



A Network-Tuned Asset Allocation Framework: Integrating TMFG Filtering and Shapley-Valued Stock Selection for Emerging Markets

Hafizah Bahaludin

Department of Computational & Theoretical Sciences, Kulliyah of Science, International Islamic University Malaysia (IIUM), Pahang, Malaysia
hafizahbahaludin@iium.edu.my

KEY TAKEAWAY

Winning by Staying Peripheral: A Network-Game Theory Framework for Portfolio Construction

A novel two-stage framework combining TMFG for stock selection and Shapley values for weighting delivers a 2.02 in-sample Sharpe ratio and cuts COVID-19 drawdown nearly in half compared with the market, offering fund managers a principled and crisis-resilient alternative to equal-weight portfolios.

PROBLEM

Estimation Fragility: Classical Mean-Variance optimization requires calculating 17,955 parameters for 189 stocks, creating extreme sensitivity to estimation errors and portfolio instability

Topology Discard: Prior Malaysian network studies rely on Minimum Spanning Trees (MST) which discard most of correlation information, eliminating higher-order structures needed to find true diversification

The PBMZI Gap: No empirical studies have mapped the PRIBUMI Bursa Malaysia Zakat Index (PBMZI) using network filtering or cooperative game theory for capital preservation

OBJECTIVES

Map Regime Shifts: Construct TMFG-filtered financial networks across four market regimes (2018–2024) to track evolving dependency structures.

Isolate Peripheral Assets: Formulate a unified Peripheral Index to identify stocks topologically insulated from systemic contagion.

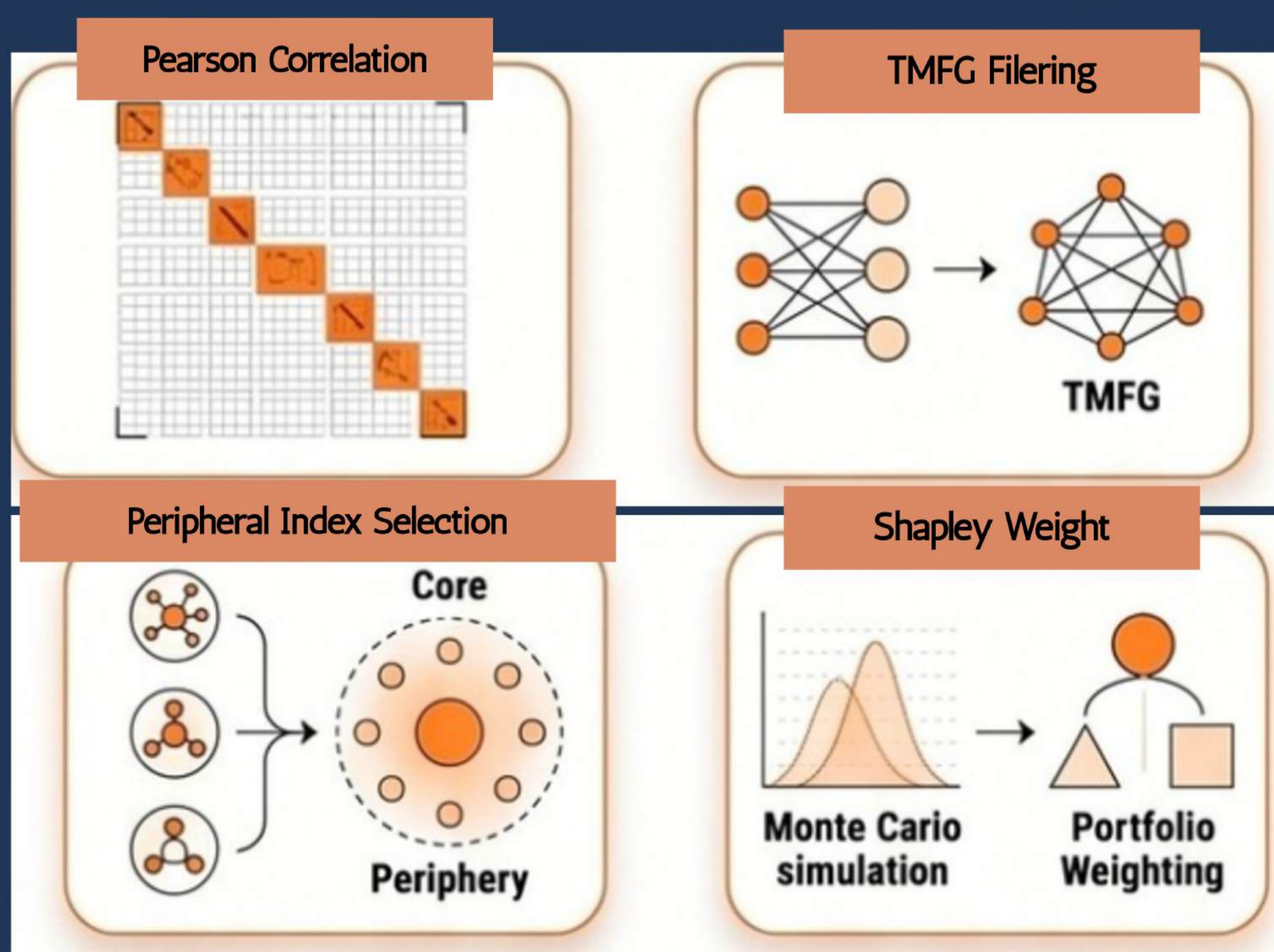
Optimize via Cooperative Games: Deploy Monte Carlo Shapley value optimization to assign capital weights strictly to assets demonstrating positive marginal Sharpe contributions.

Stress-Test Downside Resilience: Formally evaluate out-of-time portfolio drawdown protection during the extreme market shock.

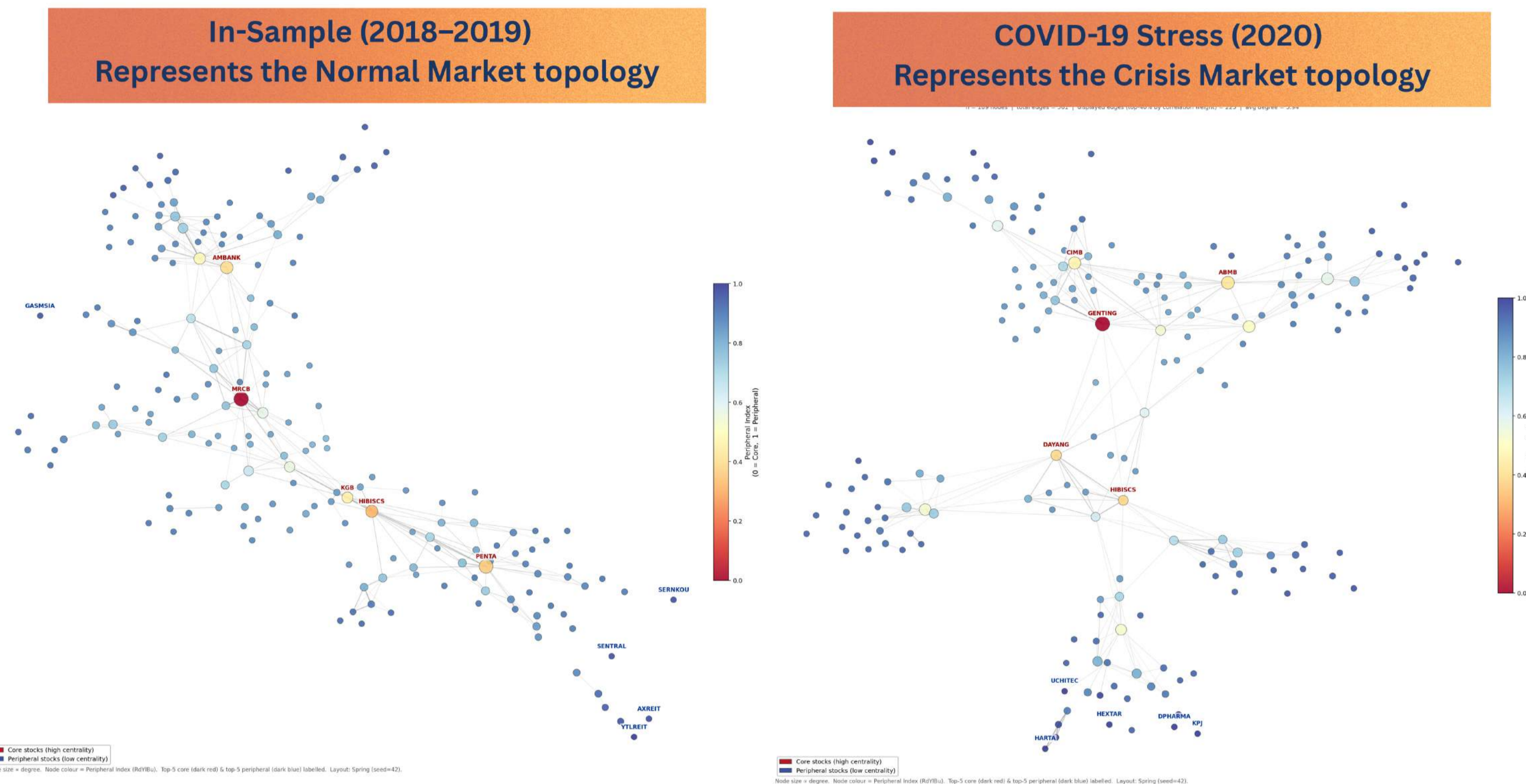
DATA

- Universe Construction: 189 stocks listed on PBMZI (pruned from 221 stocks using a robust 6-step cleaning and winsorization pipeline).
- Temporal Windows:
 - In-Sample (IS): Jan 2018 – Dec 2019 (521 days) | Baseline training.
 - COVID-19 Stress: Jan 2020 – Dec 2020 (262 days) | Out-of-time crash validation.
 - OOS-Train: Jan 2021 – Dec 2022 (521 days) | Symmetric post-crisis model rebuild.
 - OOS-Test: Jan 2023 – Oct 2024 (466 days) | True unseen holdout testing.

METHODOLOGY



TMFG NETWORK



Normal Regime (2018–19): Infrastructure (MRCB) dominates the network core, while stable consumer defensives (NESTLE, QL) occupy the distant, isolated periphery.

COVID-19 Stress (2020): GENTING pulls into the absolute core due to pandemic revenue shocks, while healthcare equities (HARTA, KPJ) decouple completely to the extreme periphery—conferring systemic risk insulation.

PERFORMANCE METRICS

PERIOD	TMFG-SHAPLEY SHARPE	MARKET SHARPE	TMFG MAX DRAWDOWN	MARKET MAX DRAWDOWN
In-Sample (2018-19)	2.02	-0.45	-7.6%	-20.5%
COVID-19 (2020)	0.21	0.39	-14.8%	-27.9%
OOS-Train (2021-22)	1.56	-0.01	-19.8%	-16.0%
OOS-(2023-24)	-1.01	1.54	-35.8%	-8.8%

The **TMFG-Shapley model** shows strong in-sample and OOS-Train risk-adjusted performance, validating it as the study's main result. Its COVID-19 stress test further confirms that structurally peripheral stocks genuinely decouple from systemic sell-offs, while the weaker OOS-Test outcome reflects regime-change risk when the previously peripheral oil-and-gas cluster reverses and generates concentrated losses

CONCLUSIONS

TMFG-Shapley Synergy: Successfully maps high-dimensional relationships in 189 equities, delivering a powerful 198% increase in retained structural data over standard MST models.

Proven Capital Resilience: Topological peripheral isolation successfully cuts maximum drawdown in half during systemic crashes (-14.8% vs. -27.9% for the market), preserving crucial downside capital.

Vulnerability & Retraining: Out-of-sample decay in 2023–24 proves that static weights degrade during commodity reversals; fund managers must implement quarterly rolling retraining and a 15%–20% concentration cap.

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