February 5, 2025

Dear NBER Innovation Research Boot Camp Team,

I am writing to apply for the 2025 NBER Innovation Research Boot Camp. My name is Nicola Melluso, and I am currently a postdoctoral researcher at KU Leuven. My background is somewhat non-traditional for an economist: I earned my Ph.D. in business engineering two years ago, focusing on artificial intelligence and computational linguistics, and subsequently transitioned to economics.

My first publication in economics, co-authored with Sam Arts and Reinhilde Veugelers, has just been published in the *Review of Economics and Statistics*.

In the fall of 2025, I will begin a visiting appointment at MIT Sloan in Boston, hosted by Pierre Azoulay, where I hope to further develop my contributions to the economics and management of innovation.

Reinhilde Veugelers, my co-author and mentor, has written a letter of recommendation in support of my application. Enclosed with this letter, please find my curriculum vitae (including a list of my Ph.D.-level coursework) and my one-page essay describing my current and future research. I have not previously attended the NBER Entrepreneurship Research Boot Camp.

Thank you for your consideration.

Sincerely,

Nicola Melluso
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Current and future research

Nicola Melluso

Scientific progress, while driven by the pursuit of knowledge, is deeply shaped by the actions and norms of the scientific community (Dasgupta & David, 1994; Merton, 1973). A key aspect of this social dynamic is the competition among researchers for recognition and priority, which has profound implications for the trajectory of research. While recent work (e.g., Hill and Stein (2025a, 2025b)) has renewed interest in how these competitive pressures drive researchers to be *first* to a discovery—the race for priority—less attention has been paid to what happens *after* a discovery is made. A major discovery can reshape a field—leading to the emergence of new subfields, communities, conferences, journals, and parallel research agendas (Azoulay et al., 2019). Often, one group is credited, yet there are many cases where multiple independent teams receive shared recognition (Merton, 1961). When this occurs, each team may advance its own distinct line of research, raising a critical question: does post-discovery *competition for recognition* accelerate scientific advances, or does it fragment the field and slow further advances?

My research explores this critical question, examining whether shared credit for a discovery ultimately accelerates or impedes subsequent scientific advances. My aim is to adopt a quasi-experimental approach focusing on scientific prizes jointly awarded to multiple teams for the same discovery. Such shared recognition marks a critical turning point: once hailed as "superstars," the recognized scientists often shape the *formalization* of fields by championing distinct communities and establishing conferences, journals, and associations (Azoulay et al., 2010). Although formalizing a field is generally seen as beneficial for scientific progress (Stephan, 2012), it remains unclear whether parallel—and potentially *competing*—communities stimulate richer debate or instead delay subsequent novel discoveries[1]. By comparing cases where a discovery leads to *one* unified community versus *multiple* competing ones, I will test whether post-discovery competition accelerates or fragments scientific progress.

In my research, ideas serve as the primary unit of observation. They appear not only in academic papers but also in the names and descriptions of associations, conferences, and specialized journals, making them a powerful lens for tracking the formalization of the field around them (Kuhn, 1970). To empirically determine the impact of shared credit, and thus *competition for recognition*, I will compare the evolution of research fields where a given scientific idea was recognized with shared prizes to those where it was attributed to a single team, analyzing differences in the development of subsequent ideas, publications, funding, and patents. The first phase of this research has already been completed and published in the *Review of Economics and Statistics* (Arts et al., 2025). In this paper, I developed a novel method employing natural language processing to track the emergence and diffusion of scientific ideas. With this method, I can trace how ideas spread across a variety of scientific outputs, from publications to documents related to academic associations and conferences.[2]

Attending this boot camp is vital for my research purpose, as it offers a unique, hands-on integration of foundational theories (from Kuhn to Merton) and modern frameworks (from Azoulay to Hill & Stein). No other program provides such close engagement with the very scholars whose work underpins my studies. Coming from a computational social science background rather than a traditional economics training, I especially value the opportunity to deepen my theoretical grounding here. In fall 2025, I will begin a visiting appointment with Pierre Azoulay at MIT Sloan, and this boot camp will serve as a crucial bridge—ensuring I can fully capitalize on that collaboration. My research agenda will inevitably evolve through the exchange of ideas and methods, and I am ready for that recalibration, trusting that this boot camp will sharpen my work in ways no other experience could.

[1] Notable examples include shared Nobel prizes for works on cosmic radiation, radio astrophysics, magnetic resonance imaging or the recent CRISPR gene editing. All of these shared prizes between independent teams led to competing associations, conferences and publication venues.

[2] For example, in 1965, the Nobel Prize in Physics recognized parallel work on "cosmic microwave" and "background radiation." Shared credit went to two independent teams, prompting the rise of competing associations named after the recognized ideas: the "Cosmic Microwave Foundation" and the "Background Radiation Society."

References

Arts, S., Melluso, N., & Veugelers, R. (2025). Beyond citations: Measuring novel scientific ideas and their impact in publication text. *Review of Economics and Statistics*.

Azoulay, P., Fons-Rosen, C., & Graff Zivin, J. S. (2019). Does science advance one funeral at a time? *American Economic Review*, *109*(8), 2889–2920.

Azoulay, P., Graff Zivin, J. S., & Wang, J. (2010). Superstar extinction. *The Quarterly Journal of Economics*, *125*(2), 549–589.

Dasgupta, P., & David, P. A. (1994). Toward a new economics of science. *Research Policy*, *23*(5), 487–521.

Hill, R., & Stein, C. (2025a). Race to the bottom: Competition and quality in science. *(Accepted) Quarterly Journal of Economics*.

Hill, R., & Stein, C. (2025b). Scooped! estimating rewards for priority in science. *Journal of Political Economy*, *133*(3), 000–000.

Kuhn, T. S. (1970). *The structure of scientific revolutions* (3rd). University of Chicago Press.

Merton, R. K. (1961). Singletons and multiples in scientific discovery: A chapter in the sociology of science. *Proceedings of the American Philosophical Society*, *105*(5), 470–486.

Merton, R. K. (1973). The normative structure of science. In R. K. Merton (Ed.), *The sociology of science: Theoretical and empirical investigations*. University of Chicago Press.

Stephan, P. (2012). *How economics shapes science*. Harvard University Press.

Nicola Melluso

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Current Position

KU Leuven 2023 – Present
Post-doc *Leuven, Belgium*
Promoters: Sam Arts, Reihnilde Veugelers

Education

University of Pisa 2019 – 2023
PhD in Business Engineering, Summa cum Laude *Pisa, Italy*
Supervisor: Andrea Bonaccorsi

University of Pisa 2012 – 2018
BSc and MSc in Business Engineering *Pisa, Italy*

Visiting Appointments

MIT Sloan Fall 2025
Promoter: Pierre Azoulay *Boston, USA*

Copenhagen Business School 2022
Promoter: Valentina Tartari *Copenhagen, Denmark*

KU Leuven 2022
Promoter: Sam Arts *Leuven, Belgium*

Publications (Peer-Reviewed)

- Arts, S., **Melluso, N.**, & Veugelers, R. (2025). Beyond Citations: Measuring New Scientific Ideas in Publication Text. *Review of Economics and Statistics*. https://doi.org/10.1162/rest_a_01561

Working papers

- *High-Risk/High-Reward in Scientific Impact: Myth or Reality*. Single author paper. *Submitted* to *Research Policy.*
- *New Scientific Ideas and their Technological Impact.* with Sam Arts. Target journal: *Strategic Management Journal.*
- *Unexpected discovery? The role of Organizational Shortcuts* with Gino Cattani and Mariano Mastrogiorgio. Target journal: *Administrative Science Quarterly.*

Completed PhD-level Courses

- *Microeconomic Theory.* **KU Leuven**. 2023.
- *Advanced Applied Econometrics.* **KU Leuven**. 2023.
- *Economics of Science and Innovation.* **KU Leuven**. 2023.

- *Computational Economics.* **KU Leuven**. 2023.
- *Causal Machine Learning.* **KU Leuven**. 2022.
- *Advanced Strategic Managament.* **Copenaghen Business School**. 2022.

Teaching Activities

- "New Product Development" (Bachelor - University of Pisa):
  (20h/year)
  Academic years: 2020-2021, 2021-2022.
- "Causal Machine Learning for Economics" (PhD level - KU Leuven)
  (10h/year)
  Academic years:2023-2024.

Invited Talks/Seminars

- *Scientific Novelty, Complexity and Risk*. Seminar Series. UNU-MERIT, University of Maastricht (Netherlands). April 2024.
- *Scientific Novelty, Complexity and Uncertainty: What Makes Science Risky?*. Seminar Series. LUISS. Rome (Italy). April 2024.
- *New Text-Based Indicators for Measuring Scientific Novelty*. "Creativity, Science and Innovation" Seminar Series. BETA, Faculté des Sciences Economiques et de Gestion de Strasbourg (France). March 2024.
- *New Methodologies for Science and Technology Indicators*. SIRIS Academic Lab. Barcelona (Spain). October 2023.
- *Tracing the Endless Scientific Frontier from Publication Texts.* Politecnico di Milano. Milan (Italy). June 2023.
- *Natural Language Processing and Design Cognition.* Politecnico di Milano. Milan (Italy). May 2021.

Grants

- *The Anatomy of Risk in Science (ARISE)* (250,000 €). Project funded under the Horizon Europe Program (2024).

Research Initiatives

- Junior member of the Business Engineering for Data Science Lab (B4DS) an interdisciplinary laboratory at the University of Pisa that focus on research of the application of data science for business (http://b4ds.unipi.it/)

Thesis Supervision

- 23 Thesis Supervision
  - **KU Leuven**: 14 Master Students of Business Management
  - **University of Pisa**: 3 Master Students of Engineering Management; 2 master students of Business Economics; 3 bachelor students of Computer Science; 1 student of the II level master "Industry 4.0 design"

Conference Presentations

- Summer School in Science & Technology Indicators. 2024. Antwerp (Belgium). *"Scientific Complexity and Uncertainty"*.
- Summer School in Economic Fitness and Complexity. 2024. Maastrich (Netherlands). *"Scientific Complexity and Uncertainty"*.
- DRUID. 2024. Nice (France). *"Scientific Complexity and Uncertainty"*.
- Workshop on the Organisation, Economics and Policy of Scientific Research 2024 (WOEPS2024). Turin. *"Scientific Complexity and Uncertainty."*
- National Bureau of Economic Research (NBER). Summer Institute 2023. Science of Science Funding. 2023. Boston. *"Tracing the Endless Scientific Frontier in Publication Text"*
- Workshop on the Organisation, Economics and Policy of Scientific Research 2023 (WOEPSR2023). Munich. *"Tracing the Endless Scientific Frontier in Publication Text"*
- Early-career Research Policy Conference. 2023. Online. *"How easy (or difficult) is it to develop a novel technology? Evidence from language network evolution"*
- DRUID. 2023. Lisbon. *"Tracing the Endless Scientific Frontier in Publication Text"*
- REGIS Summer School. 2023. Pisa. *"Tracing the Endless Scientific Frontier in Publication Text"*
- INGENIO PhD Working Days. 2023. Valencia. *"Unveiling the Difficulty of Developing a Novel Technology"*
- R&D Management Conference. 2022. Trento. *"Fast Detection of Relationships between Technolo- gies and Skills: applying Text Mining to Unconventional Data Source"*
- Design Computing and Cognition Conference. 2022. Glasgow. *"The ABC (Af- fordance-Bias-Cognition) Reasoning of Product-Use Interaction: A Text Mining Approach"*
- Summer School on Science & Technology Indicators. 2022. Leuven. *"New Text Mining Techniques to Detect Novelty in Scientific Publications"*
- International Conference on Scientometrics and Informetrics (ISSI). 2021. Leuven. *"Detecting interdisciplinarity in top-class research via topic modeling"*
- R&D Management Conference 2019. Paris. *"Towards Automatic building of Human-Machine Conversational System to support Maintenance Processes"*