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Modelling and management of mortality risk: a review

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Abstract

In the first part of the paper, we consider the wide range of extrapolative stochastic mortality models that have been proposed over the last 15–20 years. A number of models that we consider are framed in discrete time and place emphasis on the statistical aspects of modelling and forecasting. We discuss how these models can be evaluated, compared and contrasted. We also discuss a discrete-time market model that facilitates valuation of mortality-linked contracts with embedded options. We then review several approaches to modelling mortality in continuous time. These models tend to be simpler in nature, but make it possible to examine the potential for dynamic hedging of mortality risk. Finally, we review a range of financial instruments (traded

and over-the-counter) that could be used to hedge mortality risk. Some of these, such as mortality swaps, already exist, while others anticipate future developments in the market.

Keywords:

Stochastic mortality models | Short-rate models | Market models | Cohort effect | SCOR market model | Mortality-linked securities | Mortality swaps | q-forwards

Notes

[1]In our notation the subscript c in $m_c(t, x)$ distinguishes the crude or actual death rate from the underlying or expected death rate.

[2]To date, we are unaware of any studies that have explicitly attempted to model the exposures as unobserved variables.

[3]The discrete-time models described in Section 4 can all be described as short-rate models, with the exception of the market model in Section 4.7.

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