

A Robust Approach to Stochastic Mortality Modelling

Helena Aro
Department of Mathematics and Systems Analysis
Faculty of Information and Natural Sciences
Helsinki University of Technology
PL 1100, 02015 TKK
haro@math.hut.fi
tel. +358 40 740 1717

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This paper proposes a general approach to stochastic mortality modelling. The logit transforms of mortality rates are modelled by linear combinations of user-specified basis functions of the cohorts. This flexibility allows for an easy incorporation of population specific characteristics as well as expert forecasts in the calibration of the model. The uncertainties in the future development of mortality rates are captured by easily interpretable risk factors, which facilitates the study of the relationships between mortality rates and economic factors. This is an important issue in the engineering of mortality-linked securities.

The chosen model is fitted into data by the maximum log-likelihood method, deviating from the usual assumption that the number of deaths per year in an age cohort follows the Poisson distribution. Instead, we assume deaths to be binomially distributed, which, combined with the chosen parameterization, results in a convex target function for minimization, hence guaranteeing a unique minimum point and adding to the robustness of the model.

As an example, we consider Finnish adult (from 18 to 100 years) mortality for males and females in the past semicentury. Basis functions are chosen to be piecewise linear, and the optimal number of risk factors, and consequently basis functions, is determined. Using the resulting model, we present simulations for future development of Finnish mortality rates.