

Structured Volatility Matrix Estimation for Non-synchronized High-frequency Financial Data

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Abstract

Recently several large volatility matrix estimation procedures have been developed for factor-based Itô processes whose integrated volatility matrix consists of low-rank and sparse matrices. Their performance depends on the accuracy of input volatility matrix estimators. When estimating co-volatilities based on high-frequency data, one of the crucial challenges is non-synchronization for illiquid assets, which makes their co-volatility estimators inaccurate. In this paper, we study how to estimate the large integrated volatility matrix without using co-volatilities of illiquid assets. Specifically, we pretend that the co-volatilities for illiquid assets are missing, and estimate the low-rank matrix using a matrix completion scheme with a structured missing pattern. To further regularize the sparse volatility matrix, we employ the principal orthogonal complement thresholding method (POET). We also investigate the asymptotic properties of the proposed estimation procedure and demonstrate its advantages over using co-volatilities of illiquid assets. The advantages of our methods are also verified by an extensive simulation study and illustrated by high-frequency financial data for constituents of the S&P 500 index.