Rui Da

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EDUCATION

University of Chicago Booth School of Business *2016 -2023 (expected)*
Ph.D. candidate in Econometrics and Statistics

Princeton University *2013-2015*
Ph.D. student in Physics

Nanjing University *2009-2013*
B.Sc. in Physics

RESEARCH INTERESTS

Financial Economics, Econometrics, Machine Learning in Finance

JOB MARKET PAPER

Market Efficiency with Many Investors
Modern financial markets contain many investors. In this context, we study the role of information in investor decision-making, and the informational efficiency and liquidity of the market. An equilibrium is characterized in closed-form for a continuous-time economy with many market participants and imperfect competition, in which investors receive private information with varying quality, and are heterogeneous in their misperception of the information quality. In equilibrium, investor heterogeneity in their misperception generates return predictability by investors' trading, and trading of different investors follows a simple factor structure with weak factors. To conduct empirical analysis that builds on these equilibrium implications, we develop a new big-data econometric method that utilizes the factor structure to accommodate the high-dimensionality of these implications. Applying the framework to price and institution holding data of the US stock market, we document that individual institution's trading with impotent predictive power can collectively generate significant return predictability that persists for about a quarter. We estimate dynamic price impact of around 0.25 at quarterly frequency, a moderate misperception of institutions on their information quality, and institutions' contributions to the informational efficiency of the market.

PUBLICATIONS

When Moving-Average Models Meet High-Frequency Data: Uniform Inference on Volatility
with Dacheng Xiu
Econometrica, November, 2021
We conduct inference on volatility with noisy high-frequency data. We assume the observed transaction price follows a continuous-time It-semimartingale, contaminated by a discrete-time moving-average noise process associated with the arrival of trades. We estimate volatility, defined as the quadratic variation of the semimartingale, by maximizing the likelihood of a misspecified moving-average model, with its order selected based on an information criterion. Our inference is uniformly valid over a large class of noise processes whose magnitude and dependence structure vary with sample size. We show that the convergence rate of our estimator dominates $n^{1/4}$ as noise vanishes, and is determined by the selected order of noise dependence when noise is sufficiently small. Our implementation guarantees positive estimates in finite samples.

WORKING PAPERS

The Statistical Limit of Arbitrage
with Stefan Nagel and Dacheng Xiu
November, 2022
When alphas are weak and rare, and arbitrageurs have to learn about alphas from historical data, there is a gap between Sharpe ratio that is feasible for them to achieve and the infeasible Sharpe ratio that could be obtained with perfect knowledge of parameters in the return generating process. This statistical limit to arbitrage widens the bounds within which alphas can survive in equilibrium relative to the arbitrage pricing theory (APT) in which arbitrageurs are endowed with perfect knowledge. We derive the optimal Sharpe ratio achievable by any feasible arbitrage strategy, and illustrate in a simple model how this Sharpe ratio varies with the strength and sparsity of alpha signals, which characterize the difficulty of arbitrageurs learning problem. Furthermore, we design an all-weather arbitrage strategy that achieves this optimal Sharpe ratio regardless of the conditions of alpha signals. Our empirical analysis of equity returns shows that this optimal strategy, along with other feasible strategies based on multiple-testing, LASSO, and Ridge methods, achieve a moderately low Sharpe ratio out of sample, in spite of a considerably higher infeasible Sharpe ratio, consistent with absence of feasible near-arbitrage opportunities and relevance of statistical limits to arbitrage.

Disentangling Autocorrelated Intraday Returns
with Dacheng Xiu
revision requested by Journal of Econometrics, May, 2021
We propose a semiparametric approach to disentangling the autocovariance of equity returns at high frequency. We assume the observed price consists of an efficient component that follows a nonparametric continuous-time Itô-semimartingale, along with a market microstructure component that follows a discrete-time moving-average model. Our quasi-likelihood procedure relies on a misspecified moving-average model selected by information criteria. We establish the model-selection consistency, provide a central limit theory on autocovariance parameters, and show their consistency uniformly over a large class of models that allow for an arbitrary noise magnitude and a flexible dependence structure. We also provide a quadratic representation of the likelihood estimator, which sheds light on its connection with nonparametric kernel estimators. Our simulation evidence suggests that our estimator outperforms the nonparametric alternatives particularly when noise magnitude is small. We apply this estimator to S&P 1500 index constituents, and find that in recent years the microstructure friction has become smaller but existed in 5-minute returns, particularly in small caps, and that the average duration of autocorrelations for large caps has shrunk considerably to merely 10 seconds.

AWARDS

J. Michael Harrison Doctoral Prize	*2021*
The Oscar Mayer Fellowship	*2020 - 2021*
Ph.D. Program Fellowship, The University of Chicago Booth School of Business	*2016 - 2020*
Natural Science Fellowship, Princeton University	*2013 - 2014*
Cross-disciplinary Scholars in Science and Technology, University of California, Los Angeles	*2012*

REFEREE ACTIVITIES

Economics and Statistics, Management Science, Journal of Econometrics, Journal of Business & Economic Statistics, Journal of Financial Econometrics, Statistica Sinica

TEACHING ASSISTANTSHIPS

Statistical Inference (Ph.D.), The University of Chicago Booth School of Business	*2018 - 2020*
General Physics (Undergraduate), Princeton University	*2015*
Mapping the Universe (Undergraduate), Princeton University	*2014*

SKILLS

Programming: Stata,R, Matlab, Python, SAS, Mathematica.
Languages: Chinese (native), English (professional)
Miscellaneous: Tennis (USTA 4.0)

REFERENCES

Zhiguo He (co-chair)
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