

RESEARCH INSIGHT

Volatility peaks before diversification recovers

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Executive summary



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Volatility recovers faster than market structure.

Key findings

- Sector commonality rises beyond the quietest volatility range.
- Volatility peaked after 5.5 days. Market structure peaked after 43.
- Larger shocks left deeper, longer-lasting common-factor dominance.

Key metrics

Complete VIX shock events	28
Median VIX peak	Day 5.5
Median PC1 peak	Day 43
Strongest VIX association	60-day maximum, 0.458
Period	2000–2026

Why it matters

A declining VIX does not necessarily mean diversification has recovered. Stress can retreat while sector returns remain dominated by a common factor, leaving portfolios more structurally dependent than headline volatility suggests.

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When sector independence begins to weaken

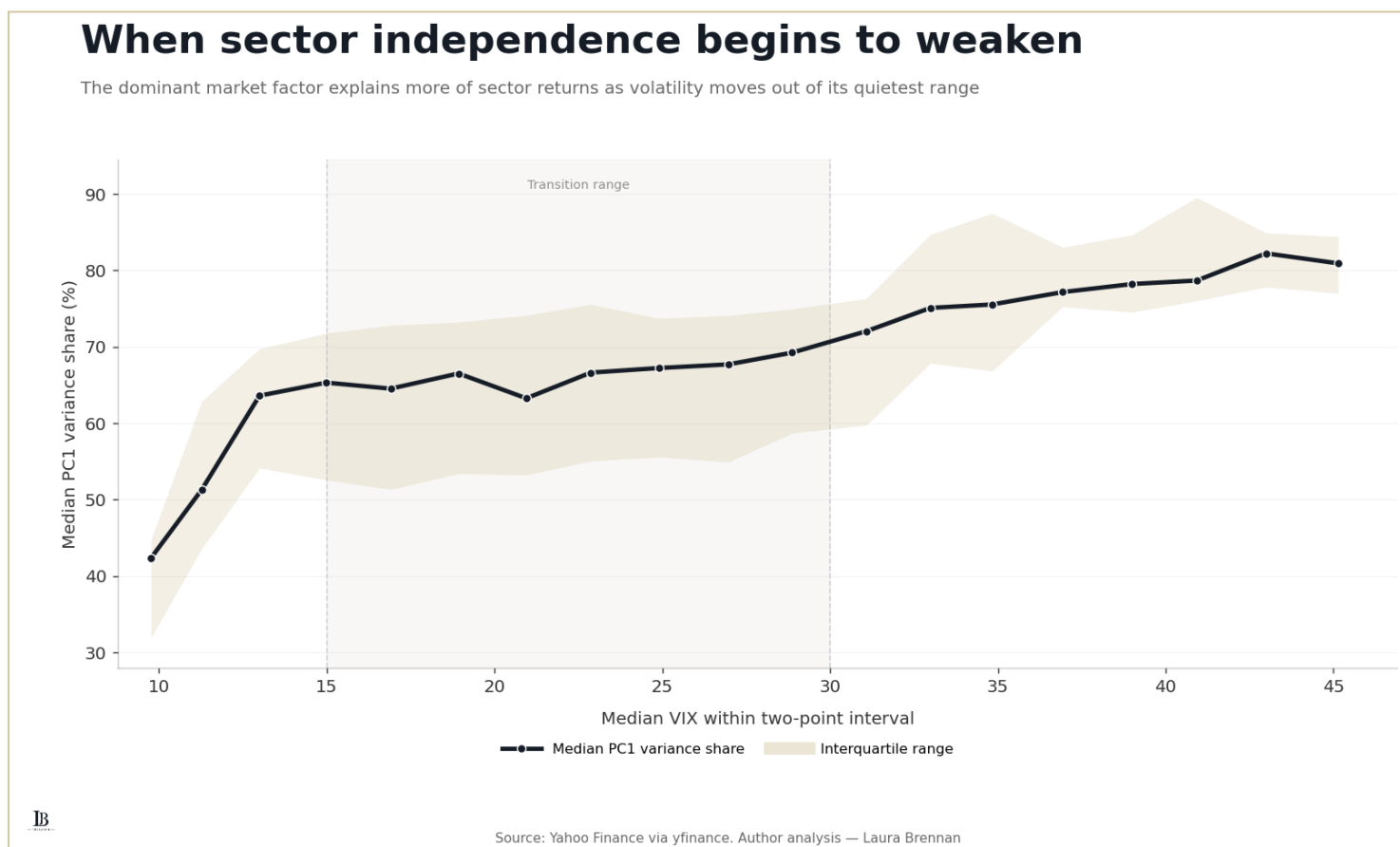


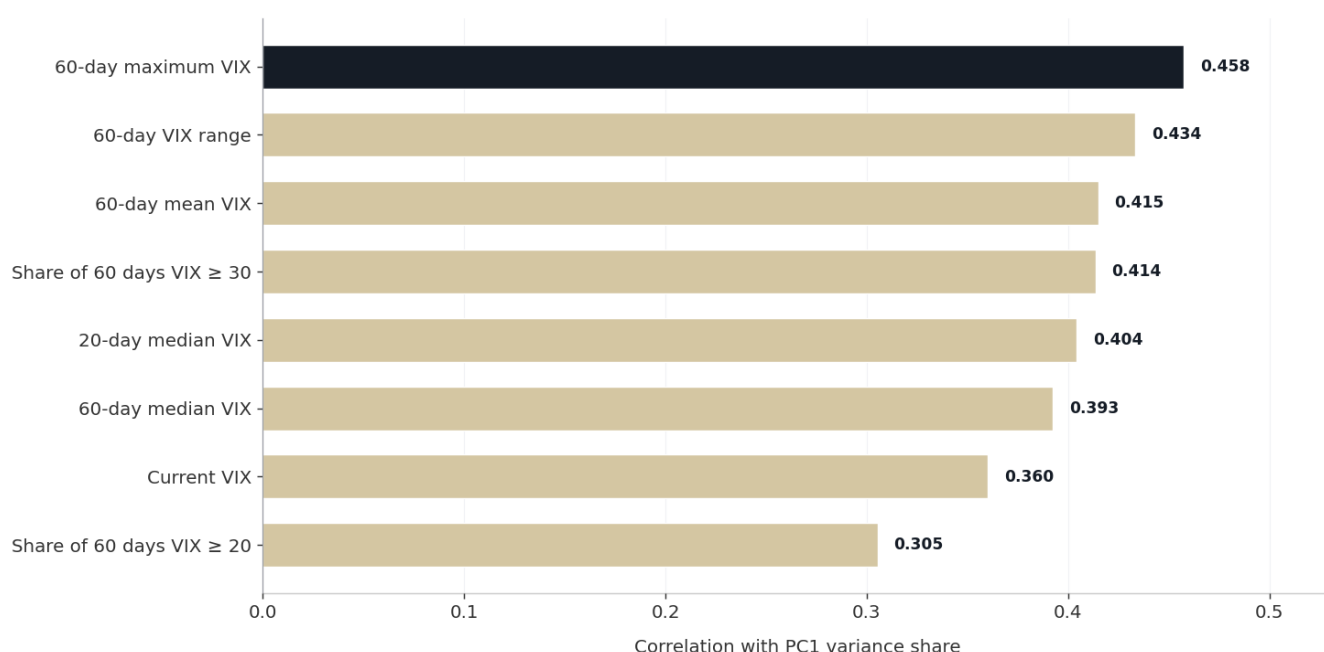
Figure 1. Median PC1 variance share across VIX intervals.

Sector commonality rises sharply as volatility moves beyond its quietest range. Median PC1 variance share increases from around 42% at the lowest VIX levels to more than 60% as VIX approaches 15. The relationship then strengthens more gradually through the transition range before rising again at higher volatility levels. Above a VIX of 30, the dominant market factor typically explains more than 70% of standardised sector-return variation. The result suggests that diversification can begin weakening before volatility reaches extreme levels. Sector independence is already declining while headline stress still appears moderate.

Market structure reflects more than today's VIX

Market structure reflects more than today's VIX

Sector commonality is more closely associated with the recent volatility peak than with the current reading



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Source: Yahoo Finance via yfinance. Author analysis — Laura Brennan

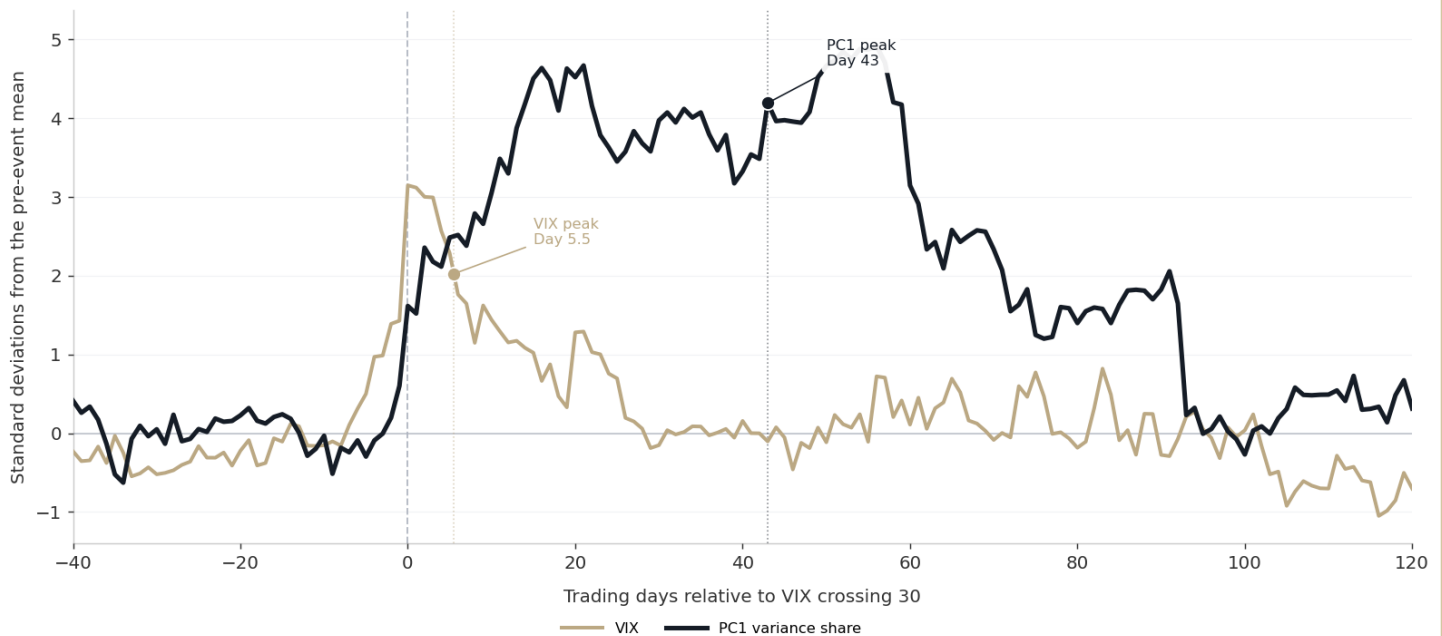
Figure 2. Correlation between PC1 variance share and alternative VIX measures.

Current VIX is positively associated with common-factor dominance, but it is not the strongest measure. PC1 variance share is most closely associated with the maximum VIX observed over the previous 60 trading days, with a correlation of 0.458. The 60-day VIX range, mean and frequency of readings above 30 also show stronger relationships than the current VIX level. This indicates that realised market structure reflects recent stress exposure rather than only today's volatility reading. A market can appear calmer while sector returns continue to carry the imprint of an earlier shock.

Volatility peaks before diversification recovers

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Across 28 complete VIX shock events, visible stress fades while common-factor dominance continues to rise



Source: Yahoo Finance via yfinance. Author analysis — Laura Brennan

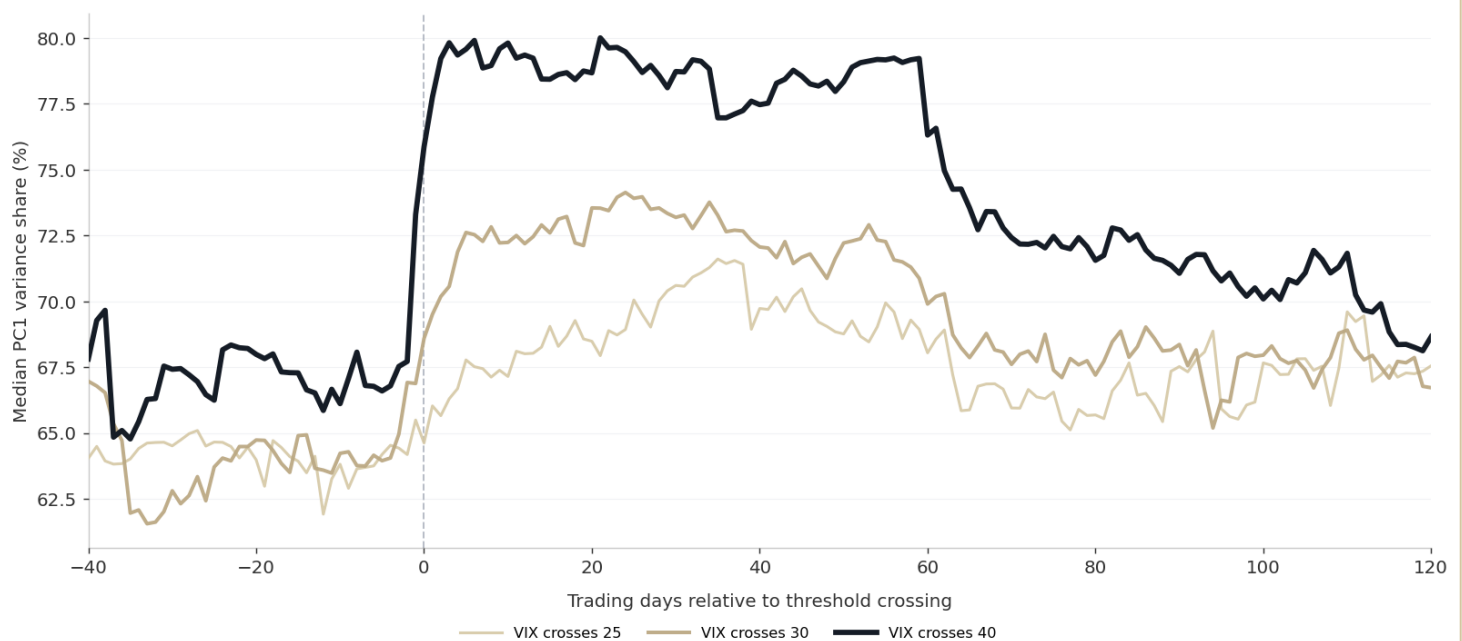
Figure 3. Standardised VIX and PC1 paths around VIX shock events.

Across 28 complete VIX shock events, volatility rises quickly around the threshold crossing and reaches its median peak after 5.5 trading days. Common-factor dominance follows a slower path. Median PC1 variance share continues rising after VIX begins to retreat and reaches its median peak after 43 trading days. The difference is substantial. Visible stress peaks within the first week, while the dependence structure across sector returns continues tightening for several additional weeks. A falling VIX therefore does not imply that diversification has normalised. The immediate shock fades first. Market structure recovers later.

Larger shocks leave a deeper structural imprint

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Common-factor dominance rises more sharply and remains elevated longer after more severe volatility events



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Source: Yahoo Finance via yfinance. Author analysis — Laura Brennan

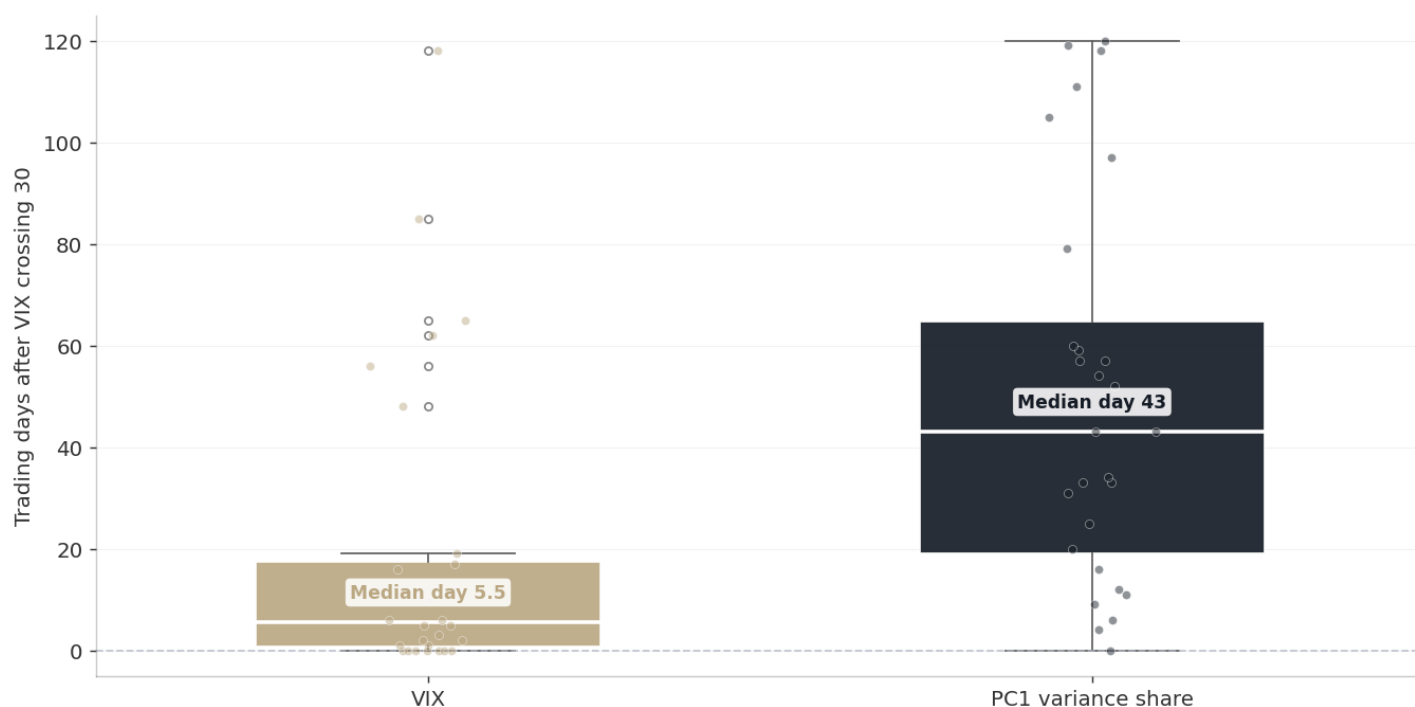
Figure 4. Median PC1 response across alternative VIX shock thresholds.

The observed structural response is stronger at higher volatility thresholds. VIX crossings of 25 are followed by a moderate increase in common-factor dominance. Crossings of 30 produce a larger and more persistent response. Events in which VIX crosses 40 generate the sharpest increase, with median PC1 variance share moving close to 80% shortly after the shock. The difference remains visible well beyond the initial event. Common-factor dominance stays higher for longer following the most severe volatility episodes. Larger shocks therefore do more than raise volatility. They leave a deeper and more persistent imprint on the dependence structure between sectors.

Market structure peaks much later than volatility

Market structure peaks much later than volatility

Across complete VIX shock events, the median common-factor peak arrives more than seven weeks after the volatility peak



Source: Yahoo Finance via yfinance. Author analysis — Laura Brennan

Figure 5. Distribution of peak timing following VIX crossings of 30.

The distribution of peak timings confirms that the lag between volatility and market structure is not driven by a small number of unusual events. VIX peaks are concentrated near the start of the post-event window, with a median of 5.5 trading days. PC1 peaks occur much later, with a median of 43 days and substantially greater dispersion across events. Some volatility episodes continue developing for longer, but the broader separation remains clear. The typical volatility peak arrives early. The structural peak occurs several weeks later. Diversification recovery is therefore slower and less uniform than the initial volatility response.

Methodology

Data

Sample period

2000–31 July 2026

Universe

U.S. equity sectors represented by SPDR ETFs:

- XLB Materials
- XLE Energy
- XLF Financials
- XLI Industrials
- XLK Technology
- XLP Consumer Staples
- XLU Utilities
- XLV Healthcare
- XLY Consumer Discretionary
- XLRE Real Estate, when sufficient history is available
- XLC Communication Services, when sufficient history is available

Volatility measure

CBOE Volatility Index, VIX

Data source

Yahoo Finance, accessed through yfinance. Daily auto-adjusted closing prices.

Daily auto-adjusted closing prices are converted into logarithmic returns. The available sector universe expands as newer ETFs enter the sample.

Measures

Principal component analysis

Sector returns are standardised within each 60-trading-day rolling window.

Principal component analysis is then applied to the rolling sector-return matrix. The variance share explained by the first principal component measures how much of total standardised sector-return variation is attributable to the dominant common factor.

Higher PC1 variance share indicates that sectors are increasingly responding to the same underlying market force. Lower values indicate greater independence across sector returns.

Average sector correlation

Pairwise sector-return correlations are estimated within the same rolling window and averaged across the available sector universe.

Average correlation is used as a supporting measure of commonality. It is closely related to PC1 variance share, although PC1 remains the primary structural measure throughout the analysis.

Rolling estimation

PC1 variance share and average sector correlation are estimated using a 60-trading-day rolling window, recalculated daily.

Windows require sufficient observations and at least three available sector series. The number of sectors therefore varies from nine to eleven through the sample.

Volatility measures

The analysis compares PC1 variance share with several measures of current and recent volatility:

- Current VIX
- 20-day median VIX
- 60-day median VIX
- 60-day mean VIX
- 60-day maximum VIX
- 60-day VIX range
- Share of the previous 60 days with VIX at or above 20
- Share of the previous 60 days with VIX at or above 30

Pearson and Spearman correlations are calculated between each volatility measure and rolling PC1 variance share.

This comparison distinguishes between the market's current stress level and its recent exposure to elevated volatility.

Event-study design

Primary event definition

An event occurs when VIX crosses 30 from below. To reduce overlap between closely spaced episodes, events must be separated by at least 60 trading days.

Event window

- 40 trading days before the threshold crossing
- 120 trading days after the threshold crossing

Thirty threshold-crossing events met the 60-trading-day separation rule. Twenty-eight contained complete pre-event and post-event windows and were retained for the main analysis.

Standardisation

For each event, VIX and PC1 variance share are standardised relative to their own pre-event distribution from day -40 to day -1. The reported event paths show the median standardised value across complete events for each relative trading day.

Peak timing

For every event, the timing of the maximum VIX and maximum PC1 variance share is recorded within the 120-day post-event period. The median and distribution of these peak dates are then compared across events.

Alternative thresholds

The event study is repeated using VIX thresholds of 25, 30 and 40. This tests whether the depth and persistence of common-factor dominance change with shock severity.

Research workflow

Step	Description
Data	Daily sector ETF prices and VIX
Returns	Daily logarithmic sector returns
Standardisation	Rolling z-scores within each PCA window
Structural measure	First principal component variance share
Supporting measure	Average pairwise sector correlation
Rolling window	60 trading days
Primary event	VIX crossing 30 from below
Event separation	Minimum 60 trading days
Event window	Day -40 to day +120
Complete events	28

Interpretation

Higher PC1 variance share indicates that sector returns are increasingly dominated by a common market factor. A decline in VIX alongside elevated PC1 therefore represents a market in which visible volatility has eased, but diversification remains structurally weakened.

Research implications

The evidence presented in this report shows that volatility and diversification recover on different timelines.

Key observations

- Sector commonality begins increasing before volatility reaches extreme levels.
- Current VIX does not fully capture the effect of recent stress on market structure.
- Volatility typically peaks within the first week after a shock.
- Common-factor dominance continues rising for several additional weeks.
- Larger volatility shocks produce deeper and more persistent structural compression.
- PC1 peak timing varies across events but remains substantially later than the typical VIX peak.
- A falling VIX is not equivalent to restored diversification.

Together, these results suggest that headline volatility provides only a partial view of market recovery. VIX captures the immediate intensity of stress. Rolling PC1 variance share captures how strongly sector returns remain tied to a common source of variation. Monitoring both helps distinguish between a market that appears calmer and one whose underlying diversification structure has genuinely normalised.

References

Data

Yahoo Finance, accessed through yfinance.

SPDR sector ETFs: XLB, XLE, XLF, XLI, XLK, XLP, XLU, XLV, XLY, XLRE and XLC.

CBOE Volatility Index, VIX.

Data through 31 July 2026.

Methodology

Jolliffe, I. T. and Cadima, J. (2016). “Principal component analysis: a review and recent developments.” *Philosophical Transactions of the Royal Society A*, 374(2065).

Pearson, K. (1901). “On lines and planes of closest fit to systems of points in space.” *Philosophical Magazine*, 2(11), 559–572.

Software

Python, pandas, NumPy, scikit-learn, statsmodels, matplotlib and yfinance.

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