Yuan Hu

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February 5, 2025

Application for the NBER Innovation Research Boot Camp 2025

Dear Sir or Madam,

My name is Yuan Hu and I am writing to register my interest in the NBER Innovation Research Boot Camp 2025. I am currently pursuing a Ph.D. in Economics at Imperial College Business School under the supervision of Prof. Jonathan Haskel and Dr. Esther Boler. Since 2017, I have also been working closely as research assistant and collaborator with Professor Saul Estrin at the London School of Economics.

My research interests lie in the economics of innovation and science. Currently, I focus on green technology and inventors. My ongoing project, featured in the CEPR VoxEU talk *The next generation from the PSE-CEPR Policy Forum 2024*, studies how Hurricane Katrina — the costliest and one of the deadliest storms in U.S. history — shaped inventors' technological direction, specifically influencing green and non-green innovation. Using hazard and patent data for US inventors in a difference-in-differences design, I find that the hurricane significantly reduced the production of green patents, while leaving non-green patents unaffected. This highlights the particular vulnerability of green innovation to disruptive events, likely due to its reliance on greater knowledge diversity and larger technological distance in specialized expertise among research team members. For more details on this study, please refer to my one-page essay, or view my interview (https://cepr.org/multimedia/next-generation-pse-2024).

Moving forward, I aim to expand my research focus to investigate how scientists create green scientific knowledge and how this knowledge translates into technological developments that address climate and environmental challenges. Additionally, I have two research projects that explore factors influencing firms' innovation performance in emerging markets – One published in *PLOS One*, and the other under its third review in *Journal of Management Studies*. More details are available in my one-page essay.

Despite having attended the NBER Entrepreneurship Boot Camp in 2022, I am eager to participate in this Innovation Boot Camp as my research interests have evolved from entrepreneurship and innovation to innovation and science. This program perfectly aligns with my current research interests and provides a valuable opportunity to develop and refine my ideas alongside leading experts in the field. In particular, I am excited about engaging with course instructors whose cutting-edge research has advanced our understanding of scientists and inventors: Pierre Azoulay and his co-authors find that scientists from outside fields are more likely to enter and succeed, following the loss of a star scientist; Ina Ganguli's research reveals the determinants of scientist mobility and demonstrates how scientist immigration facilitates knowledge diffusion; Kyle Myers's work underscores the substantial funding required to induce a scientist to change their research direction by a small amount; John Van Reenen and his collaborators have uncovered a significant causal effect of early-life exposure to innovation on the probability of becoming an inventor.

I believe my participation in the Boot Camp would not only introduce fresh perspectives to my work, but also contribute to discussions on green innovation, which is crucial for facilitating the green transition and promoting sustainable development, especially in the face of the escalating challenges posed by climate change.

Please find enclosed my curriculum vitae, a one-page essay stating my present and future research, as well as motivation for this application. For any questions, please feel free to contact me at the number and email address listed above. Thank you for considering my application. I look forward to hearing from you.

Yours sincerely,
Yuan Hu

Reference

Jonathan Haskel

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Yuan Hu

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Education

2018 – to date	**Imperial College London**
	Ph.D. Economics, Business School
2015 – 2017	**London School of Economics**
	M.Sc. Economics (two-year programme)
2011 – 2015	**Peking University**
	Bachelor in Economics, The National School of Development
	Bachelor in Korean Language and Culture, The School of Foreign Languages

Completed PhD courses

2022 Autumn	**Institute For Progress**
	Economics of Ideas, Science and Innovation
2019 – 2020	**London School of Economics**
	Macroeconomics for Research Students, Political Economy for Research Students, Labour Economics for Research Students
2018 – 2019	**Imperial College Business School**
	Microeconomics, Econometrics 1, Econometrics 2, Corporate Finance, Empirical Corporate Finance, Data Analysis Tools, Entrepreneurship, Innovation Management

Research Interests

Economics of Innovation, Green Innovation and Sustainability, Environmental Economics, Development Economics

Publications

[1] Agglomeration Costs Limit Sustainable Innovation in Cities in Developing Economies (with Saul Estrin, Daniel Shapiro and Peng Zhang), *PLOS One*, 2024

Working Papers

[1] Knowledge Diversity and Innovation Resilience: Green Technological Change After Natural Disasters

[2] Exporting Modes as Learning Strategies of African Firms: The Moderating Effect of Absorptive Capacity (with Saul Estrin and Lilac Nachum), under third review *Journal of Management Studies*

Work in Progress

[1] Path Dependency for Inventors? Evidence from Green vs Non-Green Innovation

[2] Individualism and Green Innovation (with Saul Estrin)

[3] The Role of Institutions in Shaping the Relationship Between Agglomeration and Innovation in Emerging Markets (with Saul Estrin, Daniel Shapiro and Peng Zhang)

[4] GVC Participation as a Venue for Firms' Upgrading? Towards a Theory of Capability Development via Global Integration (with Saul Estrin and Lilac Nachum)

Seminars, Workshops and Conferences

2025	Northwestern Kellogg (CSSI), Rotterdam School of Management;
2024	LSE PRINZ/POID seminar, PSE-CEPR Policy Forum 2024 (Organized by Esther Duflo), Columbia University Ph.D. Workshop in Sustainable Development, Tenth ZEW/MaCCI Conference on the Economics of Innovation and Patenting, Naples School of Economics: 3rd PhD and Post-Doctoral Workshop, AOM The Organisation of Science PDW, AOM Technology and Innovation Management (TIM) Division Doctoral Student Consortium, AOM Strategic Management (STR) Division Dissertation Consortium: The Job Market and Beyond, DRUID24, 13th Oxford Residence Week for Entrepreneurship Scholars;
2023	12th Oxford Residence Week for Entrepreneurship Scholars, Imperial College Business School Economics & Public Policy Department Internal Seminar, Essex Paper Development Workshop for Early Career Scholars on Innovation, Technology and R&D Management;
2022	NBER Entrepreneurship Research Boot Camp, NBER Summer Institute Entrepreneurship, 11th Oxford Residence Week for Entrepreneurship Scholars;
2021	PhD Research Day in Strategy, Entrepreneurship and Innovation organised jointly by The Business School, City, London Business School and Imperial College Business School;
2020	American Economic Association (AEA) Annual Meeting

Research Assistant

2017 – to date	**London School of Economics**
	Prof. Saul Estrin

Teaching Assistant

2022 – 2023	**Imperial College Business School**
	Dr. Sam Asher
	Analytics for Applied Economics and Business (MSc Level)
2021 – 2022	**Imperial College Business School**
	Prof. Ralf Martin
	Analytics for Applied Economics and Business (MSc Level)

Professional Service

2023 – to date Oxford Residence Week for Entrepreneurship Scholars
Assistant to organisers Prof. Saul Estrin, Prof. Maryann Feldman and Prof. Janet Bercovitz

Honours and Scholarships

Imperial College Business School

2018 – to date Graduate Teaching Assistant Scholarship

Peking University

2014 Hana Financial Group Scholarship

2013 National Scholarship from The Ministry of Education of China

Languages

Chinese (native), English (fluent), Korean (fluent), German (basic)

IT Skills

Stata, R, Matlab, Python, LaTeX, Microsoft Office

My current research centers around innovation, as it is crucial to addressing climate and environmental challenges, boosting economic growth and improving living standards. Particularly, I am interested in what could inspire or hinder the creation of new technological and scientific knowledge, with a focus on individual inventors and green innovation which combats climate change and facilitates sustainable development.

In my ongoing project featured in the episode at CEPR VoxEU talk – The next generation: PSE 2024 (https://cepr.org/multimedia/next-generation-pse-2024), I study how disruptions to knowledge production – such as natural disasters – shape technological direction at the inventor level. Climate change will lead to more destructive events like hurricanes that disrupt knowledge creation, yet these disasters may also raise inventors' environmental awareness and spur green innovation. Focusing on Hurricane Katrina, one of the costliest and deadliest storms in the United States, this work studies its effects on both green and non-green innovation. Using hazard and patent data for US inventors in a difference-in-differences design, I find that Hurricane Katrina reduced inventors' production of green patents, while non-green patents were unaffected. The distance in technological expertise among inventors within a research team (knowledge diversity) is greater in a green innovation team, which likely makes it more difficult to substitute for an affected inventor and continue their technological tasks, thus hindering the development of green technology. The negative impacts of Katrina are more pronounced for patents produced by teams with greater technological distance, and for inventors with more technologically distant collaborators before Katrina. These results suggest that climate change, particularly through natural disasters, can disrupt human efforts to address it. Moreover, knowledge diversity may reduce the resilience of technological development in the face of such disruptions.

Moving forward, I aim to investigate whether path dependence — where past advances in a technology sector facilitate further advances in the same sector — applies to individual inventors' innovation trajectories in green versus non-green innovation. Building on past literature and my current project, I consider green innovation as a sector drawing on a broad range of technological areas, while non-green innovation relies on more specialized, narrow knowledge bases. I am also interested in whether collaborators of inventors affected by Katrina were more likely to engage in green innovation. I would like to submit the green innovation papers to top economics journals, e.g., American Economic Review (AER). Beyond inventors and green technology, I plan to expand my research agenda to include the economics of science. Specifically, I aim to explore how scientists generate green scientific knowledge that supports green technology and how this knowledge translates into practical solutions for environmental and climate challenges.

Additionally, I have two research projects that explore factors influencing firms' innovation performance in emerging markets. The first, published in *PLOS One*, shows that in developing countries, innovation initially rises with urban economic density but then declines — most sharply in the largest cities. This contrasts with developed countries, where agglomeration benefits outweigh costs, suggesting that policies from developed contexts may not translate well to developing ones. The second project, currently under third review in *Journal of Management Studies*, finds that African firms pursuing combined direct and indirect export strategies innovate more than those using a single strategy. These findings challenge the global value chain (GVC) model as a growth driver for African firms, contrasting with East Asian studies where GVC participation under global brands is viewed as the key mechanism for learning.

I am eager to participate in the Innovation Research Boot Camp for three compelling reasons. Firstly, the resonance between this program and my research agenda provides an invaluable opportunity for inspiration and the development of my research work. The lecture instructors are experts on science and innovation, including Pierre Azoulay, Ina Ganguli, Kyle Myers and John Van Reenen who have produced prominent work on scientists and inventors. I also look forward to attending the NBER Summer Institute Innovation Policy meeting to learn more about frontier research. Secondly, I am well-qualified for this program, with a solid foundation in economics built over a decade. This journey spans from undergraduate lectures at Peking University to master courses at LSE and Ph.D.-level training at Imperial and LSE. Thirdly, I believe my participation in the Boot Camp would introduce novel perspectives, particularly in the realm of green innovation. Understanding the factors that encourage green innovation is crucial for facilitating the green transition and promoting sustainable development, especially in the face of the escalating challenges posed by climate change.

Imperial College Business School

Imperial means Intelligent Business

Wednesday, 29 January 2025

Brett Maranjian, NBER, by email.
Innovation bootcamp
maranjian@nber.org

Dear Brett,

RE: Yuan HU

I've been asked to write a short letter in support of Yuan HU.

Yuan is a PhD student at Imperial College Business School, Imperial College London. As you will have seen from her application, she has been at the college since 2018. I have been her part-time supervisor since then.

Yuan is a diligent and hard-working student whose time on her PhD has been significantly affected, like others, by COVID. She's completed a number of interesting studies for her PhD. She's a strong applied economist who has applied frontier econometric techniques to a number of distinct areas, with the main focus being on economics around innovation. She's developed a strong interest in green innovation, and uses various techniques to analyse patents to distinguish between green and non green patents.

You will see from her CV that she has a number of projects completed and in train. Yuan has a co-authored paper which has already been accepted, at PLOSOne, on the benefits of agglomeration externalities in developing countries.

In one of her chapters, Yuan uses USA state data to study whether investment rates change in a US state when there is a unified government (that is, the same party controlling both executive and legislature) rather than a divided government.

Her job market paper uses information on the location of patentees to try to work out whether, controlling for other factors, Hurricane Katrina changed the nature of innovation. She splits her innovation into “green” or not and finds stronger negative effects on green patenting. An important finding is that green innovation seems to need more “dispersed” teams. Scientists on green innovation patents are likely, it seems in the data, to be in a more technologically distant team. This might mean that the patenting such teams are more vulnerable to shocks hitting part of the team.

She has applied for the innovation bootcamp having done the entrepreneurship bootcamp in 2022. She understands that she will provide a note regarding this in her application.

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I'm happy to recommend her most warmly for the Bootcamp.

I hope this is helpful.

Yours



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