National Bureau of Economic Research
1050 Massachusetts Avenue
Cambridge, MA 02138

Nils H. Lehr
nilslehr@bu.edu
37 Egremont Rd, Apartment 6
Brighton, MA 02135
Mobile: 617-417-4235

Re: NBER Entrepreneurship Research Boot Camp 2020

To Whom It May Concern,

thank you for considering my application for the NBER Entrepreneurship Research Boot Camp 2020. I would be very excited to participate in this event to advance my research and learn from the great scholars in this field.

Please find my application materials below. Stephen James Terry will provide a letter of reference separately.

Many thanks and kind regards,
Nils H. Lehr

Letter of Motivation

To Whom It May Concern,

thank you for considering my application. I would be thrilled to get the opportunity to advance my research and learn from the great scholars in this field at the NBER Entrepreneurship Research Boot Camp 2020. As a third year PhD student in Economics, I have already been exposed to a wide range of topics in growth macroeconomics, however, I did not have the chance yet to focus on entrepreneurship in particular. I believe that the Research Boot Camp could be an important step stone to the further development of my research agenda.

In my current research I focus on the intersection between technology adoption, workforce aging, and economic growth. In particular, I investigate whether the rapid workforce aging in the US post 1990 has contributed to the well documented slow down in productivity growth through the channel of technology adoption. Using the computer as a case study, I show that there are strong cohort effects in the adoption of new technologies. Workers aged 55-59 in 1989 had a 10 percentage point lower adoption rate of computers at the workplace compared to those aged 40-44.

I highlight that these differences matter by building an endogenous growth model with overlapping generations and costly technology adoption by workers. The latter allows me to match the downwards sloping life cycle profile of technology adoption as older workers have less remaining time in the labor market and thus lower returns to human capital investment. The model predicts that a population shift towards an older workforce with lead to lower adoption rates of new technologies via a simple composition effect. This in turn lowers investment in the associated capital and profits for entrepreneurs developing new technologies. The latter then implies lower investment in R&D in the first place and thus lower economic growth.

I verify the model's predictions for investment in new equipment and R&D using a local labor markets approach. In particular, I show that firms in commuting zones with younger workforce investment more in computer equipment, employ a higher share of R&D workers, and expend more on R&D as measured by the associated wage bill. These results suggest that workforce aging is likely to have long-run implication for innovation and economic growth in the US with potentially large benefits to policies aimed at training older workers in new technologies.

One of the key insights of this analysis, the importance of workforce composition, appears to translate directly to entrepreneurship. Entrepreneurial success will not only depend on the initial idea, but also on whether the entrepreneur can find the right workers to implement it, at what cost, and how large the advantage of the new company will be with respect to existing firms. Each for these factors is likely to dependent on the (local) workforce composition. This is especially true if the entrepreneur is unable to implement the idea herself.

For example, an entrepreneur with a vision to apply robotics and AI to life stock farming, but without the detailed coding or robotics knowledge, will need to find the right workers to implement her vision in the local

labor market. This might not be feasible if the labor market is dominated by an aging workforce specialized in older technologies. Similarly, this might not be profitable or otherwise financially feasible if there are few (young) workers with the appropriate skill set and many companies competing for them. Thus, the supply of skills is a key success factor to entrepreneurship.

Finally, note that the supply of skills will also affect the choice of technology and thereby might affect the entrepreneurship decision in the first place. For example, consider a potential entrepreneur with an idea for a data analytics based company. The entrepreneur could choose to build on basic machine learning algorithms or develop a deep learning based approach, where the latter requires a deeper knowledge of recent technological developments. Depending on the available skill in the local labor market, only the former approach might be feasible, however, the less advanced approach might also lead to a lesser advantage over established competitors in the market, rendering entrepreneurship more risky and less profitable. Resulting, a potential entrepreneur might forgo an opportunity due to skill scarcity in the local labor market.

In future work I plan to build on these considerations and develop a framework that marries entrepreneurial competition and firm dynamics with learning and technology adoption dynamics in the labor market. I believe that this could yield far reaching insights into productivity dynamics, the role of entrepreneurship in economic growth, and the recent slow down in productivity growth in advanced economies.

The NBER Entrepreneurship Boot Camp would be a great opportunity for me to kick start this agenda. Besides broadening my understanding of the existing literature, it would give me the opportunity to potentially get feedback on my existing ideas and develop new ones. Furthermore, exposure to a wide ranging set of research on entrepreneurship will allow me to connect to existing literature better and raise my awareness for potential resources, data sources, and researchers working on similar problems.

I would also be enthusiastic about the opportunity to discuss the lecture material and exchange ideas with fellow participants in the event. I am a firm believer in exchange and collaboration and would be very excited to share, discuss, and explore with fellow PhD students sharing my academic interests.

Thank you again for considering my application. I would be excited to be an active participant in the NBER Entrepreneurship Research Boot Camp 2020.

Many thanks and kind regards,
Nils H. Lehr

NILS H. LEHR

nilslehr@bu.edu

Office Contact Information
270 Bay State Rd - Department of Economics
Boston, MA 02215
Office: B03A
Mobile: +1 (617) 417 4235

Home Contact Information
37 Egremont Rd
Apartment 6
Brighton, MA 02135

Personal Information:

Date of birth: August 22nd 1991
Citizenship: Germany

Education

Boston University, 2017 to present
Ph.D. Candidate in Economics
Expected Completion Date: June 2022

Barcelona Graduate School of Economics, 2015 to 2016
Master in Economics and Finance
Ranked 3rd out of 90

Humboldt University Berlin, 2011 to 2014
Bachelor of Science in Economics
References:

Stephen Terry
Boston University
(617) 353-4455
stephent@bu.edu

Pascual Restrepo
Boston University
(617) 353-6824
pascual@bu.edu

Teaching and Research Fields

Primary fields: Macroeconomics, Labor
Secondary fields: Economic Growth, Technological Change and Innovation, Entrepreneurship

Teaching Experience

Summer Semester, 2019, EC 704: Advanced Macroeconomics, Boston University, Teaching Assistant for Professor Adam Guren and Professor Robert King Winter Semester, 2018, EC 102: Introduction to Macroeconomics, Boston University, Teaching Assistant

Research Experience and Other Employment

Summer Semester, 2020, Research Assistant for Professor Pascual Restrepo
Winter Semester, 2019. Research Assistant for Professor Stephen Terry
Summer, 2019, Summer Research Assistant for Professor Pascual Restrepo
Summer, 2018, Summer Research Assistant for Professor Pascual Restrepo
September 2016 to July 2017, Senior Associate, Deloitte LLP, Economic Consulting

Presentations

March, 2020, ZEW International Conference on "The German Labor Market in a Globalized World: Trade, Technology, and Demographics" [Likely to be cancelled due to the Coronavirus]
March, 2020, Green Line Macro Meeting [Cancelled due to the Coronavirus]

Honors and Awards

2019/2020 Best Second Year Paper Prize for "Aging, Technology Adoption, and Growth"

Research Papers in Progress

"Aging, Technology Adoption, and Growth"
This paper explores whether workforce aging in the US has contributed to the recent slowdown in productivity growth and investment through its impact on technology adoption. I document that older workers were slow to adopt computers during the peak adoption period from 1989 to 2003. Motivated by this evidence I build an endogenous growth, overlapping generation model with costly learning that replicates the observed cohort effects. The model predicts a slowdown in investment in new equipment and R&D in response to an aging workforce as well as lower productivity growth in the long run. I confirm the first two predictions using a local labor markets approach by showing that firms in commuting zones with an aging workforce invested less in computers and have lower R&D expenditures.

"Do Charities Respond?" (with Christine Exley and Stephen Terry)
We investigate business cycle dynamics in the US charity sector using micro data covering the universe of charities in the US. Revenues and expenditures at the firm and CZ level are strongly pro-cyclical patterns indicating that charities generally do not expand their services in times of need. Furthermore, we identify supply shocks using charity-parent relationships and document that charities expand their local activity in response to a positive supply shocks to available funds. Our results are broadly in line with a model of financial frictions in the charity sector.

"Measuring Skill-Biased Technological Change in US Patents" (with Natalia Umansky Casapa)
We use quantitative text analysis methods to document the extend of skill biased technological change in US patents since the 1970s. Our methodology leverages occupation descriptions provided by the US Department of Labor to identify skill-bias and takes into account tasks changes across occupation since 1977. We explore the local drivers of Skill-Biased Innovation using inventor locations and explore the impact of the local wage structure, inequality, and public funding of research.

Boston University Transcript Preview

Contact

view: **with Name and ID** | without Name and ID

This is a preview of your Boston University transcript only.
A preview is not available for Wheelock College (1888 – May 2018) transcripts.

Boston University and Wheelock College (1888 – May 2018) transcripts may be requested by
selecting the Order Transcript button.

Order Transcript

- For confidentiality, your name will be displayed for only **20** seconds. If you wish to print this Transcript with the name and id, please do so **NOW**!

Student Name: Nils Haakon Lehr **Student Id:** U30-89-3881

(Please note that the name and ID fields are read only for your protection. If the information in them is incorrect please contact Link support.)

DEGREE AWARDED

None

BASIS OF ADMISSION

Humboldt Universitaet zu Berlin
Berlin, Germany
Bachelor of Science
Universidad Pompeu Fabra
Barcelona, Spain
Master in Economics and Financ

PROGRAM OF STUDY

GRS, Ph.D., Economics

COURSE CODE	COURSE TITLE	CREDIT	GRADE	HONOR POINTS	SEM-GPI CUM-GPA
FALL 2017					
ADMITTED to Graduate School of Arts and Sciences					
Doctor of Philosophy					
GRS EC701	MICROECON THRY	4.0	**A-**	14.8	
GRS EC702	MACRO THEORY	4.0	**A**	16.0	
GRS EC705	INTRO MATH ECON	4.0	**A-**	14.8	
GRS EC707	ADV STATISTICS	4.0	**A-**	14.8	3.78
					3.78
SPRING 2018					
GRS EC703	ADV MICR THEORY	4.0	**A**	16.0	
GRS EC704	ADV MACRO THEOR	4.0	**A**	16.0	
GRS EC708	ADV ECNMETRIC 1	4.0	**A**	16.0	

GRS EC742 APPLIED MACROEC	4.0	**A**	16.0	4.00
				3.89
FALL 2018				
GRS EC699 TEACHNG COLL EC	2.0	**P**	0.0	
GRS EC709 ADV ECNMETRIC 2	4.0	**A-**	14.8	
GRS EC741 TOP IN MAC/MON	4.0	**A**	16.0	
GRS EC745 ASSET-PRICING	4.0	**A-**	14.8	
GRS EC791 INT'L TRADE	4.0	**A**	16.0	3.85
				3.88
SPRING 2019				
GRS EC699 TEACHNG COLL EC	2.0	**P**	0.0	
GRS EC732 TOP INDUST ORG	4.0	**A**	16.0	
GRS EC762 TOP APP PUB FIN	4.0	**A-**	14.8	
GRS EC794 FIN ECONOMETRIC	4.0	**A-**	14.8	3.80
				3.86
FALL 2019				
GRS EC902 DW MACROECON 1	2.0	**P**	0.0	
GRS EC943 DS MACRO/MONEY1	4.0	**A**	16.0	4.00
				3.87
SPRING 2020				
GRS EC904 DW MACRO ECON 2	2.0		0.0	

Cumulative Credits Earned : 70.0
Cumulative Grade Point Average : 3.87

ACADEMIC PROJECTS

Graduate School of Arts and Sciences
Doctor of Philosophy
PH.D. QUALIFYING EXAM:
06/05/2018

End of Transcript

Contact

Generated Fri Feb 7 17:04:12 2020
Copyright ©, Boston University
Information Services and Technology

Boston University College of Arts & Sciences
Department of Economics

13 March 2020

Dear Colleagues,

I'm writing to recommend **Nils Lehr,** a BU economics PhD student and advisee of mine, for admission to the NBER's 2020 Entrepreneurship Bootcamp. **Nils would be an ideal choice for your program.**

Nils' research agenda is active and tied directly to entrepreneurship and innovation. In his main research project so far, Nils tackles an ambitious question while simultaneously bringing something new to the conversation. He asks whether the aging of the US population matters for income and growth at the macro level. Now, due to the magnitude of the recent shifts in US population dynamics, papers on the consequences of demographic decline are sprouting up quite frequently in macro. Nevertheless, Nils' analysis is novel in this space. From an entrepreneurship perspective, understanding the sources and consequences of declining growth and dynamism in the US economy is of course crucial.

In addition to empirical work described further below, Nils emphasizes an interesting theoretical possibility. After a population growth decline, the share of young within the population will fall during an aging process. The young, with longer horizons than the old, may be more willing to spend the time, effort, and resources to adopt new technologies. So with a graying population, macro productivity may decline both in a static/levels sense (with less adoption of new technologies today, and hence lower productivity today) and in a dynamic/growth sense (because the creators of new technologies anticipate lower adoption in future, and invest less in the creation of new technologies). The natural predictions are that economic growth rates, investment rates, and innovation rates should decline with the aging of the population.

The key insight Nils adds to the existing literature here is that demographic shifts may matter not only because of changes in the growth of the overall size of the population, which is the typical focus of other papers in this area, but also purely through an age composition effect on technology adoption. Nils' theoretical analysis demonstrates an ability to craft clean, intuitive models sharply focused on a single insight and delivering robust predictions about his central questions.

Nils did not stop at simply proposing this new theoretical idea. In his paper, he pushes forward with first rate empirical execution. The empirical portion of his paper splits into two components. Initially, he adopts the Current Population Survey special questions on computer usage for a case study. Adoption of computers in the workplace is heterogeneous across age groups, declining relatively strongly with age. This set of evidence, while suggestive, is mostly descriptive. I'd like to note that I don't usually have the opportunity to engage with my empirical macro students on the subtleties of age-cohort-time identification challenges, but I was pleased to see after pushing him on this that Nils is entirely on top of these details in a way that speaks well of his broader

applied toolkit and instincts. He is careful not to overclaim based on these descriptive technology adoption patterns.

After studying technology adoption, Nils moves on to the second step of his empirical analysis, which seeks to understand whether aging causes declining investment and innovation. Exploiting commuting zone-level variation in historical fertility rates, Nils instruments for the age composition of these locations in recent years. Mapping industries, which have a slow-moving geographical distribution, to locations, Nils then constructs a derived instrument for industry-level worker age compositions. The key identifying assumption is that, conditional upon a rich set of disaggregated trends and fixed effects, historical variation in fertility rates across decades is uncorrelated with recent fluctuations in a local industry's incentives to innovate or invest. The resulting IV regressions reveal that historical local fertility fluctuations are powerful predictors of industry age composition in industries recently, and that a younger workforce appears to cause higher tangible and intangible/innovative investments at the industry level.

Taken together, Nils' paper demonstrates good judgement along three dimensions. He chose to attack an important question. He also chose to investigate this question with a novel theoretical idea, cleanly implemented. And, finally, he chose to implement a set of direct empirical tests of his mechanism using disaggregated variation. To my mind, this is a winning combination, and the results speak well to both this paper's potential impact as well as to Nils' future as an applied macro researcher.

In his first two years at BU, Nils has already made a deep impression on our macro group. His second-year paper, tightly focused on innovation, won our department's paper prize by general acclaim, and he's well known in our department as a top independent researcher, research assistant, and teacher.

Based on my experiencing teaching him in multiple PhD courses and advising him on subsequent research projects, I have little doubt that he will be a prepared, engaged, and creative participant in your camp.

Because of Nils' strong existing research, his engaged participation in our macro group, and his exciting agenda in the area of innovation and entrepreneurship, **I am pleased to strongly recommend Nils for your bootcamp.**

Best,



Stephen J. Terry