Application for the NBER Innovation Research Boot Camp 2023
Bernardo Ribeiro
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I am in the fifth year of the Ph.D. program at Yale University's Department of Economics, where I have been enrolled continuously since 2018. Below I present my CV, which includes a list of all completed Ph.D. courses, and an essay describing my research and the reasons for participating in the NBER Innovation Boot Camp.

Bernardo Silva de Carvalho Ribeiro

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Curriculum Vitae

Fields of concentration:

Primary fields: Growth, Innovation, Macroeconomics.

Secondary fields: Spatial Economics, International Trade.

Education:

Ph.D., Economics, Yale University (Expected: 2024),

M.Phil., Economics, Yale University (2021),

M.A., Economics, Yale University (2020),

M.A., Economics, PUC-Rio (2018),

B.A., Economics, Federal University of Minas Gerais (UFMG), (2015).

Comprehensive Examinations Completed:

2020 (Oral): Macroeconomics (with distinction), International Trade.

2019 (Written): Microeconomics and Macroeconomics.

Advisors:

Professor Fabrizio Zilibotti,

Professor Michael Peters,

Professor Samuel Kortum.

Work in Progress:

"Growing through Technical Change: a Tale of Old and New Technologies" (2023) [Link to a preliminary and incomplete draft].

"Endogenous Growth with Multiple Vintages: the allocation of R&D and Innovation" (2023).

"Spatial Consequences of Corruption: Entry and Location Decisions of Firms" joint with Alvaro Cox (2023).

Working Papers:

"International Macroeconomic Vulnerability", with D. Guillen, M. Garcia, and J. Velloso, *Insper Working Paper* (2022), *PUC-Rio Working Paper* n. 691 (2022). [Link to paper]

Fellowships, Honors and Awards:

University Dissertation Fellowship, (2023).

Doctoral Fellowship, Yale University, (2018–2022).

Cowles Foundation & Economic Growth Center Fellowship, (2018 – 2023).

CNPq full scholarship for master's degree program (2016-2018).

Undergraduate Independent Research Program (PET) scholarship, from CAPES (2012-2015).

Summer Research paper award, PUC-Rio, (2017).

PhD courses completed:

2018 – 2019 Academic year, Yale University:

- Gen Econ Theory: Microeconomics
- Gen Econ Theory: Macroeconomics
- Econometrics I
- Gen Econ Theory: Microeconomics II
- Gen Econ Theory: Macroeconomics II
- Econometrics II

2019 – 2020 Academic year, Yale University:

- Continuous-Time Macroeconomics
- Advanced Macroeconomics I
- International Trade I
- Time Series Econometrics
- Advanced Macroeconomics II
- International Trade II
- Gen Econ History: Western Europe
- Topics in Empirical Econ & Public Policy

Teaching Experience:

Yale University, *Undergraduate*:

- Fall 2020, Teaching Assistant to Prof. Ilse Lindenlaub and Dr. Marnix Amand, Intermediate Macroeconomics.
- Spring 2021, Teaching Assistant to Prof. Fabrizio Zilibotti, Intermediate Macroeconomics.

- Fall 2021, Teaching Assistant to Prof. Willian Nordhaus, Intermediate Macroeconomics.
- Spring 2022, Teaching Assistant to Prof. Aleh Tsyvinskiand Dr. William Hawkins, Introductory Macroeconomics.

PUC-Rio, *Graduate*:

- Fall 2017, Teaching Assistant to Prof. Tiago Berriel, Macroeconomics II.
- Spring 2017, Teaching Assistant to Prof. Diogo Guillén, Empirical Macroeconomics.

Conference presentations:

Brazilian Econometric Society, 2017 meeting.

Brazilian Association of Researchers in Economic History (ABPHE), 2013 meeting.

Out-of-class Activities and other Academic Experiences:

Academic journal for undergraduates: *Revista Multiface Online (2013 – 2015)*

- Editor: v.2, 2014.
- Managing Editor: v.1, 2013.

Project: Introducing economics for low-income high school students, under the supervision of Prof. Bernardo Campolina.

- Lecturer at the State School Anita Brandão, Belo Horizonte, Brazil (2013-2014).

Summer school, London School of Economics (LSE), (2015).

- Course: *Money and Banking (advanced course)*.

Undergraduate independent research Program (PET), from CAPES, at UFMG, (2012-2015).

Languages:

English (advanced).
Portuguese (native).

Research Interests

Overview

Technological change is a crucial driver of economic growth. In a world with many and heterogenous technologies – even within a narrow sector, multiple vintages coexist at a given point in time, with different ages, different intrinsic properties, and different potential – my research is currently focused on how innovation efforts are distributed across them, and how such allocation influences growth and welfare. I describe below the two main projects I have been pursuing during my Ph.D., as well as my future research plans. Knowing the importance of ideas for growth, I believe the NBER Innovation Research Bootcamp will be an exciting and precious opportunity to be, myself, exposed to new ideas, topics, relevant questions, and to a research community that can so much benefit and guide my future endeavors.

Growing through Technical Change: a tale of old and new technologies

In this project (for which a preliminary draft is available through the link in my CV), I start by documenting how important technological transitions across history show that declining technologies experience significant patenting activity and innovation for a prolonged period. Although the innovation flow into outdated technologies is smaller than in the rising ones, and contracts over time, the innovation magnitudes are similar and comparable for a prolonged period. On top of this evidence, a natural question emerges: are we innovating too much in old technologies? Is it efficiency what we observe? To answer these questions, I develop a growth model of directed technical change featuring, endogenously, a rising and a declining technology. The former is intrinsically better, and, as it is continuously perfected by cumulative innovation, it becomes cheaper and gradually replaces the latter. Importantly, the theory shows how the competitive equilibrium is inefficient: the share of scientists targeting the old technology at each point in time is above the optimum, i.e., too much innovation is done in old technologies. Although the social value of an innovation is higher than the market value for both technologies, as the spillovers of current innovation on future innovation (building on giants' shoulders) are not internalized by patent holders – this discrepancy is higher for the new technology.

Endogenous Growth with Multiple Vintages: the allocation of R&D and Innovation

Technologies do not emerge as an off-the-shelf resource to be used and replace older ones. Such transition requires continuous perfection and streamlining of the frontier, and, at the same time, is also marked by the persistence of innovative efforts in the older technologies, as the research project I described above documents. How we allocate innovation between different vintages is crucial, as it influences the speed of the transition and the trade-off between current and future output. In this project, to quantitatively and theoretically study this issue, I build a tractable endogenous growth model featuring a continuous arrival of new technologies, which gradually replace each other. *R&D* labs can direct innovation not only to the newest one, but to all the technologies already known. On the one hand, newer vintages are intrinsically more efficient; on the other, they are relatively unexplored, and there are not yet giant shoulders to stand on. From this trade-off, an endogenous U-shaped distribution of *R&D* expenditures across technologies of different ages emerges as an equilibrium object and can be tracked across time. Using patent data, I show how to construct the empirical counterpart of this distribution, by observing the

patent flow into different technology cohorts or the citation pattern dynamics. The data supports the result of a U-shape.

As I keep making progress in the theory and evidence related to the distribution of innovation across vintages, my intention is to investigate the role of policy in improving the allocation of R&D expenditures (the results from my first research project described above suggest that the market allocation may not be efficient, with too many resources channeled to old technologies). Moreover, it will be interesting to visit the debate concerning the productivity slowdown in the United States in recent decades through the lens of my theory, i.e., on how it can be associated with the emergence (or lack of emergence) of new vintages, or with the allocation of research among technologies.

Above all, I want to deepen my understanding of the key questions and relevant issues to be addressed by research in the economics of growth and innovation. This will allow me to explore new avenues in the coming years. The NBER Innovation Research Bootcamp is a unique opportunity for that.

From: Fabrizio Zilibotti <zilibotti@gmail.com>
Subject: NBER Innovation Research Boot Camp 2023 - Bernardo Ribeiro
To: maranjian@nber.org

I am writing to strongly recommend Bernardo Ribeiro for the NBER Innovation Research Boot Camp 2023. Bernardo is an advisee of mine and one of the best PhD students at Yale in its cohort (in the market) next year.

Sent from my IPhone

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Prof. Fabrizio Zilibotti
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and Development Economics
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