Longevity Risk Management for Life and Variable Annuities: Effectiveness of Static Hedging using Longevity Bonds and Derivatives

Andrew Ngai
PricewaterhouseCoopers
Sydney, Australia
andrew.ngai@au.pwc.com

Michael Sherris
Australian School of Business
University of New South Wales
m.sherris@unsw.edu.au

April 9, 2010

Abstract

For many years the longevity risk of individuals has been underestimated as survival probabilities improved across the developed world. The uncertainty and volatility of future longevity has posed significant risk issues for both individuals and product providers of annuities and pensions. This paper investigates the effectiveness of static hedging strategies for longevity risk management using longevity bonds and derivatives (q-forwards) for the retail products: life annuity, deferred life annuity, indexed life annuity and variable annuity with guaranteed lifetime benefits. Improved market and mortality models are developed for the underlying risks in annuities. The market model is a regime switching vector error correction model for GDP, inflation, interest rates and share prices. The mortality model is a discrete time logit model for mortality rates with age dependence. Models were estimated using Australian data. Basis risk between annuitant portfolios and population mortality was based on UK experience. Results show that static hedging using q-forwards or longevity bonds reduce longevity risk substantially for life annuities, but significantly less for deferred annuities. For inflation indexed annuities static hedging of longevity is less effective because of inflation risk. Variable annuities provide limited longevity protection compared to life annuities and indexed annuities, as a result longevity risk hedging adds little value for these products.

Keywords: longevity risk, risk based capital, static hedging, q-forwards, longevity bonds, life annuities, variable annuities

JEL Classifications: G22, C50