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Pricing Variable Annuity Guarantees in a Local Volatility framework

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In this paper, we study the price of Variable Annuity Guarantees, especially of Guaranteed Annuity Options (GAO) and Guaranteed Minimum Income Benefit (GMIB), and this in the settings of a derivative pricing model where the underlying spot (the fund) is locally governed by a geometric Brownian motion with local volatility, while interest rates follow a Hull-White one-factor Gaussian model. Notwithstanding the fact that in this framework, the local volatility depends on a particularly complicated expectation where no closed-form expression exists and it is neither directly related to European call prices or other liquid products, we present in this contribution different methods to calibrate the local volatility model. We further compare Variable Annuity Guarantee prices obtained in three different settings, namely the local volatility, the stochastic volatility and the constant volatility models all combined with stochastic interest rates and show that an appropriate volatility modelling is important for these long-dated derivatives. More precisely, we compare prices of GAO, GMIB Rider and barrier types GAO obtained by using local volatility, stochastic volatility and constant volatility models.

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