

Federal Reserve Bank of Philadelphia
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Education

Ph.D., Economics, *University of Pennsylvania* (Penn), December 2015 (Thesis title: “Bayesian GMM”)
– Advisors: Francis X. Diebold and Frank Schorfheide; Committee members: Xu Cheng and Francis J. DiTraglia
B.A./M.A., Economics, *Sungkyunkwan University* (SKKU), (February 2007/August 2008)

Employment

Federal Reserve Bank of Philadelphia

2025– Senior Economic Advisor and Machine Learning Economist, Research Department
2021–2024 Economic Advisor and Machine Learning Economist, Research Department
2019–2020 Senior Machine Learning Economist, Research Department

University of Pennsylvania, Wharton School

2023– Lecturer (Part-Time), Department of Statistics and Data Science

University of Illinois at Urbana-Champaign

2015–2019 Assistant Professor (2016–2019), Lecturer (2015–2016), Department of Economics

Editorial positions

2025– Associate Editor, *Journal of Applied Econometrics*
2020– Associate Editor, *International Journal of Forecasting*
2023– Editorial Board Member, *Forecasting*

Publications and accepted papers (peer-reviewed academic articles)

1. “Inference Based on Time-Varying SVARs Identified with Sign Restrictions,” with Jonas E. Arias (Philadelphia Fed), Juan Rubio-Ramírez (Emory), Daniel F. Waggoner (Atlanta Fed and Emory), *Review of Economic Studies*, forthcoming.
2. “On the Aggregation of Probability Assessments: Regularized Mixtures of Predictive Densities for Eurozone Inflation,” with Francis X. Diebold (Penn) and Boyuan Zhang (Penn), *Journal of Econometrics*, 2023.
3. “Macroeconomic Forecasting and Variable Ordering in Multivariate Stochastic Volatility Models,” with Jonas Arias (Philadelphia Fed) and Juan Rubio-Ramírez (Emory), *Journal of Econometrics*, 2023.
4. “The Causal Effects of Lockdown Policies on Health and Macroeconomic Outcomes,” with Jonas Arias (Philadelphia Fed), Jesús Fernández-Villaverde (Penn), and Juan Rubio-Ramírez (Emory), *American Economic Journal: Macroeconomics*, 2023.
5. “A Statistical Learning Approach to Land Valuation: Optimizing the Use of External Information,” with David Albouy (UIUC), *Journal of Housing Economics*, 2022.
6. “Bayesian Estimation and Comparison of Conditional Moment Models,” with Siddhartha Chib (WUSTL) and Anna Simoni (CNRS), *Journal of the Royal Statistical Society: Series B*, 2022.
7. “DSGE-SVt: An Econometric Toolkit for High-Dimensional DSGE Models with SV and t Errors,” with Siddhartha Chib (WUSTL) and Fei Tan (SLU), *Computational Economics*, 2021.
8. “Probability Forecast Combination via Entropy Regularized Wasserstein Distance,” with Ryan Cumings-Menon (Census), *Entropy*, 2020.
9. “A New Approach to Identifying the Real Effects of Uncertainty Shocks,” with Molin Zhong (FRB), *Journal of Business and Economic Statistics*, 2020.
10. “Machine Learning for Regularized Survey Forecast Combination: Partially-Egalitarian Lasso and its Derivatives,” with Francis X. Diebold (Penn), *International Journal of Forecasting*, 2019.
11. “Bayesian Estimation and Comparison of Moment Condition Models,” with Siddhartha Chib (WUSTL) and Anna Simoni (CNRS), *Journal of the American Statistical Association (Theory & Methods)*, 2018.
12. “On the Comparison of Interval Forecasts,” with Ross Askanazi (Cornerstone), Francis X. Diebold (Penn), and Frank Schorfheide (Penn), *Journal of Time Series Analysis*, 2018.
13. “Metropolitan Land Values,” with David Albouy (UIUC) and Gabriel Ehrlich (Michigan), *Review of Economics and Statistics*, 2018.

14. “Measuring International Uncertainty: the Case of Korea,” with Boyuan Zhang (UIUC), Molin Zhong (FRB), and Dong Jin Lee (Bank of Korea), *Economics Letters*, 2018.
15. “Real-Time Forecast Evaluation of DSGE Models with Stochastic Volatility,” with Francis X. Diebold (Penn) and Frank Schorfheide (Penn), *Journal of Econometrics*, 2017.
16. “Assessing Point Forecast Accuracy by Stochastic Error Distance,” with Francis X. Diebold (Penn), , 2017.
17. “Does Realized Volatility Help Bond Yield Density Prediction?,” with Molin Zhong (FRB), *International Journal of Forecasting*, 2017.
18. “Assessing Point Forecast Accuracy by Stochastic Loss Distance,” with Francis X. Diebold (Penn), *Economics Letters*, 2015.

Other publications

19. “Failure of Silicon Valley Bank Reduced Local Consumer Spending but Had Limited Effect on Aggregate Spending,” with Edmund S. Crawley and Taeyoung Doh, *Economic Bulletin*, 2023.
20. “Measuring Disagreement in Probabilistic and Density Forecasts,” with Ryan Cumings-Menon (Census) and Keith Sill (Philadelphia Fed), *JSM Proceedings, Business and Economic Statistics Section, American Statistical Association*, 2020.
21. “Tracking U.S. Real GDP Growth During the Pandemic,” with Jonas E. Arias (Philadelphia Fed), *Economic Insights*, 2020.
22. “Bayesian GMM,” *Publicly Accessible Penn Dissertations*, 2015.

Working papers

23. “Capital-Based Corporate Tax Benefits: Endogenous Misallocation through Lobbying,” with Tanida Arayavechkit (World Bank) and Felipe E. Saffie (Virginia), last revised 2019, *under revision for the Journal of the European Economic Association*.
24. “Testing for Endogeneity: A Moment-Based Bayesian Approach,” with with Siddhartha Chib (WUSTL) and Anna Simoni (CNRS), last revised 2024, *submitted*.
25. “Measuring Fairness in the US Mortgage Market,” with Hadi Elzayn (Meta), Simon Freyaldenhoven (Philadelphia Fed), Ryan C. Kobler (Philadelphia Fed), last revised 2024.
26. “Constructing Applicants from Loan-level Data: A Case Study of Mortgage Applications,” with Hadi Elzayn (Meta), Simon Freyaldenhoven (Philadelphia Fed), last revised 2024.
27. “Tracking U.S. Retail Sales in Real-Time with Consumer Card Spending Data from Multiple Sources,” with Ryan C. Kobler (Philadelphia Fed), last revised 2024.
28. “On the Wisdom of Crowds (of Economists),” with Francis X. Diebold (Penn) and Aaron Mora (University of South Carolina), last revised 2025.

Software Packages

1. **ForeComp**: Size-Power Tradeoff Visualization for Equal Predictive Ability of Two Forecasts, 2023. [\[CRAN\]](#).

Other professional activities

- ◊ **Referee**: *AEJ-Macroeconomics*, *Advances in Econometrics*, *Applied Economics*, *Applied Economics Letters* (×2), *Australian Economic Papers*, *Bayesian Analysis* (×2), *Brazilian Journal of Probability and Statistics*, *Canadian Journal of Economics*, *Economic Notes*, *Econometric Reviews* (×3), *Econometrics and Statistics* (×2), *Economics Letters* (×2), *Empirical Economics* (×2), *Entropy*, *European Economic Review* (×2), *Finance Research Letters*, *Forecasting* (×3), *IMF Economic Review*, *International Economic Review* (×2), *International Journal of Central Banking*, *International Journal of Forecasting* (×5), *International Review of Analysis*, *Journal of Applied Econometrics* (×10), *Journal of Banking and Finance*, *Journal of Business and Economic Statistics* (×15), *Journal of Business Cycle Research*, *Journal of Econometrics* (×14), *Journal of Economic Dynamics and Control* (×4), *Journal of Economic Studies*, *Journal of Economic Theory and Econometrics*, *Journal of Empirical Finance*, *Journal of Finance*, *Journal of Financial Econometrics*, *Journal of Forecasting* (×3), *Journal of Macroeconomics*, *Journal of Money, Credit, and Banking*, *Macroeconomic Dynamics* (×3), *Management Science*, *Oxford Bulletin of Economics and Statistics* (×3), *Quantitative Economics* (×3), *Quantitative Finance and Economics*, *Real Estate Economics* (×2), *Review of Economics and Statistics* (×3), *Statistica Sinica*, *Studies in Nonlinear Dynamics & Econometrics*, *International Journal of Central Banking*, *Risk Journals*.

- ◇ **Reviewer:** National Science Foundation (×3), Social Sciences and Humanities Research Council of Canada, Society for Computational Economics (student prize).
- ◇ **Conference organized or assisted:**
 - “IAAE Annual Conferences”, Scientific Committee (2023, 2024).
 - “NBER-NSF Seminar on Bayesian Inference in Econometrics and Statistics,” Local organizer (2023, 2025).
 - “Conference on Frontiers in ML and Economics: Methods and Applications,” Co-organizer (2022, 2024).
 - “Machine Learning at Central Banks,” Co-organizer (2021).
 - “Young Scholars Conference on Machine Learning in Economics and Finance,” Co-organizer (2021, 2022, 2023).

Presentations (*=“scheduled”)

- ◇ **Seminars:** Virtual Time Series Seminar (Jan, 2025), Rutgers University (Dec, 2024), University of Pennsylvania (Oct, 2021), University of Oklahoma (Feb, 2021), KAEA Virtual Seminar (Aug, 2020), Philadelphia Fed (brown bag seminar, Apr, 2020), Philadelphia Fed (Dec, 2018), Binghamton (Oct, 2017), Vanderbilt (Nov, 2016), Penn State (Oct, 2016), Purdue University (Apr, 2016), Atlanta Fed (Mar, 2016), UIUC (Internal seminar, March, 2016), Indiana University (Nov, 2015), Boston College (Nov, 2015), Cleveland Fed (Nov, 2015), Brown University (Oct, 2015), Université of Montréal (Oct, 2015), Philadelphia Fed (Jun, 2015), Sungkyunkwan University (Feb, 2015), Universitat Pompeu Fabra (Feb, 2015), University of Illinois at Urbana-Champaign (Feb, 2015), Board of Governors (Jan, 2015), University of Chicago (Booth, Jan, 2015), University of Toronto (Jan, 2015), University of Pennsylvania (Oct, 2014).
- ◇ **Conferences:**
 - ◇ Keynote speeches: RCEA International Conference in Economics, Econometrics and Finance (May, 2024).
 - ◇ Presentations: [2022] Payments, Lending, and Innovations in Consumer Finance (Philadelphia Fed, Oct) [2021] System econometrics (Virtual, Oct); [2020] Joint Statistical Meeting 2020 (Virtual, Aug); [2015-16] Annual Conference on Real-Time Data Analysis, Methods, and Applications in Macroeconomics and Finance (CIRANO, Oct), SNDE conference (Univ. of Alabama, Mar), Boneyard Conference (UIUC, Apr); [2014-15] NBER-NSF Seminar on Bayesian Inference in Econometrics and Statistics (Washington University in St. Louis, May), NBER Summer Institute (July); [Before 2014] SoFiE-OMI Summer School (University of Oxford), International Symposium on Forecasting (KAIST, Seoul), Western Economic Association International 83rd Annual Conference.
 - ◇ Discussions ([Click here for discussion slides](#)): Interagency Risk Quantification Forum (FDIC, 2022), Conference on Real-Time Data Analysis, Methods, and Applications (FRB Philadelphia, 2020), System Committee on Econometrics Meeting (FRB Philadelphia, 2019).

Other service and experience

- ◇ Economist recruiting committee, Federal Reserve Bank of Philadelphia, 2020, 2021, 2022, 2023, 2024.
- ◇ Past service at UIUC: organizer of econometrics seminar (2015–2016, 2018–2019), Junior faculty recruiting committee (2015–2016, 2016–2017), Awards committee (2015–2016), Faculty partner for the Freeman Fellows Program (2015–2016), Third year paper adviser/reader (×3).
- ◇ Research collaborator for the project on “Developing Korean Uncertainty Index,” Bank of Korea, 2016.
- ◇ Visiting Research Scholar, Department of Economics, Texas A&M University, 2008–2009.
- ◇ Research Assistant for Professor Frank Schorheide (Penn), 2011–2015.
- ◇ Research Assistant for Professor Joon Y. Park (SKKU and Indiana Univ.), 2007–2008.

Fellowships, honors, and awards

- ◇ Wharton Teaching Excellence Award, Penn, 2023–2024.
- ◇ KAEA Young Scholar Award, The Korea-America Economic Association, 2020.
- ◇ David C. Lincoln Fellow, 2019–2020 (joint with David Albouy, UIUC).
- ◇ List of Teachers Ranked as Excellent (outstanding with *), UIUC, Fall 2015, Spring 2018*, Fall 2018*.
- ◇ Excellence in Teaching a Field Course (Ph.D.), UIUC, Spring 2016.
- ◇ University Fellowship, Penn, 2009–2010.
- ◇ Dean’s Award and Alumni President’s Award, SKKU, 2007.

Teaching experience

- ◇ Applied Econometrics I (Graduate), Wharton, Fall 2023, Fall 2024.
- ◇ Applied Econometrics II (Graduate), Wharton, Spring 2023, Spring 2024, Spring 2025.

- ◇ Time Series Analysis in Economics (Master), UIUC, Spring 2018, Fall 2018.
- ◇ Economic Forecasting (Undergraduate), UIUC, Spring 2016, Fall 2016, Spring 2018, Spring 2019.
- ◇ Applied Macroeconometrics (Ph.D.), UIUC, Fall 2015 and Fall 2016, Spring 2018.
- ◇ Predictive Modeling in Economics (Undergraduate), Teaching Assistant, Penn, Spring 2013 and Spring 2014.
- ◇ Econometrics I: Fundamentals (Ph.D.), Teaching Assistant, Penn, Fall 2012 and Fall 2013.
- ◇ Econometrics II: Methods (Ph.D.), Teaching Assistant, Penn, Spring 2011 and Spring 2012.
- ◇ Statistics for Economists (Undergraduate), Recitation Instructor, Penn, Fall 2010 and Fall 2011.

Ph.D. dissertation supervision, * = “expected”, m = “on the market”

| Name | Year, Univ. | Role | First position | (Co)-Main adviser |
|------------------|-------------|--------------|-------------------------|---------------------------|
| Boyuan Zhang | 2023, Penn | Member | Amazon.com | F. Diebold/F. Schorfheide |
| Mauricio Arango | 2022, UIUC | Member | Analysis Group | D. Albouy |
| Collin Philipps | 2021, UIUC | Main adviser | U.S. Air Force Academy | - |
| Aram Grigoryan | 2021, UIUC | Member | Wells Fargo | M. Polborn |
| Sebastian Laumer | 2021, UIUC | Member | UNC Greensboro | P. Amir-Ahmadi |
| Cesare Buiatti | 2019, UIUC | Main adviser | T.Rowe Price | S. Parente |
| Gustavo Cortes | 2019, UIUC | Member | Univ. of Florida | D. Bernhardt/G. Pennacchi |
| Ryan Cumings | 2019, UIUC | Member | U.S. Census Bureau | R. Koenker |
| Camila Henao | 2018, UIUC | Main adviser | T.Rowe Price | - |
| Jiah-Chian Wu | 2018, UIUC | Main adviser | National Chengchi Univ. | E. Forsythe |
| Ran Gao | 2017, UIUC | Other | Sichuan Univ. | |
| Joao B. Duarte | 2016, UIUC | Member | Cambridge Univ. | D. Bernhardt |
| Kijin Kim | 2016, UIUC | Member | Asian Development Bank | G. Hewings |

*****EOD, March 14, 2025*****