



Optimal retirement planning with a focus on single and multilife annuities

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TA3.1

No-Arbitrage ROM Simulation

Alex Weissensteiner (alwe@dtu.dk), Michael Hanke (michael.hanke@uni.li), Alois Geyer (alois.geyer@wu.ac.at)

Ledermann et al. (2011) propose random orthogonal matrix (ROM) simulation for generating multivariate samples matching means and covariances exactly. Its computational efficiency compared to standard Monte Carlo methods makes it an interesting alternative. In this paper we enhance this method's attractiveness by focusing on applications in finance. Many financial applications require simulated asset returns to be free of arbitrage opportunities. We analytically derive no-arbitrage bounds for expected excess returns to be used in the context of ROM simulation, and we establish the theoretical relation between the number of states (i.e., the sample size) and the size of (no-)arbitrage regions. Based on these results, we present a No-Arbitrage ROM simulation algorithm, which generates arbitrage-free random samples by purposefully rotating a simplex. Hence, the proposed algorithm completely avoids any need for checking samples for arbitrage. Compared to the alternative of (potentially frequent) re-sampling followed by arbitrage checks, it is considerably more efficient. As a by-product, we provide interesting geometrical insights into affine transformations associated with the No-Arbitrage ROM simulation algorithm. Furthermore, we address also the impact of short-sale constraints on no-arbitrage bounds for expected excess returns.

Keywords: scenario generation, no arbitrage, finance

TA3.2

Where would the EUR/CHF exchange rate be without the SNB's minimum exchange rate policy?

[Michael Hanke](mailto:Michael.Hanke@uni.li) (Michael.Hanke@uni.li), Alex Weissensteiner (alwe@dtu.dk), Rolf Poulsen (rolf@math.ku.dk)

Since Sept. 6, 2011, the Swiss National Bank (SNB) has been intervening on the currency markets to keep the EUR/CHF exchange rate above 1.20. We use a compound option pricing approach to estimate the latent exchange rate in the absence of the SNB's interventions together with the market's confidence in the SNB's commitment to this lower bound.

Keywords: exchange rate options, latent exchange rate, compound options

TA3.3

Optimal retirement planning with a focus on single and multilife annuities

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We optimize the asset allocation, consumption and bequest decisions of an investor with uncertain lifetime and under time-varying investment opportunities. The asset menu is given by stocks, zero coupon bonds and pure endowments with different maturities. The latter are contingent on either a single or a joint life, and pay fixed or variable benefits. We further include transaction costs on stocks and bonds, and surrender charges on pure endowments. We show that despite high surrender charges, annuities are the primary asset class in a portfolio, and that annuity income is never fully consumed, but used for rebalancing purposes. We argue that the optimal retirement product for a household is much more complex than any of those available in the market. Every household should be offered an annuity tailored to its needs, using a unique combination of assets and mortality protection levels.

Keywords: Annuities, household, stochastic programming