Identification Robust Inference in Stochastic Volatility Models with Equity Data

Xu Cheng, Eric Renault, and Paul Sangrey

In stochastic volatility asset pricing models, the volatility affects the expected return of equities through two channels: (1) the investor’s preference for high future high returns as measured by the equity risk price, and (2) the investor’s direct aversion to future volatility as measured by the volatility risk price. Disentangling these prices is difficult and poses a subtle identification that invalidates standard inference. We adopt the discrete-time exponentially affine model Khrapov and Renault (2016) develop, who link the identification of volatility risk price to the leverage effect. This effect measures the correlation between return and volatility innovations. Although theoretically less than zero, this effect is difficult to quantify empirically (Ait-Sahalia, Fan, Li, 2013). When the data's signal-to-noise ratio is small, standard tests and confidence intervals often provide misleading results.

We provide identification robust inference. In particular, we develop a minimum distance criterion that links the equity risk price, the volatility risk price, and the leverage effect to the joint conditional distributions' reduced-form parameters. The link functions are rather flat if the leverage effect is close to zero, and we cannot consistently estimate the volatility price. We derive a valid confidence set for the prices by converting the conditional likelihood ratio test in Andrews and Mikusheva (2016) study in a GMM framework a minimum distance one. These robust confidence set are uniformly valid and provide correct coverage for the prices regardless of the value of the leverage effect.