

Christa Cuchiero

born in Austria on April 13, 1983
Nationality: Austrian

Education

- March 2018 **Habilitation (venia docendi) in Mathematics**, *University of Vienna*.
- July 2007–April 2011 **Ph.D. in Mathematics**, *ETH Zürich*, Supervisor: Prof. Josef Teichmann,
Co-supervisor: Prof. Damir Filipović.
awarded with the ETH medal
- Oct. 2001–Oct. 2006 **M.Sc. in Technical Mathematics**, *Vienna University of Technology*.
Major: Applied Mathematics in Economics, diploma with highest distinction
- Sept. 2004–May 2005 **Applied Mathematics**, *Ecole Centrale Paris*.
Emphasis on Mathematical Finance and Probability
- June 2001 **Matura**, *Akademisches Gymnasium Linz*.
obtained with highest distinction

Employment and Academic Positions

- May 2020–present **Professor**, *Vienna University*, Department of Statistics and Operations
Research.
- Jan. 2020– April 2020 **Professor**, *Université de Paris (Diderot)*, Laboratoire de Probabilités,
Statistique et Modélisation.
- March 2019–Dec. 2019 **Assistant professor (tenure track)**, *Vienna University of Economics and
Business*, Institute of Statistics and Mathematics.
- Okt. 2014–Feb.2019 **Assistant professor**, *University of Vienna*, Faculty of Mathematics.
- Okt. 2016–Feb. 2017 **Research visit**, *ETH Zürich*, Departement of Mathematics, invited by the
FIM (Forschungsinstitut für Mathematik).
- April 2013–Sept. 2014 **Assistant professor**, *Vienna University of Technology*, Financial and Ac-
tuarial Mathematics.
- Jan. 2012–March 2013 **Postdoc position**, *University of Vienna*, Faculty of Mathematics.
- May 2011–Dec. 2011 **Postdoc position**, *ETH Zürich*, Department of Mathematics.
- July 2009–April 2011 **Ph.D. position**, *ETH Zürich*, Department of Mathematics.
- July 2007–June 2009 **Ph.D. position**, *Vienna University of Technology*, Financial and Actuarial
Mathematics, START-prize project “Geometry of Stochastic Differential
Equations”.
- Sept. 2006–June 2007 **Risk Analyst**, *AGF France (Allianz Group)*, Paris, Risk Management.
- Aug. 2005–Aug. 2006 **Internship at Allianz Elementar**, *ALM & Risk Controlling*, Vienna.

Current Research Interests

Probability Theory,
Stochastic Analysis &
Statistics

Stochastic processes, in particular affine and polynomial processes on different state spaces in finite and infinite dimensions, Volterra processes, measure valued processes, McKean-Vlasov SDEs, interacting particle systems, mean field games, universal approximations theorems in static and dynamic situations, stochastic representations and numerics of (non-linear) PDEs, semimartingale theory, Markov processes, functional analytic methods, statistics of stochastic processes, statistics with high-frequency data, covariance estimation, robust model calibration.

Fields of Applications

Mathematical finance, Economics and Quantitative Risk Management, in particular multivariate stochastic and rough volatility modeling, stochastic portfolio theory and model-free portfolio optimization, systemic risk, data driven risk inference, large financial markets, arbitrage theory, interest rate theory (multiple yield curves) ;
Biology, in particular population genetics;
Computer Science, in particular theory and applications of machine learning, especially of deep neural networks and reservoir computing.

Awards and Prizes

2019 **START Prize**

2018 **Bruti-Liberati Visiting Fellowship in Sydney 2018**

2017 **Prix de l'Institut Europlace de Finance (EIF):** Best paper award in finance for the article "A General HJM Framework for Multiple Yield Curve Modeling" jointly written with Claudio Fontana and Alessandro Gnoatto

2012 **Ph.D. thesis awarded with the ETH medal** (granted to the best 8% of Ph.D. theses completed at ETH each year)

2002–2004 **Scholarships for outstanding studies** awarded by the TU Vienna

Co-Organization of Conferences and Workshops

June 2021 Advances in Mathematical Finance and Optimal Transport, Pisa, Italy

October 2020 - present Vienna Seminar in Mathematical Finance and Probability, Vienna, Austria

September 2020 High dimensional stochastics, Vienna, Austria

September 2020 13th European Summer School in Financial Mathematics, Vienna, Austria

May 2020-present Random ladies seminar, Vienna, Austria

June 2019 Mini-symposium "Universal structures in Mathematical Finance", ICASQF Conference, Manizales, Colombia

June 2019 Member of the Scientific Committee for the AMaMeF Conference 2019

Jan. 2019 Quantitative Finance Workshop 2019, Zurich, Switzerland

July 2018 Workshop "Dynamic uncertainty modeling", Strobl, Austria

Sept. 2017 Mini-symposium "Affine and polynomial processes in Finance", ICCF2017 Conference, Lisbon, Portugal

Sept. 2016 Conference "Vienna Congress of Mathematical Finance", Vienna, Austria

April 2016 Workshop "Pathwise methods, functional calculus and applications in Mathematical Finance", Vienna, Austria

- 2015-present Several editions of the “Freiburg-Padova-Vienna-Zurich-Seminar”, Research meeting between the Mathematical Finance groups of Freiburg, Padova, Vienna and Zurich
- Sept. 2015 Workshop “Mathematical Finance beyond classical models”, Zurich, Switzerland
- Aug. 2015 Mini-symposium “Modeling in Finance beyond classical paradigms” , ICIAM Conference, Beijing, China
- Sept. 2014 2nd European Actuarial Journal (EAJ) Conference, Vienna, Austria
- Aug. 2013 6th European Summer School in Financial Mathematics, Vienna, Austria
- July 2012 Organization of the Mini-symposium “Matrix valued processes and multivariate stochastic volatility modeling”, SIAM Conference, Minneapolis, USA

Editorial activities and referee activity

- January 2020 - Associate Editor for Mathematical Finance
- July 2018 - Associate Editor for the Journal of Computational Finance
- Jan. 2017 - Associate Editor for Finance and Stochastics
- Referee activity Annals of Applied Probability, Stochastic Processes and their Applications, Finance and Stochastics, Mathematical Finance, SIAM Journal on Financial Mathematics, Electronic Journal of Probability, Statistics and Probability Letters, etc.
- Jury member External jury member in several thesis and habilitaiton committees

Memberships

- Bachelier Finance Society
- Wolfgang Pauli Institute, Vienna

Successful application for research projects

- 2019 **START - Prize: “Universal structures in Mathematical Finance”**, 72 months, 1 200 000 EUR
- 2018 **DFG - FWF - Project: “Dynamic uncertainty modeling”**, PI in Vienna (jointly with Thorsten Schmidt and Irene Klein), 36 months, 324 000 EUR
- 2016 **WWTF - Project: “Macroprudential bank regulation: a continuous time approach”**, joint application with Walter Schachermayer and Jean-Charles Rochet, July 2017 - Dec. 2021, 600 000 EUR

Talks

more than 130 (see my homepage)

Invited Talks (December 2017 - November 2020, key note speaker is highlighted with (*))

“Universality of affine and polynomial processes”

- Vienna Probability Seminar, Zoom, Vienna, November 2020
- Workshop on new Challenges in the Interplay between Finance and Insurance, Zoom, Oberwolfach, October 2020 (*)
- Bachelier-One-World-Seminar, Zoom, September 2020 (*)
- Conference on High-Dimensional Stochastics, Zoom, Vienna, September 2020

“Machine Learning in Finance”

- Talk at the insurance company Uniqa, Vienna, November 2019

“Deep neural networks, generic universal interpolation and controlled differential equations”

- Oxford Stochastic Analysis and Mathematical Finance Seminar, Zoom, Oxford, October 2020
- Advances in Financial Mathematics 2020, Paris, January 2020 (*)
- Seminar talk, Oslo, November 2019
- Vienna Congress on Mathematical Finance, Vienna, September 2019 (*)

“A neural network approach to calibration of local stochastic volatility models”

- Workshop on Market generators, Zoom, London, May 2020
- V Workshop on Dynamical Systems and Brain-Inspired Information Processing, Konstanz, July 2019
- 9th General AMaMeF Conference, Paris, June 2019

“Learning multi-curve interest rate models”

- ICIAM 2019, Recent advances in interest rate modeling, Valencia, July 2019

“Neural network approaches to infinite dimensional calibration and prediction problems”

- Seminar at UCSB, Zoom, Santa Barbara, April 2020
- QMF 2019, Sydney, December 2019 (*)

“Consistent minimal market models for the growth optimal portfolio”

- Paris Bachelier Seminar, Paris, March 2020
- Workshop in honour of Eckhard Platen, Sydney, December 2019 (*)

“Measure valued processes for energy markets”

- Spatus-Workshop, Zoom, Oslo, August 2020

“Existence and stability for stochastic Volterra equations with jumps”

- Stochastic processes and their applications, Chicago, July 2019

“Rough covariance modeling - theory and empirics”

- Frontiers in Quantitative Finance, Copenhagen, November 2019
- ÖMG Conference, Dornbirn, September 2019
- ICASQF, Manizales, June 2019
- SIAM Conference on Financial Mathematics and Engineering, June 2019 (*)
- Research seminar in financial and insurance mathematics, ETH Zurich, March 2019
- Bachelier Colloquium, Metabief, January 2019 (*)
- Quantitative Methods in Finance, Sydney, Dec. 2018 (*)
- London Mathematical Finance Seminar, London, Nov. 2018

“Infinite dimensional polynomial processes”

- Kolloquium Wahrscheinlichkeitstheorie, Berlin, May 2019
- Mathematical Finance Workshop, Connecticut, Oct. 2018
- Innovative Research in Mathematical Finance in Honor of Yuri Kabanov, Sept. 2018 (*)
- Conference on advanced methods in Mathematical Finance, Angers, Aug. 2018
- Probability Seminar at Korteweg-de Vries Institute for Mathematics, Amsterdam, June 2018
- 9th International Workshop on Applied Probability, Budapest, June 2018
- Workshop on Stochastic Modelling and Financial Applications, Verona, June 2018 (*)

“Calibration of financial models using neural networks”

- DEM Workshop in Financial Mathematics, Verona, Oct. 2018 (*)
- NUS-USPC Machine Learning and Fintech Conference, Singapore, April 2018 (*)

“High and infinite dimensional finance in the light of affine and polynomial processes”

- Probability and Computational Finance Seminar, Carnegie Mellon University, Pittsburgh, Jan. 2018

“Rough volatility modeling from an affine point of view”

- Actuarial and Financial Mathematics Conference, Brussels, Feb. 2018 (*)
- Stochastic analysis and modeling conference, Verona, Dec. 2017 (*)

“Markovian representations of stochastic Volterra equations”

- Mini-Workshop on high-dimensional BSDEs and PDEs, Essen, May 2018 (*)
- Stochastic analysis and its applications, Oaxaca, May 2018
- Bachelier Seminar, Paris, Dec. 2017

“(Probability) measure-valued polynomial diffusions”

- De Finetti Risk Seminar, Milan, Dec. 2017
- Mathematical Finance Workshop, Paris-Diderot, Dec. 2017

“Universal portfolios and model-free portfolio optimization”

- SIAM Conference on Financial Mathematics and Engineering, June 2019

Teaching experience

- Fall 2020 **Advanced stochastic modeling**, *University of Vienna*.
- Fall 2020 **Linear Algebra**, *University of Vienna*.
- Fall 2020 **Introduction to Mathematical Finance**, *University of Vienna*.
- Spring 2020 **Mathematical Optimizsation**, *University of Vienna*.
- Spring 2020 **Mathematical Finance I**, *Université de Paris*.
- Spring 2020 **Lecture for Machine Learning in Finance**, *Université de Paris*.
- Fall 2019 **Lecture and Exercises for Machine Learning in Finance (Master/PhD)**, *Vienna University of Economics and Business*.
- Spring 2019 **Lecture on Continuous Time Finance I**, *Vienna University of Economics and Business*.
- Fall 2018 **Lecture and Exercises on Mathematical Finance in discrete time**, *University of Vienna*.
- Spring 2018 **Proseminar on Mathematical Finance in Continuous Time**, *University of Vienna*.
- Fall 2017 **Lecture on Stochastic Analysis**, *University of Vienna*.
- Fall 2017 **Exercises on Mathematical Finance in Discrete Time**, *University of Vienna*.
- Spring 2017 **Proseminar on Mathematical Finance in Continuous Time**, *University of Vienna*.
- Spring 2017 **Exercises on Probability Theory and Statistics**, *University of Vienna*.
- Spring 2016 **Lecture and Exercises on Mathematical Finance in Continuous Time**, *University of Vienna*.
- Fall 2015 **Lecture and Exercises on Mathematical Finance in Discrete Time**, *University of Vienna*.
- Spring 2015 **Exercises on Mathematical Finance in Continuous Time**, *University of Vienna*.
- Fall 2014 **Exercises on Mathematical Finance in Discrete Time**, *University of Vienna*.
- Spring 2014 **Lecture on Mathematical Finance (discrete time)**, *Vienna University of Technology*.
- Fall 2013 **Lecture on Interest Rate Theory**, *Vienna University of Technology*.
- Fall 2013 **Exercises on Life Insurance Mathematics**, *Vienna University of Technology*.
- Spring 2013 **Exercises on Mathematical Finance: Continuous Time Models**, *Vienna University of Technology*.
- Spring 2013 **Exercises on Mathematical Finance in Continuous Time**, *University of Vienna*.
- Fall 2012 **Exercises on Mathematical Finance in Discrete Time**, *University of Vienna*.
- Spring 2011 **Exercises on Brownian Motion and Stochastic Calculus**, *ETH Zürich*.
- Fall 2010 **Exercises on Probability Theory**, *ETH Zürich*.
- Spring 2010 **Exercises on Probability Theory and Statistics**, *ETH Zürich*.
- Fall 2009 **Exercises on Mathematical Finance**, *ETH Zürich*.

Ph.D and Postdoc Supervision

Benedict Bauer	Ph.D student, co-supervision (since May 2020) with Stefan Gerhold at the Technical University of Vienna
Eva Flonner	Ph.D student, co-supervision (since October 2020) with Zehra Eksi at WU Vienna
Guido Gazzani	Ph.D student, co-supervision (since October 2019) with Irene Klein at the University of Vienna
Francesco Guida	Ph.D student, co-supervision (since February 2018) with Luca di Persio at the University of Verona
Tonio Möllmann	Ph.D student, co-supervision (since June 2017) with Maria Elvira Mancino and Josef Teichmann at the Scuola Normale Superiore in Pisa
Francesca Primavera	Ph.D student (since October 2020)
Stefan Rigger	Ph.D student (since September 2018)
Sara Svaluto-Ferro	Postdoc (since March 2018)

Master and Bachelor thesis (Co)-Supervision

Jakob Steininger	<i>Deep reinforcement learning for portfolio optimization</i> , Master thesis, WU Vienna, 2020
Eva Flonner	<i>Rough covariance estimation - a neural network approach</i> , Master thesis, WU Vienna, 2020
Andreas Celary	<i>Rough volatility in Bitcoin markets</i> , Master thesis, University of Vienna 2019
Anela Jahic	<i>Volatility forecasting with neural networks</i> , Master thesis, University of Vienna 2019
Sabrina Kellner	<i>Machine Learning in Market Risk Management</i> , MBA thesis, Vienna University of Economics and Business, 2019
Lukas Anzeletti	<i>Ray-Knight Theorems</i> , Bachelor thesis, University of Vienna 2018
Michele Giordano	<i>Affine Volterra processes with jumps</i> , Master thesis, University of Pisa 2018
Dorothea Zvonarich	<i>American options</i> , Bachelor thesis, University of Vienna 2018
Jasmin Riegler	<i>Swaption Pricing with a Linear-Rational Term Structure Model</i> , Master thesis, University of Vienna 2017
Mark Ballandies and Simon Hurwitz	<i>Rough fractional stochastic volatility models</i> , Master thesis, ETH Zürich 2017
Tobias Klocker	<i>Online Portfolio selection</i> , Bachelor thesis, University of Vienna 2017
Sarina Kohlfürst	<i>Riskmanagement and Value at Risk</i> , Bachelor thesis, University of Vienna 2017
Tobias Salzer	<i>Topics in Ruin Theory</i> , Bachelor thesis, University of Vienna, 2017
Matthäus Geiger	<i>The Arbitrage Pricing Model</i> , Master thesis, University of Vienna and ETH Zürich, 2016
Lisa Neitzel	<i>Optionen und Martingale und deren Integration in einem anwendungsbezogenen Mathematikunterricht</i> , Master Thesis, University of Vienna, 2014
Laura-Maria Orth	<i>The multidimensional Heston stochastic volatility model</i> , Master thesis, Vienna University of Technology, 2014

- Sabine Polzer *Modellierung von Elektrizitäts-Forwardpreisen*, Master thesis, Vienna University of Technology, 2014
- Ev Bretschneider *Das Binomialmodell zur Bewertung von Optionen*, Bachelor thesis, University of Vienna, 2012
- Judith Mühlböck *Das Black-Scholes-Modell, implizite Volatilität und die Monte Carlo Methode*, Bachelor thesis, University of Vienna, 2012
- Alessandro Gnoatto *Yield curve shapes for affine processes on positive definite matrices*, Master thesis, ETH Zürich, 2011

Mentoring activity

- July 2017 Financial Mathematics Team Challenge, Project with 4 students on “Calibration with neural networks”, University of Cape Town
- July 2016 Financial Mathematics Team Challenge, Project with 4 students on “Calibration of polynomial market weights models”, University of Cape Town

Programing skills

Matlab, Python, R

Languages

German (native), English (fluent), French (fluent)

Publications (peer-reviewed)

- (20) C. Cuchiero, W. Khosrawi and J. Teichmann, *A generative adversarial network approach to calibration of local stochastic volatility models*, Risk 2020, <https://arxiv.org/abs/2005.02505>
- (19) C. Cuchiero and S. Svaluto-Ferro, *Infinite dimensional polynomial processes*, to appear in Finance and Stochastics 2020, <https://arxiv.org/abs/1911.02614>
- (18) C. Cuchiero, M. Larsson and J. Teichmann, *Deep neural networks, generic universal interpolation, and controlled ODEs*, SIAM Journal on Mathematics of Data Science, 2(3):901–919, 2020, <https://arxiv.org/abs/1908.07838>
- (17) C. Cuchiero and J. Teichmann, *Generalized Feller processes and Markovian lifts of stochastic Volterra processes: the affine case*, Journal of Evolution Equations, 1–48, 2020, <https://doi.org/10.1007/s00028-020-00557-2>, <https://arxiv.org/abs/1804.10450>
- (16) C. Cuchiero and J. Teichmann, *Markovian lifts of positive semidefinite affine Volterra type processes*, Decisions in Economics and Finance, 42(2):407–448, 2019, <https://arxiv.org/abs/1907.01917>
- (15) C. Cuchiero, M. Larsson and S. Svaluto-Ferro, *Probability measure-valued polynomial diffusions*, Electronic Journal of Probability, 24, 2019, <https://arxiv.org/abs/1807.03229>
- (14) C. Cuchiero, I. Klein, J. Josef Teichmann, *A fundamental theorem of asset pricing for continuous time large financial markets in a two filtration setting*, to appear in Theory of Probability and its applications, 2019, <https://arxiv.org/abs/1705.02087>
- (13) C. Cuchiero, *Polynomial processes in stochastic portfolio theory*, Stochastic processes and their applications, 129(5):1829-1872, 2019, <https://arxiv.org/abs/1705.03647>
- (12) C. Cuchiero, M. Larsson and S. Svaluto-Ferro, *Polynomial jump-diffusions on the unit simplex*, Annals of Applied Probability, 28(4):2451-2500, 2018, <http://arxiv.org/abs/1612.04266v1>
- (11) C. Cuchiero, W. Schachermayer and L. Wong, *Cover's universal portfolio, stochastic portfolio theory and the numéraire portfolio*, Mathematical Finance, 29(3):773–803, 2019, <http://arxiv.org/abs/1611.09631v1>
- (10) C. Cuchiero, C. Fontana and A. Gnoatto, *Affine multiple yield curve models*, Mathematical Finance, 29(2):568-611, 2019, <http://arxiv.org/pdf/1603.00527v1.pdf>
- (9) C. Cuchiero, I. Klein and J. Teichmann, *A new perspective on the fundamental theorem of asset pricing for large financial markets*, Theory of Probability and its Applications, 60(4):561-579, 2016, <http://arxiv.org/pdf/1412.7562v1.pdf>

- (8) C. Cuchiero, C. Fontana and A. Gnoatto, *A general HJM framework for multiple yield curve modeling*, Finance and Stochastics, 20(2):267–320, 2016, <http://arxiv.org/pdf/1406.4301.pdf>
- (7) C. Cuchiero and J. Teichmann, *A convergence result for the Emery topology and a variant of the proof of the fundamental theorem of asset pricing*, Finance and Stochastics, 19(4): 743-761, 2015, <http://arxiv.org/pdf/1406.5414.pdf>
- (6) C. Cuchiero and J. Teichmann, *Fourier transform methods for pathwise covariance estimation in the presence of jumps*, Stochastic processes and their applications, 125(1):116-160, 2015, <http://arxiv.org/pdf/1301.3602.pdf>
- (5) C. Cuchiero, M. Keller-Ressel, E. Mayerhofer and J. Teichmann, *Affine processes on symmetric cones*, Journal of Theoretical Probability, 2014, <http://arxiv.org/pdf/1112.1233v1.pdf>
- (4) C. Cuchiero and J. Teichmann, *Path properties and regularity of affine processes on general state spaces*, Séminaire de Probabilités XLV, 2013, <http://arxiv.org/pdf/1107.1607v2.pdf>
- (3) C. Cuchiero, M. Keller-Ressel and J. Teichmann, *Polynomial processes and their applications to mathematical finance*, Finance and Stochastics, 16(4):711-740, 2012, <http://arxiv.org/pdf/0812.4740v2.pdf>
- (2) C. Cuchiero, D. Filipović, E. Mayerhofer and J. Teichmann, *Affine processes on positive semidefinite matrices*, Annals of Applied Probability, 21(2):397-463, 2011, <http://arxiv.org/pdf/0910.0137v3.pdf>
- (1) C. Cuchiero, D. Filipović and J. Teichmann, *Affine Models*, Encyclopedia of Quantitative Finance, 2010, <http://arxiv.org/pdf/0809.1985v2.pdf>

Other publications

- (21) C. Cuchiero, *Universal structures in Mathematical Finance*, Internationale Mathematische Nachrichten, 08/2020

Preprints

- (24) C. Cuchiero, L. Gonon, L. Grigoryeva, Lyudmila, J.P. Ortega and J. Teichmann, *Discrete-time signatures and randomness in reservoir computing*, 2020, Preprint, <https://arxiv.org/abs/2010.14615>
- (23) C. Cuchiero, S. Rigger, S. Svaluto-Ferro, *Propagation of minimality in the supercooled Stefan problem*, 2020, Preprint, <https://arxiv.org/abs/2010.03580>
- (22) E. Abi Jaber, C. Cuchiero, M. Larsson and S. Pulido, *A weak solution theory for stochastic Volterra equations of convolution type*, 2019, Preprint, <https://arxiv.org/abs/1909.01166>

Working Papers

- (29) C. Cuchiero, S. Svaluto-Ferro and J. Teichmann, *Universality of affine and polynomial processes*, Working paper, 2020

- (28) C. Cuchiero, L. Gonon, L. Grigoryeva, J.-P. Ortega and J. Teichmann, *Approximation of dynamics by randomized signature*, Working paper, 2020
- (27) C. Cuchiero, M.Larsson and J. Teichmann, *Controlled differential equations on convenient spaces*, Working paper, 2020
- (26) S. Cox, C. Cuchiero and A. Khedher, *Operator valued Wishart processes*, Working paper, 2020
- (25) C. Cuchiero and D. Pröml, *Model-free portfolio theory*, Working paper, 2020

Habilitation and Ph.D.

- Habilitation Thesis High dimensional finance beyond classical paradigms - multiple yield curves, robust calibration and model-free portfolio selection
- Ph.D. Thesis Affine and polynomial processes
<http://e-collection.library.ethz.ch/eserv/eth:4629/eth-4629-02.pdf>