On the Estimation of Integrated Covariance Matrices of High Dimensional Diffusion Processes

Xinghua Zheng
Department of ISOM
Hong Kong University of Science and Technology
Clear Water Bay, Kowloon, Hong Kong
xhzheng@ust.hk

Abstract

We consider the estimation of integrated covariance matrices of high dimensional diffusion processes by using high frequency data. We start by studying the most commonly used estimator, the realized covariance matrix (RCV). We show that in the high dimensional case when the dimension p and the observation frequency n grow in the same rate, the limiting empirical spectral distribution of RCV depends on the covolatility processes not only through the underlying integrated covariance matrix Sigma, but also on how the covolatility processes vary in time. In particular, for two high dimensional diffusion processes with the same integrated covariance matrix, the empirical spectral distributions of their RCVs can be very different. Hence in terms of making inference about the spectrum of the integrated covariance matrix, the RCV is in general *not* a good proxy to rely on in the high dimensional case. We then propose an alternative estimator, the time-variation adjusted realized covariance matrix (TVARCV), for a class of diffusion processes. We show that the limiting empirical spectral distribution of our proposed estimator TVARCV does depend solely on that of Sigma through a Marcenko-Pastur equation, and hence the TVARCV can be used to recover the empirical spectral distribution of Sigma by inverting the Marcenko-Pastur equation, which can then be applied to further applications such as portfolio allocation, risk management, etc..

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