Local Variance Gamma and Explicit Calibration to Option Prices

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Abstract:

In some options markets (e.g. commodities), options are listed with only a single maturity for each underlying. In others, (e.g. equities, currencies), options are listed with multiple maturities. In this paper, we analyze a special class of pure jump Markov martingale models and provide an algorithm for calibrating such model to match the market prices of European options of multiple strikes and maturities. This algorithm matches option prices exaclty and only requires solving several one-dimensional root-search problems and applying elementary functions. We show how to construct a time-homogeneous process which meets a single smile, and a piecewise time-homogeneous process which can meet multiple smiles.