Dr Kathyrn R Fair

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Education

University of Waterloo

Waterloo, Canada

Ph.D., Applied Mathematics — *2020*

- Modelling resilience and sustainability of complex human-environment systems in agriculture and ecology (`http://hdl.handle.net/10012/15966`)

University of Guelph

Guelph, Canada

Honours B.Sc., Physical Science — *2014*

Teaching experience

School of Computing and Creative Technologies, University of the West of England

Bristol, UK

Lecturer in Data Science — *2025-*

- Deliver lectures and practical sessions across undergraduate, top-up, and Masters programmes in Data Science
- Supervise and mentor student group and individual projects, guiding the development of reproducible workflows, methodological rigour, and clear analytical narratives
- Provide structured guidance on project scoping, data acquisition, model selection, and result interpretation for students at multiple levels
- Contribute to assessment, ensuring alignment with programme learning outcomes and academic standards
- Offer academic advising and targeted feedback to strengthen students' quantitative skills, communication, and independent research capacity

Faculty of Law, University College London

London, UK

Honorary Fellow — *2025-*

- Developing executive education lectures on computational methods for lawyers and public policy professionals, including fundamentals of modelling, data analysis, and simulation with real-world policy examples
- Delivering these lecturers as part of UCL's Executive Programme on Competition, Technology, and Public Policy, and UCL's Continuining Professional Development course 'Computational Methods for Lawyers'

ADR UK/National Center for Research Methods

London, UK

Course developer and Instructor — *2025-*

- Co-developing a training course on applied data science using UK administrative datasets
- Leading the Python component with a focus on data wrangingling, reproducibility, data pipelines, and research applications (July 2025)

University of Waterloo

Waterloo, ON, Canada

Instructor — *2018*

- Instructor for first-year engineering calculus (MATH 118) within the Faculty of Mathematics
- Lectured and provided administrative support as an instructor to a class of 90+ students
- Revised and enhanced study materials to improve readability and student comprehension, including developing summary materials of key topics for pre-exam revision
- Coordinated within a team of instructors to deliver course material to a cohort of 800+ students

University of Waterloo

Waterloo, ON, Canada

Teaching assistant

2014-2020

- Teaching assistant for the Faculty of Mathematics and Department of Applied Mathematics
- Led seminars/tutorials with an interactive component, including introductory coding (Excel), facilitated marking, supervised undergraduate markers, and ran help sessions
- Performed this role across 8 courses, engaging with students from engineering, and the physical, biological, and social sciences to deliver content on calculus and mathematical modelling relevant to their disciplines

Research experience

School of Computing and Creative Technologies, University of the West of England

Bristol, United Kingdom

Lecturer in Data Science

2025-

- Develop and extend agent-based models of labour mobility, incorporating dynamic skill evolution, discrimination mechanisms, and stochastic job-creation/destruction processes
- Integrate calibrated sorting models with ABMs to study how skills, complementarities, and firm heterogeneity co-evolve under counterfactual policy scenarios
- Lead research on skills-based labour-market analysis, including RCA-based skill representations, similarity metrics, and their predictive value for occupational mobility
- Advance Bayesian network methods for causal inference in skill acquisition, with applications to policy evaluation and workforce-planning
- Produce policy-facing analytical outputs for national and regional stakeholders, leveraging large administrative data sources and multi-hour simulation pipelines
- Develop quantitative frameworks for evaluating labour-market interventions (e.g., hiring discrimination, skills shocks, technological change) using calibrated, multi-model simulation

Public Policy Programme, The Alan Turing Institute

London, United Kingdom

Senior Research Associate

2024-2025

- Led development of agent-based models of UK labour markets, analysing how hiring discrimination shapes skill acquisition trajectories and productivity outcomes.
- Led the design and implementation of Bayesian methods for causal inference of skill acquisition using directed acyclic graphs.
- Developed stochastic-process and network-science techniques to quantify the role of skills in predicting labour mobility in the United States.
- Co-designed analyses and interpretable models of informal labour, skill synergies, and firm dynamics using community-detection methods, machine learning, and information-theoretic tools.

The Department for Business and Trade, Government of the United Kingdom

London, United Kingdom

Data Science Academic Advisor

2024-2025

- Embedded role supporting skills and workforce modelling
- Adapt analyses of how skills facilitate labour mobility, developed at the ATI, to a UK context
- Support in-house use by DBT of the labour flow network model I developed at the ATI to generate evidence bases for policy
- Develop and deliver technical training on agent-based modelling

Public Policy Programme, The Alan Turing Institute

London, United Kingdom

Research Associate

2021-2024

- Developed an agent-based model of the UK labour market that emerges realistic patterns of labour mobility (`https://github.com/alan-turing-institute/UK-LabourFlowNetwork-Model`), developed with stakeholder input from DBT
- Developed and implemented in Python a stochastic method for emerging empirical age structures in agent-based models
- Hired and supervised graduate-level research assistants undertaking projects related to economic complexity and labour markets

School of Environmental Sciences, University of Guelph *Guelph, Canada*

Postdoctoral Fellow *2020-2021*

- Lead modelling of SARS-CoV-2 transmission in Ontario, Canada (`https://github.com/k3fair/COVID-19-ON-model.git`)
- Used simulations to retrospectively predict the impact of non-pharmaceutical interventions (NPIs) in mitigating transmission and COVID-19 deaths, and evaluate the impact of individual people's decisions to adhere to NPIs

Department of Applied Mathematics, University of Waterloo *Waterloo, Canada*

Graduate Research Assistant *2014-2020*

- Modelled global agri-food trade flows as dynamic networks to discover their relevant characteristics and gain insight into their response to shocks, with applications to food security
- Modelled forest-grassland mosaic ecosystem to explore how forest cover and spatial structure are impacted by disturbance regimes, focusing on climate change driven disturbances
- Modelled a trade-networked human metapopulation to explore the system's temporal evolution in the context of sustainability and equality
- Wrote a successful application for a Waterloo Gender Equity Grant; hired and supervised undergraduate research assistants for this project examining gender-pay gaps in Canadian academia

School of Environmental Sciences, University of Guelph *Guelph, Canada*

Undergraduate Research Assistant *2013-2014*

- Analysed global agri-food trade flows to explore their characteristics and temporal dynamics
- Formulated an agent-based model simulating the dynamics of forest-grassland mosaic ecosystems to explore the impact of human influence and potential conservation policy implementations

Publications

- Fair, K. R., & Guerrero, O. A. (2024). A Method for Emerging Empirical Age Structures in Agent-Based Models with Exogenous Survival Probabilities. *Journal of Artificial Societies & Social Simulation*, 27(1).
- Fair, K. R., Karatayev, V. A., Anand, M., & Bauch, C. T. (2024). Impact of population behavioural responses on the critical community size of infectious diseases. *Theoretical Ecology*, 17(3), 269-280.
- Fair, K. R., Karatayev, V. A., Anand, M., & Bauch, C. T. (2022). Estimating COVID-19 cases and deaths prevented by non-pharmaceutical interventions, and the impact of individual actions: A retrospective model-based analysis. *Epidemics*, 39, 100557. DOI: 10.1016/j.epidem.2022.100557
- Fair, K. R., Anand, M., & Bauch, C.T. (2020). Spatial Structure in Protected Forest-Grassland Mosaics: Exploring Futures Under Climate Change. *Global change biology* 26(11), 6097-6115. DOI: 10.1111/gcb.15288
- Fair, K. R., Bauch, C. T., & Anand, M. (2017). Dynamics of the Global Wheat Trade Network and Resilience to Shocks. *Scientific reports*, 7(1), 7177. DOI: 10.1038/s41598-017-07202-y

Funding

- ADR UK Research Fellowship (£163,523) - ADR UK/UKRI (2024-2026)
- Secondment/reasearch funding (£30,000) - UK Department for Business and Trade (2024-)
- Waterloo Gender Equity Grant (£5,600) - The University of Waterloo (2017)

Presentations

- Invited talks:
  - Fair, K.R. & Guerrero, O.A. (2024). Agent-based modelling of the labour market. Exploratory Workshop - Complexity Science and Competition Law and Policy: Setting the Agenda. Univeristy College London/International Institute for Applied Systems Analysis. Vienna, Austria.
  - Fair, K.R. Labour skills & emerging technologies: Looking to the future of work (2024). AI Skills for the Future of Work, World Youth Skills Day 2024. UNESCO. Virtual.
  - Fair, K.R., Meine, D., & Guerrero, O.A. (2024). Labour flow networks. Cross-government AI Analysis Working Group, Government of the United Kingdom. Virtual.
  - Fair, K.R. & Guerrero, O.A. (2024). Endogenous labour flow networks: A bottom-up model to analyse long-term employment dynamics. International Partnership on Automated Job Coding. Virtual.
  - Fair, K. R., Karatayev, V. A., Anand, M. & Bauch, C. T. (2021). Physical distancing, school/workplace closure, and COVID-19 disease burden in 2020: how many lives did we save?. University of Guelph One Health Institute Seminar Series - Winter 2021. Virtual.
- Conference presentations:
  - Fair, K.R., Kessler, Z.B, & Guerrero, O.A. (2024). Do skills predict labour mobility? Delving deeper into the drivers of job switches. Conference on Complex Systems 2024, Exeter, United Kingdom.
  - Fair, K.R., Meine, D., & Guerrero, O.A. (2024). Endogenous labour flow networks and the skills evolution of the UK labour market. Conference on Complex Systems 2024, Exeter, United Kingdom.
  - Fair, K.R., & Guerrero, O.A. (2023). Emerging Labour Flow Networks. 9th International Conference on Computational Social Science, Copenhagen, Denmark.
  - Fair, K.R. & Guerrero, O.A. (2022). Endogenous labour flow networks: A bottom-up model to analyse long-term employment dynamics. 7th workshop on Complexity in Economics and Finance - satellite of Conference on Complex Systems 2022, Palma, Mallorca, Spain.
  - Fair, K.R. & Guerrero, O.A. (2022). Endogenous labour flow networks: A bottom-up model to analyse long-term employment dynamics. Data-driven economic agent-based models workshop, Pisa, Italy.
  - Fair, K.R. & Guerrero, O.A. (2022). Endogenous labour flow networks: A bottom-up model to analyse long-term employment dynamics. Complex Networks in Economics and Innovation - satellite of NetSci 2022, virtual.
  - Fair, K.R. & Guerrero, O.A. (2022). Endogenous labour flow networks: A bottom-up model to analyse long-term employment dynamics. Data Natives 2022, London, England.
  - Fair, K. R., Karatayev, V. A., Anand, M. & Bauch, C. T. (2021). Estimating COVID-19 cases and deaths prevented by non-pharmaceutical interventions in 2020-2021, and the impact of individual actions: a retrospective model-based analysis. Canadian Applied and Industrial Mathematics Society Meeting 2021, virtual.
  - Fair, K. R., Karatayev, V. A., Anand, M. & Bauch, C. T. (2021). Policy in a pandemic: Physical distancing, school/workplace closure, and SARS-CoV-2 spread. Joint Mathematical Epidemiology and Math Education Society for Mathematical Biology Subgroup Meeting 2021, virtual.
  - Fair, K. R., Anand, M., & Bauch, C. T. (2019). Spatially explicit models for forest-grassland mosaics: Exploring climate change scenarios. The V Applied Mathematics, Modeling and Computational Science International Conference, Waterloo, Ontario, Canada.
  - Fair, K. R., Anand, M., & Bauch, C. T. (2019). Climate Change & the Future of Forest-Grassland Mosaics. Canadian Society for Ecological Economics Conference, Waterloo, Ontario, Canada.
  - Fair, K. R., Anand, M., & Bauch, C. T. (2018). Spatial and Social Aspects of Bistability in Mosaic Ecosystems. Ecological Society of America General Meeting, New Orleans, Louisiana, United States of America
  - Fair, K. R., Anand, M., & Bauch, C. T. (2018). Spatial and Social Aspects of Bistability in Mosaic Ecosystems. Canadian Society for Ecology and Evolution Meeting, Guelph, Ontario, Canada
  - Fair, K. R., Bauch, C. T., & Anand, M. (2017). Projected Dynamics of the Global Wheat Trade Network and Resilience to Shocks. Living on the Precipice: Interdisciplinary Conference on Resilience in Complex Natural and Human Systems, Waterloo, Ontario, Canada
  - Fair, K. R., Anand, M., & Bauch, C. T. (2017). Impact of Spatial Structure and Human Dynamics on Environment Systems. The IV Applied Mathematics, Modeling and Computational Science International Conference, Waterloo, Ontario, Canada

Service, Mentoring, and Outreach

Public Policy Programme, The Alan Turing Institute *London, United Kingdom*

Research Associate/Senior Research Associate *2021-present*

- Supervised graduate-level RAs on DBT- and ATI-funded projects
- Contributed open-source code and visualisation tools for policy application

Waterloo Institute for Complexity & Innovation *Waterloo, ON, Canada*

Member of Conference Organizing Committee *2016-2017*

- Chaired the sub-committee charged with designing and implementing the graduate workshop entitled "Transdisciplinarity in Resilience Research: Formulating Diverse Conceptions of Complex Systems", hosted at the University of Waterloo as part of Waterloo Institute for Complexity & Innovation's "Living on the Precipice: Interdisciplinary Conference on Resilience in Complex Natural and Human Systems"
- Contributed to the planning and staging of the conference as a whole

Technical skills

- Programming: Python (pandas, scikit-learn, NetworkX, NumPy, CDlib), R (ggplot, tidyverse, igraph), Netlogo, Gephi
- Reproducibility: GitHub, Jupyter
- Teaching tools: LaTeX, Zoom
- Data: UK Labour Force Survey, Annual Survey of Hours and Earnings, O*NET occupational skills database, COVID-19 case data, Google Mobility Data, ESA Satellite imagery, UN statistics division population and agriculture production and trade data