MODELLING DEPENDENT DATA FOR LONGEVITY PROJECTIONS

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Abstract.
The risk profile of an insurance company involved in annuity business is heavily affected by the uncertainty in the mortality trend projections. It is problematic to capture the trend in the future survival pattern, in particular at retirement ages when the rectangularization phenomenon and random fluctuations are combined. Another important aspect affecting the projections is related to the so-called cohort-period effect. In particular, the mortality experience of the industrialized world over the course of the twentieth century would suggest substantial age-time interactions: the two dominant trends affecting different age groups at different times. From a statistical point of view, it reveals a dependency structure. Also the dependence between ages is an important component in the modeling of mortality (Barrieu et al. 2011). It is observed that the mortality improvements are similar for individuals of contiguous ages (Wills and Sherris 2008). Moreover, considering the dataset by single ages, the correlations between the residuals for adjacent age groups tend to be high (as noted in Denton et al 2005). This suggests exploring the dependency structure, also across time, in other words the inter-period correlation. The aim of this paper is to improve the methodology for forecasting mortality in order to enhance model performance and increase forecasting power by capturing the dependency structure of contiguous observations in the population. We provide an appropriate methodology for measuring the uncertainty in projections in the Lee Carter context, based on a tailor-made bootstrap instead of an ordinary bootstrap. Using a case study, we explore the empirical results with a graphical analysis.

Keywords: Longevity,, Dependence, Lee Carter , Bootstrap