

Dynamic Asset-Liability Management with Longevity Risk and Derivatives

Patrick L. Brockett

Department of Information, Risk, and Operations Management
Red McCombs School of Business
The University of Texas at Austin
Austin, TX 78712
brockett@mail.utexas.edu

Yinglu Deng*

Department of Information, Risk, and Operations Management
Red McCombs School of Business
The University of Texas at Austin
Austin, TX 78712
yinglu.deng@phd.mcombs.utexas.edu

Richard D. MacMinn

Katie School of Insurance
College of Business
Illinois State University
Normal, Illinois 61790-5480
richard.macminn@ilstu.edu

April 27, 2010

*indicates corresponding author

Abstract

The worldwide ageing problem has caused a heavy burden for pensions and annuity providers, who need to manage the unpredictable guarantee liability linked with the life expectancy of retirees. To avoid the tremendous inadequacy or shortfall, the pensions and annuity providers have to improve the asset-liability management (ALM) which allocates assets strategically over time to achieve sufficient returns to cover liabilities. Since the longevity risk has significantly affected the asset-liability balance, the ALM model needs to accommodate the longevity risk and its derivatives in the investment strategy. Our paper is the first to study the multi-period dynamic asset-liability management engaging the impact of the longevity risk. Our model improves the objective function, extends the investment horizon to multi-period and accounts for the fat-tail, skewness effect of the investment portfolio including derivatives. We propose a discrete time, multi-period stochastic programming model to analyze the optimal asset allocation and the investment performance for different conditions: 1) The longevity risk is not considered in the asset-liability management, 2) The longevity risk is considered in the asset-liability management, but no longevity risk derivative is available for the hedging purpose of pensions. 3) The longevity risk is considered in the asset-liability management, and the longevity risk derivative is available for the hedging purpose of pensions. The results show that it is necessary to accommodate longevity risk in the ALM; the results also show the benefits of using longevity derivatives to hedge that risk and reduce insolvency risk.

Keywords: Longevity Risk; Asset-Liability Management; Stochastic Programming Model.