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Stochastic mortality under measure changes

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Abstract

We provide a self-contained analysis of a class of continuous-time stochastic mortality models that have gained popularity in the last few years. We describe some of their advantages and limitations, examining whether their features survive equivalent changes of measures. This is important when using the same model for both market-consistent valuation and risk management of life insurance liabilities. We provide a numerical example based on the calibration to the French annuity market of a risk-neutral version of the model proposed by Lee & Carter (1992).

Keywords:

Stochastic mortality | Lee–Carter model | Mortality risk premium | Fair valuation | Mortality-linked securities

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Notes

1. This may be the case even with deterministic death rates: large portfolios may reduce to classes of very few policies once contracts are disaggregated by relevant risk characteristics; in secondary markets, portfolios that are very large in value may contain very few homogeneous contracts (e.g. Life Settlements portfolios).

2. All filtrations are assumed to satisfy the usual conditions, i.e. right-continuity and -completeness.

3. In the following, we use the notation , for .

4. That is, for all t. We use the notation t∧s:=min(t,s) throughout the paper.

5. We consider its right-continuous-with-left-limits modification.

6. We use the convention that stands for integration over (0,t].

7. With regard to (A1), we mean that may not be continuous.

8. A situation when a non-zero mortality risk premium must rely on a change of intensity is when is independent of , and hence the hazard process is deterministic.

9. See http://www.mortality.org.

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