



What Drives Tech Stock Volatility?

VIX vs. Federal Funds Rate as Predictors of AAPL Volatility (2016–2026)

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Agenda

- **Research Question**
- **Data & Sources**
- **Methodology**
- **Visualizations**
- **Key Findings**
- **Recommendations**

What actually moves tech stock volatility?

Hypothesis A

Market Fear (VIX)

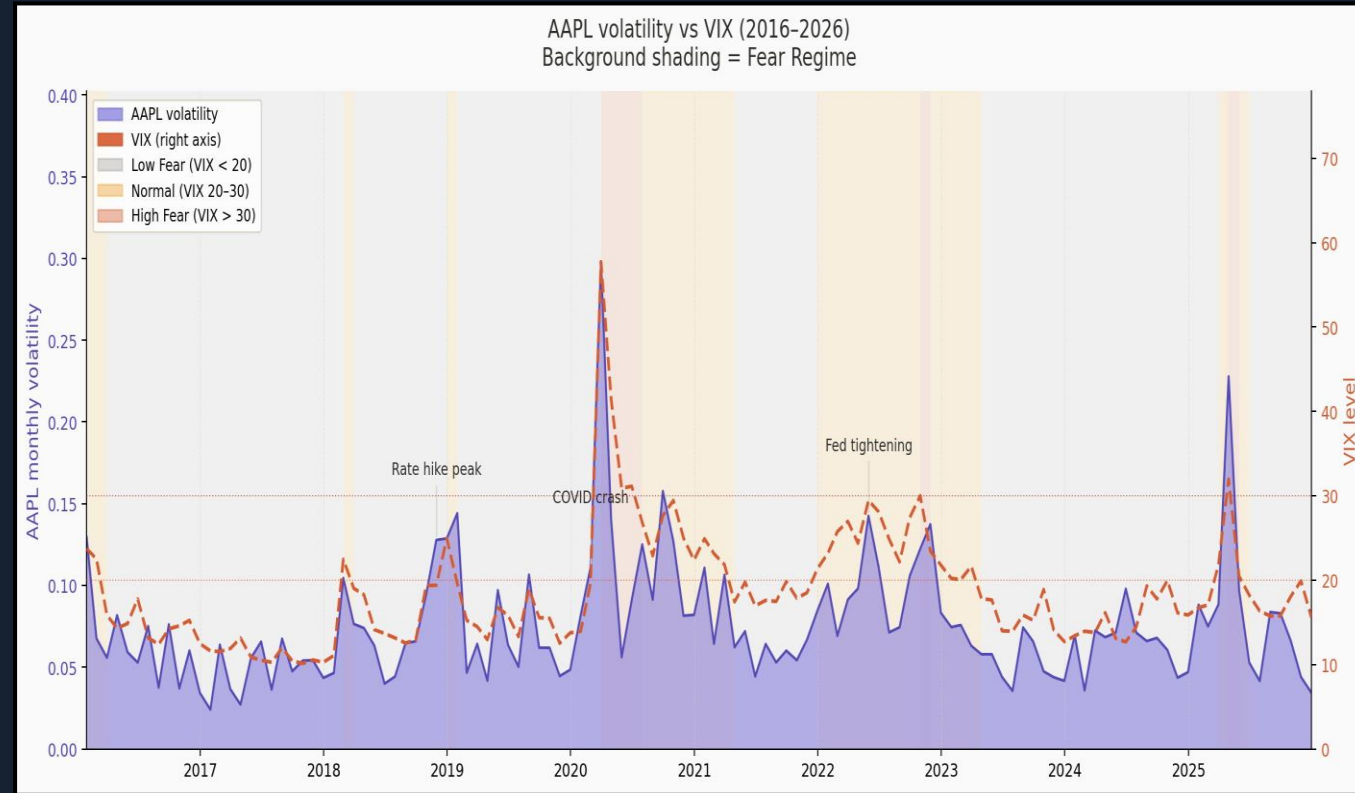
Sentiment and systemic anxiety drive volatility spikes through panic-driven trading.

VS

Hypothesis B

Monetary Policy (FFR)

The Federal Funds Rate drives volatility by changing the cost of capital.



VIX and AAPL move in lockstep

Three variables, one decade of data

AAPL Volatility

Dependent variable

2016-2016 Monthly std. dev. of daily log returns $\times \sqrt{21}$. Downloaded via yfinance.

Yahoo Finance

VIX Index

Primary predictor

CBOE Volatility Index — proxy for market-wide fear. Monthly average.

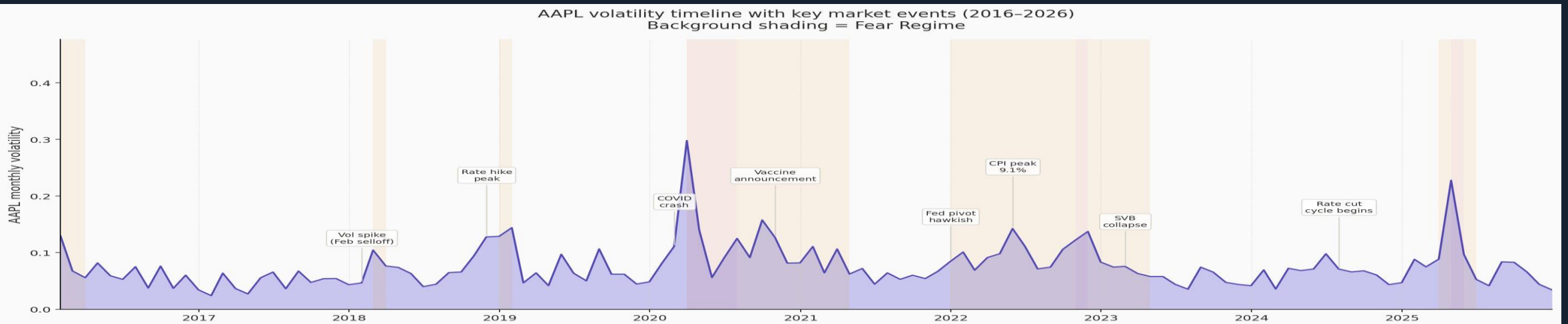
CBOE + Yahoo

Fed Funds Rate

Competing predictor

Federal Funds Effective Rate (FEDFUNDS). Monthly observations.

FRED / St. Louis Fed



From raw prices to actionable insight

01

Data Collection

Downloaded daily prices for 7 tech stocks + VIX via yfinance. Fed Funds Rate via FRED API. 2016–2026.

02

Volatility Calculation

Monthly volatility = $\sigma(\text{daily log returns}) \times \sqrt{21}$.
Annualized to monthly trading-day basis.

03

Regime Classification

Manual (VIX < 20 / 20–30 / > 30) + K-Means clustering (k=3) for algorithmic validation.

04

Statistical Analysis

OLS multiple regression: $\text{AAPL_Vol} \sim \text{VIX} + \text{FFR}$. Rolling 12-month correlation. KDE distributions.

9 charts across 4 analytical layers

Chapter 1: Setting the Stage

Event Timeline (annotated)

Chapter 2: The Pattern

Dual Area Chart · K-Means Scatter · Rolling Correlation

Chapter 3: The Evidence

Violin Plot · Correlation Matrix · Dumbbell Chart

Chapter 4: So What?

Diverging Bar Chart · Regime Transition Diagram

VIX is the primary driver — not interest rates

Strong +

VIX–AAPL corr

Weak

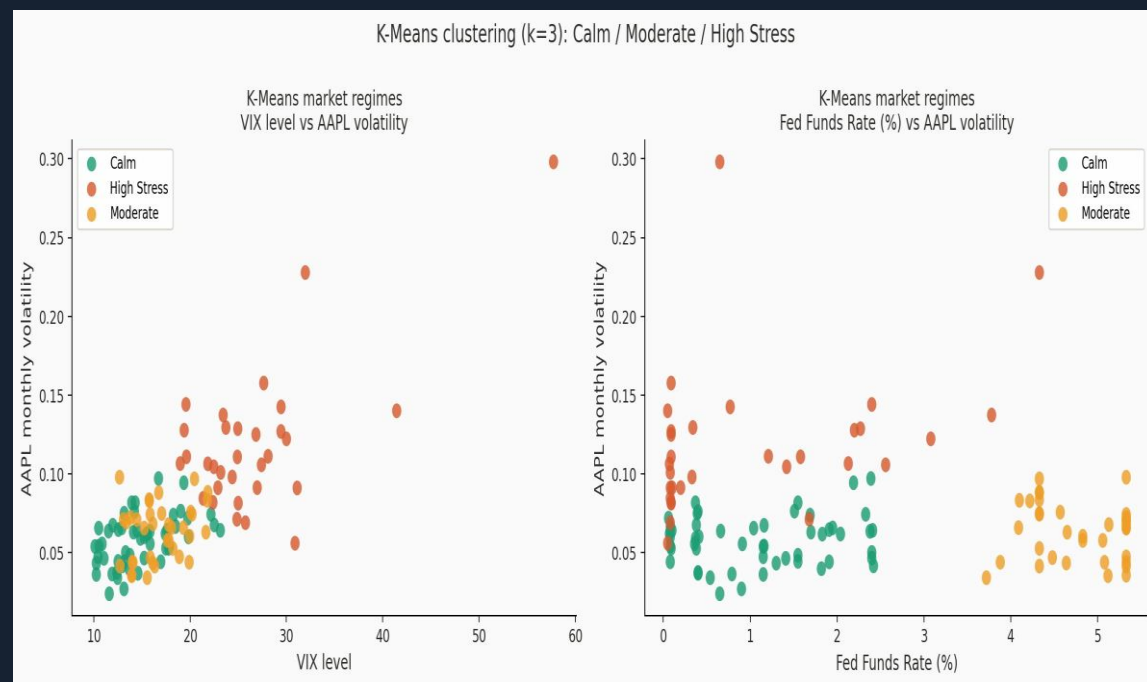
FFR–AAPL corr

~0.95

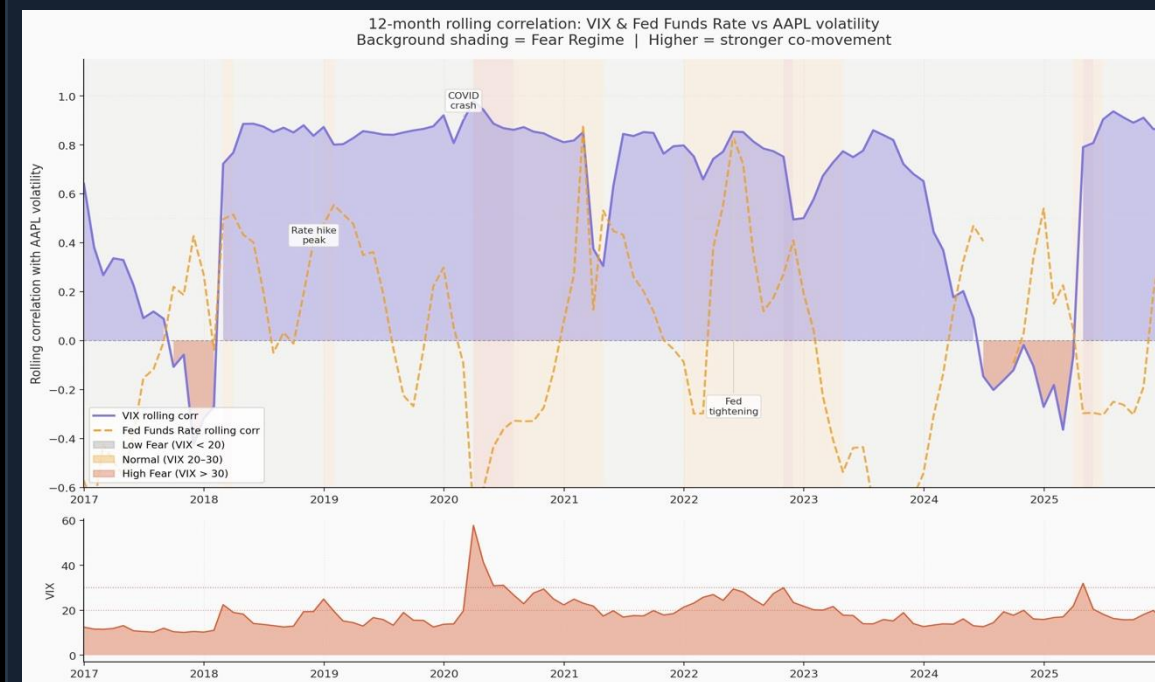
Peak rolling corr
(COVID crash)

R^2 0.63

VIX explains
63% of variance



K-Means confirms VIX=20 as natural boundary



Rolling corr peaks at ~0.95 during COVID (Mar 2020)

KEY FINDING 02

VIX 20 is the break point —volatility regimes are distinct

Low Fear

VIX < 20

Median volatility

0.04–0.07

Normal

VIX 20–30

Median volatility

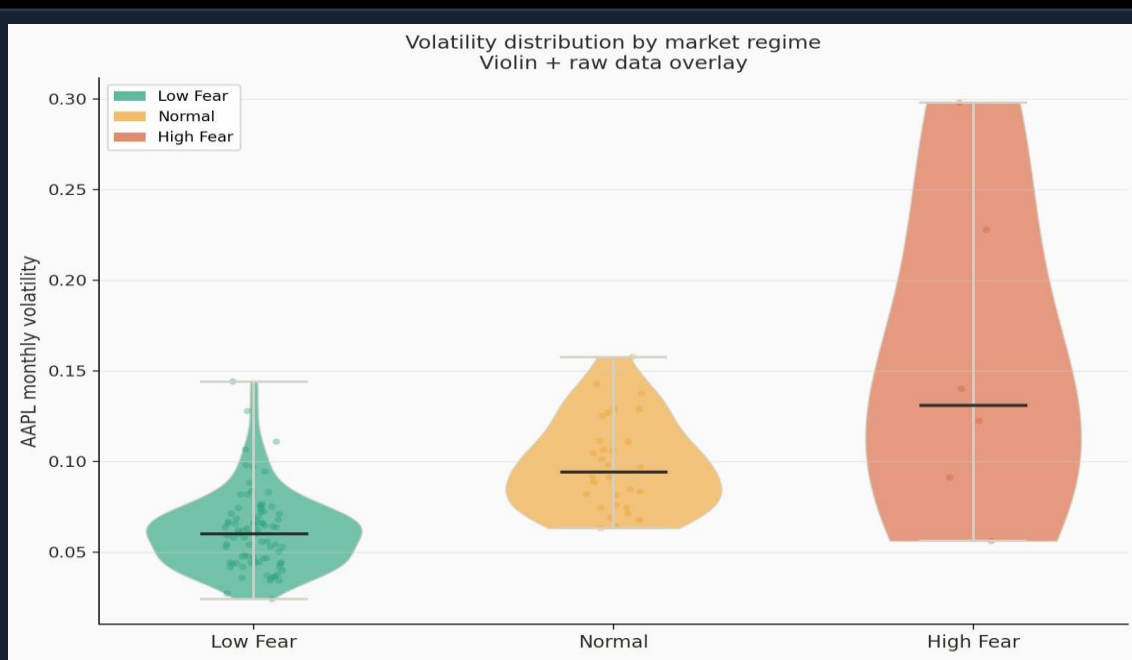
0.07–0.10

High Fear

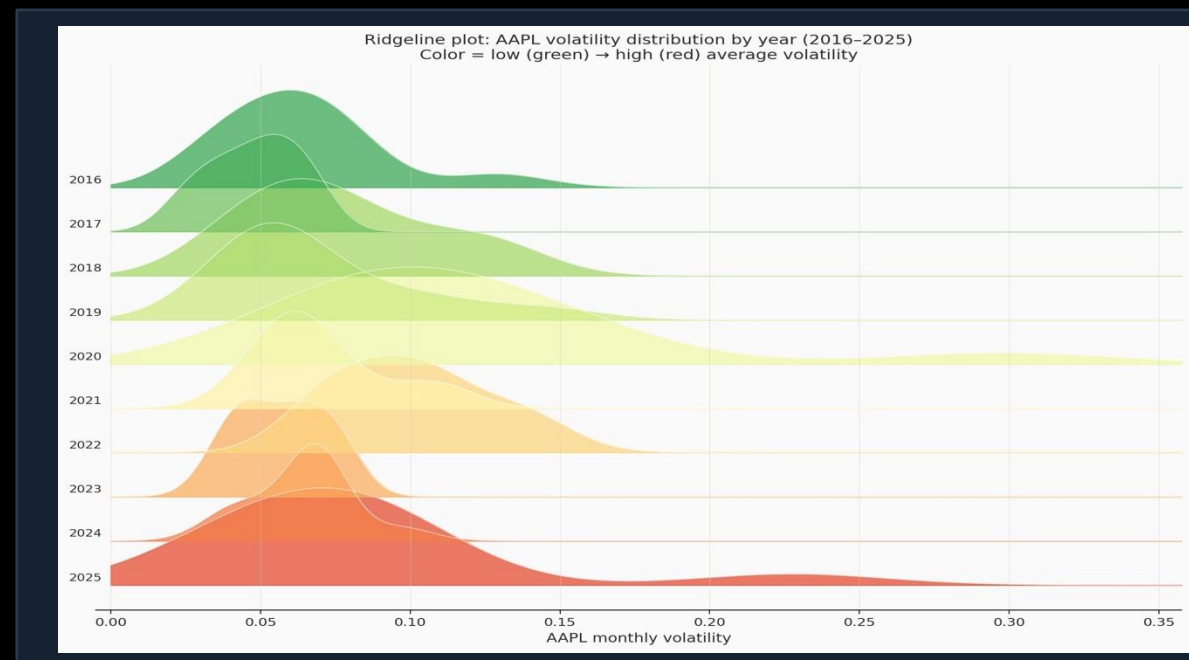
VIX > 30

Median volatility

0.13+



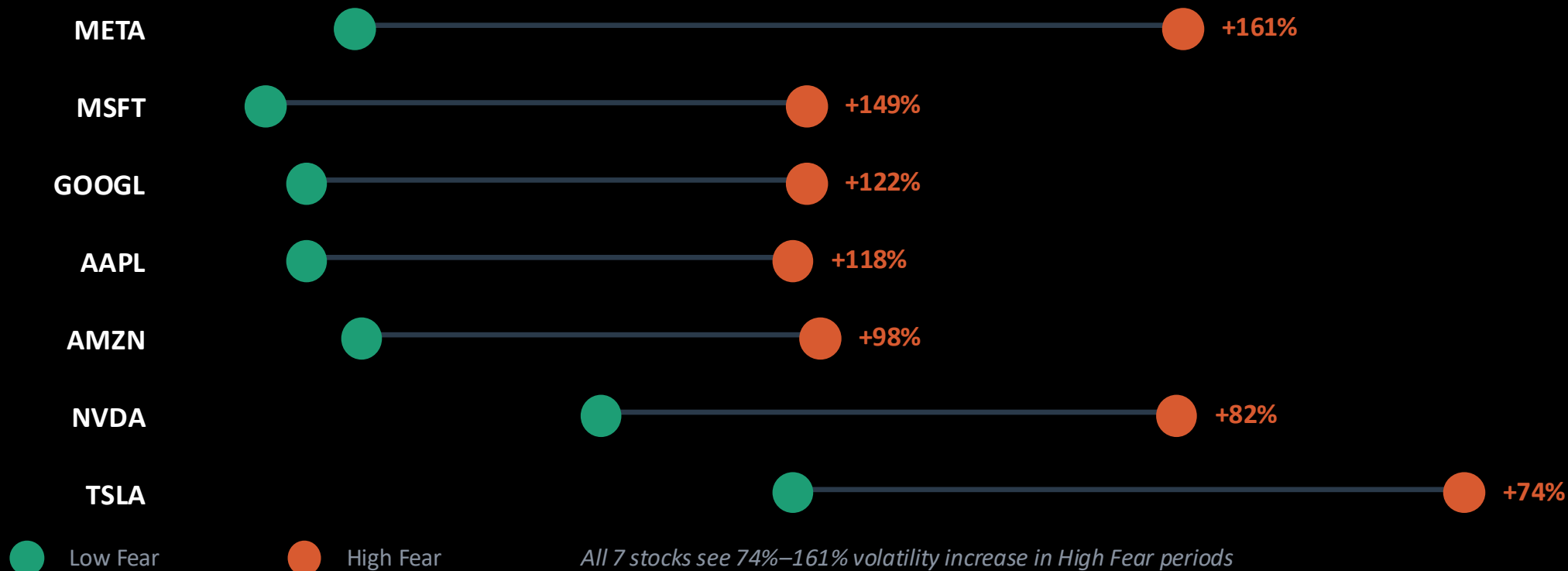
High Fear = fat tails + unpredictable distribution



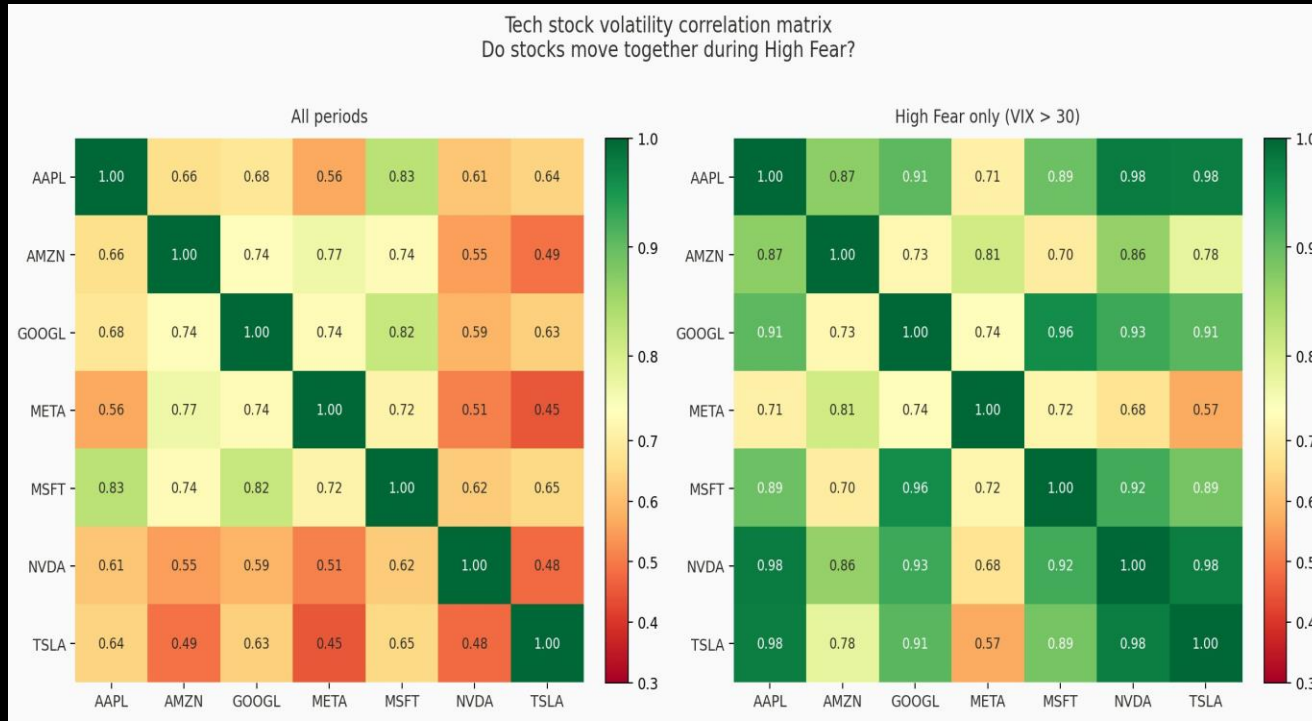
2020 stands out as a complete distributional outlier

Not all stocks respond equally — high-beta names amplify fear

Volatility jump: Low Fear → High Fear (median monthly vol)



Not all stocks respond equally — high-beta names amplify fear



All Periods: Correlations range from 0.45 to 0.83, suggesting moderate co-movement under normal market conditions — diversification across these 7 tech stocks provides meaningful risk reduction.

High Fear Only (VIX > 30): Correlations surge to 0.71–0.98, with NVDA–TSLA reaching 0.98 and AAPL–NVDA hitting 0.98 — the portfolio effectively collapses into a single risk factor.

In High Fear: all correlations approach 1.0 — diversification fails

Three actions for portfolio managers

01

Monitor VIX, not Fed announcements

Use VIX as your primary risk signal. Trigger hedging strategies when VIX sustains above 20, not when rate decisions are announced — our data shows rates have minimal predictive power on tech volatility.

02

Rebalance away from high-beta names in High Fear

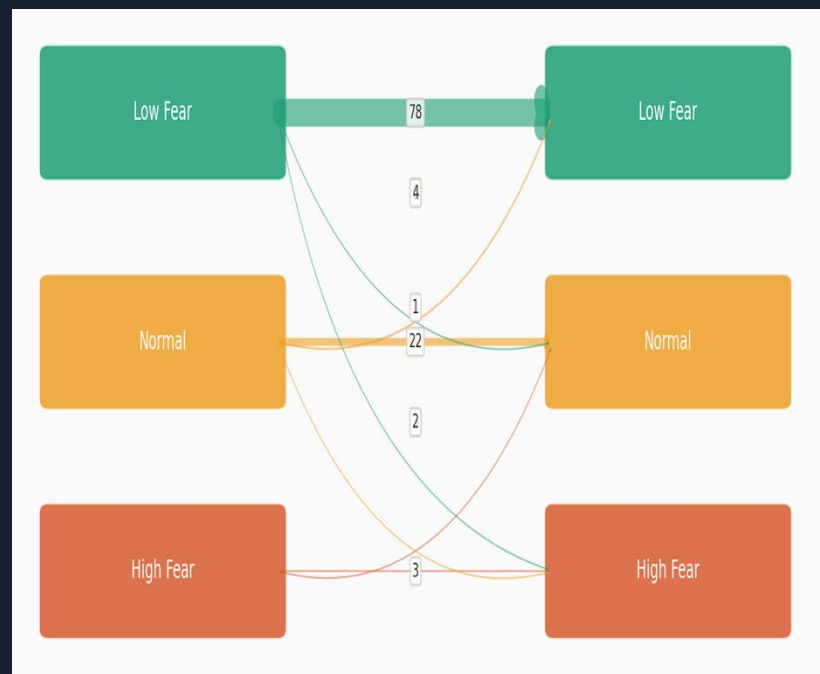
META, MSFT, and GOOGL show 120–160% volatility jumps in High Fear regimes. Reduce exposure to these names proactively when VIX approaches 20 rather than reacting after the spike.

03

Shift future research to CPI and inflation

Interest rates failed as a direct predictor. The next research question: does CPI data drive market anxiety (VIX) as a secondary channel? If so, inflation becomes the leading indicator to watch.

Regime transition diagram: how often does market shift

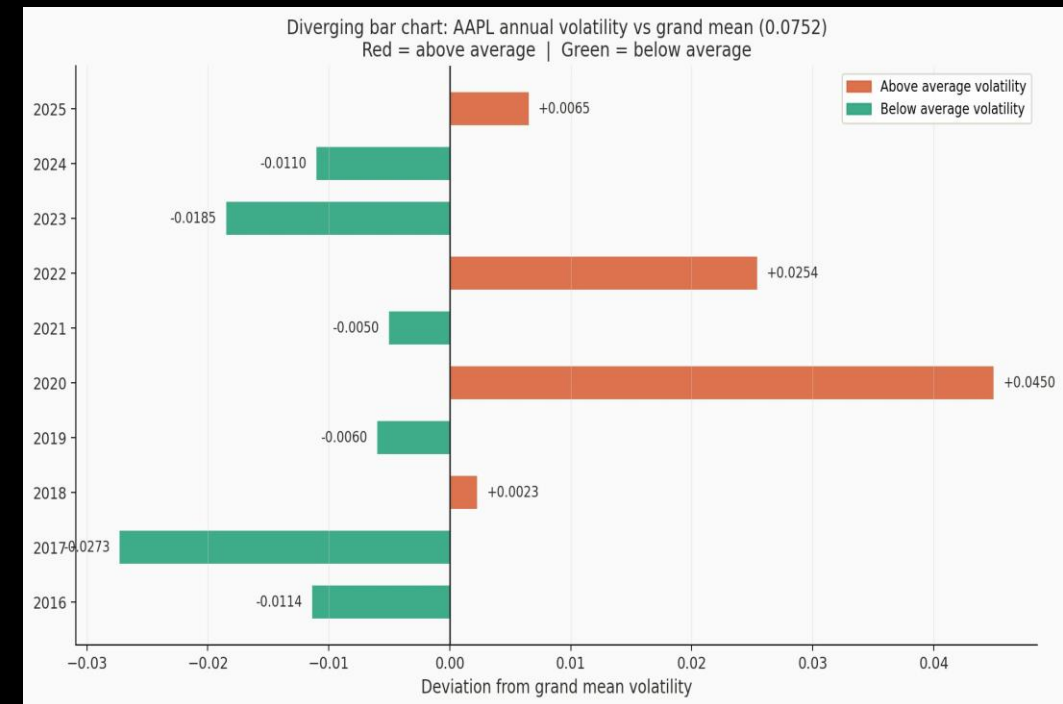


Low Fear persists 78 months — act before the shift

CONCLUSION

Market fear is the true driver of tech stock volatility.

- VIX explains 63% of AAPL volatility variance, FFR does not
- VIX = 20 validated by both manual analysis and K-Means algorithm
- In High Fear, all stocks correlate ≈ 1.0 (correlate strongly) — diversification fails



2020 was +60% above the 10-year mean