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Research Statement

I am a macroeconomist with an interest in the theory and empirics of economic growth. In my work, I use direct, comprehensive, micro-level data on innovation to inform original theories of endogenous growth, both through reduced form analyses and through the estimation of structural models. In my research, I investigate the role that factors such as economic geography, scientific progress, human capital and culture play in determining the path of technological change. I also ask how technology feeds back in shaping those factors. To address these questions, I use data on patenting, scientific publications and federal contracts, among the others, that I personally assemble starting from primary sources. I plan to use these datasets extensively in my future research. I also plan to look for new data sources that can improve our understanding of technological change and its consequences for the economy and the society as a whole.

"The Geography of Unconventional Innovation" with Enrico Berkes

Presented at the 2015 Meeting of the Society of Economic Dynamics (Warsaw), the World Congress of the Econometric Society (Montreal), the Federal Reserve Bank of Chicago, the 2014 Conference of Swiss Economists Abroad (Zurich) and Northwestern Macro Lunch.

In my job market paper, that is joint work with my fellow PhD student Enrico Berkes, we study the importance of population density as a driver of innovation. Current theories of endogenous growth and knowledge diffusion predict a positive correlation between population density and innovation. The main intuition is that the more frequently people interact, the more rapidly will existing knowledge diffuse and new ideas be generated.

In our paper, we confront this powerful intuition by assembling a novel dataset based on the universe of patents issued by the USPTO[1] between 2002 and 2014. We locate each grant to the finest possible level that we can uniquely identify, i.e. the County Sub-Division. Contrary to what we would expect, we find that a big share of innovation in the United States originates from low-density places. To interpret this fact, we propose the view that informal interactions in high-density cities help knowledge flows between technologically distant fields, but are less relevant for spreading knowledge between close fields. We formulate a notion of conventionality to assess the frequency of knowledge flows between different technological classes, based on the network of patent citations. Consistently with our view, we find that innovations originating from high-density areas are more likely to be built upon uncommon combinations of prior knowledge.

These findings motivate us to build a model of endogenous growth in a spatial economy that endogenously generates the pattern observed in the data: specialized clusters emerge in low-density areas and produce conventional innovation, whereas high-density cities diversify and become hubs for the development of unconventional ideas. The model reconciles the tension between returns to local specialization (Marshall 1890) and returns to diversity (Jacobs 1969) and predicts the emergence of asymmetric cities - both in their size and degree of diversification -

[1] United States Patents and Trademark Office

without assuming ex-ante heterogeneous agents. We use the model to perform a policy analysis and find that implementing a system of place-based subsidies can have sizeable welfare effects by changing both the intensity and composition of innovation activity.

"The Economic Effects of Scientific Shocks" with Matteo Li Bergolis

Presented at the Federal Reserve Bank of St Louis, the 2014 North-American Meeting of the Econometric Society (Minneapolis) and Northwestern Macro Lunch.

The importance of basic research for economic growth is widely recognized, but most theories of endogenous growth do not explicitly consider scientific discoveries as a driver of technological change. One of the reasons is the lack of consistent measures of scientific progress. Another reason is the difficulty in isolating exogenous shifts in the scientific base and in linking it to observable economic indicators. In this paper, we propose a new method to address those difficulties, and use it to empirically assess the importance of scientific advances in shaping firm dynamics. We use a string-matching algorithm to combine data from the Web of Science with patent data from the USPTO. We then link the patents to data on publicly traded companies from Compustat to measure firm-level response to the greatest scientific papers of the last decades. This methodology allows us to construct an observable link between shocks that occur in the scientific world and real economic outcomes.

We find that the unexpected arrival of a seminal paper is followed by a significant resource reallocation towards responding firms. Physical capital, employment, R&D stock and R&D investment significantly increase following the shock. We also find that measures of profitability are not affected on average. However, this fact reflects large heterogeneity across different episodes. To explain these findings, we build a model of endogenous growth in which the economy is randomly hit by sector-specific discoveries, "scientific shocks". Ex-ante, agents cannot distinguish between valuable insights (breakthroughs) and unprofitable ones (dead-ends): telling them apart requires costly investment. Following a breakthrough shock, resource reallocation is slow and persistent, reflecting both the progressive learning that follows the initial skepticism, and the gradual building of new technologies in response to the novel scientific insight. After a dead-end shock, resource reallocation has a boom-bust shape, with capital quickly reverting back as disillusion replaces the early wave of enthusiasm. The model delivers a simple restriction that allows us to separate breakthroughs from dead-ends in the data. After imposing this restriction, we test the model's implications in a reduced-form exercise. The empirical analysis suggests that scientific shocks are an important driver of firm dynamics and can help explain why some firms flourish and become technological leaders in their markets and other firms fail. The data also support the idea that systematic uncertainty permeates the early stages of new technological waves, with skepticism and over-enthusiasm emerging in turn as natural consequences.

In ongoing work related to this paper, we isolate an exogenous source of variation in firms' response to seminal discoveries. Using a comprehensive match of all the papers in the Web of Science since 1945 to all the USPTO patents since 1976, we propose a measure of *ex-ante* exposure of firms to the arrival of new scientific papers. To this end, we compare the scientific base on which the patenting activity of responding firms is built *before* the paper's appearance, with the

scientific base of the seminal paper itself. First stage results suggest that this ex-ante information on firm's patenting is highly informative of a firm's propensity to respond.

"Employment Protection, Investment in Job-Specific Skills, and Inequality Trends in the United States and Europe" with Matthias Doepke (in progress)

In this work in progress with Matthias Doepke, we explore how labor protection legislation shapes the incentives to invest in job-specific skills. The data suggest that long-term tenure is considerably higher in Europe, in particular for unskilled workers. We propose that different tenure-skills relations can induce different choices in the organizational structure of firms. These can be designed as to favor or discourage investment in firm-specific skills. We explore quantitatively the implications of this mechanism for the different experiences in the evolution of inequality in Europe and the United States in the last decades.

"Does Innovation Potential Affect Local Development?" with Enrico Berkes (in progress)

To be presented at the 2015 Conference of Swiss Economists Abroad (Fribourg)

In this work in progress with Enrico Berkes, we propose a methodology to isolate exogenous shifts in the innovation potential of U.S. locations, and use it to assess the impact of innovativeness on real economic outcomes at the local level. First, we link the universe of contracts issued by US federal agencies from 2000 to 2015 to information on the patenting activity of contractors from the USPTO. Using a difference-in-difference approach, we construct series of shocks to patenting in different technological areas and U.S. location. Second, we study how this increase in innovation activity propagates throughout a technological network inferred from patent citations. We show that this network is stable over time, and use it to investigate how ideas spread across space, time and technology classes. This allows us to build a series of shocks to local innovation potential. We argue that, once the channel of input-output linkages is accounted for, these shocks are orthogonal to other shocks that affect local economic outcomes. Finally, we use them to estimate what is the causal impact of expanding the innovation potential of a geographic location on real economic outcomes.