Curriculum Vitæ

Personal information

Surnames, first name	**CARRO PATIÑO, Adrián**
Nationality, date of birth	Spanish, 14/01/1987
Postal address	Banco de España, Calle de Alcalá, 48, 28014 Madrid, Spain
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Email	adrian.carro@bde.es
Online academic IDs	ORCID: 0000-0001-9838-3027 ResearcherID: F-7290-2016
	ResearchGate: Adrian_Carro Google Scholar: Adrián Carro

Research fields

Topics	Macroeconomics, real estate, macroprudential policy, financial stability, systemic risk
Methods	Agent-based modelling, network science, data science, complexity science

Work experience

Oct. 2019 – present	**Banco de España**, Financial Stability and Macroprudential Policy Department, Macroprudential Policy Division: Research Economist
Oct. 2019 – present	**University of Oxford**, Institute for New Economic Thinking (INET) at the Oxford Martin School: Associate
Oct. 2016 – Sep. 2019	**University of Oxford**, Institute for New Economic Thinking (INET) at the Oxford Martin School: Postdoctoral Research Officer
Oct. 2016 – Sep. 2019	**University of Oxford**, Oxford Martin School: Oxford Martin Fellow
Nov. 2017 – Sep. 2019	**Bank of England**, Macro-Financial Risks Division: Visiting Fellow

Education

2011 – 2016	**PhD in Physics**, Universitat del les Illes Balears – CSIC, Institute for Cross-Disciplinary Physics and Complex Systems (IFISC). Advisors: Prof. Raúl Toral, Prof. Maxi San Miguel Thesis: Individual-based models of collective dynamics in socio-economic systems
2010 – 2011	**MSc in Theoretical Physics of Complex Systems.** Université Pierre et Marie Curie (Paris 6) and École Normale Supérieure. Advisor: Prof. Gérard Weisbuch Thesis: Sustainable development & spatial inhomogeneities: the role of transportation cost
2005 – 2010	**BSc in Physics.** Universidade de Santiago de Compostela

Publications

Peer-reviewed journals (13)

Carro, A. (2023). Taming the housing roller coaster: The impact of macroprudential policy on the house price cycle. *Journal of Economic Dynamics and Control*, 104753
[Impact Factor: 1.9; RePEc Rank All Years: 40; RePEc Rank Last 10 Years: 64]

Carro, A., Hinterschweiger, M., Uluc, A., Farmer, J. D. (2023). Heterogeneous effects and spillovers of macroprudential policy in an agent-based model of the UK housing market. *Industrial and Corporate Change, 32*(2), 386–432
[Impact Factor: 2.5; RePEc Rank All Years: 115; RePEc Rank Last 10 Years: 170]

Carro, A., Stupariu, P. (2023). Uncertainty, non-linear contagion and the credit quality channel: An application to the Spanish interbank market. *Journal of Financial Stability*, Accepted
[Impact Factor: 5.4; RePEc Rank All Years: 95; RePEc Rank Last 10 Years: 56]

Glavatskiy, K. S., Prokopenko, M., Carro, A., Ormerod, P., Harré, M. (2021). Explaining herding and volatility in the cyclical price dynamics of urban housing markets using a large-scale agent-based model. *SN Business & Economics, 1*(76)

Yang, J., Carro, A. (2020). Two tales of complex system analysis: MaxEnt and agent-based modeling. *The European Physical Journal Special Topics, 229*, 1623-1643
[Impact Factor: 2.210; Scimago Rank: 2nd quartile in misc. physics and astronomy]

Artime, O., Carro, A., Fernández-Peralta, A., Ramasco, J. J., San Miguel, M., Toral, R. (2019). Herding and idiosyncratic choices: Nonlinearity and aging-induced transitions in the noisy voter model. *Comptes Rendus Physique, 20*(6), 262
[Impact Factor: 2.892; Scimago Rank: 1st quartile in misc. physics and astronomy]

Fernández-Peralta, A., Toral, R., Carro, A., San Miguel, M. (2018). Stochastic pair approximation treatment of the noisy voter model. *New Journal of Physics, 20*, 103045
[Impact Factor: 3.579; Scimago Rank: 1st quartile in misc. physics and astronomy]

Fernández-Peralta, A., Toral, R., Carro, A., San Miguel, M. (2018). Analytical and numerical study of the non-linear noisy voter model on complex networks. *Chaos: An Interdisciplinary Journal of Nonlinear Science, 28*, 075516
[Impact Factor: 2.415; Scimago Rank: 18th journal in statistical and nonlinear physics]

Carro, A., Toral, R., San Miguel, M. (2016). Coupled dynamics of node and link states in complex networks: A model for language competition. *New Journal of Physics, 18*, 113056
[Impact Factor: 3.579; Scimago Rank: 1st quartile in misc. physics and astronomy]

Carro, A., Toral, R., San Miguel, M., (2016). The noisy voter model on complex networks. *Scientific Reports, 6*, 24775
[Impact Factor: 4.122; Scimago Rank: 5th journal in multidisciplinary science]

Carro, A., Toral, R., San Miguel, M. (2015). Markets, Herding and Response to External Information. *PLoS ONE, 10*(7), e0133287
[Impact Factor: 2.766; Scimago Rank: 1st quartile in agricultural and biological sciences]

Carro, A., Vazquez, F., Toral, R., San Miguel, M. (2014). Fragmentation transition in a coevolving network with link-state dynamics. *Physical Review E, 89*(6), 062802
[Impact Factor: 2.284; Scimago Rank: 9th journal in statistical and nonlinear physics]

Carro, A., Toral, R., San Miguel, M. (2013). The role of noise and initial conditions in the asymptotic solution of a bounded confidence, continuous-opinion model. *Journal of Statistical Physics, 151*(1-2), 131-149
[Impact Factor: 1.496; Scimago Rank: 10th journal in statistical and nonlinear physics]

Peer-reviewed conference proceedings (1)

Taghawi-Nejad, D., Tanin, R. H., Del Rio Chanona, M. R., Carro, A., Farmer, J. D., Heinrich, T., Sabuco, J., Straka, M. J. (2017). ABCE: A python library for economic agent-based modeling. *International Conference on Social Informatics*, 17-30

Working papers

2020 – present

The impact of prudential regulation on the UK housing market and economy: Insights from an agent-based model (with Bardoscia, M., Hinterschweiger, M., Uluç, A., Popoyan, L., Napoletano, M., and Roventini, A.) [To appear as a Bank of England Staff Working Paper, in final stages of editorial process]

2023 – present

The emergence, development and use of agent-based modelling and complexity economics methods at central banks (with Borsos, A., Kaszowska, J., Uluç, A., and Zhang, Y.) [Pre-accepted perspective/review chapter of the upcoming IV volume of the book series *The Economy as an Evolving Complex System*]

2023 – present

Housing markets, macroeconomic dynamics and financial stability: Exploring the interaction between monetary and macroprudential policies

Policy briefs and technical reports

Lord, A., Dunning, R., Dockerill, B., Burgess, G., Carro, A., Crook, T., Watkins, C., Whitehead, C. (2018). The Incidence, Value and Delivery of Planning Obligations and Community Infrastructure Levy in England in 2016-17. *Ministry of Housing, Communities and Local Government*

Conferences and workshops

Oct. 2023 — **Workshop on Price Volatility in Goods and Services Markets, Utrecht, The Netherlands.** Talk: *Taming the housing roller coaster: The impact of macroprudential policy on the house price cycle*

Jul. 2023 — **Workshop on Complex system approaches to 21st century challenges: inequality, climate change, and new technologies, Santa Fe Institute, Santa Fe, New Mexico, USA.** Talk: *The impact of prudential regulation on the UK housing market and economy: Insights from an agent-based model*

Jul. 2023 — **CEF'23, 29th International Conference on Computing in Economics and Finance, Nice, France.** Talk: *Taming the housing roller coaster: The impact of macroprudential policy on the house price cycle*

Oct. 2022 — **MPPG Annual Research Workshop, Central Bank of Malta, Valletta, Malta.** Talk: *Could Spain be Less Different? Exploring the Effects of Macroprudential Policy on the House Price Cycle*

Sep. 2022 — **IFABS'22, Annual Conference of the International Finance and Banking Society, Napoli, Italy.** Talk: *Could Spain be Less Different? Exploring the Effects of Macroprudential Policy on the House Price Cycle*

Nov. 2021 — **IV Conference on Financial Stability, Banco de Mexico-CEMLA-Bank of Canada-University of Zurich, Mexico City, Mexico.** Talk: *Uncertainty, non-linear contagion and the credit quality channel: an application to the Spanish interbank market*

Sep. 2021 — **IFABS'21, Annual Conference of the International Finance and Banking Society, Oxford, UK.** Talk: *Uncertainty, non-linear contagion and the credit quality channel: an application to the Spanish interbank market*

Jun. 2019 — **WEHIA'19, 24th Workshop on Economic Science with Heterogeneous Interacting Agents, City, University of London, UK.** Talk: *The impact of transport infrastructure on housing markets: An agent-based modelling approach*

Jun. 2018 — **Seminar at the OECD, Paris, France.** Invited seminar: *Agent-based modelling for public policy: A housing market example*

Jun. 2018 — **Oxford Summer School on Economic Networks, University of Oxford, UK.** Invited lecture: *Network structure in simple agent-based models: analytical approaches*

Jun. 2018 — **Modelling Complex Urban Environments, University of Waterloo, Canada.** Invited lecture: *Emergence of boom and bust cycles in an agent-based model of the housing market.* Talk: *The impact of transport infrastructure on housing markets: An agent-based modelling approach*

Sep. 2017 — **Heterogeneous Agents and Agent-based Modelling: The Intersection of Policy and Research, Department of the Treasury, Washington, D.C., USA.** Organised by the Office of Financial Research (OFR), Brandeis University, and the Bank of England.

Sep. 2017 — **Course on agent-based modelling for policy (within the "10 years from the crash" programme), London, UK.** Invited talk: *Agent-based modelling for policy design: two housing market examples*

Jul. 2017 — **Urban Analytics Data Dive, Alan Turing Institute, London, UK.** Team awarded second place for the challenge "Where could we build more houses?"

Feb. 2017 — **Seminar at the Financial Computing & Analytics group, UCL, London, UK.** Invited talk: *Herding behaviour and financial markets: the role of topology and external information*

Jan. 2017	**Industrial and Infrastructure Strategy post Brexit: Understanding the Issues and Managing the Risks and Uncertainty, London, UK.** Invited talk: *Using agent-based modelling to evaluate the benefits of infrastructure systems*
Sep. 2016	**CCS'16, Conference on Complex Systems, Amsterdam, The Netherlands.** Talk: *The noisy voter model on complex networks*. Talk: *Coupled dynamics of node and link states: A model for language competition*
Sep. 2015	**EC2015, Econophysics Colloquium, Prague, Czech Republic.** Talk: *Network effects on an agent-based market model with herding behavior*
Jun. 2015	**IC2S2, International Conference on Computational Social Science, Helsinki, Finland.** Poster: *Markets, herding and response to external information*. Poster: *Coupled dynamics of node and link states: a model for language competition*
Jun. 2013	**WEHIA'13, 18th Workshop on Economic Science with Heterogeneous Interacting Agents, Reykjavík University, Iceland.** Poster: *Network effects on the local and dynamic properties of an agent-based herding model*
Jun. 2012	**WEHIA'12, 17th Workshop on Economic Science with Heterogeneous Interacting Agents, University of Pantheon-Assas Paris II, Paris, France.** Talk: *Stochastic resonance and diversity in an agent-based herding model*
Between 2011 and 2017	Apart from these, I also presented 8 posters, 9 talks, and 1 invited talk at 12 other national and international conferences and 4 summer schools (details available upon request)

Honours and awards

2012 – 2016	**Scholarship of the Training Programme for Academic Staff (FPU).** Funded by: Ministry of Education of Spain. Scholarship number: AP2012-0547. Personally awarded.
2009 – 2010	**Undergraduate Research Fellowship.** Funded by: Ministry of Education of Spain. Personally awarded.

Research visits

Jan. – Feb. 2019	**University of Sydney**, Centre for Complex Systems. Host: Prof. Mikhail Prokopenko
Jan. – Feb. 2018	**University of Cape Town**, African Institute of Financial Markets and Risk Management (AIFMRM). Host: Dr. Co-Pierre Georg
Apr. – Jun. 2016	**University of Oxford**, Institute for New Economic Thinking (INET) at the Oxford Martin School. Host: Prof. Doyne Farmer

Other professional activities

Teaching experience	Teaching Assistant for Statistical Mechanics (4th year undergraduate level), Universitat de les Illes Balears, Spain.
	Supervision of 4 students on different undergraduate and postgraduate research projects, University of Oxford, UK.
Refereeing	Journal of Economic Interaction and Coordination, Advances in Complex Systems, Chaos, Environment and Planning B - Urban Analytics and City Science, Journal of Statistical Mechanics: Theory and Experiment, Language Dynamics and Change, Physica A, SocInfo2017 - International Conference on Social Informatics
Conference organisation	Co-organiser of the workshop "Young Researchers at the Crossroads" (2017), linked to the conference "Crossroads in Complex Systems", Universitat de les Illes Balears, Spain.

Computer skills

Programming languages: **Fortran, C/C++, Java, Python**
Data analysis and graphing software: Python (Matplotlib, networkX, pandas)
Simulation methods: Molecular Dynamics, Monte Carlo, Agent-Based Simulation
Text processing and office packages: LaTeX, LibreOffice, Microsoft Office

Language skills

Mother tongue	**Spanish**
Foreign languages	**English:** C2 Proficient user **French:** C1 Proficient user **German:** A1 Basic user
Feb. 2013	**DALF C1 test (Diplôme Approfondi de Langue Française).** Score: 69.5 / 100 Alliance Française, Palma de Mallorca, Spain
Aug. 2008	**IELTS test (International English Language Testing System).** Band score: 7.5 / 9 Sheffield Hallam University, Sheffield, United Kingdom