Professional Statement

Martin Beraja, MIT Department of Economics

February 2022

I am an economist who studies macroeconomics. I have two lines of research: first, on business cycles and stabilization policy; and second, on new technologies and the role of governments. I have tackled these questions by sometimes developing theory, sometimes using novel data and empirics, but most often by bringing the two together. Below I describe my research and teaching and service to MIT.

1. Business cycles and stabilization policy

What are the causes and consequences of business cycles and inflation? How can monetary and fiscal policies alleviate recessions? Researchers face two challenges in tackling these macroeconomic questions: cause and effect are hard to identify when many forces are at play simultaneously — as is common in the aggregate economy — and it is hard to measure equilibrium effects directly in the data or to construct counterfactuals scenarios from evidence alone. My work combines data and models to address these challenges in order to study business cycles and stabilization policy.

1.1 From regional to aggregate business cycles

Regions in the US endured the Great Recession with varying degrees of severity. For instance, while house prices crashed and unemployment soared in California, Texas was much less affected. These regional experiences are in many ways like repeated and smaller versions of US business cycles. As such, they enlarge the number of observations that we can learn from, and provide sources of variation to identify the drivers of business cycles or the effects of policy. Yet, *naively* comparing the experiences of California and Texas — as the literature has often done — and then making inferences about, for example, the Great Recession is problematic because of economic mechanisms and shocks that differ between regional and aggregate economies.

Two of my papers have advanced this argument. They have pushed an agenda forward that shows how to draw inferences from regional evidence about the aggregate economy with the aid of theoretical models. Given the wealth of regional data available, my hope is that these papers provide a bridge between researchers estimating structural models and those using regional variation to estimate empirical responses to shocks, further improving our understanding of business cycles and the effects of fiscal and monetary policy.

In **"The Aggregate Implications of Regional Business Cycles"** (joint with Erik Hurst and Juan Ospina. **Lead Article, Econometrica, 2019**) we first document a strong relationship across US states between employment and wage growth during the Great Recession. This contrasts with the muted response of aggregate wages during this period despite employment falling sharply. The fact that wages did not move much during the Great Recession has led many to conclude that nominal wages must be quite rigid. However, if wages were quite rigid, why was there such a strong correlation between wages and employment at the regional level? And, what does this regional evidence imply about the drivers of the Great Recession? To answer these questions, we present a methodology that combines our regional evidence with aggregate data to estimate a New Keynesian DSGE model of a monetary union. When it comes to understanding the drivers of the Great Recession and its aftermath, our methodology yields dramatically different results compared to estimating our model only with aggregate data — the leading approach in the theoretical literature — or extrapolating from regional evidence alone — a common approach in the empirical literature.

In **"Regional Heterogeneity and the Refinancing Channel of Monetary Policy"** (joint with Andreas Fuster, Erik Hurst and Joseph Vavra. **The Quarterly Journal of Economics, 2019**) we study monetary policy in an economy like the US where a large part of household debt takes the form of fixed-rate mortgages with a refinancing option. Following interest rate cuts, these debt contracts encourage households to refinance and extract equity. As such, the strength of this "refinancing channel" for the transmission of monetary policy depends on the regional distribution of equity. We start by exploiting regional variation in refinancing following the first round of QE1 — the Fed's large-scale asset purchases that decreased mortgage rates. We find that the hardest hit regions refinanced much less since most households did not have enough equity. Then, we build a heterogeneous-agent model of household refinancing and explore the aggregate implications of our evidence. We show that the distribution of equity during the Great Recession hampered the ability of monetary policy to stimulate the economy, whereas the opposite occurred in earlier recessions.

2. Consumer spending in durable goods

Spending in durables is particularly sensitive to income changes. For example, consumers aggressively cut purchases of cars and furniture in recessions, or ramp them up when they receive a government transfer. As such, the dynamics of durables spending can shape business cycles and how policy should be designed.

In **"Demand Composition and the Strength of Recoveries"** (joint with Christian K. Wolf. **R&R, The Review of Economic Studies**) we begin from the observation that "pent-up demand" should be stronger for durables. If a consumer decides against buying a car in a recession, she simply postpones that spending for later. This spending reversal is likely to be weaker for services and non-durables — the lost spending on haircuts may simply be foregone. We argue that, as a result, recoveries from demand-driven recessions with spending cuts concentrated in services or non-durables will tend to be weaker than recoveries from recessions more biased towards durables. Intuitively, the smaller the durables bias, the less the recovery is bolstered by pent-up demand. We show that this prediction holds in standard business-cycle models, and document two pieces of supporting evidence: pent-up demand effects are present in US time series data, and the prediction on recovery strength is consistent with the cross-section of regional business cycles. Quantitatively, we find large effects of demand composition on recovery strength. Lastly, we show that if the Fed applied a one-size-fits-all policy, it would hike rates *too fast* after services recessions.

In **ongoing work**, we are estimating non-linearities in the responses of durables spending to transfers. This has implications for optimal transfers design: how large they should be and who they should target.

3. Counterfactuals with respect to policy changes

Analyzing counterfactual questions often requires building structural models. This can be daunting when we are uncertain about features of models that are hard to distinguish in the data and reasonable a-priori. If counterfactuals differ under alternative models, their credibility is undermined. The concern is particularly relevant when evaluating changes in policy rules — e.g., how the Fed sets interest rates. Are there then reasonable circumstances when we can analyze a counterfactual policy rule without fully specifying a model?

In **"A Semi-structural Methodology for Policy Counterfactuals"** (**forthcoming, Journal of Political Economy**), I propose a novel method to tackle this question. It is useful when linearizing models is reasonable — common in the business cycles literature — and we do not wish to fully specify a structural model, yet we are worried about using reduced-form approaches that are not immune to Lucas Critique. The methodology rests on the insight that many linearized models satisfy a *principle of counterfactual equivalence:* they are observationally equivalent under a benchmark policy rule and yield an identical counterfactual equilibrium under an alternative one. As an application, I use the methodology to quantify how US fiscal integration contributes to regional stabilization.

3. Nominal rigidities

Nominal rigidities, such as when firms cannot adjust prices or wages easily, are a key friction that shape how shocks and policy changes affect the economy. In past and ongoing work, I document evidence for stickiness in prices and wages. I use it to quantify the costs of inflation or to inform models of business cycles.

In leading macroeconomic models, inflation is costly because it distorts price setting decisions. My lived experience in Argentina tells me that this *must* be true. Yet, evidence on the costs of high inflation is scant. In **"From Hyperinflation to Stable Prices: Argentina's Evidence on Menu cost Models"** (joint with Fernando Alvarez, Martin Gonzalez-Rozada, and Andy Neumeyer. **The Quarterly Journal of Economics, 2019**) we study how inflation affects firms' price setting behavior. For a class of models with a fixed-cost of adjusting pricing, we first derive several predictions about how price setting changes with inflation both at very high and at near-zero inflation rates. Then, we validate these predictions by using micro-level price data from Argentina between 1988 to 1997 — a unique experience where monthly inflation ranged from almost 200 percent to less than zero. We conclude by showing that a hyper-inflation generates large economic costs, whereas inflation rates below 50 percent, much higher than what developed countries have ever experienced, generate relatively small costs.

In **future work**, I aim to quantify the extent to which inflation hurts workers when wages adjust infrequently, since a fear of inflation eroding wages is a key concern in many surveys. In **a separate paper**, we are exploring how wage rigidities affect vacancy posting using novel administrative data from Chile.

2. New technologies and the role of governments

New technologies — like AI and robots — hold the potential to transform modern economies but have brought new challenges to the fore. This has raised questions about the role of governments. When technologies use data, what innovation policies and regulations are appropriate? Could governments misuse AI as a tool of social control? When technologies automate jobs and displace workers, how should governments respond? My work informs these (and related) questions by documenting evidence and studying optimal policies.

2.1 AI, data, and the government

Two of my papers study the interplay between AI, data and the government. They emphasize that AI technologies are not only data-intensive but also *dual-use* (they have government and commercial applications). For both, we have gathered comprehensive information on facial recognition AI firms and government procurement contracts in China — a prototypical setting in which to examine these issues.

Most research and discussions on the economics of data and AI have focused on privately collected data. Yet, throughout history, states have also collected massive datasets. Because of states' key role in many areas — e.g. public security or health care — government data in these areas far exceeds in magnitude and scope privately collected data, or may lack substitutes altogether. Firms often gain access to this valuable data when providing services to the state. In **"Data-intensive Innovation and the State: Evidence from AI Firms in China"** (joint with David Y. Yang and Noam Yuchtman. **Forthcoming, The Review of Economic Studies**) we show that access to government data can stimulate commercial AI innovation; in part because data and trained algorithms are shareable across government and commercial uses. We collect information on AI contracts with public security agencies and AI firms' software production. We then classify contracts as data-rich or data-scarce depending on the agencies' capacity to collect surveillance video — a common training data for facial recognition algorithms. We find that the receipt of a data-rich contract differentially stimulates commercial AI software innovation. Our findings suggest that access to government data may have contributed to Chinese firms' emergence as leading innovators in facial recognition AI. More generally, they indicate that governments' AI procurement and data provision can act as innovation policies in the age of data-intensive innovation. But is the public provision of data justified on normative grounds, especially when citizens are concerned about privacy? We are studying this question in a **separate paper**.

A darker side of government use of AI is that it can infringe on civil liberties or, worse, enhance government capacity for repression and social control. These fears have long been expressed in fictional depictions of AI. But are they a reality? In **"AI-tocracy"** (joint with Andrew Kao, David Y. Yang and Noam Yuchtman. **Under review**) we show that AI innovation and a modern autocracy can mutually reinforce each other. We first document that AI strengthens political control: Chinese public security agencies in locations experiencing more political unrest procure more facial recognition AI, which in turn suppresses subsequent unrest. We then show that AI innovation benefits too: AI firms innovate more after obtaining a contract. These findings suggest that part of China's coercive capacity stems from AI, and its politics may not chill AI innovation but rather stimulate it. Looking ahead, one worries that, if exported abroad, Chinese surveillance AI may beget more autocracies — an issue that we are already exploring in **a separate paper**.

In **ongoing work**, I am building a model of the life-cycle of concentrated industries, like those where data leads to economies of scale. We use it to analyze the optimal dynamic regulation of such industries.

2.2 The impact of new technologies on workers and how governments should respond

Workers have been anxious about new technologies throughout history. Machines could replace them, lowering their earnings or outright pushing them into unemployment. Inequality could rise fast while productivity increases could take longer than an average working lifetime. These fears have once more been fueled by the potential widespread adoption of automation technologies like robots and AI. My research studies the dynamic adjustment of labor markets and inequality to new technologies, and how policy should be designed.

Admittedly, pervasive technological unemployment has never occurred and is unlikely to happen in the future. It is also true that workers displaced by automation have faced real costs and will likely do so again. So, how should a government respond to automation? Despite the growing public interest in this question, the literature has yet to produce optimal policy results that take into account the frictions that displaced workers face in practice. In **"Inefficient Automation"** (joint with Nathan Zorzi. **Under Review**), we

take worker displacement seriously and characterize optimal policies that can help the economy's adjustment. We recognize that workers face two important frictions. First, reallocation is slow: workers face barriers to mobility and may go through unemployment. Second, credit markets are imperfect: workers have a limited ability to borrow, especially when changing jobs. We first show that these frictions result in inefficient automation. Firms are effectively too patient when they automate, and (partly) overlook the time it takes for workers to reallocate and automation's benefit to materialize. We then study a second best problem where the government can tax automation but lacks redistributive tools to fully overcome borrowing frictions. The equilibrium is (constrained) inefficient — automation and reallocation impose pecuniary externalities on workers. The government finds it optimal to tax automation while the labor market adjusts, even when it has no preference for redistribution. Quantitatively, we find large welfare gains from slowing down automation.

When innovations enhance certain skills, inequality can rise fast. The economy's adjustment, however, can take decades; with productivity increases benefitting future generations alone. But do economies adjust slowly to certain technological innovations and more rapidly to others? Studies on these questions are scarce despite much evidence showing that technologies differ in their impact on workers and speed of diffusion. In **"Fast and Slow Technological Transitions"** (joint with Rodrigo Adão and Nitya Pandalai-Nayar. **Under review**) we argue that the adjustment is slower when innovations affect production activities that use more specific skills. The reason is that the adjustment is driven more by the slow entry of younger generations who invest in skills that became more valuable and less by the fast reallocation of older workers whose skills must be transferred across activities. We build a model of technological transitions that exhibits these features, motivated by new evidence showing that the U.S. labor market adjusted differently to two major innovations: Electricity in the early 20th century, and ICT in the late 20th century. Our model yields a novel q-theory representation of equilibrium dynamics linking skill differences across generations to lifetime wage differentials (q). This allows us to characterize when technological transitions are faster and explain why the adjustment to ICT, but not Electricity, relied entirely on the slow entry of younger generations.

In **ongoing work**, we are studying how governments should respond to increases in labor income risk caused by automation. In a separate paper, we are using the tools developed in the papers above to study how governments should manage declining regions as they experience large population declines.

4. Teaching and Service to MIT

Every year since joining MIT I have taught half a 2nd year PhD course (14.461 Advanced Macroeconomics) and an introductory undergraduate course (14.02 Principles of Macroeconomics). For 14.461, I have developed an original course on macroeconomics research that combines empirics and theory. Beyond teaching tools and papers, I try to help students develop softer research skills. For example, in open-ended problem sets, I ask them to test a hypothesis in a dataset or to extend a model to fit new facts; or, I discuss early versions of a seminal paper to show them how research evolves. In 14.461, I teach basic macro models and connect them to current and historical events. Although I mostly follow a textbook, over the years I have added topics that the students were interested in (e.g., income inequality or hyperinflations). Lately, I have also changed how I evaluate students. I now ask them to research and present two case studies on historical episodes that are interpretable through models that we have seen in class. Overall, I am very happy with the change. There have been some great case studies, often inspired by the students' home countries. Moreover, working with their case study group helped them connect with and learn from others, which was particularly important while MIT went remote during the Covid-19 pandemic. Compared to written exams though, the students may put less effort in learning the material that is not directly relevant to their case studies.

I am currently advising Andrea Manera and Marc de la Barrera (soon to complete their PhDs) and have been the advisor of Michele Fornino (graduated in 2021). I have also been a third reader in four dissertations, and met with several of our job market candidates to discuss their research or hone their interview pitches.

Finally, regarding my service to MIT, I have been in the PhD admissions committee every year since 2018. This requires evaluating hundreds of files, weighing the applicants' potential to become researchers together with financial and diversity considerations. This task is one of my biggest responsibilities. Being admitted to MIT can change a life, especially of students from underrepresented groups. I have also interviewed and recruited junior faculty every year, and co-organized the Macro seminar every Spring. Moreover, I was part of two panels on helping students transition towards being a thesis-writer, and gave an IAP lecture.