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Editorial: Financial modeling with frictions

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Editorial on the Research Topic
Financial modeling with frictions

Financial markets, as observed in practice, are inherently incomplete due to a variety of structural and dynamic features. These include stochastic dynamics of state variables, discontinuities in asset paths, varying degrees of persistence in time series, and long-memory effects in probability distributions. Capturing these complexities requires sophisticated mathematical models that reflect the real-world deviations from classical financial theories.

Beyond intrinsic uncertainty, real economies are further affected by frictions, such as transaction costs, illiquidity, tax burdens, funding asymmetries, and market segmentation. These imperfections challenge the assumption of complete markets and impact key financial decisions. For example, when the number of risk sources exceeds that of tradable instruments, as in jump-diffusion or stochastic volatility settings, hedging becomes impossible. Likewise, bid-ask spreads and discrete trading mechanics undermine pricing linearity and contribute to market incompleteness.

This Research Topic on *Financial Modeling with Frictions* gathers a series of cutting-edge contributions that tackle such challenges. Topics span transaction costs, liquidity constraints, price jumps, and asymmetric information, namely the central factors for the development of realistic financial models. These works not only advance theoretical understanding, but also propose innovative computational tools to manage the impact of frictions on pricing, hedging, and portfolio optimization. The Research Topic supports the Journal's mission to promote rigorous quantitative research in finance and foster interdisciplinary connections among mathematics, statistics, and economics.

Market frictions can also emerge from limited access to diversified capital markets, especially in financially underdeveloped economies. The paper by Terbish et al. addresses this context through a continuous-time model of optimal consumption and pension insurance for individuals with uncertain lifetimes. Under CARA utility preferences, individuals receive stochastic wage income and allocate it among consumption, pension insurance, and interest-bearing savings, mirroring conditions in economies with restricted access to equity markets. By applying dynamic programming techniques, the authors derive closed-form optimal strategies and provide an empirical calibration. Notably, the analysis reveals that higher risk aversion lowers consumption relative to wealth, and that wealth and consumption may be inversely related across individuals with different attitudes toward risk.

Market frictions also affect the structure of arbitrage and execution costs, particularly in markets exhibiting long memory and self-similarity. Two contributions in this Research Topic address these themes. Webb reviews the application of fractional stochastic volatility (FSV) models in market microstructure and optimal execution. FSV models incorporate fractional differentiation to account for long-range dependence and volatility clustering, key features in high-frequency markets. These models effectively capture liquidity constraints, order flow dynamics, and price impact, thereby enhancing the modeling of transaction costs and execution risk.

Complementing this, the paper by Bianchi et al. proposes a new methodology to detect the presence of scaling in financial data, with the aim of evaluating market liquidity from an innovative perspective based on the Fractal Market Hypothesis. The authors develop an algorithm that dynamically estimates the self-similarity between distributions of log-returns at different time horizons, using the Kolmogorov–Smirnov test as a comparison criterion. Low values of the self-similarity parameter indicate potential liquidity shortfalls, as they reflect a convergence of market participants' decision horizons. The approach is tested on real data from 183 stocks of the S&P500 between 2000 and 2023, highlighting the method's ability to identify episodes of illiquidity during phases of financial stress. The work stands out for its focus on the entire distribution of returns, overcoming the limitations of traditional measures merely based on moments.

Together, these contributions enrich the ongoing debate on market efficiency, liquidity, and the role of heterogeneity in financial decision-making.

Transaction costs represent a classical form of market friction, as they prevent costless trading and break the assumption of frictionless markets typically used in idealized models. The paper by Veliu et al. analyzes the impact of transaction costs in the construction of minimum-risk portfolios, focusing on risk parity models. In particular, the authors propose an extension of traditional models (Mean-Variance and CVaR) by explicitly considering fixed and variable transaction costs in the optimization problem. Applying such models to both equity and cryptocurrency portfolios, they show that transaction costs can significantly reduce net returns (0.5–2% per year), particularly in strategies with high rebalancing frequency. Within the set of analyzed models, CVaR-based risk parity strategies turn out to be more robust and cost-efficient in high-volatility environments, like, e.g., crypto markets. The results emphasize the need to consider transaction costs at the allocation stage of the portfolio selection process to avoid suboptimal performance.

Information asymmetries represent another form of market frictions. The paper by Carannante et al. deals with this topic and the effective integration and valuation of ESG factors in the insurance industry. Specifically, the paper explores how ESG corporate reputation influences the pricing of insurance products through the notion of a sustainability premium. Relying on behavioral finance and prospect theory, the authors model the subjective valuation of ESG commitment by policyholders and derive a framework in which higher perceived ESG performance translates into an actuarially meaningful premium component. Their approach incorporates probability weighting functions and value functions with asymmetric curvature, allowing for heterogeneity in consumer preferences and biases. The work applies this framework to a portfolio of European insurance companies, offering numerical evidence of the economic value associated with ESG investments. This contribution highlights the interplay between non-financial corporate attributes and insurance pricing, offering a novel path to integrate ESG considerations into actuarial practice.

Also contributing to the discussion on long memory and market frictions, the paper by Subramoney et al. explores how persistent volatility and distributional asymmetries influence risk measurement in crypto-asset markets. The authors extend traditional GARCH and GAS models by introducing their long-memory counterparts, FIAPARCH and LMGAS, augmented with heavy-tailed innovations such as the Generalized Hyperbolic and Generalised Lambda Distributions, to capture the empirical dynamics of cryptocurrency returns more accurately. Their empirical strategy combines Value-at-Risk estimation, rigorous backtesting procedures, and volatility forecast evaluations, demonstrating the superior performance of these enriched models, particularly in the tails, relative to standard specifications. The findings emphasize the importance of incorporating volatility persistence and non-Gaussian shocks into risk assessment, particularly in incomplete and frictional financial environments where short memory frameworks frequently underestimate tail risk and misrepresent the structural complexity of market behaviour.

Finally, the contribution by Liu addresses frictions arising from informational noise and model uncertainty in financial forecasting. The paper introduces the so called M-A-BiLSTM, a hybrid deep learning architecture that combines Bidirectional LSTM networks, Attention mechanisms, and Multilayer Perceptrons to enhance the extraction of relevant signals from noisy price data. By capturing both forward and backward temporal dependencies and emphasizing the most informative features, the model improves predictive accuracy across different asset classes, including technology and energy stocks. By developing flexible architectures that adapt to the structural complexity of financial data, the proposed methodology contributes to the growing body of tools that bridge the gap between theoretical modeling and real-world market behavior, particularly in environments characterized by volatility clustering, partial observability, and behavioral feedbacks.

The present Research Topic provides readers with a comprehensive overview of current advances in financial modeling under real-world market frictions. The contributions collected here showcase a variety of methodological approaches and applications, highlighting both the theoretical depth and practical relevance of this research area. Yet, important challenges remain. Future research could delve deeper into the practical implementation of these models, particularly focusing on the calibration of frictions using data-driven methods and machine learning techniques. Further exploration is also needed in emerging areas where frictions are still relatively under-identified, such as climate finance, ethical finance, and decentralized finance. Moreover, integrating frictions into the modeling of emerging risks, especially those with economic and actuarial dimensions, can support the development of decision-making tools that are better aligned

with real-world market complexities and compliant with evolving regulatory frameworks.

By bringing together different perspectives, we aim to stimulate further inquiry and interdisciplinary dialogue. We thank all the authors, reviewers, and contributors for their valuable work, and we trust that these papers will serve as a useful reference for researchers, practitioners, and policymakers alike.

Author contributions

DM: Validation, Conceptualization, Data curation, Project administration, Supervision, Investigation, Methodology, Writing – review & editing, Funding acquisition, Resources, Visualization, Writing – original draft, Formal analysis, Software. AM: Project administration, Supervision, Validation, Conceptualization, Writing – review & editing, Methodology, Data curation, Writing – original draft, Investigation, Resources, Software, Visualization, Funding acquisition, Formal analysis. IO: Project administration, Visualization, Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Validation, Supervision, Data curation, Investigation, Funding acquisition, Software, Conceptualization, Resources. IS: Project administration, Conceptualization, Methodology, Funding acquisition, Supervision, Validation, Writing – review & editing, Writing – original draft, Investigation, Software, Visualization, Resources, Formal analysis, Data curation.

Conflict of interest

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