Parametric Inference and Dynamic State Recovery from Option Panels

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Abstract

We develop a new parametric estimation procedure for option panels observed with error which relies on asymptotic approximations assuming an ever increasing set of observed option prices in the moneyness-maturity (cross-sectional) dimension, but with a fixed time span. We develop consistent estimators of the parameter vector and the dynamic realization of the state vector that governs the option price dynamics. The estimators converge stably to a mixed-Gaussian law and we develop feasible estimators for the limiting variance. We provide semiparametric tests for the option price dynamics based on the distance between the spot volatility extracted from the options and the one obtained nonparametrically from high-frequency data on the underlying asset. We further construct new formal tests of the model fit for specific regions of the volatility surface and for the stability of the risk-neutral dynamics over a given period of time. In an empirical application to S&P 500 index options we find strong evidence for time-varying jump risk premiums and a more flexible relation between risk premiums and volatility.

Keywords: Option Pricing, Inference, Risk Premia, Jumps, Latent State Vector, Stochastic Volatility, Specification Testing, Stable Convergence.