

# Probability in Finance and Insurance

YUFEI ZHANG

Department of Statistics, London School of Economics

PhD Open day, 28 November 2022

9 faculty members and 8 PhD students.

Experts on quantitative decision making in finance and insurance.

- ▶ Stochastic modelling, analysis and simulation.

Cutting-edge research in

- ▶ decision making with model uncertainty,
- ▶ valuation of exotic financial securities,
- ▶ multi-agent systems in finance and science,
- ▶ stochastic simulation and machine learning in finance.

- ▶ Robust decision making under model uncertainty.
- ▶ Quantitative risk measurement, in particular
  - ◇ insurance-linked securities,
  - ◇ environmental economics.



- ▶ Lévy processes and applications.
- ▶ Optimal stopping/prediction problem.
- ▶ Erik is generally interested in supervising talented and motivated students in a wide range of topics. His previous PhD students have written theses on the following:
  - ◇ Essays in tail risk and asset pricing in credit markets. <http://etheses.lse.ac.uk/4404/>
  - ◇ Pricing financial and insurance products in the multivariate setting.  
<http://etheses.lse.ac.uk/4296/>
  - ◇ Optimal prediction problems and the last zero of spectrally negative Lévy processes.  
<http://etheses.lse.ac.uk/4257/>



- ▶ Market microstructure:
  - ◇ How are prices determined in equilibrium?
  - ◇ What determines the liquidity and trade volume?
  - ◇ What are the incentives for traders to acquire private information?
  - ◇ What are the causes of price volatility?
- ▶ Markov process: theories and financial applications.
- ▶ Monte-Carlo methods for stochastic differential equations: convergence theory and financial applications.



- ▶ Point processes, in particular Hawkes process based models.
- ▶ Integer-valued time series and their connection to (estimation of) branching and point processes.
- ▶ Valuation of path-dependent financial products, such as quantile/Parisian options in finance, and ruin probabilities in insurance.
- ▶ Monte Carlo simulation involving all of the above but also functionals of Lévy processes.



- ▶ Risk management
  - ◇ Distortion risk measures: estimation, computation and multivariate extensions.
  - ◇ Model ambiguity.
- ▶ Insurance mathematics
  - ◇ Pricing under dynamic risk measures.
  - ◇ Risk sharing and capital allocation, such as reinsurance pricing.
  - ◇ Sustainable finance and insurance, new emerging risks.

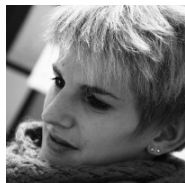


- ▶ Arbitrage-free principle and growth-optimal portfolio.
  - ◊ I. Karatzas, and C. Kardaras (2021), Portfolio Theory and Arbitrage: A Course in Mathematical Finance.
- ▶ Portfolio Optimisation: asymptotic, robust, drawdown-constrained.
- ▶ Mathematical Economics: equilibrium of strategic risk-sharing and price impact models.
- ▶ Stochastic analysis and convex analysis.





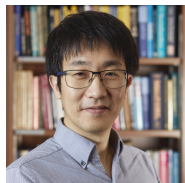
- ▶ Mathematics of deep learning.
- ▶ High frequency econometrics: nonparametric estimation and hypothesis testing.
- ▶ Mean-field games and their connections with machine learning.



- ▶ Interacting particle systems in finance and science and their asymptotic limits.
- ▶ Stochastic analysis and weak convergence theory.
- ▶ Systemic risk modelling.
- ▶ Pricing of credit derivatives and empirical analysis of contagion effects.



- ▶ Mathematics of reinforcement learning: sample complexity, robustness and scalability.
- ▶ Stochastic control, nonconvex optimisation, and high-dimensional probability & statistics.
- ▶ Application in finance: online insurance pricing and optimal liquidation.



# Get connected!

Website: <https://www.lse.ac.uk/Statistics/Research/Probability-in-Finance-and-Insurance>



Pauline Barrieu



Erik Baurdoux



Umut Cetin



Angelos Dassios



Daniela Escobar



Kostas Kardaras



Giulia Livieri



Andreas Søjmark



Yufei Zhang