

## Pricing holder-extendable call options with mean-reverting stochastic volatility

### ABSTRACT

Options with extendable features have many applications in finance and these provide the motivation for this study. The pricing of extendable options when the underlying asset follows a geometric Brownian motion with constant volatility has appeared in the literature. In this paper, we consider holder-extendable call options when the underlying asset follows a mean-reverting stochastic volatility. The option price is expressed in integral forms which have known closed-form characteristic functions. We price these options using a fast Fourier transform, a finite difference method and Monte Carlo simulation, and we determine the efficiency and accuracy of the Fourier method in pricing holder-extendable call options for Heston parameters calibrated from the subprime crisis. We show that the fast Fourier transform reduces the computational time required to produce a range of holder-extendable call option prices by at least an order of magnitude. Numerical results also demonstrate that when the Heston correlation is negative, the Black–Scholes model under-prices in-the-money and over-prices out-of-the-money holder-extendable call options compared with the Heston model, which is analogous to the behaviour for vanilla calls.

**Keyword:** Extendable options; Heston model; Fast fourier transform; Finite difference method; Monte Carlo simulation