

## **TIES: Selected Doctoral Theses**

**TITLE:**

**“Essays on the Very Invisible College: Global Science and African Participation**

– Caroline Viola Fry (2020)

**COMMITTEE:**

Scott Stern (chair), Pierre Azoulay, Ezra Zuckerman-Sivan

**ABSTRACT:**

Despite globalization, innovative activities remain concentrated in a handful of high-income countries. Leveraging knowledge and resources in these locations through ties in the global network presents opportunities for emerging economies. This dissertation consists of three essays studying the role of international ties in the development of scientific capacity in sub-Saharan Africa. Each chapter helps to uncover a different feature of the way in which, and the scope by which, international ties impact African science, and ultimately facilitate technological catch-up and economic growth. Chapter 1 is an introductory chapter, and chapters 2-4 are specific research applications. Chapter 2 explores the value of international relationships to African scientists leveraging a unique opportunity afforded to some scientists to develop these relationships: the 2014 Ebola epidemic. Chapter 3 studies the spillover impact of the return home of American trained scientists to African institutions. Chapter 4 explores a macro-association between foreign knowledge stocks and African scientific productivity.

**TITLE:**

**“Essays on Innovation and Uncertainty”** – Ankur Chavda (2019)

**COMMITTEE:**

Scott Stern (chair), Pierre Azoulay, Shane Greenstein

**ABSTRACT:**

In Chapter 1 I study how innovative firms often try out new ideas before fully investing in them as a kind of experimentation on those ideas. This experimentation generates an early signal of final outcomes, allowing potentially bad ideas to be terminated before those outcomes are realized. But not committing to ideas by retaining right to terminate can also be detrimental to outcomes, by for example attracting lower quality workers or shifting worker effort away from final outcomes towards passing the experimentation phase. In this paper I explore this tension, asking when does experimentation improve final outcomes. I test a theoretical model of experimentation against a dataset of television shows that both enables an estimate of the treatment effect of experimentation and allows a test for selection bias. I find evidence that experimentation may both handicap worker recruitment and adversely shift effort. This results in experimentation only improving final outcomes when it terminates enough bad ideas, otherwise experimentation is detrimental as its benefits are unable to overcome its downside: the lack of commitment.

In Chapter 2 I consider how entrepreneurs in high growth industries face a unique form of uncertainty in their search for strategies to execute their ideas: the underlying distribution of potential outcomes is unknown. This uncertainty creates an opportunity for venture capitalists to extract value in certain cases by resolving that uncertainty and improving the search prospects for entrepreneurs. This paper models the optimal search problem faced by entrepreneurs and finds the value generated by venture capitalists is non-monotonic in the best strategy discovered so far by an entrepreneur. Our results suggest the rents captured by venture capital may be driven by selection of a specific kind of entrepreneur: one with a great idea but poor strategy for executing that idea.

In Chapter 3 I investigate the decision to vertically integrate; an important optimization decision made by firms. However, this decision not only affects the firm itself, it also influences the firm's industry as the relationships between firms is changed. This paper is an empirical study of how vertical integration impacts an industry, specifically the set of new products developed each year: the direction of innovation. Television shows can either be financed independently of the show's broadcast network or partially funded by the show's broadcast network; this variation in funding changes the owner of the television show and is therefore a form of vertical integration. Using a regulatory shock that restricted the networks' incentives to fund television shows, I find a drop in vertical integration contemporaneous with a shift away from dramas and an overall decrease in the introduction of new show genre combinations. My results demonstrate how organizational form affects an industry's rate and direction of innovation.

**TITLE:**

**"Essays on Economic Sociology of Innovation and Entrepreneurship" – Hye Jun Kim (2019)**

**COMMITTEE:**

Ezra Zuckerman-Sivan (chair), Pierre Azoulay, Matt Marx

**ABSTRACT:**

This dissertation considers how innovation and entrepreneurship are developed, encouraged, and evaluated with the theoretical lens of economic sociology. The first chapter investigates who becomes an entrepreneur among the pool of general consumers. The process by which individuals become entrepreneurs is often described as a decisive moment of transition, yet it necessarily involves a series of smaller steps. By collapsing the transition stages of knitting hobbyists' transition to producers who sell their original design patterns, the study examines the distinctive characteristics that affect users' decision to (a) create new products and (b) commercialize them. In particular, I show that more experienced, disobedient, and committed knitters tend to make the first transition and create new products, while knitters who make the second transition and sell their products tend to be less experienced, disobedient, and committed, compare to the sharing producers who do not commercialize their products.

The second chapter examines the role of social capital in revealing and encouraging avocational entrepreneurship. To the question of how social capital benefits innovation and entrepreneurship, existing literature has provided one dominant answer: the inflow of new information and knowledge recombination promote innovative ideas. In this study, I suggest a novel insight on the benefit of social capital on an individual's transition to avocational entrepreneurs: social networks provide potential entrepreneurs self-confidence on the promise of their new ideas and encourages their entry into the market. Using a unique setting in a niche field of knitting, I first show that there are individuals with great potential to become innovators. Also, using a matched sample of potential innovators, I show that an individual's participation in a closely connected local group encourages her transition to an entrepreneur, especially for those who already have the necessary skills for the transition. The empirical analysis resonates with qualitative evidence that knitting hobbyists make the transition to entrepreneurs when encouraged by their friends.

The third chapter (co-authored with Pierre Azoulay and Ezra Zuckerman) considers commitment-based typecasting among knit designers. We show that "commitment-based typecasting" has two characteristic features: asymmetry in audience valuation and retrospective reevaluation. When a novice performer experiences an "identity shock" that suggests that she is more committed to the audience for one category than another, "betrayed" audience tends to regard her as having always been less committed to the rival audience/category. We test this theory in the domain of knitting, where there is a divide between avant-garde knitters and traditional

knitters, and we show that when a novice knit designer is first published in the publication associated with one category, this elicits a retrospective devaluation of her prior work by the audience of the opposing category.

**TITLE:**

**“Making the Cut: The Rate and Direction of CRISPR Innovation”** – Samantha Zyontz (2019)

**COMMITTEE:**

Scott Stern (chair), Pierre Azoulay, Jeffrey Furman

**ABSTRACT:**

This dissertation explores, in real time, key institutional factors contributing to the diffusion and impact of a breakthrough technology from its very first days. The set of studies provide a nuanced picture of the actors, institutions, technologies, and rules necessary for knowledge managers to make systematic comparisons among strategies to encourage innovation in emerging industries.

The first chapter examines whether the introduction of a breakthrough technology, the CRISPR DNA-editing system, affects the trajectory of a scientific field through project selection and new entry. Using proprietary data from the primary distributor of CRISPR to academic scientists, Addgene, the study shows that the relative proportion of scientists focusing on editing mammalian cells after the introduction of CRISPR increased over their counterparts working in bacteria and other eukaryotes. The shift towards mammalian research may result mostly from entry of new authors.

The second chapter (with Neil Thompson), explores whether characteristics of individual scientists who experiment with CRISPR differ from those who incorporate that experimentation into a new project. Using Addgene data we separately observe both groups by matching CRISPR orders to scientists' publication histories. We find that some characteristics (e.g., proximity to the discoverers) do not impact experimentation but do influence the ability to publish, empirically showing that access to a complex new tool does not automatically translate into the ability to use the tool.

The third chapter builds on the previous two by noting that many new tools require specialized complementary know-how to be applied effectively and delving into how teams form to acquire that know-how. Teams in any research domain face the tradeoff of either acquiring this know-how themselves or working with scarce external tool specialists who also have a choice over domain teams. CRISPR enables identification of external tool specialists on research teams by exploiting natural difficulties of applying the tool across disease domains. External tool specialists appear more often in teams for difficult diseases, especially in subsequent innovations, suggesting that external tool specialists may be more attracted to complex but influential problems.

**TITLE:**

**“Essays on Learning and Strategy in Research and Development”** -- Joshua Krieger (2017)

**COMMITTEE:**

Pierre Azoulay (chair), Alessandro Bonatti, Fiona Murray, Scott Stern

**ABSTRACT:**

This dissertation investigates how research organizations learn from and adapt to new knowledge. In particular, I examine how news about scandals, stigmas and failures influences the direction of research and development efforts. These negative information shocks force research organizations to pause, interpret external signals, and apply any lessons to their own project portfolios. I investigate how these negative information events impact decisions in the settings of scientific publishing and drug development.

In the first essay, I study the impact of scientific retractions on citation patterns and funding in the retracted paper's intellectual field. I investigate how the retraction disclosure and affected field's

characteristics influence the extent of these spillover effects. The second essay evaluates how retraction scandals damage individual scientists' reputations. This study shows that the magnitude of the retraction penalty depends on a scientist's prominence and whether or not the retraction event involved "misconduct." In the third essay, I analyze how late-stage drug development failures alter competitor's project continuation decisions. I separate technological learning effects from market competition effects, and grade decision-making across firms.

**TITLE:**

**“Evaluating Entrepreneurship Programs: Theory and Evidence”** -- Daniel Fehder (2016)

**COMMITTEE:**

Fiona Murray (chair), Scott Stern, Ezra Zuckerman-Sivan, Yael Hochberg

**ABSTRACT:**

This dissertation consists of three essays studying the impact of a relatively recent type of entrepreneurship program (startup accelerators) on the performance of firms, regions, and the selection of early-stage projects in the economy. The first essay (joint work with Yael Hochberg) explores the impact of startup accelerators on the level of early-stage entrepreneurial activity in their region. Recent years have seen the rapid emergence of a new type of program aimed at seeding startup companies. These programs, often referred to as accelerators, differ from previously known seed-stage institutions such as incubators and angel groups. While proliferation of such accelerators is evident, evidence on efficacy and role of these programs is scant. Nonetheless, local governments and founders of such programs often cite the motivation for their establishment and funding as the desire to transform their local economies through the establishment of a startup technology cluster in their region. In this paper, we attempt to assess the impact that such programs can have on the entrepreneurial ecosystem of the regions in which they are established, by exploring the effects of accelerators on the availability and provision of seed and early stage venture capital funding in the local region.

The second essay explores the relationship between a startup's founding region, accelerator admission and startup performance. Entrepreneurs combine resources from numerous sources as they build their firms but are constrained by their social and geographic proximity to these resources. I use this insight as a starting point to explore whether accelerators act as a complement or substitute for initial location. Using data from MassChallenge, a leading startup accelerator in Boston, I use a regression discontinuity framework to evaluate both the overall impact of the program on its portfolio of startups and its heterogeneity based on: 1) the level of entrepreneurship resources in a startup's founding region and 2) their ability to access those resources. Startups birthed in neighborhoods with higher levels of entrepreneurial resources also derive a larger benefit from admission to MassChallenge. Within the accelerator, startups from richer ecosystems also receive referrals at higher rates, expanding their social capital relative to entrepreneurs from less rich regions. This finding suggests that founding regions shape a startup's performance within the accelerator and that accelerators change the way in which startup founders are able to access and leverage resources in their home region.

The third essay explores the actual selection mechanisms inside an accelerator program. There is a growing awareness that variation in the institutional arrangements used in the selection of ideas and ventures can have an impact on the types of projects undertaken by innovators. This in turn shapes not only types of new innovations but also the types of innovators we expect that enter the economy. To date, research has focused on the composition of selection committees or differences across quite distinctive evaluation mechanisms (e.g. crowds versus expert committees). This study hopes to ask a related but unanswered question: Will a fixed set of judges evaluate a fixed

set of businesses opportunities differently if they are assigned to different "evaluation regimes". Specifically, we examine the degree to which status characteristics such as gender and elite education are critical determinates of project evaluation across two distinct evaluation approaches – paper-based and committee-based.. We find a strong, positive effect for gender and other characteristics in a committee-based evaluation scheme where founder characteristics are more salient to judges. Our findings contribute to a deeper understanding of both the evaluation of early-stage firms and the role of bias in decision making in settings of considerable uncertainty.