Valuation of Variable Annuity Guarantees

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Abstract
In this talk we discuss methodologies for fair pricing of variable annuity guarantees such as Guaranteed Minimum Withdrawal Benefit (GMWB). These products offer protection from market downturns and gain from market upside, and may include additional death benefit guarantees. Valuation of these products should simultaneously deal with financial risk, mortality risk and human behavior. We consider valuation under the "optimal" and pre-defined policyholder behaviors, extensions to stochastic mortality and stochastic interest rate models, and valuation in a presence of management fees charged for the management of underlying investment account.

The talk is based on several recent papers:

- J. Sun, P.V. Shevchenko, M.C. Fung (2017). A Note on the Impact of Management Fees on the Pricing of Variable Annuity Guarantees. Preprint, http://ssrn.com/abstract=2967045
- P.V. Shevchenko and X. Luo (2017). Valuation of Variable Annuities with Guaranteed Minimum Withdrawal Benefit under Stochastic Interest Rate. To appear in *Insurance: Mathematics and Economics*. Preprint http://arxiv.org/abs/1602.03238.
- P.V. Shevchenko and X. Luo (2016). A unified pricing of variable annuity guarantees under the optimal stochastic control framework. *Risks* 4(3), 22:1-22:31, doi:10.3390/risks4030022. Preprint, http://arxiv.org/abs/1605.00339.
- X. Luo and P.V. Shevchenko (2015). Fast Numerical Method for Pricing of Variable Annuities with Guaranteed Minimum Withdrawal Benefit under Optimal Withdrawal Strategy. *International Journal of Financial Engineering* 2(3), 1550024 (26 pages). http://ssrn.com/abstract=2517094 .
- X. Luo and P.V. Shevchenko (2015). Valuation of Variable Annuities with Guaranteed Minimum Withdrawal and Death Benefits via Stochastic Control Optimization. *Insurance: Mathematics and Economics* 62, 5-15. http://ssrn.com/abstract=2528355
- X. Luo, P.V. Shevchenko (2015). Variable Annuity with GMWB: surrender or not, that is the question. In T. Weber, M. J. McPhee, and R. S. Anderssen (Eds.), MODSIM2015, pp. 959-965, http://www.mssanz.org.au/modsim2015/E1/luo.pdf