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## Pricing Guaranteed Minimum Death Benefits under Stochastic Volatility and Stochastic Interest Rate

*Xiao Wei<sup>1</sup> and Sha Li*

<sup>1</sup>Central University of Finance and Economics, P.R. China ; [weixiao@cufe.edu.cn](mailto:weixiao@cufe.edu.cn)

We consider the pricing problem of Guarantee Minimum Death Benefits (GMDB) that credit the annuitants the investment return of equities while limiting the downside risk of equities by providing the minimum death benefits. GMDB usually cover a long annuity period, since it involves long term investment in the equity market, it's appropriate to include the stochastic volatility and stochastic interest rate in the GMDB pricing. We propose a new method that combines the idea of Vec̆er (2001) to replicate the account value of the contract at the time of payment paid and the Cosine expansion for fast calculation of conditional expectation value. Numerical test will be done to compare the efficiency of the new method and the effect of the stochastic volatility and stochastic interest rate will be examined as well.