



**BHARATHIDASAN
UNIVERSITY**
Tiruchirappalli- 620024
Tamil Nadu, India.

Programme: M.Sc. Statistics

Course Title: Demography and Official Statistics

Course Code: 23ST05DEC

Unit-III
Demography

Dr. T. Jai Sankar
Associate Professor and Head
Department of Statistics

Ms. E. Devi
Guest Faculty
Department of Statistics

UNIT - III

Population Distribution

- The term population distribution pertains to the pattern of distribution of people all over the earth's surface. Approximately, 90 percent of the current world population lives in around 10 percent of the available land area.
- Broadly, a vast majority of about 60 percent of the current world's population is covered by around 10 most populous countries in the world.

The density of Population:

- It is generally the ratio of the total number of people to that of the size of the land. Calculating the density of population is important to understand the pattern of population inflation
- The population density is calculated using the number of persons living in a square

Factors influencing the Distribution of Population

Population distribution can be influenced by various factors. Out of which, some of the geographical factors and economic factors act more. Here are a few economic and geographic factors, to mention a few. They indirectly govern the population distribution and density of population.

Geographic Factors

- **Climate:** Human habitation cannot handle extreme climates, which are very hot or cold deserts; hence, a very low population is found in such areas. People are more attracted to and prefer areas with a comfortable climate, with little seasonal variation, and a stable environment. For example, historians from early periods inhabited the Mediterranean regions because of their pleasant climate and supporting weather.
- **Soil:** Fertile soil is a must for agricultural and allied activities. Fertile loamy soil is very important for agriculture as it supports intensive agriculture, and gradually, more population is found in these regions.

Economic Factors

Minerals: Industries are largely found in the areas where large mineral deposits surround. This generates greater employability. The skilled and semi-skilled workers who are in search of employment move to these areas. This increases the density of

population in such areas. Katanga Zambia copper belt in Africa is the classic example in this scenario due to its abundant mineral resources.

Urbanization:

Urbanization happened because of migration from rural to urban areas. The creation of urban areas resulted in improved overall life quality in terms of employment, educational opportunities, transport, etc. Which are better than that of the rural areas. The rural to urban migration happens due to the attraction of city life and amenities availability, which results in the increase of the population size in the city or urban region.

Industrialization:

Industrial belts have good job opportunities. which attracts a large group of people to the areas of industries. This not just includes the industry operators, but, jobs such as transport operators, shopkeepers, bank employees, doctors, and other such services also get attracted. A classic example of population density due to industrial development is the Kobe-Osaka region of Japan. It became thickly populated due to several industries.

Social and Cultural Factors

- Places with religious or cultural significance also attract a large number of people
- Places with social and political unrest don't excite population density to increase.
- In recent times, schemes, where governments offer grants for people to live in sparsely populated areas and move away from overcrowded places, have arisen.

Population Growth

- The term population growth or population change means the number of people inhabiting or entering a particular country or a region during a specific time. This can be either positive or negative.
- The population density can be indicated in numbers or terms of percentage.
- Economic development of a particular area, social upliftment, regional development, and background change, etc., can be estimated or evaluated with the measure of population change in a particular area

Basic terminology Migration:

- Basic terminology to learn under migration is Place of origin and Place of destination.
- The place of origin is the location from which one has migrated, and the place of destination is the location to which one has arrived after migration. This clearly shows a decrease in population in the origin location and an increase in population in the destination location.
- Migration is also said to be an attempt to achieve population and resource balance.
- Migrants can be permanent, seasonal, or transitory.
- People may migrate from one location to another. They can occur from rural to rural, rural to urban, urban to urban, and urban to rural areas.
- Immigrants are migrant workers who move from their place of origin to another location.
- Emigrants are people who have left their home country.
- several industries.

Basic Concepts of Population Geography

Growth of Population: The change in population in an area between two points of time is called population growth.

Growth Rate of Population: The population change expressed in terms of percentage is called the population growth rate.

Natural Growth of Population: Natural growth of population is the difference between births and deaths in a specific region between two points of time.

$$\text{Natural Growth} = \text{Births in an area} - \text{Deaths in an area}$$

Actual Growth of Population: Births in an area – Deaths in an area + Migration into the area – Migration out of the area.

Positive Growth of Population: Positive growth of population can be determined when a larger birth rate than the death rate is observed between two-time points. It can also be calculated when a huge number of people migrate to that place permanently, which increases the population density over the area.

Negative Growth of Population: The negative growth of population can be determined when there is a fall in the birth rate below the death rate at a particular place over a time. When people move out or migrate from a particular place to another, creating a dip in the population density in that particular place.

Migration

Migration is the third component of population change, the other two being mortality and fertility. The nature of migration as a factor affecting population size is different from that of mortality and fertility. Migration is not a biological variable, while both mortality and fertility operate within the biological framework, though social, cultural, economic and political factors do exercise some influence on it. Migration may be considered as a symptom of basic social change. In most countries it has been observed that industrialization and economic development have been accompanied by large scale movements of people from areas of town, from towns to towns to other towns, and from one country to the other.

Factors that influence migration:

- **The Push factors:** Moving out of a place or shifting from a place of origin makes the place less attractive and results in unemployment, poor living conditions, unpleasant climate, etc.
- **The Pull factors:** Pull factors make the destination place more attractive than the place of origin. The new place may be better for job opportunities and living conditions, security of life and property, peace and stability, and a pleasant climate.

Concepts of Migration

The collection and analysis of migration data are carried out on the basis of a standard set of definitions of concepts.

Migration study resolves around

1. Internal migration

Internal migration is the migration of persons within a country

2. International migration

International migration refers to the movement of people from one country to another.

3. Immigration and Emigration

The terms immigration and emigration refer respectively to movement into or out of a particular territory, and are used only in connection with the international migration.

4. In-migration and Out-migration

In- migration is movement into a particular area while Out-migration is movement out of a particular area. In these cases the movement takes place internally within a country.

5. Migratory movement

The term is used in cases when a section of population movement occurs due to the migration process.

6. Place of Origin/ Place of Departure and Place of Destination/ Pace of Arrival

The place from where a move is made is the place of origin or departure. The place of arrival or the place of destination refers to the place at which the movement terminates.

7. Gross and net migration

The total of the arrivals of the immigrants and in-migrants and departures of emigrants and out-migrants is known as gross migration or the volume of migration. Net migration is the difference between the total number of persons who arrive and the total number of persons who leave. This is also referred to as the balance of migration.

8. Migration streams

The total number of moves made during a given migration interval which have a common area of origin and a common area of destination.

Methods of Measuring Internal Migration

Generally for estimation of internal migration is done by following processes

Direct Techniques

- This process is based on the data obtained from asking direct questions which are asked during a census on the movements of a person.

- Questions like- The place of birth of the person, the last previous place of residence of the person, the duration of stay of a person at the present place of residence.
- On the basis of question – “The place of birth of the person” the information can classify the population on two groups.

Non-migrants

Those who have enumerated in the place where they are born.

There are several advantages as well as disadvantages of using information of the place of birth to measure lifetime internal migration. The question on place of birth is easily understandable, simple and is expected that a person would remember his/her place of birth and thus the information from this question is accurate and complete.

In India, girls usually go to their parents' home for their first delivery. The child born at the home of the mother's parents by definition becomes a lifetime migrant, although being a non migrant. It has therefore been suggested that for a proper analysis of migration information, the usual place of residence of the parents should be taken as the place of birth of such a child rather than the place where the birth actually occurred.

Indirect Techniques

- ✓ This technique of estimation on migration does not require asking questions, the final estimation is done through total counts of census and the available age sex distribution of the population.
- ✓ The growth in the population of any area or region is basically due to natural increase of excess of births over deaths and migration movements.
- ✓ The tools to arrive these estimations are-
 - **Using vital statistics method**

Countries where reliable information on the birth and death of inhabitants is available, the estimation of a natural increase between two successive census operations can be obtained. The estimation of net migration can also be done subtracting the natural increase from the total population change.

In developing countries the data on births and deaths obtained from vital registration systems are not accurate and adequate, hence are poor quality. The errors in reporting of births and deaths therefore affect the estimation of net migration based on this approach.

- **The use of estimates of the probability of survival**

The approach for estimating the net internal migration for the period between two census operations is based on the survivorship probabilities obtained from existing life tables. The basic information needed is the age distribution of sex as enumerated in each area in two successive census operations and a set of survivorship ratios which may be applied to the population of the first census in order to derive an estimate of the number of persons expected to survive to the second census. The differences between the enumerated populations give the estimation of net internal migration.

International Migration

1. The United Nations Statistics Division, under the guidance of the United Nations Expert Group on Migration Statistics, has initiated revisions of the 1998 Recommendations on Statistics of International Migration (referred to as the 1998 Recommendations hereafter). Up until now, the definition of international migrant as stipulated in the 1998 Recommendations has supported to a certain degree comparability across countries. However, more than 20 years have passed since the 1998 Recommendations were published. Up until the Covid-19 pandemic in 2020, the obstacles of international migration were reduced. In particular, modern communication technologies and the increased convenience of travel lessened the psychological burden of living in other countries as migrants were able to remain in frequent contact with their families and friends in their origin countries. This includes both temporary and permanent moves associated with education or job opportunities and those due to political or environmental circumstances.

2. Increases in the levels and changing patterns of international migration, including asylum seekers and refugees, have raised the demand for accurate and timely data. Calls for better data from a number of initiatives have stressed the need to collect and use migration statistics to develop evidence-based migration policies and guide the integration of migrants into national development planning. These data are also needed for estimating populations and understanding demographic change.

3. Quality and timely data on international migration are needed for many reasons. They are increasingly related to population growth or decline, economic development, and

environmental concerns. As international mobility involves movements of persons from one country to another, there is a need for sharing data on these movements and ensuring they are comparable over time. Without such data, it is not possible to estimate the size of countries' Diasporas abroad or to benchmark the size and characteristics of international migration stocks and flows.

4. New migration patterns have already triggered various statistical initiatives. Other types of mobility, such as cross border and seasonal workers who do not necessarily meet the duration requirement of an international migrant, are considered policy relevant and now part of the framework in measuring migrant workers (ILO, 2018). The longitudinal aspect of migration is also endorsed by the work of an United Nations Economic Commission for Europe (UNECE) Task Force which is going to be published in the form of a recommendation.

5. The current international recommendations on statistics related to population favour the use of the concept of 'usual residence' although other population definitions exist. The variety of measures used to define populations is directly related to the variety of measures used to define migrant populations and migration flows. For a registered population, the 'non-vital' entries into (exits from) the population would be the persons newly registered (de-registered); for a 'permanent resident population', the persons joining are those receiving a permanent residence permit; and so forth. Other population bases are primarily used for administrative purposes.

6. Recent discussions on the relevance of concepts on international migration and the applicability of their definitions have raised some critical questions. For instance:

- a) Are the concepts "long-term migrant" or "usual resident population" too rigid to explain population changes in a modern world?
- b) How do the 1998 Recommendations on concepts and definitions meet policy needs and provide relevant data for analysing the impact of international migration and related phenomena on the economic and social situation of a country?

7. How countries measure international migration has also changed over the past 20 years. Many European countries and some countries in other regions are moving towards integrated statistical population register systems and linking other types of administrative

records. On one hand, this move improves the efficiency of national statistical systems in producing data; on the other hand, data generated from such systems have limitations that are common to any statistic based on administrative records.

8. Finally, despite continuous efforts made at the international and national level to promote the adoption of the 1998 Recommendations, widespread application of the Recommendations by countries has not been achieved. The 1998 Recommendations were often seen as a theoretical framework that is difficult to operationalize.

9. The conceptual frameworks and definitions presented in this document provide the basis for the revision of the 1998 Recommendations. The major aims of the revised Recommendations include:

- a. Building stronger links with data needs for policy making;
- b. Providing guidance on data collection and analyses;
- c. Revisiting the concept and definition of an international migrant and related phenomena;
- d. Covering new migration patterns and new data sources; and
- e. Incorporating relevant frameworks, such as the 2018 International Recommendations on Refugee Statistics⁷ and the new guidelines of the International Labour Organization concerning statistics on international labour migrations, while ensuring harmonization across them.

10. The final output of the Task Force is intended to be a (short) document to be used in the overall revision of the 1998 Recommendations. Given the logical association between the definition of migration and the definition of population, the proposal by the Task Force also includes a discussion for definition of population other than ‘usually resident’.

Urban:

Urban Area:

- An urban area is characterized by a high population density and the presence of built-up infrastructure such as buildings, roads, and other amenities.
- It includes cities and towns, and the demarcation between urban and rural areas is often based on population density and land use criteria.

Population Density:

- Urban areas typically have higher population density compared to rural areas. Population density is the number of people living per unit of land area.

Economic Activities:

- Urban areas often serve as centers for economic activities such as commerce, industry, and services. Cities tend to be hubs for job opportunities and economic development.

Infrastructure:

Urban areas are characterized by well-developed infrastructure, including transportation networks, utilities, educational institutions, healthcare facilities, and cultural amenities.

Diverse Population:

- Urban areas are often more culturally diverse and may attract people from different regions and backgrounds.

Metropolitan:**Metropolitan Area:**

- A metropolitan area encompasses a central city and its surrounding suburbs, often forming a larger economic and social region.
- It includes both the urban core and the adjacent areas that are economically and socially integrated with the central city.

Population Growth:

- Metropolitan areas tend to experience population growth due to factors like suburbanization, migration, and natural increase.

Economic Integration:

- Metropolitan areas are characterized by economic integration across the central city and its suburbs. Jobs, housing, and services are often distributed across the entire metropolitan region.

Transportation Networks:

- Efficient transportation networks connect the central city to its suburbs, facilitating the movement of people and goods within the metropolitan area.

Functional Interdependence:

- There is functional interdependence between the central city and its suburbs, meaning that activities such as work, residence, and recreation are spread across the entire metropolitan region.

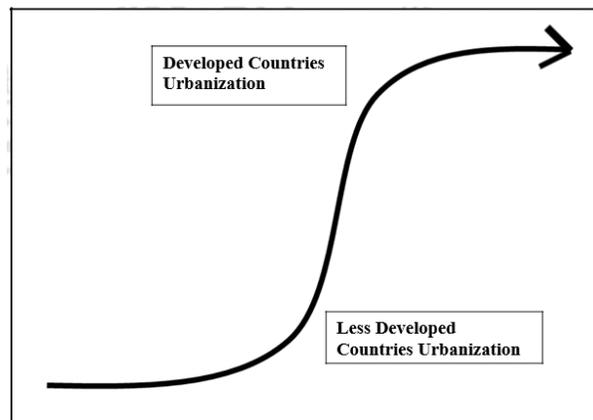
Governmental Organization:

- Metropolitan areas may have specific governance structures that address regional planning and coordination among various municipalities within the larger region.

Urbanization in Developed and Developing Countries around the World

Urbanization is basically a process of population concentration; a phenomenon which results in change in the places where people reside due to changing conditions in society at large. These changes occur in two ways – one through the multiplication of the sites where the population tends to concentrate and secondly by the increase in size of such population sites.

S-Shaped Curve of Urbanization



Urbanization in developed countries

The process of urbanization in developed countries was characterized with the following components –

- There was a high rate of increase in per capita product (15-30 per cent). This was because efficiency in production was increasing in the manufacturing sector.

- There was a substantial growth in population (10 percent per decade), because the death rate was declining as a result of medical advancements.
- There was structural change in the relative importance of different sectors of the economy.
 - ✓ Decline in the proportion of workers in agriculture because production efficiency had increased maximum in this sector.
 - ✓ Shift towards manufacturing and utilities (water supply, electricity, sewerage, transport, power generation) within manufacturing also there was a shift from production of the consumer to capital goods.
 - ✓ Increase in people engaged in professions like doctors, engineers, architecture, scientists etc.
- There was a high rate of expansion in foreign trade.
- The change in the average size of production unit from small to big and from unorganized to organized.
- There was very significant rural to urban migration because of advancement in the agricultural sector and factory towns started developing.

Kingsley Davis plotted levels of urbanization for many advanced countries and came to the conclusion that all the advanced countries follow the S- shape curve path of urbanization.

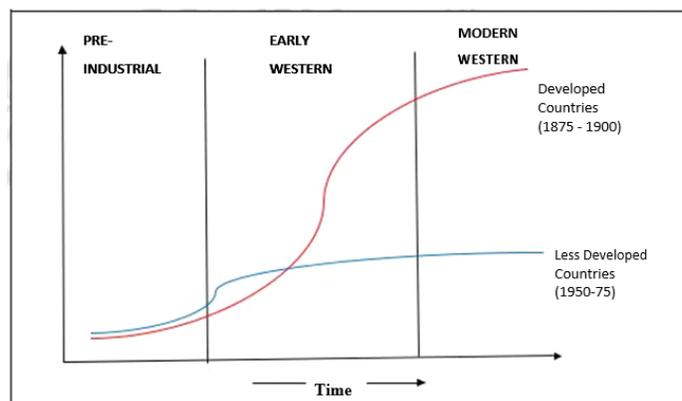
They experienced three stages –

- There were low levels of urbanization (10 – 12 per cent) when industries were near rivers in rural areas. Due to industrialization there was little increase in the levels of urbanization (15 – 18 per cent).
- The invention of the steam engine led to the development of factory towns with Iron and steel and textiles as important industries. Because of this, urbanization started growing at a very fast rate. Number of towns came up with industries like Iron and steel and textile, Engineering goods, Electrical and Electronics.
- By the 1920s the process of urbanization was changed by sub-urbanization but at a very slow pace; because the underground railways were set up in major cities. Moreover, after the 1920's, automobiles especially cars became more affordable making it convenient to live in the suburbs.

Developing countries

The countries that generally came under this category were basically colonies. These countries were characterized with the following features –

- Development of only port cities with the rest of the country having very low levels of urbanization.
- In the last 60 years population growth in developed countries has increased 2.7 percent times while in third world countries it has increased by 6.5 per cent times.
- Major urbanization in third world countries but this is taking place in the backdrop of low levels of economic development and industrialization.
- There were very low levels of life expectancy, education and energy consumption.
- There is massive rural-urban migration but for different reasons.



Stable Population:

- A stable population is a theoretical concept that represents a population in which the age-specific birth and death rates remain constant over time.
- In a stable population, the size and structure of the population remain constant from one generation to the next.
- It assumes a constant age-specific fertility rate, mortality rate, and net migration rate, resulting in a stable age distribution over time.
- Stable population models are useful for studying long-term demographic trends and making population projections.

Quasi Population:

- The term "quasi population" is often used in the context of age distribution or age structure analysis, especially when dealing with populations that are not stable.
- Unlike a stable population, a quasi population does not necessarily have constant birth and death rates or a constant age distribution.
- Quasi populations are often used in demographic studies to analyze age structures and demographic characteristics over a specific period, even if the population is not stable.
- This term is particularly useful when dealing with real-world populations that experience changes in birth rates, death rates, and migration patterns over time.

Intrinsic growth

Two approaches will be presented: an approximate one and an exact one.

1. Approximate calculation of the intrinsic growth rate and the stable age distribution

We use the net reproduction rate (NRR), which can be computed on the basis of the age specific rate for fertility and mortality. We derive an approximate expression for the intrinsic growth, which is somewhat easier to understand and simpler to compute two formulae that give results that are very close.

The annual growth rate in the stable population equals r . Therefore we can write

$$\text{NRR} = (1+r)^T$$

$$\text{Then } r = -1$$

$$= (\text{NRR})^{1/T} - 1$$

$$r = -1$$

2. Exact calculation of the intrinsic growth rate and the stable age distribution.

In the Appendix I prove the following exact expression for the intrinsic growth rate r :

$$\left\{ f_x \left(\frac{L_x}{l_0} \right) \right\} = 1$$

Here r is expressed as a function of age specific birth rates (only female births) and age specific mortality.

Systematic search:

- Choose $r = -1$, In other words, the approximate solution
- Check the sum in the left hand side of (4) with $r = r_1$: is $\text{sum}(r_1) = 1$?
- If not, choose a new value r_2 for $r = r_2 = r_1 + [\text{sum}(r_1 - 1)] / \mu$
- Check now the sum against one: is $\text{sum}(r_2) = 1$? If not, repeat the previous step as often as is necessary
- $r_3 = r_2 + [\text{sum}(r_2 - 1)] / \mu$
- $r_4 = r_3 + [\text{sum}(r_3 - 1)] / \mu$
