



Actuarial Studies Seminar
Macquarie University
14 October 2009

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A way of pricing a longevity bond

During the last decade, there has been dramatic increase of the average lifetime, i.e. there is the trend of individuals to live longer and longer. As a consequence, life and pension insurance companies have paid attention to quantify and manage the systematic mortality risk, i.e. the longevity risk. As this systematic mortality risk is fundamentally different from its counterpart, the companies cannot diversify this risk by increasing their portfolio sizes. It is obvious that the mortality table estimated a decade ago is not good and sufficient enough to price life insurance products that contain this risk, e.g. life annuity and pure endowment. Therefore, the prime challenge to the life and pension insurance companies is to model the mortality rate that can accommodate recent improvement of survival rate at older ages. Based on the England Interim Life Tables and using a jump diffusion process for the mortality improvement process, we estimate the average of the mortality improvements and the jump magnitude in the mortality improvements fixing other parameters. As an example of implementing this result, we price a 25-year longevity bond starting at age 65, that is one of the mortality-linked contracts. To do so, we regress the average and jump magnitude in the mortality improvements with which we project their 25-year values respectively. Using this projected values, we simulate to obtain a mortality improvement process starting 2004 to 2028. An numerical calculation of a 25-year longevity bond sold in 2004 is shown compared to its counterpart sold in 1980.

This is joint work with Nigel Chan, Department of Statistics and Actuarial Science, Faculty of Science, The University of Hong Kong.