October 2024's Top Papers in Quant Finance, Including AI & LLM in Finance

ZanistaAI

November 18, 2024

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List of Topics

Client Story: PivotalEdge Capital, LLC

Artificial Intelligence and LLMs in Finance and Trading

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PivotalEdge Capital Revolutionizes Financial Services Industry with Proprietary, Non-Discretionary, AI Trading Infrastructure

Sid Ghatak
PivotalEdge Capital, LLC

Our Client

PivotalEdge Capital utilizes a proprietary, non-discretionary AI trading infrastructure to transform asset management with high transparency and data-centric decision-making.

- PivotalEdge's approach integrates domain expertise directly into AI models, enabling more accurate and data-backed trading predictions compared to traditional discretionary or quantitative models.
- The firm's focus on causal relationships, rather than simple data correlations, ensures predictions are grounded in financial realities, enhancing reliability and transparency in trading strategies.
- PivotalEdge emphasizes "small AI" models that consume less data and energy, offering superior transparency and accuracy, setting a new standard for AI-driven asset management.

Scaling Core Earnings Measurement with Large Language Models

M Shaffer, CCY Wang, Available at SSRN, 2024 papers.ssrn.com
University of Southern California, Harvard Business School

Results - Key Findings

This paper evaluates the effectiveness of Large Language Models (LLMs) in measuring firms' core earnings through 10-K filings, demonstrating their potential to improve over traditional measures using structured prompts.

- LLMs, when prompted with a structured "sequential" approach, produce core earnings measures that outperform GAAP Net Income and other common metrics in predicting average future earnings.
- Unlike an unstructured "baseline" approach, the sequential method accurately distinguishes non-recurring from recurring earnings elements, improving predictive validity and reducing conflation with other financial concepts.
- The sequentially prompted LLM-based core earnings measure exhibits high predictive ability for long-term net income and correlates strongly with future market valuations, suggesting significant cost-reduction potential in analyzing financial disclosures.

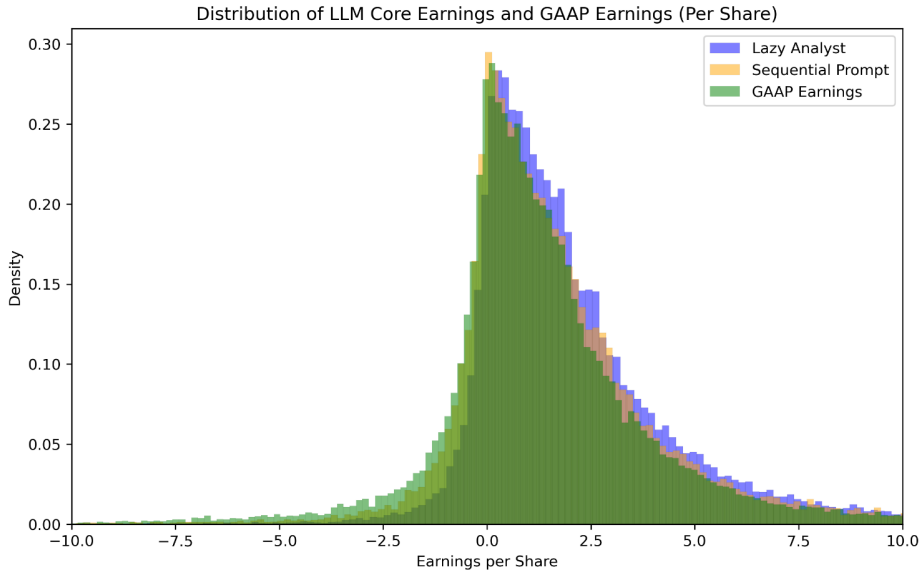

Figure 2 displays histograms of the distribution of GAAP Net Income and the two LLM-based alternative earnings measures, all in per-share terms

- Lazy Analyst Core Earnings per Share: Core earnings estimated using the "Lazy Analyst" LLM prompt, divided by the number of shares outstanding
- Sequential Prompt Core Earnings per Share: Core earnings estimated using the sequential LLM prompt approach, divided by the number of shares outstanding
- GAAP Earnings (Net Income per Share): Net Income divided by the number of shares outstanding.

Machine Learning for Interest Rates: Using Auto-Encoders for the Risk-Neutral Modeling of Yield Curves

A Lyashenko, F Mercurio, A Sokol, Available at SSRN 4967989, 2024 papers.ssrn.com
Quantitative Risk Management, Bloomberg, CompatibL

Results - Key Findings

The paper introduces a risk-neutral modeling approach for yield curves using autoencoders (AE) to capture the historical structure of interest rates while incorporating no-arbitrage dynamics.

- Autoencoders provide a low-dimensional representation of yield curves, enabling historical consistency and efficient calibration to market-implied prices.
- The paper derives a framework for ensuring arbitrage-free evolution of forward rate curves, using a convexity-driven deviation from the AE manifold.
- Numerical results demonstrate the application of the framework to market swap data across multiple currencies, highlighting accurate curve representation and stability in hedging.

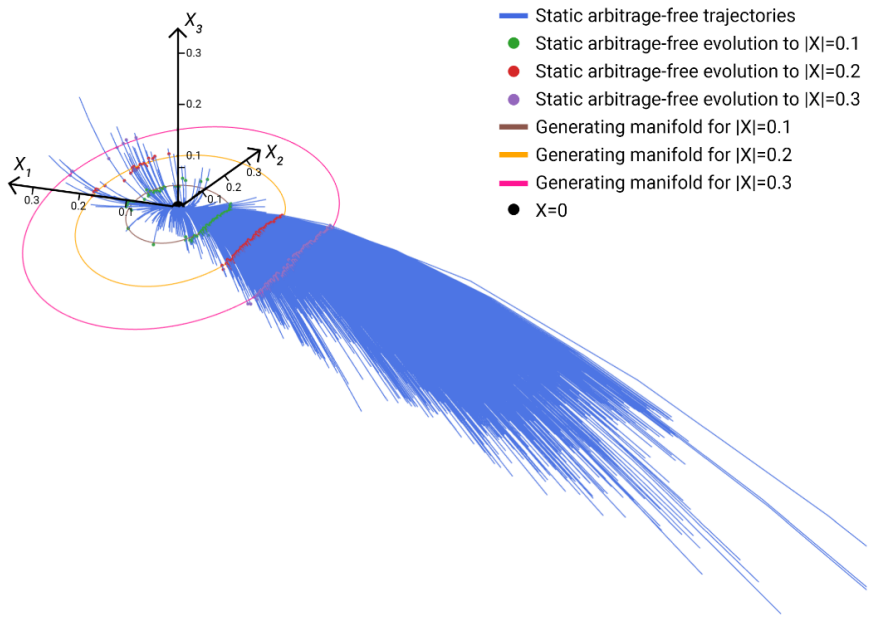

Figure 1: Static arbitrage-free trajectories (in blue) and generating manifold rings $\mathcal{M}_Y^X$ for three possible choices of $\delta = 0.1, 0.2, 0.3$.

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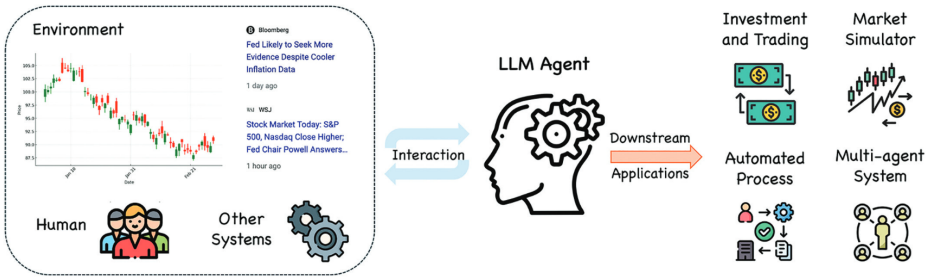
Large Language Models for Financial and Investment Management: Applications and Benchmarks

Kong Y, Nie Y, Dong X, Mulvey JM, Poor HV, Wen Q, Zohren S
University of Oxford, Princeton University, Squirrel Ai

Results - Key Findings

- LLM-based multi-agent systems demonstrate significant enhancements in financial tasks such as automated trading, corporate strategy planning, and market sentiment analysis by using collaborative specialized agents and self-reflective reasoning frameworks.
- Comprehensive benchmarks like FLUE and PIXIU provide a robust evaluation of LLM capabilities across financial NLP tasks, improving model accuracy in financial prediction, named entity recognition, and sentiment analysis using large-scale, domain-specific datasets.
- Language-specific benchmarks highlight the necessity for tailored evaluations in various linguistic contexts, enhancing financial LLMs' adaptability and effectiveness across global markets while also addressing challenges like data privacy and computational costs.

EXHIBIT 5
Illustration of Financial Tasks Related to Agent-Based Modeling



The paper discusses the transformative applications of LLMs in the financial domain, with emphasis on trading, corporate planning, financial sentiment analysis, and benchmarks for model evaluation.

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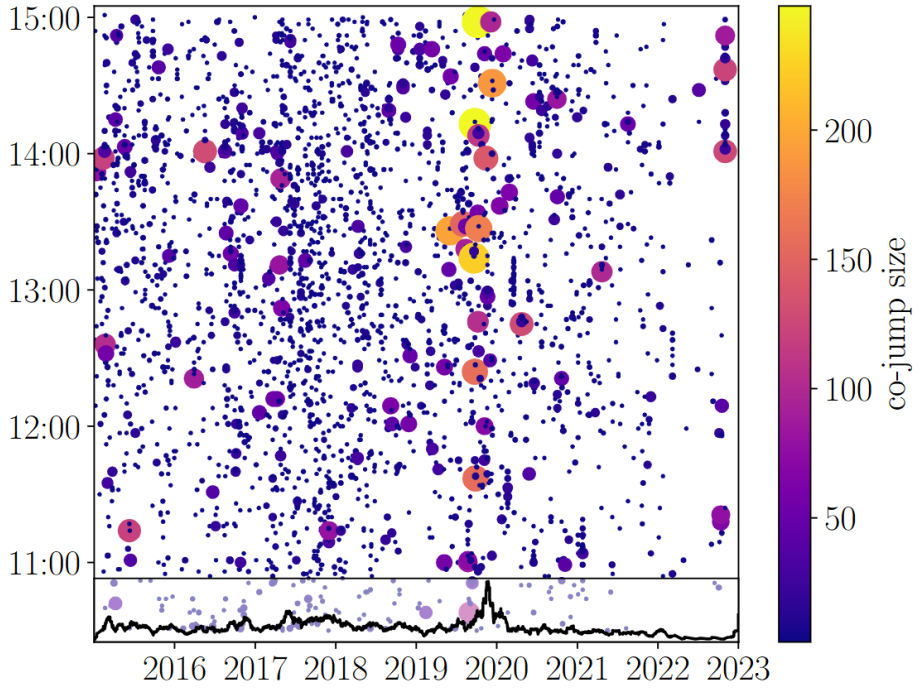
Riding Wavelets: A Method to Discover New Classes of Financial Price Jumps

C Aubrun, R Morel, M Benzaquen, JP Bouchaud, 2024 cnrs.hal.science
Capital Fund Management, École polytechnique, École Normale Supérieure

Results - Key Findings

The paper presents a novel unsupervised classification method using multi-scale wavelet representations to distinguish different types of financial price jumps and co-jumps, revealing new insights into their endogenous or exogenous nature.

- Time-asymmetry of volatility is identified as the major feature separating endogenous and exogenous price jumps, with endogenous jumps exhibiting more symmetric behavior and exogenous ones showing stronger post-jump volatility.
- Local mean-reversion and trend alignment are two additional key features that help identify new classes of price jumps, such as "mean-reverting" and "trend-aligned" jumps, expanding beyond traditional categorizations.
- Analysis reveals that many large co-jumps are driven by endogenous contagion mechanisms rather than exogenous news events, underscoring the interconnected and reflexive nature of market dynamics.



The image depicts co-jumps among 295 U.S. stocks over an eight-year period. The horizontal axis shows the dates of co-jump events, while the vertical axis represents the times of day they occurred. Each circle signifies a co-jump, with its size and color indicating the number of stocks experiencing simultaneous jumps within a one-minute interval—larger, warmer-colored circles denote more stocks. Notably, there's a concentration of larger co-jumps around October 2019, highlighted by a peak in the inset graph displaying a rolling 30-day count of jumps, reaching a maximum of 27003 during this period. This illustrates periods of heightened market activity and potential contagion effects.

Modeling News Interactions and Influence for Financial Market Prediction

M Wang, SB Cohen, T Ma - arXiv preprint arXiv:2410.10614, 2024 - arxiv.org
The University of Edinburgh

Results - Key Findings

The study introduces FININ, a model that outperforms existing market prediction methods by integrating news interactions and market data to improve financial forecasting.

- FININ improves daily Sharpe ratios for S& P 500 by 0.429 and NASDAQ 100 by 0.341 demonstrating superior market prediction through integrating news interactions and market data.
- Key findings reveal delayed market pricing of news, long memory effect of news, limitations of sentiment analysis, and highlight the importance of comprehensive news analysis.
- The model employs a data fusion encoder and a market-aware influence quantifier, tested on extensive datasets covering 15 years and over 2.7 million news articles.

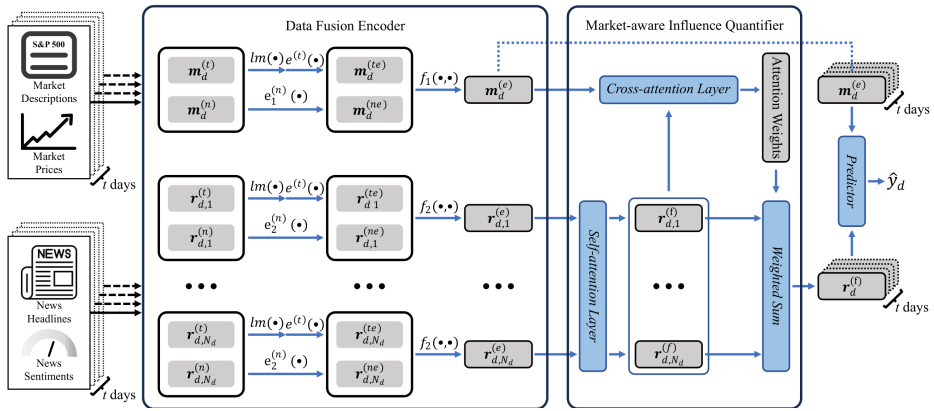


Figure 2 illustrates the FININ model, consisting of a Data Fusion Encoder and a Market-aware Influence Quantifier. It shows the process of extracting market and news text features, integrating them through cross-attention layers, and producing outputs that reflect market-aware insights. The diagram highlights the flow of data through various components, including the use of multi-layer perceptrons and attention layers to refine and contextualize features for market analysis. (p4) **Intro** The paper introduces FININ, a model designed to enhance financial market prediction by capturing interactions between news items and their influence on market prices. It aims to address the complexity of news diffusion into market prices using multi-modal data integration from market data and news articles.

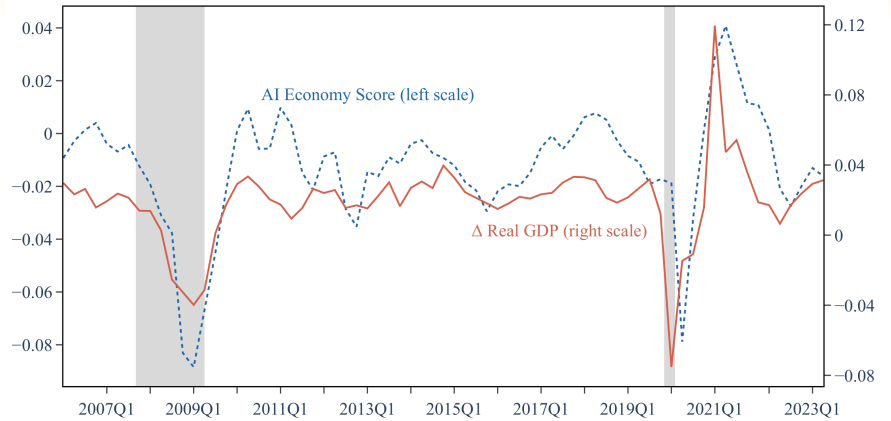
Harnessing Generative AI for Economic Insights

M Jha, J Qian, M Weber, B Yang - arXiv preprint arXiv:2410.03897, 2024 - arxiv.org
University of Chicago, Booth School of Business, Georgia State University

Results - Key Findings

The AI Economy Score, derived from managerial expectations, is introduced as a robust predictor of future economic indicators, outperforming existing measures.

- The AI Economy Score, derived from managerial expectations in conference calls, significantly predicts future economic indicators such as GDP growth, production, and employment.
- Its predictive power surpasses existing measures like survey forecasts, offering unique insights for macroeconomic and microeconomic decision-making.
- The study uses a vector autoregression framework, highlighting the AI Economy Score's long-term predictability and micro-level insights valuable to researchers, policymakers, and investors.



(b) *AI Economy Score* vs. SPF Forecasts

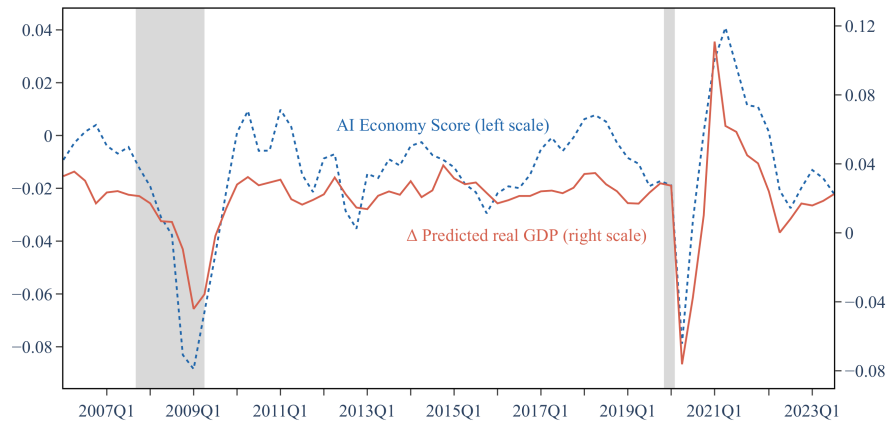


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Figure shows two line graphs comparing the AI Economy Score with Realized GDP Growth and SPF Forecasts from 2007Q1 to 2023Q1. The first graph illustrates the AI Economy Score against Real GDP changes, while the second graph compares it with Predicted Real GDP. Both graphs use dual axes to represent the AI Economy Score and GDP metrics, highlighting trends and fluctuations over time. (p28)

Enhancing Markowitz's portfolio selection paradigm with machine learning

M Lpez de Prado, J Simonian, FA Fabozzi - Annals of Operations , 2024 - Springer
Stevens Institute of Technology, Cornell University

Results - Key Findings

The study demonstrates that a Deep Q-Network (DQN)-based strategy significantly outperforms traditional portfolio management methods, yielding higher profits and lower risks in multi-asset portfolios.

- The DQN-based strategy outperforms ten traditional portfolio management strategies with 30% higher profits and shows the lowest risk as indicated by the Sharpe ratio and Max Drawdown metrics.
- The authors adapt DQN for multi-asset portfolios using a discrete action space, combining it with CNNs and dueling Q-networks, and introduce a novel method for discretizing market actions to enhance DQN's applicability to financial markets.
- Testing on five low-relevance American stocks using historical price data, the DQN strategy consistently yields better returns and lower risks using reinforcement learning techniques focused on maximizing cumulative future rewards.

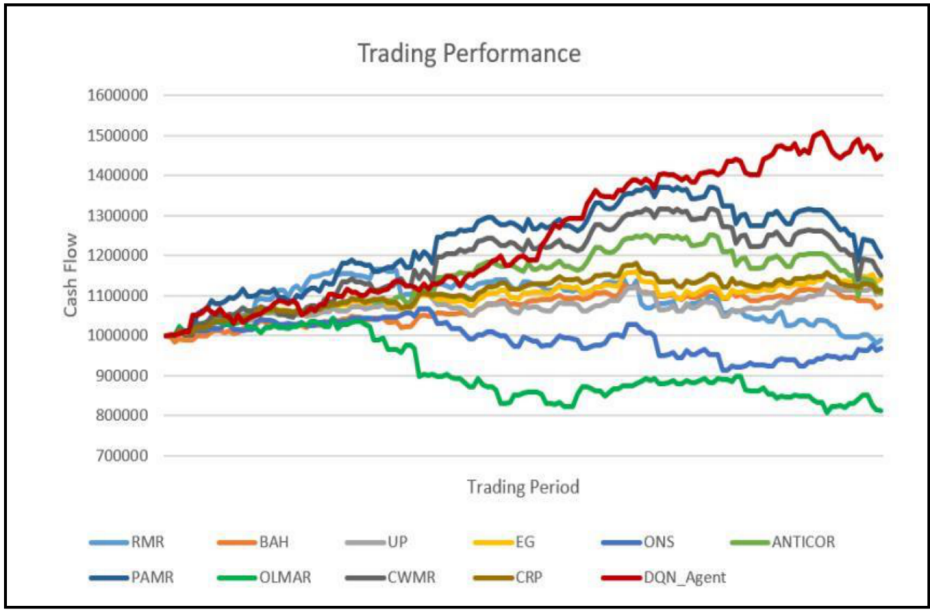

Figure 5 illustrates the accumulative return over the investment horizon of the test period as a learning continuous from 2017/01/05 to 2017/11/17. Overall, the DQN strategy outperforms the benchmark strategies for the majority of the test trading period. Though the advantage is not quite obvious at the beginning, the DQN strategy tends to show strong benefits after the middle trading period. (p7)

Mixing It Up: The Cocktail Effect of Multi-Task Fine-Tuning on LLM Performance–A Case Study in Finance

M Brief, O Ovadia, G Shenderovitz, NB Yoash - arXiv preprint arXiv , 2024 - arxiv.org
Microsoft, Tel Aviv University

Results - Key Findings

Multi-task fine-tuning significantly enhances LLM performance on financial tasks, allowing smaller models to outperform larger ones by leveraging synergies between related tasks.

- The study shows that Phi-3-Mini, a smaller model, outperforms the larger GPT-4-o on financial benchmarks through multi-task fine-tuning.
- Empirical validation of the 'cocktail effect' demonstrates that training on multiple related tasks improves model performance.
- The research introduces general instruction data as regularization, improves numerical reasoning with mathematical data, and involves training 220 models using a systematic approach to explore dataset interactions.

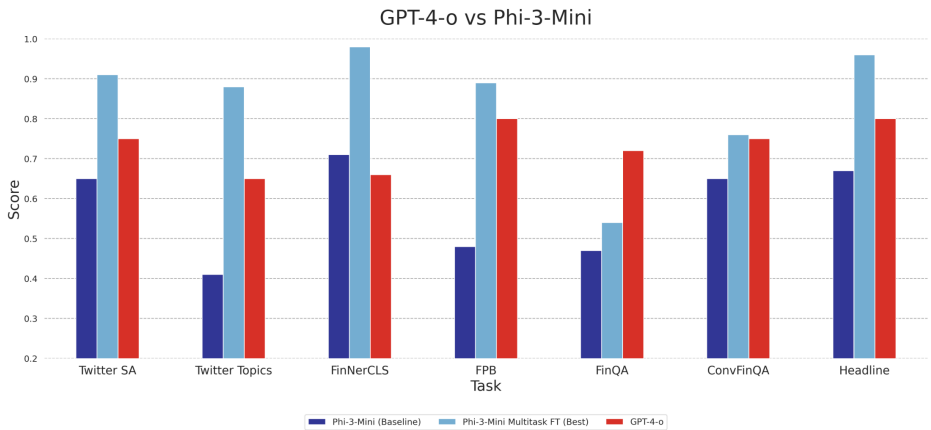

Figure 1 compares performance across financial tasks between GPT-4-o, the baseline Phi-3-Mini model, and the best results achieved by multi-task fine-tuning of Phi-3-Mini. It shows a bar chart with tasks like Twitter SA, Twitter Topics, FinNerCLS, FPB Task, FinQA, ConvFinQA, and Headline, highlighting differences in scores among the models. (p2) **Intro** The study explores the effectiveness of multi-task fine-tuning of large language models (LLMs) in finance, challenging the notion that single-task fine-tuning is optimal. It aims to demonstrate that training on multiple related tasks can enhance model performance, using Phi-3-Mini to surpass larger models like GPT-4-o on financial benchmarks.

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A Spatio-Temporal Diffusion Model for Missing and Real-Time Financial Data Inference

Y Fang, R Liu, H Huang, P Zhao, Q Wu - Proceedings of the 33rd ACM , 2024 - dl.acm.org
City University of Hong Kong, Brunel University London

Results - Key Findings

The study introduces a novel Spatio-Temporal Diffusion Model (STDM) that significantly enhances financial data imputation by capturing spatio-temporal interdependencies.

- Key contributions include characteristic-specific projection, cross-sectional graph convolution, and an implicit sampler for efficient sampling, reducing computational memory usage while maintaining high accuracy.
- The model outperformed existing methods on the OSAP dataset, validated through extensive experiments including ablation studies and factor portfolio construction.
- Findings highlight the importance of spatial and temporal dependencies in financial data imputation, offering a robust solution for real-time financial analysis and empirical asset pricing.

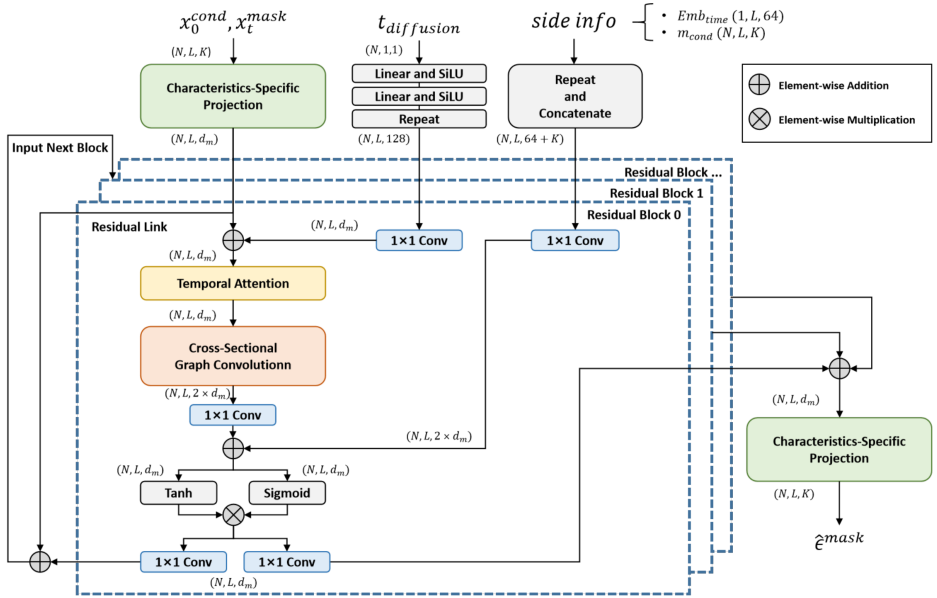

Figure 1 illustrates the architecture of the predictor in STDM for financial data inference. It includes multiple residual blocks with the same structure, each learning its own parameters. The input data, diffusion step, and side information are converted into features. The Characteristics-specific Projection transforms features, while Temporal Attention and Cross-Sectional Graph Convolution extract spatio-temporal interdependence. (p3)

Simulate and Optimise: A two-layer mortgage simulator for designing novel mortgage assistance products

L Ardon, BP Evans, D Garg, AL Narayanan - arXiv preprint arXiv , 2024 - arxiv.org
J.P. Morgan AI Research, University of Sydney

Results - Key Findings

The study develops a novel two-layer simulation approach to optimize mortgage assistance products, enhancing household resilience to financial shocks and aiding policymakers.

- Authors extend agent-based models for counterfactual analysis and product-conditioned policy learning, proposing a generic parameterized financial product configuration for efficient impact exploration.
- The methodology involves a simulation layer for household behavior and an optimization layer for product design, using census-calibrated data.
- Adaptive simulation identifies beneficial product configurations, reducing delinquency rates and improving social welfare, providing a scalable, cost-effective tool for policymakers and financial institutions.

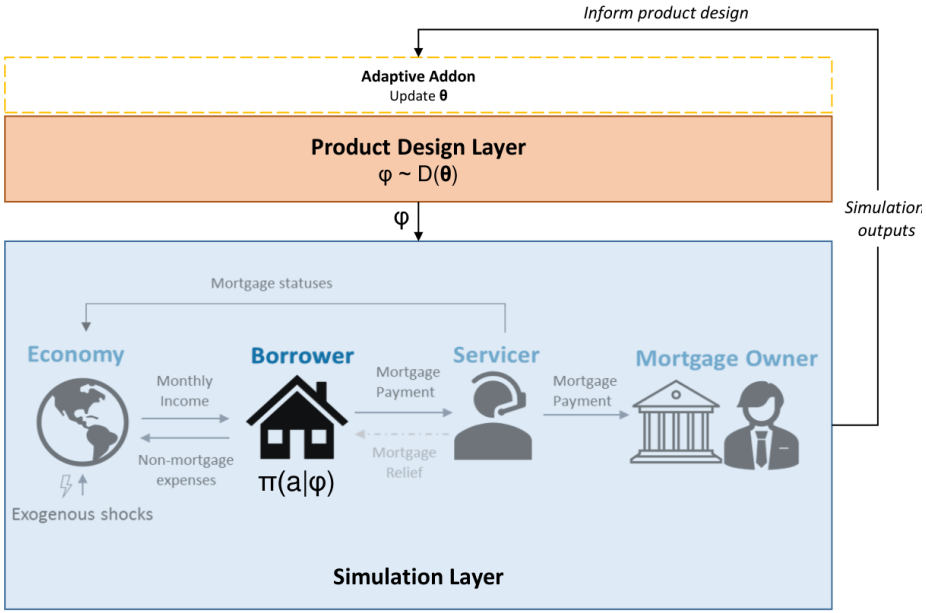

Figure 1 illustrates a proposed two-layer approach for mortgage product optimization. It features an outer product design layer and an inner simulation layer. The inner layer is conditioned on the output from the outer layer, optimizing household policies and product distribution parameters. The diagram shows the interaction between the economy, borrower, and mortgage ecosystem, highlighting the adaptive nature of the approach. (p2)

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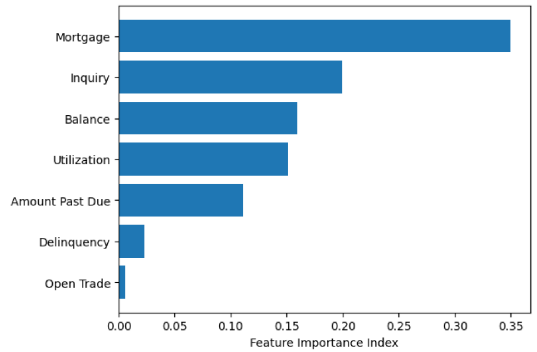
Less Discriminatory Alternative and Interpretable XGBoost Framework for Binary Classification

A Pangia, A Sudjianto, A Zhang, T Khan - arXiv preprint arXiv:2410.19067, 2024 - arxiv.org
Wells Fargo, University of North Carolina at Charlotte

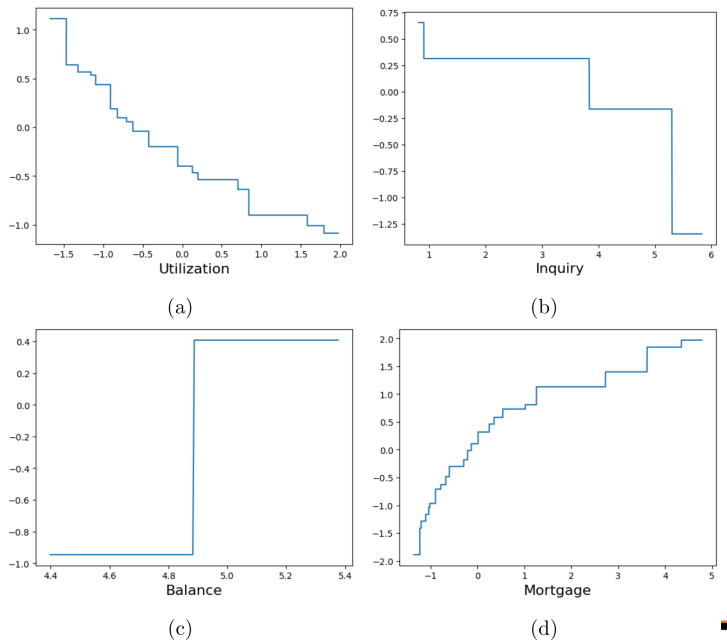
Results - Key Findings

The study presents LDA-XGB1, a new framework that enhances XGBoost with fairness constraints to balance accuracy and fairness in financial lending models.

- LDA-XGB1 integrates fairness constraints and monotonicity into XGBoost, outperforming traditional fair lending models by reducing bias against protected groups while maintaining interpretability.
- The authors propose a biobjective optimization approach using binning and information value, introducing terms like 'Less Discriminatory Alternative' and 'Fairness Information Value' (FIV) to mitigate disparate impacts.
- Tested on simulated and real-world datasets, LDA-XGB1 adjusts the trade-off between fairness and accuracy, demonstrating potential to meet regulatory requirements and serve as a powerful tool for financial institutions.



e 3: SimuCredit data: feature importance plot of the monotonic XGB1 M



A horizontal bar chart depicts feature importance in the monotonic XGB1 model, with Mortgage having the highest importance among Inquiry, Balance, Utilization, Amount Past Due, Delinquency, and Open Trade. (p15)

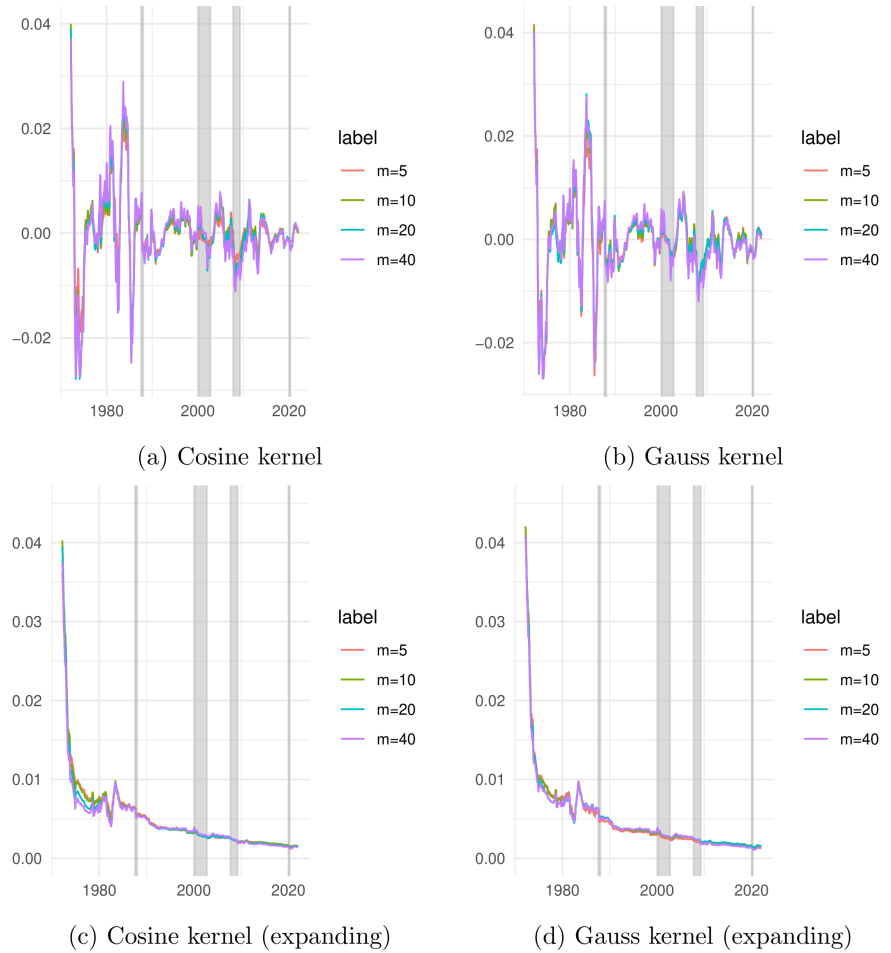
Joint Estimation of Conditional Mean and Covariance for Unbalanced Panels

D Filipovic, P Schneider - arXiv preprint arXiv:2410.21858, 2024 - arxiv.org
EPFL, Swiss Finance Institute

Results - Key Findings

The study introduces a nonparametric model for jointly estimating conditional means and covariances in unbalanced panels, outperforming traditional models in empirical asset pricing.

- The model demonstrates consistency and finite-sample guarantees, maintains positive semidefiniteness and symmetry in covariance matrices, and outperforms traditional models.
- Applied to US stock returns from 1962 to 2021, it shows substantial out-of-sample Sharpe ratios and significant improvements over constant covariance models, with predictive power validated using statistical scoring rules.
- The research employs a convex optimization approach with low-rank approximation and Nyström method, ensuring computational efficiency and facilitating large-scale empirical analysis.



(a) Cosine kernel (b) Gauss kernel

(c) Cosine kernel (expanding) (d) Gauss kernel (expanding)

Figure shows four line graphs comparing the out-of-sample predictive R performance using Cosine and Gauss kernels. Each graph displays data for different values of m (5, 10, 20, 40) over time, with shaded areas indicating major market crashes. The analysis uses unbalanced US common stock excess returns from 1962 to 2021. (p23)

Dynamic Factor Allocation Leveraging Regime-Switching Signals

Y Shu, JM Mulvey - arXiv preprint arXiv:2410.14841, 2024 - arxiv.org
Princeton University

Results - Key Findings

This study shows that using regime-switching signals via the sparse jump model improves factor allocation performance and offers a robust dynamic asset allocation method.

- By applying the sparse jump model to identify market regimes, the authors achieved positive Sharpe ratios across all factors with low correlations among them.
- Integrating regime inferences into the Black-Litterman framework results in a dynamic allocation strategy that enhances the information ratio and reduces maximum drawdown compared to a static benchmark.
- The research employs seven U.S. equity indices, utilizing historical data and market environment features, introducing a novel approach to factor regime analysis distinct from traditional factor timing strategies.

Figure shows a plot of cumulative active returns for the Value Factor from 2012 to 2024. It includes shaded areas representing bull (green) and bear (red) regimes. The plot uses Sparse Jump Models to identify these regimes, with a blue line indicating the cumulative returns over time. (p10)

Statistical Arbitrage in Rank Space

YF Li, G Papanicolaou - arXiv preprint arXiv:2410.06568, 2024 - arxiv.org
Stanford University

Results - Key Findings

The study demonstrates that statistical arbitrage in rank space using neural networks significantly outperforms traditional models due to enhanced mean-reversion and a stable market structure.

- The authors developed a framework including intraday rebalancing and neural networks, achieving an average annual return of 35.68% and a Sharpe ratio of 3.28 from 2007 to 2022.
- The research introduces the concept of rank space, highlighting its single-factor-driven market structure and robust mean-reversion properties that outperform name space in statistical arbitrage.
- Neural networks in rank space significantly outperform parametric models, leveraging flexible leverage and reduced holding times, using U.S. equity data, PCA for market decomposition, and neural networks for portfolio optimization.

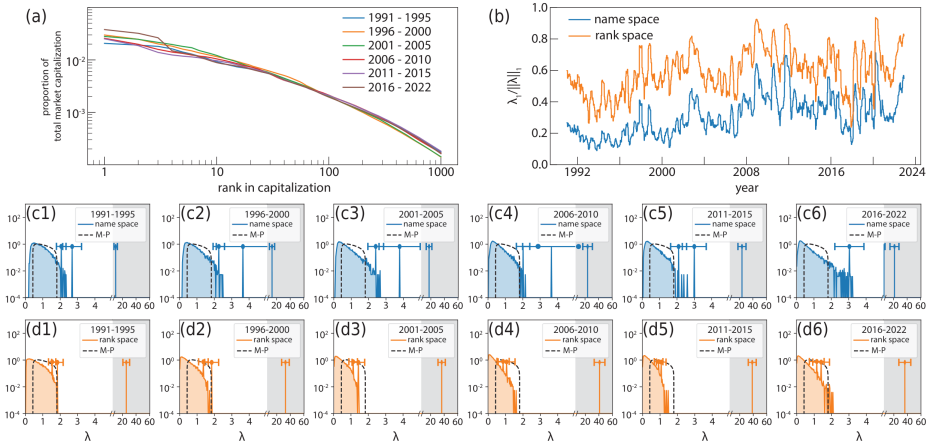


Figure shows multiple plots comparing market structure in name space versus rank space. (a) Displays the proportion of total market capitalization versus ranks in capitalization over different years. (b) Illustrates the principal eigenvalue of correlation matrices in name space and rank space over time. (c1-c6) Present the empirical probability distribution density of the eigenvalue spectrum of correlation matrices, highlighting differences between name space and rank space, with emphasis on the Marchenko-Pastur distribution and eigenvalue separation. (p27) **Intro** The paper explores statistical arbitrage in rank space, where stocks are indexed by capitalization ranks rather than company names. This approach offers a stable market structure and enhanced mean-reversion of residual returns, aiming to demonstrate superior performance over traditional name space methods using neural networks and parametric models.

Mean-variance and mean-ETL optimizations in portfolio selection: an update

BP Shao, JB Guerard Jr, G Xu - Annals of Operations Research, 2024 - Springer
Tudor Investment Corporation, New York, NY, USA, Independent Financial Researcher, Bluffton, SC, 29910, USA

Results - Key Findings

Using a composite variable of analysts' forecasts in robust regression and optimized portfolios yields significant active returns, even after accounting for transaction costs.

- Using a composite variable of analysts' forecasts, revisions, and their direction in robust regression models yields significant active returns, and Mean-Variance and Mean-Expected Tail Loss (ETL) optimizations produce statistically significant active returns that pass data mining corrections tests.
- The research employs time series models with multivariate normal tempered stable innovations for out-of-sample scenarios, addresses outliers using the Beaton-Tukey bi-weight regression technique, and manages multicollinearity for efficient regression estimates.
- The study confirms the effectiveness of robust regression models and highlights the potential for optimized portfolios to achieve excess returns, even after accounting for transaction costs.

About

The paper updates on mean-variance and mean-ETL optimizations in portfolio selection, highlighting robust regression models' effectiveness.

Intro

This paper updates the application of Mean-Variance (MV) and Mean-Expected Tail Loss (ETL) optimization techniques in portfolio selection, focusing on earnings forecasting and robust regression models. It aims to demonstrate the value of these methods in generating statistically significant active returns.

Conclusion

The research underscores the effectiveness of MV and ETL optimizations in portfolio selection, suggesting their potential for generating excess returns. Future research could explore further applications of robust regression techniques and optimization methods in diverse financial contexts.

Extracting Alpha from Financial Analyst Networks

D Gorduza, Y Kong, X Dong, S Zohren - arXiv preprint arXiv:2410.20597, 2024 - arxiv.org
University of Oxford

Results - Key Findings

The study demonstrates that graph attention networks applied to analyst coverage networks significantly improve trading strategies by capturing complex firm relationships.

- The study uses a graph attention network (GAT) to model analyst coverage networks, significantly enhancing trading strategies with annualized returns of 29.44% and a Sharpe ratio of 4.06 outperforming traditional methods.
- By capturing complex, non-linear relationships between firms, the GAT model learns to predict stock performance by analyzing both firm-specific and network data, offering a flexible and adaptive trading strategy.
- The research constructs a network from 2006-2022 stock prices and analyst estimates, where edges represent shared analyst coverage, demonstrating the effectiveness of GATs in financial applications and emphasizing the potential of graph machine learning in financial markets.

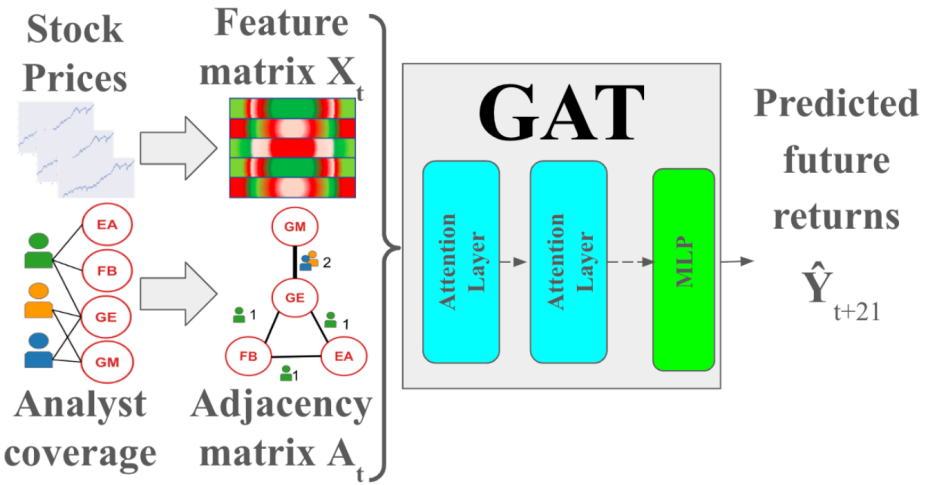


Figure: Pipeline of the proposed GAT trading model, illustrating the flow from stock prices, feature matrix, analyst coverage, and adjacency matrix to predicted future returns using a GAT model. (p4)

Predicting the equity premium with a high threshold risk level and the price of risk

N Bansal, C Stivers - Financial Management, 2024 - Wiley Online Library
University of Louisville, College of Business

Results - Key Findings

The study shows that the U.S. equity premium is effectively predicted using VIX and sentiment indices, offering robust and significant forecasting insights.

- The model reveals that the equity premium decreases with sentimentindicating low-risk periodsbut increases significantly when VIX exceeds its 80th to 85th percentile, signaling market stress and higher risk.
- Predictive adjusted R^2 values are 19% for 6-month and 29% for 12-month horizons, demonstrating robust predictive power across various time frames and market conditions.
- Using data from 1990 to 2023, the study employs both in-sample and out-of-sample evaluations with control variables, providing a nuanced understanding of market dynamics and enhancing financial forecasting and risk assessment.

About

The study models U.S. equity premium using VIX and sentiment, highlighting nonlinear VIX impact during market stress.

Intro

The study examines the U.S. equity premium from 1990 to 2023 using a model incorporating the VIX and Baker-Wurgler sentiment index. It aims to capture time variation in the equity premium, focusing on how sentiment and VIX levels influence risk and the price of risk.

Conclusion

The research suggests that understanding VIX and sentiment can improve equity premium predictions, especially during market stress. These findings can aid investors in risk assessment and financial forecasting. Future research could explore additional variables or apply this model to other markets for broader insights.

A Global-in-Time Neural Network Approach to Dynamic Portfolio Optimization

PM van Staden, PA Forsyth, Y Li - Applied Mathematical Finance, 2024 - Taylor & Francis
University of Waterloo, Distinguished Professor Emeritus

Results - Key Findings

The study demonstrates a novel global-in-time neural network model for dynamic portfolio optimization that outperforms traditional methods without relying on dynamic programming.

- Successfully applies a global-in-time neural network model to dynamic portfolio optimization without relying on dynamic programming, offering a more flexible and efficient method for complex financial problems.
- Proposes new methodologies with innovative techniques and terminology that enhance the understanding and application of neural networks in finance.
- Uses advanced neural network architectures and financial market simulations to show that neural networks can handle the intricacies of portfolio optimization, potentially outperforming traditional methods and providing a new avenue for financial optimization.

About

The paper presents a neural network method for dynamic portfolio optimization, avoiding dynamic programming techniques.

Intro

The paper introduces a novel neural network approach to dynamic portfolio optimization, bypassing traditional dynamic programming techniques. It aims to address complex financial decision-making problems by leveraging advanced neural network methodologies, offering a fresh perspective on optimizing investment portfolios under various constraints.

Conclusion

The research suggests that neural networks can revolutionize portfolio optimization, offering practical applications in finance. Future research could explore further enhancements and broader applications. The study's limitations include the need for extensive computational resources, suggesting future work on improving efficiency and scalability.

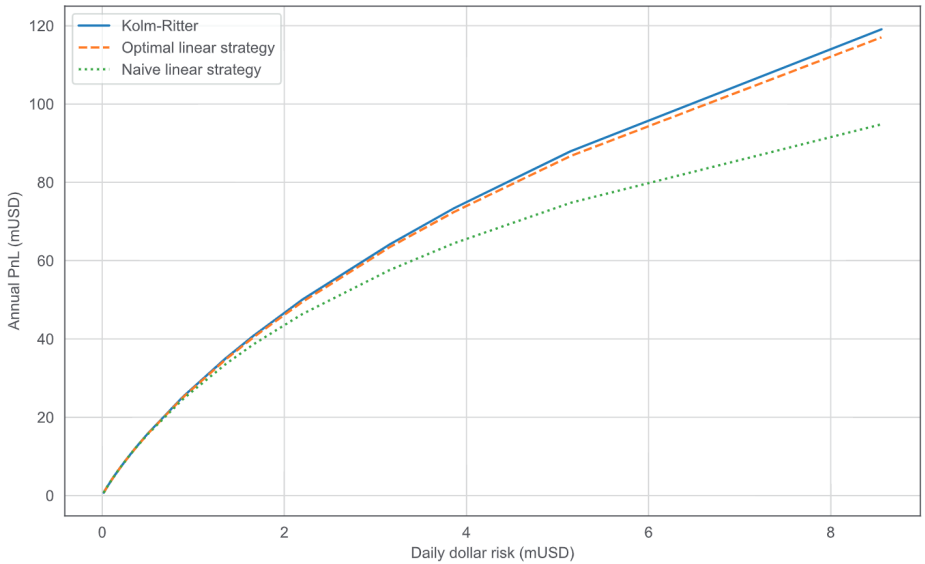
Tackling nonlinear price impact with linear strategies

Brokmann X, Itkin D, Muhle-Karbe J, Schmidt P. Mathematical Finance. 2024 Oct 15.
Qube Research and Technologies, Imperial College London, LSE

Results - Key Findings

The paper shows that linear trading strategies optimized for quadratic price impact can achieve near-optimal performance even in markets with nonlinear price impacts, using an appropriately tuned effective cost parameter.

- Linear trading strategies optimized for quadratic costs can approximate the optimal strategy for nonlinear price impacts, achieving performance losses of less than 2% across a wide range of risk levels.
- The effective quadratic cost parameter, when adjusted for the concavity of price impact, allows linear strategies to match the performance of complex numerical algorithms with minimal computational effort.
- The method demonstrates strong applicability in practical scenarios without requiring sophisticated numerical solutions, extending analytical approaches for linear-quadratic problems to nonlinear market impacts.



The figure illustrates the annual profit and loss (P&L) curves as a function of daily dollar risk for three strategies: the Kolm-Ritter Viterbi algorithm (solid blue line), a naive linear strategy with quadratic costs matched to the average trade size (dotted green line), and an optimized linear strategy with quadratic costs chosen to maximize P&L under nonlinear impact costs (dashed orange line). The optimized linear strategy closely approximates the performance of the Kolm-Ritter approach, highlighting the potential effectiveness of adjusted linear strategies even in contexts with nonlinear market impact.

No Tick-Size Too Small: A General Method for Modelling Small Tick Limit Order Books

K Jain, JF Muzy, J Kochems, E Bacry - arXiv preprint arXiv:2410.08744, 2024 - arxiv.org
University College London, University of Oxford

Results - Key Findings

The study presents a universal Hawkes Process model for simulating Limit Order Book dynamics, highlighting key differences among large, medium, and small tick stocks.

- The study identifies key stylized facts differentiating large, medium, and small tick stocks, using metrics from high-resolution Limit Order Book data of 15 stocks categorized by average spread and price, highlighting significant differences in spread, price changes, and liquidity distribution.
- It proposes a universal Hawkes Process model to simulate LOB dynamics across different tick sizes, accounting for sparsity and multi-tick price moves; demonstrates its universality through simulations transitioning stylized facts between assets; and contributes a novel approach to modeling LOB dynamics, addressing challenges in small tick stocks, and suggesting future research directions.

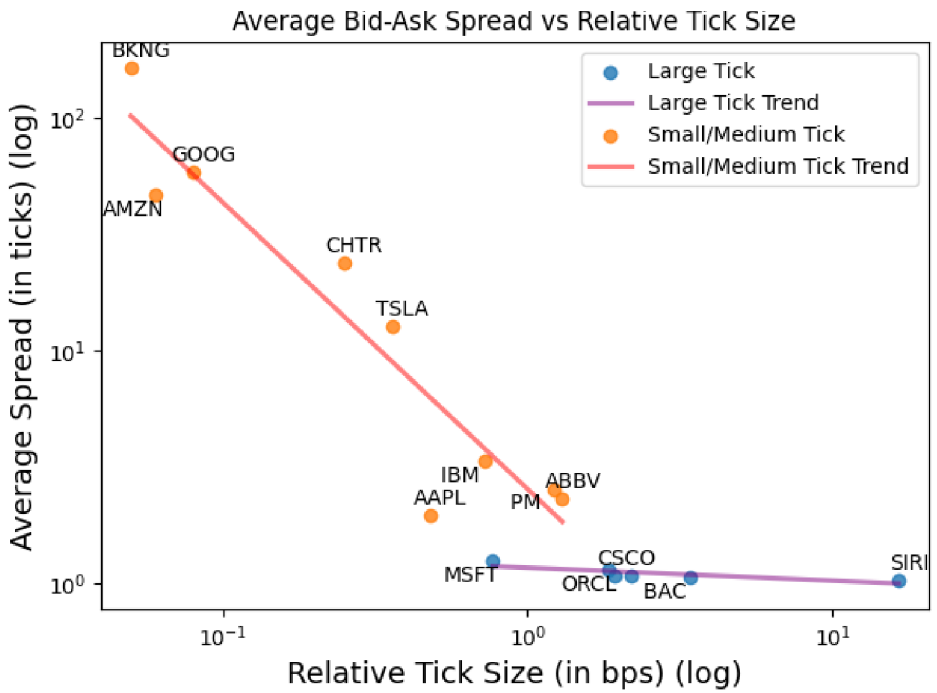


Figure shows a log-log plot of Average Bid-Ask Spread vs Relative Tick Size. It includes data points for various stocks, categorized by tick size: Large Tick and Small/Medium Tick. The plot indicates a trend where the average spread is proportional to the average mid-price, with a distinct slope for large tick stocks and a linear relationship for small/medium tick stocks. The legend differentiates between large tick and small/medium tick trends. (p6)

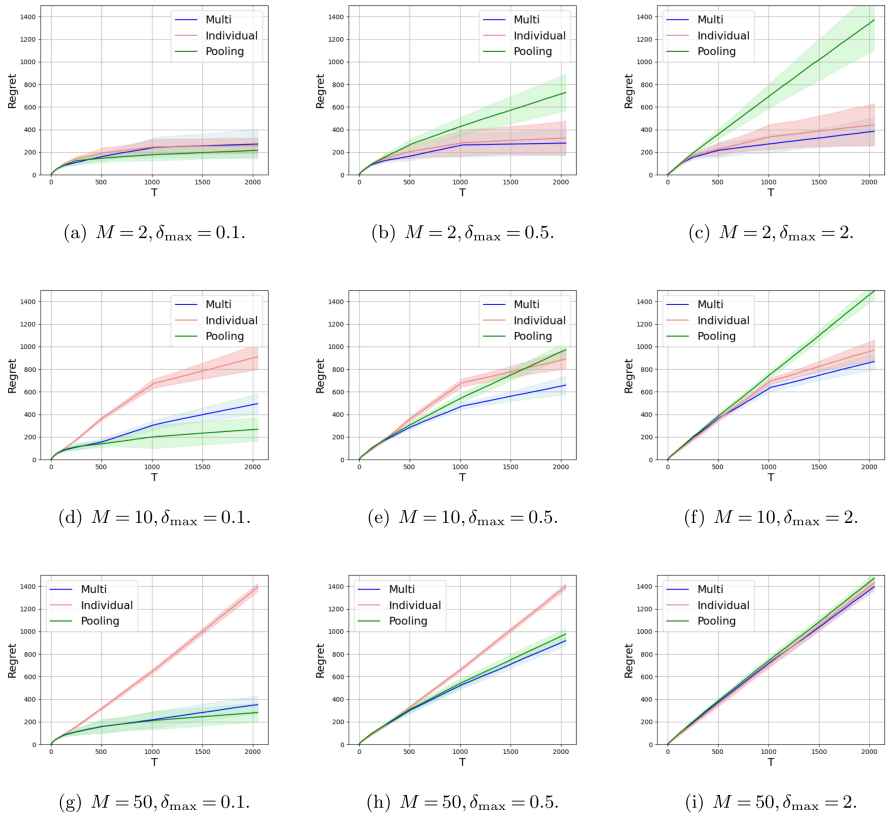
Multi-Task Dynamic Pricing in Credit Market with Contextual Information

A Javanmard, J Ji, R Xu - arXiv preprint arXiv:2410.14839, 2024 - arxiv.org
New York University, University of Southern California

Results - Key Findings

The study introduces the TSMT algorithm, enhancing pricing accuracy of financial securities by leveraging structural similarities among them.

- The TSMT algorithm operates in an episodic setting, leveraging structural similarities among securities to outperform individual and pooled pricing strategies in financial markets.
- It employs a linear contextual model for competitor pricing and uses maximum likelihood estimation for parameter estimation, effectively handling data scarcity and censored feedback.
- The algorithm adapts to the similarity structure of securities, achieving a regret bound that scales with the number of securities and their dissimilarity, and demonstrates superior performance on synthetic and real datasets, including pricing U.S. corporate bonds.



(a) $M = 2, \delta_{\max} = 0.1$. (b) $M = 2, \delta_{\max} = 0.5$. (c) $M = 2, \delta_{\max} = 2$.

(d) $M = 10, \delta_{\max} = 0.1$. (e) $M = 10, \delta_{\max} = 0.5$. (f) $M = 10, \delta_{\max} = 2$.

(g) $M = 50, \delta_{\max} = 0.1$. (h) $M = 50, \delta_{\max} = 0.5$. (i) $M = 50, \delta_{\max} = 2$.

Figure shows regrets across diverse problem configurations under uniform arrivals compared against two benchmark policies: individual learning and pooling. The solid curves depict regrets averaged over 30 random instances, while the shaded areas denote the associated plus/minus one standard deviation ranges. Multi-task learning consistently outperforms the other two strategies when ˙max is not too small. Even when multi-task learning is not the best among the three, it tends to be close to the best one. (p19)

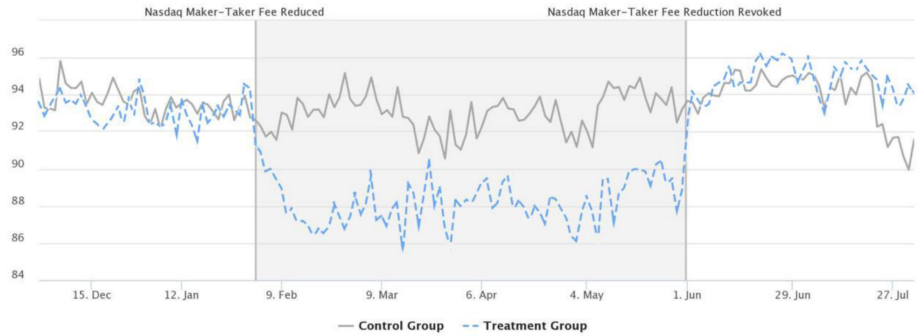
Does Maker-Taker Limit Order Subsidy Improve Market Outcomes? Quasi-Natural Experimental Evidence

Y Lin, PL Swan, FHB Harris - Journal of Banking & Finance, 2024 - Elsevier
University of New South Wales, Wake Forest University

Results - Key Findings

The study shows that maker-taker subsidies improve market efficiency but increase transaction costs, and their removal harms market quality, influencing market behavior.

- Maker-taker subsidies significantly improve market depth and efficiency but increase transaction costs due to longer limit order queues.
- The NASDAQ fee pilot showed that removing these subsidies reduced market share and worsened market quality, contradicting the 'washout' theory and revealing that fee structures significantly affect market behavior.
- By integrating regulatory frameworks into existing models and emphasizing raw prices over cum-fee prices, the authors used proprietary NASDAQ data and a difference-in-differences approach to analyze the impact of fee changes, providing new insights into subsidies' role in market microstructure.



Panel B: Price impact at the NASDAQ

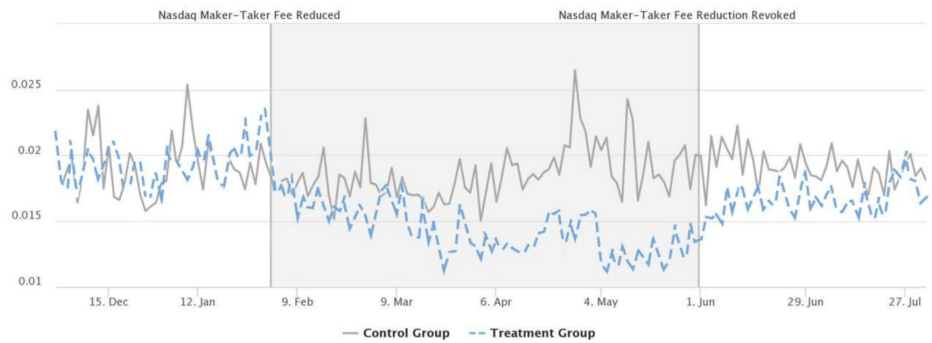


Figure B shows the price impact at the NASDAQ in a 5-second interval. It compares the control group and treatment group under different conditions, such as 'Nasdaq Maker-Taker Fee Reduced' and 'Nasdaq Maker-Taker Fee Reduction Revoked'. The chart displays fluctuations in price impact over time, with data points plotted from December 15 to June 27. (p6)

Optimal execution with deterministically time varying liquidity: well posedness and price manipulation

G Palmari, F Lillo, Z Eisler - arXiv preprint arXiv:2410.04867, 2024 - arxiv.org
Imperial College London, Universit di Bologna

Results - Key Findings

The study finds that optimal execution problems with time-varying liquidity can prevent price manipulation by ensuring well-posedness under specific conditions.

- Defined strong and weak well-posedness in optimal execution with time-varying liquidity, using B-matrix theory to ensure non-negative transaction costs.
- Proposed new conditions to avoid transaction-triggered price manipulation, demonstrating the robustness of the Almgren-Chriss model with time-dependent impacts in both discrete and continuous time frameworks.
- Validated theoretical results through calculus of variations and numerical simulations, emphasizing the importance of controlling liquidity variation speed to maintain well-posedness and offering insights into practical trading strategies.

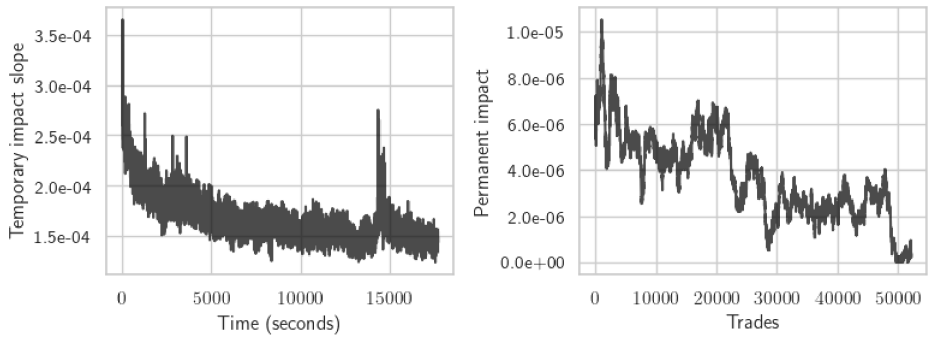


Figure 1 shows two graphs. The left graph depicts the average intraday temporary impact dynamics for Microsoft shares over June 2021, with time in seconds on the x-axis and temporary impact slope on the y-axis. The right graph illustrates the intraday permanent impact dynamics for Microsoft shares on June 10, 2021, with trades on the x-axis and permanent impact on the y-axis. (p2) **Intro** The paper explores optimal execution in financial markets with time-varying liquidity, focusing on well-posedness and price manipulation within the Almgren-Chriss framework. It aims to establish conditions for unique solutions and prevent transaction-triggered price manipulation, supported by numerical analyses of impact parameter dynamics.

Simulating and analyzing a sparse order book: an application to intraday electricity markets

P Bergault, E Cognville - arXiv preprint arXiv:2410.06839, 2024 - arxiv.org
Universit Paris Dauphine-PSL, EDF R& D

Results - Key Findings

The study develops an inhomogeneous Poisson process model to simulate order flows in illiquid markets, providing a more accurate representation of LOB dynamics.

- Applied the model to the European intraday electricity market, analyzing EPEX Spot data from the German and French markets with a focus on hourly delivery periods.
- Findings reveal the model captures the sporadic nature of order arrivals and cancellations, with simulations showing large spreads and increased price movements near maturity that align with observed market behaviors.
- Highlights limitations in capturing extreme events, suggesting improvements with Hawkes processes, and offers a robust framework adaptable to various illiquid markets, providing valuable insights for traders, regulators, and policymakers.

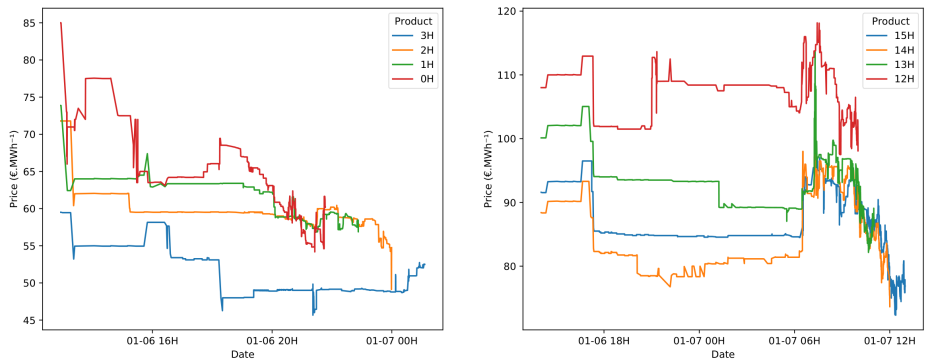


Figure 1: Intraday mid-prices evolution for the trading session on January 07, 2021

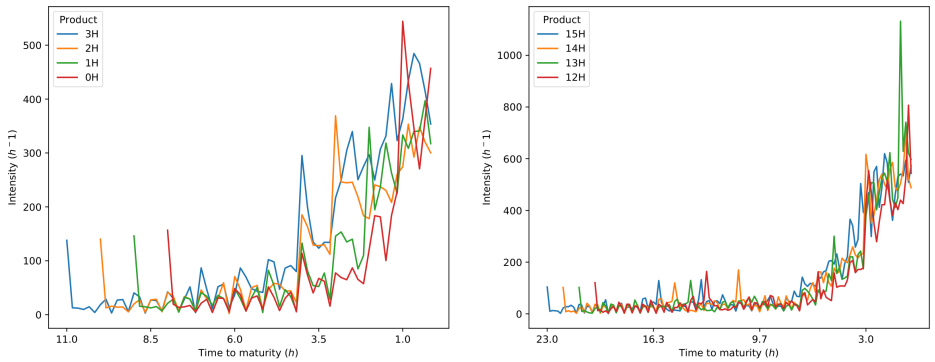


Figure 1 shows the intraday mid-prices evolution for the trading session on January 07, 2021, with different products represented by distinct lines. Figure 2 illustrates the mean intensity of interactions with the market on January 2021, showing variations over time to maturity for different products. (p4)

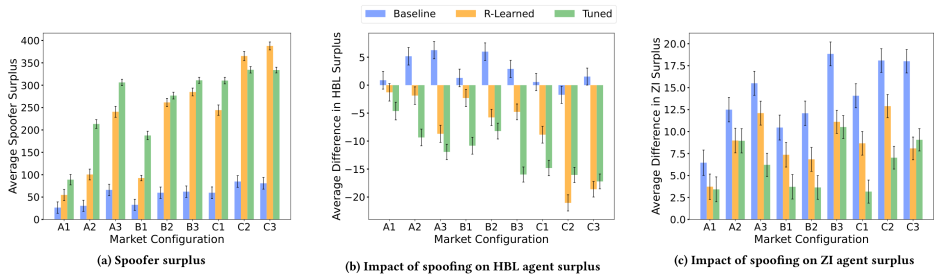
The Effect of Liquidity on the Spoofability of Financial Markets

A Gu, Y Wang, C Mascioli, M Chakraborty, R Savani - 2024 - ueaeprints.uea.ac.uk
University of Michigan, University of Liverpool

Results - Key Findings

The study demonstrates that high market liquidity reduces the effectiveness of spoofing, suggesting that maintaining liquidity serves as a defense against market manipulation.

- Researchers developed advanced spoofing strategies using reinforcement learning and parameter optimization, outperforming existing methods in profitability and market impact within agent-based simulations employing zero intelligence and heuristic belief learning agents.
- Two spoofing behavior regimes were identified based on market liquidity: in high liquidity markets, spoofers engage in low-profit, high-frequency trading requiring frequent spoofer arrivals; in low liquidity markets, spoofers achieve high-profit, low-frequency trading.
- The findings suggest that maintaining adequate market liquidity can naturally defend against spoofing, providing valuable insights for financial regulation.



(a) Spoofer surplus (b) Impact of spoofing on HBL agent surplus (c) Impact of spoofing on ZI agent surplus

Figure 2 shows the spoofer surplus and the effect of spoofing on background traders. It includes three bar charts: (a) Spoofer surplus, (b) Impact of spoofing on HBL agent surplus, and (c) Impact of spoofing on ZI agent surplus. Each chart compares different market configurations (A1, A2, A3, B1, B2, B3, C1, C2, C3) and uses color-coded bars to represent different strategies (Baseline, R-Learned, Tuned). Error bars indicate standard errors. (p6) **Intro** The paper explores the impact of market liquidity on spoofing, a manipulative trading practice, using an agent-based market simulator. It aims to identify market conditions vulnerable to spoofing and how liquidity influences spoofer behavior, aiding regulatory bodies in developing effective detection and prevention strategies. **Conclusion** The research suggests that enhancing market liquidity can mitigate spoofing, offering insights for regulatory strategies. Potential applications include improving market stability and developing spoofing detection methods. Future research could explore other market manipulation forms and refine agent-based models for broader financial market applications.

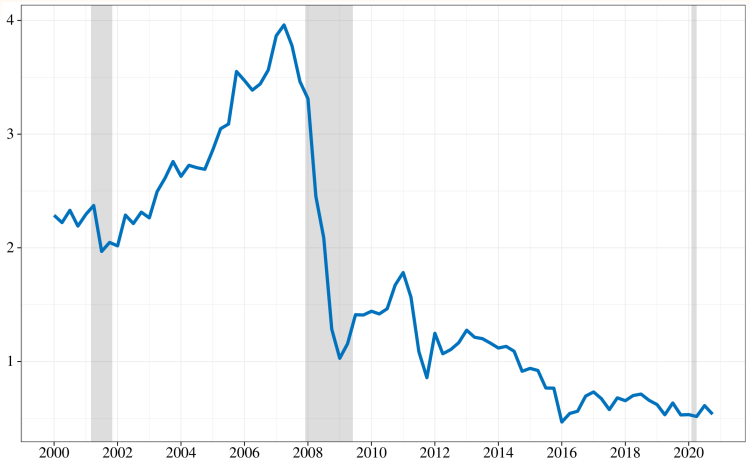
Inventory, market making, and liquidity in OTC markets

A Cohen, M Kargar, B Lester, PO Weill - Journal of Economic Theory, 2024 - Elsevier
Federal Reserve Bank of Philadelphia, UCLA

Results - Key Findings

The study models how dealers' inventory costs and post-crisis regulations in OTC markets affect liquidity and welfare through a calibrated search-theoretic framework.

- Dealers in OTC markets must hold inventory to facilitate trades, impacting liquidity measures like bid-ask spreads and trade volume.
- The authors model the equilibrium relationship between inventory costs and liquidity, highlighting the effects of post-crisis regulations on dealer behavior and market welfare, using a search-theoretic framework calibrated with transaction-level corporate bond market data.
- By assuming dealers can only sell assets they own, the study shows that increased inventory costs due to regulations reduce liquidity and welfare, providing insights into the trade-offs faced by dealers under regulatory constraints.



Share of corporate and foreign bond holdings for security broker-dealers. The vertical shaded ba
essions. Source: Table L.213 of the Federal Reserve's Z.1: Financial Accounts of the United S
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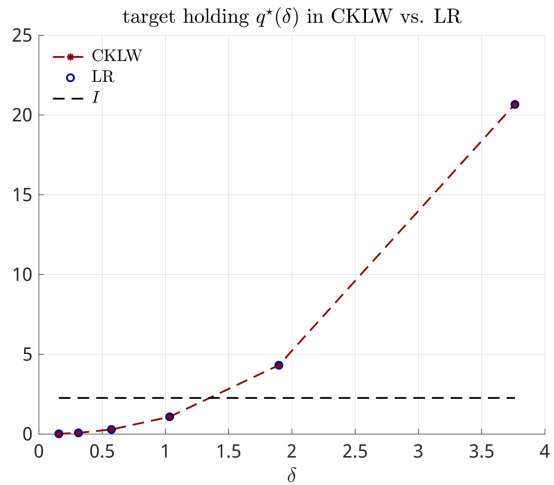


Figure shows the target asset holdings, q*(), comparing inventory constraints (CKLW) and without (LR). The horizontal line represents I in CKLW. (p27)

Forecasting realized volatility with spillover effects: Perspectives from graph neural networks

C Zhang, X Pu, M Cucuringu, X Dong - International Journal of Forecasting, 2024 - Elsevier
Oxford-Man Institute of Quantitative Finance, University of Oxford, The Alan Turing Institute, HKUST(GZ)

Results - Key Findings

The paper explores using graph neural networks (GNNs) to forecast multivariate realized volatilities while incorporating spillover effects across stocks.

Key Findings:

- Incorporating multi-hop neighbor spillover effects does not consistently improve predictive accuracy compared to models focusing solely on direct neighbors.
- Modeling nonlinear spillover effects through GNNs enhances forecasting accuracy of realized volatilities, particularly for short-term horizons (up to one week).
- Training with a quasi-likelihood loss significantly improves model performance over traditional mean squared error due to better handling of heteroskedasticity.

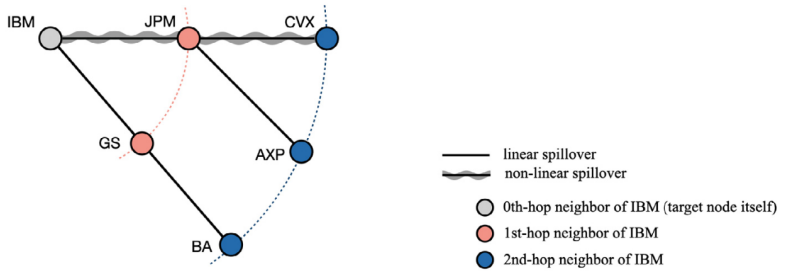


Fig. 1. Illustration of multi-hop and nonlinear volatility spillover.
Note: The target node represents the volatility of IBM. The connections are only for illustration, and hence not necessarily experiments.

This figure illustrates how volatility spills over from the target node (IBM) to other stocks through a network structure:

- The gray node (IBM) is the target node, representing itself (0th-hop).
- The red node (JPM) is a 1st-hop neighbor, indicating a direct volatility connection.
- Blue nodes (CVX, AXP, and BA) are 2nd-hop neighbors, showing indirect influences through the 1st-hop neighbor (JPM).
- Solid lines denote direct (linear) spillover effects, while wavy lines represent more complex (nonlinear) interactions.

This figure highlights the modeling of both direct and multi-hop spillover effects to enhance the accuracy of volatility forecasting.

Fast Deep Hedging with Second-Order Optimization

K Mueller, A Akkari, L Gonon, B Wood - arXiv preprint arXiv:2410.22568, 2024 - arxiv.org
Imperial College London, J.P. Morgan

Results - Key Findings

A new second-order optimization method significantly speeds up neural network training for deep hedging by 75% , improving convergence and hedging performance over standard methods.

- Proposed a second-order optimization scheme using Kronecker-factored approximate curvature (KFAC) with a shrinkage-based damping approach, significantly accelerating neural network training for deep hedging and reducing optimization steps by 75% compared to standard methods like Adam.
- Introduced a dynamically evolving action space for hedging, allowing efficient parameterization of option hedging strategies, and demonstrated effectiveness through simulation of a challenging cliquet option hedging problem in a stochastic volatility model.
- Results show that options are important for hedging and that the new method better handles high-curvature loss regions, leading to faster convergence and improved hedging performance.

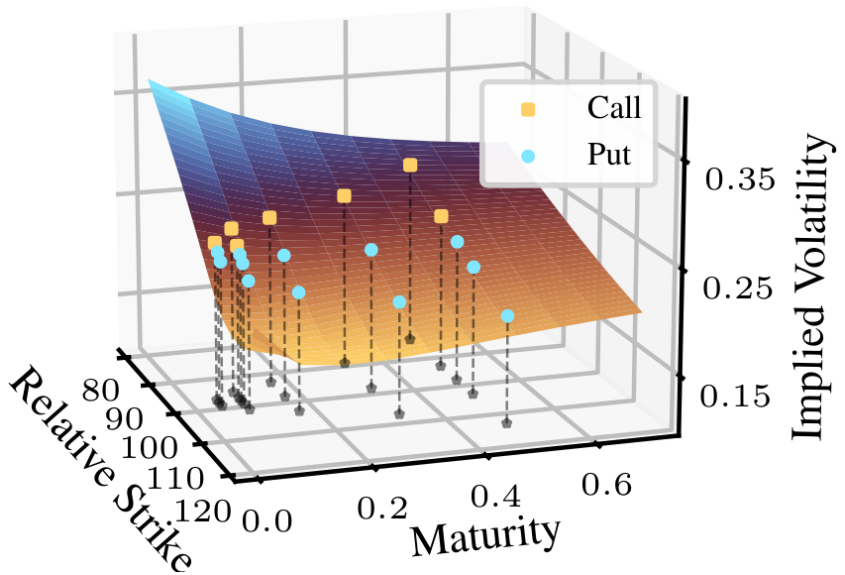


Figure 1: Floating grid. Implied volatility surface is stochastic; relative strike (in %) and maturity of tradable options are constant. Marked puts/calls are used in our experiments. (p2)

Graph Signal Processing for Global Stock Market Volatility Forecasting

Z Chi, J Gao, C Wang - arXiv preprint arXiv:2410.22706, 2024 - arxiv.org
The University of Sydney, Discipline of Business Analytics in Business School

Results - Key Findings

The study demonstrates that GSPHAR models significantly improve volatility forecasting over traditional HAR models by effectively integrating volatility spillover effects using Graph Signal Processing techniques.

- The study applies GSP techniques, using spectral graph theory and the magnet Laplacian, to construct a volatility spillover network from high-frequency realized volatility data of 24 global stock market indices, capturing complex interdependencies in financial markets.
- By introducing convolution filters with learnable weights, GSPHAR models better aggregate past information and reveal a more dynamic decaying pattern of volatility, offering a scalable and efficient solution.
- GSPHAR models outperform traditional HAR models in short, mid, and long-term forecasting tasks, highlighting the importance of directional and nonlinear volatility spillover effects, and emphasizing the potential of GSP.

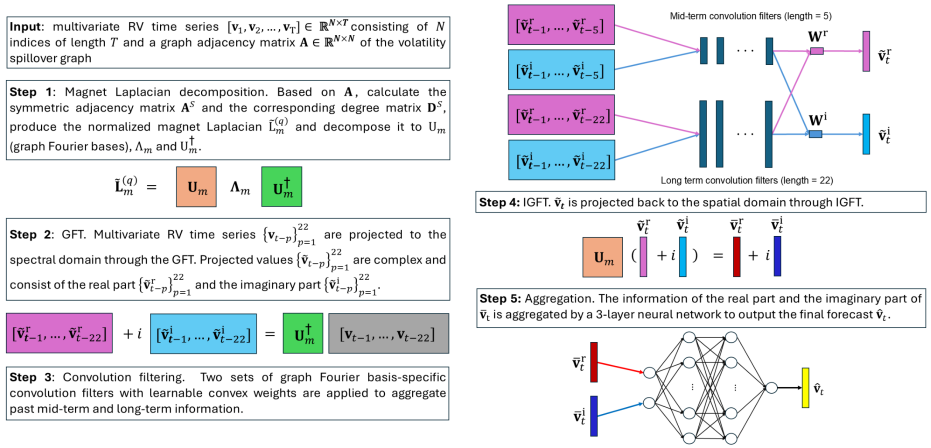


Figure illustrates the GSPHAR model architecture, detailing steps for processing multivariate RV time series. It includes magnet Laplacian decomposition, graph Fourier transform, and convolution filtering. The diagram shows the flow from input time series to final forecast, highlighting spectral domain projection, convolution layers, and aggregation using a neural network. (p17) **Intro** The paper introduces a novel multivariate framework for forecasting global stock market volatility using Graph Signal Processing (GSP) techniques. It extends the traditional Heterogeneous Auto-Regressive model by incorporating spectral analysis through graph Fourier transformation, aiming to capture volatility spillover effects across 24 global stock market indices.

Hedging via Perpetual Derivatives: Trinomial Option Pricing and Implied Parameter Surface Analysis

J Gnawali, WB Lindquist, ST Rachev - arXiv preprint arXiv:2410.04748, 2024 - arxiv.org
Texas Tech University, Professor of Mathematical Finance

Results - Key Findings

The study presents a trinomial pricing model incorporating multiple assets, offering a comprehensive framework for option pricing and parameter estimation.

- Develops a replicating portfolio to derive risk-neutral dynamics and calibrates natural-world parameters using hypothesis testing.
- Introduces a novel approach to calibrate price movement probabilities and computes implied parameter surfaces for volatility (σ), mean (μ), risk-free rate (r), and price change probabilities using historical data from major technology stocks.
- Constructs a trinomial tree model and analyzes empirical data to reveal insights into market views on future stock performance and captures the relationship between risk-neutral and real-world parameters.

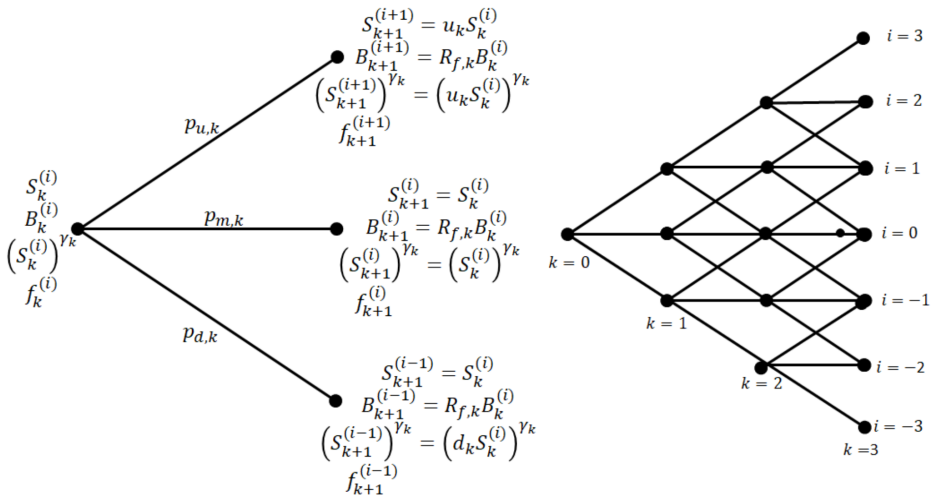


Figure 1: A trinomial tree showing (left) the pricing notation for the fundamental unit of the tree and (right) the time step k and level i indexing for a tree with three time steps. (p4)

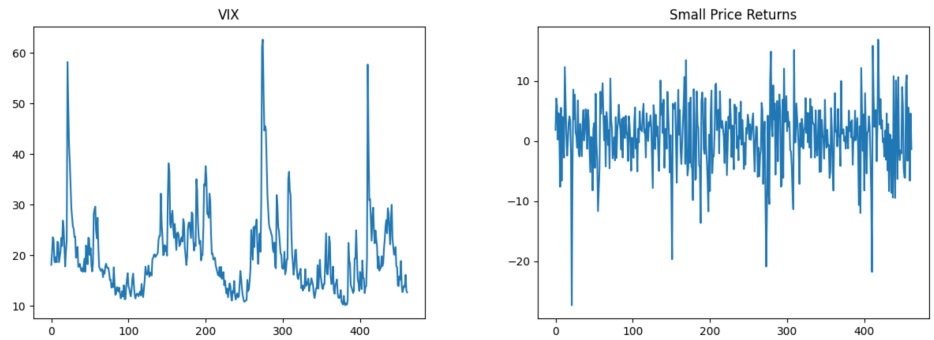
Log Heston Model for Monthly Average VIX

J Park, A Sarantsev - arXiv preprint arXiv:2410.22471, 2024 - arxiv.org
University of Michigan, Ann Arbor, University of Nevada, Reno

Results - Key Findings

Normalizing stock returns by VIX and using a log-Heston model brings returns closer to Gaussian IID variables, enhancing modeling of volatility and returns.

- Normalizing monthly stock index returns R_t by VIX VIX_t makes them closer to Gaussian IID variables, reducing skewness and kurtosis, and capturing Pareto-like tails.
- The log-Heston model, applying autoregression on the logarithm of VIX, i.e., $\log(VIX_t)$ fits better than the original Heston model in modeling volatility and returns.
- Using monthly data from 1986 to 2024, the model's residuals are non-Gaussian, with the variance-gamma distribution fitting the innovations.



(A) VIX (B) Small Price Returns

Figure shows two line graphs. (A) VIX graph displays data from Jan 1986 to Jun 2024 with values ranging from 10 to 60. (B) Small Price Returns graph shows fluctuations around zero with values between -20 and 10 over the same period. (p2) **Intro** The paper models monthly average VIX and stock index returns using a log-Heston model, where the logarithm of VIX is an autoregression of order 1. It aims to show that normalizing stock returns by VIX approximates them to Gaussian distributions, capturing real-world stock market return characteristics.

GARCH-Informed Neural Networks for Volatility Prediction in Financial Markets

Z Xu, J Liechty, S Benthall, N Skar-Gislinge - arXiv preprint arXiv , 2024 - arxiv.org
Carnegie Mellon University, New York University

Results - Key Findings

The GINN model, which integrates GARCH and LSTM methodologies, outperforms traditional models in predicting stock market volatility with enhanced accuracy and generalizability.

- The key contribution is combining GARCH's empirical market patterns with LSTM's adaptability, resulting in a model that balances accuracy and generalizability.
- The GINN model and its variant GINN-0 consistently showed superior out-of-sample prediction performance across multiple global stock indices, evaluated using metrics like R^2 MSE, and MAE.
- Inspired by Physics-Informed Machine Learning, the model uses GARCH predictions as a regularization term, capturing both short-term and long-term market features and addressing limitations of linear GARCH models and overfitting in neural networks.

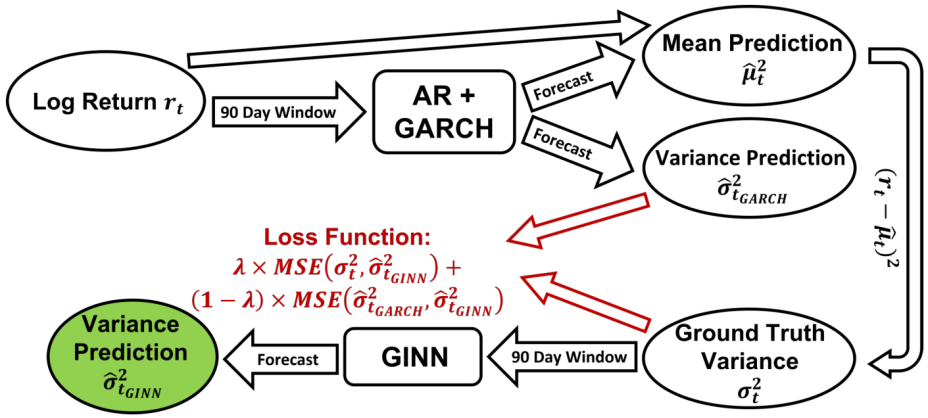


Figure 4 illustrates the variance prediction workflow diagram for the GINN model. It includes components such as Log Return, AR + GARCH, GINN, and Ground Truth Variance. The diagram shows the flow from variance prediction to loss function, highlighting the combination of MSE between GARCH and GINN predictions. (p4) **Intro** The paper introduces a novel hybrid model, GARCH-Informed Neural Network (GINN), for predicting financial market volatility. It combines the strengths of the GARCH model and LSTM neural networks to improve prediction accuracy by capturing both general market trends and finer details.

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What drives liquidity in the Chinese credit bond markets?

J Mo, MG Subrahmanyam - The Journal of Finance and Data Science, 2024 - Elsevier
New York University, NYU Shanghai

Results - Key Findings

The study examines liquidity effects in Chinese credit bond markets, finding significant differences across categories and venues, influenced by policy interventions and macroeconomic conditions.

- The research uses a comprehensive dataset from 2010 to 2019 and employs principal component analysis to measure liquidity, discovering stronger liquidity effects in the exchange market compared to other venues.
- It identifies bond risk and macroeconomic channels as key influences on liquidity effects, while firm information channels are less impactful; counterfactual analyses around policy shocks reveal changes in liquidity levels and pricing.
- The study provides new insights into the pricing of liquidity effects, emphasizing the importance of market segmentation, regulatory changes, and highlights the impact of policy interventions and macroeconomic conditions on liquidity.

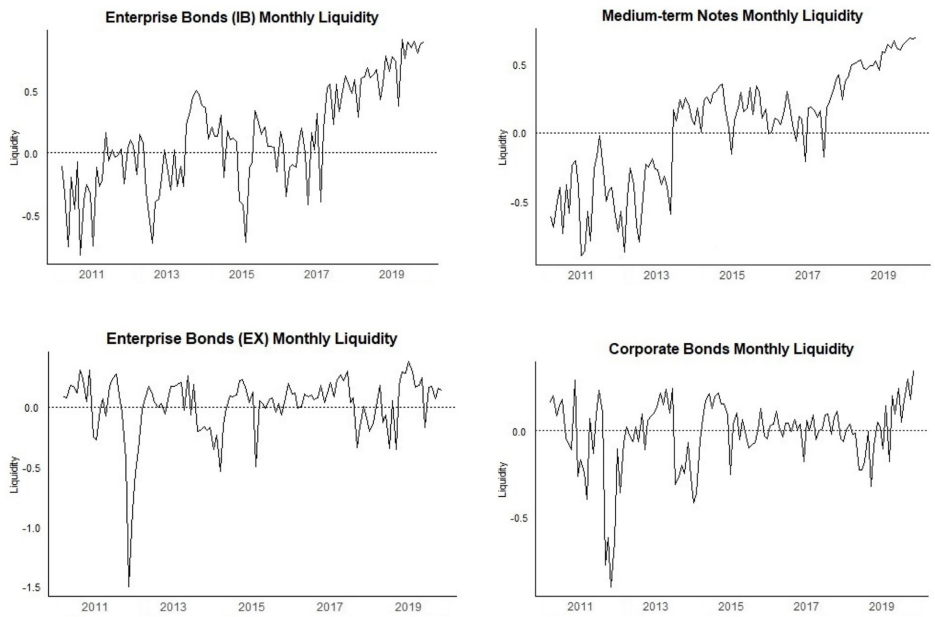


Figure shows the monthly aggregated levels of liquidity for four credit bond categories: Enterprise Bonds (IB), Medium-term Notes, Enterprise Bonds (EX), and Corporate Bonds. Liquidity is measured by the first principal component of five illiquidity proxies. Data spans from January 2010 to December 2019, sourced from the China Foreign Exchange Trade System. (p11)

Artificial intelligence and big holdings data: Opportunities for central banks

X Gabaix, RSJ Koijen, R Richmond, M Yogo - 2024 - bis.org
Harvard, NYU Stern

Results - Key Findings

By combining asset demand systems with big data and AI, the study offers central banks improved insights into financial stability and policy interventions.

- The authors introduce AI-driven embeddings and big holdings data to measure asset and investor similarities, enhancing the accuracy of asset demand systems.
- This approach helps central banks understand financial contagion, asset price fluctuations, and the impact of unconventional monetary policies, enabling better policy design such as climate stress tests and currency reserve management.
- The research uses advanced econometric tools and high-quality portfolio data, highlighting the inelastic nature of investor demand and challenging traditional financial models.

About

BIS paper explores AI and big data's role in central bank policies, asset pricing, and financial stability.

Intro

The paper explores how asset demand systems, enhanced by AI and big holdings data, can help central banks assess and predict the impact of policy interventions on asset prices, wealth distribution, and financial stability. It emphasizes the importance of realistic models for effective policy-making.

Conclusion

The research suggests that AI-enhanced asset demand systems can improve central bank policy-making by providing deeper insights into market dynamics. Potential applications include designing stress tests and understanding crowded trades. Future research could expand on these models to further enhance financial stability and policy effectiveness.

GMM Estimation with Brownian Kernels Applied to Income Inequality Measurement

JS Cho, PCB Phillips - 2024 - 121.254.254.220
Yale University, Yonsei University

Results - Key Findings

The authors develop BM-GMM and BB-GMM methods with Brownian kernels for infinite-dimensional GMM estimation to robustly analyze income inequality, revealing it peaks early in careers.

- The study introduces BM-GMM and BB-GMM methods using Brownian motion and Brownian bridge kernels in infinite-dimensional GMM estimation, providing a unified and robust framework, and proposes a new U-test for overidentification complementing the traditional J-test.
- Empirical analysis using the Continuous Work History Sample database and minimum Cramr-von Mises distance estimation reveals labor income inequality peaks in early career years, suggesting targeted economic policies could reduce inequality.
- The findings highlight the importance of considering persistently correlated moment conditions and the impact of high-dimensional weight matrices in econometric analysis.

About

The paper explores GMM estimation using Brownian kernels for income inequality measurement, proposing a new U-test.

Intro

The paper explores the asymptotic properties of infinite-dimensional GMM estimation using Brownian motion and Brownian bridge kernels, focusing on income inequality measurement. It aims to address the challenges of high-dimensional GMM estimation and proposes new methods for testing distributional specifications and overidentification in econometric models.

Conclusion

The research offers valuable insights into econometric modeling, particularly in measuring income inequality. Its methods can be applied to various economic hypotheses, emphasizing early career interventions to reduce inequality. Future research could explore other Gaussian processes and further refine the proposed testing methods.

Taming the Curse of Dimensionality: Quantitative Economics with Deep Learning

J Fernndez-Villaverde, G Nuo, J Perla - 2024 - nber.org
University of Pennsylvania, Banco de Espaa

Results - Key Findings

The paper demonstrates that deep neural networks can overcome the curse of dimensionality in dynamic equilibrium models, enhancing computational efficiency in economics.

- Deep neural networks effectively solve high-dimensional dynamic equilibrium models, outperforming traditional methods such as in the stochastic neoclassical growth model.
- Neural networks generalize familiar economic methods, offering new perspectives on functional approximations and efficient computation in macroeconomics, finance, and game theory.
- Training neural networks to approximate policy functions and solve equilibrium conditions using iterative simulated data provides robust solutions to complex, previously intractable economic problems.

About

The paper explores using deep learning to address dimensionality challenges in solving dynamic equilibrium models in economics.

Intro

The paper explores how deep learning can address challenges in quantitative economics, particularly in solving high-dimensional dynamic equilibrium models. It highlights the potential of deep neural networks to manage the curse of dimensionality, offering a promising approach to solving complex economic models across various fields.

Conclusion

The study concludes that deep neural networks offer a transformative approach to solving complex economic models, expanding the scope of quantitative economics. Potential applications include climate change modeling and nonlinear economic shock analysis, with future research needed to explore representation theory and hardware advancements for further improvements.

The Negative Mean Output Gap and the Symmetry Bias of Statistical Filters

S Aiyar, S Voigts - IMF Economic Review, 2024 - Springer
IMF, Johns Hopkins University

Results - Key Findings

The study reveals that symmetry bias in standard filters leads to underestimation of potential output in deep recessions, resulting in weak policies and greater output losses.

- Standard statistical filters underestimate potential output during deep recessions due to symmetry bias, leading to weak policy responses and increased output losses.
- The authors demonstrate this impact using simulated data from a New Keynesian model with labor search frictions and downward nominal wage rigidity.
- Symmetry bias causes premature tightening of policies during the deepest 25% of recessions, amplifying output losses by over a third, highlighting the need for accurate output gap estimation for effective countercyclical policy.

About

The paper discusses the negative mean output gap and symmetry bias in statistical filters affecting policy responses.

Intro

The paper examines the negative mean output gap and symmetry bias in statistical filters within a New Keynesian model. It highlights how downward nominal wage rigidity exacerbates employment declines during recessions, leading to policy errors when standard output gap estimation methods assume a zero mean.

Conclusion

The research underscores the need for improved output gap estimation methods to avoid policy errors during recessions. It suggests future research to refine statistical filters and explore their implications for monetary and fiscal policy, aiming for more accurate economic stabilization strategies.

Stylized facts in money markets: an empirical analysis of the eurozone data

VL Coz, N Allaire, M Benzaquen, D Challet - arXiv preprint arXiv , 2024 - arxiv.org
Ecole Polytechnique, European Central Bank

Results - Key Findings

The paper shows that LCR regulation prompted increased evergreen repos, resulting in a denser, more stable eurozone interbank network focused on secured lending.

- Following LCR regulation, there was a significant increase in evergreen repurchase agreements, indicating a shift towards secured lending in the eurozone interbank market.
- The authors measured collateral re-use rates, confirming a rate around 1 in the eurozone, consistent with existing literature, and observed a denser, more symmetrical interbank network compared to unsecured markets.
- Using data from the ECB's MMSR database, the study analyzed transaction volumes, network stability, and collateral chains among the largest eurozone banks, highlighting that evergreen repos effectively navigate LCR constraints and provide insights into the structural dynamics of the interbank market.

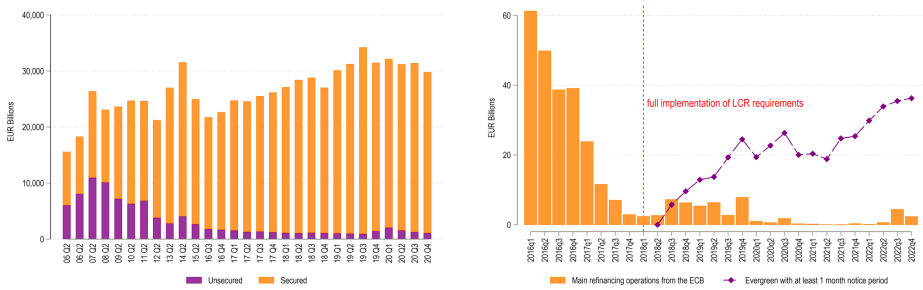


Figure 1 shows a bar chart depicting the cumulative quarterly turnover in the euro area unsecured and secured money market segments. It includes data from the Euro Area Money Market Survey until Q2 2015 and Money Market Statistical Reporting (MMSR) data thereafter. The chart considers transactions with deposit-taking institutions and CCPs, including both borrowing and lending transactions across all collateral types and maturities. (p2) **Intro** The study examines changes in the eurozone interbank market post-2008 financial crisis, focusing on secured transactions and network topology. It uses ECB's Money Markets Statistical Reporting database to analyze the impact of regulations like the Liquidity Coverage Ratio on the 47 largest banks' refinancing activities. **Conclusion** The research underscores the eurozone's interbank market's stability and increased secured transaction density. It suggests potential applications in regulatory policy adjustments and financial stability assessments. Future research could explore broader implications of these findings on global money markets.

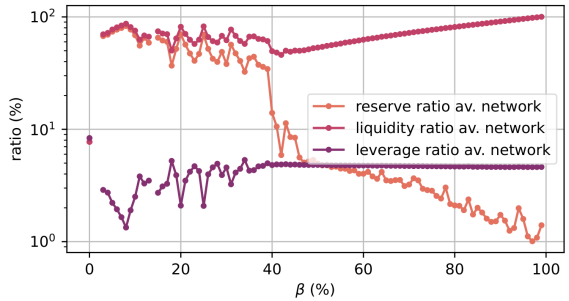
A minimal model of money creation under regulatory constraints

VL Coz, M Benzaquen, D Challet - arXiv preprint arXiv:2410.18145, 2024 - arxiv.org
cole Polytechnique, CentraleSuplec

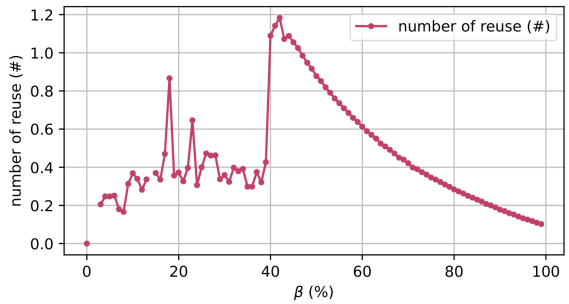
Results - Key Findings

The study uses an agent-based model to show how banks' management of liquidity under regulatory constraints affects money market dynamics and financial stability.

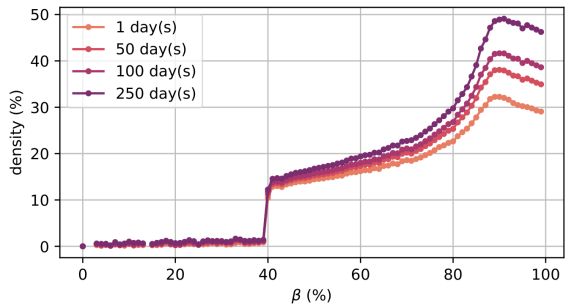
- Banks' asymmetric responses to payment shocks while managing liquidity coverage ratios (LCR) lead to excess liquidity in money markets.
- Collateral re-use increases with scarcity, and evergreen repos enable banks to manage liquidity needs without affecting LCR.
- The simulation highlights the importance of secured transactions in maintaining financial stability and provides insights into the effects of regulatory constraints on money market dynamics.



(a) Average regulatory ratios.



(b) Collateral re-use.



(c) Network density.

Figure 7 shows three plots of (a) average regulatory ratios, (b) collateral re-use, and (c) network density as functions of deposit outflow rate, illustrating changes in ratios, reuse counts, and network density with varying values. (p12)

Can Competition Increase Profits in Factor Investing?

V DeMiguel, A Martin-Utrera - Management Science, 2024 - pubsonline.informs.org
London Business School, Iowa State University

Results - Key Findings

The study shows that while competition exploiting the same factor reduces profits, diversifying across different factors can enhance profits by mitigating negative impacts.

- Competition among investors exploiting the same factor diminishes profits due to negative price impacts, whereas competition exploiting different factors enhances profits through trading diversification.
- Diversification allows for netting trades across factors, mitigating negative impacts and introducing a positive externality from trading diversification.
- Using data from 18 factors and mutual fund holdings, the authors employ game-theoretic models and empirical analysis to demonstrate the dual nature of competition's impact on factor investing profits, offering new insights into managing factor investing strategies.

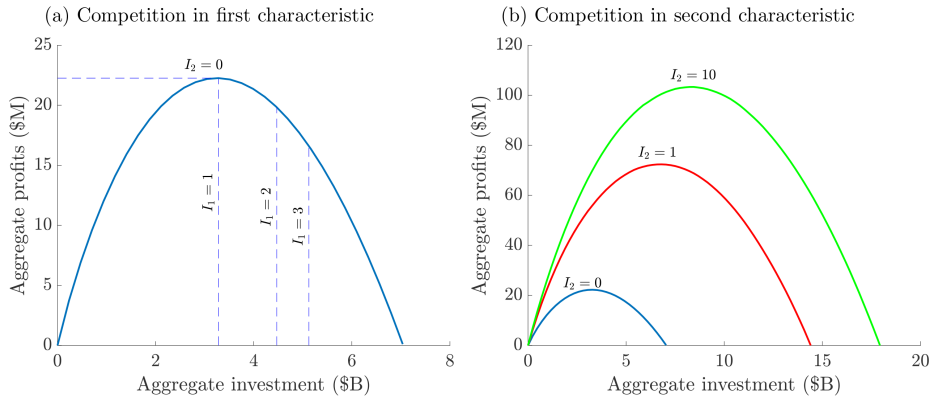


Figure shows two plots illustrating the effect of competition on profits in factor investing. Panel (a) depicts aggregate profits from the first characteristic as a function of aggregate investment, with different lines for varying numbers of investors exploiting the second characteristic. Panel (b) shows aggregate profits from the second characteristic, comparing cases with zero, one, and ten investors exploiting it. The horizontal axis represents aggregate investment in billions of dollars, while the vertical axis shows aggregate annual profits in millions of dollars. (p5) **Intro** The paper explores how competition affects profits in factor investing, using a game-theoretic model. It examines the impact of investor competition on profits from exploiting factors, highlighting both negative and positive externalities. The study aims to understand how trading diversification influences these dynamics.

Conditional Forecasting of Margin Calls using Dynamic Graph Neural Networks

M Citterio, M D'Errico, G Visentin - arXiv preprint arXiv:2410.23275, 2024 - arxiv.org
European Central Bank, ETH Z"urich

Results - Key Findings

A novel DGNN architecture is presented for accurate forecasting of net variation margins up to 21 days ahead in financial networks, enhancing systemic risk monitoring.

- The research integrates network dynamics into stress-testing by introducing a dynamic financial network model where entities trade Overnight Indexed Swaps, with topology evolving based on reference rates.
- The methodology involves simulating data and training the DGNN on these simulations, leveraging a GC-LSTM model to capture temporal and spatial patterns.
- Findings demonstrate the model's ability to generalize and predict under stress test scenarios, offering insights into market reactions to interest rate shocks and marking a shift from ex-post to ex-ante systemic risk assessment.

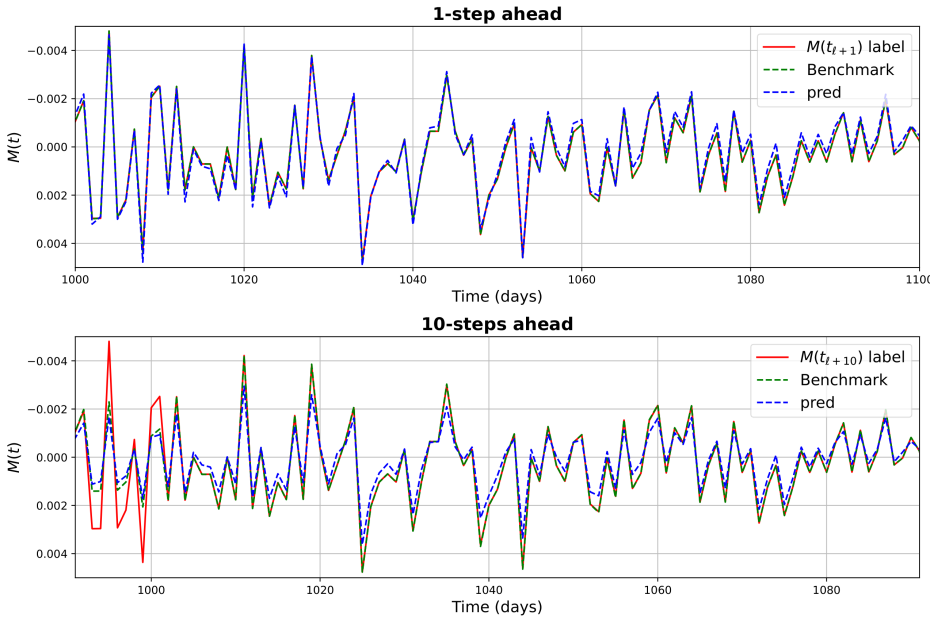


Figure shows two line graphs comparing predictions and benchmarks for 1-step and 10-steps ahead forecasts of M(t) over time (days). The top graph illustrates the 1-step ahead prediction, while the bottom graph depicts the 10-steps ahead prediction. Both graphs include lines for M(t+1) label, Benchmark, and pred, highlighting the differences in prediction accuracy over time. (p22)

Time-Series Foundation Model for Value-at-Risk

A Goel, P Pasricha, J Kanniainen - arXiv preprint arXiv:2410.11773, 2024 - arxiv.org
Tampere University, Indian Institute of Technology Ropar

Results - Key Findings

The study demonstrates that a fine-tuned Google's TimesFM model outperforms traditional econometric models in VaR estimation, promoting data-driven financial modeling.

- The research introduces TimesFM, a pre-trained time-series foundation model, for VaR forecasting, emphasizing the critical role of fine-tuning to enhance performance.
- Fine-tuned TimesFM surpasses traditional econometric models like GARCH and GAS in VaR estimation across various levels, showcasing the potential of foundation models in financial risk management.
- Using 19 years of daily return data from the S&P 100 index and backtesting metrics like the actual-over-expected ratio and quantile score loss function, the study suggests a shift towards data-driven approaches over traditional econometric techniques.

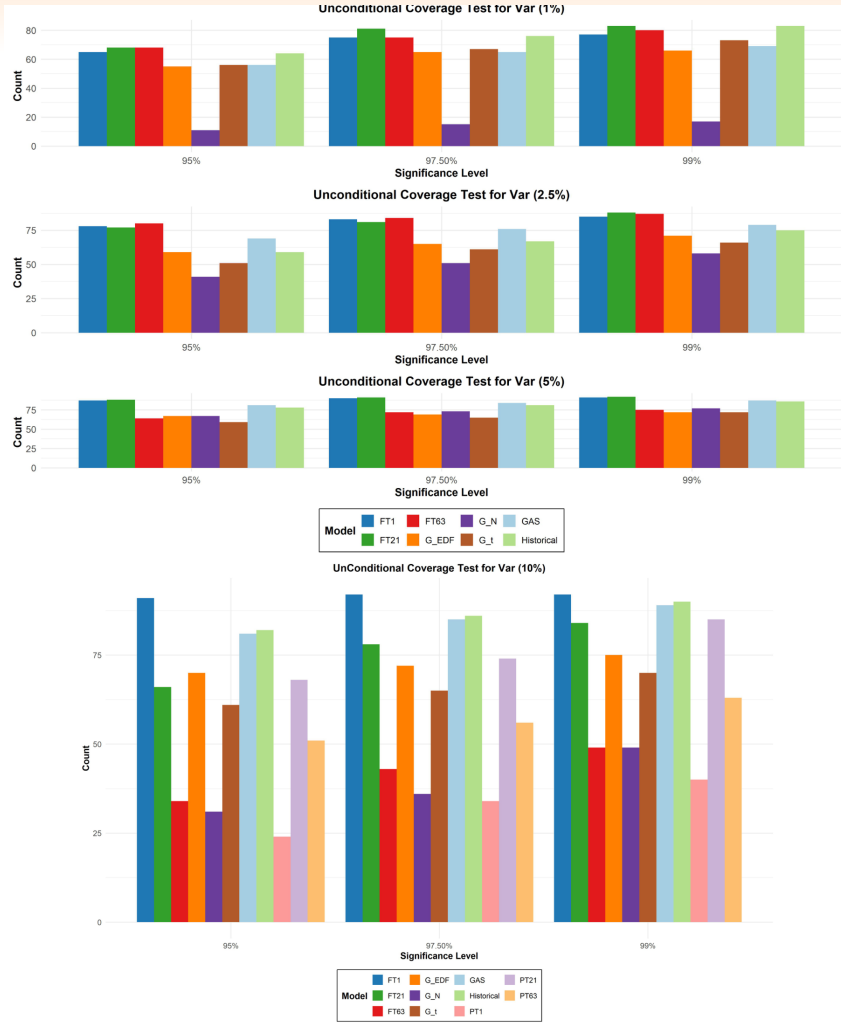


Figure shows bar plots of the number of assets for which the null hypothesis in the Unconditional Coverage test at various Value at Risk levels was not rejected. A higher number indicates better model performance, reflecting closer alignment between observed and expected VaR violations. Results are reported for four VaR confidence levels (1% , 2.5% , 5% , and 10%) across different models. (p22)

Model Validation Practice in Banking: A Structured Approach

A Sudjianto, A Zhang - arXiv preprint arXiv:2410.13877, 2024 - arxiv.org
Wells Fargo

Results - Key Findings

The survey highlights the importance of comprehensive model validation in banking, emphasizing conceptual soundness, outcome analysis, and monitoring for reliable performance and compliance.

- The survey structures a comprehensive approach to model validation in banking, emphasizing three components: conceptual soundness evaluation, outcome analysis, and ongoing monitoring to ensure model integrity, risk mitigation, and regulatory compliance.
- Drawing from over a decade of experience, the authors reinforce the significance of existing practices without introducing new terminology, underscoring the necessity of continuous monitoring and evaluation.
- While data collection and analysis methods are not detailed, the research focuses on practical application and adherence to regulatory standards, stressing the critical role of model validation in maintaining trust and supporting decision-making in the banking industry.

About

The paper discusses structured model validation practices in banking, focusing on risk management and regulatory compliance.

Intro

This paper reviews model validation practices in banking, focusing on Model Risk Management since SR11-7/OCC11-12 guidance. It aims to ensure predictive models for credit risk, fraud detection, and capital planning are reliable, conceptually sound, and meet regulatory standards, forming the basis for critical business decisions.

Conclusion

The study underscores the importance of robust model validation in banking, suggesting its application in risk mitigation and regulatory compliance. Future research could explore enhanced validation techniques. The research is crucial for ensuring reliable models that support key banking decisions.

What Drives Liquidity on Decentralized Exchanges? Evidence from the Uniswap Protocol

BZ Zhu, D Liu, X Wan, G Liao, CC Moallemi - arXiv preprint arXiv , 2024 - arxiv.org
Columbia University, Uniswap Labs

Results - Key Findings

The study identifies factors influencing liquidity in Uniswap v3, introduces a new metric, and examines how competition and external liquidity affect DeFi liquidity dynamics.

- The study finds that gas prices, token returns, and volatility primarily affect liquidity concentration, while fee revenue and markout influence both total value locked (TVL) and concentration in Uniswap v3.
- By introducing the v2 counterfactual spread metric, the research enables detailed analysis of liquidity concentration, identifies predictive factors for liquidity, and provides significant insights into DeFi liquidity dynamics.
- The study highlights that increased DEX competition and private liquidity sources lead to liquidity fragmentation, affecting Uniswap v3's market depth, using regression models on data from Uniswap v3 pools across Ethereum and Layer 2 networks.

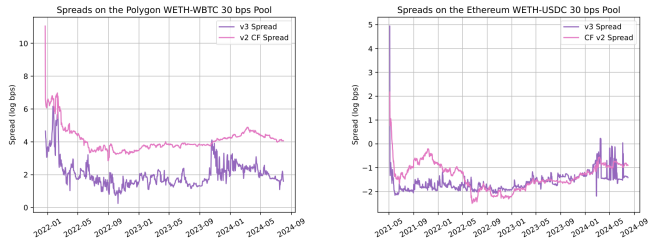


Fig. 2: Time series for effective spread and counterfactual v2 spread for the selected liquidity pools.

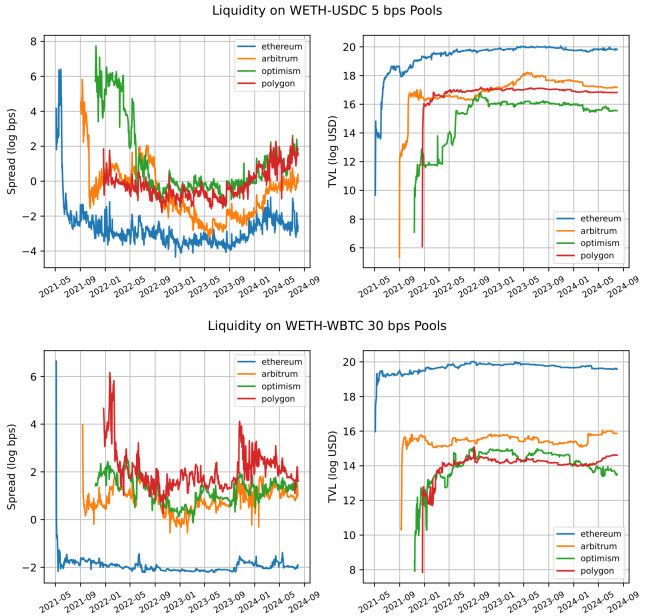


Fig. 3: Time series for effective spread (when trading 1 WETH) and TVL on selected liquidity pools.

AgileRate: Bringing Adaptivity and Robustness to DeFi Lending Markets

M Bastankhah, V Nadkarni, X Wang - arXiv preprint arXiv , 2024 - arxiv.org
University of Illinois Urbana-Champaign, Princeton University

Results - Key Findings

AgileRate's dynamic model significantly improves market utilization and reduces liquidation risks compared to static models by using an adaptive interest rate controller with a Recursive Least Squares algorithm.

- The authors developed an adaptive interest rate controller using a Recursive Least Squares algorithm, introducing new terminology and claims about interest rate convergence and utilization stability.
- Research shows that AgileRate outperforms static protocols in maintaining optimal utilization and reducing liquidation risks, evidenced by a low best-fit error on Aave data.
- The study analyzes Aave data and applies theoretical guarantees to assess vulnerability to adversarial manipulation, highlighting the trade-off between adaptivity and robustness in dynamic market conditions.

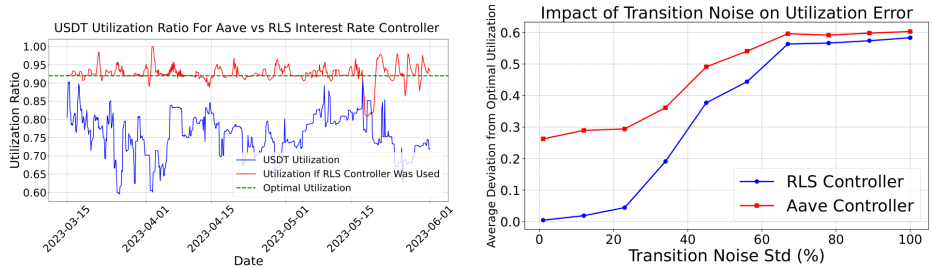


Figure compares the utilization between RLS-based controller and Aave's static curves, showing data over time. It also illustrates the impact of transition noise on utilization error for RLS and Aave controllers, highlighting the RLS controller's consistent performance even under high transition noise levels. (p14) **Intro** The paper introduces AgileRate, a dynamic model for DeFi lending markets that adapts to market changes using evolving demand and supply curves and an adaptive interest rate controller. It aims to address inefficiencies and risks in current platforms like Aave and Compound by enhancing utilization stability and minimizing liquidations. **Conclusion** The research suggests AgileRate can enhance DeFi lending platforms by improving market stability and reducing risks. Potential applications include more resilient financial systems. Future research could explore further optimization and broader implementation. The study highlights the importance of adaptive models in evolving financial landscapes.

XForecast: Evaluating Natural Language Explanations for Time Series Forecasting

T Aksu, C Liu, A Saha, S Tan, C Xiong - arXiv preprint arXiv , 2024 - arxiv.org
National University of Singapore, Salesforce Research

Results - Key Findings

The study presents new metrics to evaluate natural language explanations for time series forecasts, finding numerical reasoning crucial over model size for explanation quality.

- Introduces two new simulatability-based metrics, direct and synthetic simulatability, to evaluate natural language explanations for time series forecasts, assessing how explanations help predict model forecasts and generalize to new data.
- Finds that numerical reasoning, rather than model size, is crucial for explanation quality; experiments show these metrics align with human judgments, effectively distinguishing good from poor explanations.
- Validates metrics with various datasets and models, emphasizing more insightful explanations for statistical models over deep learning, and introduces a novel approach for evaluating explanations and a baseline for natural language explainers.

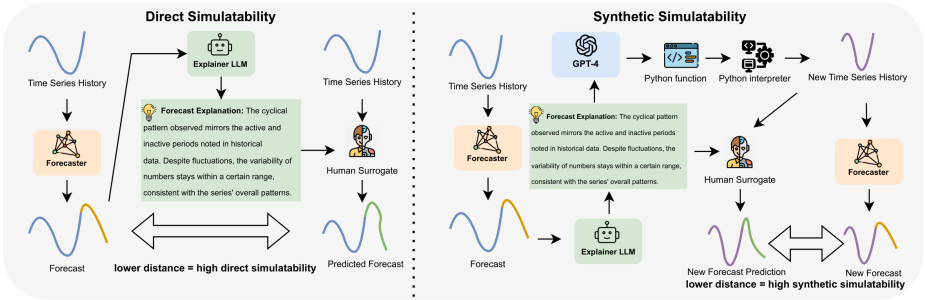


Figure 2 illustrates two metrics for evaluating explanations of black box forecasting models. The left side shows direct simulability, measuring the distance between the ground truth and the simulated forecast. The right side shows synthetic simulability, which involves simulations on a new time series. (p3) **Intro** The paper introduces XForecast, a study on evaluating natural language explanations for time series forecasting. It aims to make model predictions more accessible to non-experts by using natural language explanations, addressing the challenge of evaluating these explanations due to complex causal relationships in time series data.

Online conformal inference for multi-step time series forecasting

X Wang, RJ Hyndman - arXiv preprint arXiv:2410.13115, 2024 - arxiv.org
Department of Econometrics & Business Statistics, Monash University, Professor of Statistics, Monash University

Results - Key Findings

The paper introduces the AcMCP method to improve multi-step prediction intervals by accounting for serial correlations in forecast errors of non-stationary autoregressive processes.

- The paper finds that optimal h -step-ahead forecast errors in non-stationary autoregressive processes exhibit serial correlation up to lag $(h-1)$ and introduces the AcMCP method to incorporate these autocorrelations.
- AcMCP produces statistically efficient prediction intervals with long-run coverage guarantees without assuming data distribution shifts, demonstrated through simulations and applications to electricity demand and eating-out expenditure forecasting.
- The study extends conformal prediction to multi-step time series using unified notation, focusing on adaptive prediction intervals that achieve target coverage within local windows under varying conditions.

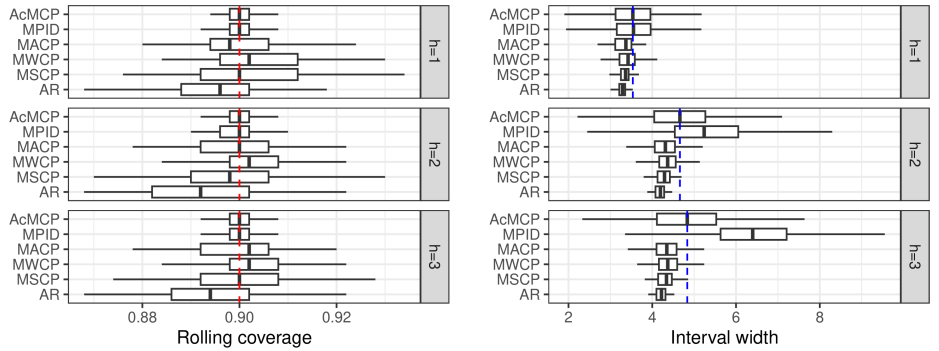


Figure 3: AR(2) simulation results showing boxplots of the rolling coverage and interval width for each method across different forecast horizons. The red dashed lines show the target coverage level, while the blue dashed lines indicate the median interval width of the AcMCP method. (p18) **Intro** The paper addresses constructing distribution-free prediction intervals for multi-step time series forecasting, focusing on temporal dependencies in forecast errors. It introduces the Autocorrelated Multi-step Conformal Prediction (AcMCP) method, which incorporates autocorrelations to enhance statistical efficiency and ensure long-run coverage guarantees for multi-step predictions.

Exploring the Frontier: Research Beyond Our Shortlist

- Beyond the Selection: Noteworthy Papers Ranked by Relevance, Impact, Authorship, Publication, and Citations

Artificial Intelligence and LLMs in Finance and Trading

1. GPT-Signal: Generative AI for Semi-automated Feature Engineering in the Alpha Research Process
2. Generative AI in Financial Reporting
3. Aligning LLMs with Human Instructions and Stock Market Feedback in Financial Sentiment Analysis
4. CustomizedFinGPT Search Agents Using Foundation Models
5. Large Language Models in Economics
6. The macroeconomic implications of the Gen-AI economy
7. What Role Does AI Play In Modern Financial Transactions?
8. Efficient Training of Neural Stochastic Differential Equations by Matching Finite Dimensional Distributions
9. Generation of synthetic financial time series by diffusion models
10. Financial Time Series Forecasting Based on Adversarial Training and Dynamic Weight Design
11. A scoping review of ChatGPT research in accounting and finance
12. Opportunities and Challenges of Generative-AI in Finance

Exploring the Frontier: Research Beyond Our Shortlist (contd.)

13. Multiple Objectives Escaping Bird Search Optimization and Its application in Stock Market Prediction Based on Transformer Model
14. FinTeamExperts: Role Specialized MOEs For Financial Analysis
15. Financemath: Knowledge-intensive math reasoning in finance domains
16. Deep Learning in Finance: A Survey of Applications and Techniques
17. Natural language processing in finance: A survey
18. FLAG: Financial Long Document Classification via AMR-based GNN
19. The Local Effects of Artificial Intelligence Labor Investments: Evidence from the Municipal Bond Market
20. Enhancing LLM Trading Performance with Fact-Subjectivity Aware Reasoning
21. The Role of Artificial Intelligence in Investment Decision-Making: Opportunities and Risks for Financial Institutions
22. From Facts to Insights: A Study on the Generation and Evaluation of Analytical Reports for Deciphering Earnings Calls
23. Temporal Relational Reasoning of Large Language Models for Detecting Stock Portfolio Crashes
24. GraphVAE: Unveiling Dynamic Stock Relationships with Variational Autoencoder-based Factor Modeling
25. Mapping Hong Kong's Financial Ecosystem: A Network Analysis of the SFC's Licensed Professionals and Institutions
26. FAMMA: A Benchmark for Financial Domain Multilingual Multimodal Question Answering

Exploring the Frontier: Research Beyond Our Shortlist (contd.)

27. Exploiting Risk-Aversion and Size-dependent fees in FX Trading with Fitted Natural Actor-Critic
28. Distilling Analysis from Generative Models for Investment Decisions
29. Large Legislative Models: Towards Efficient AI Policymaking in Economic Simulations
30. The effect of ESG divergence on the financial performance of Hong Kong-listed firms: an artificial neural network approach
31. A comparative analysis of SHAP, LIME, ANCHORS, and DICE for interpreting a dense neural network in Credit Card Fraud Detection
32. Hierarchical Reinforced Trader (HRT): A Bi-Level Approach for Optimizing Stock Selection and Execution
33. The Perks and Perils of Machine Learning in Business and Economic Research
34. Decrypting Corporate Speak: GPT-Assisted Measurement of Facts and Tones in Earnings Calls
35. TraderTalk: An LLM Behavioural ABM applied to Simulating Human Bilateral Trading Interactions
36. Enhancing Compliance And Kyc Processes Through Ai, Ocr, And Automation: A Costeffective- Approach

Advancements in Portfolio Strategy and Market Prediction

37. Deep Learning Methods for S Shaped Utility Maximisation with a Random Reference Point

Exploring the Frontier: Research Beyond Our Shortlist (contd.)

38. Two-fund separation under hyperbolically distributed returns and concave utility function
39. Robust forward investment and consumption under drift and volatility uncertainties: A randomization approach
40. Clustering Digital Assets Using Path Signatures: Application to Portfolio Construction
41. Machine Learning for Real-Time Portfolio Rebalancing: A Novel Approach to Financial Optimization
42. Time evaluation of portfolio for asymmetrically informed traders
43. Conformal Predictive Portfolio Selection
44. Predicting the stock market prices using a machine learning-based framework during crisis periods
45. MFB: A Generalized Multimodal Fusion Approach for Bitcoin Price Prediction Using Time-Lagged Sentiment and Indicator Features
46. Kendall Correlation Coefficients for Portfolio Optimization
47. Delegated portfolio management with random default
48. Deep prediction on financial market sequence for enhancing economic policies
49. Economic Theory and Machine Learning Integration in Asset Pricing and Portfolio Optimization: A Bibliometric Analysis and Conceptual Framework
50. Generalized Distribution Prediction for Asset Returns
51. Unlocking predictive potential: the frequency-domain approach to equity premium forecasting

Exploring the Frontier: Research Beyond Our Shortlist (contd.)

52. Improving out-of-sample forecasts of stock price indexes with forecast reconciliation and clustering
53. A Comparative Analysis of Deep Learning and Traditional Statistics for Stock Price and Return Forecasting
54. A Fully Analog Pipeline for Portfolio Optimization

Electronic Financial Markets and Limit Order Books (LOB)

55. Reinforcement Learning in Non-Markov Market-Making
56. Double Auctions: Formalization and Automated Checkers
57. A Financial Market Simulation Environment for Trading Agents Using Deep Reinforcement Learning
58. Price impact and long-term profitability of energy storage
59. Information Externalities, Free Riding, and Optimal Exploration in the UK Oil Industry

Advancements in Financial Derivative Modeling and Volatility

60. Graph-Based Methods for Forecasting Realized Covariances
61. Discrete approximation of risk-based prices under volatility uncertainty
62. A second order finite volume IMEX Runge-Kutta scheme for two dimensional PDEs in finance
63. No arbitrage and the existence of ACLMMs in general diffusion models
64. Numerical analysis of American option pricing in a two-asset jump-diffusion model

Exploring the Frontier: Research Beyond Our Shortlist (contd.)

65. European Option Pricing in Regime Switching Framework via Physics-Informed Residual Learning
66. Efficient calibration of the shifted square-root diffusion model to credit default swap spreads using asymptotic approximations
67. A Data Driven Study on Fractional Black-Scholes-Merton Equation Using Physics Informed Neural Network
68. Automated Volatility Forecasting
69. Exploiting News Analytics for Volatility Forecasting
70. Multi-model transfer function approach tuned by PSO for predicting stock market implied volatility explained by uncertainty indexes
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127. HiMTM: Hierarchical Multi-Scale Masked Time Series Modeling with Self-Distillation for Long-Term Forecasting
128. FlexTSF: A Universal Forecasting Model for Time Series with Variable Regularities
129. Novel Bayesian algorithms for ARFIMA long-memory processes: a comparison between MCMC and ABC approaches
130. Recurrent Neural Goodness-of-Fit Test for Time Series
131. xLSTM-Mixer: Multivariate Time Series Forecasting by Mixing via Scalar Memories
132. Context is Key: A Benchmark for Forecasting with Essential Textual Information

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133. Graph Neural Flows for Unveiling Systemic Interactions Among Irregularly Sampled Time Series
134. TimeMixer++: A General Time Series Pattern Machine for Universal Predictive Analysis
135. Timer-XL: Long-Context Transformers for Unified Time Series Forecasting
136. Inferring Latent Graphs from Stationary Signals Using a Graphical Autoregressive Model
137. Metadata Matters for Time Series: Informative Forecasting with Transformers
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