Mike Andrews

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March 30, 2016

NBER
Entrepreneurship Boot Camp
1050 Massachusetts Ave.
Cambridge, MA 02138

To Whom It May Concern,

I am applying to the NBER Entrepreneurship Boot Camp. I am currently a 4th year PhD student at the University of Iowa and a Kauffman Dissertation Fellowship winner. My research has two main strands. First, I use historical patent data to study the demographics of inventors and the effect of colleges on patenting. Second, I study theoretical models of patent races. I believe that both the empirical and theoretical tools are essential to understand the process of innovation and entrepreneurship.

Nicolas Ziebarth, my dissertation advisor and a research fellow at NBER, has written my letter of recommendation. His letter has been sent separately to Rob Shannon. Also enclosed are my CV, a list of current and completed courses, and an essay explaining my research and why I would like to attend the boot camp. Please feel free to contact me for any additional information.

Thank you very much for your consideration. I look forward to hearing from you soon.

Sincerely,

Michael Andrews

Michael Andrews

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EDUCATION

Degree	Field	Institution	Year
Ph.D.	Economics	University of Iowa	May 2017 (expected)
M.A.	Economics	University of Iowa	May 2014
B.A. with honors	Economics	University of Maryland	May 2011
B.S.	Supply Chain Mgmt	University of Maryland	May 2011

PROFESSIONAL EXPERIENCE

Head Teaching Assistant

Principles of Microeconomics, University of Iowa, Spring 2014 - Fall 2015

Teaching Assistant

Principles of Microeconomics, University of Iowa, Fall 2012 - Fall 2013

Senior Invention Consultant

Thoughts to Paper, Germantown, MD June 2011 - July 2012

WORK IN PROGRESS

"Two Ways to the Top: Patent Races with Multiple Innovation Technologies"

"Inventive Activity in Nineteenth and Early Twentieth Century America" with Sarada and Nicolas Ziebarth

"The Causal Effects of New Universities on Local Patenting: Evidence from the Formative Years of U.S. Higher Education, 1870-1940"

PRESENTATIONS

"The Causal Effects of New Universities on Local Patenting: Evidence from the Formative Years of U.S. Higher Education, 1870-1940"

Kauffman Emerging Scholars Conference, Kauffman Foundation, Kansas City, February 2016

"Product Characteristic Choice with Heterogeneous Firms"
Iowa Alumni Conference, University of Iowa, March 2015

AWARDS AND HONORS

Kauffman Dissertation Fellowship in Entrepreneurship, Kauffman Foundation, Winter 2016
Post-Comprehensive Research Summer Award, Graduate College, University of Iowa, Summer 2015

Last Modified: March 14, 2016

Semester	Course Title	Professor	Additional Details
Fall 2015	Seminar in Economic Theory	Nicholas Yannelis	
Fall 2015	Contemporary Topics	Kyungmin "Teddy"	Search Theory
Fall 2015	Contemporary Topics	Michael Choi	Applied search theory
Spring 2015	Contemporary Topics	Nicolas Ziebarth & Alice Schoonbroodt	Spatial econ; demographic & fertility econ
Spring 2015	Workshop in Macro & Monetary Econ	Rabah Amir	
Spring 2015	Readings	Alice Schoonbroodt	
Fall 2014	International Trade Theory	Ray Riezman	
Fall 2014	Contemporary Topics	Anne Villamil	Occupational Choice, Bankruptcy
Fall 2014	Contemporary Topics	Nicolas Ziebarth & Michael Choi	Monetary Economics: New Keynesian & New Monetarist
Spring 2014	Econometrics II	Antonio Galvao	
Spring 2014	Contemporary Topics	Kyungmin "Teddy" Kim	Information and Contracts
Spring 2014	Industrial Organization	Rabah Amir	
Fall 2014	Econometrics I	Alex Poirier	
Fall 2014	Contemporary Topics	Ray Riezman	Political Economy
Fall 2014	Analysis I	Paul Muhly	Math Department PhD Course
Spring 2013	Macroeconomics II	Alice Schoonbroodt	
Spring 2013	Microeconomics II	Nicholas Yannelis	
Spring 2013	Analysis II	Doru Cojoc	
Fall 2012	Macroeconomics I	Martin Gervais	
Fall 2012	Microeconomics I	Ayca Kaya	
Fall 2012	Analysis I	Doru Cojoc	

I have been fascinated by innovation since at least my first job out of college, working to help small businesses file patent applications. Economists know that new ideas spur the innovations that drive economic growth. But we know much less about what spurs these new ideas. What kinds of people create new knowledge? Can policy make people more inventive?

In my dissertation, I explore these questions. In one paper, I estimate the effect of establishing a new college or university on patenting. Economists believe that higher education plays a key role in promoting entrepreneurship and innovation, but definitive answers are hard to come by. What would Silicon Valley look like without Stanford and the University of California? Answering this question is typically very difficult because there is no counterfactual Silicon Valley. Just as importantly, it is not clear by what mechanisms colleges increase invention. Is invention driven by faculty patenting, by local firms interacting with faculty researchers, or by graduates spreading their knowledge in the workplace? Or do colleges increase invention simply because they bring together a large group of people, producing agglomeration spillovers?

I exploit historical natural experiments to identify counterfactual college counties. When establishing public universities, U.S. states could locate the new institution anywhere within their borders. After comparing the thousands of potential sites, states ended up with a few finalist locations. By digging through the historical record, it is often possible to identify these finalist locations. I show that the finalists are very similar along a number of observable dimensions and, importantly, after going through the political process and the quirks of history, which location actually ends up with the college is as good as randomly assigned. Thus, the losing finalists are valid counterfactuals for the towns that actually received new colleges. Using this method, I find winning counties increased patenting by 58% relative to the losing finalists after establishment of a college. In a median-patenting county, this is an increase of roughly one additional patent every two years. To get a sense of the mechanisms by which colleges increase patenting, I compare counties that received new colleges to counties that received other state institutions at the same time, such as prisons, hospitals, and insane asylums. The patenting rates in both types of sites appear very similar both before and after the establishment of a new college, suggesting that a large part of the increase in patenting is due to agglomeration. This is a very preliminary result, but if true it suggests that we may be giving colleges too much credit for promoting invention.

In another paper, my coauthors and I match the universe of U.S. patents from 1870-1940

to the 100% U.S. decennial population census. This matching allows us to track demographic trends of inventors over a 70 year period as well as see how regional factors are correlated with patenting by different groups. Not surprisingly, blacks and women are systematically underrepresented in patenting, a pattern that has persisted to the present day. We view constructing this dataset as only the first step in a much larger research program; the ultimate goal is to understand how to make the invention process more inclusive. The demographic inventor data can also be leveraged to gain insights into the effects of colleges on patenting explored in my first paper. Using the matched patent-census data, it is possible to learn whether the extra patents in college towns come from college-age individuals and whether inventors are college town natives or if they move there after the college opens.

In my final paper, I study how competition affects the kinds of innovation strategies that firms pursue in a quality ladder model. In contrast to most other racing models, in my model firms have two choices to make: how much R&D effort to exert and what kind of "innovation technology" to use. A "standard innovation technology" has a high probability of success, but the cost increases for the follower as it falls further behind the leader on the quality ladder. A "radical innovation technology" has a lower probability of success, but the cost does not depend on the gap between firms. Thus, when the gap becomes sufficiently large, the follower switches to use the radical innovation. If the follower has a single success using either innovation, it leapfrogs the leader. When only the standard innovation is available, the equilibrium has the inverted-U property described in several other papers in environments without leapfrogging: both firms exert the highest effort when the gap is small and lower effort when the gap is large. When both innovation technologies are available, the relationship between competition and innovation is much more subtle. Comparative statics that change payoffs with one innovation technology "trickle down" and affect firms' choices in other states in nontrivial ways. Understanding these kinds of comparative statics has important implications for designing R&D subsidies that target different types of firms or different types of innovative activities.

I am very excited to attend the 2016 NBER Entrepreneurship Boot Camp. Understanding who creates good ideas is a key piece of the entrepreneurship puzzle. I look forward to discussing these ideas with the faculty and other boot campers in Cambridge, as well as hearing their views about the future of entrepreneurship research.

I am happy to write this recommendation letter for Michael J. Andrews, a third year PhD student here at the University of Iowa. I have now known Mike for two years and, based on that, have a good sense of his current and potential research. He is a real diamond in the rough.

Mike's current research is focused on how innovators choose in which *direction* to innovate. His motivating example is a well-known one in the entrepreneurship literature: the hard disk drive industry. The industry experienced a major innovation in the 1980s with the physical shrinking of the disk. Before this innovation occurred, all of the innovations came in the form of increasing the capacity of the disk. Many people have written about this industry including the seminal work by Clayton Christensen to more recent structural work by Mitsuru Igami. Christen's work distinguished between sustaining (increases in memory capacity) and breakthrough (smaller physical size) innovations. He argued that it was a follower (Connor Peripherals) who made the breakthrough innovation in this industry rather than the leader (Seagate). Christensen goes on to argue that this is the case in a number of industries with leaders making the sustaining innovations while followers make the breakthroughs.

To do this, he conceptualizes a breakthrough innovation as a product that meets an unexpected shift in consumers' marginal rate of substitution between different features of a product. Given this (small) chance for preferences to switch, in which direction should firms choose to innovate? Mike makes the reasonable assumption that leaders and followers innovate starting from their respective current locations in the product space. By the triangle inequality, the follower will, in general, be relatively closer to the consumer's indifference curve in the case when preferences switch. Hence, it is relatively cheaper for the follower to innovate in the breakthrough direction. The intuition here is that if a follower wants to innovate in a sustaining direction, effectively the firm first has to first innovate to the leader's current level *and then* go further in the sustaining direction. Mike shows how if the leader and follower start with the same prior on the probability of this preference shift and learn about it over time, the follower will be the first to switch from the sustaining to the breakthrough innovation. The beauty of the model is in its simplicity. It captures an important part of a rather amorphous concept in a way that lends itself to sharp analysis.

So far his work has been theoretical in nature, with some additional extensions on repeated innovations and the efficiency of the outcome in the works. Going forward, he is planning to provide additional evidence for the theory from the hard disk industry. While

Igami developed a structural model for the industry to understand the replacement and cannibalization effects, he only considered a single dimension of innovation, the storage capacity of a hard disk. Mike is in the process of extending Igami's original dataset to include more detailed information on the physical shrinking size of the drives. Mike and I have also been discussing the golf driver industry as another possible test for the theory. In the earlier 90s, there was a breakthrough innovation with the introduction of the titanium driver with a completely redesigned head. This was followed by sustaining innovations that increased the head size up to the United States Golf Association limit of 450cc. Mike has been collecting driver reviews from a major golf magazine for the past 25 years. These reviews provide information on the specs of all the major club manufactures' newest models (along with retail prices). The hope is that this industry will complement the empirical analysis of the hard disk industry.

Part of what makes this work most impressive is the independent thought involved. None of the people Mike talks to here are experts in this area. We taught him some basic models and tricks, but the idea and all of the details are completely his own. I was rather stunned to see this paper drop on my desk. This is why being able to attend the boot camp would be so incredibly valuable for him. I actually cannot imagine someone else having a higher marginal value of attendance. Mike needs seasoning. He needs to talk to other faculty and graduate students working in this area. He needs to know more about what is going on in the field, both empirically and theoretically.

Given what I have seen from Mike, I am certain he would take every last advantage of the opportunity to attend. He is incredibly dedicated to his work, eager to learn, and open to criticism. (He's also an uncommonly good presenter, particularly for a graduate student.) The department here has had some outstanding graduate students in the past with people placed at Chicago, Princeton, and NYU. Only time will tell if Mike can achieve those lofty standards, but he certainly has potential. If you have any questions, please feel free to contact me at nicolas.lehmannziebarth@gmail.com.

Sincerely,

Nicolas L. Ziebarth
Assistant Professor of Economics
University of Iowa and NBER