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March 29, 2015

NBER Entrepreneurship Research Boot Camp

Dear Colleagues,

It is a complete pleasure to recommend **Xi (Alex) He** for enrollment in the NBER Entrepreneurship Research Boot Camp this summer. Alex is exceptionally well suited to the ERBC program because Alex is himself remarkably entrepreneurial, inquisitive, and self-directed. After gaining admission to the MIT Ph.D. program but while still a student at Tsinghua University, Alex tracked me down during a conference in Beijing to see if he could start research prior to commencing the MIT program. I hired him that same summer (in 2013) and I immediately found him invaluable. Alex has been a lead research assistant on a data-intensive project that asks how rising competition from manufacturers in developing countries (China in particular) is shaping the rate and direction of innovative activity among U.S. competitors—both directly, within import-competing sectors, and indirectly, through upstream and downstream input-output linkages with other supplier and customer sectors.[1]

Alex's initial task was to link the vast NBER patent database to inventors' affiliated firms and then to assign these firms (proportionately, in many cases) to their respective industries. Anyone familiar with this database is well aware what a messy, imperfect process this was bound to be. Alex was dauntless. He helped to develop an algorithm using the Bing search engine to disambiguate hundreds of variations of company names (e.g., if you type "IB & M" into Bing, its top suggested match will be IBM—you see the potential). He matched these data to CompuStat and CIQ, and then invested hundreds of hours to check and refine data quality.

As we were just launching the inferential side of the project, Alex began "scouting" out the analysis—estimating preliminary regressions and writing them up, scouring current working papers for overlapping and complementary projects, and suggesting alternative data sets that other teams were simultaneously developing. It is in no sense generous to say that Alex's self-directed forays into the analysis sharpened our thinking, gave rapid shape to the project, and refined our empirical approach beyond what we would have accomplished with an equally hard-working but *not* equally entrepreneurial RA. If there weren't already so damned many authors on the paper already, I'd probably make Alex a coauthor now. But

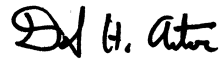
[1] This work, joint with Pian Shu of HBS (an ERBC alumna), Gary Pisano (HBS), David Dorn (U. Zurich), and Gordon Hanson (UCSD), is related to the 2015 *ReStud* paper by Bloom, Draca and Van Reenen, but it uses different identification and, so far, has yielded surprisingly distinct results.

that's okay; he's only completing his second year, and I expect that we will collaborate extensively in the immediate future.

As Alex lead the charge on the RA project, he developed complementary projects, some of which are described in his application essay. In one promising project, Alex asks how Chinese import competition affects the allocation of talent and inventor mobility across firms, industries and regions. Another nice project (launching soon) will explore how the wage returns from innovations are distributed among individual innovators, workers within innovating firms, and more broadly among workers with proximate skills or locations. This work will use employer-employee matched data from IAB in Germany and Longitudinal Business Database at the Census Research Data Center (RDC). Alex applied for the RDC data in the early fall, and his application is well along in the approval process. Thus, I think this project will easily come to fruition in the coming academic year. More generally, Alex has one or two interesting ideas a week. When we meet in office hours, as we often do, my challenge is never to help Alex to develop ideas but instead to direct his bounty of energy and creativity towards its highest use.

In summary, Xi (Alex) Hi is a first rate young scholar who fosters a deep interest in understanding innovation, entrepreneurship, and the interactions between product and labor markets in directing and rewarding talent. Though I should not speculate at this point, I suspect that Alex will be among our top Ph.D. students in a few year's time. If he is permitted to enroll in the ERBC program, Alex will tear through the full corpus of suggested literature, participate in each lecture, and (politely) ask as many good questions as time permits. I give Alex my highest recommendation for participation in ERBC.

Sincerely,



David H. Autor

Xi (Alex) He

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March 23, 2015

Dear Professor,

I'm a second-year PhD in Economics at MIT and am writing to apply for the 8th Entrepreneurship Research Boot Camp to be held at NBER this summer. I'm very interested in entrepreneurship and would welcome the opportunity to learn and discuss research on entrepreneurship and related topics with faculty and students in the boot camp.

My Curriculum Vitae and essay are enclosed for your review. My recommendation letter is written by Professor David Autor (dautor@mit.edu).

Thank you for your consideration.

Sincerely yours,

Xi He

XI (ALEX) HE
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Contact Information

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Education:

Massachusetts Institute of Technology, 2013 to present
Ph.D., Economics

Tsinghua University, 2009-2013
B.A., Economics, Finance and Applied Mathematics, honors/highest distinction

Fields:

Primary: Labor Economics, Macroeconomics
Secondary: Industrial Organization, Econometrics

Teaching Experience:

Fall 2013	Analytics of Finance (15.450), Massachusetts Institute of Technology.
Fall 2012	Principles of Economics, Tsinghua University.

Research Experience and Other Employment:

2013-present	MIT, Research Assistant, Professor David Autor.
2012	UC Berkeley, Research Assistant, Professor Stefano DellaVigna.
2011	Roland Berger Strategy Consultants, Intern.

Honors, Scholarships, and Fellowships:

2012	Best Teaching Assistant Award, Tsinghua University
2012	Comprehensive First Prize Scholarship, Tsinghua University
2011	Comprehensive First Prize Scholarship, Tsinghua University
2010	Comprehensive First Prize Scholarship, Tsinghua University
2009	1st Class Freshmen Scholarship, Tsinghua University

Research Papers:

"Technology Spillovers through the Innovation Network"

"A Theory of Intermediated Investment with Hyperbolic Discounting Investors" (with Feng Gao and Ping He)

List of PhD Courses Taken:
Labor Economics I, Advanced Macroeconomics I, Industrial Organization I, Advanced Topics in Industrial Organization, Public Economics II, Microeconomic Theory I-IV, Time Series Analysis, Nonlinear Econometric Analysis, Applied Econometrics, Contract Theory (audit), Economics of Ideas, Innovation and Entrepreneurship (audit), Public Economics (Berkeley), Applications of Psychology and Economics (Berkeley)

List of PhD Courses in Progress:
Labor Economics II, Advanced Macroeconomics II, International Trade, Topics in Inequality, Corporate Finance and Banking (Harvard)

Why I want to attend the Boot Camp

There is a set of core questions in economic growth and technological change for which we have theories but empirical evidence has been quite limited. In my research I hope to bridge this gap by using detailed micro-level data to test or quantify the theoretical mechanisms. I believe the Entrepreneurship Research Boot Camp would be a great opportunity for me to learn about new researches and institutions of entrepreneurial firms, which play an important role in fomenting innovations and spurring economic growth.

One area of research I have been involved in is to examine how macroeconomic events, like international trade, affect innovations in economies with micro-level heterogeneity. Since I started graduate school, I have been working as an RA on the project "**Foreign Competition and Domestic Innovation: Evidence from U.S. Patents**" by Professor David Autor and coauthors which studies the impact of import competition from China on innovations of US manufacturing firms. We used novel Internet search algorithm to match all the patents between 1976 and 2013 to US public firms in the CompuStat dataset. While theoretically the relationship between competition and innovation is ambiguous, previous work[1] found that Chinese import led to increased technical change using firm-level data in Europe. In contrast, our preliminary results suggest that manufacturing industries that faced greater import competition from China experienced a decline in patenting. The results have motivated my ongoing work, in which I study how Chinese import competition affects the allocation of talent and inventor mobility across firms, industries and regions. Increasing import competition may induce inventors to move across industries, especially for young inventors and inventors working in small firms, which may have large impacts on the technological progress and productivity across different sectors in the long run.

To understand the aggregate effects of shocks on innovation in an economy with heterogeneous firms, my related research explores firm-level interactions in the innovation network. As shown in the work by Bloom, Schankerman and Van Reenen (BSV)[2], positive knowledge spillovers dominate negative business stealing effects and the social returns to R&D exceeds private returns. In the paper "**Technology Spillovers through the Innovation Network**", I extended BSV by adding technology spillovers from upstream technology fields using the innovation network constructed from patent citations. For a technology class, its upstream fields are the fields that patents in the class mostly cite from. I find knowledge spillovers from firms innovating in upstream fields are as large as knowledge spillovers from firms innovating in the same fields. Besides, firm's R&D responds positively to R&D of firms in upstream

[1] Bloom, N., Draca, M. and Van Reenen, J. (2015), "Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity", Review of Economic Studies.

[2] Bloom, N., Schankerman, M. and Van Reenen, J. (2013), "Identifying technology spillovers and product market rivalry", Econometrica.

fields, but not to R&D of firms in downstream fields or the same fields. I also find that smaller firms tend to innovate in more fundamental and upstream technology fields, which challenges the view that smaller firms operate in technological niches and generate lower social returns to R&D. These results highlight the importance of considering directed innovation network when studying technology spillovers.

A second area of research I'm interested in is how innovation and technical change affects workers' employment and wage inequality with firm-level heterogeneity and frictional labor market. The number of patent applications declined after 2001 when the Internet bubble burst. Surprisingly, I find that almost all of the decline in patenting was from technology classes outside the computer and software sector. During the same period, in the early 2000s, the US also experienced stagnant wage and employment growth among high skilled workers[3] and declining capital investment. In future research I aim to explore how changes in innovation and technology affects employment and wages in a heterogeneous-firm framework where different firms use different production technologies, and examine the implications for labor reallocation and wage inequality across firms, and the matching between workers and firms. To study this question I plan to use detailed firm-level data, such as employer-employee matched data from IAB in Germany and Longitudinal Business Database at the Census Bureau (which I'm applying for now).

For my current and future research it is important to incorporate insights from entrepreneurship. Entrepreneurial firms tend to be more upstream in the technology space, so their direction and level of innovation determines the direction and pace of technical change. Young and small entrepreneurial firms also account for a large part of new jobs being created. While many courses I took have touched on the topic of entrepreneurship, I hope to learn more about the characteristics and institutions of entrepreneurial firms—specifically how they are financed, what technologies they use and invest in, and how they hire and pay workers— and the consequences for the rest of the economy.

The NBER Entrepreneurship Research Boot Camp is an exciting opportunity for me to know more about the field of entrepreneurship while I start doing more research on entrepreneurship and related fields in the summer of my second year. I look forward to studying and discussing research in entrepreneurship with the leading scholars in the field and students from other universities who share similar interests.

[3] Beaudry, P., Green, D. and Sand, B. (2014), "The Declining Fortunes of the Young Since 2000", American Economic Review P&P.