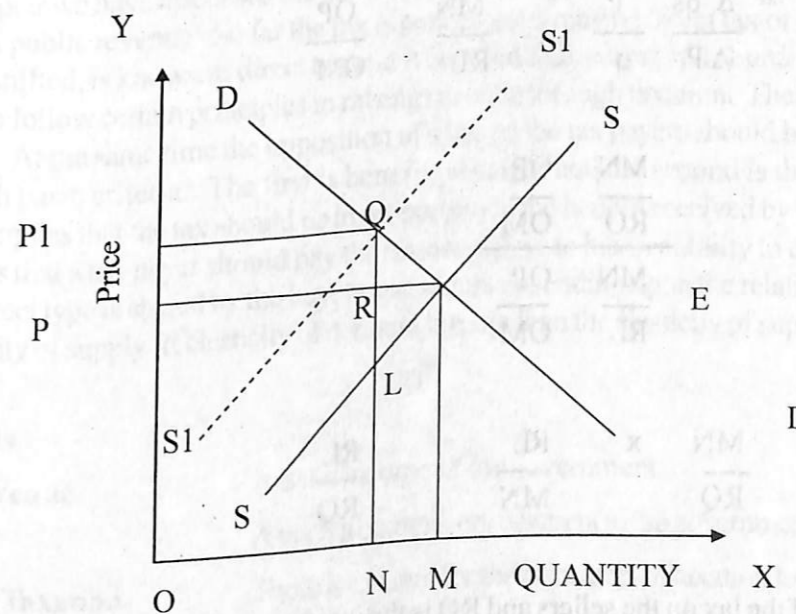


Fig 3.1. Incidence of a Tax

DD is the demand curve for the commodity and SS is its supply curve before the imposition of tax on it. Intersection between demand and supply curves at E determines equilibrium price (OP) and quantity (OM). Suppose a unit sale tax is imposed on the commodity by the government equal to LQ. This will raise the supply price of the commodity by the sellers as the unit tax SS1 will now be included by the sellers in their supply price. As a result, the supply curve will shift to the left, say to S1S1. The new supply curve S1S1 intersects the demand curve DD at the point Q and determines the equilibrium price OP1 and quantity ON. It shows that the price for the buyers has risen by PP1 or RQ whereas tax per unit is LQ which the sellers will bear. The buyers will bear the burden of a tax to the extent of increased price. Thus, the incidence of the tax borne by the buyers will be equal to RQ. The remaining part of the tax RL will be borne by the sellers. Now, it can be shown that the incidence of the tax RL and RQ on the sellers and buyers respectively is equal to the ratio of the elasticity of demand and the elasticity of supply.

$$\frac{RL}{RQ} = \frac{\text{Incidence of tax on the sellers}}{\text{Incidence of tax on the buyers}}$$

Elasticity of demand when price increases from OP to OP1 in the fig 3.1 will be

$$e_d = \frac{\Delta qd}{\Delta P} \cdot \frac{P}{q} = \frac{MN}{RQ} \cdot \frac{OP}{OM}$$

Similarly, elasticity of supply when the price received by the sellers falls from OP or ME to NL and the quantity sold declines from OM to ON, can be calculated as

$$e_s = \frac{\Delta qs}{\Delta P} \cdot \frac{P}{q} = \frac{MN}{RL} \cdot \frac{OP}{OM}$$

$$\begin{aligned} \text{Then,} \quad & \frac{MN}{RQ} \cdot \frac{OP}{OM} \\ &= \frac{MN}{RL} \cdot \frac{OP}{OM} \end{aligned}$$

$$= \frac{MN}{RQ} \times \frac{RL}{MN} = \frac{RL}{RQ}$$

Since RL is the incidence of the tax on the sellers and RQ is the incidence of tax on buyers, we find that

$$\frac{RL}{RQ} = \frac{\text{incidence on sellers}}{\text{incidence on buyers}} = \frac{\text{price elasticity of demand}}{\text{price elasticity of supply}}$$

To conclude, to what extent the burden of the tax will be shifted and the proportion in which the buyers will share the incidence of a commodity depends on the elasticities of demand and supply. What exactly incidence of tax on buyers RQ and incidence of tax on sellers RL will be equal to the ratio

$$\frac{e_d}{e_s} = \frac{RL}{RQ}$$

If the elasticity of demand for a commodity is zero, then the incidence of tax on the sellers RL will be zero and the incidence of tax RQ on buyers will be equal to the whole tax per unit. On the other hand, if the elasticity of supply is zero, then the incidence of tax on sellers RL will be equal to the whole amount and the incidence on the buyers is zero.

If elasticity of demand is infinity then it follows that the whole burden of the tax will fall on the sellers. On the other hand, if elasticity of supply is infinity, then the whole burden of the tax will fall on the buyers.

Check Your Progress-V

1. What is shifting of a tax?
2. What is incidence of a tax?
3. What is burden of a tax?
4. Why impact and incidence of direct tax is the same?

3.8 Let Us Sum Up

In this chapter we have discussed the various sources of public revenue. We have also discussed tax and non-tax sources of public revenue. So far the tax is concerned it may be direct tax or indirect tax. A tax, whose burden cannot be shifted, is known as direct tax and it is called indirect tax if its burden is possible to be shifted. Government has to follow certain principles in raising revenue through taxation. These principles are known as canons of taxation. At the same time the imposition of a tax on the tax payers should be based on certain criteria. There are two such basic criteria. The first is benefit principle and the second is the ability to pay principle. Benefit principle implies that the tax should be in proportion to the benefit received by the tax payer and ability to pay principle refers that a tax payer should pay the tax according to his/her ability to do so. The burden of a tax particularly of indirect type is shared by the buyers and sellers depending upon the relative strength of elasticity of demand and elasticity of supply. If elasticity of demand is more than the elasticity of supply higher burden will fall on the sellers.

3.9 Key Words

Public Revenue	:	It is the income of the government.
Tax	:	A tax is a compulsory payment to the government by the citizen if imposed.
Canons of Taxation	:	These are meant for the principles of taxation followed by the government while it is imposed.
Direct Tax	:	Direct Taxes are those which are levied directly on the individuals and firms and the entire burden is borne by those on whom they are imposed.
Indirect Tax	:	Indirect taxes are those which are levied on production and sale of commodities and their burden can be shifted.

Benefit-theory of Taxation: According to this theory of taxation, citizens should be asked to pay taxes in proportion to the benefits they received from the service rendered by the Government

Ability-To-Pay-Principle: It implies that the individuals should be asked to pay taxes according to their ability to pay.

Incidence of Tax : It means that who and in what proportion bears the final burden of a tax.

Impact of Tax : This is the initial burden of tax on a person or firm.

Tax burden : The amount of money paid as tax by the tax-payers to the Government

3.10 Check Your Learning

1. Write the different source of public revenue.
2. Explain briefly the various canon of taxation.
3. Discuss critically the Benefit Received Theory of Taxation.
4. Explain the various criteria of ability-to-pay which is the best index of ability to pay.
5. Distinguish between direct and indirect taxes. What are the relative advantages and disadvantages of the direct and indirect taxes?
6. Briefly note the basic characteristics of good tax system.
7. What is meant by the term "incidence of tax"? Differentiate between the impact and incidence of a tax.
8. Discuss the incidence of a tax under pure competition. To what extent a firm can shift the burden of a tax on the consumer?

3.11 Suggested Readings

- Chowdhury, R.K. Public Finance, Kalyani Publishing House, Mumbai.
- Herber, B.P., Modern Public Finance, 1988, Richard D. Irwin, Inc. Home wood, Illinois, All India Travelles Book seller, Delhi.
- Prest, A.R., Public Finance in Theory and Practice, 1975, Weidenfield and Nicolson, London.

3.11 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. A compulsory levy imposed by the government to private individuals and organizations.
2. A tax is imposed by the government without rendering any service or commodities whereas price is a charge on individuals or organization for purchase of goods and services. A tax is a compulsory payment while price is always a voluntary payment.
3. A compulsory payment to the government made by those who obtain a service in return.
4. A fee is charged for a specific service which is rendered primarily in public interest whereas price is a payment for the purchase of goods and services.

5. A tax is a compulsory levy and if this tax is levied in proportion to the special benefit derived to defray the cost then it is called special assessment tax.
6. Escheat is the claim of the state to a deceased's assets if s/he dies without a successor or heir.
7. Specified amount of money deposited in government's fold for certain purposes.

Check Your Progress-II

1. Canons of taxation refer to the principles of raising revenue keeping social objectives in mind.
2. A tax where the tax amount rises more than proportionally in response to the rise in income.

Check Your Progress-III

1. A direct tax is that tax which is legally paid by the persons on whom it is imposed. The burden of the tax falls on the person who paid it.
2. Income tax is imposed on the income of the person directly who pays it and bears the burden.
3. Every person should pay tax according to their ability to pay.
4. Indirect tax is a tax which is levied indirectly on production and sale of commodities and services. It is imposed on a person but paid partly or wholly by another.
5. Custom duties is a tax imposed on imports. It is an indirect tax.

Check Your Progress-IV

1. When a tax payer escapes the burden of a tax and shifts it to others.
2. It refers to one who and in what proportion bears the final burden of the tax.
3. Burden of a tax is the actual amount of money paid as a tax by the payer.
4. Impact and incidence of direct tax is the same because there is no shifting of tax. The tax payer bears the burden.

Check Your Progress-V

1. It means the equal treatment of equals.
2. It refers to unequal treatment of unequals.
3. It implies that the tax burden in terms of utility sacrificed due to tax payment should be equal for all tax payers.
4. The payment of tax should be such that the sacrifice of utility as a proportion of his income should be equal for all tax payers.
5. The tax burden should be such that the marginal sacrifice of utility after tax payment should be equal for all tax payers.

PUBLIC DEBT AND GOVERNMENT BUDGET

Structure

- 4.0 Objectives
- 4.1 Introduction
- 4.2 Meaning of Public Debt
- 4.3 Objectives of Public Debt.
- 4.4 Classification of Public Debt.
- 4.5 Burden of Public Debt.
 - 4.5.1 Burden of Internal Public Debt
 - 4.5.2 Burden of External Public Debt
- 4.6 Repayment of Public Debt.
- 4.7 Government Budget.
 - 4.7.1 Balance and unbalanced Budget
 - 4.7.2 Deficits in Government Budget
- 4.8 Let us Sum Up
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- 4.12 Hints/Answers to Questions in Check Your Progress

4.0 Objectives

The objective of the present unit is to introduce the concept of public borrowing or public debt which is considered as income of the government in underdeveloped countries. After reading this Unit, you will be able to:

- know different types and sources of public debt;
- understand what is meant by burden of debt; and
- learn about the concept and components in government budget.

4.1 Introduction

In the previous unit we have seen the different sources of public revenue and discussed tax as the most important source of government income in details including the sharing of tax burden among the buyers and sellers. It may so happen that the government's revenue may not be sufficient to meet all its expenditures. It is to be mentioned that unlike the private individual, the government first plans its expenditure and then thinks of sources of revenue. Naturally, there may be occasions when the government may intend to spend more than its revenue. Under such a situation the government may borrow from the public or from foreign governments.

Government of a country borrows from different sources, both internal and external, to bridge the gap between its expenditure and income. It should be remembered that every debt has some burden on the economy and people of the county. At the same time, all debts should be repaid and government does it through various ways. We shall discuss all these issues in this chapter.

4.2 Meaning of Public Debt

Government of a country gets income from two sources, namely, public revenue and public borrowing. Public borrowing or public debt refers to borrowing by a government from within the country or from abroad, from private individuals or associations of individuals or from banking and non-banking financial institutions.

Check Your Progress .I

1. What do you understand by public debt?

4.3 Objectives of Public Debt

The following are the principal objectives of raising loans by the Government.

- i. **Bridging the gap between revenues and expenditures:** It often happens that towards the end of the financial year, government experiences shortage of funds. To cover this gap between revenue and expenditure, the government raises temporary loans or gets 'ways and means' advance from the central bank of the country. In India, the government issues what are called 'Treasury Bills' which are repayable after three months.
- ii. **Financing Public works programme:** During depression particularly in developed countries, the government has to launch public works programme to provide employment. In this way, money is injected into the economy to lift the depression. For this purpose, it becomes necessary to raise public loans to ensure economic stability.
- iii. **Curbing Inflation:** When inflation in the economy is rampant and it is desired to bring down the prices, the government issues public loans. In this way, money or purchasing power is drawn for the public. Reduction in money supply will bring down prices and hence inflation is checked.
- iv. **Financing economic development:** The under developed countries are desired to achieve speedy economic development, which involves huge investment. They are unable to raise adequate finances through taxation. Hence, resort to public borrowing in these countries becomes necessary.
- v. **Financing the public sector:** An economic system like mixed economy, public sector plays an important role in the development. For several reasons- economic, political and social, there has to be a rapidly expanding public sector. The financing of this sector is not possible without resort of public borrowing.
- vi. **War Finance:** some unavoidable happenings which cause a sudden spurt in government expenditure such as wars or natural calamities require funds which are met through public borrowing.

Thus, public borrowing is necessitated by the requirements of filling the gap between revenue and expenditure, public programme, economic development and to meet unforeseen expenditure in connection to wars or natural calamities.

Check your progress .II

1. What is war finance?
2. What is public sector?

4.4 Classification of Public Debt

Public debts differ from one another in many respects. These differences are due to either the markets in which the loan are floated, the rate of interest offered on the government bonds, the conditions of repayment or the purpose for which they are used. Thus, on different criteria public debt can be classified into various categories. The main classifications of public debt can be discussed as below:

1. Productive and unproductive debt

Public borrowing is incurred for various purposes. Sometime, a government borrows money in order to construct a railway line or a canal, sometime money is borrowed for purpose of famine relief, and sometime it is borrowed to wipe off a deficit in the government budget. The productive debt is expected to create assets which will yield income sufficient to pay the principal and interest on the loan. The debt incurred by the government for constructing a railway line or irrigation canal that pays is productive debt.

However, public debt incurred to wipe off budget deficit or to help provide employment to the people in the famine stricken areas and to supply people with food is unproductive debt as it does not create productive debt is that debt whose proceeds are spent by the government for productive purposes. The spending of such a revenue of the government out of which it can pay the interest as well as the principal of the debt. Thus, productive proceeds of which are not spent for directly by productive purposes. Such loans do not add to the productive capacity of the country.

2. Internal and External Debt

The government of a country can go to domestic and or international capital market and borrow funds from there. Internal debt is that debt which is raised by the government from the individuals and institutions within the country. While external debt refers to that loan which is borrowed by the government from individuals, institutions and or governments of foreign countries.

3. Voluntary and Forced Debt

Voluntary debt is raised from the people on a voluntary basis without any coercion on the people. Ordinarily, public debt is a voluntary debt. However, sometimes the government may take loan from the public even against their wishes. For example, at the time of national crisis live war, the government may go the extent of taking forced loans from the public. In other words, loans given to the government by the people on their own accord are called voluntary debt, whereas compulsory or forced debt comprises of these loans which are taken by the government by coercing the people by virtue of its sovereign powers.

4. Funded and Unfunded Debt

Funded debt is that public debt for the payment of which the government establishes a separate fund. Every year the government credits a certain amount of money to this fund. On maturity, the debt is repaid out of this particular fund. An unfunded public debt is that debt for the repayment of which the government creates no separate fund. The interest on this debt is repaid by the government out of its ordinary income. The principal amount is repaid by contracting additional loans from the market. It is on this account that a funded debt is sometimes referred to as a floating debt. The funded debt is also referred to as a long-term debt whereas the unfunded debt is called a short-term debt. Unfunded debts are generally repaid within a year. Treasury bills are unfunded debts because these are generally taken for a period of three or six months and are never for a period longer than a year.

5. Redeemable and Irredeemable Debt

Redeemable public debt refers to that debt the principal amount of which is repaid by the government after a pre-determined period of time. The government regularly pays interest on this debt. On the expiry of the period of maturity of debt, the government pays the principal amount to the lenders. It is on this account that it is known as a redeemable debt. In order to repay this loan, the government establishes a sinking fund and credits a fixed amount of money every year to this fund. On the expiry of the debt period the principal amount is repaid out of this sinking fund. Public loans are mostly redeemable. A non-redeemable public debt is that debt the principal amount of which never returned by the government although the government continues to pay interest on it permanently.

Check you progress-III

1. Distinguish between productive and unproductive public debt.
2. Define internal and external public debt.

4.5 Burden of Public Debt

The burden of public debt refers to costs or disadvantages that are imposed upon the economy when public outlays are loan-financed rather than tax-financed. Here, we shall discuss the burden of internal as well as external public debt.

4.5.1 Burden of Internal Public Debt

The burden of internal public debt can be discussed under the following headings.

i. Direct Money Burden

In the case of internal public debt, there is no direct money burden on the community as a whole since the payment of interest on public debt and the imposition of taxation to pay the interest involve simply a transfer of purchasing power from one group of persons to another. In fact, taxes raised in order to pay the interest on government bonds are imposed on and paid by the rich people who also are the purchasers; government takes away money from their left pockets and returns it back in their right pockets. Thus, under internal debt there is only a redistribution of purchasing power. To the extent that the bond-holders and tax-payers are the same set of persons, there may not be any net burden at all on the community. However, to the extent the bond holders and the tax-payers belong to different income groups, there will occur some changes in the distribution of income between different sections of people in the society.

ii. Indirect Money burden

When government spends the loan proceeds on development projects, it results in the creation of demand for several commodities and services. Consequently, the prices of these goods and services rise, imposing additional burden on society. This is the indirect money burden of internal Public debt.

iii. Direct real burden

The government repays the principal amount and interest of internal debt by imposing new taxes on the people. Ordinarily, the tax payers are poor people while lenders are relatively rich. When the government pays the principal and interest to the bond holders after collecting money through taxes imposed on the people, it results in the transfer of purchasing power from poorer sections to the richer sections of the community. Consequently, the inequalities in the distribution of incomes and wealth in society get further accentuated. Moreover, the tax payers are generally the active people, while lenders are invariably inactive people mostly living on their past accumulated wealth. The ultimate result of the repayment of internal public debt is that wealth gets transferred from the active sections of society to the inactive sections. This is contrary to the national interests. This is the direct real burden of internal public debt.

iv. Indirect real burden

The government imposes additional taxes on the people to repay the public debt. As a result of this, the economic inequalities in the country get further accentuated as most of the taxes are levied on poor people in the form of indirect taxes. This adversely affects the capacity to work and to save of the people. Consequently, the productive power of the people declines. This is the indirect real burden of internal public debt.

4.5.2 Burden of External Public Debt

The burden of external public debt can be discussed as follows:

i. **Direct money burden:** In the case of external public borrowing, after the maturity of debt, the debtor country has to pay the creditor country the principal amount of loan in terms of foreign exchange. In order to earn this foreign exchange, the country has to make exports. Such exports for which the country receives no payment from the foreign country are known as "unrequired exports" and represent direct money burden of an external debt.

ii. **Indirect money burden:** The debtor country has to pay interest in terms of the goods and services to the creditor country. In other words, the debtor country has to export goods and services on a large scale to the creditor country. This inevitability results in a rise in the prices of these goods and services in the country. As a consequence, there is steep fall in the economic welfare of the community. This fall in country's welfare shows the indirect money burden of the external public borrowings.

iii. **Direct real burden:** The government very often imposes new taxes on the people to repay the external debt. Ordinarily, the burden of these taxes falls more heavily on the poorer than on the richer sections of the society. This shows the direct real burden of external public borrowings.

iv. **Indirect real burden:** The government imposes taxes on the people to repay the external debt as a consequence of which the capacity of the people to work and to save declines. Ultimately, this declines in people's capacities produces unfavorable effects on production. It shows the indirect real burden of an external public debt.

Check Your Progress-IV

1. What is burden of public debt?
2. What is money burden of public debt?
3. What is real burden of public debt?
4. What is direct burden of public debt?
5. What is indirect burden of public debt?

4.6 Repayment of Public Debt

It is necessary that public debt should be paid. Debt repayment maintains and strengthens the national credit. If the record of repayment is good, it will be easy to raise funds at the time of national emergency. Redemption of public debt can be defined as a repayment of public debt. Different methods are used by the government to redeem its debt. Some of the methods are discussed below:

i. **Budget surplus:** When the government of a country experiences surplus in its budget, it may utilize this budget surplus to pay off its debt to the people. Normally, the government utilizes the budget surplus to purchase from the markets its own bonds and securities from the people. This results in an automatic liquidation of its debt liability.

ii. **Terminal Annuity:** In this case, the government pays off the public debt on the basis of terminal annuity. Under this method, the government pays off its debt in equal annual installments which includes interest, besides the principal amount involved. The burden of debt goes on decreasing and at the time of the maturity it is already fully paid off. This is a convenient method of paying off the public debt. Although the government becomes bound to spare the sum specified every year. Yet it does not have to pay off the entire debt in one lump sum.

iii. **Sinking Fund:** Under this method, the government establishes a separate fund known as the "sinking fund" for the repayment of public debt. The government credits every year a fixed amount of money to this fund. By the time of debt matures, the fund accumulates enough amount to pay off not only the principal amount of the debt but also the interest on the loan. The sinking fund is of two types: (a) certain sinking fund; (b) uncertain sinking fund. A 'certain sinking fund' is one into which the government annually credits a fixed sum of money while an 'uncertain sinking fund' is one into which the amount is credited only when the government secures a surplus in the budget.

iv. **Debt Conversion:** Under this method, a high-interest public debt is converted into a low-interest public debt. Sometimes, it happens that although the ruling rate of interest in the market is high when the government contracts the debt but after some time the interest rate in the market falls down. In such a case, government converts its old high-interest cost debt into a new low-interest cost debt. In other words, the government contracts a new debt at the lower-interest rate and utilizes its proceed to pay off the old high-interest debt.

v. **Compulsory Reduction in Rate of Interest:** When the government is confronted with financial crisis, it may reduce the interest rate on its debt unilaterally on a basis of compulsion. In such a situation, the creditors have no option except to accept the reduced rate of interest. Ordinarily, the government does not resort to this unilateral compulsory reduction in the interest rate. However, in extraordinary unusual times, the government may be compelled to take resort to this revolutionary unusual step in order to reduce its financial liabilities.

vi. **Capital Levy:** This method of public debt redemption provides for imposing "all at once" tax on all the capital value possessions of the people. Above the capital possessions of a minimum limit of value, all capital goods are taxed. This means acquiring funds for debt redemption all at a time. For the repayment of Public debt, government imposes a levy on a progressive scale on the capital of the people. However, small properties are exempted from such a levy.

However, although capital levy is a quick and equitable method of debt redemption but it is not advisable to take resort to it in preference to other methods of debt redemption. Except in case of emergency or abnormal situations, capital levy is not a practical method of debt redemption. This may rather be called an artificial method of debt redemption.

v. **Repudiation of Debt:** The earliest way for the government to get rid of the burden of payment of a loan is the repudiation of public debt. When the government repudiates public debt, it does not recognize its obligation to pay the loan. Consequently, it refuses to pay the interest as well as the principal amount of debt. Repudiation is certainly not paying off a debt but destroying it. In normal conditions, a government does not like to repudiate its debt because by adopting such a policy, the credit of the government falls and it faces difficulty in getting new loans. In the case of external public debt, the repudiation of debt is more dangerous.

Check Your Progress-V

1. What do you mean by redemption of public debt?
2. Explain the concept of sinking fund.
3. What is debt conversion?
4. What is terminal annuity?

4.7 Government Budget

Now you will know about following facts:

- (i) Government budget;
- (ii) Types of budget- Balanced and Unbalanced; and
- (iii) Concept of deficit in the Government Budget
 - Revenue deficit,
 - Fiscal deficit, and
 - Budgetary deficit.

4.7.1 Balanced and Unbalanced Budget

A budget is not only a financial statement of actual and anticipated revenues and outlays of the government but also a document of detailed programmes and policies of actions which government desire to pursue in the coming years for raising the economic activity. That is, a government budget is a financial plan covering outlays and receipts of the government. "Usually it is embodied in a document that may be called the budget, but the budget is much more than that. It is the outcome of a process that includes preparation of the financial plan, review of the plan by the legislature where there is one, execution of the plan, and (ideally) evolution and public reporting of the results". A budget may be balanced or unbalanced.

Balanced Budget

A budget is said to be balanced if the revenue of the government is just sufficient for meeting its expenditure over the period under consideration. With regard to the concept of balanced budget, the following three preliminary questions arise. (i) What should be included in the expenditure? (ii) what should be included in the revenue? (iii) What length or period of time should be chosen as the accounting period?

So far as the expenditure is concerned, we should exclude from it all the debt repayment, even under statutory or attached sinking funds. If during the period under consideration, there is any net debt repayment, the budget may reasonably be said to be balanced. Like wise, all borrowing made for productive purposes, such as loan expenditure incurred for executing certain public works, should be excluded.

So far as the revenue side of the budget is concerned, we should exclude from it all those receipts which are in the nature of capital, such as the proceeds of sales of public property, or the sum drawn from the reserves accumulated out of previous surpluses because the diminutions of public capital assets is equivalent to an increase in the dead-weight public debt. There is, however, no ground for excluding the revenue derived from taxes assessed on private capital, such as death duties.

So far as the time length is concerned there is nothing sacrosanct about choosing a year as the accounting period of a budget although traditionally this is the most usually selected period.

Unbalanced budget

A budget is said to be unbalanced if current expenditure of the government is not equal to current revenues. An unbalanced budget may be of two types-surplus budget and deficit budget. When current income of the government exceeds its current expenditure then that is known as surplus budget. On the other hand, when total current income of the government falls short to the total current expenditure, then that is called a deficit budget.

4.7.2 Deficits in Government Budget

In this section we have defined three concepts of deficit. These are revenue deficit, fiscal deficit and budgetary deficit.

Revenue deficit: Revenue deficit is defined as the difference between revenue receipts (tax and non-tax) and revenue expenditure i.e. current expenditure. So Revenue deficit (RD=Revenue Expenditure-Revenue Receipts)

Fiscal Deficit: Fiscal deficit takes into consideration total resource gap in terms of excess of total government expenditure over revenue receipts and grants. This concept fully reflects the indebtedness of the government. Fiscal deficit is defined as the sum of budget deficit and borrowings. That is Fiscal Deficit= Budget Deficit+ Borrowings or $FD=RD+Deficit\ on\ current\ Account\ (other\ than\ borrowings);$

Or $FD= Total\ Expenditure-(Revenue\ Receipts+ Recovery\ of\ loans+ Receipts\ from\ the\ sale\ of\ assets).$

Budgetary Deficit: The conventional Budget Deficit is the difference between all receipts and expenditure, revenue as well as capital. It is also called over all budgetary deficits. This deficit is met by net addition to the treasury Bills issued by the Reserve Bank of India and drawing down of cash balances kept with the Reserve bank of India.

So Budget Deficit= Total Expenditure-Total Receipts (excluding net sale of Treasury Bills).

Check Your Progress-VI

1. What is budget?
2. What is balanced budget?
3. Explain the concept of revenue deficit.
4. Explain the concept of budget deficit.
5. Explain the concept of fiscal deficit.

4.8 Let Us Sum Up

In modern age every government has to borrow funds for a number of reasons and it is known as public debt. Government can raise funds from internal sources as well as external sources. A debt is known as internal public debt if it is taken from the individuals or institutions established within the national boundary. When debt is taken from foreign individuals, institutions or governments, it is termed as external public debt. In this context it is important to note that there is a cost of every public debt. This cost is known as burden of public debt. Public debt burden can be direct money burden or indirect money burden as it can also be direct real burden and indirect real burden for both internal public debt and external public debt. Like private debt, public debt in most cases is repaid for which a number of methods such as budget surplus, sinking fund, terminal annuity, etc are adopted.

Government budget which is not only annual accounts of its income and expenditure but also a document of economic policies of the government may either be surplus or deficit. The budget is said to be a surplus budget if the income of the government during a financial year is greater than its expenditure. On the other hand, it is deficit, if income falls short to the expenditure.

4.9 Key Words

Public Debt : It refers borrowing of a government.

Productive and unproductive public debt : Productive debt means that debt which is used to create assets. While unproductive debt refers to the debt which is used for unproductive purposes and they do not add to the productive capacity to the country.

Internal and External public debt : Internal public debt is raised within the country. External debt refers to that loans which borrowed from foreign countries.

Voluntary and Forced Debt : A debt is voluntary if there is no coercion on the people. It is forced if it is raised by coercion.

Public Debt Burden : The burden of public debt means the costs or disadvantages that are imposed upon the economy when public expenditures are financed through loans rather than taxes.

Money Burden : The cost of the public debt on the society of money that arises from the imposition of taxes on the people.

Real Burden : Real burden means the actual impact of the taxes imposed for raising funds to redeem debt on the economy as a whole.

Redemption of Public debt : Redemption of public debt implies repayment of public debt.

Budget : A government budget is a financial plan covering outlays and receipts of the government.

Balanced Budget : It refers the equality between government revenues and expenditures.

Unbalanced Budget : A budget is unbalanced if revenues and expenditures of the government are unequal.

Revenue deficit : Difference between revenue receipts and revenue expenditure.

Budget deficit : It is the difference between to the expenditure and total receipts of the government

Fiscal deficit : It refers to the sum of budget deficit and borrowings of the government

4.10 Check Your Learning

1. What do you understand by public debt? Briefly explain the objectives of public debt.
2. Discuss various types of public debt. Distinguish between internal public debt and external public debt.
3. Explain the nature of the burden of public debt. In what ways national debt becomes a real burden on a community?
4. Discuss the various methods of redemption of public debt.
5. Distinguish between balanced and unbalanced budget.
6. What do you mean by deficit in government budget? Distinguish between fiscal deficit and budget deficit.

4.11 Suggested Readings

- Dalton, H : Principles of Public Finance, 1978 edition, Allied Publishers, Bombay.
- Herber, B.P. : Modern Public Finance, 1988, Richard D. Irwin, Inc. Home wood, Illinois, All India Travelles Book seller, Delhi.
- Mishra, B: Economics of Public Finance, 1997, Mc Millan India Ltd, New Delhi.
- Musgrave, Richard A. & Musgrave, Peggy B.: Public Finance Theory and Practice, 1989, Mc Graw Hill Book Co. New York.
- Singh, S.K. : Public Finance in Theory and Practice, S. Chand & Company Ltd, New Delhi, 2004.

4.11 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. The borrowings by a government from within the country or from abroad.

Check Your Progress-II

1. The finance which is spent for the war purposes.
2. Government owned enterprises.

Check Your Progress-III

1. Productive debt is that debt which creates assets and yields sufficient income to pay the principle and interest on the loan. Unproductive debt is the dead weight debt which does not create productive assets.
2. Loans raised by the government from within the boundary of the country constitute internal public debt. Borrowings by the government from abroad constitute external public debt.

Check Your Progress-IV

1. It refers to costs or disadvantages imposed on the economy for repayment of debt.
2. Money burden of public debt is the costs or disadvantages that arise from the repayment of debt by government leading to changes in distribution of income.
3. Costs or disadvantages that arise due to imposition of new taxes by government to repay the principal amount and interest.
4. Direct burden of public debt refers to those debt whose repayment gives direct burden to the people, firms or agencies, etc.
5. Indirect burden of public debt refers to those debt whose repayment gives an indirect burden to the people, firms or agencies by reducing productive capacity.

Check Your Progress-V

1. Redemption of public debt means the repayment of debt.
2. A type of repayment of outstanding debt by government in which the government credits every year a fixed amount of money to the fund.
3. The process of converting a high-interest public debt into a low-interest public debt.
4. The method of paying off debts in equal annual instalments which include interests, besides the principal amount involved.

Check Your Progress-VI

1. A budget is a financial plan covering outlays and receipts of the government.
2. When the revenue receipt of the government is equal to the expenditure side, it is called balanced budget.
3. Revenue deficit is the difference between revenue receipts and current expenditure of the government.
4. The budget deficit is the difference between total expenditure and total receipts. This deficit is met by net addition to the treasury bills issued and drawing down of cash balance with the Reserve Bank of India.
5. Fiscal deficit is the difference between total expenditure and sum of revenue receipts, recovered loans and receipts from the sale of assets. It is the sum of budget deficits and borrowings.

DEFICIT FINANCING**Structure**

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|-----|---|
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5.0 Objectives

The principal objective of unit V is to introduce the readers to an important concept of public finance, the concept of deficit financing. This topic will help the readers to understand, how and to what extent the method of deficit financing is useful in developing a country like us. So, after reading this Unit, the learners will be able to

- learn about the concept of deficit financing;
- know the significance of deficit financing in economic development; and
- evaluate deficit financing in the process of economic development

5.1 Introduction

In the previous Unit, we have discussed about the public debt which in developing countries, is considered as a component of public revenue. Some times, government deliberately creates a gap in public budget and that gap is bridged by expanding money supply in the economy. This method is known as deficit financing.

5.2 Meaning of Deficit financing

Deficit financing at present has become an important method of financing the government expenditure particularly in developing countries. Deficit financing is said to have been practiced whenever government expenditure exceeds the receipts from the public like taxes, fees and borrowings from the public. Such an excess of government expenditure is financed either by reducing the cash balances of the government (held in the Reserve Bank of India or in the state treasuries) or by borrowing from the Reserve Bank of India. Both these methods of financing the deficit would have the effect of expanding money supply held by the public.

According to the Draft First Five Year Plan, "the term deficit financing is used to denote the direct addition to gross national expenditure through budget deficits, whether the deficits are on revenue account or on capital account. The essence of such a policy lies, therefore, in Government spending in excess of the revenue it received in the shape of taxes, earnings of state enterprises, loans from the public, deposits and funds and other miscellaneous sources. The government may cover the deficit either by running down its accumulated balances or by borrowing from the banking system (mainly from the Central Bank of the country and thus creating new money)".

Therefore, deficit financing is that part of government expenditure which is met either by drawing down the cash balances of the government or by resorting to borrowing from the Reserve Bank of India. This definition of deficit financing identifies it with that part of government expenditure the finance of which leads to a net increase in money supply.

There is a difference in the method of deficit financing practiced by the developed countries and the under developed countries. In advanced countries, deficit financing takes place by the Government borrowing from the banking system when the Government sells government securities either to individual bank depositors or directly to the banks. In both cases additional credit is created by the banking system. In the case of under-developed countries, where the banking habit is not fully developed, deficit financing takes the form of the issue of the banking system in general. The central bank issues paper currency in lieu of the government securities deposited with it. Thus, deficit financing in the ultimate analysis means issuing more notes.

5.2.1 Deficit financing and deficit budgeting

Deficit financing may be distinguished from deficit budgeting. When current expenditure exceeds current revenue it is said to be deficit budgeting. In this case, no item on capital account is taken into consideration.

On the other hand, when we take into consideration not only current receipts but also receipts on capital account, e.g., public borrowing, and we still find a gap between receipts and expenditure, the method of financing used to cover this gap is called deficit financing. In other words, in the case of deficit financing, the volume of deficit is measured in terms of overall budget deficit, i.e., the aggregate of the deficit on both the revenue and capital account.

Check Your Progress-I

1. Define deficit financing.
2. Distinguish between deficit financing and deficit budgeting.

5.3 Advantages of Deficit Financing

The main advantages of deficit financing may be discussed as follows:

1. Mobilization of additional resources for development

The rationale for deficit financing in developing countries like India lies in meeting of the financial requirements of the country. In a situation when the country is not able to mobilize enough resources from taxes and borrowings and there are several development projects crying for funds, the government finds this measure handy.

2. Building up social and economic overheads

Deficit financing in developing country is an useful and effective method of building social and economic overheads which are considered as the prerequisites for development of the country.

3. To meet the needs of funds

In India, the democratic set up is such that the government finds it difficult to make adequate tax efforts and this inadequacy is further accentuated by the voluntary character of public borrowings which may or may not and usually does not come up to yield the desired amount of funds. Consequently, in a country like India, deficit financing is to be necessarily used.

4. To utilize unemployed or under-employed resources and surplus labour more fully

The methods of deficit financing helps in utilizing the unemployed and underemployed resources included labour to a greater extent through creating more employment opportunities and opening the possibility of resource utilization.

5. Does not create direct burden to the citizens

As distinguished from taxation which is compulsory and whose magnitude and impact can be seen and felt, deficit financing is concealed from the public view. Deficit financing does not take any money from anybody's pocket while at the same time it can create resources in no time and in any amount desired by the government.

6. To come out from depression

Deficit financing is very much useful in depression. During depression it expands income, employment output without inflation.

7. It leads to increase in demand

Moreover, a small dose of deficit financing in a developing country like India will help to increase the money supply and push up demand. The increased demand for goods and services will naturally lead to increase in production, incomes and employment in the economy.

Check Your Progress-II

1. Explain the concept of social and economic overheads building.
2. How deficit financing is helpful in depression?
3. How deficit financing creates employment?

5.4 Limitations of Deficit Financing

Since the technique of deficit financing involves an expansion of money supply in the economy without in any way directly and simultaneously increasing the total real output, it has resulted in many evil effects. The important evil effects of deficit financing are discussed below.

1. Rise in Prices

In the case of deficit financing, the supply of money is apt to be larger than what can be absorbed by the economy at current prices. The increase in the money supply raises the aggregate demand for goods and services in the economy. Since the aggregate real output is not rising as fast as the supply of money, inflationary pressures appear in the form of ever escalating prices.

2. Speculative activities

On the basis of currency newly issued by the government and the Reserve Bank of India, the commercial banks found themselves with larger cash reserves to create larger amount of credit in the economy. The phenomenon of speculation, hoarding operations in essential commodities etc. is caused mainly due to easy availability of bank credit in the economy arising from deficit financing.

3. Adverse effects on savings

The household savings which contribute substantially to domestic savings are directly related to the price level. These savings did not show a fast rising trend due to the increasing prices which resulted from deficit financing.

4. Less investment

Investment too got distorted with the establishment of many new large factories biased in favour of the luxury and non-essential goods whose prices showed rising tendency as these were not subjected to price controls. Rising money incomes greatly favour large producers, and not persons with fixed incomes, earning fixed salaries and wages. The higher income groups, through their money role, directed scarce resources to the production of non-essential goods. Consequently, the government's effort of getting additional resources is partly nullified by such a reduction of resources for development of the economy. Thus, deficit financing leading to inflation has encouraged those types of investment activities which are not desirable for a developing country like India.

5. Inequalities of income and wealth

When inflation occurs as a result of deficit financing, the richer sections of the society are able to maintain and in fact raise their consumption level while the poorer sections find it difficult to stay in the old position. The money incomes of the fixed income earners not rising enough to neutralize fully the rise in prices, their consumption levels fall. In other words, the forced saving that deficit financing imposes largely comes from the poorer sections of the society. Thus, deficit financing distributes the burden of economic development inequitably with a heavy tilt against the poorer sections of the population.

6. Self-destructive in nature

Further, deficit financing is self-destructive in nature. It is argued that deficit financing leads to inflation. However, the rise in prices is not a permanent feature because as soon as goods start flowing from development project, the prices fall. Thus, it is self-destructive in nature.

Therefore, deficit financing creates inflationary rise in prices, accentuates the inequalities of incomes and wealth, discourage savings and distorts investment. However, all these disadvantages of deficit financing arise if it has not been kept within the limit of prudence. Therefore, it is extremely necessary to keep deficit financing within a limit. What should be safe limit depends upon the following factors.

1. The amount of deficit financing should be limited to the needs and requirements of the economy. It depends on:
 - (a) The past experience showing the relationship between the money supply and general price level.
 - (b) The rate of growth of national product.
 - (c) The size of the credit multiplier.
 - (d) Tolerance level of the people to accept the rise in prices.
 - (e) The rate at which the non-monetized part of the economy is monetized.
2. The second important factor determining the safe limit of deficit financing is the extent of the effective effort made by the government to mop up the surplus money created in the economy as result of deficit financing.
3. Controls on prices of essential goods and wages will help to curb the inflationary impact on the low income groups and the extent to which these controls are successful, the volume of deficit financing may be raised.

Therefore, a limited amount of deficit financing is necessary to promote the economic development of an underdeveloped economy like India having large resources awaiting exploitation and large population to feed. If, however, the safe limit of deficit financing is crossed the consequences will be harmful. This is what is happening in India at present. Every year the government exceeds the safe limit of deficit financing by resorting to deficit financing in excess of the targeted amount.

Check Your Progress-III

1. What do you understand by limitations of deficit financing?
2. How deficit financing encourages speculative activities?
3. How deficit financing push up the prices?
4. How deficit financing discourages investment?

5.5 Let Us Sum Up

Deficit financing is a method to balancing between total expenditure and total receipts of the government. In other words, deficit financing is that part of government expenditure which is met either by drawing down the cash balances of the government or by resorting to borrowing from the Central Bank of the country. And this certainly leads to a net increase in money supply in the economy. Deficit financing method is practiced because it has certain advantages. It (i) helps in mobilization of resources for development, (ii) creates social and economic overheads, (iii) brings the economy out from depression, and (iv) leads to increase in demand and growth. But since the deficit financing involves an expansion of money supply in the economy without increasing the real output, it results in many evil effects such as (i) rise in prices, (ii) rise in speculative activities, (iii) reduction in savings and investment, and (iv) creation of inequalities of income and wealth in the society.

5.6 Key Words

Deficit Financing: It refers to the direct addition to gross national expenditure through budget deficits covered either running down government balances or borrowing from the Central Bank.

Deficit budgeting: Implies a situation when current expenditure of the government exceeds current revenue.

Safe Limit of Deficit Financing: It means the limit of the deficit financing which avoid the negative effects of it, such as price can rise, less savings & investment and inequalities.

5.7 Check Your Learning

1. Explain the role of deficit financing in developing countries
2. What do you understand by deficit financing?
3. Discuss the advantages of deficit financing.
4. Briefly examine the limitations of deficit financing.

5.8 Suggested Readings

1. Herber, B.P. : Modern Public Finance, 1988, Richard D. Irwin, Inc. Home wood, Illinois, All India Travelles Book seller, Delhi.
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3. Singh, S.K. : Public Finance in Theory and Practice, 2004, S. Chand & Company Ltd, New Delhi.

5.9 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. Deficit financing is the financing of deliberately created gap between public revenue and public expenditure on both current account as well as on capital account.
2. Deficit budgeting occurs when current expenditure exceeds current revenue. In deficit financing the deficit arises both in current account and capital account.

Check Your Progress-II

1. Social overheads building are investments on education, public health, communications, transportation and conventional public utilities like light, water, power, Irrigation and drainage schemes, etc. Economic overheads building are investments on agriculture, industry or commerce, etc.
2. Deficit financing helps to overcome the depression by increasing the income, output without inflation through requisite supply of money to put idle resources to work.
3. Deficit financing creates employment by utilizing the unemployed and under employed resources and opening the possibility of resource utilization.

Check Your Progress-III

1. Deficit financing expands the money supply of the economy and without a productive support raises the price. The evil effect of an increasing money supply is a limitation of deficit financing.
2. Deficit financing encourages speculative activities through hoarding operations in essential commodities etc. due to easy availability of bank credit.
3. Deficit financing increase the supply of money in the economy which raises aggregate demand for goods and services in the economy. But supply of goods and services does not increase as does the money supply, so it pushes up the prices.
4. Deficit financing leads to inflation consequently favouring higher income groups and directing scarce resources to production of non-essential goods.

Unit-VI

DEFINITION AND USES OF STATISTICS

Structure

- 6.0 Objectives
- 6.1 Introduction
- 6.2 Definition
- 6.3 Uses of statistics
- 6.4 Limitations of Statistics
- 6.5 Relation of Statistics with Economics
- 6.6 Let Us Sum Up
- 6.7 Key Words
- 6.8 Check Your Learning
- 6.9 Suggested Readings
- 6.10 Hints/Answers to Questions in Check Your Progress

6.0 Objectives

After reading this unit, the learners should be able to

- define the term 'statistics';
- learn the nature and scope of statistics;
- know the use and application of statistics; and
- know the relationship between statistics and economics.

6.1 Introduction

The word, 'Statistics' has been derived either from the Latin word 'status' or Italian word 'statista' or German word 'statistic' which means 'a political state'. In the old days statistics was regarded as the "Science of Statecraft" and was the by product of the administrative activity of the state. It has been the traditional function of the governments to keep records of population, births, deaths, taxes, etc. But in modern age the scope of statistics is wide enough. Statistical methods are now widely used in various diversified fields such as agriculture, economics, commerce, sociology, etc. In your every day life you come across about various facts which are quantitative in nature such as grown rate of the economy, temperature of your town or population of your state. The expression of house issues in quantitative term improves our understanding regarding the magnitude under consideration which in tern help not only to compare but also in formation of policies or measures to control for the betterment of the mankind.

6.2 Definition of statistics

The term 'statistics' is a familiar word to us now-a-days. This word is used in two different senses: singular and plural senses. In plural sense it refers to numerical statements of facts or simply data with respect to an activity. In singular sense it refers to the subject of scientific activity like other subjects such as mathematics or economics. For example, the data relating to the national income of the country in various years, the volume of exports and imports in different years, the price of a commodity at different places etc, refer to statistics used in plural sense. The word statistics when used in singular sense implies statistical methods or the science of statistics. It refers to the body of methods or techniques used for the collection, presentation, analysis and interpretation of quantitative data. Thus, the word statistics refers either to quantitative information in its plural sense or to a body of methods dealing with quantitative information. it is in singular sense that statistics is used in this Unit.

Statistics as quantitative information

It should be remembered that quantitative or numerical information are statistical data but not all numerical data is statistical. Hence, it is necessary to examine a few definitions of statistics to understand the characteristics of statistical data.

A large number of statisticians have put forward the definitions of statistics in plural sense. Webster defined statistics as "the classified facts representing the conditions of the people in a State... Specially those facts which can be stated in numbers or in tables of numbers or in any tabular or classified arrangement. According to Yula and Kendall, "By statistics we mean quantitative data affected to a marked extent by multiplicity of causes". Prof. Horace Secrist who defined statistics as follows:

"By statistics we mean aggregates of facts affected to a marked extent by multiplicity of causes, numerically expressed, enumerated or estimated according to reasonable standards of accuracy, collected in a systematic manner for a predetermined purpose and placed in relation to each other".

This definition clearly points out certain characteristics which numerical data must possess in order that they may be called statistics. These are as follows:

1 Statistics are aggregate of facts

Single and isolated figures are not statistics. For example, if we say that student 'A' has obtained 60 marks in economics, then it can not be a statistical statement. Whereas if we note the marks obtained by a number of students such as A, B, C... In this subject we get a set of data, then it can be termed as statistics.

2. Statistics are affected to a marked extent by multiplicity of causes

The data relating to a phenomenon like consumption of any item, production of a particular crop which are affected by a number of factors will called statistics. The consumption of a good is affected by several factors like income of the consumer, price of the good, prices of related goods, etc. Similarly, the production of a particular crop such as rice is affected by soil quality, rainfall, temperature, etc

3. Statistics are numerically expressed

A statement can not be termed as statistics unless it is numerically expressed. The statement 'population in Arunachal Pradesh is increasing' or 'area of shifting cultivation in the state has decreased' do not constitute statistics.

4. Statistics are enumerated or estimated according to a reasonable standards of accuracy

Facts and figures about any phenomenon can be derived either by counting and measurement or estimates. Estimates can not be as precise and accurate as actual counts or measurements. The degree of accuracy desired largely depends on the nature and object of the enquiry.

5. Statistics are collected in a systematic manner

Before collecting statistics a suitable plan of data collection should be prepared and the work carried out in a systematic way. Data collected in a haphazard manner would very likely lead to fallacious conclusions.

6. Statistics are collected for a pre-determined purpose

The purpose of collecting data must be decided in advance. The purpose should be specific and well defined.

7. Statistics should be placed in relation to each other

The numerical facts should be comparable if they are to be called statistics. Statistical data are often compared period-wise or region-wise. For example, population of Arunachal Pradesh at a particular point may be compared with that of earlier years or with the population of other states in India. Valid comparisons can be made only if the data are homogeneous, i.e., relate to the same phenomenon or subject. It would be meaningless to compare the population of Arunachal Pradesh with the elephants of Assam.

In the absence of the above characteristics, numerical data can not be called statistics and hence "all statistics are numerical statements of facts but all numerical statements of facts are not statistics".

Statistics as a body of methods

The large volume of numerical information gives rise to the need for systematic methods which can be used to collect, analyze and interpret the information effectively. Statistics when used in singular sense, refers to the subject statistics comprising the body of methods which deals in the collection, organization, analysis and interpretation of data. Different writers have defined statistics as a subject differently. Some of the definitions are mentioned below.

Selling man defines statistics as "the science which deals with the methods of collecting, classifying, presenting, comparing and interpreting numerical data collected to throw some light on any sphere of enquiry".

According to Wallis and Roberts "Statistics may be regarded as a body of methods for making wise decisions in the face of uncertainty".

According to Berenson and Levin, "The Science of statistics can be viewed as the application of the scientific method in the analysis of numerical data for the purpose of making rational decisions".

Croxton and Cowden have given a very simple and concise definition of statistics. In their view "statistics may be defined as the collection, presentation, analysis and interpretation of numerical data". This definition clearly points out four stages in a statistical investigation, namely:

- (i) collection of data;
- (ii) presentation of data;
- (iii) analysis of data; and
- (iv) interpretation of data.

Collection of data

Collection of data constitutes the first step in a statistical investigation. Data should be collected carefully because they form the foundation of statistical analysis. If data are faulty, the conclusion drawn can never be reliable.

Presentation of data

After data have been collected they are ready for presentation. Data presented in an orderly manner facilitate statistical analysis. There are two different methods in which the collected data may be presented. These are:

- (i) tables
- (ii) diagrams, and graphs.

Analysis of data

The third step of a statistical investigation is to analyze the statistical data. The purpose of analyzing data is to dig out information useful for decision making. The common methods used in analyzing data are central tendency, measures of dispersion, correlation and regression etc.

Interpretation of data

The last stage in statistical investigation is interpretation, i.e. drawing conclusions from the data collected and analyzed. Interpretation of data needs skills and experience. Correct interpretation will lead to a valid conclusion of the study and thus can aid one in taking suitable decisions.

Check your progress- I

1. Define statistics in plural sense
2. Ram has scored 46 runs in a cricket match, is this statistics in plural sense?
3. Karmal is an honest boy- why is not statistics?
4. What is collection of data?
5. What do you mean by statistical methods?
6. What is presentation of data?

6.3 Uses of Statistics

Robert W. Burgess had nicely summed up the uses or functions of statistics as "The fundamental gospel of statistics is to push back the domain of ignorance, rule of thumb, arbitrary of premature decisions, traditions and dogmatism and to increase the domain in which decisions are made and principles are formulated on the basis of analysed quantitative facts". However, we discuss below some important uses of statistics:

1. To present facts in definite form

With the help of statistical methods general statements of facts are presented in a precise and definite form. For instance, 'the average performance of students in Economics is good' is a general statement. This statement may be presented in a more precise and definite form by saying that 'the average performance of students in Economics is 68 percent'.

2. To simplify raw data

The data collected by the investigators are called raw data which are often unintelligible. Statistics make the collected data understandable by condensing them through classification and tabulation.

3. To facilitate comparison

Unless figures are compared with the others of the same kind they are often devoid of any meaning. For example, the computation of real per capita income of Arunachal Pradesh helps in comparing the standard of living of the people in the State over the years. Likewise, computation of per capita income in different states in India throw light on the comparative study of the economic conditions prevailing in different states.

4. To formulate and test hypothesis

Statistical methods are extremely helpful in formulating and testing hypothesis and developing new theories. For example, the hypothesis that 'the role of market in the life of rural tribal in Arunachal Pradesh is negligible' can be tested with the help of statistical methods.

5. To Predict future value

A knowledge of future trend is very helpful in framing suitable policies and plans. Statistical methods provide helpful means of forecasting future events. For instance, on the basis of data pertaining to the sales of a particular product during the last 10 years the marketing manager of a business enterprise can estimate the likely sale of the product during the coming year.

6. To help formulating suitable policies

Policy formulation needs accurate data and appreciation of the significance of relationship that exists. Because policy formulation deals with a predictive action in future. Statistics provide this basic material for framing suitable policies. For example, data about population, its distribution by age and sex and other socio-economic characteristics, the rate of growth of population, migration, area, etc., help in determining the future needs such as food, clothing, housing, education, recreational facilities, water, electricity, transportation system. Similarly, detailed information on the unemployed persons like what types of qualification, skills, experiences they have would go along way in framing suitable policy to tackle the problem of unemployment.

7. To measure uncertainty

Probability theory is perhaps the most important branch of statistics and it forms the basis of modern statistics. With the help of probability the chance of occurrences of uncertain events can be measured numerically. Measurement of uncertain events in numerical terms helps in decision-making process.

Check Your Progress-II

1. How statistics simplify raw data?
2. How statistics helps the comparison?
3. How statistics helps in formulating policies?

6.4 Limitations of Statistics

Despite the usefulness of statistics in many fields, it suffers from certain limitations. These limitations of statistical method should be kept in mind while using them. The following are the some of the important limitations of the science of statistics.

1. Statistics does not deal with single object

Statistics does not deal with single individual or object. It deals with a group of individuals or objects and indicates the characteristic of the whole group.

2. Statistics deals only with quantitative characteristics.

Statistical method can be applied only to quantitative data. These methods can not be applied to qualitative characteristic like intelligence, honesty, beauty, etc. unless they are expressed in quantitative terms by same indirect methods.

3. Statistical results are true only on an average

The conclusions obtained statistically are not universally true- they are true only under certain conditions. This is because statistics as a science is less exact as compared to natural science.

4. Statistics is only one of the methods of studying a problem

Statistical tools do not provide the best solution under all circumstances. Very often, it is necessary to consider a problem in the light of a country's culture, religion and philosophy. Statistics can not be of much help in studying such problems.

5. Statistics can be misused

The greatest limitation of statistics is that there is liable to be misused. Statistical methods should be applied and must be handled with utmost care by experts only, otherwise one may arrive at incorrect conclusion. If statistical techniques are applied by persons having good knowledge of statistics than correct conclusion will be arrived at. Statistics may prove dangerous in the hands of inefficient persons.

Check Your Progress-III

1. What do you mean by limitation of statistics?

6.5 Relation of Statistics with Economics

Statistical analysis is indispensable in economics. The statement of Alfred Marshall "Statistics are the straw out of which I, like every other economist, have to make bricks" proves the significance of statistics in economics. Economics is

concerned with the production and distribution of wealth as well as the complex institutional set-up connected with the consumption, saving and investment of income. Statistical data and statistical methods are of immense help in the proper understanding of the economic problems and in the formulation of economic policies. For example, what to produce, how to produce and for whom to produce these are the questions that need a lot of statistical data in the absence of which it is not possible to arrive at correct decisions. Statistics of production help in adjusting the supply to demand. Statistics of consumption enables us to find out the way in which people of different strata of society spend their income. Such statistics are very helpful in knowing the standard of living and taxable capacity of the people. In the field of exchange we study markets, laws of prices based on supply and demand, cost of production, banking and credit instruments etc. What shall be the price of a particular commodity if its supply increases, or decreases? What price should a monopolist charge in order to reap the maximum profits? - these are the questions which can best be answered with the help of statistics. In fact, statistics are the very foundation-stone of the theory of exchange. In distribution, too, statistics plays a vital role. How the national income is to be calculated and how it is to be distributed, these are the questions which cannot be answered without statistics. In reducing disparities in the distribution of income and wealth statistics are of immense help. Similarly in solving problems of rising prices, growing population, unemployment, poverty etc one has to rely heavily on statistics. In fact most of the economic policies would be a leap in the dark in absence of appropriate statistical information.

Statistical measures such as correlation and regression are used to study the relationship between economic variables which is important for making decisions. For testing various economic hypotheses use of statistical tests is a must. As a matter of fact, tools of statistics are indispensable for a better understanding of economic problems.

Check Your Progress-IV

1. Why statistics is so close to economics?
2. Can you explain economics without the help of statistics?

6.6 Let Us Sum Up

The term 'Statistics' has been derived from the Latin word 'status', which refers to 'a political state.' In modern age statistics is a familiar word and is used in two different senses, singular and plural. In plural sense it means numerical statements regarding facts or simply data with respect to an activity. In singular sense it refers to the subject of scientific activity like other subjects like mathematics or economics.

Statistics is widely used in present age. It helps to present fact in definite form, simplifies raw data, facilitates comparison, predicts future values, measures uncertainly, etc. But like other branch of knowledge, statistics suffers from certain limitations such as it does not deal with single object, it deals only with quantitative characteristics, results are true only on an average, it can also mislead if not handled efficiently.

There is a very close relationship between statistics and economics. Statistical data and statistical methods are of immense help in the proper understanding of the economic problems and in the formulation of economic policies regarding production, consumption, exports & imports, price level, unemployment, rate of interest, etc.

6.7 Key Words

Statistics: In its plural sense refers in terms of numbers or numerical data, such as national income statistics, statistics relating to exports, imports, etc. In singular sense, the word statistics refers to the subject statistics comprising the body of methods which deals in collection, summarization, analysis and interpretation of data.

Data: Data refers to any group of measurements that happen to interest us.

Uses of statistics: The various applications in different disciplines are known as uses or functions of statistics.

Limitations of statistics: The short-comings of statistics are called limitations of statistics.

Variable: A variable is a characteristic that may take on different values at different times, places or situations.

6.8 Check Your Learning

1. What is statistics? Discuss various characteristics of statistics?
2. Briefly discuss the uses of statistics. What are the limitations of statistics?
3. Elucidate the relationship between statistics and Economics.

6.9 Suggested Readings

Gupta, S.P. - Statistics, S. Chand, New Delhi.

A.L. Nagar and R.K. Das - Basic Statistics, Oxford, Delhi.

A.G. Goon, M.K. Gupta and B. Das Gupta - Basic Statistics, World Press, Kolkata.

6.10 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. Statistics in plural sense can be defined as a numerical statement of facts or simply quantitative data.
2. It is statistics in plural sense because it is a quantitative information.
3. It is a description of an attribute and not a quantitative information.

- 4 Collection of data is a carefully statistical investigation for reaching at clear and sound decisions.
- 5 The word statistics when used in singular sense implies statistical methods or the body of methods/ techniques used for the collection, presentation, analysis and interpretation of quantitative data.
- 6 When the data are presented in orderly manner to facilitate statistical analysis, it is called as a presentation of data. Data can be presented graphically or in tabular forms.

Check Your Progress-II

1. Statistics simplify raw data by arranging them orderly manner through presentation and classification so as to make them manageable, understandable and intelligible.
2. Statistics provides tools like mean, median, mode to compare two or more sets of data and enables a better appreciation of their significance.
3. Statistics shows the relationship between variably relating to a phenomenon. Understanding of these relationship help in interpretation and making policy decisions.

Check Your Progress-III

1. Despite the usefulness of statistics in many fields, it suffers from some/certain loopholes because of its possibility of being wrongly used. This is the limitation of statistics.

Check Your Progress-IV

1. Because statistical data and statistical methods are of immense help in the proper understanding, an analysis of economic problems and in the formulation of the economic policies.
2. Economics cannot be explain without the help of statistics because statistical analysis is indispensable in economics. The significance of statistics in economics can be proved through the statement of Alfred Marshall, "statistics are the straw out which I, like every other economists, have to make bricks."

UNIT-VII

COLLECTION, CLASSIFICATION AND TABULATION OF DATA

Structure

- 7.0 Objectives
- 7.1 Introduction
- 7.2 Collection of Data
 - 7.2.1 Methods of Collecting Primary Data
 - 7.2.2 Methods of Secondary Data Collection
 - 7.2.3 Unpublished Sources.
- 7.3 Classification of Data
 - 7.3.1 Meaning of classification
 - 7.3.2: Objectives of classification
 - 7.3.3 Types of classification
- 7.4 Tabulation of Data
 - 7.4.1: Significant or Importance of Tabulation
 - 7.4.2: Parts of a Table
 - 7.4.3 Types of table
- 7.5 Frequency Distribution
- 7.6 Presentation of Data through diagrams and graphs histogram, frequency polygon, frequency curve, and olive.
 - 7.6.1. Histogram
 - 7.6.2 Frequency Polygon
 - 7.6.3 Frequency Curve
 - 7.6.4 Cumulative Frequency Curve or Ogive
- 7.7 Let Us Sum Up
- 7.8 Key Words
- 7.9 Check your Learning
- 7.10 Suggested Readings
- 7.11 Hints/Answers to Questions in Check Your Progress

7.0 Objectives

The previous unit dealt with the introduction of the subject statistics. In this present unit you will learn various steps followed in statistical investigation. Precisely, you should be able to:

- know the sources of data and learn the methods of collection of data from various sources;
- learn the need for and techniques and types of classification of collected data; and
- learn the ways of presentation of data for further statistical treatment.

7.1 Introduction

In previous chapter we defined statistics as methods comprising collection, tabulation, analysis and interpretation of statistical data. For any statistical investigation the first step is the collection of data regarding the problem under investigation. Then the collected data are arranged in order to get some unanimity in the data set on the basis of common features. These arranged or classified data are presented in tabular form for getting more precise information. One form of tabulation is the use of frequency distribution in take form known as frequency table. When data are ordered according to frequency, they can be presented in diagrams and graphs which give us a quick look regarding the basic features of a data set.

7.2 Collection of Statistical data

Collection of data is the first step of a statistical enquiry. For any statistical investigation two types of data may be collected. These are primary data and Secondary data.

Primary data : The data which are collected from its source of origin for the first time and have never been used for any purpose earlier are called primary data. An individual collects primary data directly from the actual field of enquiry. Such data are original in character and are generated in large number of surveys conducted mostly by government and also by some individuals, institutions and research bodies. For example, data obtained in a population census by the office of the Registrar General and Census Commissioner are Primary data.

Secondary data : The data which were previously collected by some individual or agency as primary data for a certain purpose and are now compiled to extract some other information are termed as secondary data. For example, for the office of the Registrar General and Census Commissioner the Census data are primary where as for all others, who use such data, they are secondary.

7.2.1 Methods of Collecting Primary Data

The various methods of primary data collection are as follows:

- i) Direct Personal Interviews
- ii) Indirect Oral Interviews
- iii) Information from correspondents
- iv) Mailed questionnaire method
- v) Schedules sent through enumerators

I. Direct Personal Interviews

In this method, there is a face-to-face contact with the persons from whom the information is to be obtained. The interviewer asks informants questions pertaining to the survey and collects the desired information.

Merits of direct personal interview method

- i. The information obtained by this method is likely to be more accurate because the interviewer can clear up doubts of the informants about certain questions and then obtain correct information. In case the interviewer apprehends that the informant is not giving accurate information, he may cross-examine him and thereby try to obtain the information.
- ii. Responses are more encouraging as most people are willing to supply information when approached personally.

- iii. In this method, a delicate situation can usually be handled more effectively by a personal interview than by other survey techniques.
- iv. The language of communication can be adjusted to the status and educational level of the person interviewed, thus avoiding inconvenience and misinterpretation on the part of the informant.

Demerits of personal interview method

- i. It may be very costly where the number of persons to be interviewed is large and they are spread over a wide area.
- ii. The chances of personal prejudice and bias are greater under this method as compared to other methods.
- iii. More time is required because interviews can be held only at the convenience of the informants.

II. Indirect Oral Interviews

Under this method of data collection, the investigator contracts third parties called witnesses capable of supplying the necessary information. The method is generally adopted in those cases where the information to be obtained is of a complex nature and the informants are not inclined to respond if approached directly. For instance, in an enquiry regarding addiction to drugs, alcohol, etc., people may be reluctant to supply information about their own habits. It would be necessary in that case to get the desired information from those dealing in drugs, liquor or other people who may be knowing them, for example, their neighbours, friends, etc.

Merits of Indirect Oral Interviews

- i. It is less expensive as compared to the direct method.
- ii. The chance of obtaining accurate data is higher because the informants are not directly affected in responding to the researcher.

Demerits of Indirect Oral Interviews

- i. If the respondents are reluctant as they are not the party, the probability of getting accurate information under study becomes very low.
- ii. If the people do not know the full facts of the problem under investigation or if they are prejudiced it will not be possible to arrive at correct conclusions.
- iii. It is also time consuming method of data collection.

III. Information from Correspondents

Under this method, the investigator appoints local agents or correspondents in different places to collect information. These correspondents collect and transmit the information to the central office where the data are processed. Newspaper agencies generally adopt this method. This method is also adopted by various departments of government in such cases where regular information is to be collected from a wide area.

Merits of information from correspondents

- i. This method is cheaper than many other methods.
- ii. It helps in collecting information from various places in a quick and accurate manner.

Demerits of information from correspondents

- i. It may not always ensure accurate results because of the personal prejudice and bias of the correspondents.
- ii. It involves a complex procedure.

IV. Mailed Questionnaire Method

In this method, information is collected from various sources by mailing then questionnaire containing a list of questions to the informants. Necessary instructions are given in the questionnaire and blank spaces are kept for providing answers. Informants are requested to return the questionnaires duly filled in.

Merits of mailed questionnaire method

- i. It is also relatively cheap and expeditious provided the informants respond in time.
- ii. This method can be easily adopted where the field of investigation is very vast and the informants are spread over a wide geographical area.
- iii. On questions of a personal nature or questions requiring reaction by the family, this method is superior to personal interview method.

Demerits of mailed questionnaire method

- i. This method is applicable only where the informants are literate people so that they can understand written questions and send the answers in writing.
- ii. It involves certain uncertainty about the response. Co-operation on the part of informants may be difficult to presume.
- iii. The information supplied by the informants may not be correct and it may be difficult to verify the accuracy.

V. Schedules Sent Through Enumerators

In this method, the investigators or enumerators personally meet the informants with the list of questions (i.e. schedule) in their hands. The investigators explain the questions to the informants and they themselves write down the answers given by the informants. The essential difference between the mailed questionnaire method and this method is that where as in the former the questionnaire is sent to the informants by post, in the latter the enumerators carry the schedule personally to the informants.

Merits of Schedules sent through Investigators method

- i. It can be applied in those cases where informants are illiterate.
- ii. There is very little non-response as the enumerators go personally to obtain the information.
- iii. The information received is more reliable as the accuracy of the statements can be checked by supplementary questions where necessary.

Demerits of Schedules Sent through investigators method

- i. This method is relatively costly because enumerators are generally paid persons.
- ii. The success of the method depends largely upon the training imparted to the enumerators.
- iii. Skilled interviewing requires experience and training, without good interviewing most of the information collected is of doubtful value.

- iv. The way in which the enumerators conduct the interview could affect the data collected. When questions are asked by a member of different interviewers, it is possible that variations in the personalities of the interviewers will cause variation in the answers obtained. This variation will not be obvious. Hence every effort must be made to remove as much of variation as possible due to different interviewers.

7.2.2 Methods of Collection of Secondary Data

In many studies the investigators find the need of data already collected by others. There is a vast amount of published information from which statistical studies may be made and fresh statistics are constantly in a state of production. The sources of secondary data can broadly be classified as: (i) published sources and (2) unpublished sources.

Published Sources

The various sources of published data are:

- i. Reports and official publications. They include:
 - a) International bodies such as the 'World Bank', 'International Labour Organization', 'Statistical Office of the United Nations'.
 - b) Central and State Governments such as Abstract of the Indian Union, Economic Survey of India, etc.
 - c) Reports of the Ad-hoc Committees and Commissions appointed by the government such as Sarkaria Committee, Nanabati Committee, Jha Committee, Pathak Committee, Finance Committees, Fifth Pay Commission, etc.
2. Semi-official publications of various local bodies such as Municipal Corporations, Panchayats, etc.
3. Publications of autonomous and private institutes such as
 - (a) Trade and professional bodies, such as, the Federation of Indian Chambers and Commerce and Industry, the Institute of Chartered Accounts, the Institute of Foreign Trade, the prestigious journals of these institutes are respectively, 'Economic Trends', 'The Chartered Accountant', 'Foreign Trade Review'.
 - (b) Financial and economic journals such as Indian Economic Review, 'Economic and Political Weekly', 'Reserve Bank of India Bulletin', 'Indian Finance'.
 - (c) Annual reports of Joint Stock Companies and Corporations.
 - (d) Publications, brought about by various autonomous Research Institutes and Scholars such as Institute of Economic Growth, Delhi; Research Journal of Rajiv Gandhi University, Itanagar; National Institute of Applied Economic Research, New Delhi; etc.

7.2.3 Unpublished Sources

All statistical materials are not always published. There are various sources of unpublished data such as records maintained by various Government and private offices, Studies made by research institutes, scholars, etc. Such sources can also be used by the investigator wherever necessary.

Census and Sample method

Primary data are collected by using any of the method discussed above. However, the required information may be obtained by following either the census method or the sample method.

Census Method and Sample Method

Census or Complete Enumeration method of collection refers to the study of all the items or observations in the population or universe. Thus, in census method the entire population is investigated and on the basis of this investigation conclusion about the population characteristics is drawn. For example, if we require to know the average height of the present students of Rajiv Gandhi University, the individual heights of all the students are taken into consideration. Such an enumeration is called census or complete enumeration. Population or Universe may be understood as totality of observation. For example, if we study the marks secured by the students in schools of Arunachal Pradesh, then all the students in all the schools constitute the population.

In sample method instead of investigating all the items in a population, some specific items are selected from the population of study. The set of these selected items is known as sample. On the basis of the sample study inference is drawn about the population characteristics under study. For example, if we want to know the average income of the farmers of Arunachal Pradesh, we can select some farmers randomly and obtain the average income of these selected farmers. And on the basis of this average income we can draw conclusion about the average income of the farmers of Arunachal Pradesh. When your mother cooks and wants to know if rice is cooked, she takes a few grains from the pot to taste. On the basis of this test she concludes if rice is ready or needs some more time for cooking. This act is an example of sample method. She does not taste all the grains to arrive at a conclusion for the whole. This is called generalisation. Sampling method helps in such type of generalisations. Here all the items are not verified, only a few items give idea for the all. That is why the part which is to be verified needs to be representative of the population. In other words, the part or the sample will carry all the characteristics which the population has.

As has been said, the sample is a sub-set (a part) of the population. A population may be a sample depending on the purpose of study. In our example of studying the marks secured by the students in schools of Arunachal Pradesh, all the students in all the schools constitute the population. But if we intend to study the marks of students in schools of north-east India, then the schools of Arunachal Pradesh will constitute the sample for the study.

Merits of Sample Method

- i) **Economical:** Since only some units of the population are studied in sample method it involves less cost & hence economical
- ii) **Time Saving:** This method is time saving as limited numbers of items of the population are studied.
- iii) **Administrative convenience:** There is administrative convenience in handling a limited number of them more efficiently and capable investigators may be appointed.

Demerits of Sample Method

- i) **Partial investigation:** Since a sample is a part of the population it can not fully represent the population. Hence it is a partial investigation of the population. Moreover, if the method of sample is not scientific, the results may be biased.
- ii) **Difficulties in Selecting Representative Sample:** It is not an easy task to select a sample which would represent more or less the characteristics of the entire population.

- iii) **Selection of Proper Sample Needs Specialized Knowledge:** There are several techniques of selecting a sample from a population. One must have the specialized knowledge of choosing a representative sample from the population by applying the most appropriate technique.

Merits of Census Method

- i) **More Reliable and Accurate:** Results based on census method are more reliable and accurate since each and every item of the population is studied.
- ii) **Less Biased:** Results based on census method are less biased because there is total absence of investigator's direction in regard to the selection of items are to be taken for investigation.
- iii) **Provides Extensive Information:** Since all the items of the population are studied hence information obtained through census method is quite exhaustive.
- iv) **Mandatory in some situations:** One must resort to census survey when (a) the population is small, (b) the presence of even a single defective unit may cause severe harm.

Demerits of census Method

- i) **It is very costly method:** This is a costly method as all the units of the population or universe are to be studied. As such this method is not generally used for ordinary investigation. Only the government or some big institutions can afford to use this method.
- ii) **It is a time consuming method:** Obviously it requires much time as each and every unit of the population is to be investigated.
- iii) **It requires large manpower:** Census method requires a large number of enumerators which creates a problem in conducting census survey method of data collection.

Check your progress-I

1. What is primary data?
2. What is secondary data?
3. Distinguish between schedule and questionnaire.
4. What is Census method?
5. What is sample method?

7.3 Classification of Data

Data collected by either sampling method or census method are called raw data. These raw data, unless arranged in a suitable form and presented in a proper manner, will not serve any purpose to the researcher. Classification and tabulation of raw data enable the investigators to find out the salient characteristics of the data.

7.3.1 Meaning of classification

Classification of raw data implies their arrangement into groups or classes on the basis of similarities and resemblances. Secrist defined "classification is the process of arranging data into sequences and groups according to the common characteristics or separating them into different or related parts". According to A.M. 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".

Classification makes the data easily understandable and it reveals the true significance of the data. In order to analyse the collected data classification is a step to be followed must. For example, workers of a factory can be classified in many ways. If the data related to them are classified with respect to gender (male and female), age (between 15-20, 20-25, etc), years of experience (1,2,----- 10, etc), qualification Matric, H.S, Graduate, Post Graduate, etc), then only the data become suitable for analysis.

7.3.2: Objectives of classification

The main objectives of classifying statistical data are:

- To condense the mass of data in such a manner that similarities and dissimilarities can be readily apprehended.
- To facilitate comparison.
- To highlight the most significant features of the data at a glance.
- To enable a statistical treatment of the material collected.

7.3.3 Types of classification

Broadly, the data can be classified on the following four bases:

- Geographical, i.e., area-wise, e.g., cities, states.
- Chronological, i.e., on the basis of time
- Qualitative, i.e. on the basis of some attributes.
- Quantitative, i.e, in terms of magnitudes.

Geographical Classification

In this type of classification data are classified on the basis of geographical or locational differences between the various items, like states, districts, cities, etc. For instance, the number of students in various colleges of Arunachal Pradesh may be presented place-wise in the following manner. College-wise student numbers in various colleges of AP in 2005-06.

Name of the College	Number of students in 2005-06 Academic Session.
D.N. Govt. College, Itanagar	2,130
J.N. College, Pasighat	1,853
I.G.G College, Tezu	836
Govt. College, Bomdila	620
Donyi Polo Govt. College, Kamki	766
Rang-Frah Govt. College, Changlang	280
Tirap College, Deomali	190

Chronological Classification

When data are classified according to time, then that classification is known as chronological classification. For example, we may present the figures of population of Arunachal Pradesh as follows:

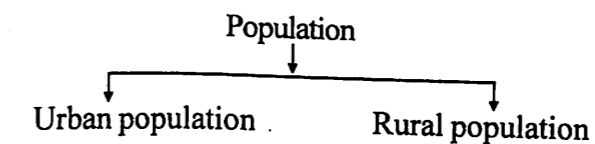
Year	Population
1961	336558
1971	467511
1981	628050
1991	864558
2001	1091117

Time series are usually listed in chronological orders, normally starting with the earliest period.

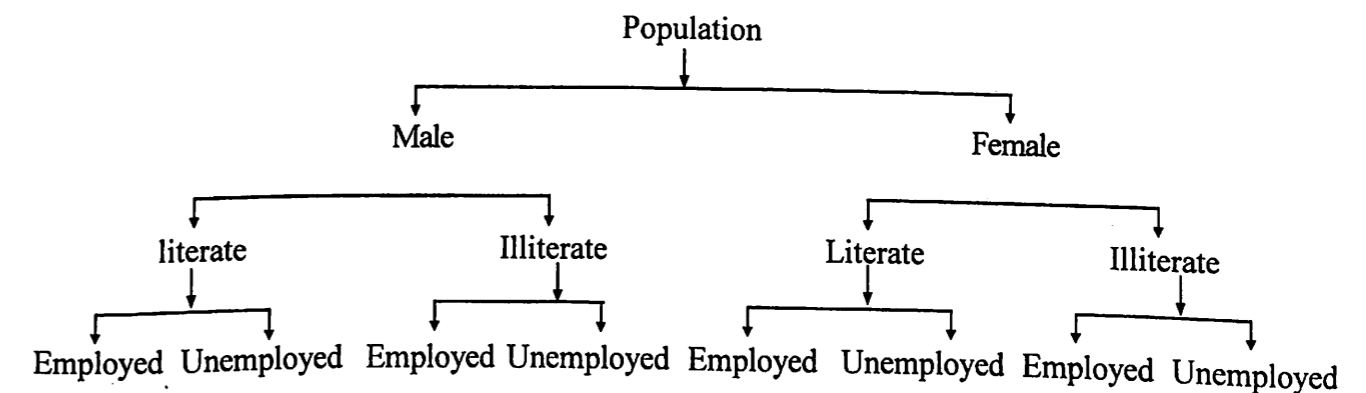
Qualitative classification

In qualitative classification data are classified on the basis of some attribute or quality such as sex, colour, religion, literacy, etc. It is to be noted that the attribute under the study can not be measured: One can only find out whether it is present or absent in the units of the population. There are two types of classifications according to attributes. If classification of items or individuals is made on the basis of a single attribute then such a classification is called simple classification. On the other hand, if items or individuals are classified on the basis of more than one attributes then such a classification is called manifold classification.

If we classify the population on the basis of the attribute of urban/rural then it will be a case of simple classification. This is shown below:



Again, if we classify the population on the basis of their sex, literacy status, employment status, and so on then it will be a case of manifold classification. This is shown below:



Quantitative Classification

Quantitative classification refers to the classification of data according to some characteristics that can be measured, such as height, weight, income, sales, profits, production, etc. For example, marks obtained by the students in a paper, say, English of BA first year in University Examination may be classified as follows:

Marks	No. of students
0-10	15
10-20	27
20-30	60
30-40	120
40-50	51
50-60	36
60-70	10
above-70	2

Such a distribution is known as simple frequency distribution. In this type of classification, there are two elements, namely (i) the variable, i.e., the marks in our example and (ii) the frequency, i.e., the number of students in each class. There are 15 students who have obtained marks ranging from 0-10.

- Check your progress-II**
1. Define data.
 2. Define attribute

7.4 Tabulation of Data

The collected data, after classification are recorded in rows and columns to give them tabular form. Tabular presentation of data, more conveniently known as tabulation, may be defined as "the orderly or systematic presentation of numerical data in rows and columns designed to clarify the problem under consideration and to facilitate the comparison between the figures".

7.4.1 Significant or Importance of Tabulation

- i. It simplifies complex data, when data are tabulated all unnecessary details and repetition are avoided. As data are presented systematically in rows and columns, the reader gets a very clear idea of what the table presents.
- ii. It facilitates comparison. Since a table is divided into various parts and for each part there are totals and sub-totals, the relationship between different parts of the data can be studied much more easily with the help of the table.
- iii. It gives identity to the data. When the data are arranged in a table with a title and number they can be distinctly identified and can be used as a source reference in the interpretation of a problem.
- iv. It reveals patterns. Tabulation reveals pattern within the figures which can not be seen in the normative form. It also facilitates the summation of the figures if the reader desires to check the totals.

7.4.2 Parts of a Table

A table generally consists of the following parts.

- i. **Table Number:** Each table should be numbered. It facilitates easy reference. The table number may be given either in the centre at the top above the title or inside of the title at the top or in the bottom of the table on the left hand side.

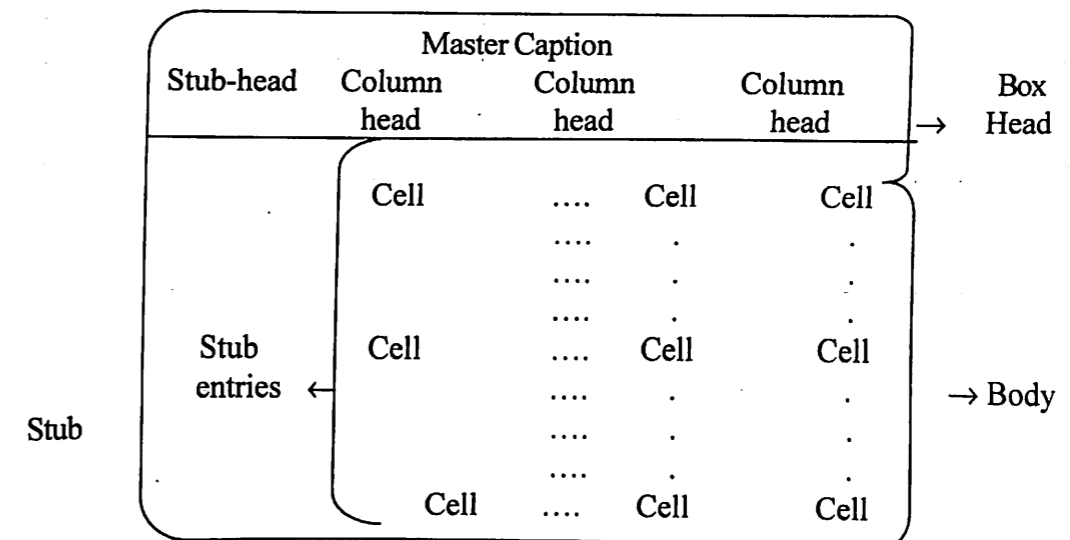
- ii. **Title of the Table:** A table must have a suitable title. The title is a description of the contents of the table. A complete title has to answer the question what, where and when in that sequence. The title of the table should be clear, brief and self explanatory. Its lettering should be the most prominent of any lettering on the table.
- iii. **Caption:** Caption is the headings for the columns. It explains what the column represents. It may consist of one or more column headings. Under a column heading there may be sub-heads. The caption should be clearly defined and placed out the middle of the column. If the different columns are expressed in different units, the units should be mentioned with the captions.
- iv. **Stub:** The extreme left hand column of the table which contain the headings of the rows is called stub.
- v. **Body of the table:** It is the main part of the table containing the numerical figures. This is the most vital part of the table.
- vi. **Head note:** It is a brief explanatory statement applying to all or a major part of the material in the table, and is placed below the point centered and enclosed in brackets. For example, unit of measurement such as Rs. "In thousands", etc are written in head note.
- vii. **Foot note:** Anything in a table which the reader may find difficult to understand from the title, caption and stubs should be explained in footnotes. The footnote is generally placed at the bottom of the table.
- viii. **Source:** The source or sources of the data embodied in the table should be mentioned beneath the table if data are collected from secondary sources. It is mentioned below the footnote.

Below we present a format of a representative table showing its different parts:

FORMAT

Table Number

Title..... Head Note.....



Footnotes, if any
Source note.....

7.4.3 Types of table

Tables are classified as

- (i) simple tables, and
- (ii) complex tables.

Simple tables: Tables which are prepared on the basis of only one characteristic of the collected data are known as simple tables. Simple tables are also called one-way tables.

Table No. 7.1

Department wise classification of students in University

Department	No. of Students
Economics	36
Education	50
History	103
Political Science	85

Complex tables: Tables which show more than one characteristics of the data are known as complex tables. We may have a two-way complex table showing two characteristics, a three-way complex table showing three characteristics and a multi-way complex table showing several characteristics. A two-way, three-way and multi-way complex table may also be called a two-fold, three-fold and multifold complex table respectively.

Table No. 7.2

Department wise and gender wise classification of University students

Department	No of Students		
	Boys	Girls	Total
Economics	20	16	36
Education	32	18	50
History	58	45	103
Pol-science	46	39	85

Table No. 7.3

Three-way Table

Department	No. of students					
	Boys			Girls		
	Tribal	Non-tribal	Total	Tribal	Non-tribal	Total
Economics	10	10	20	6	10	16
Education	21	11	31	13	5	18
History	38	20	58	29	16	45
Pol-science	32	14	46	27	12	39

Check your progress-III

1. Define caption of a table.
2. Define stub of a table.

7.5 Frequency Distribution

Frequency distribution is a tabular presentation that generally organizes data into classes in terms of class intervals and shows the number of observation, called frequency, falling into each of these classes.

However, frequency distribution can be constructed for discrete variable as well as continuous variable. A frequency distribution prepared for a discrete variable is called a discrete distribution and a frequency distribution prepared for a continuous variable is called a continuous distribution. It should be noted that a variable which takes specific values only between two fixed limits is called a discrete variable. Whereas a variable which can take any value between two fixed limits is called a continuous variable.

Discrete Frequency Distribution

In this distribution we have just to count the number of times a particular value is repeated which is called the frequency of that class. In order to facilitate counting prepare a column of "tallies". In another column, place all possible values of the variable from the lowest to the highest. Then put a bar opposite the particular value to which it relates to facilitate counting, block of five bars are prepared and some space is left in between each blocks. Finally we count the number of bars and get frequency with respect to each value of the variable.

The process has been applied in the following example.

Illustration 1. In a survey of 45 families in a town, the number of children per family was recorded and the following data obtained:

6	2	0	5	7	1	1	5	4
3	0	3	1	2	2	2	4	5
3	3	2	2	1	0	5	6	1
4	5	6	1	1	2	2	3	4
7	2	2	0	4	3	2	1	4

Represent the data in the form of a discrete frequency distribution.

FREQUENCY DISTRIBUTION OF THE NUMBER OF CHILDREN

No. of Children	Tallies	Frequency
0		4
1	111	8
2	1	11
3	1	6
4	1	6
5		5
6	111	3
7	11	2

Total = 45

Continuous Frequency Distribution

A frequency distribution prepared for a continuous variable in terms of class intervals is called a continuous frequency distribution. This type of distribution is most popular in practice. The following technical terms are important when a continuous frequency distribution is formed, i.e. data are classified according to class intervals:

- i) **Class Limits:** the class limits are the lowest and the highest values that can be included in the class. For example, take the class 10-20. The lowest value is 10 and the highest 20. The two boundaries of class are known as the lower limit and the upper limit of the class. The lower limit of a class is the value below which there can be no item in the class. The upper limit of a class is the value above which no item can belong to that class. Of the class 10-19, 10 is the lower limit and 19 is the upper limit. That is, in this class there can be no value which is less than 10 and more than 19.
- ii) **Class Intervals:** the difference between the upper and lower limit of a class is known as the class interval of that class. For example, in the class 10-20, the class interval is $(20-10)=10$, whereas it is $(19-10)=9$ in the class 10-19. the length of the class interval is also called 'width of class interval' or 'size of class interval'. If in a frequency distribution the length of the class interval is same then the frequency distribution is said to be a frequency distribution with equal class interval. For example, in the distribution 0-10, 10-20, 20-30, 30-40, 40-50, the class interval is 10 in all classes hence it is a distribution of equal class interval. On the other hand, if in a frequency distribution the length of all the class intervals is not the same then such a distribution is called a frequency distribution with unequal class intervals. An example of such distribution is 0-10, 10-20, 20-40, 40-70.
- iii) **Class Frequency:** the number of observations corresponding to a particular class is known as the frequency of that class or the class frequency. For example, if the frequency in the class 10-20 is 5, then it implies that the particular item occurs 5 times in this class.
- iv) **Class Mid-point or Class Mark**

It is the value lying half-way between the lower and upper class limits of a class interval. Mid-point of a class is obtained as follows.

Mid-point of a class = $\frac{\text{Upper limit of the class} + \text{Lower limit of the class}}{2}$

For example mid-point of the class 10-20 is $\frac{10+20}{2} = 15$

There are two methods of classifying the data according to class intervals, name

(a) inclusive method, and

(b) exclusive method.

- a) **Inclusive Method:** In a frequency distribution with class intervals, say 0-9, 10-19, 20-29, 30-39... Both upper and lower limits of a class are included in that class. For example, both the figures 10 and 19 of the class 10-19 which are lower and upper class limits respectively are included in the class. Here the class defined by the intervals 10-19 includes the numbers greater than or equal to 10 but less than or equal to 19. The method of classification of data in terms of class intervals in which both the lower limit and upper limit of any class are included in the class is known as the inclusive method of classification.

- b) **Exclusive Method:** On the other hand, in case of a distribution like 0-10, 10-20, 20-30, 30-40... While the lower limit of a class is include in that class, the upper limit is not included. For example, the class defined by the interval 0-10 includes the numbers which are greater than or equal to zero but less than 10. This method of classification of data in terms of class intervals in which the lower limit of any class is included in that class but the upper limit is not included is known as the exclusive method of classification.

It should be noted that a discrete frequency distribution with class intervals is an inclusive frequency distribution and a continuous frequency distribution is an exclusive frequency distribution.

- v) **Class Boundaries or True Limits of class intervals**

To ensure the continuity and to get correct class intervals we should adopt 'exclusive' method of classification. However, where inclusive' method has been adopted it is necessary to make an adjustment to determine the correct class interval to have continuity. The adjustment consists of finding the difference between the lower limit of the second class and the upper limit of the first class, dividing the difference by two, subtracting the value so obtained from all lower limits and adding the value of all upper limits. For example, in the classes 0-9, 10-19... the difference is $10-9=1$, hence the current limits would be 0-9.5, 9.5-19.5, 19.5-29.5... these new true class limits are known as class boundaries. Conversion of class limits to class boundaries is necessary when continuous variables recorded in discrete form are classified by using inclusive type class intervals.

- vi) **Open end distributions**

An open end distribution is one in which one or two classes lack one class limit. It is possible that the first class intervals may not have the lower limit and the last class interval may not have the upper limit in a frequency distribution. Such a distribution is known as open-end distribution. For example, less than 10, 10-20, 20-30, 30-40, above 40.

In the above distribution the first class interval is presented as "less than 10" and hence the first class does not possess the lower limit. Again, the last class is presented as "40 and above" and hence there is no upper limit of this class. Each of these two class intervals is called an open-end class interval.

Illustration: The marks obtained by 60 students given below:

48	35	22	39	56	11	28	38	45	15
21	13	38	45	03	33	29	30	07	65
44	30	19	5	44	15	7	25	52	20
30	31	46	36	2	41	46	18	28	61
32	30	47	30	50	38	42	30	9	24
48	31	19	06	23	28	17	53	22	21

Construct a grouped frequency distribution

Solution: The lowest value is 2 and the highest value is 65. The appropriate class intervals shall be 10 to form 7 classes.

Frequency Distribution

Names	Tallies	No. of students
0-10	11	7
10-20	111	8
20-30	11	12
30-40	1111 1	16
40-50	1	11
50-60	1111	4
60-70	11	2
		Total= 60

Cumulative frequency

If we add the sum of the frequencies of all the classes preceding to a particular class to the frequency of that class then the result obtained is called the cumulative frequency of that class. From the definition it is clear that the simple frequency and the cumulative frequency of the first class in a frequency distribution are one and the same. The cumulative frequency of the second class is equal to the simple frequency of that class plus the simple frequency of the first class. The cumulative frequency of the third class is equal to the simple frequency of that class plus the cumulative frequency of the second class and so on.

A cumulative frequency can either be a "less than" cumulative frequency distribution or a "more than" cumulative frequency distribution. In less than type cumulative frequency distribution the cumulative frequencies are in ascending order and in more than type cumulative frequency distribution the cumulative frequencies are in descending order.

Below we illustrate as to how to present a less than type cumulative frequency distribution and a greater than type cumulative frequency distribution.

CUMULATIVE FREQUENCY DISTRIBUTION

Names	Frequency	Cumulative Less than type	Frequency Greater than type
0-10	7	7	53+7=60
10-20	8	7+8=15	45+8=53
20-30	12	15+12=27	33+12=45
30-40	16	27+16=43	17+16=33
40-50	11	43+11=54	6+11=17
50-60	4	54+4=58	2+4=6
60-70	2	58+2=60	2

Check your progress-IV

1. What do you mean by discrete number?
2. Explain the concept of frequency.
3. How do you construct continuous frequency distribution?
4. What is frequency distribution?
5. What are class limits?
6. What is cumulative frequency?

7.6 Presentation of Data by Graphs through diagrams and graphs histogram, frequency polygon

In the previous section we have discussed the techniques of classification and tabulation that helps in summarizing the collected data and presenting them in a systematic manner. However, these forms of presentation do not always prove to be interesting to the common man. Too many figures are often confusing and may fail to convey the message effectively to those for whom they are meant.

One of the most convincing and appealing ways in which statistical results may be presented is through diagrams and graphs. Evidence of there can be found in newspapers, magazines, journals, advertisements, etc. There are numerous ways in which statistical data may be displayed pictorially such as different types of diagrams, graphs and maps. An attempt is made in this section to illustrate some of the major types of graphs frequently used in presenting statistical data.

A frequency distribution can be presented graphically in any of the following ways:

- a. Histogram
- b. Frequency Polygon.
- c. Frequency curve
- d. 'Ogives' or cumulative frequency curve.

7.6.1. Histogram

The graph by which the frequencies of various class intervals of a frequency distribution with the help of adjacent vertical rectangles are shown is called a histogram. At the first step, the actual class intervals are marked on the x-axis choosing a suitable scale. Then taking these as bases, rectangles are to be drawn continuously on these bases. When the class intervals are equal then the heights of the rectangles will be proportional to the frequencies, but if the width of the class is not equal then the height of the rectangles will be proportional to the ratio of the length of the class-intervals to their corresponding class frequencies.

Illustration:

Represent the following data by means of a histogram.

Daily wages (in Rs.)	No. of Workers
0-10	2
10-20	12
20-30	20
30-40	15
40-50	10
50-60	3

Solution: Since the class intervals are equal, we can construct histogram as follows:

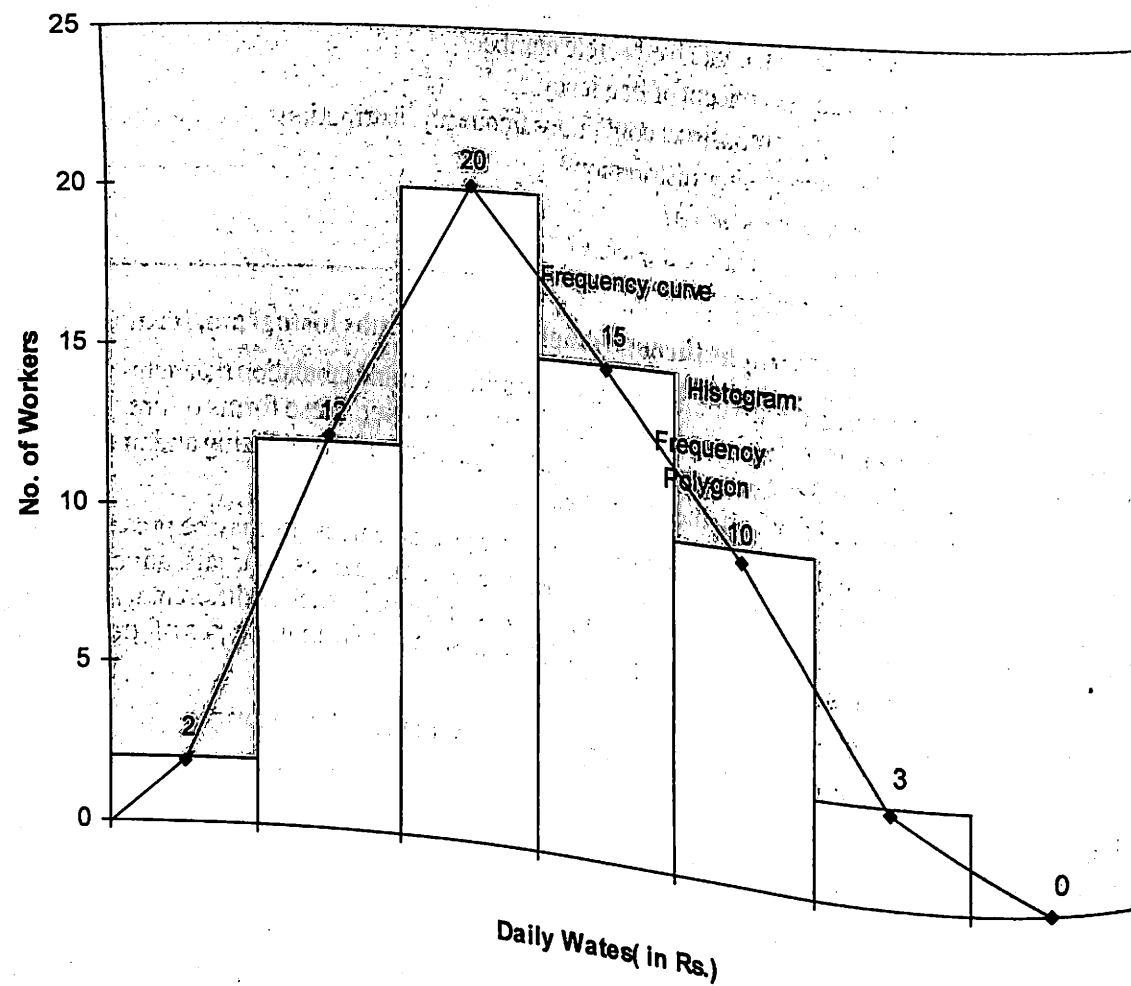
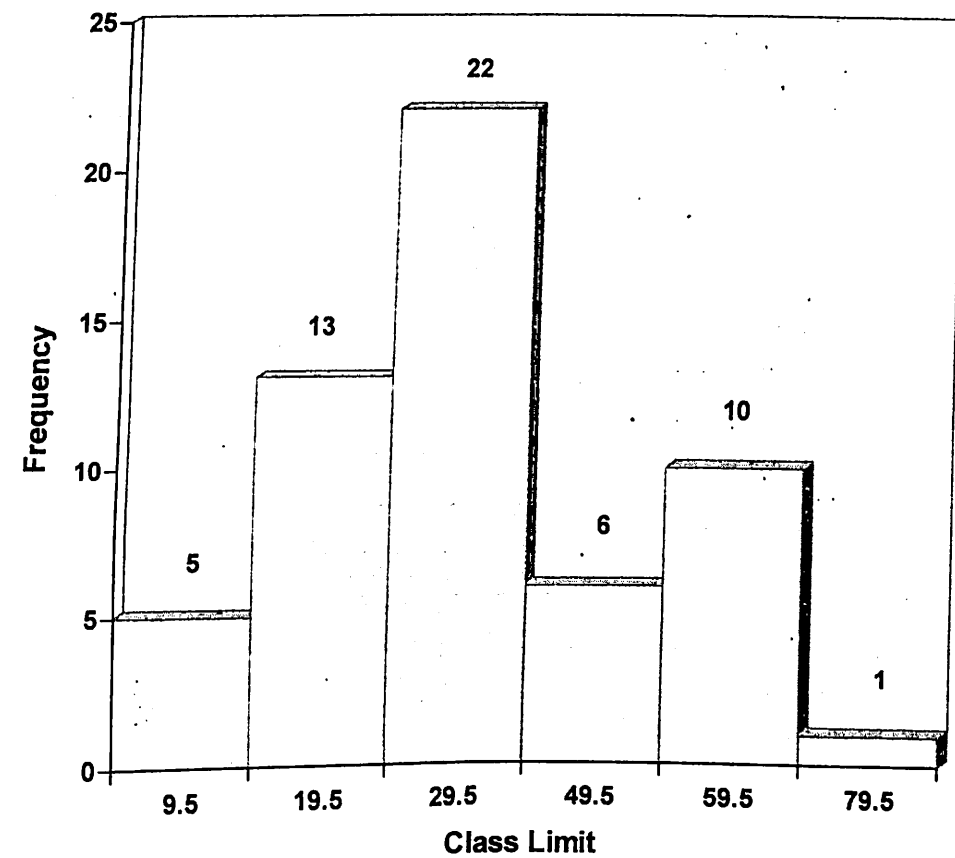


Illustration: Represent the following data by means of a histogram:

Solution: As the classes are of inclusive types we need to convert these class limits into class boundaries. Secondly we find classes are not of equal width. The lowest class interval is 10, The frequencies of the classes 30-49 & 60-79 shall be divided by 2, since the class intervals in these two classes is double.

True class boundaries	Frequency
0 - 9.5	2
9.5 - 19.5	12
19.5 - 29.5	20
29.5 - 49.5	15
49.5 - 59.5	10
59.5 - 79.5	3



7.6.2 Frequency Polygon

The graph obtained by joining the mid-points of the upper horizontal sides of the adjacent rectangles of a histogram by line segments is called a frequency polygon. We can also draw frequency polygon directly without obtaining from histogram. For this we take the mid-points of the class intervals on the x-axis and the frequencies of the class intervals are to be plotted against the corresponding class mid points along the y-axis. Then these plotted points are to be joined by line segments. Then the end points of the graph so obtained are to be joined with the mid-points of the two frequency. The graph obtained thereby is the desired frequency polygon.

7.6.3 Frequency Curve

Frequency curve is drawn freehand in such a manner that the area included under the curve is approximately the same as that of the polygon. The object of drawing a smoothed frequency curve is to eliminate as far as possible accidental variations that might be present in the data. While smoothing a frequency polygon the fact that it is really derived from the histogram should always be kept in mind. This would imply that the top of the curve would overtop the highest point of the polygon particularly which the magnitude of class-interval is large.

7.6.4 Cumulative Frequency Curve or Ogive

The graphical representation of a cumulative frequency distribution is known as the cumulative frequency or ogive. The first step is the construction of cumulative frequency columns from simple frequency. Then the upper class limits of the class intervals are marked on the x-axis. Then these points are plotted by showing the corresponding cumulative frequencies on the y-axis. Then these points are connected by drawing smooth curve

with free hand. This curve is the cumulative frequency curve or the ogive. Depending upon the pattern of drawing the graph we get two types of ogives namely, less than type ogive and more (or greater) than type ogive. The method of drawing both types of ogive is explained below.

Illustration; Draw the less than type ogive and the more-than type ogive of the following frequency distribution.

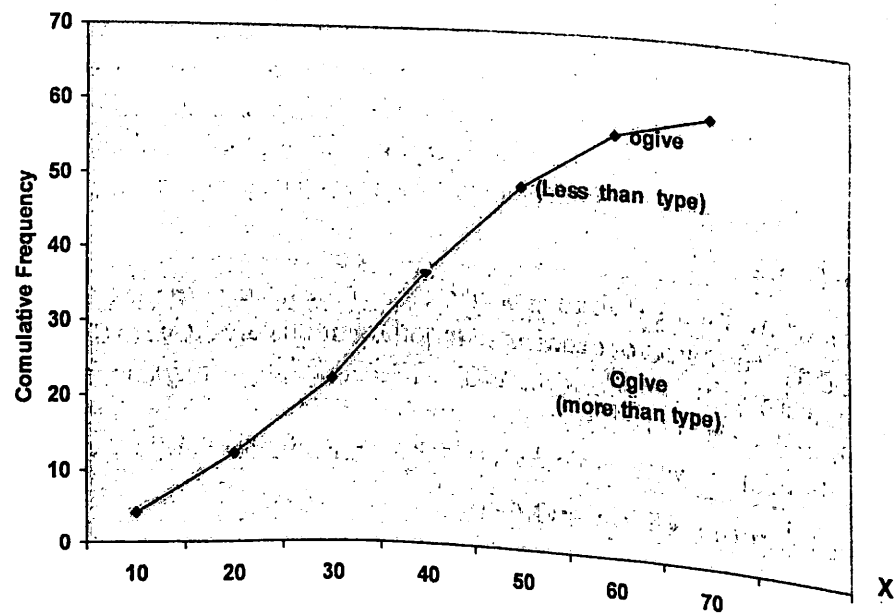
Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of Students	4	8	10	15	12	8	3

Solution:

The class intervals of the given frequency distribution are as per the exclusive. Hence the lower and upper limits of a class may be taken as the actual lower and upper limit of that class.

Class Interval	Frequency	Cumulative frequency	
		Less than type	More than type
0-10	4	4	60
10-20	8	12	56
20-30	10	22	48
30-40	15	37	38
40-50	12	49	23
50-60	8	57	11
60-70	3	60	3

Draw diagram



Check your progress-V

1. Define histogram.
2. Define frequency polygon.
3. Define frequency curve.

7.7 Let Us Sum Up

In this Unit we have taken up collection, classification and tabulation of statistical data. Data are of two types-primary data and secondary data. The data which are collected from its source of origin for the first time are called primary data. Secondary data are those data which were previously collected by some individual or agency for a certain purpose and are now compiled to extract some other information. The primary data are collected with the help of a number of methods such as direct personal interviews, indirect oral interviews, information from correspondents, mailed questionnaire method, and schedules sent through enumerators. Secondary data sources can be published or unpublished. The various sources of published data are

- (i) reports and official publications,
- (ii) Semi-official publication, and
- (iii) publications of autonomous and private institutions.

The required information from the primary data may be obtained by following either the census method or the sample method. Census or complete enumeration method of data collection refers to the study of all the items or observations in the population or universe. In sample method, on the other hand instead of investigating all the items in a population, some specific items are selected from the population for study and inferences are drawn regarding the population on the basis of the sample study.

The collected data are arranged in groups according to the common characteristics called classification of data. Classification makes the data easily understandable and it reveals the true significance of the data. Generally data are classified on the basis of location, period or time, quality, and quantity. The collected data after classification are recorded in rows and columns to give them tabular form and turned as tabulation of data. A statistical table has some important parts like, table number, title, caption, stub, body of the table, etc. A related issue of tabulation is frequency distribution. Frequency distribution is a tabular presentation of that generally organizes data into classes in terms of class intervals and shows the number of observations, called frequency, falling into each of these classes.

A frequency distribution can be presented graphically with the help of histogram, frequency polygon, frequency curve, and ogive. Graphical presentation of frequency distribution is one of the most convincing and appealing ways in which statistical results may be presented.

7.8 Key Words

- Primary Data** : Data collected from its source of origin for the first time and have never been used for any purpose earlier.
- Secondary Data** : Data previously collected by some individual or agency as primary data for a certain purpose and used by others.

Schedule and Questionnaire:

A schedule is a list of questions for collecting primary data to be filled in by the investigator or by the enumerators who are especially appointed for the purpose. A questionnaire is a list of questions pertaining to some enquiry which are usually sent through mail to the informants for answering the questions.

Census survey and sample survey

Census method of investigation is that method in which data are collected covering every item of the population or universe relating to the problem under investigation. On the other hand, sample method of investigation is that method in which data are collected from a sample of items drawn from the population and inference relating to the particular study of the population is made on the basis of these sample data.

- Population** : It refers to the set of all items or observations relating to any investigation.
- Sample** : Refers to a portion of the population selected so as to represent the whole population.
- Classification of data** : It implies the arrangement of raw data into groups or classes on the basis of their resemblances.
- Tabulation of data** : A systematic presentation of numerical data in rows and columns is termed as tabulation of data.
- Frequency** : It refers the number of times an observation is repeated.
- Frequency distribution** : Means a tabular summary of a set of data showing the frequency of items or observations in each of several non-overlapping classes.
- Cumulative frequency** : When we add the frequencies of the preceding classes to the frequency of a class then the result obtained is called the cumulative frequency of that class.
- Histogram** : Histogram is a graphical presentation of a continuous frequency distribution.
- Frequency polygon** : it is a graph formed by plotting class frequencies against the mid points of the corresponding classes and joining them and then extending its two ends to meet the horizontal axis at the mid-points of the two classes one of which precedes the first class and the other succeeds the last class.
- Ogive** : It refers to the graph of a cumulative frequency distribution.

7.9 Check your Learning:

1. Distinguish between primary data and secondary data.
2. Discuss the various methods of primary data collection.
3. Compare sample and census methods of data collection.
4. Discuss various types of classification of statistical data.
5. What do you understand by tabulation? What are the different parts of a table?
6. Prepare a blank table showing the distribution of the population in three important towns of Arunachal Pradesh according to sex, literacy and religion.

7. What do you mean by frequency distribution? Explain the construction of a frequency distribution.
8. How would you construct a frequency distribution table?
9. What are the steps necessary in forming a frequency distribution from raw data?
10. Define the following terms:
Class limits, class boundaries, frequency, cumulative frequency, mid value and class interval.
11. Marks obtained by 60 students are given below, prepare a frequency distribution table from these data.

40	55	16	28	38	15	26	48	09	17
35	39	33	25	18	59	62	45	39	31
25	35	38	49	52	34	16	13	23	19
52	58	36	36	03	11	29	59	37	38
50	07	42	37	32	29	38	45	48	51
20	33	38	39	42	55	37	28	17	39

12. Write short notes on (i) Histogram, (ii) Frequency polygon, (iii) ogive.
13. Construct histogram, frequency polygon and ogive from the data given below.

40	55	16	28	38	15	26	48	09	17
35	39	33	25	18	59	62	45	39	31
25	35	38	49	52	34	16	13	23	19
52	58	36	36	03	11	29	59	37	38
50	07	42	37	32	29	38	45	48	51
20	33	38	39	42	55	37	28	17	39

7.10 Suggested Readings

- S.P. Gupta - Statistics, S. Chand, New Delhi.
- A.L. Nagar and R.K. Das - Basic Statistics, Oxford, Delhi.
- A.G. Good, M.K. Gupta and B. Das Gupta - Basic Statistics, World Press, Kolkata.

7.11 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. Primary data : Data which are collected from original source for the first time and have never been used for any purpose.
2. Secondary data : Data which were collected previously by some individual/individuals/organisations for certain purposes.

- Questionnaire is a format for collecting information to questions in it, which the respondent fills in. A schedule, on the other hand is also such a format, the questions in which are filled in a face to face situation by another person of the investigator.
- Census method refers to the study of all individual items or observations in the population or universe.
- Sample method refers to the study of selected items from the population.

Check Your Progress-II

- Data:** The data are the facts, periods and other relevant materials, past and present, serving us the bases for study and analysis. The data may be quantitative or qualitative.
- Attribute:** The attribute is a quality like sex, age, caste, colour, etc. which can not be measured but whose presence or absence could be found in the population of study.

Check Your Progress-III

- Caption :** Caption is the heading for the columns of a table.
- Stub :** The extreme left hand column of a table which contains the headings of the row is called stub.

Check Your Progress-IV

- Discrete number:** refers to those numbers or variable which takes specific values only between two fixed limits.
- Frequency distribution:** The frequency distribution is a tabular presentation in which data are organised into classes in terms of class intervals and showing corresponding frequencies.
- Class limits:** The class intervals which represent all the values between certain limits.
- Cumulative frequency:** If we add the sum of the frequencies of all the classes preceding to a particular class to the frequency of that class then the result obtained is called cumulative frequency.
- Concept of frequency:** The frequency is the number of times an observation appears in the distribution. The frequency distribution is a tabular presentation in which data are organised in terms of class intervals and showing respective frequencies.

Check Your Progress-V

- Histogram :** A histogram is a graph of rectangles drawn with classes as bases and corresponding frequencies as heights.
- A frequency polygon is a figure drawn joining points corresponding to the mid value of a class and the respective frequency by straight lines.
- A frequency curve is a figure drawn joining points corresponding to the mid-value of a class and the respective frequency by free-hand smoothed curves.

Unit-VIII

MEASURES OF CENTRAL TENDENCY AND DISPERSION AND CONSTRUCTION OF PRICE INDEX

Structure

- 8.0 Objectives
- 8.1 Introduction
- 8.2 Measures of Central Tendency
 - 8.2.1 Arithmetic Mean
 - * Median
 - * Modes
- 8.3 Measures of Dispersion
 - * Range
 - * Standard deviation
- 8.4 Index Number
 - * Definition
 - * Construction of Price Index Number.
- 8.5 Let Us Sum Up
- 8.6 Key Words
- 8.7 Check Your Learning
- 8.8 Suggested Readings
- 8.9 Hints/Answers to Questions in Check Your Progress.

8.0 Objectives

The objectives of this unit is to introduce the readers with the applications of statistical methods in analysing the data and finding out the representative value from a data set to get the idea about the basic characteristics of the whole data.

8.1 Introduction

In the previous chapter we have discussed how statistical data are collected, classified and tabulated, and presented in graphs. But they do not provide a numerical expression which summarises the characteristics of the whole set of data under study. For this purpose we try to find out the most representative value with the help of some statistical methods known as measures of central tendency. These measures give the figure which represents the basic characteristics of the data under study but fail to demonstrate the nature of the data set. To understand the nature of the distribution we apply another statistical methods known as measure of dispersions. Sometimes we need also to know the average change of certain related variables of a particular problem with respect to time or location, which can be solved with the help of a method of statistics known as index number. Index number indicates the average rate of change of the variables under study and the most common but important index number is price index number.

8.2 Measure of Central Tendency

A measure of central tendency or an average of a certain distribution is a representative value of that distribution which 'enables us to comprehend in a single effort the significance of the whole'.

Briefly, we may say that an average of a distribution of the values of a certain variable is a representative of that value. Such a representative value obviously be greater than the lowest value and less than the highest

value of the distribution. It should be a value somewhere between these two limits, possibly at the centre, where most of the series concentrate. Such figures are called measures of central Tendency or Averages. Since an average reflects this tendency of data, hence an average is also called a measure of central tendency.

The word 'average' has been defined by various authors. Some important definitions are given below:

"Average is an attempt to find one single figure to describe whole of figures". - Clark.

"An average value is a single value within the range of the data that is used to represent all of the values in the series. Since an average is somewhere within the range of the data, it is also called a measure of central value". - Croxton and Cowden.

Characteristics of a good Average

According to Yule and Kendall an average will be termed good or efficient if possesses the following characteristics:

- It should be easy to understand.
- The average should be easily determined.
- The average of a variable should be based on all the values of the variable. This means that in the formula for average all the values of the variable should be incorporated.
- The average should not be unduly affected by extreme values, i.e., the formula for average should be such that it does not show large change due to the presence of one or two very large or very small values of the variable.
- The average should be rigidly defined. It means that the definition should be so clear that the interpretation of the definition does not differ from person to person.
- It should be amenable to further algebraic treatment.
- The value of average should not change significantly along with the change in sample. This means that the values of the averages of different samples of the same size drawn from the same population should have small variations. In other words, an average should possess sampling stability.

Types of Averages

There are three important measures of central tendency. There are:

1. Arithmetic mean.
2. Median
3. Mode.

8.2.1 Arithmetic Mean

The most popular and widely used measure of representing the entire data by one value is called arithmetic mean.

Simple Arithmetic Mean- individual observations

The process of computing mean for individual observations (where frequencies are not attached) is known as simple arithmetic mean and is very easy to compute.

n

If x_1, x_2, \dots, x_n are 'n' observations, then the arithmetic mean of this set of data denoted by \bar{x} is equal to

$$\frac{x_1 + x_2 + x_3 + \dots + x_n}{n}$$

$$\text{or } \bar{x} = \frac{1}{n} \sum_{i=1}^n X_i$$

When n = total number of observation.

Illustration 1: Marks obtained by a student in an examination given below. Calculate the arithmetic mean.

Marks: 56 45 36 62 49 50 38 55

Solution: Here, $n = 8$

$$= \frac{56 + 45 + 36 + 62 + 49 + 50 + 38 + 55}{8}$$

$$= \frac{391}{8}$$

$$= 48.88$$

$$\therefore \bar{x} = 48.88$$

So, average marks obtained by the student is 48.88

Short-cut method

The arithmetic mean can be calculated by using, what is known as an arbitrary origin. When deviation is taken from the arbitrary origin, the formula for

$$\bar{x} = A + \frac{\sum d}{n}$$

Where A = the arbitrary origin
 $d = (X_i - A)$, the deviation of items from A

Steps to be followed

1. Take an assumed arbitrary origin A .
2. Take the deviations of items from A and denote these deviations by d .
3. Obtain the sum of these deviations, i.e. $\sum d$

4. Apply the formula $\bar{x} = A + \frac{\sum d}{n}$

From illustration I: Calculate A.M by short-cut method

Say $A = 50$

Marks **$d = Xi - 50$**

56	+6
45	-5
36	-14
62	+12
49	-1
50	0
38	-12
55	+25

$$d = -32 + 23 = -9$$

$$\bar{x} = A + \frac{\sum d}{n}$$

$$= 50 + \frac{(-9)}{8}$$

$$= 50 - \frac{(-9)}{8}$$

$$= 50 - 1.12$$

$$= 48.88$$

So mean or average marks of the student is 48.88

If the different values of the variable is accompanied by frequencies, than the calculated average of such a variable is known as arithmetic mean for data in group. It can be calculated for both discrete series and continuous series.

Calculation of Arithmetic Mean-Discrete Series

If $x_1, x_2, x_3, \dots, x_n$ are n number of observations with $f_1, f_2, f_3, \dots, f_n$ frequencies respectively, then the arithmetic mean of such a distribution is denoted by \bar{X} and is equal to

$$\frac{f_1x_1 + f_2x_2 + f_3x_3 + \dots + f_nx_n}{f_1 + f_2 + f_3 + \dots + f_n}$$

$$\text{or } \bar{x} = \frac{1}{n} \sum_{i=1}^n fix_i$$

Where $N =$ total number of frequency $= \sum fi$

Illustration 2: Calculate A.M. from the data given below

X_i	f_i
20	8
25	10
30	15
35	20
40	12
45	8
50	5

Solution:

x_i	f_i	fix_i
20	8	160
25	10	250
30	15	450
35	20	700
40	12	480
45	8	360
50	5	250
	$N = \Sigma = 78$	$\Sigma fix_i = 2650$

So arithmetic mean

$$\bar{x} = \frac{2650}{78} = 33.97$$

$$= 33.97$$

Short cut method

The formula used in this method is

$$\bar{x} = A + \frac{\sum fidi}{N}$$

X_i	F_i		$Fidi$
20	8	-15	-120
25	10	-10	-100
30	15	-5	-75
35	20	0	0
40	12	+5	+60
45	8	+10	+80
50	5	+15	+75
	$\Sigma F_i = 78$		$\Sigma Fidi = -295 + 215 = -80$

$$AM \bar{x} = A + \frac{1}{N} \sum fidi$$

$$= 35 + \frac{-80}{78} = 35 - 1.03$$

$$= 33.97$$

Calculation of Arithmetic Mean-Continuous Series

If the frequencies are distributed in class intervals, i.e., when we have grouped frequency distribution we need to follow the first step as the step of finding out the mid-value of every class interval. When column of mid-values is constructed, we can apply the formula used for discrete frequency distribution for calculating arithmetic mean. You know that the mid-value of any class is the middle-most value of that class and can be calculated as the average of the two class limits. For example, if the class interval is 20-30, then the mid-value of this class is obviously 25 because this is the middle most value of this class and can be calculated as: . In this way mid-value of all classes are calculated before finding out the arithmetic mean of continuous grouped frequency distribution.

Illustration 3: Calculate mean of the following distribution:

Daily wage (in Rs.) 0-10, 10-20, 20-30, 30-40, 40-50, 50-60.
No. of labourers: 4, 20, 25, 32, 13, 6

Solution →

As the frequencies are given in each class, we are to first locate the mid-values of each class

wages	No of labourers(fi)	Mid value(xi)	f _{ixi}
0-10	4	5	20
10-20	20	15	300
20-30	25	25	625
30-40	32	35	1120
40-50	13	45	585
50-60	6	55	330
	ΣFi = 100		ΣF_{ixi} = 2980

So arithmetic mean

$$\bar{x} = \frac{2980}{100} = 29.80$$

Therefore, average wage = Rs.29.80

Short-cut method

When short cut method is used, arithmetic mean is computed by applying the following formula

$$\bar{x} = A + \frac{\sum fidi}{N}$$

The above problem is solved in short-cut method

Wages	Frequency	Mid value	di = xi-30	fidi
0-10	4	5	-25	-100
10-20	20	15	-15	-300
20-30	25	25	-5	-125
30-40	32	35	+5	+160
40-50	13	45	+15	+195
50-60	6	55	+25	+150
	N = 100		Σfidi = 20	

$$\begin{aligned} \bar{x} &= A + \frac{\sum fidi}{N} \\ &= 30 + \frac{(-20)}{100} = 30 - \frac{20}{100} \\ &= 30 - 0.2 \\ &= 29.80 \end{aligned}$$

So average wage = Rs. 29.80

Another step can also be added in short-cut method by changing the scale. Then the formula will be

$$\bar{x} = A + \frac{\sum fidi}{N} \times i$$

Where i = class interval i.e. difference between upper class limit and lower class limit.

Illustration 4 : Calculate Arithmetic mean for the frequency distribution given below;

Class limits	Frequency
0-9	8
10-19	13
20-29	18
30-39	17
40-49	11
50-59	5

Solution: Class marks are to be calculated at the first step which is the average of the lower upper class limits. The width of the class is $14.5 - 4.5 = 10$

Class limits	Frequency	Mid value	$d = \frac{Xi - 34.5}{10}$	fidi
0-9	8	4.5	-3	-24
10-19	13	14.5	-2	-26
20-29	18	24.5	-1	-18
30-39	17	34.5	0	0
40-49	11	44.5	+1	+11
50-59	5	54.5	+2	+10
	N=72			$\Sigma fidi = -47$

$$\bar{x} = A + \frac{\sum fidi}{N} \times i$$

Here, $A = 34.5$

$i = 10$

$N = 72$

$\sum fidi = -47$

Putting these values in above formula we get;

$$\bar{x} = 34.5 + \frac{-47}{72} \times 10$$

$$34.5 - 0.653 \times 10$$

$$34.5 - 6.53 = 28.97$$

Merits and Demerits of Arithmetic Mean

Merits:

1. A.M. is easy to determine and understand.
2. A.M. of a distribution is based on all the observations.
3. It can be used for further algebraic treatment.
4. The formula for A.M is rigidly defined.
5. A.M. provides a good basis for comparison.
6. For calculating A.M. of a series, its values need not be arranged in a given order.
7. If the A.M. and the number of observations of a distributions are known then the sum of the observation of the distribution can be known.

Demerits:

1. A.M. is unduly affected by the extreme values.
2. In case even a single observation of a series is missing, one can not determine the A.M. of the series.
3. The determination of A.M. of a grouped frequency distribution is based on the unrealistic assumption that the observations of each class is concentrated at the centre of that class.

* Median

The median by definition refers to the middle value in a distribution. Median is that value of the observation which divides the distribution in two equal parts when arranged in ascending order or descending order.

Median of Individual Series

In order to determine the median of an individual series, first of all the values of the distribution will have to be arranged either in ascending order or descending order if they are already not arranged in a finite order. If there are odd numbers of values in the series, then the $\frac{(n+1)}{2}$ th value from the beginning (and so from the end) will be the median. If the number of values is even then the average of the $\frac{n}{2}$ th value and the $\left\{\frac{n}{2} + 1\right\}$ th value will be the median.

Illustration 1: Find the median value of the following distribution:

15 19 09 27 21 39 03

Solution: First arrange these values in ascending order to get.

03 09 15 19 21 27 39

As the number of values is odd and equal to 7
So, $n = 7$ In such a case the median

$$\left\{\frac{n+1}{2}\right\} \text{th value i.e. } \frac{7+1}{2} = 4\text{th value}$$

4th value of the arranged series is 19
So, median = 19

Illustration 2: Find out the median of the distribution as follows

41 18 52 39 25 48 26

Solution: By arranging the values in ascending order we get
18 25 26 39 41 48 52 61

Here the number of observation is equal to 8, hence even number. Therefore, the median is the average of the 4th and 5th values. This is equal to

$$\frac{39 + 41}{2} = \frac{80}{2} = 40$$

So, median = 40

Computation of median-Discrete series

The followings steps are followed for computing median of discrete series.

Step 1: Arrange the data in ascending or descending order of magnitude

Step 2: Find out the cumulative frequencies

Step 3: Apply the formula: Median = Size of $\frac{N+1}{2}$

Step 4: Look at the cumulative frequency column and find that total which is either equal to $\frac{N+1}{2}$ or next higher to that and determine the value of the variable corresponding to it. It gives the value of median.

Illustration 3: Determine median for the following distribution.

Marks:	20, 25, 30, 35, 40, 45, 50, 55, 60
No. of Students:	7, 12, 19, 26, 30, 19, 13, 10, 5

Solution →

Marks	No. of students	Cumulative frequency
20	7	7
25	12	19
30	19	38
35	26	64
40	30	94
45	19	123
50	13	136
55	10	146
60	5	151
N=151		

$$\text{Median} = \text{Size of } \frac{N+1}{2} \text{ th item} = \frac{151+1}{2} = \frac{152}{2} = 76 \text{th items}$$

Size of the 76th item = 40 because 76 is the cumulative frequency of 40.
Hence, median = 40

Calculation of Median - continuous series

For continuous series, the following steps are followed to calculate median.

Step 1: Determine the median class. Median class is located on the basis

of $\frac{N}{2}$. The detection of median class is similar to the detection of median class of discrete series just discussed above

Step 2: After ascertaining the class in which median lies, the following formula is used for determining the exact value of median.

$$\text{Median} = L + \frac{\frac{N}{2} - F}{fm} \times i$$

Where,

- L = lower class boundary of the median class
- F = Cumulative frequency preceding of the median class
- fm = class frequency of the median class
- i = width of the median class.

Illustration 4: Calculate the median for the following distribution.

Daily wage (in Rs):	30-40	40-50	50-60	60-70	70-80	80-90
No. of workers:	5	12	18	15	11	4

Solution →

Daily wage	No. of workers	Culative Frequency
30-40	5	5
40-50	12	17
50-60	18	35
60-70	15	50
70-80	11	61
80-90	4	65
N=65		

$$\frac{N}{2} \text{ th items} = \frac{65}{2} = 32.5 \text{ th items}$$

Hence Median class = (50 - 60)

$$\text{So } L = 50 \quad F = 17 \quad i = (60 - 50) = 10$$

$$\frac{N}{2} = 32.5 \quad fm = 18$$

$$\text{Median} = 50 + \frac{32.5 - 17}{18} \times 10$$

$$50 + \frac{15.5}{18} \times 10 = 50 + \frac{155}{18} = 50 + 8.61$$

58.61

So median wage = Rs. 58.61

Illustration 5: Calculate the median for the following data

Weight (in gms.)	No. Of Orange
410-419	14
420-429	20
430-439	42
440-449	54
450-459	45
460-469	18
470-479	7

Solution: Since we are given inclusive class intervals, we should convert it to the exclusive one i.e. convert the class limits in to class boundaries. This is done here by deducing 0.5 from the lower limit and adding 0.5 with the upper limit.

Class boundaries	Frequency	Cumulative frequency
409.5 - 419.5	14	14
419.5 - 429.5	20	34
429.5 - 439.5	42	76
439.5 - 449.5	54	130
449.5 - 459.5	45	175
459.5 - 469.5	18	193
469.5 - 479.5	7	200

N=200

Median class = $\frac{N}{2}$ th items = 200 = 100th item

So, median lies between 439.5 - 449.5

Here, L = 439.5, F = 76, fm = 54, i = 10

Median = $439.5 + \frac{100 - 76}{54 - 42} \times 10 = 439.5 + 4.44 = 443.94$

Hence median weight of the oranges is 443.94 gms.

Merits and Demerits of Median

Merits :

1. Median is not affected by extreme values.
2. Median is easy to understand as well as easy to determine
3. Median can also be determined graphically
4. Median of individual observations and discrete series can be determined simply by observation.

Demerits:

1. The distribution has to be arranged for determining median of a distribution.
2. Median of a distribution is not based on all the observations of the distribution.
3. In comparison to mean it is more affected by fluctuations of sampling. This means that if we draw samples of size n from a population of size N , then the relative differences among the various sample medians is more than the relative differences among the various sample mean.

* Modes

The mode of a distribution is that observation of the distribution whose frequency is the maximum. It should be remembered that mode is not unique. This means that a distribution may have more than one mode.

It is clear that for individual observation without any frequency distribution does not have a mode. In case of a discrete frequency distribution, mode can be detected by inspection. Mode of a grouped frequency distribution is obtained by using the following formula:

$$\text{Mode} = L + \frac{f_0 - f_{-1}}{2f_0 - f_{-1} - f_1} \times i$$

Where,

L = Lower limit/lower boundary of the modal class
 f_0 = frequency of the modal class
 f_{-1} = class frequency preceding of the modal class
 f_{+1} = Class frequency following the modal class.
i = Class interval or width of the class limits.

Illustration 1: Determine the mode of the following distribution

Size of shoes:	1	2	3	4	5	6	7	8	9
No. of persons wearing:	58	15	25	30	42	20	11	3	

Solution: The highest frequency of this distribution is 42 corresponds to 6. Hence mode = 6.

Illustration 2: Calculate mode for the following data.

Marks	No. of students
0-10	4
10-20	14
20-30	21
30-40	30
40-50	43
50-60	19
60-70	8
70-80	2

Solution: Since the frequency of the class 40-50 is maximum, hence this is the modal class. Here we have

$$L=40, f_1=30, f_0=43, f_1=19, i=10$$

$$\begin{aligned} \text{So, mode} &= 40 + \frac{43-30}{2 \times 43 - 30 - 19} \times 10 \\ &= 40 + \frac{13}{37} \times 10 \\ &= 40 + 3.51 \\ &= 43.51 \\ \text{So mode} &= 43.51 \end{aligned}$$

Merits & Demerits of Mode

Merits

1. The mode of discrete frequency distribution is obtained by observation.
2. Mode is not affected by extreme values.
3. Mode is easy to understand.
4. Mode can be determined graphically.

Demerits:

1. Mode is not based on all the observations.
2. Mode is not suitable for further algebraic treatment.
3. Mode is not rigidly defined.
4. While dealing with quantitative data, the demerits of the mode outweigh its good features and hence it is seldom used.

Check your progress-I

1. What is mean?
2. What is median?
3. What is mode?

8.1 Measures of Dispersions

Introduction

The various measures of central value discussed in previous section give us one single value or figure that represents the entire data. However, measures of central tendency, very often, are not full representative of a given set of data. This happens when the extent of variation of individual values in relation to average, or in relation to the other values is large. For example, suppose Batsman A scores 9 to 91 runs in three successive innings and other values is large. For example, suppose Batsman B scores 40, 32 and 28 runs respectively. The average run of both the batsman is $100/3 = 33.33$ but variation of individual values is large. From the average run scored we can conclude that performance of both the batsman is the same. But individual runs establish the fact that Batsman B is more consistent than Batsman A. Therefore, when the extent of variation or scatteredness of the individual values of a distribution or series in relation to their average or in relation to the other values in large then measures of central tendency or averages cannot be representative of the distribution. Hence it is important for any investigation not only to know the average of any type (mean, median or mode) but also the scatteredness of the various observations of a distribution.

Scattered of data about an average is termed as dispersion or variation. To quote Spiegel, "The degree to which numerical data tend to spread about an average value is called variation or dispersion". According to Simpson and Kafka "The measurement of the scatteredness of the mass of figures in a series about an average is called measure of variation or dispersion".

Properties of a Good measure of Variation

A good measure of dispersion should possess the following properties.

1. It should be simple to understand.
2. It should be easy to compute.
3. It should be rigidly defined.
4. It should be based on all the observation of the distribution.
5. It should be unduly affected by extreme items.
6. It should be amenable to further algebraic treatment.
7. It should have sampling stability.

Measures of Dispersion

There are a large number of methods - absolute methods and relative methods used in measuring the degree of variation of the data in a particular distribution. We shall discuss here two absolute measures of dispersion. There are range and standard deviation.

$$\begin{aligned} \text{Range} &= L-S \\ \text{Where } L &= \text{Largest item, and} \\ S &= \text{Smallest item.} \end{aligned}$$

It should be noted that since the range of a distribution depends only on the largest and the smallest observations of the distribution hence in determining the range of an ungrouped or grouped frequency distribution

the frequencies of various observation or class intervals have no role to play. The range of a grouped frequency distribution is the difference between the upper class limit of the highest class and the lower class limit of the lowest class interval.

Illustration:

Marks obtained by the students in a class are 45 26 55 10 48 37, find the range.

Solution: The highest marks= 55
The lowest marks=10
Range = 55-10=45

Illustration : 2

Determine the range of the following distribution

Height (in cense):	162	163	164	165	166	167	168	169
No. of students	5	15	21	28	9	13	6	3

Solution :

The highest number is 169 cms.
The lowest number (height) is 162 cms
So, Range= 169-162= 7 cms

Illustration : 3

Determine the Range of the following distribution

Class intervals:	40-50	50-60	60-70	70-80	80-90
Frequency :	3	13	23	17	12

Solution :

The upper limit of the highest class (80-90)=90
The lower limit of the smallest class (40-50)=40
Range = (90-40)

Standard Deviation

The positive square root of the arithmetic mean of the squares of the deviations of the values of a distribution from its arithmetic mean is called standard deviation of that distribution and symbolically denoted by σ (signing). The standard deviation measures the absolute dispersion of a distribution; the greater the standard deviation, for the greater will be the magnitude of the deviations of the values from their mean. A small standard deviation means a high degree of uniformity of the observation as well as homogeneity of a series; a large standard deviation means just the opposite.

Calculation of Standard Deviation-Individual observation

If a variable x takes n values $x_1, x_2, x_3, \dots, x_n$ and \bar{x} be the arithmetic means of these values then

$$\begin{aligned} \sigma &= \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \dots + (x_n - \bar{x})^2}{n}} \\ &= \sqrt{\frac{\sum (x_i - \bar{x})^2}{n}} \\ &= \sqrt{\frac{\sum (x^2 - 2n\bar{x} + \bar{x}^2)}{n}} \\ &= \sqrt{\frac{\sum x^2}{n} - 2\bar{x} + \bar{x}^2} \\ &= \sqrt{\frac{1}{n} \sum x^2 - \left(\frac{1}{n} \sum x\right)^2} \end{aligned}$$

So S.D $\sigma = \sqrt{\frac{1}{n} \sum x^2 - \left(\frac{1}{n} \sum x\right)^2}$

Illustration 1:

Determine the standard deviation from the following observations:
1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13

Solution:

X	X ²
1	1
2	4
3	9
4	16
5	25
6	36
8	64
9	81
10	100
11	121
12	144
13	169
$\sum X = 84$	$\sum X^2 = 770$

$$\begin{aligned}
 S.D &= \sqrt{\frac{1}{n} \sum n^2 - \left(\frac{1}{n} \sum n\right)^2} \\
 &= \sqrt{\frac{770}{12} - \left(\frac{1}{12} \times 84\right)^2} \\
 &= \sqrt{64.17 - (7)^2} \\
 &= \sqrt{64.17 - 49} \\
 &= \sqrt{15.17} \\
 &= 3.89
 \end{aligned}$$

So standard deviation of the above observation is 3.89

Calculation of standard Deviation-Frequency Distribution

If a variable x takes the values x_1, x_2, \dots, x_n with f_1, f_2, \dots, f_n frequencies respectively, then the

$$S.D. \sigma = \sqrt{\frac{\sum f(x - \bar{x})^2}{N}} = \sqrt{\frac{\sum fn^2}{N} - \left(\frac{\sum fx}{N}\right)^2}$$

Illustration 2: Find the S.D. Deviation from the following frequency distribution.

X:	1	2	3	4	5	6
F:	2	3	4	3	2	1

Solution:

X	f	fx	fx ²
1	2	2	2
2	3	6	12
3	4	12	36
4	3	12	48
5	2	10	50
6	1	6	36
	N=15	Σfx=48	Σfx²=184

$$\begin{aligned}
 \sigma &= \sqrt{\frac{184}{15} - \left(\frac{48}{15}\right)^2} \\
 &= \sqrt{12.27 - (3.2)^2} = \sqrt{12.27 - 10.24} \\
 &= \sqrt{2.03} = 1.44
 \end{aligned}$$

So standard Deviation= 1.44

Short-cut method

It should be remembered that standard deviation does not depend on the change in origin but does on the scale. If the origin is changed from x to d by deducting a number (A) or mean of the distribution. Then the formula of standard deviation is written as -

$$\sigma = \sqrt{\frac{1}{N} \sum fd^2 - \left(\frac{\sum fd}{N}\right)^2} \times h$$

Where 'h' is the scale.

Illustration 3: Calculated standard deviation from the following frequency distribution.

Age (year):	20-25,	25-30,	30-35,	35-40,	40 - 45,	45-50
No of persons	170	110	80	45	40	35

Solution:

Age(year)	No.of persons f	Mid value x	D= X-32.5	fd	fd ²
20-25	170	22.5	-2	-340	680
25-30	110	27.5	-1	-110	110
30-35	80	32.5	0	0	0
35-40	45	37.5	+1	+45	45
40-45	40	42.5	+2	+80	160
45-50	35	47.5	+3	+105	315
	N = 480			Σfd= -220	Σfd²=1310

So putting all these value in above formula we get

$$\begin{aligned}
 S.D &= \sqrt{\frac{1310}{480} - \left(\frac{-220}{480}\right)^2} \times 5 \\
 &= \sqrt{\frac{131}{48} - \left(\frac{-11}{24}\right)^2} \times 5 \\
 &= \sqrt{2.73 - 0.2126} \times 5 \\
 &= \sqrt{2.5174} \times 5 \\
 &= 1.586 \times 5 \\
 &= 7.930
 \end{aligned}$$

So standard deviation = 7.930

Check your progress-II

1. What is dispersion?
2. Define range with an example.
3. Define standard deviation.

8.1. Index Number

Definition

An index number is defined as a specialized average designed to measure the change in a group of related variables over a period of time. Spiegel defined index number as "a statistical measure designed to show changes in a variable or a group of variables with respect to time, geographical location or other characteristics". According to Croxton and Cowdon "Index numbers are devices for measuring differences in the magnitude of a group of related variables".

In fact we are interested to know the average changes in the price or quantity during a period of time to understand the magnitude and direction of movement of these variables. Suppose we want to know the average change in prices of a set of commodities in 2005 with respect to the prices of the same set of commodities in 2001. In this case 2005 will be called current year and the year 2001 will be called the base year. Then the single number without any unit that will tell us the percentage change in the prices of the set of commodities in 2005 with respect to 2001 will be called the price index number. When the index number relates to price index then the base price is always taken as 100. If the base year is 2001 and the price index of the current year 2005 is 155 then it will indicate that the prices in 2005 have gone up 55% over base year 2001.

Usually the following notations are used to denote base year and current year prices and quantities and price and quantity indices for the current year with reference to the base year.

- P_0 = Price in the base year
 P_1 = Price in the Current year
 q_0 = Quantity in the base year.
 q_1 = Quantity in the current year.
 P_{01} = Price Index of the current year with respect to bases year.
 q_{01} = Quantity index of the current year with respect to the base year.

Construction of Price Index Number

The following steps are followed in constructing price index number.

1. **Purpose:** The purpose for which the index numbers are to be constructed must be understood clearly. That means the purpose must be clearly mentioned. For example, if it is desired to construct an index of consumer price we must know the class of consumers whose cost of living we intend to measure.
2. **Selection of Commodities:** In the next step commodities should be chosen in such a way that they are fairly representative of the phenomenon under investigation.

3. **Selection of sources of data:** A decision has to be taken about the arrangement to be made for obtaining the price quotations of the commodities selected from various centres. Utmost care should be taken in selecting the sample markets.
4. **Selection of base:** Now an appropriate period known as base year has to be taken which is always 100 for making comparison. The base should be a normal year but not be far from the current year.
5. **Choice of an average:** Usually arithmetic mean or geometric mean is used for constructing the index. Theoretically, geometric means is the best average in the construction of index numbers. But in practice, arithmetic mean.
6. **Selection of appropriate weight:** The term 'weight' refers to the relative importance of the different items in the construction of the index. All the goods purchased by the consumers are not of the equal importance and hence it is necessary to devise some suitable methods whereby the varying importance of the different commodities is taken into account. This is done by allocating weights.
7. **Selection of appropriate formula:** The last step of price index construction is the selection of appropriate formula from a large number of formulas. The selection of 94 appropriate formulas depends on the purpose of the index and data available.

Methods of Constructing price index numbers

The formulae which are used for constructing index number can be broadly classified as:

- (a) Unweighted index Numbers, and
- (b) Weighted Index Numbers.

Unweighted Index Numbers: In un-weighted Index numbers equal importance is assigned to all the item included in the index. There are two methods of constructing un-weighted index numbers namely, (1) simple Aggregate method and (2) Simple Average of Relatives Method. The price index for the current year with respect to the base year (P_{01}) is calculated as follows.

Simple Aggregate Method

The price index number calculated by this method is as follows:

$$P_{01} = \frac{\sum P_1}{\sum P_0} \times 100$$

Where $\sum P_0$ = Sum of the prices of the commodities in the base year.
 $\sum P_1$ = Sum of the prices of the commodities in the current year.

Simple Average of Relative Method

The price index calculated by this method is

$$P_{01} = \frac{\sum \left(\frac{P_1}{P_0} \times 100 \right)}{n}$$

Where n = the total number of items from which the index number is constructed.

Weighted Price Index Numbers

Weighted index number are of two types namely, (i) weighted aggregative indices, (2) weighted average of relative indices.

Weighted Aggregative Index Number

In this method, weights are assigned to various items included in the index to reflect their relative importance in the group. We have several index number formulae which involve different weighting techniques. The following formulae are important.

Laspeyre's Index

This index was devised by Laspeyre in 1864. In this method the base year quantities are taken as weights. The formula for constructing the index is

$$P_{01}^{La} = \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100$$

Paasche's index

In this index the weights are determined by quantities in the current year. The formula for constructing the index number as per this method is given by

$$P_{01}^{Pa} = \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100$$

Fisher's Index

Fisher's Index is the geometric means of Laspeyre's and Paasche's index numbers. Hence the index number is

$$P_{01}^F = \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100$$

Marshall-Edgework Index

In this method the arithmetic mean of the quantities in the base year and in the current year is taken as weights for both the base and current year. The formula for constructing index number as per this method is given below:

$$P_o^{ME} = \frac{\sum P(q_0 + q_1)}{\sum (P_o + q_1)} \times 100$$

Illustration 1: The following are the prices and quantities of 3 commodities in the years 2000 and 2004. Calculate price index number for the year 2004 by taking 2000 as the base year using.

- Laspeyre's method
- Paasche's method
- Fisher method and
- Marshall-Edge worth method.

Commodity	2000		2004	
	Price	Quantity	Price	Quantity
A	4	50	10	40
B	3	10	8	5
C	2	5	4	2

Commodity	2000		2004		P ₀ q ₀	P ₁ q ₀	P ₁ q ₁	P ₀ q ₁
	Price	Quantity	Price	Quantity				
A	4	50	10	40	200	500	400	160
B	3	10	8	5	30	80	40	15
C	2	5	4	2	10	20	8	4
					ΣP ₀ q ₀ = 240	ΣP ₁ q ₀ = 600	ΣP ₁ q ₁ = 448	ΣP ₀ q ₁ = 179

Laspeyre's Index Number

$$= \frac{\sum P_1 q_0}{\sum P_0 q_0} \times 100$$

$$= \frac{600}{240} \times 100 = 250$$

Paasche's index number

$$= \frac{\sum P_1 q_1}{\sum P_0 q_1} \times 100$$

$$= \frac{448}{179} \times 100$$

$$= 250$$

Fisher index number

$$= \sqrt{\frac{\sum P_1 q_0}{\sum P_0 q_0} \times \frac{\sum P_1 q_1}{\sum P_0 q_1}} \times 100$$

$$= \sqrt{\frac{5600}{240} \times \frac{448^{224}}{179}} \times 100$$

$$= \sqrt{\frac{1120}{179}} \times 100$$

$$= \sqrt{6.257} \times 100$$

$$= 2.5014 \times 100$$

$$= 250.14$$

Marshall-Edgeworth index number

$$= \frac{\sum P_1 (q_0 + q_1)}{\sum P_0 (q_0 + q_1)} \times 100$$

$$= \frac{\sum P_1 q_0 + \sum P_1 q_1}{\sum P_0 q_0 + \sum P_0 q_1} \times 100$$

$$= \frac{600 + 448}{240 + 179} \times 100$$

$$= \frac{1048}{419} \times 100$$

$$= 2.5012 \times 100$$

$$= 250.12$$

Check your progress-III

1. What is an index number?
2. What is a base year?
3. Define price index number.

8.5 Let Us Sum Up

A measure of central tendency or an average of a certain distribution is a representative value of that distribution which 'enables us to comprehend in a single effort the significance of the whole'. There are three important measures of central tendency. There are Arithmetic Mean (A.M), Median and Mode. Arithmetic mean as a single value widely used to represent the whole data set. Median refers to the middle value in 9 distributions while mode of a distribution is that observation a whole frequency is the maximum.

Dispersion or variation is defined as "the degree to which numerical data tend to spread about an average value". Standard deviation which is defined as the root-mean-square-deviation from arithmetic mean is considered as the most perfect measure of dispersion. A small value of standard deviation means a high degree of uniformity of the observation as well as homogeneity of a series.

An index number is defined as a specialized average designed to measure the change in a group of related variables over a period of time. The most common important index number is the consumer price index (CPI) which measures the average change in prices of certain goods over a period of time. It is used to measure the cost of living of the consumer. The steps that are followed in constructing price index number are

- (i) purpose,
- (ii) selection of commodities,
- (iii) Selection of sources of data,
- (iv) Selection of base,
- (v) choice of an average,
- (vi) selection of appropriate weight, and
- (viii) selection of appropriate formula. Laspeyres's index, Paache's index, Fisher's index, and Marshall Edgeworth Index are few important formulae used in construction of index number.

8.6 Key Words

Arithmetic Mean: Refers the average value of a set of observation and its characteristic represented by A./M

Median: Median is that value of the observation which divides the distribution in two equal parts when arranged in ascending order or descending order.

Mode: It refers that observation of a distribution which is having the maximum number of frequency.

Dispersion: Implies the degree of scattered ness of the individual figures from its average value.

Range: Defined as the difference between the value of the largest item and the value of the smallest item.

Standard deviation: It is a measure designed to show average changes in the price, quantity of value of a group of items with respect to time, geographic location or any other characteristic.

Whole sale price index numbers: It reflects the changes in the general price level of a country or an economy.

Consumer price index or cost of living index number: It measures the relative amount of money necessary to derive equal satisfaction during two periods of time, after taking into account the fluctuations in the retail prices of consumer goods during these two periods. It always relates to a specified class of people and a specified geographical area.

8.7 Check Your Learning

Measures of Central Tendency

1. What do you mean by the measures of central tendency? Discuss briefly the methods of measuring averages.
2. Examine the properties of a good average.
3. What are the measures of central tendency? Discuss the merits and demerits of these measures.
4. Find the value of arithmetic mean, median and mode from the following distribution.

Class Interval	Frequency
0-10	8
10-20	12
20-30	14
30-40	16
40-50	15
50-60	9
60-70	6
70-80	2

Measures of Dispersion

5. What do you mean by dispersion? Discuss the characteristics to be possessed by a good measure of dispersion.
6. Define standard deviation and explain why standard deviation is not widely used in statistical studies as a measure of variation.
7. Calculate standard deviation for the data given below.

Marks:	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	5	12	15	20	10	3

Index Number

8. What are index numbers? What are the uses of index numbers?
9. Discuss the construction and use of consumer price index numbers.
10. Calculate price Index Numbers for 2005 by

11. (i) Laspeyres's method, (ii) Paasche's method, (iii) Fisher's method, and (iv) Marshall-Edgeworth's method from the following:

Commodity	2000		2005	
	Price	quantity	Price	quantity
A	4	15	6	10
B	3	20	5	20
C	2	25	4	15
D	5	10	5	40

8.8 Suggested Readings

S.P Gupta : Statistics, S.Chand, New Delhi.

A.L. Nagar & R.K.Das : Basic Statistics, Oxford, Delhi

A.G.Goon, M.K. Gupta, and B.Das Gupta: Basic Statistics, World Press, Kolkata.

8.9 Hints/Answers to Questions in Check Your Progress

Check Your Progress-I

1. Mean: It is defined as the sum of values of observations divided by the number of observations.
2. Median: When observations are arranged in increasing or decreasing order of magnitude, the middle observation is the median. It may be of grouped and ungrouped data. Median is the value located in the middle of a given distribution after being arranged either in ascending or descending order as in a simple series.
3. Mode: The mode is the value which occurs the most often in the series. It is the value around which there is the greatest degree of concentration.

Check Your Progress-II

1. Dispersion: The scatteredness of data about an average is termed as dispersion or variation. It may also be termed as the degree to which numerical data tend to spread about an average value.
2. Range: The Range (R) of a set of numbers is the difference between the maximum and minimum values. It indicates the limits within which the values fall.
3. Standard Deviation: The standard deviation is the square root of the average of the squared deviations from the arithmetic mean of a set of observations.