

DEMOGRAPHY: THE PAST, PRESENT AND FUTURE

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Summary

As the theme introduction, this essay begins with a brief discussion about “What is demography” in general and what are *formal demography* and *population studies* in particular. The three distinct features of demography are summarized as: (1) *Mostly quantitative and relatively more “accurate.”* (2) *Interdisciplinary.* (3) *Applicable.* The author also emphasizes what is new in this EOLSS volume of Demography, as compared to other existing similar publications.

After a review of the historical evolution of demography and the main streams of population theories, the author presents the major demographic data sources of vital statistics, census, sampling surveys, and administrative records. The author devotes some particular attention to the American Community Survey (ACS), which represents the most substantial and innovative reform of the traditional censuses in the 1990s. The author also highlights the recent extensions of the data content in demographic surveys, namely, demographic data collections have been evolving from merely including demographic, socioeconomic and behavioral information to also including health, environmental, biomarkers and DNA information. While the author presents the promising progress in openness of demographic data sources in North America, Europe and Australia, he expresses worries about the unreasonable and unnecessary distribution restrictions of the demographic data sets in Japan, China, India, and many other developing countries. In these many countries, the census sampling data sets and the national survey data sets are not made publicly available; it is very hard for a researcher to get access to the data sets. Such a situation is very unfortunate for broad and in-depth

analyses of the data in scientific research and policy studies. This is also unfair for the tax payers who share the costs of the data collections. The author thus suggests initiating a global discussion about the openness of demographic data, while at the same time effectively protecting individuals' confidentiality.

The essay briefly discusses the fact that demographic analysis usually employs simple or modest mathematical methods, with a few exceptions for some models in mathematical demography. The basic methodological characteristics of formal demography and population studies are summarized in an easily understandable way.

Finally, the author discusses the challenges and future perspectives of demography in the following five aspects, which are also the major challenges currently faced by global communities: (1) Rapid population aging due to low fertility and longevity; (2) Changes in family; (3) Gender equality, son-preference and rising sex ratio at birth in some developing countries; (4) Demographic consequences of migration in both origination and destination regions; (5) Population and environmental sustainability; (6) Global health including reproductive health, HIV/AIDS and healthy aging.

1. Demography as a Discipline of Science

1.1. What is Demography?

According to the classic and widely accepted statement by Hauser and Duncan (1959: 2), *demography* is defined as “the study of the size, territorial distribution, and components of population, changes therein, and components of such changes.”

Almost all disciplines of social sciences and most disciplines of natural sciences deal with human beings one way or another, either directly or indirectly. Furthermore, demographic concepts (e.g., birth rate, death rate, and migration) and methods and analysis strategies (e.g., life table analysis) can be readily extended to other species (insects, animals, plants, etc.) and inanimate collectives (enterprises, automobiles, etc.). Thus, demography may provide the empirical foundation for human beings, animals, and inanimate collectives on which other relevant scientific research are built (Xie, 2000).

In general, there are two types of demography: *formal demography* (also known as demographic analysis in the classic European literature) and *population studies*. Formal demography deals with fertility, marriage/union formation and dissolution, mortality, and migration, normally using specific demographic concepts, measures and methods. Use of simple or modest mathematics is usually an essential component of formal demography. Mathematical demography (see Chapter 17 of this Volume) is an exception which employs more sophisticated mathematics. Population studies are concerned with the various determinants of population changes and the impacts of population changes on societies, economics, biological evolution, environment, politics, culture, etc. Population studies employ concepts, measures and methods of formal demography, statistics, and the other disciplines (e.g., sociology, economics, biology) to which the research topic is related. Formal demography focuses more on relations within the

demographic system while population studies cover the relations with other fields.

1.2. Distinct Features of Demography

As a scientific discipline, demography has a number of distinct features.

(1) *Mostly quantitative and relatively more “accurate.”* Description, discussion and explanation of changes in population size, structure, and distribution, as well as the demographic factors of fertility, mortality, marriage/union formation and dissolution, and migration are mostly based on demographic data. These data are generally available from the census, vital statistics and surveys, which facilitate the quantitative analysis of demography. The International Encyclopedia of the Social Sciences offers a view of demography as “the quantitative study of human populations” (Nam 1979: 486).

Demographic events such as births, marriages, divorces, deaths, and residence changes are observable and measurable. But many other social science disciplines are concerned with social or economic phenomena which cannot be easily observed and measured, such as values, attitudes, social clusters, non-wage income, management, and political views. Also, to some extent like the natural sciences, the reproduction and survival of population have certain properties of “order of nature.” For example, the relative distributions of age-specific death rates are rather similar between different time periods in a population, although the mortality level may change substantially between periods. The age trajectory of human fecundity in the absence of intervention is rather stable across populations and periods. Due to the relatively rich data resources with large sample sizes and the certain “order of nature” of the demographic processes, many people believe that, as compared to other social science disciplines, demography is the most “accurate” discipline. Philip Hauser, one of the most influential sociologists in the 20th century, stated, “working with demographic phenomena thus enables the sociologist to avoid the frustration he all too frequently encounters when neither his independent nor his dependent variables are sufficiently well measured to permit the observation of possible relationships.” Indeed, although subject to uncertainty, demographers are able to predict future population size and age structure with a relatively high degree of confidence, utilizing information pertaining to past fertility, mortality, migration, and the “order of nature” in age patterns of demographic processes and population dynamics (Xie 2000).

Furthermore, as Samuel Preston pointed out, one of the virtues of demography, related to its “accuracy” mentioned above, is that demographers often spend a good deal of time studying the quality of demographic data. This is a legitimate research area in demography, which is not true of many other social sciences. That is part of the reason why demographic data are generally of good quality. Demography is also the most inductive of the social sciences, “learning the truth from facts,” which we may consider a virtue as well.

(2) *Interdisciplinary.* As defined earlier, population studies, which consist in large part of demography, are typically interdisciplinary, crossing over between formal demography and other disciplines, such as sociology, economics, health science,

gerontology, geography, biology, business and governmental management. For example, demographers draw heavily on biology and sociology for the study of fertility and population aging, on economics and geography for the study of migration and the labor force, and on health sciences for the analysis of mortality. The centers and institutes of demography all over the world are interdisciplinary, with researchers and faculty from various disciplines and departments, while demographic centers in many universities are administratively affiliated with a department, mostly sociology or economics. A typical example is the national research entity the “Netherlands Interdisciplinary Demographic Institute,” part of the Royal Netherlands Academy of Arts and Sciences. Another example is the classic and the most influential book on demography “The Study of Population: An Inventory and Appraisal” by Hauser and Duncan (1959), which includes such chapters as Sociology and Demography, Economics and Demography, Genetics and Demography, Physical Anthropology and Demography, Geography and Demography, and Ecology and Demography. Due to its interdisciplinary nature, there is usually no undergraduate major of demography in the higher education systems.

(3) *Applicable*. Demography is one of the most widely applied disciplines of science, due to the nature of its subject – size, structure, and factors affecting changes in human population, which are intellectually intriguing and certainly of broad public interest. Population changes influence the provision of health care, family planning services, education, welfare, housing, other programs of public service, and government budgets. They influence the work of financial institutions, the communications industries, and recreation agencies. For example, as the baby-boom cohorts arrived at schools, local school systems had to absorb a giant wave of students at each successive grade, recruit new teachers, and find additional classroom space; the opposite occurred when the baby- trough cohorts reached schooling ages. The fact that the population changes have been much more dramatic in developing countries than in the developed countries has led Caldwell (1996) to conclude that “No other social-science discipline than demography had turned so far toward Third World studies,” although most demographic concepts, theories, and methods originate from Europe and North America.

The close correlation between demographic changes and industries dealing with housing and other household consumption is another good example of applicability. Not only must housing units be built to accommodate the growing or shrinking demand of households for living space, but they must be matched in terms of a variety of characteristics of the population and households, such as type/size of households and age/sex/income of the household members. Prskawetz and colleagues (2004) provided an interesting case demonstrating the applicability of demographic analysis on business forecasting and planning. They found that it would yield seriously misleading results regarding the future increase in automobile use in Austria if one simply multiplied the anticipated number of households in the future by the average number of automobiles per household observed in recent years. This is because future Austrian households will be comprised of many more one- and two-person households (which mostly need only one car) than today's households. They applied more sophisticated demographic methods and produced more realistic and detailed projections of future households by household types/sizes/age of householders and automobile use. Similar implications may also be relevant to other business analyses, for example, of usages of energy,

housing, furniture, and other goods/services consumed by households in many countries for which future trends indicate many more one- and two-person households.

Demographic influences are pervasive in every facet of social, economic and political life; the possible applications of demography are useful to understand the nature of any defined population group or activity in our society. However, the reader should avoid adopting a stance of demographic determinism. Demographic factors alone cannot account for the social and economic changes observed. For example, demographic facts alone cannot serve as the basis for decisions to expand or shrink the programs of public education, local commuting, housing construction and health services. This is why demographic studies must be interdisciplinary and correlated or integrated with other disciplines, as we discussed earlier.

1.3. What is New in this Volume?

What is new in this EOLSS volume of Demography, as compared to other existing similar publications? In his presidential address at the Population Association of America annual meeting in 1979, Charles B. Nam (1979: 485) stated that “Demography was ignored as a field of knowledge in its own right” and “this uncertain place of demography is plainly indicated by its treatment in the Encyclopedia Britannica, the most scholarly and authoritative of the English language general encyclopedias. Demography received its only citation under sociology, as a cognate discipline along with criminology, penology, social psychology, and human geography.”

However, as to be reviewed later, demography has been growing quickly since 1970s, accompanied with the rapid increase in population data sources and computing technology, which largely enhanced methodological development and applicability of demography in societies. Consequently, for the first time in the multi-discipline and multi-volume general encyclopedias for the broad audiences of non-experts and experts, EOLSS under the auspices of UNESCO includes “Demography” as a distinct volume, which may be regarded as an indicator that the world community recognizes demography as a distinct discipline of science.

Following this introduction essay, each of the 22 chapters covers a sub-field of demography in depth and contains relevant and necessary details of the established knowledge associated with it. The volume aims to be of value to the various audiences of both non-specialists and experts who seek a comprehensive understanding of issues related to human population.

2. Historical Evolution of Demography and Population Theories

2.1. Progress of Demography as a Scientific Discipline

Population counts and statistics date back to thousands of years ago. One of the earliest documented censuses was taken in the year 500-499 BC by the Persian Empire's military for issuing land grants and taxation purposes. The world's oldest extant census data came from China during the Han Dynasty, taken in the fall of 2 AD and considered

by scholars to be relatively accurate. At that time there were 57.5 million persons living in Han China, the world's largest population (<http://en.wikipedia.org/wiki/Census>). In the Middle Ages, the most famous census was the Domesday Book, undertaken in 1086 AD by William I of England, who wanted to properly collect taxes. These earliest censuses were mainly for taxing and military recruiting and thus usually focused on male adults only. In 1370, the Chinese Min dynasty conducted a census including name, age, sex, and relationship to the household head for all members of the household, which is rather similar to the short-form of the modern census. The U.S. and U.K. started the modern censuses in 1790 and 1801, respectively.

The early population data collections for governors' ruling purposes certainly created the need and incentive for the methodological development of demography. Formal demography began to emerge when John Graunt estimated the first life table for the population of London in 1662. Graunt is generally regarded as the father of demography. The influential (but mostly unverified by empirical evidence) political economic investigation of population growth by Malthus in 1798 stimulated interdisciplinary studies between demography and the other disciplines. The most remarkable milestone of mathematical demographic innovation was due to the work of Alfred J. Lotka in 1922. Lotka invented the mathematical equations expressing the "law" of the intrinsic relationship between birth rate, death rate, population growth rate, and age structure in a stable population in which birth and death rates were kept constant in the long-run. Following Lotka's milestone innovation, the rapid development of both formal demography and interdisciplinary studies of population has occurred, since the 1950s. Such rapid development was due to increasing practical needs, expansion of population data sources, and the booming of computing technologies in the recent decades.

In addition to the increasing volume of demographic publications, other marks of the progress of demography during the last few decades include the first world conference of demographers held in 1927, and the establishment of the International Union for the Scientific Study of Population (IUSSP) in 1928. Subsequently, national organizations of demographers in almost all countries in the world as well as regional organizations of population associations (e.g. European, Asian and African Associations of Population Studies) emerged and grew quickly. The number of IUSSP members increased from 35 in 1928 to more than two thousand from 140 countries today. In recent years, the Population Association of America (PAA) annual meeting usually has about 3,000 participants each year from the U.S. and all over the world.

With the rapid and steady growth as a profession in recent decades, demography has stronger influence and receives wider citations than the other disciplines of social science. For example, on the basis of data assembled by the Institute for Scientific Information, 64 percent of the articles published in demography journals are cited at least once in the first five years following their publication, in contrast to 52 percent for the social sciences in general and seven percent for the humanities (Van Dalen and Henkens 1999: 230).

Furthermore, given the wide concern about population growth, demography has played important roles in the world politics. For example, there have been a series of

intergovernmental population conferences that have adopted World Population Action Plans and have defined all sorts of principles concerning population health, family planning, reproductive health, welfare, and poverty elevation. Such international population activities have also greatly influenced the status of women and human rights, and enabled international co-operation and funding (United Nations Funds for Population Activities).

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Biographical Sketch

Zeng Yi is a Professor at the Center for the Study of Aging and Human Development and Geriatric Division / Dept of Medicine of Medical School, and Institute of Population Research and Dept. of Sociology, Duke University. He is also a Professor at the China Center for Economic Research, National School of Development at Peking University in China, and Distinguished Research Scholar of the Max Planck Institute for Demographic Research (MPIDR) in Germany. He received his doctoral degree from Brussels Free University in May 1986, and conducted post-doctoral study at Princeton University in 1986-87. Up to Feb. 2008, he has had 81 professional articles written in English published in academic journals or as book chapters in the United States and Europe; among them, 51 articles were published in anonymous, peer-reviewed academic journals. He has had 85 professional articles written in Chinese and published in China; among them, 55 articles were published in national top Chinese academic journals. He has published sixteen books, including five research books (as first author), such as "Family Dynamics in China," published by the University of Wisconsin Press; one textbook on demographic methods (as the sole author); two volumes of demographic software and user's manuals (as the first author) on family status life table analysis; six edited books (four as the chief editor, and two as the second editor), such as the 2005 and 2008 books published by Springer for which he served as the chief editor. Six of Zeng Yi's published books were written in English, one was written in both Chinese and English, and the remainders were written in Chinese.

Zeng Yi has been awarded more than ten national and international academic prizes, such as the Dorothy Thomas Prize of the Population Association of America, the Harold D. Lasswell Prize in Policy Science awarded by the international journal *Policy Sciences* and Kluwer Academic Publishers, the second-class prize for advancement of science and technology awarded by the State Sciences and Technology Commission of China, the first-class prize for advancement of science and technology awarded by the State Education Commission, and the highest academic honor of Peking University: "Prize for Outstanding Contributions in Sciences."

According to the search report, up to March 1, 2008, the internationally most important literature sources SSCI (Social Science Citation Index) and SCI (Science Citation Index), published in the U.S., indicate that Zeng Yi's articles and books have been cited in 755 journal articles by authors other than Zeng Yi. Among them, 440 citations refer to the work of Zeng Yi as the first author; 315 citations refer to the work of Zeng Yi as a co-author. Zeng Yi is one of the authors of "High Impact Papers" worldwide in the period of 1981 -1998, as announced by International Scientific Institute (ISI) in September, 2000.