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Statistical Demography and Forecasting

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Demography as a subject is by definition statistical. However, the applications of statistics have seen a paradigm shift in the recent past partly because of the availability of more accurate data on demographic processes and partly because of the advancement in statistical research. A few decades ago books containing methods of indirect estimation and mathematical and cohort component methods of population projections were very popular but they do not serve the current needs of applied demographers who are handling some new issues related to business and public policy. Their work requires new models of population processes. These models are only available in journals of statistics, mathematics and demography, and reports of consultancy projects. So there is a need for a comprehensive book that covers the latest developments in statistical demography. The book under review meets this need quite well. The authors articulate that in our times there are three main reasons for application of statistical methods in demography: namely, exploring subpopulation variations in the demographic rates; the issue of estimation involving forecasting; and methodological requirements of studying the new population groups for policy making. This book is written for those who are involved in research and consultancy in applied demography and are concerned with statistical inference using random sampling procedures, statistical modeling and error analysis.

The book begins with the discussion of sources of demographic data. This includes introducing the concepts of open and closed populations, *De Facto* and *De Jure* populations, registration data and epidemiologic studies. It also includes discussion of sampling and other statistical methods used in evaluation and adjustment of census data. Sampling theory covering simple random, stratified, cluster and systematic sampling and methods of estimation of mean and variance follows it. Under replication estimates of variance, Jackknife estimates, bootstrap estimates and replication weights are covered.

Some of the most important themes in statistical demography are: construction of deterministic and stochastic life tables, estimation using stable population model and distributions fitting fertility process. Considering those themes, this book provides a lucid discussion of exponential distribution and Poisson character of demographic events. Thus it helps in examining the effect of changing mortality on life expectancy, basics of pension funding, effect of heterogeneity in mortality on average life expectancy, relationship between parity and period measures, multistate settings and multiple decrement life tables for nuptiality and disability insurance, and simulation of waiting times. The effect of heterogeneity of population on overall indices is a useful feature of this book. Few available

books in demography touch upon this issue. This not only sensitizes readers to effects of variations between population subgroups but also provides a more reliable method of estimating the population variables.

Above all, demography is an empirical science. For those working with empirical data, and not deeply interested in mathematical statistics, the book includes formulation of different forms of regression models, estimation and the multi-state models involving simple understanding of matrix algebra. Here the reader is exposed to loglinear models, proportional hazard models, special models of nuptiality and migration, and demographic functions of population vectors or vital events. One useful contribution of the book is to draw researchers' attention to variations in population density and population characteristics, a theme that was so far belonged to the domain of geographers.

Regarding the issue of forecasting, the book presents various approaches to forecasting rates involving stationary processes, handling of non-constant means and heteroscedastic innovations. The idea of deterministic and stochastic volatility (tendency for some indicators to show more variability sometimes) taken from stock option trading is a useful addition to the inventory of demographics. The discussion of error analysis, to which two full chapters are devoted, is quite freshening. Census actuaries often have knowledge of undercount or overcount in census figures. They wish to understand the effect of such errors on mortality and forecasts. Similarly those depending on dual record system may like to know about the components of errors and their impact on demographic models. The book establishes analytical and statistical relationships between the errors and estimates when data are obtained from census and dual registration data.

At the end two chapters are devoted to problems of special groups: one to applications in computation of pension benefits, aids to municipal bodies, and public liabilities touching upon social security administration, and the other to small area estimates. Formula based allocations of resources, loss functions for small area estimates and cost-benefit analysis of demographic data provide a new perspective to demographers who have been accustomed to routine analysis of national and regional level rates and ratios.

The methods are illustrated with examples from Europe and the United States. The book will be useful for teachers, researchers and consultants dealing with formulation of statistical models, estimation and forecasting in demography. Those interested in deeper understanding of a particular issue will find a good number of references from journals and reports published during the last ten years.