Lévy-Itō models for Interest Rates

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Abstract. We consider the relation between risk and return in a large class of asset pricing models of the so-called Lévy-Itō type, where the market filtration is generated by a Brownian motion of dimension n and together with an independent ``space-time'' Poisson random measure of dimension $m + 1$. Building on Brody, Hughston & Mackie (2012) Proc. Roy. Soc. A 468, 1778-1798, we represent the market as a pair consisting of (a) a family of ``investment-grade'' assets offering a positive risk premium, and (b) a compatible pricing kernel, with the property that (after adjustment for dividends) the product of the pricing kernel with any asset price is a martingale under the ``real-world'' measure.

We construct a general expression in such a setting for the risk premium offered by an asset, given as a non-linear function of the relevant volatility and risk aversion processes. We are led in this way to a broad family of interest rate models with jumps, represented by a general Lévy-Itō pricing kernel together with associated family discount bonds of all maturities. Our approach is to construct the bond price processes explicitly. In the talk, I will present several examples of interest rate models constructed in this spirit, along with numerical simulations of the resulting interest rates and bond price processes. (Work with Lane Hughston, Brunel University and University College London).