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Population Projections: Review of Uses, Methods, Procedures and Data Sources

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1. Introduction

Generally the information about population totals is not available except Census year. Hence we need to estimate population totals for the intermediate years. The information about future or past population totals is called an estimate.,

The population estimates can be obtained in many ways. Some methods use the past or most recent census using component, regression or ratio technique. for these methods data from administrative records or sample surveys is used. Some other methods develop estimates using interpolation technique over the dates between censuses. few methods gives estimated population figures by age, sex, race and other variety of socioeconomic and demographic characteristics. whereas some methods provide the estimated directly for the total population.

Generally, the term projection or a forecast is often used interchangeably by the demographers. Information about the future is termed as either a projection or a forecast. These terms can be differentiated according to the likelihood of their expected outcome.

A projection, under certain set of assumptions, is defined the numerical outcome of the future population. The conditional calculations provides a projection which can answer the future population if a particular set of assumptions hold true. Although the projected population figures can be judged by the merits of its assumptions.

A forecast is a projection that is most likely accurate population prediction. Forecast represents a precise standpoint concerning the legality of the primary data and assumptions. A forecast replicate a verdict and it can be established as right or wrong by future events. The term projection is a more inclusive term than forecast: Forecasts are subset of projections that is all forecasts can be projections but not vice-versa. Both Projections and forecasts include information regarding age, sex, race, and other properties of population totals.

Uses of Population Projections

Population projections are useful for the various purposes of Central and States governments and Private agencies for planning purposes. Population projections provide a instrument for analyzing the growth components and the underlying assumptions sensitivity. population Projections helps in improving the understanding about the determinants of change in population. These projections may help to answer the questions such as:

- What will be effect of 15% decline in birth rates on the population size and age structure?
- What will be the elimination of all deaths due to a particular cause (such as AIDS) affect the growth rate of population?
- How much will be the migration into a particular area if a new plant or factory unit (which provide employment to 1,000 people) were opened?

We cannot see into the future and hence we are always unaware of the scenarios in the future. In this case, a range of scenarios can be assumed based on different assumptions which are reasonable. Other scenarios indicates the possible variations in trends of future demographic characteristics, that facilitates alternative planning for “worst-case” outcomes. Certain outcomes are useful to noise warnings regarding the apparent negative implications of particular trends and with appropriate actions these outcomes can be prevented from occurring.

Another important use of the population projections is that it provides a rational basis for decision making and planning. The variations in the population dynamics and compositions have important implications on the politics, economics, social-cultural and environment. For this reason, projections of population become basis for producing projections of births, households, families, school enrollment, and labor force. Decision makers in the public and private sectors gets tremendous help from population projections.

National level population projections are useful in planning for future Social Security and healthcare facilities (Lee and Tuljapurkar, 1997; Miller, 2001). State level population projections are useful in determining demand of water in future (Texas Water Development Board, 1997) and the expenditures on welfare (Opitz and Nelson, 1996). The projections at local level are useful in estimating the need for new public schools (Swanson et al., 1998) and to select sites for fire stations (Tayman, Parrott, and Carnevale, 1994). The population projections can be used by the Business enterprises to forecast the demands for their products (Thomas, 1994) and to foresee the costs related to the current and retired employees (Kintner and Swanson, 1994). The other cases in which population projections can be used to forecast the demand for housing (Mason, 1996), determine the number of people with disabilities (Michaud, George, and Loh, 1996), determine the number of sentenced criminals (Oregon Office of Economic analysis, 2000).

In population projections, the future is very well coupled to the past. projections based on past trend of population totals and relationships adds our understanding about the population growth dynamics and often provides future population changes that are adequately precise to support excellent decision-making. The population projections are very important part of demographic analysis.

Population Projection Methods

Population projections can be obtained using one of the following methods.

1. Subjective methods
2. Objective methods

In subjective methods data used for prediction, techniques used for prediction, and assumptions underlying predictions are not clearly acknowledged due to which other researchers and analysts cannot reproduce these predictions exactly.

In objective methods data used for prediction, techniques used for prediction, and assumptions underlying predictions are clearly acknowledged and hence other researchers and analysts are capable of reproducing these predictions exactly. It is important to note that for projection of population, at some level, every method of population projection needs the application of judgment. It is essential to note that objective methods also need judgments regarding selection of variables for projection, selection of data sources for projections and the proper choice of projection techniques.

The Objective methods of population projections are classified in to following three major categories (Smith et al. (2001).

1. Trend extrapolation
2. Cohort-component
3. Structural models.

In Trend extrapolation methods, the historical trends are studied assuming its continuation into future. In trend extrapolation, historical trends are used to forecast or project the future population figures.

In the Cohort-component method, population is divided into smaller age-sex cohorts which is major factor for the fertility, mortality and migration. The trends of fertility, mortality and migration are different for each age-sex group. These age-sex groups are called as cohorts.

Various techniques are available to project each of the three important components (fertility, mortality and migration) of population growth.

In Structural Models we study the observed relationship between demographic and other variables. Regression analysis is used to develop a structural model for the projections of population into the future. sometimes we may need to incorporate more than one techniques. for example, structural models can be used along with cohort-component methods or cohort-component method can be integrated with the trend extrapolation method or structural models.

Data Sources

Source of historical data used for projection along with methods and assumptions used for the projection of populations into the future is one of the major factor that affects the accuracy of the projections. The Census figures of population along with the post-censal estimates of population figures serve as the foundation for the population upon which projections are based. The other sources of data that are of immense use are records of vital statistics, birth records, death records, records of migration. school enrollment records, voter registration lists, social security enrollees such as AADHAR, employment records, tax records etc. Sometimes, the data generated from sample surveys is also useful. In order to obtain the useful and accurate projections it is essential to find a accurate and comprehensive source of data.

Alternative Series

Generally the projected future population figures are generally far from the actual figures in terms of the magnitude, distribution and composition. To understand this uncertainty, the researchers (producers of the projections) often produce number of alternative series. each projected series may be produced under different assumptions. this technique is followed throughout the world (Australian Bureau of Statistics, 2000; Bongaarts and Bulatao, 2000; George, 2001; and Mosert and van Tonder, 1987). Generally, alternative series are based on the different combinations assumptions and same method of projection. Sometimes, these multiple series are produced using different techniques of population projections under same assumptions.

Generally, multiple alternative series are often based on different combinations of assumptions regarding mortality, fertility, and migration. The multiple alternative series can vary considerably from each other. Commonly, it is in the practice to generate two, three, or four alternative series. even if each alternative series is reasonable, one might be favorable to the others. Here it is important to note the point that generation of multiple series of population projections is not the only way to handle the issue of uncertainty.

Geographic Areas

Generally the population projections are needed according to various geographical areas. Sometimes, the projections are needed for the following sectors.

1. World as a whole
2. Major regions of the world
3. National level,
4. Subnational areas.

The subnational areas may include States, provinces, Districts, Cities, and individual blocks. It is observed that many of the variables used for the population projections that affect the methodology and analysis of population projections are the similar for all geographic areas. Although we may find some important differences according to the geographical area as below.

1. Reliable Data are easily available for nations than for subnational areas. For large subnational areas

reliable Data are easily available for nations than for subnational areas.
2. Migration is typically one of the important factor that plays an important role in growth of population for subnational areas as compared to the nations and for small subnational areas than for large subnational areas.
3. Generally it is observed that the population growth rates are more variable for subnational areas than for nations and for small subnational areas than large subnational areas.

The choice of source of data, technique of prediction and underlying assumptions of projections may vary at the level of each geographical are for which projections are to be made.

Majority of the research work that has been carried out on the methodology and analysis of population projections by considering projections at global, national and regional levels (Bongaarts and Bulatao, 2000; O'Neill et al., 2001; Lutz, Vaupel, and Ahlburg, 1999). Some studies have been done specially for the projections at subnational areas also. (Davis, 1995; Pittenger, 1976; Smith et al., 2001).

2. Producers of population projections

International producers

The agencies listed below produce population projections for the world as a whole, major regions of the world, and almost all countries.

1. The United Nations (UN)
2. The World Bank; and
3. The International Programs Center.

The international Program Centre is a part of the Population Division of the U.S. Census Bureau.

The first complete set population projections at national, regional and world as a whole was published by the United Nations (UN) in 1958. The second set was published in 1966 and since then it published a new set every two years since 1978 (O'Neill et al., 2001: 207). UN (1998) The United Nations (UN) provides population projection information according to age-sex structure which includes several variants based on variety of combinations of underlying assumptions. For these projections, United Nations (UN) integrate the information from the latest 10 round of censuses in each country beside this, the latest vital statistics and international migration data is also used..

The next producer of international population figures is the World Bank that produces national, regional, and global population projections since 1978 . Some of the sets of population projections that are produced by World bank include alternative series, where as other includes only a single series. Currently World Bank produces population projections only for internal use. Earlier (till mid-1990s) World Bank used to publish the projections in various issues of the World Development Report. (O'Neill et al., 2001: 208).

Since 1985, the International Programs Center (Population Division) of the U.S. Census Bureau started producing national, regional, and global population projections.These upodates on the projections of population are also published nearly every other year (O'Neill et al., 2001: 208). These projections which coversoverall 227 countries and the major important regions of the globe are also available online at its "International Data Base (U.S. Census Bureau, 2001). These population projections of the total population are available in 10-year intervals through 2050. The population projections according to age and sex are available for the period 2000 - 2025. The other agencies which produces international population projections (Cruijsen, 1994; EUROSTAT, 1998) includes:

1. Population Reference Bureau,
2. The International Institute for Applied Systems Analysis (IIASA)
3. The Statistical Office of the European Communities (EUROSTAT)
4. Australian National University,
5. The Futures Group,
6. U.S. National Research Council.

National producers

In each country, there are many agencies which involves in the production of national-level population projections for that country. Generally, these agencies are either the part of the national government or they work for the corresponding national governments. The national level population projections produced by the agencies of various countries are different in accordance with the methodology, underlying assumptions, source and quality of the input data, frequency and length of projections and quantity of details provided.

Some of the major national producers are listed below.

1. Indian Office of the Registrar General, 2001U.S. Census Bureau,
2. Australian Bureau of Statistics,
3. Israeli Central Bureau of Statistics, 1987,
4. Statistics New Zealand, 2000

Sub-national producers

Different Research institutions, government agencies and private businesses require subnational population projections. These institutions and agencies also involved in producing subnational population projections. Most of the state governments of various countries make projections at states level, district level, cities, blocks/wards, and other small areas. Over the last few years, subnational (especially small areas) population projections are commonly in demand by the local governments and the private businesses.

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