

ATR Volatility Expansion Event Study

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Volatility Expansion as a Predictor of Abnormal Returns

March 2026

The Average True Range (ATR) measures market volatility by decomposing the daily trading range into a smoothed average. Unlike directional indicators, ATR captures the magnitude of price movement irrespective of direction. The True Range for each day is the maximum of three values: the current high minus the current low, the absolute difference between the current high and the previous close, and the absolute difference between the current low and the previous close. ATR is then computed as an exponentially weighted moving average using Wilder's smoothing.

Volatility clustering the empirical observation that large price changes tend to follow large price changes is one of the most robust stylized facts in financial markets. When ATR spikes relative to its recent history, it signals a regime shift in the stock's volatility structure. Such expansions may be driven by earnings surprises, macro shocks, liquidity events, or stop-loss cascades. The key research question is whether these volatility expansion events carry predictive information about subsequent returns: do stocks that experience sudden ATR spikes tend to continue trending (momentum), mean-revert (overreaction), or show no systematic pattern?

We normalize ATR by the closing price (ATR%) to enable cross-sectional comparisons and define a volatility expansion event as ATR% crossing above its trailing 252-day 90th percentile. This captures genuinely unusual volatility relative to each stock's own recent history, adapting to regime changes and avoiding look-ahead bias.

2. Event Definition

True Range: $TR(t) = \max(\text{High}(t) - \text{Low}(t), |\text{High}(t) - \text{Close}(t-1)|, |\text{Low}(t) - \text{Close}(t-1)|)$. Average True Range (Wilder's smoothing, $n=14$): $ATR(t) = [ATR(t-1) \times 13 + TR(t)] / 14$, seeded with the mean of the first 14 TR values. $ATR\% = ATR / \text{Close} \times 100$.

Event trigger: Ticker X has a volatility expansion event on date D if $ATR\%(D)$ exceeds the 90th percentile of $ATR\%$ computed over the trailing 252 trading days (D_{252} through D_1). A 10-trading-day cool-down period is enforced between consecutive events for the same ticker to prevent event clustering. This rule is fully deterministic, uses only information available at time D, and avoids look-ahead bias.

3. Experiments and Results

3.1 Dataset

The dataset contains daily OHLCV data for 14 S&P 500 constituent stocks (BA, CSCO, DVN, EQIX, GILD, ISRG, NVR, PODD, TER, TKO, TPR, TROW, UAL, VRTX) spanning January 2, 2020 through

February 27, 2026 (approximately 1,547 trading days per ticker). The market benchmark is an equal-weighted average daily return of all 14 stocks.

3.2 Single-Stock Validation

Figure 1 shows CSCO in 2023 with one volatility expansion event identified on November 16, when ATR% spiked above its trailing 90th percentile. The visual confirms the trigger fires correctly at a point where intraday range expanded drastically, coinciding with the post-earnings volatility surge.

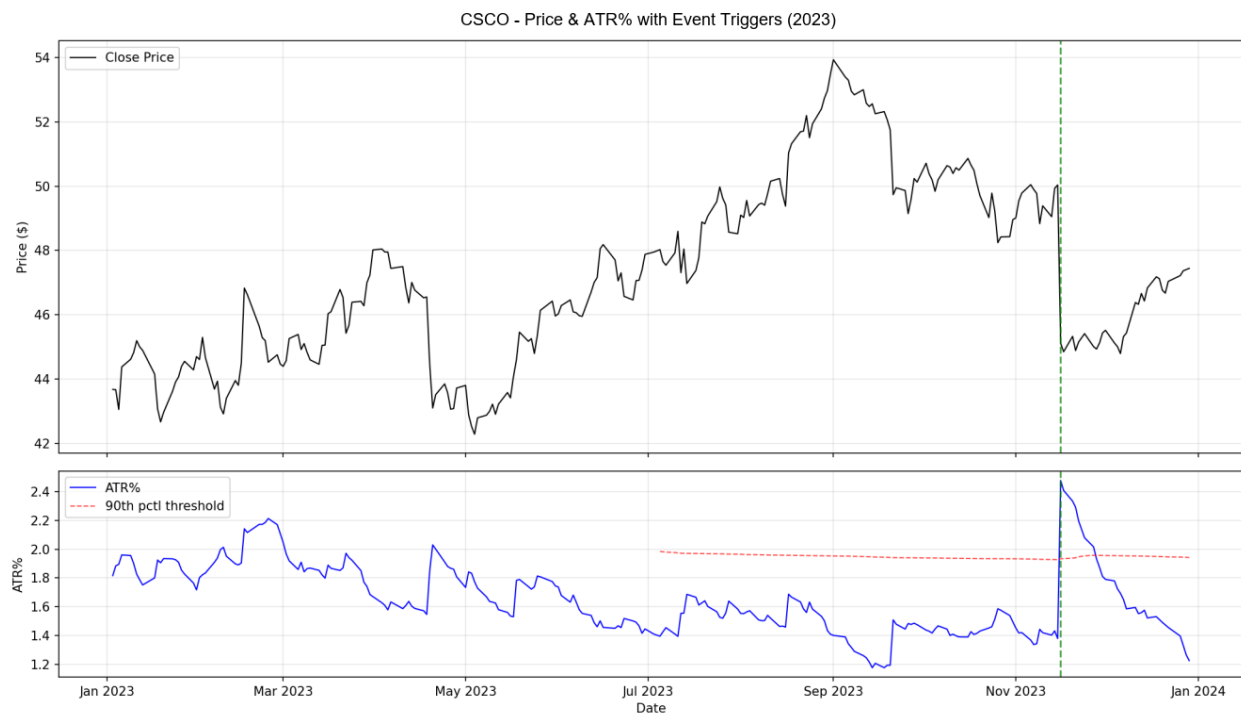


Figure 1: CSCO price (top) and ATR% with event trigger (bottom), 2023

3.3 Event Study Results

Applying the trigger rule across all 14 stocks produced 282 events (278 usable for the event study). The market-adjusted event study reveals a clear pattern: stocks experiencing ATR% breakouts exhibit significantly negative cumulative abnormal returns in the subsequent 20 trading days.

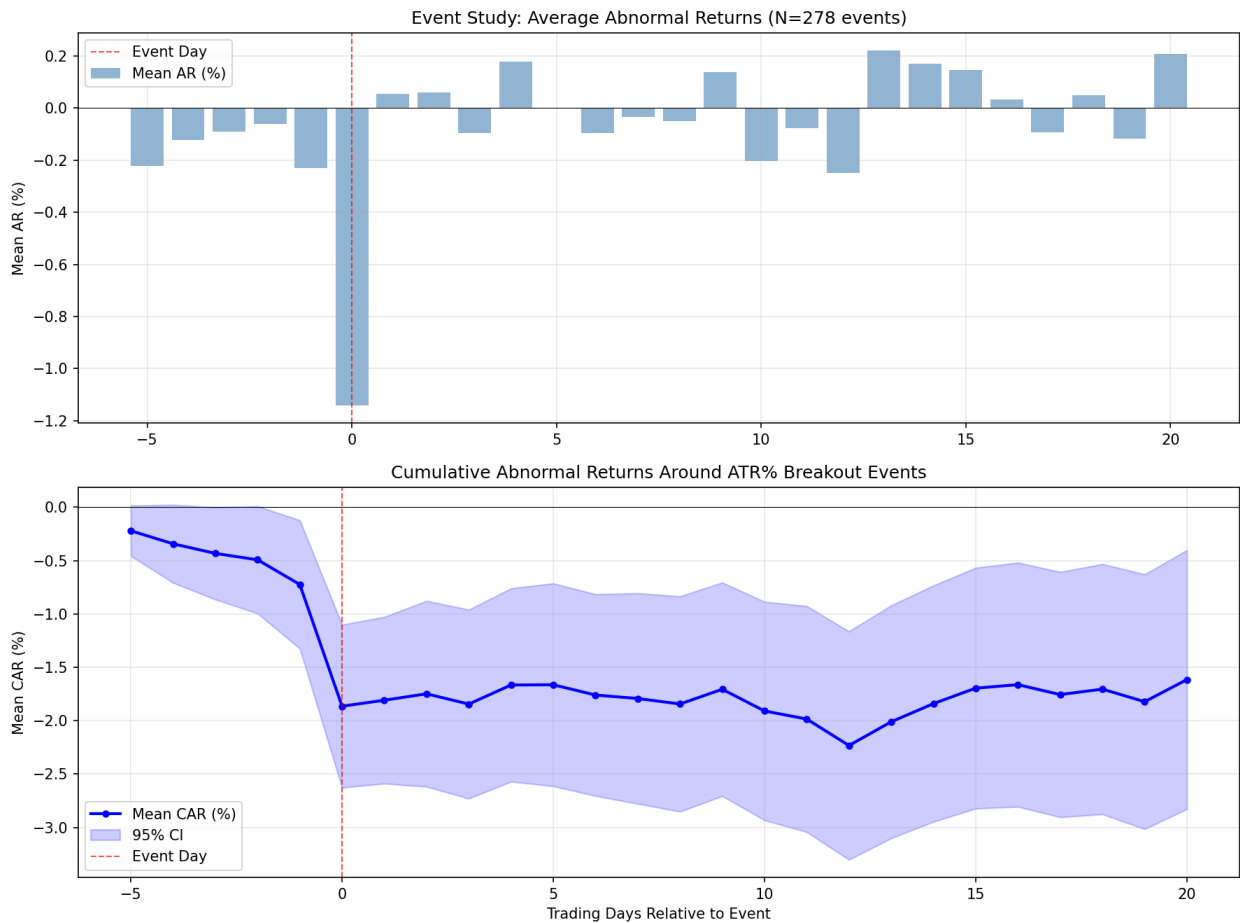


Figure 2: Average abnormal returns (top) and cumulative abnormal returns (bottom) around ATR% breakout events

Key numeric results: CAR at event day (day 0) is 1.87%, reflecting the contemporaneous negative abnormal return on the event day itself. CAR at day +5 is 1.66%, at day +10 is 1.91%, and at day +20 is 1.62% (t-statistic = 2.61, significant at the 5% level). The CAR remains negative and statistically significant throughout the post-event window, indicating persistent underperformance rather than a transient shock.

Window	Day 0	Day +5	Day +10	Day +20
CAR (%)	1.87	1.66	1.91	1.62
t-stat	4.79	3.43	3.66	2.61

Table 1: CAR and t-statistics at selected post-event horizons (N = 278 events)

3.4 Robustness Checks

We varied the ATR lookback period (n = 10, 14, 20) and the percentile threshold (85th, 90th, 95th). Results are consistent: negative post-event CAR persists across all specifications. The effect strengthens

with higher thresholds the 95th percentile yields CAR of 2.83% ($t = 3.90$) at day +20, compared to 1.36% ($t = 2.47$) for the 85th percentile. ATR lookback variations show

moderate sensitivity: $n=14$ and $n=20$ produce significant results while $n=10$ yields a weaker but directionally consistent signal (CAR = 0.93%, $t = 1.53$).

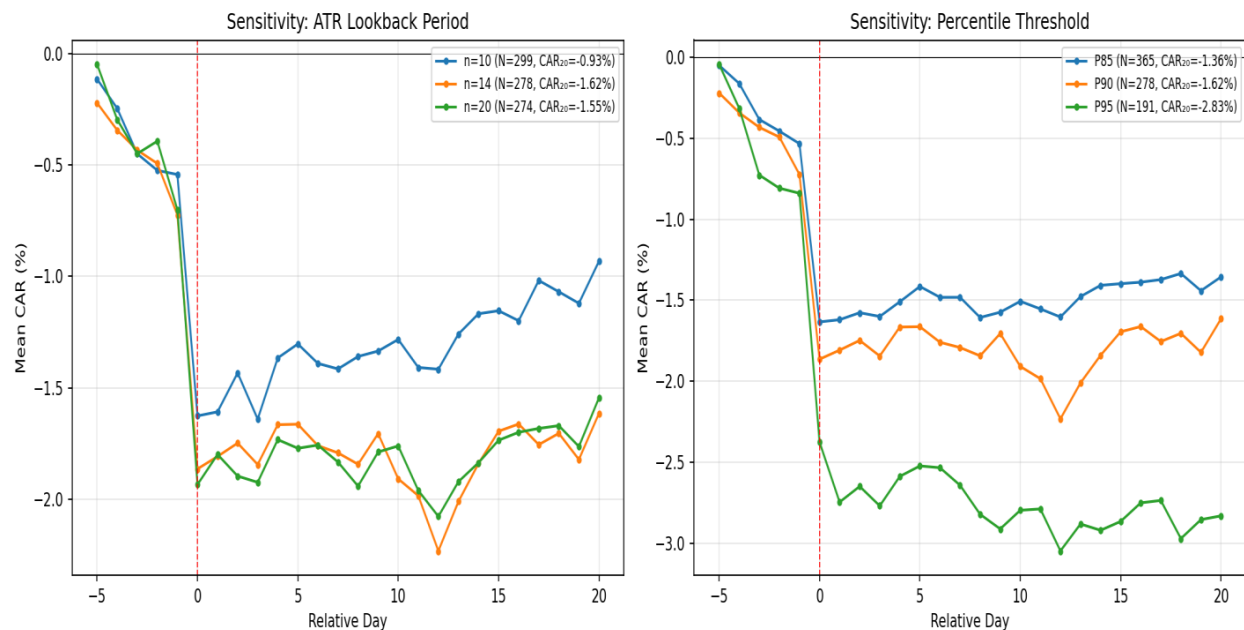


Figure 3: Robustness: CAR curves under varying ATR lookback (left) and percentile threshold (right)

3.5 Per-Ticker Segmentation

Figure 4 decomposes the aggregate result by individual ticker. The negative CAR pattern is not uniform: some stocks (e.g., BA, UAL, DVN) show pronounced post-event underperformance, while others (e.g., NVR, VRTX) display more neutral or mixed patterns. This heterogeneity suggests the signal may be stronger for cyclical or high-beta names that are more susceptible to volatility-driven repricing.

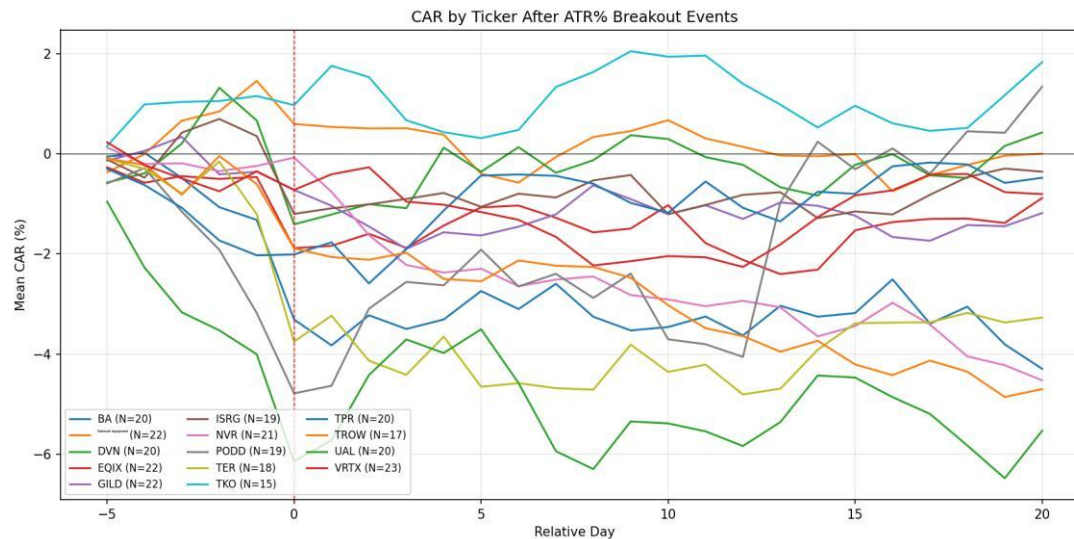


Figure 4: CAR by individual ticker after ATR% breakout events

4. Conclusion

The ATR% percentile breakout event is statistically predictive of future abnormal returns, but in the opposite direction from a simple momentum hypothesis. Stocks experiencing extreme volatility expansions tend to underperform the market by approximately 1.6% over the following 20 trading days.

This is consistent with a mean-reversion or overreaction interpretation:

Sudden volatility spikes may reflect panic selling, forced liquidations, or stop-loss cascades that temporarily push prices below fair value but the subsequent recovery is incomplete within our event window, suggesting the market interprets these events as genuinely negative information rather than pure noise.

A potential trading application would be a short-biased strategy:

- sell (or underweight) stocks on the day ATR% crosses the 90th percentile of trailing volatility, with a 1020 day holding period.
- Risk controls should include position sizing inversely proportional to the stock's own ATR (to normalize dollar risk), a maximum loss stop at $2 \times \text{ATR}$, and sector diversification to mitigate the concentration risk evident in Figure 4.

For future research, three refinements merit investigation:

1. First, combining the ATR event with a directional filter (e.g., requiring that the stock's close is below its 50-day moving average on the event day) could sharpen the signal by isolating volatility expansions associated with downside moves.

2. Second, a volume confirmation rule requiring above-average volume on the event day might filter out low-conviction signals.
3. Third, expanding the universe to the full S&P 500 would provide the cross-sectional breadth needed to assess sector-level effects and improve statistical power.