

Momentum Stock Screening

Executive Summary

This project develops a systematic momentum-based equity screening pipeline, with a particular emphasis on identifying early signs of bullish breakouts. By leveraging a suite of well-established technical indicators, including RSI and MACD, the strategy aims to quantitatively filter a broad universe of Nasdaq-100 stocks for those demonstrating potential for sustained upward momentum.

The analysis begins with automated data ingestion from Yahoo Finance, covering daily OHLCV data of the past six years. Each security is then evaluated against a composite of momentum criteria derived from technical indicators, designed to capture breakout conditions by measuring trend strength, buying/selling pressure, and unusual volume activity.

Following signal generation, a backtesting module evaluates the forward returns of stocks that historically met the defined signal conditions to ensure the edge's statistical robustness. The analysis spans multiple holding periods and includes benchmarks such as randomized baseline performance and statistical tests (t-statistics and p-values).

Findings from this project validate the core momentum signal and establish a reproducible Python-based screening and backtesting framework that can be scaled across equity universes. This lays the foundation for integrating systematic momentum detection into a broader quantitative research pipeline.

Methodology¹

The signal generation relies on the following technical indicators:

- Bollinger Bands (BBands): Measure price volatility by defining dynamic upper and lower bands based on a moving average and 1.5 standard deviations.
- Exponential Moving Average (EMA): A weighted moving average prioritizing recent prices. A short-term EMA (20-period) and a long-term EMA (50-period) are used.
- Relative Strength Index (RSI): Assesses the speed and magnitude of recent price changes to identify overbought or oversold conditions.
- Moving Average Convergence Divergence (MACD): Calculates the difference between two EMAs (12- and 26-period) and compares it to its signal line for momentum insights.
- Average Directional Index (ADX): Measures the strength of a trend regardless of its direction.
- Volume Rate of Change (VROC): Tracks the percentage change in trading volume over a specified lookback period.

These indicators serve specific purposes in the strategy²:

- Breakout Detection (BBands): A closing price above the upper band signals a breakout, indicating potential strong bullish momentum.
- Uptrend Confirmation (EMAs and ADX): Indicators such as price closing above an EMA, the short-term EMA crossing above the long-term EMA, a positive EMA

¹ For specific implementation, please refer to the .ipynb file.

² The exact numbers for parameters, such as thresholds, are determined through trial-and-error.

slope, an ADX value exceeding 23, and a rising ADX slope suggest a strengthening uptrend.

- **Momentum Check (RSI and MACD):** Bullish momentum is confirmed when RSI is above 50, the MACD histogram is non-negative, and the MACD value is above zero.
- **Volume Support (VROC):** An increasing VROC value above 0.38 indicates volume expansion, supporting the price movement.

The above identifies timestamps when the market is in a bullish phase, but to pinpoint a true breakout, one should avoid entering late in the bull run, as this phase often precedes a downturn. Slowing momentum can be identified as follows:

- **Late-Entry Filter (RSI and MACD):** An RSI above 73, a declining MACD histogram, a rising RSI over the past three weeks, and flattening slopes of RSI or MACD.

All conditions, except the late-entry filter, are assigned integer scores that sum to a total ranging from 0 to 12. An entry signal is triggered only when the total score reaches at least 10 and the late-entry filter is not activated.

To evaluate the strategy's performance, it is benchmarked against a random bootstrapping method using average return and win rate over various holding periods for all Nasdaq-100 stocks. Additionally, t-statistics and p-values assess the statistical significance of the observed edge. Return histograms illustrate the distribution of returns across different hold durations.

Results

Backtest Statistics across various hold periods

hold_period	avg_return	win_rate	random_avg_return	random_win_rate	n_signals	t_stat	p_val
2	-0.002	0.500	-0.002	0.812	16.0	-0.01	0.99
5	0.014	0.562	-0.009	0.500	16.0	1.26	0.22
10	0.014	0.562	-0.014	0.375	16.0	1.40	0.17
20	0.012	0.562	-0.031	0.312	16.0	1.60	0.12
50	0.032	0.562	0.017	0.500	16.0	0.31	0.76

Breakout Detection for AAPL



Discussion and Key Insights

The breakout detection strategy shows modest signs of outperformance overall.

At intermediate holding periods (5–20 days), it demonstrates some edge, with average returns reaching about 1.4% and win rates of 56.2% compared to 31.2–50% for random entries. Although the t-statistics of 1.26–1.60 and p-values of 0.22–0.12 fall short of conventional statistical significance thresholds, they still suggest a mild degree of predictive value. Breakouts may require some time to consolidate before delivering potential upside, and the strategy suits medium-term momentum capture better than short-term scalping.

Over a 50-day horizon, the strategy achieves its highest raw average return at 3.2%, yet its advantage over the random benchmark shrinks to just 1.5%. The win rate margin narrows to only 6.2 percentage points, and the low t-statistic (0.31) along with the high p-value (0.76) reinforces that long-term holding dilutes the breakout signal. Broader market trends, sector rotations, and macroeconomic factors likely overshadow the initial momentum, and breakouts are best exploited before such forces dominate.

In very short timeframes, such as 2 days, breakout signals appear to be overwhelmed by market noise and microstructure effects. The strategy's performance offers no meaningful advantage over random entries, with an average return of -0.2% and a win rate of 50%. This aligns with the intuition that true breakouts often require multiple sessions to attract follow-through buying or selling pressure before price trends become sustainable.

Notably, the strategy performs especially well for relatively involatile stocks, such as AAPL, delivering an observable edge across all hold periods. In particular, the 10-day window (truncated in the result image due to space) yields a 4.8% average return and a 77.8% win rate, statistically significant at a 2.34 t-stat and a 0.03 p-value.

One key limitation is the scarcity of signals—only 16 over six years—which constrains statistical power of the observed positive bias. This small sample size increases the likelihood of false negatives. One likely cause is the late-entry filter's tendency to reject trades after sustained RSI growth, which is too strict of a condition. A more nuanced late bull detection should allow the strategy to capture more valid breakout opportunities.

Conclusion

This project produces a systematic, indicator-driven approach to detecting early-stage bullish breakouts within the Nasdaq-100 universe. By combining multiple technical indicators into a composite scoring model, the framework captures breakout conditions with measurable—albeit modest—predictive value, particularly in the 5–20 day holding range.

The findings suggest that breakout momentum requires a period of consolidation before realizing its upside potential, making medium-term horizons the most favorable. Results show pockets of strong performance—especially in low-volatility, large-cap stocks like AAPL—but the strategy's overall statistical edge is constrained by a low signal frequency and potentially over-restrictive late-entry filtering.

These limitations highlight a key avenue for future work: loosening or adapting the late bull detection criteria to capture a broader set of valid breakout scenarios. Integrating volatility-based adjustments, optimizing indicator thresholds, and integrating regime filters could further enhance robustness.