

Spline Models as Flexible Alternatives to the Lee-Carter Model

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Abstract

One of the many challenges in insurance pricing is to accurately model and predict mortality, a task for which the Lee-Carter model has served as a benchmark in Sweden for several decades. In this study, the spline models will be examined as an alternative. Spline models are a set of flexible functions designed for interpolation and the creation of smooth surfaces. In total, two Lee-Carter models will be constructed: a standard model and a smoothed model, as commonly used in Swedish mortality models, as well as three spline models with different bases and penalties. Mortality rates will then be forecast, and the predicted mortality rates will be compared against the observed mortality rates for several data periods and metrics, including term life insurance and life annuity pricing errors. The spline models will prove to be less dependent on the training period than the Lee-Carter models, while the Lee-Carter models will be shown to estimate more accurate and stable pricing for modern data with aggregated population and death counts. For the gender-specific models, the spline models will provide marginally more accurate average pricing but will be more sensitive to the mortality shock observed during the COVID-19 period near the boundary.

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