

A Bayesian model comparison for changing mortalities:
evaluating the longevity risk in Japan
(Preliminary Version)

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keywords Bayesian model comparison; Japanese mortality rates; Lee-Carter methodology; life annuity; longevity risk; Markov-chain Monte Carlo method; survivor bond; risk neutral pricing; entropy

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Abstract

We present a Bayesian approach to compare models for forecasting mortality rates under the framework of the Lee Carter methodology. We consider the original normal log-bilinear formulation of the methodology as well as the recently proposed Poisson log-bilinear formulation. For each formulation we consider three models for the time parameter in the methodology to account for changing mortalities: the deterministic trend model, the stochastic trend model and the stationary (no trend) model. Markov-chain Monte Carlo methods are used to sample the predictive distributions from each model and to calculate the marginal likelihoods for the model selection. Our approach is applied to Japanese male mortality rates from 1970 to 2003. Results show that the stochastic trend model is most appropriate for forecasting mortality rates both for the normal and the Poisson formulation. We then use the selected model to evaluate the longevity risk in Japan by calculating the posterior predictive distributions of the life annuities for the population at age 65. We also present a Bayesian approach to pricing the longevity risk in the survivor bond designed by Denuit et al. (2007)