William Brasic

3rd Year Doctoral Student in Economics

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Education

The University of Arizona May 2027
Ph.D., Economics

University of Nevada-Las Vegas May 2022
M.S., Data Intelligence and Applied Economics *GPA: 4.0/4.0*

University of Nevada-Las Vegas August 2020
B.A., Economics (Magna Cum Laude) *GPA: 3.87/4.0*

Relevant Coursework at The University of Arizona

Courses: Statistical Machine Learning, Machine Learning Theory, Bandits and Reinforcement Learning Theory, Neural Networks, Probabilistic Graphical Models, Nonlinear Optimization, Econometrics I-III, Econometric Modeling I-II, Industrial Organization and Regulation I-II, Labor Economics I, Game Theory, Consumer Theory, General Equilibrium Theory, Dynamic Programming, Mathematical Economics

Relevant Coursework at University of Nevada-Las Vegas

Courses: Introduction to Machine Learning, Time Series Forecasting, Big Data Analytics, Software Concepts, Advanced Software Concepts, Database Management, Econometrics I-II, Mathematical Economics, Real Analysis I, Advanced Matrix Theory, Probability Theory, Mathematical Statistics

Research Interests

Industrial Organization, Machine Learning, Applied Econometrics

Research

Works in Progress

Tacit Collusion with Asymmetric Policy Gradient-Based Pricing Algorithms

Reinforcement Learning, Industrial Organization, Antitrust, Game Theory, PyTorch 2024-Present

- Algorithms are increasingly taking precedence over humans in the pricing of goods and services, empowering firms to swiftly respond to market shifts with unparalleled precision. The current experimental algorithmic pricing literature as solely investigated the collusive capacity of either: (1) slow tabular-based reinforcement learning algorithms, (2) algorithms restricted to dealing with discrete action spaces, or (3) entirely homogeneous AI systems. Additionally, studies have largely avoided transfer learning: the ability of a trained reinforcement learning-based pricing algorithm agent to transfer knowledge from the learning environment to a potentially different ecosystem. Skeptics of tacit algorithmic collusion argue that these voids diminish the practical plausibility of this phenomenon. The first part of this paper shows that two state-of-the-art asymmetric deep reinforcement learning algorithms, Proximal Policy Optimization (PPO) and Soft Actor Critic (SAC), acting in a Bertrand-Markov pricing game with continuous action spaces converge to anti-competitive policies in a much shorter time than that previously reported. These collusive outcomes are sustained through the implementation of learned trigger strategies. Subsequently, the latter section shows that these algorithms can be trained in one environment and successfully transfer this knowledge to similarly related environments retaining supracompetitive outcomes.

When Asymmetric Pricing Algorithms Collide

Reinforcement Learning, Industrial Organization, Antitrust, Game Theory, C++, MATLAB 2023-2024

- Algorithms are increasingly superseding humans in the pricing of goods and services, enabling firms to swiftly adapt to shifting market dynamics with greater precision. Despite the widespread adoption of these algorithms, there remains a scarcity of knowledge regarding their specific configurations and their impact on competition. I investigate algorithmic heterogeneity to assess whether asymmetric reinforcement learning-based pricing algorithms can effectively learn to engage in tacit collusion within a repeated Bertrand-Markov pricing environment. My analysis reveals that diverse algorithms can indeed learn to tacitly collude, consistently setting prices above competitive levels and sustaining such supracometitive outcomes via the implementation of learned trigger strategies. This practice results in enhanced firm profitability, while concurrently diminishing consumer welfare.

Financial Literacy and Senior-Aged Food Insecurity

Applied Econometrics, R 2021-2022

- Food insecurity remains one of the most significant public health concerns in the United States today with this being particularly true for the senior population. Using original survey data collected in Clark County, NV, I investigate the link between financial literacy and senior food security relying on perceived parental financial confidence as an exclusion restriction. My results indicate that financial literacy broadly, and financial behaviors specifically, can play a critical role in lessening the propensity for a senior household to be classified as food insecure.

Sole Instructor of Record

Introduction to Econometrics: ECON 418-518 (In-person)

Econometrics, Statistical Inference, Machine Learning, R Fall 2024

- Solely instructed 40+ students on econometrics and machine learning algorithms
- Taught students how to use the R language for data science, econometrics, and machine learning

Research Assistant

Is Inflation in the U.S. Harder to Predict After COVID-19?

Machine Learning, Applied Econometrics, R Summer 2024

- Gathered monthly inflation data
- Constructed multiple forecasting models to predict inflation using the R language

Climate Damages

Applied Econometrics, R, STATA Summer 2024

- Worked with a team of doctoral economics students writing code for a project regarding estimating climate damages
- Translated STATA code into the R language while eliminating potential bottlenecks

Exogenous Productivity Data Generating Process

Monte Carlo Simulation, Applied Econometrics, R 2021-2022

- Designed a data generating process and constructed a Monte Carlo simulation in the R language
- The paper that this DGP was created for concerns estimating production functions when output is given exogenously

Teaching Assistant

BNAN 276: Statistical Inference

Probability Theory, Statistical Inference, Excel Summer 2024

- Held office hours to help students with homework assignments and studying for exams
- Assisted instructor with grading

ECON 200: Basic Economic Issues

Microeconomics, Macroeconomics, Python 2022-2024

- Led a small team of 10+ undergraduate, masters, and Ph.D. students as the head teaching assistant in operating this 500+ student course
- Wrote Python code to automate participation recording and uploading exam scores into the online grade portal

Skills

Languages (most to least proficiency): Python, R, MATLAB, C/C++, SQL, Java, Julia
Tools: Git/GitHub, VS Code, Jupyter, RStudio, CLion, Atom, Eclipse
Libraries: Pandas, NumPy, statsmodels, scikit-learn, PyTorch, Matplotlib, seaborn, ggplot2, data.table, tidyverse

Scholarships, Fellowships, and Grants

Roots for Resilience Data Science Fellowship ($7,000.00) | *The University of Arizona* 2024
Joseph Smeeding Memorial Scholarship in Economics ($1,490.00) | *The University of Arizona* 2023
George W. Coleman Scholarship in Economics ($2,000.00) | *The University of Arizona* 2023
Graduate Access Fellowship ($8,000.00) | *The University of Arizona* 2022
Lee Business School Graduate College Scholarship ($1,000.00) | *University of Nevada-Las Vegas* 2021
Graduate Access Grant ($1,000.00) | *University of Nevada-Las Vegas* 2020

References

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