Bowen Lou

Contact Information

The Wharton School, OID Department
500 Jon M. Huntsman Hall
3730 Walnut Street
Philadelphia, PA, 19104

Phone number: +1 (773) 988-3840
Email: bowenlou@wharton.upenn.edu
Website: www.bowenlou.org

Selected Graduate-Level Coursework

- **Economics** Microeconomic Theory, Game Theory, Decision Processes and Behavioral Economics Seminar(Prof Uri Simonsohn), Numerical Methods in Economics(Prof Ulrich Doraszelski), Empirical Methods for Industrial Organization(Prof Aviv Nevo)
- **Statistics** Online Methods in Machine Learning, Topics in Machine Learning & Econometrics, Applied Econometrics(Prof Paul Shaman), Statistical Inference, Observational Studies(Prof Dylan Small), Nonparametrics & Log-Linear Models(Prof Paul Rosenbaum), Data Analytics and Statistical Computing(Prof Andreas Buja), Advanced Data Analytics(Leskovec, Rajaraman and Ullman's book), Data Mining(Prof Matt Taddy)
- **Information Management & Strategy** Information Strategy and Economics(Prof Lorin Hitt), Pro-Seminar in Technology Strategy & Innovation, Corporate Strategy(Prof Harbir Singh)
- **Operations Management** Optimization, Operations Management Seminar(Prof Xuanming Su)
- **Sociology** Organizational Analysis(Prof Edward Laumann), Computational Social Science
- **Computer Science** Databases, Data Warehousing, Algorithms, Computer Systems, Object Oriented Architecture, Practicum Project on Network Analysis of Natural Language

Education

The Wharton School, University of Pennsylvania(UPenn), PA, USA — Expected 2020
Ph.D Candidate, Operations, Information and Decisions Department
Track: Information Systems

The Wharton School, University of Pennsylvania(UPenn), PA, USA — Expected 2019
M.A. in Statistics

University of Chicago (UChicago), IL, USA — 2014
M.S. in Computer Science, Specialized in Data Analytics

Shanghai Jiao Tong University (SJTU), Shanghai, China — 2013
B.Eng in Information Security

University of California, Los Angeles (UCLA), CA, USA — 2011
Visiting Student, Summer School

Research Interest

Topics: Artificial Intelligence; Big Data Analytics; Economics of Information Systems; FinTech; Healthcare; Social Media & User Generated Content; Technological Innovation

Methods: Bio- & Chemo-informatics; Econometrics; Machine Learning; Natural Language Processing; Network Science

Selected Research Abstract

1. Artificial Intelligence and Drug Innovation. (with Lynn Wu, Under Review)

Abstract: We study how artificial intelligence can influence the drug discovery and development process in the global pharmaceutical industry. Despite an enormous amount of time and financial resources invested in developing drugs, pharmaceutical firms experience declines in novelty for drugs they produced. As AI becomes an important general purpose technology (GPT), it could be used to address some known challenges in the drug development process. Using two large-scale datasets that contain detailed historical records of global drug development and patents, we identify AI-related patents to approximate firms' AI capabilities and construct a relatively new similarity-based metric to measure drug novelty based on their chemical structure. By differentiating multiple stages in the drug development process, we examine where AI is most effective in developing new drugs. We find that AI can primarily affect the earliest stage in drug discovery when tasks are heavily dependent on automatic data processing and reasoning. However, it may not necessarily help with the more expensive and risky clinical trial stages that require substantial human engagements and interventions. Additionally, AI can facilitate drug discovery for drugs at the medium level of

chemical novelty but is not helpful with drugs at the extreme ends of the spectrum, those that are entirely novel or incremental me-too drugs. Our study sheds light on the understanding of the roles and limitations modern technology can have on drug development, one of the most complex innovation processes in the world.

2. Data Analytics Skills, Innovation and Firm Productivity. (with Lynn Wu & Lorin Hitt, *Management Science*, Forthcoming)

   Abstract: We examine the relationship between data analytics capabilities and innovation using detailed firm-level data. To measure innovation, we first utilize a survey to capture two types of firm practices, process improvement and new technology development for 331 firms. We then use patent data to further analyze new technology development for a broader sample of more than 2,000 publicly-traded firms. We find that data analytics capabilities are more likely to be present and are more valuable in firms that are oriented around process improvement and that create new technologies by combining a diverse set of existing technologies than they are in firms that are focused on generating entirely new technologies. These results are consistent with the theory that data analytics are complementary to certain types of innovation because they enable firms to expand the search space of existing knowledge to combine into new technologies, as well as the theoretical arguments that data analytics support incremental process improvements. Data analytics appear less effective for developing entirely new technologies or creating combinations involving a few areas of knowledge, innovative approaches where there is either limited data or limited value in integrating diverse knowledge. Overall, our results suggest firms that have historically focused on specific types of innovation—process innovation and innovation by diverse recombination—may receive the most benefits from using data analytics.

3. Data Analytics Supports Decentralized Innovation. (with Lynn Wu & Lorin Hitt, *Management Science*, Forthcoming)

   Abstract: Data analytics technology can accelerate the innovation process by enabling existing knowledge to be identified, accessed, combined and deployed to address new problem domains. However, like prior advances in information technology, the ability of firms to exploit these opportunities depends on a variety of complementary human capital and organizational capabilities. We focus on whether analytics is more valuable in firms where innovation within a firm has decentralized groups of inventors or centralized ones. Our analysis draws on prior work measuring firm analytics capability using detailed employee-level data and matches these data to metrics on intra-firm inventor networks that reveal whether a firm's innovation structure is centralized or decentralized. In a panel of 1,864 publicly-traded firms from the years 1988 to 2013, we find that firms with a decentralized innovation structure have a greater demand for analytics skills and receive greater productivity benefits from their analytics capabilities, consistent with a complementarity between analytics and decentralized innovation. We also find that analytics helps decentralized structures to create new combinations and reuse of existing technologies, consistent with the ability of analytics to link knowledge across diverse domains and to integrate external knowledge into the firm. Furthermore, the effect primarily comes from the analytics capabilities of the non-inventor employees as opposed to inventors themselves. These results show that the benefit of analytics on innovation depends on existing organizational structures. Similar to the IT-productivity paradox, these results can help explain a contemporary analytics-innovation paradox — the apparent slowdown in innovation despite the recent increase in analytics investments.

SHORT SUMMARY

Bowen Lou is a rising fifth-year doctoral candidate in the Operations, Information and Decisions department of the Wharton School, with specialization in Information Systems.

His current research topics are related to Artificial Intelligence (AI), Innovation & Economics. He is interested in studying the economic relationship among investment in modern technologies such as AI, innovation, and firm performance. Bowen is also passionate about proposing or applying eclectic but robust solutions from network science and natural language processing to derive valuable insights in large-scale datasets and solve real-world problems.