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A multivariate jump-driven financial asset model

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Abstract

We discuss a Lévy multivariate model for financial assets which incorporates jumps, skewness, kurtosis and stochastic volatility. We use it to describe the behaviour of a series of stocks or indexes and to study a multi-firm, value-based default model. Starting from an independent Brownian world, we introduce jumps and other deviations from normality, including non-Gaussian dependence. We use a stochastic time-change technique and provide the details for a Gamma change. The main feature of the model is the fact that—opposite to other, non-jointly Gaussian settings—its risk-neutral dependence can be calibrated from univariate derivative prices, providing a surprisingly good fit.

Keywords:

Lévy processes | Multivariate asset modelling | Copulas | Risk neutral dependence

Notes

†For an extensive discussion of the economic interpretation of time change and its relationship with the market activity, see Geman and Ané (2000).

†Note that in theory we can make the Brownian motions depedent on each other (as in Madan and Seneta (1987)). However, this would lead to a quadratic incerase in the parameters and would generate an estimation problem of the correlation structure, as discussed before.

‡Extensions to common stochastic voltaility time changes can be part of future research.