1. A Review of Demographic Forecasting Models for Mortality

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Abstract

The goal of Chapter 1 is to describe and comment on the methods and approaches that have been in use or have emerged in recent years. Section 1.1 introduces the most common classifications of forecasting models for mortality. Section 1.2 is devoted to a brief historical review of parameterisation functions. In this context, attention is paid to prediction based on parameterised age schedules, in particular by using time series models. Section 1.3 focuses on the (statistical association) models of Lee and Carter and Section 1.4 characterises the (log-linear) age-period-cohort models. In Section 1.5 the reader can find a review of the methods used in international statistical practice and in Section 1.6 the importance of uncertainty in forecasting is addressed. Section 1.7 outlines the prospects for modelling and forecasting mortality as seen from the perspective of this chapter.

1.1 | Most Common Classifications of Forecasting Models for Mortality

A positive feature of forecasting mortality in developed countries is that adequate historical information is usually available, at least for aggregate measurements. In this case the two salient questions facing a forecaster are finding an accurate description of the past, and secondly, taking on judgemental factors in order to produce plausible forecasts. The first can be viewed as a technical problem essentially concerned with modelling and

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estimating a time- and age-specific measure of mortality. Judgement comes into play since the naive forecast obtained by extrapolation may lead to nonsensical predictions. Problems of forecasting specific to demography are dealt with extensively in the literature, some of which is referenced in this volume.[1] In Chapter 1 forecasting methods for mortality *alone* are discussed. Methods of forecasting mortality and health *jointly* are discussed by health forecasters (Van den Berg Jeths *et al.,* Chapter 2 in this volume). Two lines of forecasting and/or making projections of mortality are included: one scientifically oriented and one with a practical orientation. In considering the practice of forecasting mortality, the procedures applied by international organisations, such as Eurostat, the World Bank and the United Nations, are discussed. National practices are beyond the scope of this chapter. The discussion below is intentionally concise, in line with the goal of this review, namely to describe and comment on the methods that have been used or have emerged in recent years. This chapter does not strive to present a practical guide for forecasters or a systematic discussion of the most commonly used statistical forecasting approaches for mortality.

Forecasting of mortality has traditionally been a central issue among actuaries and demographers. In recent years, however, interest in the development of new models and strategies for modelling and forecasting mortality has slightly decreased in actuarial science and demography. Interest in this field has, on the other hand, grown in quantitative research on ageing, that is in biostatics, genetics, evolutionary biology, gerontology, and geriatrics (see also Yashin, Chapter 11 in this volume). New methods of modelling and forecasting mortality and health as a joint category has received considerable attention from quantitatively oriented public health scientists (Van den Berg Jeths *et al.,* Chapter 2 in this volume).

In demography, several recent publications have made significant contributions to the methodological aspects of forecasting of mortality (e.g. in alphabetical order: Benjamin and Soliman, 1993; Gomez de Leon and Texmon, 1992; Keyfitz, 1991; Lopez and Hakama, 1986; Murphy, 1990; Olshansky, 1988; Pollard, 1987 and Willekens, 1990). Pollard (1987) reviewed a variety of methods which have been suggested by actuaries and demographers for the projection of age-specific mortality rates: projection by extrapolation of

[1] See also the special issues of the International Journal of Forecasting 8(3), 1992, and of the Mathematical Population Studies 5(3), 1995.