Cross-Asset Contagion in Stress Regimes

Evidence from Bitcoin Crash Events and Equity Correlation Breakdown (2020–2026)

ABSTRACT

Traditional portfolio theory assumes that defensive, low-beta equities provide diversification benefits during periods of market stress. This study examines whether those benefits persist during crypto-led liquidity shocks.

Using over 2,200 trading days between 2020 and 2026, I analyze regime-dependent correlations between Bitcoin and selected equity groups. Stress regimes are defined as weekly Bitcoin drawdowns exceeding 10%, consistent with institutional market conventions for correction-level declines.

The results reveal a **structural breakdown in diversification**. During stress regimes, correlations between Bitcoin and defensive equities rise from a baseline of **0.07** to **0.42**, approaching the correlation levels observed in high-beta, sentiment-driven equities. This convergence indicates that Bitcoin functions as a **high-frequency proxy for systemic liquidity stress**, signaling periods when cross-asset correlations tighten, and traditional diversification temporarily weakens.

PROBLEM STATEMENT

- **Theoretical Background**
  - Modern Portfolio Theory (MPT) relies on **low or stable correlations** across assets to reduce portfolio risk. Defensive equities such as Consumer Staples and Healthcare—are widely held for their perceived resilience during market downturns.
- **Motivation**
  - With the financialization of cryptocurrencies, Bitcoin has become deeply intertwined with global liquidity conditions. Its 24/7 trading structure and sensitivity to leverage make it a potential early indicator of risk-off environments.

Research Question

Do Bitcoin crash events coincide with a regime-dependent breakdown in the correlation structure between high-beta and defensive equities?

ASSET SELECTION RATIONALE

Why These Stocks?

The analysis deliberately uses a **small, representative asset set** rather than a broad index universe to maintain interpretability and clarity.

Group A: Sentiment-Driven / High-Beta Equities

- **Coinbase (COIN)**
- **MicroStrategy (MSTR)**
- **Tesla (TSLA)**
- **NVIDIA (NVDA)**

Rationale:
These stocks exhibit:

- High volatility and growth orientation
- Strong sensitivity to retail sentiment and liquidity conditions
- Elevated beta during speculative market phases

They serve as proxies for **risk-on equity behavior**.

Group B: Defensive / Low-Beta Equities

- **Johnson & Johnson (JNJ)**
- **Coca-Cola (KO)**
- **Procter & Gamble (PG)**

Rationale:
These companies are:

- Cash-flow stable
- Low-beta, dividend-paying
- Commonly used for capital preservation and defensive allocation

They represent assets where **diversification is explicitly expected to hold**.

REGIME DEFINITION & THRESHOLD JUSTIFICATION

Why a 10% Bitcoin Drawdown?

The stress regime is defined as:

Weekly Bitcoin return ≤ −10%

This threshold aligns with **institutional market conventions**:

Market Term	Typical Definition
Pullback	~5% decline
Correction	**~10% decline**
Bear Market	~20% decline

A 10% weekly move in Bitcoin corresponds to **tail-risk behavior**, capturing extreme liquidity stress without being overly restrictive. This approach prioritizes **transparency and interpretability** over model complexity.

METHODOLOGY

Data

- Daily adjusted closing prices (Yahoo Finance)
- Period: **January 2020 – 2026**

Steps

1. Compute daily log returns
2. Identify stress regimes based on Bitcoin weekly returns
3. Segment returns into **Normal** and **Crisis** regimes
4. Compute Pearson correlations between Bitcoin and each equity
5. Compare correlation structures across regimes

RESULTS

Key Finding: Correlation Convergence During Stress

Regime	High-Beta Equities	Defensive Equities
Normal	0.36	**0.07**
Crisis	0.45	**0.42**
Absolute Change	+0.09	**+0.35**

Interpretation

- Defensive equities are effectively uncorrelated with Bitcoin in normal conditions.
- During Bitcoin crash regimes, defensive stocks become **moderately correlated**, nearly matching high-beta equities.
- The correlation gap between "risky" and "defensive" assets narrows from **0.29** to **0.03**, indicating a **temporary failure of diversification**.

This does **not** imply that defensive stocks become speculative.
It implies that **their diversification benefit weakens precisely when it is most needed**.

CAUSALITY CLARIFICATION

This study **does not claim**:

- Bitcoin causes equity sell-offs
- Crypto drives institutional portfolio decisions

Instead:

- Bitcoin crashes are treated as a **symptom of broader risk-off and liquidity-tightening environments**

- In such regimes, market participants de-risk across asset classes simultaneously

FAQ's (SELECTED)

Why Bitcoin instead of VIX?
Bitcoin trades continuously and reacts rapidly to retail leverage and liquidity shocks, often before equity markets open. It complements—not replaces—traditional volatility indices.

Isn't correlation increase from 0.07 misleading in percentage terms?
Yes, which is why the analysis emphasizes **absolute changes** rather than relative percentages. A +0.35 shift represents a material structural change in the correlation matrix.

What is the practical implication?
Static correlation assumptions underestimate portfolio risk during stress regimes, potentially leading to higher drawdowns and VaR breaches.

LIMITATIONS & EXTENSIONS

Limitations

- Threshold-based regime definition
- Small, representative asset set
- Static Pearson correlations

Future Extensions

- VIX-based regime validation
- Rolling correlation analysis
- Portfolio-level VaR / Expected Shortfall backtesting
- Time-varying correlation models (e.g., DCC-GARCH)

AREAS FOR IMPROVEMENT / SUGGESTIONS:

1. **Robustness Checks**
    - Consider testing alternative crisis thresholds (e.g., -8%, -12%) to ensure results are not sensitive to your chosen cutoff.
    - You could also try using rolling correlations or time-varying models (e.g., DCC-GARCH) to validate the regime-based findings.
2. **Statistical Significance**
    - While you show correlation changes, adding confidence intervals or p-values for correlation differences would strengthen inferential claims.
3. **Model Extension**
    - The LSTM section is a nice touch, but it feels somewhat disconnected from the main correlation analysis. Consider integrating regime labels as features in the LSTM or using it to forecast correlation regimes.

4. **Broader Context**
    - Briefly compare your findings to existing literature on cross-asset contagion (e.g., during the 2008 crisis or COVID-19 crash). This would contextualize your contribution.
5. **Limitations Section**
    - In the PDF, you note limitations well. In the notebook, you could add a brief reflection on data quality, survivorship bias, or the assumption of linear correlation (Pearson).