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## Editorial

# Special issue “Mathematical methods and models in economics and finance”

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Economic and financial systems increasingly demand modelling frameworks that can represent uncertainty, structural changes, heterogeneous behavior, information frictions, and nonlinear feedback. This Special Issue, *Mathematical Methods and Models in Economics and Finance*, was conceived as a venue for original contributions that advance mathematical methodologies and, at the same time, improve our understanding of economic and financial phenomena through rigorous modelling and analysis.

The eight papers published in this Special Issue reflect this dual objective. They range from stochastic modelling and control to regime-switching valuation, econometric forecasting with time-varying spillovers, learning-based stochastic dynamics, fractional-order modelling, and nonlinear dynamical analysis in strategic competition. Beyond methodological variety, the contributions share a common perspective: mathematically explicit structure remains essential for interpretation, stress testing, and decision support in markets where data are abundant but mechanisms are complex.

In the first group of papers, the emphasis is on **valuation and long-horizon decision problems under realistic market frictions**. Wanrong Mu and Congjin Zhou develop an indifference-valuation framework for non-performing loan-backed securities in an incomplete-market setting, highlighting how investor risk preferences and macroeconomic regimes shape implied values through a regime-dependent repayment mechanism. Zongqi Sun, Peng Yang, Ying Wang, and Jing Lu study the pre-retirement investment problem for defined-contribution pensions under wealth management fees, using a dynamic optimization formulation to characterize optimal allocations and to quantify how fee intensity and loss-penalty design jointly affect strategy and terminal outcomes.

A second set of contributions focuses on **volatility, forecasting, and data-driven stochastic modelling**. **Xinyu Wu, Yuanzheng Liu, Junlin Pu, and Xiaona Wang** propose a dynamic spillover CARR–MIDAS specification for Chinese crude oil futures volatility, allowing spillover strength from the U.S. market to vary across regimes; their results underscore that transmission effects are time-varying and that accommodating regime dependence improves forecasting performance and economic value in portfolio applications. **Xiao Qi, Tianyao Duan, Lihua Wang, and Huan Guo** introduce an extended fractional neural stochastic differential equation network to simulate and forecast stock prices under long-memory dynamics; the paper also illustrates how generated paths can be integrated into derivative valuation via simulation-based procedures for option pricing.

The Special Issue also contains a contribution on **strategic trading and market microstructure under imperfect information**. **Kai Xiao** investigates a continuous-time insider trading model in which the insider is risk-seeking and market makers observe only partial signals. By combining optimal filtering with stochastic control methods, the study derives equilibrium characterizations and discusses how information revelation, trading intensity, and liquidity evolve when observability constraints interact with preferences and volatility.

In the next group, **nonlinear dynamics and fractional-order effects are used to explain complex behavior in competition models**. **Nengfa Wang, Kai Gu, Zixin Liu, and Changjin Xu** analyze a fractional-order Cournot–Bertrand duopoly with time delays, establishing stability conditions and Hopf bifurcation thresholds and showing how delays and memory (through the fractional order) can materially affect equilibrium robustness. **Bashir Al-Hdaibat and A. Alameer** study a Cournot duopoly model with a log-linear price function and quadratic costs, deriving explicit equilibria and mapping stability regions; the analysis documents transitions to more complex dynamics via bifurcation mechanisms, providing a structured account of how cyclical and irregular behavior can emerge from standard strategic interactions.

Finally, **Sabri T. M. Thabet, Reem M. Alraimy, Imed Kedim, Aiman Mukheimer, and Thabet Abdeljawad** examine a **financial bubble model through a new fractional-derivative framework**. The work addresses well-posedness and stability questions and complements the theoretical development with numerical illustrations, highlighting the role of fractional structure as a parsimonious way to capture persistence and memory effects across different phases of bubble dynamics.

This Special Issue received a total of 42 submissions, all of which were processed under the journal's standard peer-review procedures to ensure scientific rigor and thematic coherence. Finally, only 8 papers were published. As Guest Editors, we sincerely thank all authors for their contributions, the reviewers for their careful evaluations and constructive recommendations, and the editorial office of AIMS Mathematics for its support throughout the editorial process.

We hope that this Special Issue will serve as a useful reference for researchers and practitioners working at the intersection of mathematical methods, economics, and finance, and that it will stimulate further work that is both mathematically rigorous and substantively grounded.

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### **Conflict of interest**

The authors declare no conflict of interest.



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