Clemens Possnig

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Education

University of British Columbia — *Vancouver, Canada*

PhD Economics — *2016 - 2023 (expected)*

- Fields: Game Theory, Algorithmic Learning, Econometric Theory
- Committee: Li Hao (co-supervisor), Vitor Farinha Luz (co-supervisor), Michael Peters

Institute for Advanced Studies — *Vienna, Austria*

MSc Economics — *2014 - 2016*

Karl Franzens University — *Graz, Austria*

BA Economics — *2010-2014*

References

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Papers

Working papers

Reinforcement Learning and Collusion, ***Job Market Paper***

This paper presents an analytical characterisation of the outcomes that can arise when firms use algorithms to compete. This characterisation can be used to determine which market conditions and details of a class of algorithms will lead to collusion with positive probability. For an important subset of the algorithm class, I show that the points of convergence of algorithm policies coincide with Markov-perfect equilibria of the repeated game that are attracting with respect to a tractable differential equation. Using this insight, I give necessary and sufficient conditions on market conditions and algorithms for the stage-game Nash equilibrium to never be learned. Applying the approach in a Cournot game, I give testable conditions on market fundamentals and algorithms such that collusive policies will be learned with positive probability. The conditions on algorithms consist of their specific policy updating scheme and a novel categorization of the information that algorithm policies are conditioned on. My class contains algorithms known as

actor-critic, which are widely studied in the computer science literature and form the basis of many real-world applications.

Consistency of Multi-Agent Batch Reinforcement Learning

This paper provides asymptotic results for a class of actor-critic batch - reinforcement learning algorithms in the multi-agent setting. At each period, each agent faces an estimation problem (the critic, e.g. estimating value function $Q(s,a)$), and a policy updating problem. The estimation step is done by parametric function estimation based on a batch of past observations. I give sufficient conditions on the environment, growth rate of the batch-size and speed of their stepsizes, so that each agent's parametric function estimator is consistent in the following sense: For large t, the optimal parameter θ_t is close to a true optimal parameter θ_t^*, depending on t only through the current period's policy profile.
This result greatly simplifies the asymptotic analysis of multi-agent learning, e.g. in the application of long-run characterisations using stochastic approximation techniques.

Estimating Diffusion over multiple large Networks in a dynamic linear panel Model (with Andreea Rotarescu and Kevin Song)

Spillover of economic outcomes often arises over multiple networks, and distinguishing their separate roles is important in empirical research. For example, the direction of spillover between two groups (such as banks and industrial sectors linked in a bipartite graph) has important economic implications, and a researcher may want to learn which direction appears prominent in data. For this, we need to have an empirical methodology that allows for both directions of spillover simultaneously. In this paper, we develop a dynamic linear panel model and asymptotic inference with large n and small T, where both directions of spillover are accommodated through multiple networks. Using the methodology developed here, we perform an empirical study of spillovers between bank weakness and zombie-firm congestion in industrial sectors, using firm-bank matched data from Spain between 2005 and 2012. Overall, we find that there is positive spillover in both directions between banks and sectors.

Awards, Fellowships, & Grants

2016-2021	**Four Year Fellowship**, University of British Columbia	*CAD 20,000-26,000 p.a.*
2019,2020	**Graduate Fellowship in Gambling Research 6798**, University of British Columbia	*CAD 32,000 p.a.*
2020	**SSHRC Explore - Faculty of Arts Adaptation Research Assistant Grant**, University of British Columbia	*CAD 4,000*
2019	**Faculty of Arts Graduate Award**, University of British Columbia	*CAD 3,800*
2018	**Best 2nd Year Paper Award**, University of British Columbia	*CAD 1,000*
2017	**Best Student in 1st Year Micro, Macro and Econometrics Class**, University of British Columbia	*CAD 600*
2014-2016	**Full Scholarship**, IHS Vienna	*EUR 20,000*
2015	**Excellence Award**, IHS Vienna	

Presentations (including forthcoming)

2022 ACM Economics and Computation, Game Theory and Applications, CORS/INFORMS, Canadian Economic Theory

2021 Stony Brook International Conference on Game Theory

Teaching Experience

2020	**Comprehensive Exam in Microeconomics**, Official Tutor	*UBC*
2018,2019	**PhD Math Camp**, Instructor (Math review course for 1st year PhD students)	*UBC*
2017,2018	**Microeconomics**, Teaching Assistant (MA level)	*UBC*
2015	**Time Series Econometrics**, Teaching Assistant (MSc level)	*IHS Vienna*

Languages

Software

MATLAB, PYTHON, JULIA, SQL

Language

English (Fluent), German (Native), French (CEPR: C1), Spanish (CEPR: B2), Mandarin (CEPR: A2)