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Research Interests

Empirical Operation Management, Structural Estimation, Econometrics, Machine Learning, Data-driven Decision Making and Financial Engineering

Education

Columbia University, Graduate School of Business

- Ph.D. Candidate in Decision, Risk and Operations 2014-Present

Journal Publication

Customer Preference and Station Network in the London Bike Share System

Management Science, Major Revision

(Joint work with Fanyin Zheng, Elena Belavina and Karan Girotra)

Abstract We study customer preference for the bike share system in the city of London. We estimate a structural demand model on the station network to learn the preference parameters and use the estimated model to provide insights on the design and expansion of the bike share system. We highlight the importance of network effects in understanding customer demand and evaluating expansion strategies of transportation networks. In the particular example of the London bike share system, we find that allocating resources to some areas of the station network can be 10 times more beneficial than others in terms of system usage, and that the currently implemented station density rule is far from ideal. We develop a new method to deal with the endogeneity problem of the choice set in estimating demand for network products. Our method can be applied to other settings, in which the available set of products or services depends on demand.

Working papers

Machine Learning in Demand Estimation with Long-tail Data

(Joint work with Fanyin Zheng)

Abstract Long tail distributions in sales or market share data have long been an issue for empirical studies in areas such as economics, operations and marketing, and it is increasingly common nowadays with more

detailed level of data available and many more products being offered at places like online retailers. Classic discrete choice estimation framework ignoring zeros and small shares will yield inconsistent estimates. However, focusing only on top selling products in estimation are popular in practice and there are very few studies on the subject. In this work we first show that biased demand estimates, if used as an input to subsequent tasks such as pricing and assortment optimization, could lead to managerial decisions far away from optimal. We then introduce a new two-stage estimator to solve the problem: our solution applies machine learning algorithms to estimate market shares in the first stage, and in the second stage we utilize the first stage results to correct for the selection bias in demand estimates. We provide theoretical support for our proposal and show that our approach works better than traditional methods using simulations. We also compare our estimators with existing alternatives in real data applications.

Buy Rough, Sell Smooth

(Joint work with Paul Glasserman)

Abstract Recent work has documented roughness in the time series of S&P 500 volatility and investigated its implications for option pricing. We study a strategy for trading stocks based on measures of their implied and realized roughness. A strategy that goes long the roughest stocks and short the smoothest stocks earns statistically significant excess annual returns of 6% or more, depending on the time periods and strategy details. The profitability of the strategy is not explained by standard factors. We compare alternative measures of roughness in volatility and find that the profitability of the strategy is greater when we sort stocks based on implied rather than realized roughness. We interpret the profitability of the strategy as compensation for near-term event risk.

Conference Presentations

“Customer Preference and Station Network in the London Bike Share System”

- INFORMS Annual Meeting, Phoenix AZ Nov 2018
- MSOM Service SIG Meeting (8/66 submissions), Dallas TX July 2018
- INFORMS Annual Meeting, Houston TX Oct 2017
- Empirical OM Workshop, Philadelphia PA Sept 2017
- MSOM Annual Conference, Chapel Hill NC June 2017
- Marketplace Innovation Workshop, Stanford CA June 2017

“Machine Learning in Demand Estimation with Long-tail Data”

- INFORMS Annual Meeting, Phoenix AZ Nov 2018
- INFORMS RMP Annual Conference, Toronto, Canada June 2018

“Buy Rough, Sell Smooth”

- Bloomberg Quant Seminar, New York NY April 2018

Industry Experience

- Airbnb marketplace: working on demand estimation and pricing
- Bank of America: working on constructing portfolio with given macro risk exposures
- PricewaterhouseCoopers: derivatives valuation and quantitative advisory for insurance companies

Computer Skills

Proficient in R, Python, C/C++, Java, Matlab, VBA; Familiar with Spark, SQL and Linux Bash

Reference

Prof. Paul Glasserman

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Prof. Fanyin Zheng

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(From outside Columbia University)

Prof. Karan Girotra

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