

# Renato Zimmermann

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## Education

University of Toronto, PhD in Economics	Sep 2023 – Now
University of Toronto, MA in Economics	Sep 2022 – May 2023
University of Toronto Mississauga, HBSec in Computer Science and Economics	Sep 2018 – May 2022
<ul style="list-style-type: none"><li>CGPA: 3.97/4.0; Dean's List 2019-2022; Rotary Club of Mississauga Scholar</li><li>Outstanding Program Performance Award; Dean's Award for Research Excellence</li></ul>	

## Workshops

NBER, Heterogeneous-Agent Macroeconomics Workshop	Jun 2025
University of Chicago Optimization-Conscious Econometrics	May 2023

## Experience

<b>Course Instructor</b> , University of Toronto – Toronto, ON	Jan 2023 – Now
<ul style="list-style-type: none"><li>Computer Science: CSC258 (Computer Organization); CSC207 (Software Design)</li><li>Economics: ECO482 (Machine Learning Applications in Macroeconomic Finance)</li></ul>	
<b>Teaching Assistant</b> , University of Toronto – Toronto, ON	Sep 2020 – Now
<ul style="list-style-type: none"><li>Worked on 15+ economics and computer science courses.</li><li>Economics Courses (Sample): ECO2101/ECO2100 (PhD Macroeconomics I/II); ECO2107 (Monetary Theory); ECO2460 (Economic Applications of Machine Learning).</li><li>Computer Science Courses (Sample): CSC236 (Introduction to the Theory of Computation); CSC311 (Introduction to Machine Learning); CSC367 (Parallel Programming).</li></ul>	
<b>Research Assistant (Murat Celik)</b> , University of Toronto – Toronto, ON	May 2023 – Sep 2025
<ul style="list-style-type: none"><li>Re-write and optimize Matlab code in Julia to solve a heterogeneous agent macroeconomic model.</li><li>Achieve 30x speed improvement by leveraging advanced code optimization and numerical procedures.</li><li>Adapt the model to be fully compliant of automatic differentiation to improve estimation efficiency.</li></ul>	
<b>Research Assistant (Sebastian Dyrda)</b> , University of Toronto – Toronto, ON	May 2021 – May 2024
<ul style="list-style-type: none"><li>Design, implement and test global nonlinear optimizer in modern object-oriented Coarray (MPI) Fortran.</li><li>Read literature and study techniques to optimize code for high performance computing environments.</li><li>Run and profile massively-distributed models in up to 6000 cores in the Compute Canada supercomputer.</li></ul>	
<b>Research Assistant (Xu Tian)</b> , University of Toronto – Toronto, ON	Feb 2021 – Oct 2023
<ul style="list-style-type: none"><li>Create high-performance parallel algorithms in C++ to scrape, process and analyze 4TB+ of financial data.</li><li>Design and implement dynamic structural models for research in corporate finance using Matlab and Fortran.</li><li>Accelerate computationally-intensive routines with GPUs and use MPI to parallelise estimation.</li></ul>	
<b>Research Assistant (Marlene Koffi)</b> , University of Toronto – Toronto, ON	May 2022 – Sep 2022
<ul style="list-style-type: none"><li>Implement language processing models using techniques from machine learning and neural networks.</li><li>Parallelize and optimize mathematical code for research in gender economics.</li><li>Profile code used for large scale parallelism in supercomputer clusters.</li></ul>	
<b>Research Assistant (Ismael Mourifie)</b> , University of Toronto – Toronto, ON	Sep 2022 – May 2023
<ul style="list-style-type: none"><li>Translate structural econometric models from Matlab to Fortran and optimize memory and cache efficiency.</li><li>Design and implement distributed implementations of main research algorithms.</li><li>Improve total program execution speed from 1.2 hours (reported by PI) to 6.8 seconds.</li></ul>	

## Working Papers

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### Modeling Social Learning Using Dyna-Q and Ant Colony Optimization

2023

*Conferences:* The Carroll Round XVII

*Abstract:* This paper introduces a novel way of modeling social learning in macroeconomics using techniques from model-based reinforcement learning and ant colony optimization. The work extends previous works in bounded rationality and social learning by providing tools to complement previously-distinct models in adaptive learning. We test these new techniques using simulations of job search and consumption. Results demonstrate that models fit using the proposed techniques can learn core economic behaviors given no information about the environment, but do not fully fit reward functions in line with rational expectations theory.

### The Retirement Gap: Entrepreneurs, Tax Policy, and the Cost of Liquidity

Work in Progress

*With:* Sebastian Dyrda, Baxter Robinson

*Conferences:* Winter SED (Argentina, 2024); BSE Summer Forum (2025); Summer SED (Copenhagen, 2025)

*Abstract:* This paper studies how entrepreneur's income risk affects their wealth accumulation and portfolio allocation. We document novel facts about the portfolio allocation of entrepreneurs, showing that entrepreneurs hold substantial financial assets outside their business. We then build a life-cycle model of entrepreneurship that features risky intangible capital. The risky nature of intangible capital helps our model match the portfolio allocation of entrepreneurs of assets inside vs. outside their business. We demonstrate the aggregate importance of this mechanism by studying the aggregate cost of financial frictions in a model with and without intangible capital. We also study two policy applications: an expansion of small business loans and a fiscal stimulus transfer showing that the effects of both policies depend critically on the presence or absence of risky intangible capital.

### Demand, Spillovers, and Declining Entry

Work in Progress

*With:* Mahmood Haddara

*Abstract:* When a firm invests in increasing its profits, does this benefit other firms? We consider an endogenous growth model with two types of investment: innovation, which generates positive spillovers by advancing the technological frontier, and demand accumulation, which increases profits for a particular firm while leaving the technological frontier unchanged. The key novelty of our framework is to endogenously link this distinction to the level of entry in the economy. Specifically, while new firms can build on the innovations that preceded them, their initial demand stock is fixed. As a result, the distance between a potential entrant and incumbent firms depends on the composition of investment in the economy. We quantify the importance of this mechanism using a dynamic model of oligopolistic competition and endogenous growth.

### Leverage, Debt and the Investment Channel of Monetary Policy

Work in Progress

*Abstract:* I build a quantitative framework featuring two types of heterogeneous agents—households and entrepreneurs—where entrepreneurs face endogenous default risk, make an explicit debt-equity financing choice, and act as monopolistic competitors in the intermediate goods market. This structure provides a novel mechanism linking nominal rigidities directly to the financing decisions of small producers. The model shows that a monetary policy tightening has a disproportionately large negative effect on smaller, asset-constrained entrepreneurs, as risk aversion amplifies the impact of higher borrowing costs. Furthermore, the model provides a new perspective on fiscal policy, demonstrating that debt-financed expansions can be significantly dampened by a crowding-out effect on entrepreneurial investment.

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## Technologies

**Spoken Languages:** English (fluent); Portuguese (fluent); Spanish (conversational); French (conversational)

**Programming Languages:** C, C++, Fortran, Python, Julia, Matlab, SQL

**Software:** Linux, SLURM, Git/Github

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## References

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**Murat Celik**, Associate Professor, University of Toronto

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