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Pricing and Hedging Variable Annuity Guarantees with Multiasset Stochastic Investment Models

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Abstract

Variable annuities are often sold with guarantees to protect investors from downside investment risk. The majority of variable annuity guarantees are written on more than one asset, but in practice, single-asset (univariate) stochastic investment models are mostly used for pricing and hedging these guarantees. This practical shortcut may lead to proble ramework for pricin nsform multivar rts, which can ther edging can be in g error can be quan

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Notes

By natural filtration we mean the information up to and including time t.

It would be numerically very difficult to ensure that H_t is a covariance matrix if its structure is specified arbitrarily. It is typical to use an eigenvalue–eigenvector decomposition to ensure the positive definiteness of a matrix. As the dimension of the matrix increases, such a procedure becomes increasingly time-consuming and unstable.

We refer readers to Appendix A of Panjer et al. (1998) for definitions of a Radon-Nikodym derivative and a measurable event.

Siu et al. (2004) used similar arguments in deriving a univariate risk-neutral GARCH model.

We use crude Monte Carlo in our calculations. However, variance reduction methods described in Glasserman (2003) may be used.

A symmetric first difference approximation is used in our calculations.

The value of the hedge is calculated from the risk-neutral CCC-GARCH model, while the sample paths of the log returns are simulated from the CCC-GARCH model under the real-wor

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