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February 10, 2026

Application to attend the NBER Innovation Research Boot Camp 2026

Dear Members of the Committee,

I am writing to apply to the fifth NBER Innovation Research Boot Camp. Currently, I work as a postdoc at EcoAustria – Institute for Economic Research in Vienna, aiming to build a new research section in data science. My research agenda, building upon my PhD at the University of Toulouse, sits at the intersection of machine learning, economic complexity, economic history, and policy-relevant empirical research.

Although my research agenda has not been framed primarily under the label of innovation economics, it is thoroughly concerned with the processes and outcomes that define the field. My work on estimating historical GDP per capita using machine learning and biographies of notable individuals is, at its core, a study of upper-tail human capital and its role in long-run economic development. My research on digital trade measures a central output of contemporary innovation: the cross-border flows of digital products such as cloud computing, streaming services, and generative AI. My contributions to economic complexity, including the integration of patent and publication data into multidimensional complexity metrics, directly connect to the literature on knowledge accumulation, technological relatedness, and the capabilities underlying innovation. I am now eager to connect this work more explicitly to the theoretical foundations and frontier questions in the economics of innovation.

A central motivation to apply to attend this boot camp has been the list of lecturers featured in the program. Back in 2023, I attended the International Conference on Science of Sciences and Innovation (ICSSI) in Chicago, where I had the opportunity to hear keynote lectures by Pierre Azoulay and Ben Jones, who are both listed as lecturers in this boot camp. I also had the honor of having Ina Ganguli on my PhD committee, whose research on migration and knowledge diffusion has been a direct influence on my own work. Their work left a strong impression on me and I am highly motivated to engage more systematically with their research as part of the boot camp.

Please find enclosed my CV, and a one-page essay describing my research and motivation in more detail. As my recommendation letter writer, I list my PhD advisor César A. Hidalgo, Professor at the Toulouse School of Economics. Thank you very much for your time and consideration. I would be delighted to attend and look forward to hearing from you.

Sincerely,



Philipp Koch, PhD

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Professional

Senior Researcher - Head of Data Science Jan. 2025 – Present
EcoAustria - Institute for Economic Research Vienna, Austria

Lecturer in Macroeconomics Oct. 2024 – Present
Vienna University of Economics and Business Vienna, Austria

Researcher Sep. 2022 – Dec. 2024
EcoAustria - Institute for Economic Research Vienna, Austria

Visiting PhD Student Sep. 2022 – Jan. 2023
Complexity Science Hub Vienna, Austria

Junior Researcher Aug. 2020 – Aug. 2021
EcoAustria - Institute for Economic Research Vienna, Austria

Intern Jul. 2019 – Dec. 2019
Austrian National Bank - Division for Economic Studies Vienna, Austria

Research Assistant March 2018 – Jul. 2020
EcoAustria - Institute for Economic Research Vienna, Austria

Lecturer in the Fundamentals of Economics Feb. 2018
Vienna University of Economics and Business Vienna, Austria

Education

PhD in Applied Mathematics Sep. 2021 – Oct. 2024
Center for Collective Learning, ANITI, Université de Toulouse Toulouse, France
Thesis: *Machine Learning for Economic History*
Supervisor: César A. Hidalgo

MSc in Economics (Science Track) Oct. 2018 – Jul. 2020
Vienna University of Economics and Business Vienna, Austria
Thesis: *Revisiting Economic Complexity using value-added exports*
Supervisor: Jesús Crespo Cuaresma

BSc in Psychology Oct. 2015 – Present
University of Vienna Vienna, Austria

BSc in Economics & Social Sciences Oct. 2014 – Jan. 2018
Vienna University of Economics and Business Vienna, Austria

Publications (peer-reviewed)

9. Hidalgo, C., Koch, P., Coll, E. & V. Stojkoski (2025). Trading Bits for Atoms: How Digital Products Are Reshaping the Global Economy. *Communications of the ACM, 68*, 34-36.

8. Schwarzbauer, W., Bittó, V., Koch, P. & J. Steininger (2025). Mapping CO2 emissions in Global Value Chains: Does a value-added smile curve imply an emissions frown curve?. *Structural Change and Economic Dynamics, 75*, 332-348.

7. Koch, P., Stojkoski, V. & C. A. Hidalgo (2024). Augmenting the availability of historical GDP per capita estimates through machine learning. *Proceedings of the National Academy of Sciences (PNAS), 121*(39), e2402060121.

6. Stojkoski, V., Koch, P., Coll, E. & C. A. Hidalgo (2024). The Growth, Geography, and Implications of Trade in Digital Products. *Nature Communications*, 15, 5262.

5. Koch, P., Stojkoski, V. & C. A. Hidalgo (2023). The Role of Immigrants, Emigrants, and Locals in the Historical Formation of European Knowledge Agglomerations. *Regional Studies*, *58*(9), 1659–1673.

4. Stojkoski, V., Koch, P. & C. A. Hidalgo (2023). Multidimensional economic complexity and inclusive green growth. *Communications Earth & Environment, 4*, 130.

3. Schwarzbauer, W., Koch, P. & M. Wolf (2022). Park & Ride facilities and suburban sprawl. *European Planning Studies, 30*, 7, 1378-1398.

2. Koch, P. & W. Schwarzbauer (2021). Yet another space: Why the Industry Space adds value to the understanding of structural change and economic development. *Structural Change and Economic Dynamics, 59*, 198-213.

1. Koch, P. (2021). Economic Complexity and Growth: Can value-added exports better explain the link? *Economics Letters, 198*, 109682.

Work in progress

Koch, P. & V. Bittó (2026). How AI adoption shapes export performance: Evidence from Austrian firms. *Building upon a FIW policy project for the Austrian Federal Ministry of Economy, Energy and Tourism.*

Koch, P. & A. Daoud (2026). Combining satellite imagery and data on famous individuals to predict socio-economic indicators in Africa.

Awards

2025: Best Parallel Talk Award at the 11th International Conference on Computational Social Science (IC2S2) at Linköping University, Sweden.

Talks, Conferences & Visits

2025: 11th International Conference on Computational Social Science IC2S2, Linköping University, Sweden; Annual Conference of the Regional Studies Association, University of Porto; Conference on Economic Complexity, University of Toulouse; Geoffrey J.D. Hewings Regional Economics Workshop, WIFO Vienna; 4th Conference on Robots and Automation - CORA, WU Vienna.

2024: Invited seminar speaker at IAST at the Toulouse School of Economics; Conference on Economic Complexity, Corvinus University Budapest; 7th Geography of Innovation Conference, University of Manchester; 16th FIW Research Conference International Economics; European Public Choice Society Conference, Vienna University of Economics and Business; Invited seminar speaker at the University of Pécs, Hungary.

2023: Invited speaker at the workshop on the Emergence of Innovation, University of Chicago; 2nd International Conference on the Science of Science and Innovation, Northwestern University; NetSci 2023, University of Vienna; Annual Meeting of the Austrian Economic Association (NoEG), Paris Lodron University Salzburg; 14th Geoffrey J.D. Hewings Regional Economics Workshop, WIFO Vienna; PhD Workshop on Mathematics and Statistics, Toulouse School of Economics.

2022: Seminar talk at the Complexity Science Hub, Vienna; WICK10 PhD Workshop in Economics of Innovation, Complexity and Knowlegde, Collegio Carlo Alberto, Turin; 13th Geoffrey J.D. Hewings Regional Economics Workshop, WIFO Vienna; 6th Geography of Innovation Conference, Bocconi University, Milan; International PhD Course in Economic Geography, University Utrecht.

2021: WIFO Research Seminar; 13th FIW Research Conference International Economics.

2020: Harvard Growth Lab Research Seminar.

Reviewing

I reviewed research articles for npj Urban Sustainability, The World Economy, Structural Change and Economic Dynamics, Energy Policy, Scientific Reports, Journal of Business Research, European Planning Studies, Applied Economics, and Empirica.

Media

My research has been covered in several media outlets: I was invited to talk about our PNAS paper on estimating historical GDP per capita on live radio (Ö1 Punkt Eins) and write a column for the Frankfurter Allgemeine Zeitung. Our research on historical migration has been covered in Danish newspaper Weekendavisen and the podcast The Geography of Everything.

Policy Reports (selected, german)

Koch, P. & N. Graf (2025). The impact of AI on Austria's economy. *Wirtschaftspolitische Blätter, Volume 2025.*

Graf, N., Koch, P. & M. Köppl-Turyna (2025). AI Revolution: Impact on and Chances for Austria. *Study commissioned by the Austrian Federal Chancellery.*

Bittó, V., Koch, P. & W. Schwarzbauer (2024). Future perspectives on Austria's export portfolio. *Study commissioned by the Austrian Federal Ministry of Labor and Economy.*

Bittó, V., Koch, P. & W. Schwarzbauer (2023). Considering the interdependencies between industrial policy, innovation policy and climate policy. *EcoAustria Policy Note 53.*

Schwarzbauer, W. & P. Koch (2021). On the significance of free trade and global value chains for Germany and Austria. *List Forum für Wirtschafts- und Finanzpolitik, 46*, 451-470.

Köppl-Turyna, M., Koch, P. & W. Schwarzbauer (2021). Estimating the insolvency backlog and the share of firms with long-term negative equity after COVID-19 in Austria. *Study commissioned by the Austrian Federal Ministry of Digitalization and Economy.*

Koch, P. & M. Köppl-Turyna (2021). Internationally mobile workforce: A new view on competitiveness. *EcoAustria Policy Note 47.*

Köppl-Turyna, M. et al. (2021). COVID-19 measures: International comparison of COVID-19 support measures given the country-specific importance of automatic stabilizers. *Study commissioned by the Austrian Federal Ministry of Finance.*

Thomas, T., Koch, P. & W. Schwarzbauer (2019). Thoughts on the regulation of digital platforms. *EcoAustria Policy Note 34.*

References

César A. Hidalgo
Professor and Director of CCL
Toulouse School of Economics
cesifoti@gmail.com

Jesús Crespo Cuaresma
Chair of the Department of Economics
Vienna University of Economics and Business
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Essay

Philipp Koch

Data and empirical research have long helped us to acknowledge, understand and address global challenges. However, many fundamental questions in social sciences and innovation are still limited by the available data. My research seeks to overcome these limitations by augmenting economic data using machine learning techniques.

My research agenda has two overarching goals. First, I intend to advance machine learning and data augmentation as key methods in social sciences, thereby expanding the scope of what can be measured and analysed across time, space and scale. The second goal is to connect the latent structures that are revealed by machine learning approaches, such as economic complexity, to economic theory.

During my PhD in Toulouse, we used machine learning techniques for both historical and contemporary research questions. In a paper published in PNAS [1], we developed a machine-learning method to estimate GDP per capita for hundreds of European and North American regions over the past 700 years, using biographical data on hundreds of thousands of notable individuals. This work is, at its heart, a study of upper-tail human capital as a driver of long-run economic growth. Famous individuals, from scientists, inventors, artists, to scholars, are the historical face of innovative activity.

Machine learning techniques are also useful to explore contemporary innovation outcomes. In a paper in Nature Communications [2], we constructed the first bilateral estimates of digital product trade – covering cloud computing, online advertising, streaming services, and related sectors – by applying machine-learning imputation to corporate revenue data. Digital products are among the most economically significant outputs of modern innovation, yet they remain essentially invisible in standard trade statistics.

The natural next step in my research agenda is to connect it more explicitly with the theoretical core of innovation economics. Economic complexity as a field has grown rapidly [3], but its links to models of endogenous growth, knowledge spillovers, and innovation policy remain underspecified. Early work by Fleming and Sorenson [4, 5], for instance, defined innovation complexity in terms of component interdependence – a framing that maps closely onto complexity-theoretic ideas, yet these connections have not been formally developed.

Current methods for measuring economic complexity, for instance, do not allow for a coherent intertemporal interpretation. Whether a patent class is considered complex is inherently relative to other patent classes in the same time period, but not to those in earlier periods. This raises concerns about both its interpretation and its use in econometric models. I am therefore working towards an absolute interpretation of economic complexity, closely tied to theoretical considerations.

To sum up, I want to bring my data-augmentation toolkit to bear on questions where innovation economics currently lacks granular evidence. I am convinced the NBER Innovation Research Boot Camp would provide the theoretical and empirical foundations I need to do this rigorously and would help me better understand the current frontier of the field. Moreover, I hope to find future collaborators among both junior and senior scholars during the week and to begin developing joint research ideas.

References

[1] Koch, P, Stojkoski, V, & Hidalgo, C. A. (2024), Augmenting the availability of historical GDP per capita estimates through machine learning. *Proceedings of the National Academy of Sciences* **121**, e2402060121.

[2] Stojkoski, V, Koch, P, Coll, E, & Hidalgo, C. A. (2024), Estimating digital product trade through corporate revenue data. *Nature Communications* **15**, 5262.

[3] Hidalgo, C. A. (2021), Economic complexity theory and applications. *Nature Reviews Physics* **3**, 92–113.

[4] Fleming, L & Sorenson, O. (2001), Technology as a complex adaptive system: evidence from patent data. *Research Policy* **30**, 1019–1039.

[5] Sorenson, O, Rivkin, J. W, & Fleming, L. (2006), Complexity, networks and knowledge flow. *Research Policy* **35**, 994–1017.

February 10, 2026

Dear Brett,

I am writing to offer my strongest support for **Philipp Koch's** application to the NBER Innovation Research Boot Camp.

Philipp is a brilliant and accomplished young economist working at the intersection of innovation economics, economic geography, and artificial intelligence. During his three-year PhD in France, he completed three papers, one of which he published as first author in *PNAS*, introducing a method to generate historical GDP per capita estimates for European regions dating back to the 1300s. He is now completing a study on the impact of AI on export performance among Austrian firms.

Having taught at Harvard and MIT for over a decade (and now at the Toulouse School of Economics), I can say with confidence that Philipp is in the rare top 1% of the talent distribution. At the same time, he is an extremely kind, helpful, and collegial person to have around. I am sure he will be an engaged and insightful participant in the boot camp.

Please do not hesitate to let me know if you have any questions.

Sincerely,

César A. Hidalgo
Professor, Toulouse School of Economics
Director, Center for Collective Learning
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CIAS, Corvinus University of Budapest