THE UNIVERSITY OF CHICAGO | DEPARTMENT OF STATISTICS

Master's Thesis Presentation

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"Uniform Confidence Bands for the Empirical Pricing Kernel"

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Abstract

We apply the uniform confidence-band procedure of Härdle, Okhrin and Wang (2015) to S&P 500 index options from 2019–2025, with the eligible empirical sample covering 2021–2025. We recover the risk-neutral density from a locally smoothed implied-volatility smile and estimate the physical density from historical returns. Our daily cross-sections contain about 328 end-of-day quotes alongside 500 overlapping returns. Simulations calibrated to these data show that ignoring uncertainty in the physical density leads to substantial under coverage and excessive rejection of a true Black–Scholes kernel. Including that uncertainty raises simulated coverage to approximately 94%, but statistical power against a hump-shaped kernel remains limited. In the empirical monthly sample, the original-style band rejects the power family on all 56 dates, while the adjusted band rejects it on 13 dates and rejects monotonicity on four. These findings highlight the importance of physical-density uncertainty in assessing the pricing-kernel puzzle.

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