

Longevity Risk and the Econometric Analysis of Mortality Trends and Volatility

Carolyn Ndigwako Njenga
Australian School of Business
Phd Student School of Actuarial Studies
University of New South Wales Sydney NSW 2052
Australia
Email: ndigwako@hotmail.com

Michael Sherris
Australian School of Business
Professor and Head, School of Actuarial Studies
University of New South Wales Sydney NSW 2052
Australia
Email: m.sherris@unsw.edu.au

Draft Working Paper: Please do not distribute or quote without the permission of the authors. May 15, 2009

Abstract

Longevity risk and the modeling of trends and volatility for mortality improvement has attracted increased attention driven by ageing populations around the world and the expected financial implications. The original Lee-Carter model that was used for longevity risk assessment included a single improvement factor with differential impacts by age. Financial models that allow for risk pricing and risk management have attracted increasing attention along with multiple factor models. This paper investigates trends, including common trends through co-integration, and the factors driving the volatility of mortality using principal components analysis for a number of developed countries including Australia, England, Japan, Norway and USA. The results demonstrate the need for multiple factors for modeling mortality rates across all these countries. The basic structure of the Lee-Carter model can not adequately model the random variation and the full risk structure of mortality changes. Trends are found to be stochastic. Common trends and co-integrating relationships are found across ages and across countries highlighting the benefits from modeling mortality rates as a system in a Vector-Autoregressive (VAR) model and capturing long run relationships in a Vector Error-Correction Model (VECM) framework.