Stochastic Life Insurance Benefit and Annuity Modeling Using Kolmogorov Backward Equation

Jinsen Zhuang, Huaquio University, Xiamen, China
Mia Pang-Rey, Ivy D.C. Suan, and Polly W. Sy, University of the Philippines-Diliman

Abstract: In this paper, we propose an approach to determine the actuarial present value of some life contingent events under a stochastic interest rate environment. Five one-factor term structure models and the two-additive-factor Gaussian model G2++ are considered to describe the behavior of interest rates. The analytical solutions of the Kolmogorov backward equations of the six models are used to find the expected value of the interest discount function. Moreover, we introduce and modify two existing numerical methods to solve the Kolmogorov backward equations numerically. Using the China Insurance Mortality Table (2000-2003), we apply our techniques to find exactly and approximately the values of $A^{1}_{x:\overline{n}|}$ and $\ddot{a}_{x:\overline{n}|}$. Numerical results are shown and compared.