Wu Zhu

Personal Website: https://zhuwu2012.github.io/

Education

PhD in Economics, University of Pennsylvania, Expected in 2021
(Networks, Macro, Finance, and Machine Learning)
Master in Statistics, Department of Stats, Wharton, Expected in 2021
(Machine Learning)
M.A in Economics, CCER, Peking University, 2016
B.S in Materials Physics, University of Science and Technology, Beijing, 2009

Research Statement

My research spans several fields: Macroeconomics, Finance, Machine Learning, Theory, and the Chinese Economy. However, it shares a common theme - the use of big data (firm-level) to emphasize the role of networks in investor behavior, firm decision making, business cycles, asset pricing, and systemic risk. I am also an expert and extremely interested in using micro data to support a vivid macro picture.

Programming and Skills

Python (High Proficiency), R (Proficiency), Stata (High Proficiency), and SQL.

Papers under Review

1. **The Network Effects of Agency Conflicts** (with Rakesh Vohra (Penn Econ and CIS) and Yiqing Xing (JHU), Under Review) (6th Annual Conference (U Chicago Booth))
2. **Tiered Intermediation in Business Groups and Targeted SME Support** (with Yu Shi (IMF) and Robert M Townsend (MIT), Under Review) (Finalist of best Ph.D. paper (MFA, 2020), AEA 2020, IMF 2020, 6th Network Conference (UChicago,Booth,2020), Asian Econometric Meeting 2019, North American Econometric Meeting 2019, Penn, Wharton, IMF, PKU, CUFE, VOX China)

Papers on Innovation Networks

3. **Innovation Network Marries Production Network, and Business Cycle**
(Job Market Paper, with Yucheng Yang, Princeton Applied Math) (Talk: UPenn, Princeton)
The speed at which the US economy has recovered from different recessions ranges from months to years. In this paper, we argue that the underlying network of knowledge flow on technology and its interactions with production networks and cross-sectional shocks explains the large variations in the speed of recovery across recessions in US.
Besides the production linkages, firms learn insights on production from each other through the innovation networks. In general, we show that these interactions allow us to decompose the effects of shocks, even idiosyncratic shocks, on future growth into components with various levels of persistence and loadings. The persistence can be fully captured by the eigenvalue distribution of the matrix representation for the innovation network, while the loadings can be fully captured by two sufficient statistics - the correlation between the centrality in innovation networks and shocks, and the correlation between centralities in innovation and production networks.
The slow recovery occurs when the loading on the persistent component increases sharply. We further document a set of new stylized facts in US and show the importance of our channel in explaining the slow recovery. Finally, we explore the explanations of our theory on puzzles in financial markets - time-varying equity-premium and risk-free rate puzzles.
4. **Innovation Networks, Linking Complexity, and Cross Predictability**
(Finalist of best paper in investment in FMA (Financial Management Association), 6th Annual Network Conference (2020, U Chicago))

5. **Production Networks, Non-Linear Effects, and Resource Reallocation** (come out soon, draft available)
6. **Innovation Network Marries Production Network, and Asset Pricing** (come out soon, draft available)

Papers on Equity-holding Networks.

7. **Tiered Intermediation in Business Groups and Targeted SME Support** (with Yu Shi (IMF) and Robert M Townsend (MIT))
   Using a proprietary dataset covering all registered firms in China (40 million), we document a rapid expanding but structure stable firm-to-firm equity-holding networks (5 million firms in network in 2017). We show that internal capital markets in business groups can propagate corporate shareholders' credit supply shocks to their subsidiaries. An average of 16.7% local bank credit growth where corporate shareholders are located would increase subsidiaries investment by 1% of their tangible fixed asset value, which accounts for 71% (7%) of the median (average) investment rate among these firms. We argue that equity exchange is one channel through which corporate shareholders transmit bank credit supply shocks to the subsidiaries and provide evidence to support the channel.
8. **The Network Effects of Agency Conflicts** (with Rakesh Vohra (Penn Econ and CIS) and Yiqing Xing (JHU))
   We propose a model of equity holding networks that allow firms to take an investment decision in response to an exogenous shock. It encompasses various firm level frictions - default cost, limited liability, interest conflicts between shareholders and mangers and moral hazard. We argue that the underlying frictions at the firm level and not just the network structure, play a key role in amplifying or muting the propagation of exogenous shocks. In the presence of default costs or limited liability, firms make investment choices that serve to mitigate the spread of an initial shock. In the face of interest conflicts or moral hazard, shocks are amplified by firm level investments choices. We also examine the role of network structure in propagating shocks. In the presence of interest-conflicts we show, unlike other work, that denser or more integrated networks need not facilitate the propagation of shocks. This suggests a potentially important role for corporate governance in macro fluctuations.
9. **Ownership Networks and Firm Growth – What do 5 Million Firms Tell us about Chinese Economy?** (with Allen Franklin, Junhui Cai, Xian Gu, Jun "QJ" Qian, Linda Zhao) (AFA 2021, NBER China Workshop 2020, 6th Annual Network Conference 2020, MFA 2020, FMA 2020, 2nd Annual USYD Financing and Banking Research (Sydney,2019), Bank of Finland 2019)
10. **Innovation and Equity Holding Networks** (with Allen Franklin, Junhui Cai, Xian Gu, Jun "QJ" and Linda Zhao, Wharton-China Conference)
11. **State-Owned Enterprises in China Revised** (with Junhui Cai, Xian Gu, and Linda Zhao, come out soon, draft available)
12. **Entry, Exit, and Covid-19** (with Allen Franklin, Junhui Cai, Xian Gu, Jun "QJ", and Linda Zhao, in progress)

Papers on Machine Learning and Investment

13. **Semi-supervised Learning with Networking Data** (with Junhui Cai (Wharton Stats), Dan Yang (HKU), Linda Zhao (Wharton Stats), come out soon, draft available)
14. **Identifying Underlying Links, and Cross Predictability.** (with Junhui Cai (Wharton Stats), Linda Zhao (Wharton Stats), in progress)

Internship Experience

Jan2019 – Now Collaboration with Alpha Group of Wisdom Tree, Strategy Dev & Test.
Jun2018- Sep2018 IMF (International Monetary Fund), Machine Learning, Behavior Bias and Credit Market Crashes (IMF Summer Funding Internship Program for Ph.D.)
Jan2014-Jun2014 R.A. Counsellor Office of the State Council, Central Government, China.

Conference and Seminar Talk (* talk by coauthor)

AFA(Jan2021), NBER China Workshop(Dec2020)*, 6thNetwork-Conference(U Chicago, Booth), FMA(Nov2020,NYC), MFA(Mar2020, Chicago), AEA(Jan 2020,Sandiego), Summer Meeting of North American Econometric Society(July2019), IMF(Apr2019)*, Jane Street Symposium (Jan2019), Asian Meeting of Econometric Society(Jun2019, Xiamen), Bank of Finland (Jul 2019)*, Penn-Wharton-GSM(June2019), Penn Econ(Macro Lunch, 2019), Penn Econ(Micro Theory Lunch,2019), Penn Econ(Micro Empirical Lunch,2019), PKU(June 2018), Penn Econ (Econometric Lunch, April 2018), IMF(April 2018)*, Penn Wharton(Oct 2017, MBA Talk), AEA Conference San Francisco(Jan 2016)*, Alibaba(2016), NBER-CCER Conference(June 2015)*, Stockholm-China Meeting(Sep 2014).

Honors and Awards Related to Math

Finalist best paper in investment (Financial Management Association, 2020), Finalist of best Ph.D. paper (MFA,2020), Wharton Mack Institute for Innovation Fellowship(2020), UPENN SAS DEAN Travel Grant (3 Times), Meritorious Winner (First Prize), Mathematical Contest Modeling United States (2008), First Prize, Chinese National College Mathematical Competition of Modelling (2007), First prize, the 17th and 18th College Mathematical Olympic of China (highest competition at that time)

Quantitative Courses Taken (all PhD Level)

Deep Learning in Theory, Optimization in Machine Learning, Non-Parametric & Machining Learning, Data Mining, Econometrics I, Bayesian Econometrics II, Econometrics IV, Continuous Time Asset Pricing, Asset Pricing, Empirical Methodology of Asset Pricing, Empirical Corporate Finance, Probability Theory, Stochastic Process I, Stochastic Process II, Measure Theory, Real Analysis, Financial Market and Macro Finance.

Conference Organizer.

The 1st NSE Summer Conference (2014). Editors' conference of Oxford-Economic Growth handbook of Africa, Joint with World Bank &IMF (2013)