# Marijn A. Bolhuis

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**Research and Teaching Interests:** International Macroeconomics, Economic Growth, International Trade

## Education

Ph.D. in Economics, University of Toronto — 2021 (Expected)
*Committee:* Diego Restuccia (supervisor), Xiaodong Zhu, Kevin Lim
*Dissertation:* "Essays in Economic Growth"
*Honors:* Distinction in Macroeconomic Theory, GPA 4.0/4.0

Recognised Research Student in Economics, University of Oxford — 2018
*Supervisor:* Douglas Gollin

Visiting Graduate Student in Economics, University of Groningen — 2016
*Honors:* GPA 4.0/4.0

Visiting Graduate Student in Economics, University of Toronto — 2015
*Honors:* GPA 4.0/4.0

Research MSc in Economics, Utrecht University — 2014-2016
*Honors:* top of class, highest cum laude, GPA 4.0/4.0

Visiting Student in International Relations, University of Amsterdam — 2013-2014
*Honors:* GPA 4.0/4.0

B.Sc in Liberal Arts & Sciences, Utrecht University — 2010-2014
*Honors:* top 5% of class, highest cum laude, GPA 4.0/4.0
*Double major:* economics; energy science
*Double minor:* public administration; international relations

# Working Papers

**Financial Linkages and the Global Business Cycle** (Job Market Paper) with Marina M. Tavares (International Monetary Fund).

**Catch-Up Growth and Inter-Industry Productivity Spillovers in Open Economies**.
*Media Coverage:* World Bank Blogs

**Misallocation in Indian Agriculture** with Swapnika Rachapalli (University of Toronto) and Diego Restuccia (University of Toronto and NBER).

# Work in Progress

**An Intangible Stagnation Trap: Evidence from Europe**

**The Millennial Boom, the Baby Bust and the Housing Market** with Judd Cramer (Harvard University).
*Media Coverage:* VoxEU

# Policy Research on Machine Learning

**Deus ex Machina? A Framework for Macro Forecasting with Machine Learning** with Brett Rayner (International Monetary Fund). IMF Working Paper 20/45.

**The More the Merrier? A Machine Learning Algorithm for Optimal Pooling of Panel Data** with Brett Rayner (International Monetary Fund). IMF Working Paper 20/44.

# Awards and Grants

| | |
|---|---|
| Ontario Trillium Scholarship, University of Toronto | 2016 - 2020 |
| Master of Financial Economics Award, University of Toronto | 2020 |
| Department of Economics Travel Grant, University of Toronto | |
| Program Level Fellowship, University of Toronto | |
| CEA Travel Grant (declined) | 2019 |
| WEHC Travel Grant | 2018 |
| SGS Conference Grant, University of Toronto | |
| Fulbright Scholarship (declined) | 2016 |
| Doctoral Presidential Fellowship, Brown University (declined) | |
| University of Toronto Fellowship (declined) | |
| Prins Bernhard Cultuurfonds Scholarship (declined) | |
| VSBFonds Scholarship (declined) | |
| Dr. Hendrik Muller's Vaderlandsch Fonds Scholarship (declined) | |
| Vreedefonds Scholarship (declined) | |
| New School New York Provosts Scholarship (declined) | |
| EHS Bursary, Economic History Society | |
| U-Fonds Grant, Utrecht University | |
| K. F. Heinfonds Scholarship, K. F. Heinfonds | 2015 |
| Young Innovators Summer School Grant, Utrecht University | |
| Nominee Egbert Tellegen Prize, Utrecht University | 2014 |
| Honorable mention OUP Student Prize, U. of Amsterdam | 2014 |
| Winner Taste of Strategy, Boston Consulting Group | 2013 |
| Exceptional Achievement in Chemistry, KNCV & VNCI | 2010 |
| NLT Award, Landelijk Coördinatiepunt NLT | |

# Presentations at Conferences, Workshops, Seminars

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|---|---|
| RCEA 8th Biennial Conference, Waterloo (postponed) | 2020 |
| University of Toronto | |
| Warwick Economics PhD Conference | 2019 |
| International Monetary Fund 3 × (invited, February, August, October) | |
| North East Universities Development Consortium, Northwestern University | |
| University of Toronto | |
| University of Oxford | 2018 |
| World Economic History Conference, Cambridge, MA | |
| University of Toronto | |
| ASREC Conference, Boston | 2017 |
| REBO Research Day, Utrecht University | 2016 |
| Workshop Health and Welfare in the Long Run, University of Groningen | |
| Economic History Society Conference, Cambridge, UK | |

# Discussions

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| "Insurance and Propagation in Village Networks" , by Kinnan, Samphantharak, Townsend, and Vera-Cossio | 2019 |
| "Irrigation vs Education: The Long Run Effects of Opium Cultivation in British India", by Lehne | |
| "The Impact of Genetic Diversity on Religiosity", by Cesur and Yildirim | 2017 |

# Research Visits

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|---|---|
| International Monetary Fund | 2019 |
| University of Oxford | 2018 |

# Research Experience

Research Assistant, University of Toronto — 2016 - present

- to Diego Restuccia, Marco Gonzalez-Navarro, Serdar Ozkan, Murat Celik, Margarida Duarte, Burhanetting Kuruscu

PhD FIP Machine Learning Forecasting, International Monetary Fund — 2019

Research Assistant, Utrecht University — 2014 - 2016

- to Jan Luiten van Zanden, Mark Sanders

Researcher, Morgen, Dutch National Student Association for Sustainability — 2011 - 2012

# Teaching and Advising Experience

Thesis Supervisor, Utrecht University — 2019 - present

Teaching Assistant, University of Toronto 2016 - present

- ECO 101: Principles of Microeconomics
- ECO 204: Microeconomic Theory
- ECO 230: International Economic Institutions and Policy
- ECO 325: Advanced Economic Theory - Macro
- ECO 341: Twentieth Century Economic History
- ECO 342: International Economics after 1945
- ECO 349: Money, Banking and Financial Markets
- ECO 352: Special Topics in Macroeconomics
- ECO 362: Economic Growth
- ECO 364: International Trade Theory
- ECO 365: International Monetary Economics
- ECO 406: Developmental Macroeconomics
- ECO 407: Competing Views in Macroeconomic Theory and Policy

Teaching Assistant, Utrecht University 2013 - 2016

- GEO2-2212: Thermodynamics and Energy Conversions
- ECB1SO: Economics of Strategy and Organization
- ECMENE: Energy and Environmental Economics

Teacher Utrecht University Exam Preparation, Capita Selecta 2012 - 2013

- ECB1WIS: Mathematics (for economists)
- ECB1MI: Microeconomics and Institutions

Teacher and Tutor, Lyceo/StudentsPlus 2010 - 2014

- Mathematics, Physics, Chemistry, Economics, Business

## Academic Service

Founder and co-organizer of the 5060 Study Group, seminar series for PhD candidates in Economics, University of Toronto 2017-current
Student Representative, REBO Graduate School, Utrecht University 2014 - 2016
Treasurer, Morgen, Dutch National Student Association for Sustainability 2013 - 2014

## Additional Schooling

Financial Crises: A Brief History of Time, University of Copenhagen 2015
Debt Sustainability Analysis, International Monetary Fund (EdX) 2014
Sustainable Economics and Management, Witten/Heidecke University

## Skills

*Programming:* Python, R, MATLAB, ArcGIS, Stata, SPSS, EViews, SQL *Languages:* English (Fluent), Dutch (Native), German (Intermediate), French (Intermediate)

# References

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Last Updated: October 8, 2020

# Abstracts

## Financial Linkages and the Global Business Cycle

(Job Market Paper) with Marina M. Tavares (International Monetary Fund)

Business cycles tend to be highly correlated across countries, yet standard quantitative models explain only a fraction of this comovement. Motivated by the predictive power of changes in corporate funding costs for global GDP comovement, we examine the role of between-firm financial linkages in driving the global business cycle. We model multinational firms as buyers and suppliers of funding, and incorporate their cross-border linkages into a dynamic multicountry general equilibrium framework with production networks. We identify the structural parameter that governs international transmission of financial shocks using quasi-experimental variation in financing conditions of US multinationals during the 2008-09 crisis. Our framework accounts completely for countries' production, investment, labor supply, trade and financial flows in terms of different sets of shocks. Applying the model to 25 countries during the 2005-2016 period, we estimate that financial linkages account for 1/3 of global GDP comovement, and for 2/3 of comovement with the US.

## Catch-Up Growth and Inter-Industry Productivity Spillovers in Open Economies

Countries tend to export more skill-intensive products as they become more productive. This paper proposes a tractable quantitative framework to examine the role of inter-industry productivity spillovers in this development process. I document that a country's comparative advantage tends to increase in industries that employ occupations that are used most intensively in current exports. The model rationalizes these findings by incorporating occupation-specific dynamic scale economies into a multi-sector gravity framework. I estimate the model using cross-sector heterogeneity in foreign demand shocks and find that scale economies are relatively large in high-skilled production. As a result, productivity spillovers tend to be larger in richer countries, and access to foreign markets allows developing countries to shift labor into sectors that contribute more to aggregate productivity growth. Counterfactual exercises suggest that spillovers play a quantitatively substantial role in accounting for slow cross-country convergence and increase the gains from trade, especially in economies with a comparative advantage in manufacturing.

## Misallocation in Indian Agriculture

with Swapnika Rachapalli (University of Toronto) and Diego Restuccia (University of Toronto and NBER)

We study frictions in land rental markets and their impact on agricultural productivity across states in India. We exploit large variation in land market institutions across states and detailed micro data. We find strong evidence that states with more rental market activity have less dispersion in marginal products of land across farmers and land is reallocated more efficiently over time. We find substantial differences across states in the extent of extensive and intensive level rental market distortions and these differences are systematically related to rental market activity across states. Rental market distortions have substantial negative effects on agricultural productivity. For instance, eliminating distortions increases agricultural productivity by 40% in some states relative to the most productive state, Punjab.

## Deus ex Machina? A Framework for Macro Forecasting with Machine Learning

with Brett Rayner (International Monetary Fund). IMF Working Paper 20/45.

We develop a framework to nowcast (and forecast) economic variables with machine learning techniques. We explain how machine learning methods can address common shortcomings of traditional OLS-based models and use several machine learning models to predict real output growth with lower forecast errors than traditional models. By combining multiple machine learning models into ensembles, we lower forecast errors even further. We also identify measures of variable importance to help improve the transparency of machine learning-based forecasts. Applying the framework to Turkey reduces forecast errors by at least 30 percent relative to traditional models. The framework also better predicts economic volatility, suggesting that machine learning techniques could be an important part of the macro forecasting toolkit of many countries.

## The More the Merrier? A Machine Learning Algorithm for Optimal Pooling of Panel Data

with Brett Rayner (International Monetary Fund). IMF Working Paper 20/44.

We leverage insights from machine learning to optimize the tradeoff between bias and variance when estimating economic models using pooled datasets. Specifically, we develop a simple algorithm that estimates the similarity of economic structures across countries and selects the optimal pool of countries to maximize out-of-sample prediction accuracy of a model. We apply the new alogrithm by nowcasting output growth with a panel of 102 countries and are able to significantly improve forecast accuracy relative to alternative pools. The algortihm improves nowcast performance for advanced economies, as well as emerging market and developing economies, suggesting that machine learning techniques using pooled data could be an important macro tool for many countries.

## The Millennial Boom, the Baby Bust and the Housing Market

with Judd Cramer (Harvard University).

As baby boomers have begun to downsize and retire, their preferences now overlap with millennial's predilection for urban amenities and smaller living spaces. This confluence in tastes between the two largest age segments of the U.S. population has meaningfully changed the evolution of home prices in the United States. Utilizing a Bartik shift-share instrument for demography-driven demand shocks, we show that from 2000 to 2018 (i) the price growth of four- and five-bedroom houses has lagged the prices of one- and two-bedroom homes, (ii) within local labor markets, the relative home prices in baby boomer-rich zip codes have declined compared with millennial-rich neighborhoods, and (iii) the zip codes with the largest relative share of smaller homes have grown fastest. These patterns have become more pronounced during the latest economic cycle. We show that the effects are concentrated in areas where housing supply is most inelastic. If this pattern in the housing market persists or expands, the approximately $ 16.5 trillion in real estate wealth held by households headed by those aged 55 or older will be significantly affected. We find little evidence that these upcoming changes have been incorporated into current prices.

# An Intangible Stagnation Trap: Evidence from Europe

(Work in Progress)

What is the role of weak demand in accounting for the sluggish recovery after the Global Financial Crisis? I combine European firm-level data with detailed export flows to examine how firms respond to external demand shocks during the GFC. Faced with lower demand, firms do not reduce their investment in tangible capital but invest significantly less in intangible capital. These effects are persistent: 8 years after the onset of the crisis, affected firms are significantly less productive and less intangible capital intensive. I rationalize these findings using a heterogeneous firm model in which intangibles reduce marginal costs but raise fixed costs. Firms' use of intangibles is therefore more sensitive to changes in the scale of production than tangible inputs. An aggregate demand shock can lead to a stagnation trap as lower investment depresses growth, which in turn depresses aggregate demand. The model can account for the post-crisis productivity slowdown in Europe and the lagged investment rate in Europe relative to the U.S., with considerable heterogeneity across countries.