

Investigating Short-run and Long-run Equilibrium Relationships between Mortality and Interest Rate Risks

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Abstract

In this paper, we investigate the dependence between mortality risk, financial markets and economy risks. Our approach combines empirical studies with the development of theoretical models based on time series analysis.

Following the statistical method developed by Dacorogna and Cadena [1], we exploit data for 11 economically developed countries and we empirically look for the relationships existing between the performance of a mortality index and that of some economic and financial indicators through the time horizons we have chosen for each country and over the extreme years, namely during the years in which we can observe the highest changes in the mortality index.

We then focus on the relations between mortality and interest rates. Several recent works in the field of mortality modelling stress important similarities between the force of mortality and the continuously compounded interest rate: both are positive, have term structures and are stochastic. Within this theoretical framework, we select a number of models developed in interest-rate modelling (Feller, Ornstein-Uhlenbeck, Heath-Jarrow-Morton) and we calibrate them on both the in-sample data concerning 3m Treasury Bills yields, 10-y Government Bonds yields and Stock Index returns and, under proper assumptions making the same models biologically reasonable, on the in-sample data relating to mortality rates. We detect, through the out-of-sample testing and the walk forward optimization, the most suitable models for the dynamics of the force of mortality and of the interest rate. We employ Vector Autoregressions (VAR) and Vector Error Correction Models (VECM) to understand and describe the dynamic interactions and the possible long-run equilibrium relationships between mortality risk and interest rate risk. We finally perform the forecasting and carry out the analyses on the short and the long-run relations on the outcomes.

Keywords: dependence, stochastic force of mortality, interest rates, inflation, GDP, affine processes.

References

- [1] M. Dacorogna and M. Cadena. Exploring the dependence between mortality and market risks. *SCOR Papers n33*, 2015.

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