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Econometric analysis of multivariate realised QML: estimation of the covariation of equity prices under asynchronous trading

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Abstract

Estimating the covariance between assets using high frequency data is challenging due to market microstructure effects and asynchronous trading. In this paper we develop a multivariate realised quasi maximum likelihood (QML) approach, carrying out inference as if the observations arise from an asynchronously observed vector scaled Brownian model observed with error. Under stochastic volatility the resulting realised QML estimator is positive definite, uses all available data, is consistent and asymptotically mixed normal. The quasi-likelihood is computed using a Kalman filter and optimised using a relatively simple EM algorithm. We also propose an alternative estimator using a factor model, which scales well with the number of assets. We derive the theoretical properties of these estimators and prove that they achieve the efficient rate of convergence. Our estimators are also analysed using Monte Carlo methods and applied to equity data with varying levels of liquidity.

Keywords: EM algorithm; Kalman filter; market microstructure noise; asynchronous data; factor model; portfolio allocation; quasi-likelihood; semimartingale.

JEL codes: C01; C14; C58; D53; D81

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