Forecasting mortality of not extinct cohorts

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Abstract

Study background. Mortality forecasting is a topic of increasing interest in demography with crucial implications in insurance and pension policies. A vast literature proposes models to forecast mortality using cross-sectional (period) data instead of longitudinal (cohort) data. As a consequence, we mostly rely on period life tables and period life expectancy measures, which reflect cross-sectional mortality levels and not those that an exisiting cohort will eventually experience.

Objectives. The present study aims at introducing a novel method to forecast cohort mortality and cohort life expectancy of not extinct cohorts. The intent is to complete the mortality profile of cohorts borned up to 1960.

Data and methods. The proposed method is based on the penalized composite link model for ungrouping. Cohort death counts (d_x) are treated as realizations of a Poisson process. The observed part of the cohort age-at-death distribution and the unobserved right-hand tail of the age-at-death distribution of a cohort not yet extinct are modeled simultaneously by a penalized maximum likelihood. The performance of the method is investigated using cohort mortality retrived from the Human Mortality Database for Denmark and Sweden male and female populations from 1900 to 1960.

Results. The proposed method succeeds at forecasting the mortality profile of the studied populations. For cohorts that are already completed, we can observe that the fitted age-at-death distributions follow the empirical ones; whereas for cohorts that are not yet completed, the fitted age-at-death distributions show a reasonable trend. The computed cohort life expectancy at birth shows a realistic increase over calendar time.

Main conclusions. The proposed method allows to estimate age-at-death distributions for cohorts that are not yet extinct and therefore compute cohort life expectancy by means of two key modest assumptions: Death counts are interpreted as realization of Poisson distributions and the fitted age-at-death distribution is smooth.

References

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