

# Hajime Shimao

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Japanese citizen and U.S. permanent resident

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## Position

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| Assistant Professor of Data Analytics, Pennsylvania State University | 2023 - present |
| Postdoctoral Fellow, McGill University                               | 2021 - 2023    |
| Postdoctoral Fellow, Santa Fe Institute                              | 2018 - 2021    |

## Education

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|------------------------------------------------------------------------------------------------------------------------|------|
| Ph.D. Economics, Purdue University                                                                                     | 2018 |
| Dissertation: <i>Essays on Structural Econometric Modeling and Machine Learning</i>                                    |      |
| M.S. Economics, Purdue University                                                                                      | 2014 |
| M.S. Decision Science, Tokyo Institute of Technology (Concentration: Evolutionary Game Theory, Experimental Economics) | 2012 |
| B.A. Psychology, University of Tokyo (Concentration: Decision Theory)                                                  | 2009 |

## Research

### *Working Papers:*

1. “Do Fair Algorithms Improve Welfare? Evidence from the Insurance Market” (with Fei Huang and Warut Khern-am-nuai). *Revise and resubmit at Journal of Management Information Systems*. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=5112616](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5112616)
2. “Collective AI Can Amplify Tiny Perturbations into Divergent Decisions” (with Warut Khern-am-nuai and Sung Joo Kim). *Under review at Science*. <https://arxiv.org/abs/2603.09127>
3. “Low-Margin Branch Points in Deterministic LLM Deliberation” (with Warut Khern-am-nuai). *Under review at AAAI*.
4. “Direction, Not Just Margin: Boundary-Facing Perturbations Branch Deterministic LLM Deliberation” (with Warut Khern-am-nuai). *Under review at AAAI*.
5. “AI-Delegated Search: Pricing, Search Quality, and Business Model Implications” (with Tat-How Teh and Warut Khern-am-nuai). *Under review at Management Science*. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=7152098](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=7152098)
6. “The Computational Foundations of the Human World” (with Marcus J. Hamilton et al.). *Preparing for resubmission*. <https://arxiv.org/abs/2605.01680>
7. “The Complexity of Institutional Ownership” (with Xiaoxiao Li).
8. “AI-Mediated Online Marketplaces” (with Warut Khern-am-nuai, Rajib L. Saha, and Chayanin Wipusanawan). *Preparing for submission to Information Systems Research*.
9. “Functional Buffering in Urban Economies: Occupational and Industrial Turnover with Stable Skill Portfolios” (with Xiaoxiao Li). *Preparing for submission to PNAS*.
10. “AI Trading Can Make Prices More Predictable but Less Informative”. *Preparing for submission to Science*.
11. “The Cost Economics of University Consolidation: Scale, Scope, and Organizational Costs” (with Xiaoxiao Li and David Hummels).
12. “When AI Agents Write the Rules, Prediction Can Become Undecidable” (with David H. Wolpert). *Preparing for submission to Science*.

13. “Stakeholder Sentiment and Federal Reserve Policy Decisions” (with Michael Curran).
14. “Institutional Legibility and the Learnability of Firm Returns” (with Junichi Yamanoi).
15. “Cross-Country Transferability of Firm-Performance Models” (with Junichi Yamanoi).
16. “Inferring Stochastic Dynamics Reveals Atypicality and Irreversibility in Social Change” (with Youngkyoung Bae, Seungwoong Ha, Shuo (Luna) Yang, and David H. Wolpert). *Preparing for submission to Nature Communications*.
17. “Designing Probation Clocks: Learning About Research Talent under Multidimensional Performance Objectives” (with Masahiro Asami, Xiaoxiao Li, and David Hummels).
18. “Deterministic but Not Robust: Semantic Coupling and Communication Topology in AI Organizations” (with Warut Khern-am-nuai).
19. “Cost of Research and Education Activities in U.S. Colleges: Complementarity, Scalability, and Heterogeneous Efficiency” (with Xiaoxiao Li, Michael Holton Price, and Christopher P. Kempes). <https://www.researchsquare.com/article/rs-1318655/v1>
20. “Cross-Validation-Based Model Selection for Generalized Method of Moments with Application to a Dynamic Pricing Model” (with Junpei Komiyama). <https://arxiv.org/abs/1807.06993>

*Published Papers:*

1. “So You Think You Are Safe: Implications of Quality Uncertainty in Security Software” (with Warut Khern-am-nuai, Karthik Kannan, and Hooman Hidaji). *Accepted at Information Systems Research*. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2621846](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2621846)
2. “Welfare Implications of Fair and Accountable Insurance Pricing” (with Fei Huang). **Journal of Risk and Insurance**, 2026. <https://doi.org/10.1111/jori.70051>
3. “Major-Occupation Specificity and College Skill Production” (with Xiaoxiao Li and Sebastian Linde). **Journal of Human Resources**, 60(4), 2025. <https://doi.org/10.3368/jhr.1219-10631R3>
4. “Revisiting the CEO Effect Through a Machine Learning Lens” (with Sung Joo Kim, Warut Khern-am-nuai, and Maxime C. Cohen). **Management Science**, 71(6):5396–5408, 2025. <https://doi.org/10.1287/mnsc.2023.03625>
5. “Ensuring Strategic Best-Response Fairness in Machine Learning: Enhanced Color-Blind Algorithm” (with Warut Khern-am-nuai, Karthik Kannan, and Maxime C. Cohen). **Information Systems Research**, 36(4), 2025. <https://doi.org/10.1287/isre.2022.0055>
6. “The Past as a Stochastic Process” (with David Wolpert et al.). **Journal of Computer Applications in Archaeology**, 2024. <https://journal.caa-international.org/articles/10.5334/jcaa.113>
7. “The Use of AI in Legal Systems: Determining Independent Contractor vs. Employee Status” (with Maxime C. Cohen et al.). **Artificial Intelligence and Law**, 2023. <https://link.springer.com/article/10.1007/s10506-023-09353-y>
8. “An Observational Study of Health Care Provider Collaboration Networks and Heterogeneous Hospital Cost Efficiency and Quality Outcomes” (with Sebastian Linde). **Medicine**, 2022. [https://journals.lww.com/md-journal/Fulltext/2022/09300/An\\_observational\\_study\\_of\\_health\\_care\\_provider.73.aspx](https://journals.lww.com/md-journal/Fulltext/2022/09300/An_observational_study_of_health_care_provider.73.aspx)
9. “WikiArtVectors: Style and Color Representations of Artworks for Cultural Analysis via Information Theoretic Measures” (with Bhargav Srinivasa Desikan and Helena Miton). **Entropy**, 2022. <https://www.mdpi.com/1099-4300/24/9/1175>
10. “Scale and Information-Processing Thresholds in Holocene Social Evolution” (with Jaeweon Shin et al.). **Nature Communications**, 2020. <https://www.nature.com/articles/s41467-020-16035-9>
11. “Nonconvex Optimization for Fair Regression” (with Junpei Komiyama et al.). **Proceedings of the 35th International Conference on Machine Learning**, 2018. <https://proceedings.mlr.press/v80/komiyama18a.html>
12. “Reciprocity and Exclusion in Informal Financial Institutions: An Experimental Study of Rotating Savings and Credit Associations” (with Takehiko Yamato et al.). **PLOS ONE**, 2018. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0202878>

13. “Strict or Graduated Punishment? Effect of Punishment Strictness on the Evolution of Cooperation in Continuous Public Goods Games” (with Mayuko Nakamaru). **PLOS ONE**, 2013. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0059894>

*Works in Progress:*

1. “Professional Graduate Labor-Market Exposure and University Finance” (with Xiaoxiao Li and Warut Khern-am-nuai).
2. “Career Dynamics under Market Shocks: A Transition-IV Design and Counterfactual Career Simulations” (with Xiaoxiao Li and Warut Khern-am-nuai).
3. “Selling the Switch: Information Opacity, Optimal Contracting, and the Collapse of Screening in Two-Sided Computing Platforms” (with Chenglong Zhang and Warut Khern-am-nuai).
4. “A Quantitative Analysis of Human Rights” (with David H. Wolpert, Charles de Dampierre et al.).
5. “The Price of Influence: Newspaper Ownership, Editorial Bias, and the Market for Media Control” (with Shuo (Luna) Yang).
6. “When Markets Generate Uncertainty: Deterministic versus Probabilistic Learning in Asset Markets”.
7. “Reading the Market: Information and Auctioneer Skill in Sequential Dutch Auctions” (with Shosuke Noguchi).

## Awards, Grants, and Fellowships

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|-----------------------------------------------------------|---------------------------|
| Early Career Research Award at Penn State Great Valley    | 2025                      |
| Postdoctoral Research Funding from <i>IVADO</i>           | Fall 2021 - Summer 2023   |
| Graduate Scholarship, Purdue University                   | Summer 2015 - Summer 2017 |
| Fellowship from <i>Japan Student Service Organization</i> | Summer 2012 - Summer 2015 |

## Teaching Experience

*Penn State Great Valley*

- AI 575: Foundations of Predictive Analytics (master’s level; in-person and online)
- AI 500: Quantitative Methods (master’s level; in-person and online)
- AI 545: Data Mining (master’s level; in-person and online)
- AI 830: Applied Machine Learning (MBA; online)