Modelling the term structure of interest rates with jump-diffusion processes

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Abstract

In recent years there is a growing body of literature that explicitly incorporates jumps in modelling the term structure dynamics of interest rates. Das (2002), for example, extends the Vasiceck (1977) model to a jump diffusion model and shows that incorporating jumps captures many empirical features of the Fed Fund rate that can not be explained by the continuous diffusion models. Johannes (2004) proposes to estimate all the functions using some approximations and a nonparametric technique. Jarrow *et al.* (2007) find that incorporating jumps in the LIBOR rates is essential in explaining the volatility smiles of interest rate caps.

The aim of this paper is to show a different approach for estimating the risk neutral drift of the compensated interest rate process by means of the slope of the yield curve. As a consequence some of the functions of the pricing partial differential equation do not have to be explicitly estimated. This fact could allow us to obtain the yield curve and price different interest rate derivative securities more efficiently. Some similar studies have been analysed but when interest rates follow diffusion type process, see for example Gómez-Valle and Martínez-Rodríguez (2008) and (2010).

The assumption of an appropriate stochastic process for the instantaneous interest rate and the estimation of its associated functions (drift, volatility, jump intensity, …) are of crucial importance when pricing and hedging with term structure of interest rates and interest rate derivatives. Therefore, we think that any result and methodology for estimating parameters in the jump diffusion models, as the results in this paper, have important implications for the area of financial engineering.

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