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Review

Demographic forecasting: 1980 to 2005 in review

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Abstract

Approaches and developments in demographic and population forecasting since 1980 are reviewed. Three approaches to forecasting demographic processes are extrapolation, expectation (individual-level birth expectations or population-level opinions of experts), and theory-based structural modelling involving exogenous variables. Models include 0–3 factors (age, period and cohort). Decomposition and disaggregation are also used in multistate models, including macrosimulation and microsimulation. Forecasting demographic change is difficult; accuracy depends on the particular situation or trends, but it is not clear when a method will perform best. Estimates of uncertainty (model-based ex ante error, expert-opinion-based ex ante error, and ex post error) differ; uncertainty estimation is highly uncertain. Probabilistic population forecasts are based on stochastic population renewal or random scenarios. The approaches to population forecasting, demographic process forecasting and error estimation are closely linked. Complementary methods that combine approaches are increasingly employed. The paper summarises developments, assesses progress and considers the future.

Keywords: Demographic modelling; Population forecasting; Mortality; Fertility; Migration; Extrapolation; Expectations; Causal models; Disaggregation

Contents

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1. Introduction

The last twenty-five years has been an exciting period in the history of demographic forecasting. It has witnessed the emergence from a period of relative inactivity, the realisation of previously unappreciated truths about traditional methods of population projection and the development of new probabilistic approaches to the problem. This heightened activity does not seem to be a result of more demanding users; rather it appears that demographers are adopting the methods of other disciplines and applying them to their trade. Perhaps, in a world of increasing statistical sophistication, the discipline could no longer afford to have population forecasting regarded as "an old-fashioned art form, somewhat embarrassing to the profession, like a disreputable relative" (Ryder, 1990:433). Population forecasting is, after all, the public face of the profession.

Demographic forecasting is an important topic: population, household and related forecasts form the basis of social and economic planning and are fundamental to many other forecasting exercises. The many uses of population forecasts give rise to choices on several dimensions. The time horizon may be as short as a year, more commonly a generation, increasingly a life span, or occasionally longer still. The population in question may be local, national, regional or global. To provide the necessary detail, the population must be disaggregated by age and sex, and often by geographical region; yet further disaggregation may be desired. To achieve this, the three components of population change (mortality, fertility and migration) must be separately forecast and appropriately combined; each component may be decomposed and its parts independently forecast. Population forecasting is thus a highly complex and difficult undertaking (Keyfitz, 1985).

Population forecasting is also highly uncertain: as Keyfitz (1996:xii) remarked, "The best demographers do it, but none would stake their reputation on the agreement of their forecasts with the subsequent realization." Uncertainty in demographic forecasting has been a major focus, contributing to the rapidly increasing volume of published research on the overall topic. It is impossible to include all this material in a single review. Several useful collections and studies have previously appeared (notably Ahlburg & Land, 1992a; Bongaarts & Bulatao, 2000; Lutz & Goldstein, 2004a; Lutz, Vaupel, & Ahlburg, 1999; North American Actuarial Journal, 1999; Rogers, 1995a).

During the twentieth century, fertility was the most important component in determining population size.