Johan Moen-Vorum
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January 27, 2023

Application for the NBER Innovation Research Boot Camp

Dear Professors Bryan, Ganguli, and Myers,

I am writing to submit my application for the NBER Innovation Research Boot Camp. The application contains my curriculum vitae, a list of all my current and completed PhD courses, and a one-page essay describing my current and future research and my reasons for wanting to attend the boot camp. A recommendation letter will be provided by

Joseba Martinez
Assistant Professor of Economics
London Business School
jmartinez@london.edu

Best wishes,
Johan Moen-Vorum

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EDUCATION

2019 – **London Business School**, *Department of Economics*
Ph.D. in Economics

2015 – 2016 **Cornell University**, *School of Operations Research and Information Engineering*
M.Eng. in Operations Research

2012 - 2015 **INSA de Toulouse,** *Génie Mathématique et Modélisation*
B.Sc. in Mathematical Modeling

EMPLOYMENT

2018 – 2019 **Norges Bank,** *Norges Bank Research*
Junior Researcher

2016 - 2018 **Acando,** *Digital Strategy & Transformation*
Management Consultant

WORKING PAPERS

A Long Run Anatomy of Task Exposures to Technology (w/ Joseba Martinez)
Private and Social Returns to Pharmaceutical Innovation

PRESENTATIONS

2022 Symposium of the Spanish Economic Association (Valencia), EEA Annual Congress (Milan), Tilburg Growth, Trade and International Finance Conference (Tilburg)

OTHER ACTIVITIES

2021 Doctoral Student Workshop on Economics of Artificial Intelligence, *NBER*

FELLOWSHIP AND AWARDS

2019 Norges Bank PhD Scholarship

JOURNALS REFEREED FOR

Review of Economic Studies, Management Science

LANGUAGES: Norwegian (native), English (fluent), French (fluent), German (basic)

CURRENT AND COMPLETED PHD COURSES

2022	Economics of Ideas, Science and Innovation, PhD Short Course (Institute for Progress)
2021	Firm Dynamics and Economic Growth (University of Chicago)
	Economic Growth and Comparative Development (Brown University)
	Foundations of Business Research
	Topics in Econometrics
	Machine Learning
	The Economics of Industry (London School of Economics)
2020	Macroeconomics II
	Microeconomics II
	Econometrics II
	Topics in Macroeconomics
	Topics in Microeconomics
	Topics in Econometrics
	Financial Economics I/Asset Pricing
2019	Macroeconomics I
	Microeconomics I
	Econometrics I

Note: all courses are taken at London Business School unless otherwise is specified

I entered economic research to study the drivers and consequences of technological change. I find this topic important because of today's rapid technological progress and its potential to generate benefits for society. Following is a description of my current and future research and my motivation for attending the Innovation Research Boot Camp.

In the paper "Private and Social Returns to Pharmaceutical Innovation", I study how the patent term affects the direction of pharmaceutical R&D. While the patent term provides the inventor a limited window with monopoly rents, society can potentially benefit from treatments in perpetuity. In this paper, I propose a novel method for quantifying the wedge between the private and social returns to R&D for individual medical conditions. This wedge depends on the duration and severity of conditions, and I document large heterogeneities in the wedge across the 100 most common medical conditions in the US. To study its implications for R&D, I first develop a novel text-based methodology to measure the patenting intensity per medical condition in the United States between 1990 and 2019. Using WHO estimates of the impact of these conditions on the US population, I find that the elasticity of R&D is larger for high mortality, rather than chronic, conditions. Correcting for the wedge, I find this bias towards mortality is due entirely to the gap between private and social returns. These estimates contrast with recent demographic trends in the US. Over the last 30 years, there has been a shift in the disease burden from away mortality to years of life lost due to time spent in poor health. There thus seems to be a mismatch between the realized R&D of the pharmaceutical industry and the needs of society. Going forward, I seek to estimate the size of the implicit subsidy towards mortality and explore policy responses to the distortion.

In a paper co-authored with Joseba Martinez (London Business School), we study the long-run effects of technological progress on the creation and destruction of work in the US economy. To this end, we develop a novel methodology to measure the invention and diffusion of task-relevant technologies. First, we measure the relevance of US patents introduced from 1920-2018 to work tasks performed by human workers using a natural language processing algorithm. After controlling for the confounding effects of the evolution of language, we obtain a measure that we call the task relevance of newly introduced technology. In a local projections framework, we estimate the impulse response of hours worked, industry labor share, and productivity to technological innovations. We identify two technological factors that have opposing effects on workers and industries: a manual-biased factor, which decreases hours and the labor share and has no effect on productivity; and a cognitive-biased factor, which increases hours and productivity, and has no effect on the labor share. Going forward, we aim to disentangle the contribution of different technologies to these factors and explore the implications of recent technological progress for productivity and economic growth in the future. Earlier versions of the paper were presented at the NBER Summer Institute in 2020 and at the SED in 2021.

I consider the Innovation Research Boot Camp a unique opportunity to develop my research agenda on the economics of innovation, make new acquaintances, and potentially form new collaborations. I am particularly excited by the prospect of attending Heidi Williams' lecture. Her research on the drivers of innovations in healthcare markets is highly relevant to my own research. Similarly, I consider Kevin Bryan's work on directional inefficiencies in R&D to be closely related to my work on pharmaceutical innovation. I hope you will look favorably upon my application.

Thank you for your time and consideration.

Joseba Martinez
Assistant Professor of Economics
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Dear Colleague,

Recommendation letter for JOHAN MOEN-VORUM

It is with great pleasure that I recommend Johan Moen-Vorum to the Innovation Research Boot Camp 2023.

I know Johan very well. He is a PhD student in economics at London Business School (I am one of his supervisors), and my co-author on our joint work *A Long-Run Taxonomy of Task Exposures to Technology*.

Johan is a talented researcher who has found his academic passion in research at the intersection of economics, technology, and innovation. He came to LBS with a very solid foundation of analytical and mathematical skills coupled with advanced programming skills. In his time here he has developed rapidly as an economist and researcher. In particular, he has developed advanced expertise in applications of NLP algorithms to economic questions, applied both in our joint work and in his interesting and promising paper, *Private and Social Returns to Pharmaceutical Innovation*.

In his solo-authored paper, Johan studies the effect of the patent system, particularly the duration of patents, on the direction of pharmaceutical R&D. More broadly, he is after an empirical measure of the wedge between private and social benefits of innovation arising from innovators' ability to capture a fraction of rents. As he argues convincingly, pharma R&D is a very good field in which to study this broad question. The paper is very creative and in it Johan combines techniques from a number of literatures: shift-share instrumental variables regression, text similarity methods to create measures of R&D intensity and theoretical models from the health economics literature. My assessment and that of my colleagues at LBS is that in its fully realized form, Johan should aim for a top 5 publication with this paper.

I think Johan would benefit enormously from attending the bootcamp, particularly because the LBS PhD program is small, as is the broader community of junior researchers working on the economics of innovation in London. Equally, I think his fellow attendees would benefit from Johan's participation: he is deeply knowledgeable, personable, and eager to participate in research discussion and collaboration.

In summary, I recommend Johan very highly to the Innovation Research Boot Camp. Please do not hesitate to call or email if you have any further questions.

Yours sincerely,



Joseba Martinez

Assistant Professor of Economics, London Business School