ABSTRACT: In this paper, we propose a general framework of volatility inference with noisy high-frequency data. We assume the observed transaction price follows a continuous-time Itô-semimartingale, contaminated by a discrete-time moving-average noise process associated with the arrival of trades. Our estimator is obtained by maximizing the likelihood of a misspecified moving-average model of returns with homoscedastic innovations. We show that this quasi-likelihood estimator is consistent with respect to the quadratic variation of the semimartingale, and that the estimator is asymptotically mixed normal. We also present the minimax optimal bound, from which our estimator deviates slightly. Next, we propose AIC and BIC for order selection, and establish uniformly valid inference on volatility, allowing for model selection mistakes. In addition, our estimator is adaptive to the presence of the noise, and its convergence rate varies from $n^{1/4}$ to $n^{1/2}$ depending on the magnitude of the noise. We thereby provide uniform inference on volatility over small and large noises. Moreover, we show our estimator can be regarded as an iterative at-top realized kernel when noise is large. Yet unlike kernel and other nonparametric estimators, our implementation is tuning-free barring order selection, and it warrants positive estimates infinite sample. By contrast, we show the classic Whittle approximation is inconsistent under in-fill asymptotics. Finally, we provide consistent estimators of noise autocovariances and autocorrelations as by-products.

BIOGRAPHY: Dacheng Xiu is interested in developing and applying statistical methodologies to explore the economic implications of financial data. His earlier research involves risk measurement and portfolio management with high-frequency data and econometric modeling of derivatives. His current work focuses on developing machine learning solutions to big-data problems in empirical asset pricing. Xiu’s work has appeared in the Econometrica, Journal of Econometrics, and Journal of the American Statistical Association, and he has been invited to publish in the Journal of Business and Economic Statistics. He is an Associate Editor for the Journal of Econometrics and the Statistica Sinica, and also referees for many journals in the fields of econometrics, statistics, and finance. Xiu has presented his work at various conferences and university seminars. His recent paper “Inference on Risk Premia in the Presence of Omitted Factors” received the Best Conference Paper Prize at the 2017 Annual Meeting of the European Finance Association. Recently, Xiu launched a website that provides up-to-date realized volatilities of individual stocks. These daily volatilities are calculated from the stocks’ intraday transactions and the methodologies are based on his research on high-frequency data. Xiu earned his PhD and MA in applied mathematics from Princeton University, where he also did research at the Bendheim Center for Finance. Before that, he obtained a BS in mathematics from the University of Science and Technology of China.