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Moving Average-Based Estimators of Integrated Variance

Peter R. Hansen , Jeremy Large & Asger Lunde

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Abstract

We examine moving average (MA) filters for estimating the integrated variance (IV) of a financial asset price in a framework where high-frequency price data are contaminated with market microstructure noise. We show that the sum of squared MA residuals must be scaled to enable a suitable estimator of IV. The scaled estimator is shown to be consistent, first-order efficient, and asymptotically Gaussian distributed about the integrated variance under restrictive assumptions. Under more plausible assumptions, such as time-varying volatility, the MA model is misspecified. This motivates an extensive simulation study of the merits of the MA-based estimator under misspecification. Specifically, we consider nonconstant volatility combined with rounding errors and various forms of dependence between the noise and efficient returns. We benchmark the scaled MA-based estimator to subsample and realized kernel estimators and find that the MA-based estimator performs well despite the misspecification.

Keywords:

- Bias correction
- High-frequency data
- Integrated variance
- Moving average
- Realized variance
- Realized volatility

JEL Classification:

- C10
- C22
- C80

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Notes

¹Within TTS, Griffin and Oomen ([2008](#)) further distinguish two categories: In the first (transaction time sampling), $t_{i,m}$ is the time of a transaction; while in the second (for which they reserve the term, tick time sampling) $t_{i,m}$ is the time of a quote revision.

²Andersen et al. ([2001](#)) experiment with unfiltered and also linearly interpolated five-minute returns, finding similar dynamics in all cases. Nevertheless, sampling NYSE data at five-minute intervals, they find a median moving-average coefficient of -0.214 ($+ 0.214$ in the notation of this article), at which level, if the microstructure is an IID noise, the unscaled MA(1)-based estimator overstates IV by 62%.

³The main exception was σ_{low}^2 which was quite similar to σ_{high}^2 at the smaller variances. Graphs giving this information are available from the authors on request.

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