Tempered stable distributions and high frequency financial modeling

Sina Saba

Abstract

In this dissertation, we explore two applications of discrete tempered stable (DTS) distributions, a flexible class of distributions well-suited for modeling heavy-tailed and overdispersed data. DTS distributions are derived by tempering the tail of discrete stable distributions.

The first application addresses challenges in simulating positive tempered stable (PTS) distributions. Except for a few cases, there is no known simulation method for these distributions. We propose a novel simulation method using DTS distributions to approximate PTS simulations and establish a convergence rate for our estimation.

The second application focuses on modeling high-frequency financial data, or tick data, characterized by discrete price changes dictated by tick size. We compare the performance of DTS distributions against standard discrete models, specifically Poisson and negative binomial distributions, in modeling price changes. Additionally, we employ Monte Carlo methods to approximate the future distribution of portfolio values, utilizing these insights for risk assessment.