Estimation and Simulation for Multivariate Tempered Stable Distributions with Applications To Finance

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Abstract

In this thesis, we introduce a methodology for the simulation and parameter estimation of multivariate tempered stable distributions. Our approach is based on an approximation due to a discretization of the Lévy measure. We derive this discretization in general and give an explicit construction of the discretization in the bivariate case. Also, our approximation results hold for a wide class of multivariate infinitely divisible distributions.

Based on our main approximation, we develop a method for simulations, which we call the discretization and simulation (DS) method. We apply our methodology to two bivariate financial datasets related to exchange rates and perform goodness-of-fit tests to show that the multivariate tempered stable model does a good job fitting the model.

Further, we apply our model for the pricing of the bivariate basket option. Toward this end, we provide theoretical results on the existence of equivalent martingale measures. Then combing this with our model for parameter estimation and the DS method for simulation, we develop a Monte Carlo based method for option pricing. We apply it to the pricing of European call options with different strikes and the pricing of the Multi-asset rainbow option.

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