Methods of Demographic Analysis

Farhat Yusuf • Jo. M. Martins • David A. Swanson

Methods of Demographic Analysis

Springer

Farhat Yusuf
Menzies Centre for Health Policy
Sydney School of Public Health
The University of Sydney
NSW 2006, Australia
and
Department of Marketing
and Management
Faculty of Business and Economics
Macquarie University
NSW 2109, Australia

Jo. M. Martins
Department of Marketing
and Management
Faculty of Business and Economics
Macquarie University
NSW 2109, Australia

David A. Swanson
Department of Sociology
College of Humanities, Arts and Social Sciences
University of California Riverside
92521 Riverside California, USA

ISBN 978-94-007-6783-6 ISBN 978-94-007-6784-3 (eBook)
DOI 10.1007/978-94-007-6784-3
Springer Dordrecht Heidelberg New York London

Library of Congress Control Number: 2013951278

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Foreword

There have been many demography textbooks published over the past 50 years and we might ask: why is there a need for another? The answer is that, ideally, textbooks are tailored to the needs and capacities of the students that will be making use of the book. In my experience, this is particularly the case in the field of demography. Some prior textbooks in the field are pitched to a high, theoretical or mathematical level, probably aimed at people who plan to become academic demographers while others are pitched at a level where they can be understood by people undertaking training in human service occupations where some capacity with 'numbers' will be useful. Some texts assume relatively strong mathematical and statistical capacity on the part of the student while others try to steer around mere average capacity in this regard.

This book is written by a group that has had many years of experience teaching demography to business and economics students. Accordingly, they have pitched the book towards students that have relatively good mathematical and statistical skills without extending to matrix algebra or integral calculus. The book is comprehensive in its coverage of the field of demography and the student mastering the text will be competent in the professional application of demographic methods. It uses many worked examples making it clear what lies behind the formulae. The authors, therefore, have produced a book that will be useful at the undergraduate and master's levels where students have reasonably good quantitative skills. This is probably the mainstream of teaching in demography around the world.

Besides its wide coverage of standard demographic measures, the book includes chapters on sources of demographic data and data evaluation methods. It also has a long chapter on statistics taking the student through basic statistical measures through to correlation and regression. The final chapter of the book provides useful references to software packages that can be used to derive many of the measures described in the preceding chapters. Many of these packages are available on the internet and are freely downloadable.

I congratulate the authors on the production of this textbook as it occupies a niche in the range of available textbooks that needed to be occupied.

Director, Australian Demographic
and Social Research Institute
The Australian National University
and
President, International Union for the Scientific
Study of Population

Peter McDonald

Preface

Purpose

The study of populations is relevant to most human enterprises. As a discipline, demography is similar to statistics in that its methods are used in many other academic fields. In the case of demography, they include actuarial studies, business administration, criminal justice, geography, history, legal studies, marketing, organizational studies, planning, forecasting, political science, public policy and administration, health care and education, sociology, and urban studies. Demographic methods are used widely by practitioners in these fields. Given the wide audience and some of the recent developments in demographic methods, the contents of this book, with existing and newly developed methods, fill a crucial gap in the application of demographic methods.

The book encompasses the many facets of demographic and related methods and their applications. It introduces some statistical measures of relevance to the study of demography, related concepts and associated techniques. The book deals with basic population models and elaborates on the concepts of demographic stocks and flows. Further, it deals with the analysis of demographic phenomena in the context of cross-sectional and longitudinal/cohort analyses.

The book incorporates methods used in the computation of life and multiple decrement tables which are useful in studying demographic phenomena such as mortality, morbidity, and nuptiality, but other social events. An important application of the life table methodology is in population projections. The book examines alternative methods of population and related projections at both the national and sub-national levels.

Testing the accuracy of demographic data is an important precursor in demographic analysis. Methods of testing the accuracy of data, smoothing and adjustments that might be required are discussed.

The stable population model is a useful tool in the analysis of populations and of relevance to the estimation of demographic parameters from incomplete datasets.

These methods are of particular importance in developing countries that suffer from a paucity of demographic data.

Improved computer technology and software have enhanced the use of spreadsheets and other software in demographic analysis. The relevance of software in the public domain to demographic analysis is examined, as well as some proprietary packages.

Organization

The book is organized in 14 chapters. These chapters represent a progression going from basic concepts to more sophisticated ones. The first four chapters introduce demography as a field of study and analysis. The first chapter deals with the nature and historical context of demographic analysis. And the second provides the fundamental terms, definitions, and ideas about data that need to be mastered. In Chap. 3, some elementary statistical measures are described to enhance the introduction to demographic analysis. These include such basic measures as counts and frequencies, proportions, ratios, rates and probabilities, and measures of central tendency and dispersion, concentration, dissimilarity and relative difference. Correlation and regression methods are also examined. Chapter 4 covers fundamental demographic terms and measures. Taken together, Chaps. 3 and 4 provide the basic ideas and measurements underlying the size, distribution, and composition of human populations.

These ideas in turn, need to be mastered before proceeding to the following four chapters, which cover the components of population change, fertility, mortality, and migration. Chapter 5 covers fertility while Chap. 6 examines mortality. Cross-sectional and longitudinal approaches in demography are examined and synthetic measures of fertility and survival are considered. Chapter 7 covers a perspective so important to the study of mortality and survival that it is given a separate chapter, the Life Table. Chapter 8 examines migration.

In general, Chaps. 2, 3, 4, 5, 6, 7 and 8 look at demography in terms of *ascribed* characteristics. In Chap. 9, concepts, methods, and data that look at demography in terms of *achieved* characteristics are introduced. This chapter consists of methods of analysis and measures related to marital status and associated vital events, such as marriages and divorces, education, labour force, occupation, households and families.

Chapter 10 extends the concepts of a life table introduced in Chap. 7. The idea of death is broadened to the concept of a *decrement* and considers situations where cohorts may be subjected to multiple decrements, such as different causes of death. In addition, the chapter widens the concept to the building of multistate life tables concerned not only with decrements from life to death but also with possible movements among various active states, such as moving in and out of the labour force.

Chapter 11 on projections ties together the concepts, methods, and data discussed in Chaps. 4, 5, 6, 7 and 8 and include aspects of the discussions found in Chaps. 9 and 10. The chapter covers in detail the cohort-component method that is the most used technique of projecting populations by age and sex. It also discusses and illustrates the cohort-change method that requires less data. Further, it looks at projections of particular segments of the population such as people in the labour force and of school age.

All data are subject to errors. Chapter 12 describes some of the commonly used methods for testing the quality of demographic data, and procedures for adjusting and smoothing the data in order to improve their quality.

A major canon of mathematical demographic theory, the *Stable Population Model*, is the subject of Chap. 13. It extends the ideas found in Chap. 7 in a manner quite distinct from how these ideas were extended in Chap. 10. Some important properties and characteristics of this model are examined and its use in demographic analysis is discussed.

The book concludes with Chap. 14 that provides a survey of some demographic software available. Given the pace of technological change, this should be looked as a starting point, as new and useful products will have been added by the time the book is published.

Throughout the book numerical examples are given with information from a number of countries with some comparisons of national patterns. Where possible the Internet links (URLs) to various references are provided. All of these were tested in February 2013 to ensure that they were operational. However, the location of material on the Internet may have changed by the time the readers attempt to retrieve it.

Use

The material in this book is organised in a progressive manner that allows the user to move from an introductory level to more advanced methods of demographic analysis. The approach takes into consideration that users may have different levels of mathematical skill and that some would benefit from a step by step approach that makes the various methods of demographic analysis accessible to various levels of expertise. It follows a gradual build up from elementary to more advanced methods of demographic analysis. In addition to students of demography, the methods of analysis in the book are of relevance to practitioners of other disciplines and people in government and business.

Contents

List of Boxes

List of Figures

List of Tables