



Institut für Statistik und Operations Research
Department of Statistics and Operations Research



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ANNUAL REPORT 2020

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1 Foreword

I am pleased to present the Annual Report of the Department of Statistics and Operations Research, which documents some of the many achievements in 2020. The Department of Statistics and Operations Research is part of the Faculty of Business, Economics, and Statistics of the University of Vienna. Faculty members are active in research in various fields of Statistics, Econometrics, Operations Research, Applied Mathematics, and Computer Science. The department offers degree programs in Statistics at the Bachelor, Master, and PhD-level. Members of the department are also active in service teaching for other departments of the faculty, including the Department of Business Administration and the Department of Economics.

In 2020 Christa Cuchiero, Moritz Jirak, and Tatyana Krivobokova joined our department as full professors. Furthermore, Solomiia Dmytriv, Peter Kramlinger, Jérémy Leymarie, and Sara Papariello-Svaluto-Ferro took up their Post-doc positions. Lisa Carli and Sabine Sobotka-Tompits joined as administrative assistants. We are very much delighted to welcome all of them in our team. New PhD students (Prae-doc) starting in 2020 are Xandro Bayer, Guido Gazzani, Michael Kahr, Fabio Kalix, Karolina Klockmann, Bo Peng, Francesca Primavera, and Fabio Tonti. We wish them success in their studies.

There were also several departures in 2020: Mario Ruthmair and Teresa Scarinci left our department. Caroline Geiersbach successfully defended her thesis and graduated from the PhD Programme in Statistics and Operations Research. We wish them all well in their new endeavours.

I would like to express special thanks to Vera Lehmwald and Sabine Sobotka-Tompits for editing the Annual Report 2020.

Benedikt Pötscher

(Head of Department)

Vienna, March 2021

2 Faculty and Staff

Faculty

Ilya Archakov (Dr.)	Financial Econometrics
Immanuel Bomze (Prof.)	Operations Research and Quantitative Decision Support, Game Theory and Modelling of Behaviour, Optimization Theory and Application, Asymptotic Statistics, Stochastic Modelling, Dynamical Systems
Christa Cuchiero (Prof.)	Mathematical Finance and Quantitative Risk Management (Data Driven Risk Inference, Stochastic Volatility, Stochastic Portfolio Theory, Robust Portfolio Optimization, Arbitrage Theory, Interest Rate Theory, Systemic Risk), Machine Learning in Finance and Economics, Stochastic Processes in Finite and Infinite Dimensions, McKean Vlasov Equations, Interacting Particle Systems and Mean Field Games , Statistics of Stochastic Processes, Statistics with High-Frequency Data, Covariance Estimation, Robust Model Calibration, Universal Approximation Theorems in Dynamic Situations
Solomiia Dmytriv (Dr.)	High-Dimensional Statistics and Random Matrix Theory, Statistical Inference, Portfolio Optimization
Nikolaus Hautsch (Prof.)	Financial Econometrics, Econometric Modelling of Financial High-Frequency Data, Time Series Econometrics, Time-Varying Volatility and Correlation, Market Liquidity, Market Microstructure Analysis, Systemic Risk, Information Processing on Financial Markets, Risk Management
Johannes Moritz Jirak (Prof.)	High-Dimensional Statistics, Principal Component Analysis, High Frequency Analysis, Time Series Analysis, Nonparametric, Irregular Models
Irene Klein (Assoc. Prof.)	Stochastic Finance
Peter Kramlinger (Dr.)	Statistical Inference, Mixed Effect Models, Small Area Estimation
Tatyana Krivobokova (Prof.)	Non-Parametric and Bayesian Modelling and Inference, Dimension Reductions Techniques, Modelling of Dependent and Complex Data with Applications in Biophysics and Economics

Hannes Leeb (Prof.)	Model Selection and Predictive Inference when the Number of Parameters is of the Same Order as Sample Size, Inference when Fitting Mis-Specified Models. Admissibility of Confidence Sets, Pitfalls in Inference after Model Selection when Using Traditional Approaches
Jérémy Leymarie (Dr.)	
Ivana Ljubic (Ass. Prof., on leave)	Algorithmic Operations Research, Algorithm Engineering
Sara Papariello-Svaluto-Ferro (Dr.)	Stochastic Analysis, High Dimensional Jump-Diffusions, Signature Processes, Duality Methods for Stochastic Processes, Stochastic Optimal Control
Mathias Pohl (PhD)	Dependence Modeling and Copulas, High Frequency Trading, Model Ambiguity, Optimal Transport, Portfolio Optimization, Robust Optimization
Benedikt Pötscher (Prof.)	Econometrics, Statistics, Time Series Analysis
Erhard Reschenhofer (Assoc. Prof.)	Time Series Analysis, Financial Econometrics, Automatic Model Selection
Mario Ruthmair (Dr.)	Operations Research, Combinatorial Optimization, (Mixed) Integer Linear Programming, Optimization in Network Design, Transport and Logistics
Teresa Scarinci (PhD)	Optimal Control of ODEs (Sensitivity Analysis, Optimality Conditions, Numerical Approximation of Solutions of Problems with Constraints), Nonsmooth Analysis and Variational Inequalities, Numerical Analysis in Optimization and Optimal Controls, Hamilton-Jacobi-Bellman Equations
Werner Schachinger (Assoc. Prof.)	Optimization, Probabilistic Analysis of Algorithms
Lukas Steinberger (Ass.-Prof.)	Statistical Inference under Differential Privacy, High-Dimensional Data Analysis, Predictive Inference, Model Selection, Statistical vs. Computational Efficiency

Retired Faculty

Walter J. Gutjahr (Prof.)	Optimization Theory, Discrete Optimization, Stochastic Modeling, Multicriteria Decision Analysis
Georg Pflug (Prof.)	Mathematical Statistics, Stochastic Optimization, Risk Management

PhD Students

Nicolai Amann (Dipl.-Ing.)	Predictive Inference & Model Selection in High-Dimensional Linear Models
Xandro Bayer (MSc)	Machine Learning with Applications in Finance
Georg Brandstätter (Dipl.-Ing.)	Combinatorial Optimization, Integer Linear Programming, Transportation and Logistics Optimization
Markus Gabl (MSc)	Copositive Optimization, Quadratic Optimization, Conic Optimization, Robust Optimization
Guido Gazzani (M.Sc.)	Machine Learning in Finance, Robust Calibration, Robust Risk Assessment
Michael Kahr (MSc)	(Mixed) Integer Linear Programming, Stochastic and Robust Optimization, Conic Optimization, Network Optimization
Fabio Kalix (MSc)	Weak Dependence, High-Dimensional Limit Theorems and Quantitative Bounds, Bootstrap
Danijel Kivaranovic (Mag.)	Inference Post-Model-Selection, Predictive Inference with Machine Learning Algorithms
Karolina Klockmann (M.Sc.)	Non-Parametric Bayesian Modelling and Inference, Covariance Matrix Estimation
Manveer Mangat (MSc)	Times Series Analysis, Financial Econometrics
Bo Peng (MSc)	Convex and Nonsmooth Optimization, Conic Relaxations for MINLP
Francesca Primavera (Dott.)	Stochastic Modeling, Mathematical Finance
Thomas Stark (Mag.)	Time Series Analysis, Financial Econometrics
Fabio Elio Tonti (Dr.)	Dimension Reduction for Classification of Particle Systems, Time Series Classification, Applications of Spatio-Temporal Point Processes
Christian Zwatz (Mag.)	Autocorrelation Robust Testing, Spatial Econometrics

External Lecturers (Academic Year 2019/2020)

Andreas Baierl (University of Vienna), Johann Brandstetter (University of Vienna), Cordula Eggert (University of Vienna), Florian Frommlet (MedUni Vienna), Martin Glanzer (University of Vienna), Evelina Erlacher (University of Vienna), Annemarie Grass (University of Vienna), Wilfried Grossmann (University of Vienna), Sándor Guzmics (University of Vienna), Marcus Hudec (University of Vienna), Michael Jakl (University of Vienna), Raimund Kovacevic (TU Vienna), Christoph Kralj (University of Vienna), Christoph Krall (University of Vienna), Ivana Milovic (University of Vienna), Torsten Möller (University of Vienna), Herbert Nagel (University of Vienna), Daniel Obszelka (University of Vienna), Martina Pippal (University of Vienna), Robin Ristl (University of Vienna), Raphael Sahann (University of Vienna), Clemens Sauerzopf (Data Technology), Theresa Scharl-Hirsch (BOKU Vienna), Uygur Senocak (University of Vienna), Alexander Tichy (VetMedUni Vienna), Bertram Tschiderer (University of Vienna), Gabriele Uchida (University of Vienna), Claus Vogl (VetMedUni Vienna), Bertram Wassermann (University of Vienna)

Teaching Assistants (Academic Year 2019/2020)

Anja Bohatschek, Tobias Krause, Azadeh Sadat Mirtaheri, Manuel Müller, Michael Raffelsberger, Stefan Ortner, Marlene Steiner

Administrative Assistants

Julia Brandstätter, Lisa Carli, Birgit Ewald, Vera Lehmwald, Manuela Nicham-Zorn, Sabine Sobotka-Tompits

System Administrators

Stefan Geißler, Rolf Karner, Andreas Loibl, Martin Marktl, Svetlana Mihajlovic

3 Visitors

Kurt Anstreicher (Univ. Iowa, USA)

4 Teaching

Theses Supervised

PhD Theses in Progress

Supervisor	Author	Title
Immanuel Bomze, Alice Vadrot	Paul Dunshirn (PhD program Governance of Digital Practices, DSPL Political Sciences)	Information network flow control in common good applications
Immanuel Bomze	Philipp Hungerländer (Alpen-Adria-Universität Klagenfurt, Austria, PhD program Mathematics)	Extensions of the Traveling Salesman Problem
Immanuel Bomze	Markus Gabl (VGSCO program)	Conic and Quadratic Optimization tools for Optimization under Uncertainty
Immanuel Bomze, Markus Leitner	Michael Kahr (VGSCO program)	Mathematical optimization for social network analysis: Influence maximization and community detection
Immanuel Bomze	Bo Peng (VGSCO program)	Conic Optimization and MINLP for sparsity models in analytics
Immanuel Bomze, João Alves, Torsten Möller (all Research Network Data Science)	Sebastian Ratzenböck (PhD program Data Science, DSPL Informatics)	Data Science techniques in Astronomy
Christa Cuchiero, Stefan Gerhold (TU Vienna)	Benedict Bauer	Forward variance models, Schrödinger bridges and calibration
Christa Cuchiero, Zehra Eksi (WU Vienna)	Eva Flonner	Neural stochastic differential equations
Christa Cuchiero, Irene Klein	Guido Gazzani	Dynamic Uncertainty modeling in finance
Christa Cuchiero, Luca di Persio (Univ. Verona)	Francesco Guida	Measure-valued affine and polynomial processes
Christa Cuchiero, Maria Elvira Mancino & Josef Teichmann (Scuola Normale Superiore in Pisa)	Tonio Möllmann	Generalized Feller processes and stochastic representations of non-linear differential equations

Christa Cuchiero	Francesca Primavera	Signature methods from a polynomial and affine point of view
Christa Cuchiero	Stefan Rigger	Singular McKean Vlasov equations and supercooled Stefan problems
Nikolaus Hautsch	Xandro Bayer	
Tatyana Krivobokova	Karolina Klockmann	Bayesian nonparametric adaptive estimation of Toeplitz covariance matrices
Tatyana Krivobokova	Fabio Elio Tonti	
Hannes Leeb, Lukas Steinberger	Nicolai Amann	Conditional predictive inference for linear sub-models of high-dimensional data
Hannes Leeb	Danijel Kivaranovic	Statistical analysis and development of inference procedures post-model-selection
Markus Leitner, Ivana Ljubic	Georg Brandstätter	Strategic Optimization of Electric Car Sharing Systems
Georg Pflug	Sándor Guzmics	Freund copula and extensions
Benedikt M. Pötscher	Christian Zwatz	Topics in Autocorrelation Robust Testing and Spatial Models
Erhard Reschenhofer	Manveer K. Mangat	Essays on time series forecasting
Erhard Reschenhofer, Lukas Steinberger	Thomas Stark	High dimensional prediction analysis for gradient descent applied to ridge regression

Master Theses in Progress

Supervisor	Author	Title
Immanuel Bomze	Anja Bohatschek	Entwicklung und Entstehung der Isotype von Otto Neurath sowie Vergleich zum aktuellen Regelwerk zur Erstellung von Bildstatistiken
Immanuel Bomze, Stefan Pickl	Theresa Loreth	Business Continuity Management in times of crisis
Immanuel Bomze	Sandra Ines Peer	Extended trust region problem and their copositive relaxation: a simulation study
Christa Cuchiero	Abdiu Fation	The effects of inclusion and exclusion of the German midcap index on stock returns
Christa Cuchiero	Florian Redl	Deep reinforcement learning for games

Christa Cuchiero	Roman Solntsev	Forecasting Realized Volatility on the Example of the ATX
Nikolaus Hautsch	Julian Feurhuber	Intraday Dynamics of Option-Implied Variance
Nikolaus Hautsch	Yelena Holzer	Analysis of arbitrage possibilities in cryptocurrency exchanges
Nikolaus Hautsch	Zhuxi Pang	Will the outbreak of Coronavirus disease (COVID-19) affect the stock markets of infected countries?
Irene Klein	Azadeh Sadat Mirtaheri	Trading with restricted information
Irene Klein	Mariia Nikonova	Risikomaße und Aufteilung des Risikos unter Modellunsicherheit
Hannes Leeb	Manuel Müller	The convergence rate of stochastic gradient descent
Werner Schachinger	Simon Klima	Random Graphs and the Giant Component
Werner Schachinger	Rafael Jochum	Verzweigungsprozesse – Theorie und Anwendung

Master Theses Finished

Supervisor	Author	Title
Immanuel Bomze, Bertram Wassermann	Cornelia Pollack	The analysis of passenger behaviour in the Austrian railway system (ÖBB)
Christa Cuchiero	Andreas Celary	Rough volatility in Bitcoin markets
Christa Cuchiero	Eva Flonner	Rough covariance estimation - a neural network approach
Christa Cuchiero	Anela Jahic	Volatility forecasting with neural networks
Christa Cuchiero	Jakob Steininger	Deep reinforcement learning for portfolio optimization
Nikolaus Hautsch	Dilshod Agishev	Predictability of cryptocurrency returns
Nikolaus Hautsch	Bogdan Stankovski	The Influence of Chief Executive Office Departure on Stock Prices
Irene Klein	Ievgen Kolomiets	The impact of implementation of AI on financial results of "Tech Giants" in relation to stock prices

Hannes Leeb	Manuel Hahn	An analysis of a proposed model-free approach to linear least squares regression
Hannes Leeb	Mathias Wörndl	Variable selection via fixed-X and model-X knockoff procedures – detailed proofs
Lukas Steinberger	Natalie Schmerlaib	Establish a R-based automated data evaluation in routine analysis
Erhard Reschenhofer	Patrycja Pultowicz	Application of machine learning algorithms to stock price movement
Erhard Reschenhofer	Christian Url	Distribution-free predictive intervals for quantile forests
Erhard Reschenhofer	Alexander Leo Kuhn	Comparing Classes of Volatility Models
Erhard Reschenhofer	Melanie Nachreiner	Bitcoin: Eine Wechselkursanalyse
Erhard Reschenhofer	Xaver-Paul Stadlbauer	Anomaliedetektion zur Überwachung von Photovoltaikanlagen

Bachelor Theses

Immanuel Bomze (3), Christa Cuchiero (4), Mathias Pohl (3), Mario Ruthmair (2), Lukas Steinberger (9)

5 Publications

Journal Articles

Bachoc, Francois; Preinerstorfer, David; Steinberger, Lukas: Uniformly valid confidence intervals post-model-selection. In: *Annals of Statistics*. 2020; 48, 1, pp. 440-463, <https://doi.org/10.1214/19-AOS1815>

Beham, Barbara; Baierl, Andreas; Eckner, Janin: When does part-time employment allow managers with family responsibilities to stay on the career track? A vignette study among German managers. In: *European Management Journal*. 2020; 38, 4, pp. 580-590, <https://doi.org/10.1016/j.emj.2019.12.015>

Bomze, Immanuel; Rinaldi, Francesco; Zeffiro, Damiano: Active Set Complexity of the Away-Step Frank--Wolfe Algorithm. In: *SIAM Journal on Optimization*. 2020; 30, 3, pp. 2470-2500, <https://doi.org/10.1137/19M1309419>

Bomze, Immanuel; Schachinger, Werner: Constructing Patterns of (Many) ESSs Under Support Size Control. In: *Dynamic Games and Applications*. 2020; 10, 3, pp. 618-640, <https://doi.org/10.1007/s13235-019-00323-1>

Bomze, Immanuel; Schachinger, Werner; Weibull, Jörgen: Does moral play equilibrate? In: *Economic Theory*. 2021; 71, pp. 305-315, <https://doi.org/10.1007/s00199-020-01246-4> (online first 2020)

Bomze, Immanuel; Gabl, Markus: Interplay of non-convex quadratically constrained problems with adjustable robust optimization. In: *Mathematical Methods of Operations Research*. 2021; 93, 115-151, <https://doi.org/10.1007/s00186-020-00726-6> (online first 2020)

Bomze, Immanuel; Kahr, Michael; Leitner, Markus: Trust Your Data or Not—StQP Remains StQP: Community Detection via Robust Standard Quadratic Optimization. In: *Mathematics of Operations Research*. 2021; 46, 1, pp. 301-316, <https://doi.org/10.1287/moor.2020.1057> (online first 2020)

Cebiroglu, Gökhan; Hautsch, Nikolaus; Horst, Ulrich: Order Exposure and Liquidity Coordination: Does Hidden Liquidity Harm Price Efficiency? In: *Market Microstructure and Liquidity*. 2020; <https://doi.org/10.1142/S2382626620500021>

Cuchiero, Christa; Klein, Irene; Teichmann, Josef: A Fundamental Theorem of Asset Pricing for Continuous Time Large Financial Markets in a Two Filtration Setting. In: *Theory of Probability and Its Applications*. 2020; 65, 3, pp. 388-404, <https://doi.org/10.1137/S0040585X97T990022>

Cuchiero, Christa; Khosrawi-Sardroudi, Wahid; Teichmann, Josef: A generative adversarial network approach to calibration of local stochastic volatility models. In: *Risks: open access journal*. 2020; 8(4), 101, 34 pp., <https://doi.org/10.3390/risks8040101>

Cuchiero, Christa; Larsson, Martin; Teichmann, Josef: Deep neural networks, generic universal interpolation, and controlled ODEs. In: *SIAM Journal on Mathematics of Data Science*. 2020; 2, 3, pp. 901-919, <https://doi.org/10.1137/19M1284117>

Cuchiero, Christa; Teichmann, Josef: Generalized Feller processes and Markovian lifts of stochastic Volterra processes: the affine case. In: *Journal of Evolution Equations*. 2020; 20, pp. 1301–1348, <https://doi.org/10.1007/s00028-020-00557-2>

Cuchiero, Christa; Papariello-Svaluto-Ferro, Sara: Infinite dimensional polynomial processes. In: *Finance and Stochastics*. 2020; 37 pp., <https://arxiv.org/abs/1911.02614>

Cuchiero, Christa: Universal structures in Mathematical Finance. In: *International Mathematical News*. 2020; 244, 08/20

Dmytriv, Solomiia; Bodnar, Taras; Okhrin, Yarema; Parolya, Nestor; Schmid, Wolfgang: Statistical Inference for the Expected Utility Portfolio in High Dimensions. In: *IEEE Transactions on Signal Processing*. 2021; 69, pp. 1-14, <https://doi.org/10.1109/TSP.2020.3037369> (online first 2020)

Eckstein, Stephan; Kupper, Michael; Pohl, Mathias: Robust risk aggregation with neural networks. In: *Mathematical Finance: an international journal of mathematics, statistics and financial economics*. 2020; 30, 4, pp. 1229-1272, <https://doi.org/10.1111/mafi.12280>

Geiersbach, Caroline; Wollner, Winnifried: A Stochastic Gradient Method with Mesh Refinement for PDE Constrained Optimization under Uncertainty. In: *SIAM Journal on Scientific Computing*. 2020; 42, 5, pp. A2750–A2772, <https://doi.org/10.1137/19M1263297>

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- Gouveia, Luis; Leitner, Markus; Ruthmair, Mario; Sadykov, Ruslan: Corrigendum to "Extended Formulations and Branch-and-Cut Algorithms for the Black-and-White Traveling Salesman Problem" [*European Journal of Operational Research*, 262(3) 2017, 908–928]. In: *European Journal of Operational Research*. 2020; 285, 3, pp. 1199-1203, <https://doi.org/10.1016/j.ejor.2020.02.039>
- Güney, Evren; Leitner, Markus; Ruthmair, Mario; Sinnl, Markus: Large-scale Influence Maximization via Maximal Covering Location. In: *European Journal of Operational Research*. 2021; 289, 1, pp. 144-164, <https://doi.org/10.1016/j.ejor.2020.06.028> (online first 2020)
- Gutjahr, Walter; Noyan, Nilay; Vandaele, Nico; Van Wassenhove, Luk N.: Innovative approaches in humanitarian operations. In: *OR Spectrum*. 2020; 42, pp. 585-589, <https://doi.org/10.1007/s00291-020-00598-6>
- Gutjahr, Walter: Inequity-averse stochastic decision processes. In: *European Journal of Operational Research*. 2021, 288, 1, pp. 258-270, <https://doi.org/10.1016/j.ejor.2020.05.045> (online first 2020)
- Hautsch, Nikolaus; Herrera Leiva, Rodrigo: Multivariate Dynamic Intensity Peaks-Over-Threshold Models. In: *Journal of Applied Econometrics*. 2020; 35, 2, pp. 248-272, <https://doi.org/10.1002/jae.2741>
- Jirak, Johannes Moritz; Wu, Wei Biao; Zhao, Ou: Sharp connections between Berry-Esseen characteristics and Edgeworth expansions for stationary processes. In: *Transactions of the American Mathematical Society*. 2020; <https://arxiv.org/abs/2007.05717v4>
- Kahr, Michael; Leitner, Markus; Ruthmair, Mario; Sinnl, Markus: Benders decomposition for competitive influence maximization in (social) networks. In: *Omega*. 2021; 100, 102264, <https://doi.org/10.1016/j.omega.2020.102264> (online first 2020)
- Kivaranovic, Danijel; Leeb, Hannes: Expected length of post-model-selection confidence Intervals conditional on polyhedral constraints. In: *Journal of the American Statistical Association*. 2020; <https://doi.org/10.1080/01621459.2020.1732989>
- Leitner, Markus; Ljubic, Ivana; Riedler, Martin; Ruthmair, Mario: Exact approaches for the directed network design problem with relays. In: *Omega*. 2020; 91, 102005, <https://doi.org/10.1016/j.omega.2018.11.014>
- Leitner, Markus; Brandstätter, Georg; Ljubic, Ivana: Location of charging stations in electric car sharing systems. In: *Transportation Science*. 2020; 54, 5, pp. 1153-1438, <https://doi.org/10.1287/trsc.2019.0931>
- Leymarie, Jérémy; Scaillet, Olivier; Hurlin, Christophe; Banulescu, Denisa: Backtesting Marginal Expected Shortfall and Related Systemic Risk measures. In: *Management Science*. 2021; <https://doi.org/10.1287/mnsc.2020.3751> (online first 2020)

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Mangat, Manveer; Reschenhofer, Erhard: Frequency-domain evidence for climate change. In: Econometrics. 2020; 8, 3, 28, pp. 1-15, <https://doi.org/10.3390/econometrics8030028>

Pflug, Georg; Kaniovskiy, Yuriy; Kaniovskiy, Yuriy: Analysis of credit-rating migrations with genetic algorithms. In: International Journal of Bio-Inspired Computation. 2020; 16, 4, pp. 264-274, <https://doi.org/10.1504/IJBIC.2020.112348>

Pflug, Georg; Pichler, Alois; Kirui, Kipngeno Benard: ScenTrees.jl: A Julia Package for Generating Scenario Trees and Scenario Lattices for Multistage Stochastic Programming. In: Journal of Open Source Software. 2020; 5, 46, <https://doi.org/10.21105/joss.01912>

Pohl, Mathias; Ristig, Alexander; Schachermayer, Walter; Tangpi Ndounkeu, Ludovic: Theoretical and empirical analysis of trading activity. In: Mathematical Programming. 2020; 181, pp. 405-434, <https://doi.org/10.1007/s10107-018-1341-x>

Ratzenboeck, Sebastian; Meingast, Stefan; Alves, Joao; Moeller, Torsten; Bomze, Immanuel: Extended stellar systems in the solar neighborhood IV. Meingast 1: the most massive stellar stream in the solar neighborhood. In: Astronomy & Astrophysics. 2020; 639, A64, 10 pp., <https://doi.org/10.1051/0004-6361/202037591>

Reschenhofer, Erhard; Mangat, Manveer: Detecting long-range dependence with truncated ratios of periodogram ordinates. In: Communications in Statistics - Theory and Methods. 2020; 16 pp., <https://doi.org/10.1080/03610926.2019.1709646>

Reschenhofer, Erhard; Mangat, Manveer; Zwat, Christian; Guzmics, Sandor: Evaluation of current research on stock return predictability. In: Journal of Forecasting. 2020; 39, 2, pp. 334-351; <https://doi.org/10.1002/for.2629>

Reschenhofer, Erhard; Mangat, Manveer: Fast computation and practical use of amplitudes at non-Fourier frequencies. In: Computational Statistics. 2020; <https://doi.org/10.1007/s00180-020-01061-4>

Reschenhofer, Erhard; Mangat, Manveer; Stark, Thomas: Improved estimation of the memory parameter. In: Theoretical Economics Letters (TEL). 2020; 10, 1, pp. 47-68, <https://doi.org/10.4236/tel.2020.101004>

Reschenhofer, Erhard; Mangat, Manveer: Reducing the bias of the smoothed log periodogram regression for financial high-frequency data. In: Econometrics. 2020; 8(4), 40, pp. 1-15, <https://doi.org/10.3390/econometrics8040040>

Reschenhofer, Erhard; Stark, Thomas; Mangat, Manveer: Robust estimation of the memory parameter. In: Journal of Statistical and Econometric Methods. 2020; 9, 4, pp. 53-86, https://EconPapers.repec.org/RePEc:spt:stecon:v:9:y:2020:i:4:f:9_4_5

Reschenhofer, Erhard; Mangat, Manveer; Stark, Thomas: Volatility forecasts, proxies and loss functions. In: Journal of Empirical Finance. 2020; 59, December 2020, pp. 133-153

Rohde, Angelika; Steinberger, Lukas: Geometrizing rates of convergence under local differential privacy constraints. In: *Annals of Statistics*. 2020; 48, 5, pp. 2646-2670, <http://dx.doi.org/10.1214/19-AOS1901>

Schachinger, Werner: Lower bounds for maximal cp-ranks of completely positive matrices and tensors. In: *The Electronic Journal of Linear Algebra*. 2020; 36, pp. 519-541, <https://doi.org/10.13001/ela.2020.5323>

Contributions to Proceedings and Edited Books

Baierl, Andreas; Obszelka, Daniel: *Statistisches Programmieren mit R: Eine ausführliche, übersichtliche, spannende und praxiserprobte Einführung*. Springer Vieweg, 2020

Kivaranovic, Danijel; Johnson, Kory; Leeb, Hannes: Adaptive, distribution-free prediction intervals for deep neural networks. In: *Proceedings of Machine Learning Research*. 23rd International Conference on Artificial Intelligence and Statistics, 26-28 August 2020, Online. 2020; 108, pp. 1-10 PMLR 108:4346-4356

Working Papers

Cuchiero, Christa; Gonon, Lukas; Grigoryeva, Lyudmila; Ortega, Juan-Pablo; Teichmann, Josef: Discrete-time signatures and randomness in reservoir computing. In: *arXiv*. 2020; 14 pp., <https://arxiv.org/abs/2010.14615> Submitted

Cuchiero, Christa; Rigger, Stefan; Papariello-Svaluto-Ferro, Sara: Propagation of minimality in the supercooled Stefan problem. In: *arXiv*. 2020; 41 pp., <https://arxiv.org/abs/2010.03580> Submitted

Geiersbach, Caroline; Scarinci, Teresa: Stochastic Proximal Gradient Methods for Nonconvex Problems in Hilbert Spaces. In: *arXiv*. 2020; 51 pp., <https://arxiv.org/abs/2001.01329v3> Submitted

Jirak, Johannes Moritz: A Berry-Esseen bound with (almost) sharp dependence conditions. In: *arXiv*. 2020; 27 pp., <https://arxiv.org/abs/2008.07332> Submitted

Jirak, Johannes Moritz; Wahl, Martin: Relative perturbation bounds with applications to empirical covariance operators. In: *arXiv*. 2020; 55 pp., <https://arxiv.org/abs/1802.02869> Submitted

Johnson, Kory D.; Beiglböck, Mathias; Eder, Manuel; Grass, Annemarie; Hermisson, Joachim; Pammer, Gudmund; Polechová, Jitka; Toneian, Daniel; Wöfl, Benjamin: Disease Momentum: Estimating the Reproduction Number in the Presence of Superspreading. In: *arXiv*. 2020; 23 pp. <https://arxiv.org/abs/2012.08843> Submitted

Pötscher, Benedikt; Preinerstorfer, David: How Reliable are Bootstrap-based Heteroskedasticity Robust Tests? Submitted

Steinberger, Lukas; Leeb, Hannes: Conditional predictive inference for high-dimensional stable algorithms. In: *arXiv*. 2020; <https://arxiv.org/abs/1809.01412> Submitted

Steinberger, Lukas; Leeb, Hannes: Statistical inference with F-statistics when fitting simple models to high-dimensional data. In: *arXiv*. 2020; <https://arxiv.org/abs/1902.04304> Submitted

Steinberger, Lukas: Interactive versus non-interactive locally differentially private estimation: Two elbows for the quadratic functional. In: arXiv. 2020; <https://arxiv.org/abs/2003.04773> Submitted

6 Dissemination of Research

Presentations at Workshops, Conferences and Outside Seminars

	Event/Institution	Title of Presentation
Immanuel Bomze	Workshop Optimization Tales, February 2020, Rende, Italy (Keynote Speaker)	Towards responsible game theory - from Kant to a copositive view on a parametric QP
Immanuel Bomze	GDO2020 - Games, Dynamics and Optimization, February 2020, Sapienza University, Rome, Italy (Keynote Speaker)	Towards responsible game theory - from Kant to a copositive view on a parametric QP
Christa Cuchiero	Advances in Financial Mathematics 2020, January 2020, Paris, France (Keynote Speaker)	Deep neural networks, generic universal interpolation and controlled differential equations
Christa Cuchiero	XXI Workshop on Quantitative Finance, January 2020, Center for Studies in Economics and Finance, Naples, Italy	Deep neural networks, generic universal interpolation and controlled differential equations
Christa Cuchiero	Freiburg-Vienna-Zurich-Seminar (online), April 2020	Some aspects of epidemic modeling
Christa Cuchiero	Paris Bachelier Seminar, March 2020, Paris, France (Invited Speaker)	Consistent minimal market models for the growth optimal portfolio
Christa Cuchiero	Center for Financial Mathematics & Actuarial Research at UC Santa Barbara (Online Seminar), April 2020, Santa Barbara, USA (Invited Speaker)	Neural S(P)DEs for infinite dimensional calibration and prediction problems
Christa Cuchiero	First Workshop on Market Generation (online), May 2020, London, Great Britain/UK (Invited Speaker)	Deep calibration of LSV models
Christa Cuchiero	SPATUS kick-off seminar (online), August 2020, Oslo, Norway (Invited Speaker)	Measure valued processes for energy markets

Christa Cuchiero	Conference on High-dimensional Stochastics: Mathematics for Risk in Finance and Energy (online), September 2020, Vienna, Austria (Invited Speaker)	Universal properties of affine and polynomial processes
Christa Cuchiero	Bachelier Finance Society - One World seminar series (online), September 2020, Zurich, Switzerland (Invited Speaker)	Universality of affine and polynomial processes
Christa Cuchiero	Stochastic Analysis & Mathematical Finance Seminars (online), October 2020, Oxford, Great Britain/UK (Invited Speaker)	Deep neural networks, generic universal interpolation and controlled ODEs
Christa Cuchiero	New Challenges in the Interplay between Finance and Insurance (online), October 2020, Oberwolfach, Germany (Invited Speaker)	Universality of affine and polynomial processes
Christa Cuchiero	Vienna Probability Seminar (online), November 2020, Vienna, Austria (Invited Speaker)	Universality of affine and polynomial processes
Christa Cuchiero	School in Machine Learning of Dynamic Processes and Time Series Analysis (online), November 2020, Pisa, Italy (Invited Speaker)	From neural SDEs and signature methods to affine and polynomial processes and back
Christa Cuchiero	Workshop on representations of jump diffusions, Berlin-Mexico-Vienna (online), December 2020, Berlin, Germany (Invited Speaker)	Universality of affine and polynomial processes and their applications on the unit interval
Nikolaus Hautsch	Stockholm Business School (online Webinar), April 2020, Stockholm, Sweden (Invited Speaker)	Building Trust Takes Time: Limits to Arbitrage in Blockchain-Based Markets
Nikolaus Hautsch	International Association for Quantitative Finance - Thalesians Seminar Series (online), May 2020, London, Great Britain/UK	Building Trust Takes Time: Limits to Arbitrage in Blockchain-Based Markets
Irene Klein	New Challenges in the Interplay between Finance and Insurance (online), October 2020, Oberwolfach, Germany (Invited Speaker)	Risk measures under uncertainty: a Bayesian view
Hannes Leeb	International Seminar on Selective Inference (online), September 2020	Conditional Predictive Inference for High-Dimensional Stable Algorithms

Hannes Leeb	Nuffield Econometrics Seminar (online), May 2020, Oxford, Great Britain/UK	Prediction when fitting simple models to high-dimensional data
Hannes Leeb	Online Research Seminar of the Institute of Statistics and Mathematics - WU Vienna (online), November 2020, Vienna, Austria	Conditional Predictive Inference for High-Dimensional Stable Algorithms
Jérémy Leymarie	Econometric Society/Bocconi University 2020 Virtual World Congress (online), August 2020, Milan, Italy	Backtesting Marginal Expected Shortfall and Related Systemic Risk Measures
Mario Ruthmair	Netopt2020 - 9 th Winter School on Network Optimization, January 2020, Estoril, Portugal (Invited Speaker)	Optimization in Social Networks
Lukas Steinberger	13 th International Conference of the ERCIM WG on Computational and Methodological Statistics (online), 19 December 2020, Great Britain/UK	Estimating linear and quadratic functionals under local differential privacy

Departmental Seminar (ISOR Colloquium)

January 13	Giorgio Gnecco (IMT Lucca, Italy)	On the Optimal Trade-Off Between Sample Size and Precision of Supervision in Regression (joint work with F. Nutarelli)
January 20	Michael Kupper (Univ. Konstanz, Germany)	Max-stable risk measures and large deviations
January 27	Kurt Anstreicher (Univ. Iowa, USA)	Efficient Solution of Maximum-Entropy Sampling Problems
March 2	Jianzhe Trevor Zhen (Univ. Zurich, Switzerland)	Distributionally Robust Nonlinear Optimization
October 19	Werner Müller (Johannes Kepler Univ. Linz, Austria)	A design criterion for symmetric model discrimination based on flexible nominal sets
November 16	Andreas Sojmark (Imperial College London, Great Britain)	Dynamic Default Contagion in interbank systems (online)

7 Grants and Externally Funded Research Projects

Radu Ioan Bot (Principal Investigator) Immanuel Bomze (Co-Investigator), Monika Henzinger (Co-Investigator), Arnold Neumaier (Co-Investigator)	Title: VGSCO: Vienna Graduate School on Computational Optimization (2 nd Funding period) Funding: FWF Funding period: 2020-2024
Karl Franz Dörner (Project-Coordinator) Immanuel Bomze (Co-Investigator) Radu Ioan Bot (Co-Investigator) Sylvia Kritzing (Co-Investigator) Research Associates: Michael Kahr, Michael Sedlmayer, David Wolfinger	Title: Logistics decision support in the pandemic Funding: FWF Funding period: 2020-2022
Christa Cuchiero (Project-Coordinator)	Title: Universal structures in Mathematical Finance Funding: FWF, 2019 START – Prize Funding period: 2020-2026
Christa Cuchiero (Project-Coordinator), Irene Klein (Co-Investigator), Thorsten Schmidt (Co-Investigator)	Title: Dynamic Uncertainty Modeling in Finance Funding: 2018 DFG-FWF-Project Funding period: 2019-2022
Christa Cuchiero (Project-Coordinator), Walter Schachermayer (Co-Investigator)	Title: Macroprudential bank regulation: a continuous time approach Funding: WWTF Funding period: 2017-2021
Nikolaus Hautsch (Principal Investigator) Research Associate: Ilya Archakov	Title: Econometrics of Central Counterparty Risk Management Funding: FWF Funding period: 2020-2021
Nikolaus Hautsch (Principal Investigator)	Title: Vienna Graduate School of Finance Funding: doc.funds, FWF Funding period: 2018-2020
Nikolaus Hautsch (Principal Investigator) Research Associate: Ilya Archakov	Title: Order Book Foundations of Price Risks and Liquidity: An Integrated Equity and Derivatives Markets Perspective Funding: FWF Funding period: 2017-2020

Georg Pflug (Project-Coordinator),
 Teresa Scarinci (Project-Coordinator)
 Immanuel Bomze (Co-Investigator),
 Radu Ioan Bot (Co-Investigator),
 Monika Henzinger (Co-Investigator),
 Arnold Neumaier (Co-Investigator),
 Günther Raidl (Co-Investigator),
 Hermann Schichl (Co-Investigator)
 Research Associates: Axel Böhm, Marko
 Djukanovic, Markus Gabl, Caroline
 Geiersbach, Mathias Horn, Morteza
 Kimiaei, Stefan Neumann, Dang Khoa
 Nguyen

Title: Vienna Graduate School on Computational
 Optimization (VGSCO)
 Funding: FWF
 Funding period: 2016-2020

Erhard Reschenhofer (Principal
 Investigator)
 Research Associate: Thomas Stark

Title: Stock return and volatility forecasting with order
 book data
 Funding: OeNB
 Funding period: 2019-2021

8 Research Stays at Other Institutions

	Institution	Weeks
Michael Kahr	ESSEC Business School, Paris, France	26

9 Other Faculty Activities

Editorial Work

Immanuel Bomze	Associate Editor <ul style="list-style-type: none"> ▪ EURO Journal on Computational Optimization Member of Editorial Board <ul style="list-style-type: none"> ▪ Central European Journal of Operations Research ▪ European Journal of Operational Research ▪ Journal of Global Optimization ▪ Operations Research Perspectives ▪ Optimization Letters
Christa Cuchiero	Associate Editor <ul style="list-style-type: none"> ▪ Finance and Stochastics ▪ Frontiers of Mathematical Finance ▪ Journal of Computational Finance ▪ Mathematical Finance: An International Journal of Mathematics, Statistics and Financial Economics

- Walter J. Gutjahr Associate Editor
- Central European Journal of Operations Research
 - OR Spectrum
- Member of Editorial Review Board
- Production and Operations Management
- Member of Editorial Board
- EURO Journal on Decision Processes
- Walter J. Gutjahr, Nilay Noyan, Nico Vandaele & Luk N. Van Wassenhove Guest Editor
- Special Issue “Innovative approaches in humanitarian operations”. OR Spectrum 42 (2020)
- Nikolaus Hautsch Associate Editor
- Journal of Applied Econometrics
 - Journal of Business and Economic Statistics
 - International Journal of Forecasting
 - Market Microstructure and Liquidity
 - Journal of Financial Econometrics
- Editorial Board
- Econometrics
- Managing Editor
- Quantitative Finance
- Johannes Moritz Jirak Associate Editor
- Statistical Inference for Stochastic Processes
- Tatyana Krivobokova Associate Editor
- Journal of the American Statistical Association
 - Scandinavian Journal of Statistics
- Benedikt M. Pötscher Associate Editor
- Journal of Statistical Planning and Inference
- Co-Editor
- Econometric Theory
- Lukas Steinberger Associate Editor
- Statistical Papers

Refereeing

- Immanuel Bomze
- Mathematics of Operations Research
 - SIAM Journal on Optimization

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| Christa Cuchiero | <ul style="list-style-type: none"> ▪ Annals of Applied Probability ▪ Electronic Journal of Probability ▪ Finance and Stochastics ▪ Mathematical Finance: An International Journal of Mathematics, Statistics and Financial Economics ▪ SIAM Journal on Financial Mathematics ▪ Statistics & Probability Letters ▪ Stochastic Processes and their Applications |
| Walter J. Gutjahr | <ul style="list-style-type: none"> ▪ Central European Journal of Operations Research (1) ▪ Computers and Industrial Engineering (1) ▪ European Journal of Operational Research (6) ▪ International Journal of Disaster Risk Reduction (1) ▪ ITOR (1) ▪ Journal of the OR Society (1) ▪ Networks (1) ▪ OR Spectrum (3) ▪ Production and Operations Management (2) ▪ Transportation Research Part E (1) |
| Nikolaus Hautsch | <ul style="list-style-type: none"> ▪ Journal of Applied Econometrics (5) ▪ Journal of Econometrics (3) |
| Moritz Jirak | <ul style="list-style-type: none"> ▪ Annals of Statistics ▪ Bernoulli ▪ Scandinavian Journal of Statistics ▪ SIAM/ASA Journal on Uncertainty Quantification |
| Tatyana Krivobokova | <ul style="list-style-type: none"> ▪ Annals of Statistics (1) ▪ Dependence Modelling (1) ▪ IEEE Transactions on Information Theory (1) ▪ Test (1) ▪ World Development Perspectives (1) |
| Hannes Leeb | <ul style="list-style-type: none"> ▪ Econometric Theory |
| Mathias Pohl | <ul style="list-style-type: none"> ▪ Bernoulli: a journal of mathematical statistics and probability ▪ Mathematical Finance: An International Journal of Mathematics, Statistics and Financial Economics ▪ Mathematical Programming |
| Benedikt M. Pötscher | <ul style="list-style-type: none"> ▪ Econometric Theory |
| Werner Schachinger | <ul style="list-style-type: none"> ▪ Journal of Global Optimization (1) ▪ Optimization Letters (1) |
| Lukas Steinberger | <ul style="list-style-type: none"> ▪ Journal of the American Statistical Association ▪ Annals of Statistics ▪ Statistical Papers |

Other Professional Activities

- Immanuel Bomze
- Board Member of Research Network Data Science, Univ. Vienna, Austria
 - Board Member of Research Platform Governance of digital practices, Univ. Vienna, Austria
 - Deputy Director of Studies Programme Statistics, Univ. Vienna, Austria (until Sep 2020)
 - Director of Studies PhD Programme, Univ. Vienna, Austria (since Oct 2020)
 - EURO President, Lille, France, Jan 2020
 - EURO President, Rotterdam, The Netherlands, Jan 2020
 - EURO President, Leeds, UK, Feb 2020
- Christa Cuchiero
- Co-Organizer of 13th European Summer School in Financial Mathematics, Vienna, Austria, Aug/Sep 2020
 - Organizer of Conference on High-dimensional Stochastics, Vienna, Austria, Sep 2020
 - Co-Organizer of Vienna Seminar in Mathematical Finance and Probability, Vienna, Austria, Oct 2020
- Nikolaus Hautsch
- Board Member of Research Network Data Science, Univ. Vienna, Austria
 - Dean of Faculty of Business, Economics and Statistics, Univ. Vienna, Austria (until Sep 2020)
 - Deputy Head of Department (since Oct 2020)
- Irene Klein
- Co-Organizer of 13th European Summer School in Financial Mathematics, Vienna, Austria, Aug/Sep 2020
- Tatyana Krivobokova
- Board Member of Research Network Data Science, Univ. Vienna, Austria
 - Member of Appointment Committee BWL-Innovations- und Technologiemanagement, Univ. Vienna, Austria
 - Member of Selection Board for the Marie Jahoda-Stipendium of Univ. Vienna, Austria
 - Member of Study Conference SPL 4, Univ. Vienna, Austria
- Hannes Leeb
- Board Member of Research Network Data Science, Univ. Vienna, Austria
 - Deputy Director of Studies PhD Programme, Univ. Vienna, Austria (10/2019-09/2020)
 - Vice Dean Research of Faculty of Business, Economics and Statistics, Univ. Vienna, Austria (since Oct2020)
- Mathias Pohl
- Co-Organizer of 13th European Summer School in Financial Mathematics, Vienna, Austria, Aug/Sep 2020
- Benedikt M. Pötscher
- Head of Department (since Oct 2020)
 - Co-Organizer of "5th Vienna Workshop on High-dimensional Time Series in Macroeconomics and Finance - A tribute to Manfred Deistler"

- Erhard Reschenhofer
 - Deputy Head of Department (until Sep 2020)
- Werner Schachinger
 - Deputy Director of Studies Programme Statistics, Univ. Vienna, Austria (since Oct 2020)
- Lukas Steinberger
 - Head of Admission Board for Master Studies in Data Science, Univ. Vienna, Austria