Finance and Technology Programme

Report 2021-2023

Swiss
Finance
Institute
@EPFL

Vision

We aim at combining the expertise in finance, spanning asset pricing, risk management, market microstructure, corporate finance, innovation financing, and game theory, with cutting-edge technology disciplines such as data science, machine learning, artificial intelligence, computational science, cryptography, and information technology.

Team

ACADEMIC DIRECTOR
Prof. Damir Filipovic

POSTDOCS & PhD STUDENTS
Damien Ackerer
Lotfi Boudabsa
Nicolas Camenzind
Paolo Colusso
Quentin le Moal
Puneet Pasricha
Urban Ulrych

Scientific Highlights

The Finance and Technology Programme team continued, broadened and intensified their research activities at the intersection of finance, financial engineering and technology. These include (i) empirical asset pricing based on novel implementations of machine learning which achieve the highest levels of prediction performance reported in literature to date, (ii) a method for the most accurate and robust estimation of the US.Treasury zero-coupon yield curve when compared to leading benchmarks in literatur, (iii) an efficient sentiment classifier for StockTwits messages and its use for stock return prediction (iv) the development of machine learning methods for derivative pricing and risk management, (v) a stochastic model designed to simulate and price the hedging positions of a novel stablecoin, among others.

Other highlights

The Finance and Technology Conference on Crypto-Assets and Asset Tokenization in November 2021, which brought together a wide range of stakeholders, combining legal and regulatory, technological, financial, economic, and civil society perspectives. The conference presented the latest explorations and analysis of crypto-assets and asset tokenization, and their impact on banking infrastructures and financial markets.

In 2023, the “Finance and Technology Conference 2023” held in April of that year was jointly organized by the Finance and Technology Programme at EPFL and C4DT. It brought together world experts in the technology, finance, legal and regulation aspects of crypto finance, including the decentralized borrowing platform Liquity. The C4DT Observer published a report based on that event which offers an overview of the current state of the DeFi market, analyses some of the cybersecurity and financial challenges whilst also discussing some possible solutions towards adapting the regulation and legal basis, as well as technical infrastructure, to bring stability, reliability and trust to the system. We also note that several valuable knowledge exchanges and research interactions took place with teams from Swissquote and Liquity.

Events

FINANCE AND TECHNOLOGY CONFERENCE

- "Crypto-assets and Asset Tokenization"
  November 5, 2021

- "Finance and Technology Conference 2023 on Decentralized Finance"
  April 26, 2023

KNOWLEDGE EXCHANGE WORKSHOPS

- **Meeting with Quant team at Swissquote**
  (D. Filipovic with P. Pasricha and U. Ulrych), October 31, 2022

- **Swissquote "Quant talk"**
  (D. Filipovic, L. Boudabsa), June 22, 2023

Dissemination

Publications

- **Non-Standard Errors**
  (A. J. Menkveld, A. Dreber, F. Holzmeister, A. Marchal et al.), *Journal of Finance*, 2021 (SSRN)

- **A contagion process with self-exciting jumps in credit risk applications**
  (P. Pasricha with S. Dharmaraja and N. Selvaraju), *Stochastics*,1-20, 2022 (Stochastics) (arXiv)

- **A machine learning approach to portfolio pricing and risk management for high-dimensional problems** (D. Filipovic with L. Fernandez-Arjona), *Mathematical Finance*, 32(4), 982-1019, 2022 (MAFI) (arXiv) (SSRN)

- **Machine learning with kernels for portfolio valuation and risk management**
  (D. Filipovic with L. Boudabsa), *Finance and Stochastics*, 26, 131-172, 2022 (FS) (arXiv) (SSRN)

- **Pricing autocallables under local-stochastic volatility**
  (U. Ulrych, W. Farkas and F. Ferrari), *Frontiers of Mathematical Finance*, 2022 (AIMS) (SSRN)

- **Skew-Brownian motion and pricing European exchange options**
  (P. Pasricha with H. Xin-Jiang), *International Review of Financial Analysis*, 82:102120, 2022 (SPA)

- **Accelerated American Option Pricing with Deep Neural Networks**
  (U. Ulrych with D. Anderson) *Quantitative Finance and Economics*, 7(2): 207-228. doi: 10.3934/QFE.2023011, 2023 (AIMS)

- **Analysis of Large Market Data Using Neural Networks: A Causal Approach**
  (M. Divernois, J. Etesami, D. Filipovic, and N. Kiyavash), IEEE *Journal on Selected Areas in Information Theory*, 4, 833-847, 2023 (IEEE)

- **Discount Models**
  (D. Filipovic) *Finance and Stochastics*, 27, 933-946, 2023 (FS) (arXiv) (SSRN)

- **Sparse and Stable International Portfolio Optimization and Currency Risk Management.**
  (U. Ulrych with R. Burkhardt) *Journal of International Money and Finance*, Vol. 139, 102949, 2023 (SPA)

- **StockTwits Classified Sentiment and Stock Returns**
  (M. Divernois with D. Filipovic), *Digital Finance*, 2023 (Digit Finance) (SSRN)

Working Papers

- **Adaptive joint distribution learning**
  (D. Filipovic, M. Multerer and P. Schneider), 2021 (arXiv)
- **Global Currency Hedging with Ambiguity**
  (U. Ulrych with N. Vasiljević), 2021 (SSRN)
- **Dynamic Currency Hedging with Non-Gaussianity and Ambiguity**
  (U. Ulrych with P. Polak), 2021 (SSRN)
- **Machine Learning for Predicting Stock Return Volatility**
  (D. Filipovic with A. Khalilzadeh), 2021 (SSRN)
- **Mean-Covariance Robust Risk Measurement**
  (V. Nguyen, S. Shafieezadeh Abadeh, D. Filipovic, and D. Kuhn), 2021 (arXiv) (SSRN)
- **Risk & Returns around Fomc Press Conferences: A Novel Perspective from Computer Vision**
  (A. Marchal), 2021 (SSRN)
- **Copula Process Models for Financial Risk Management**
  (D. Filipovic with P. Pasricha), 2022
- **Empirical Asset pricing via Ensemble Gaussian Process Regression**
  (D. Filipovic with P. Pasricha), 2022 (arXiv) (SSRN)
- **Ensemble learning for portfolio valuation and risk management**
  (D. Filipovic with L. Boudabsa), 2022 (arXiv) (SSRN)
- **Portfolio Construction with Hierarchical Momentum**
  (U. Ulrych, A. Cirulli and M. Kobak), 2022 (SSRN)
- **Shrinking the Term Structure**
  (D. Filipovic, M. Pelger and Y. Ye), 2022 (SSRN)
- **Stripping the Discount Curve – a Robust Machine Learning Approach**
  (D. Filipovic, M. Pelger and Y. Ye), 2022 (SSRN)
- **Liquity Hedging Position: A Reduced-Form Approach**
  (D. Ackerer with D. Filipovic), 2023
- **Neural Control Systems**
  (P. Colusso with D. Filipovic), 2023 (arXiv)
- **Perpetual Futures Pricing**
  (D. Ackerer, J. Hugonnier and U. J. Jermann), 2023 (SSRN)
- **Stripping the Swiss Discount Curve**
  (N. Camenzind with D. Filipovic), 2023 (SSRN)

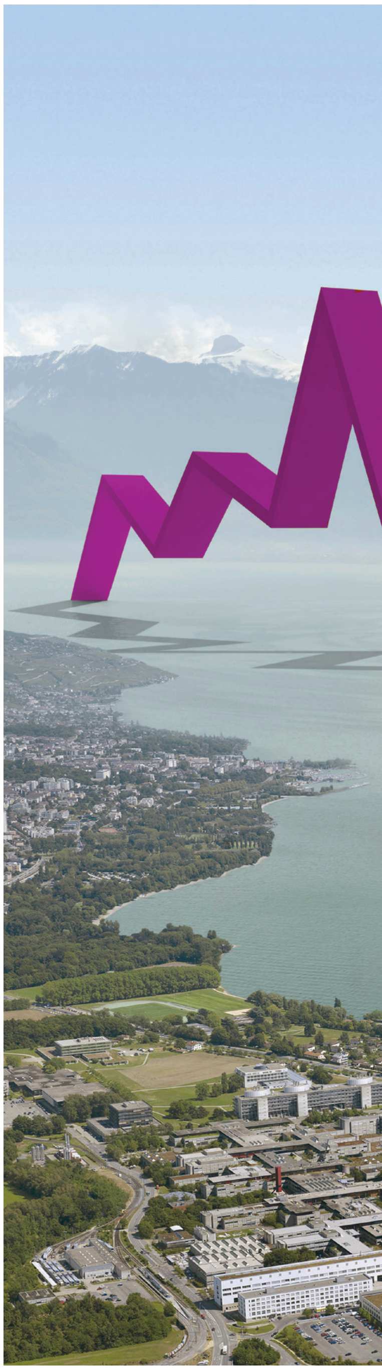
- **Time-Series Similarity Measures based on Topological Data Analysis**
  (D. Filipovic with A. Goel)
- **Smart Kernel Factors,**
  (P. Collin-Dufresne, D. Filipović and U. Ulrych)

Selected conference presentations

- **“A Machine Learning Approach to Portfolio Pricing and Risk Management for High-Dimensional Problems”** SIAM Conference on Financial Mathematics and Engineering, June 2021, (D. Filipovic)
- **"Copula Process Asset Pricing".** The Platform for Advanced Scientific Computing Conference (PASC21), July 2021, (P. Pasricha)
- **“StockTwits Sentiment Classification and Stock Returns”** International FinTech, InsurTech & Blockchain Forum, Zurich, November 2021, (D. Filipovic)
- **“Empirical Asset Pricing via Gaussian Process Regression”** SFI Research Days, Gerzensee, 8 June 2022, (D. Filipovic and P. Pasricha)
- **“Ensemble learning for portfolio valuation and risk management”,** 2nd Joint Congress of Mathematics, co-organized by the American Mathematical Society, the European Mathematical Society and the Société Mathématique de France (AMS-EMS-SMF 2022), Grenoble, France, July 2022, (L. Boudabsa)
- **“CUSO-MLSTATS 2022”** summer school, September 2022, (P. Pasricha)
- **“Stripping the Discount Curve – SAA Working Group on Yield Curves”** CONVENTION A, European Actuarial Academy online conference, 21 September 2022, (D. Filipovic)
- **“Sparse and Stable International Portfolio Optimization and Currency Risk Management”**, 17th Belgian Financial Research Forum, Vrije Universiteit Brussel, 21 April 2023, (U. Ulrych)
- **“Accelerated American Option Pricing with Deep Neural Networks”**, SIAM Conference on Financial Mathematics and Engineering, Philadelphia, 7 June 2023, (U. Ulrych)
- **“Joint Learning of International Yield Curves”**, SIAM Conference on Financial Mathematics and Engineering, Philadelphia, 7 June 2023, (D. Filipovic)
- **“Portfolio Construction with Hierarchical Momentum”**, 26th International Congress on Insurance: Mathematics and Economics, Heriot-Watt University Edinburgh, 5 July 2023, (U. Ulrych)
- **“Shrinking the Term Structure”**, European Finance Association Annual Meeting, Amsterdam, 16 August 2023, (D. Filipovic)
- **“Kernel Density Machines”**, 17th International Conference on Computational and Financial Econometrics, Berlin, 16 December 2023, (D. Filipovic)

Acknowledgments

Our sincere and deepest thanks to our industry partner Swissquote for their vital support, both in terms of knowledge exchange and funding. We are also grateful to Liquity for their generous donation and collaboration within the framework of new decentralized stablecoin and lending protocols developments. We also thank all the professors, Postdocs and PhD participating to this innovative research.



Swiss
Finance
Institute
@EPFL

Swiss Finance Institute @ EPFL
Quartier UNIL – Chamberonne
EXTRANEF 214
CH – 1015 LAUSANNE

sfi.epfl.ch