

Zhouzhou Gu

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EDUCATION

Peking University

B.S. in *Physics*, B.A. in *Economics*. GPA: 3.80 (Overall), 3.91/4.0 (Major)

Beijing, China

Aug. 2018 – July 2022

Featured Math Courses: PhD Stochastic Analysis, PhD Group Theory, Analysis I&II, Function of Real Variables, Complex Analysis, Partial Differential Equations, Ordinary Differential Equations, Linear Algebra, Probability and Statistics, Numerical Analysis;

Featured Econ/Fin Courses: PhD Macro Theory I&II (at Princeton), PhD Micro Theory I&II, PhD Econometric Theory I, PhD Macro-Finance & Monetary Economics & Macroeconomics with Agent Heterogeneity (at Princeton), PhD Corporate Finance Theory, PhD Contract Theory, Industrial Organization

CURRENT POSITION

Senior Research Specialist (Predoc), Bendheim Center for Finance, Princeton University

NJ, USA

Advisors: Prof. [Markus K. Brunnermeier](#) & Prof. [Jonathan E. Payne](#).

Sep. 2022 – Present

Fields: *Macro-finance, Macroeconomics, Asset Pricing, Machine Learning*

RESEARCH INTEREST

Macroeconomics, Inequality, Macro-finance

WORKING PAPERS

- [Deep Learning Solutions to Master Equations for Continuous Time Heterogeneous Agent Macroeconomic Models \(with Jonathan E. Payne, Mathieu Laurière and Sebastian Merkel\)](#). [[Online Appendix](#)], [[Slides](#)]

Abstract: We propose a new global solution algorithm for continuous time heterogeneous agent economies with aggregate shocks. We first approximate the state space so the master equation becomes a high, but finite, dimensional partial differential equation. We then approximate the value function using neural networks and solve the master equation using deep learning tools. The main advantage of this technique is that it breaks the “curse of dimensionality” and allows us to find global solutions to high dimensional, non-linear problems. We demonstrate our algorithm by solving two canonical models in the macroeconomics literature: the Aiyagari model and the Krusell-Smith model.

Presentation: *Society of Economic Dynamics Annual Meeting 2023**, *Society of Computational Economics Meeting**, *Econometric Society Meeting in Lausanne (DSE 2023)**, *Princeton**, *UC Berkeley**, *IMST**, *USC Marshall*, *Peking University*[†].

- [Housing Policy and Inequality \(with Jonathan E. Payne\)](#).

Abstract: Should the government encourage home ownership? To answer this question, we build a dynamic general equilibrium model with heterogeneous agents, aggregate shocks, and housing stock. We solve the model using a new global solution technique that applies deep learning tools to train an Economic Model Informed Neural Network (EMINN). This allows us to analytically and numerically investigate the relationship between inequality, financial frictions, asset pricing, and housing policy. We show that subsidies for home purchases only help poorer households that are able to hold onto their homes during recessions.

Presentation: *Econometric Society Meeting in Lausanne (DSE 2023)**

- [Deep Learning for Solving and Estimating Dynamic Macro-Finance Models \(with Wenhao Li, Lu Lu, Benjamin Fan, Edward Qiao and Anran Jiao\)](#). *Minor Revision Requested by Computational Economics*

Abstract: We develop a methodology that utilizes deep learning to simultaneously solve and estimate canonical continuous-time general equilibrium models in financial economics. We illustrate our method in two examples: (1) industrial dynamics of firms and (2) macroeconomic models with financial frictions. Through these applications, we illustrate the advantages of our method: generality, simultaneous solution and estimation, leveraging the state-of-art machine-learning techniques, and handling large state space. The method is versatile and can be applied to a vast variety of problems.

- [Pricing Long-lived Assets with Heterogeneous Agents \(with Goutham Gopalakrishna and Jonathan E. Payne\)](#).

Abstract: This technical note proposes a new methodology for using deep learning to solve macroeconomic models with long-term assets, complicated household optimization problems, and agent heterogeneity. We first characterize the equilibrium in the space of wealth shares. We then discuss how to use neural networks to approximate the equilibrium. Our resulting algorithm brings together the approaches in Gopalakrishna (2021a) and Gu, Laurière, Merkel and Payne (2023) to allow us to solve a general class of macro-finance models. We test the algorithm by solving canonical models in the literature.

Presentation: *Princeton*

Note: * presented by co-authors, [†] scheduled

WORKS IN PROGRESS

- **Segmentation, Heterogeneity, and Asset Pricing** (with [Goutham Gopalakrishina](#) and [Jonathan E. Payne](#)).
- **Optimal Green Transition** (with [Markus K. Brunnermeier](#) and [Sebastian Merkel](#)).

SELECTED RESEARCH EXPERIENCE

Marshall School of Business, University of Southern California

Remote

Research Assistant to Prof. [Wenhao Li](#)

June 2021 - June 2022

1. Implemented Narrative Structural Vector Auto Regression (NSVAR) to identify how banking-sector shocks affect the pricing of liquidity and other dynamics of the economy for Paper “Public Liquidity and Financial Crises”
2. Built up theoretical characterization for deposit competition channel of monetary policy and robustness check for generalized treasury demand function in paper “The Passthrough of Treasury Supply to Bank Deposit Funding”
3. Built up a global solution method based on cubic spline function smoothing for finite difference solution to a macro-finance model with jumps in paper “Firm Quality Dynamics and the Slippery Slope of Credit Intervention”

Department of Physics, Peking University

Beijing, China

Independent Research supervised by Prof. [Xuzong Chen](#)

Feb. 2020 - Oct. 2021

Honor Thesis: Essays on Ultra-cold Atom Physics and Dynamic Quantum Phase Transition (in Chinese)

SELECTED HONORS AND AWARDS

- Bendheim Center for Finance Travel Grant for DSE 2023 (800\$) 2023
- First Prize in National Undergraduate Math Contest 2021
- Chinese Economy Research Scholarship (Top 0.5%) 2021
- Benz Scholarship (Top 5%) 2021
- Merit Student (Top 5%) 2021, 2020
- Peking University First Prize Scholarship (Top 2%) 2020
- Academic Excellent Award (Top 5%) 2019
- Gold Medal in 19th Asian Physics Olympiad 2018
- Gold Medal in 34th Chinese Physics Olympiad (selected to **Chinese National Team**) 2017

TEACHING EXPERIENCE

Teaching Assistant for (ECO529) Money, Macro and Finance (2nd year PhD)

Princeton University

Instructor: Prof. [Markus K. Brunnermeier](#)

Fall 2023

Instructor for Continuous Time Macro-finance (1st year PhD, [Online Summer School](#)) [[Slides](#)]

Princeton University

Organized by Prof. [Markus K. Brunnermeier](#), about 200 attendants from all over the world

Summer 2023

Teaching Assistant for Undergraduate Microeconomic Theory

Peking University

Instructor: Prof. [Xin Wang](#)

Fall 2021

ADDITIONAL INFORMATION

- **Programming.** Python (Pytorch), R, C++, Matlab, L^AT_EX, Julia, Stata
- **Languages.** Chinese (Native), English (Fluent)
- **Test Scores.** TOEFL: 109 (Speaking 25), GRE: 156(V)+170(Q)+4.5(AW)

REFERENCES

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Prof. Wenhao Li
Marshall School of Business
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