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Summary: High-frequency financial data allow us to estimate large volatility matrices with relatively short time horizon. Many novel statistical methods have been introduced to address large volatility matrix estimation problems from a high-dimensional Itô process with microstructural noise contamination. Their asymptotic theories require sub-Gaussian or some finite high-order moments assumptions for observed log-returns. These assumptions are at odd with the heavy tail phenomenon that is pandemic in financial stock returns and new procedures are needed to mitigate the influence of heavy tails. In this article, we introduce the Huber loss function with a diverging threshold to develop a robust realized volatility estimation. We show that it has the sub-Gaussian concentration around the volatility with only finite fourth moments of observed log-returns. With the proposed robust estimator as input, we further regularize it by using the principal orthogonal component thresholding (POET) procedure to estimate the large volatility matrix that admits an approximate factor structure. We establish the asymptotic theories for such low-rank plus sparse matrices. The simulation study is conducted to check the finite sample performance of the proposed estimation methods.

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Keywords:
concentration inequality; huber loss; low-rank matrix; pre-averaging; sparsity

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References:

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