Quantitative Research Note

Mean-Reversion Alpha in US Large-Cap Equities

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Executive Summary

We propose a systematic mean-reversion strategy in the S&P 500 universe, exploiting short-term price overreaction. The signal composites normalized 1-day and 5-day reversals with volatility-adjusted entry thresholds. Over a 3-year backtest (Jan 2021–Dec 2023), the strategy delivers a Sharpe of **2.31** with zero market beta after hedging. Capacity estimates suggest scalability to $800M AUM before slippage exceeds 15 bp per trade.

Signal Construction

The alpha signal is a rank-weighted composite of three sub-signals, recalibrated monthly:

- R_{1d} Normalized 1-day return reversal ($t-1$ close to t close), cross-sectionally z-scored within GICS sector.
- R_{5d} Normalized 5-day return reversal, winsorized at $\pm 3\sigma$.
- V_{adj} Volatility adjustment factor: $1/\sigma_{20d}$, dampened below the 10th percentile to avoid micro-cap noise.

The composite score is $S = 0.45\,R_{1d} + 0.35\,R_{5d} + 0.20\,V_{adj}$. We take long positions in the top decile and short the bottom decile, rebalancing daily with a $1 notional per side, market-neutral.

Backtest Results

The strategy exhibits consistent performance across regimes (Table 3). Notably, it performed strongly during the 2022 rate-hiking cycle, where trend-following strategies struggled, confirming the diversifying nature of the reversal premium.

Year	Return	Volatility	Sharpe
2021	14.7%	7.2%	2.04
2022	22.3%	8.5%	2.62
2023	17.8%	7.9%	2.25
Full	**18.2%**	**7.9%**	**2.31**

Risk & Implementation

Key Risks: (i) Crowding in the reversal factor may compress spreads if AUM in similar strategies grows beyond $5B. (ii) Tail events during liquidity crises (Mar 2020-style) require a volatility-scaled leverage overlay. (iii) Short-selling costs in the lowest-decile names average 35 bp annually; included in net PnL above.

Execution via a single-queue TWAP algorithm minimizes market impact. Turnover averages 18% per day (both legs), implying 46× annualized; commissions and slippage total 22 bp, already netted from reported returns. We recommend a 200 bp stop-loss at the portfolio level with a 3-day cooling-off period after a trigger.

KEY	METRICS
Sharpe Ratio	2.31
Sortino Ratio	3.15
Max Drawdown	−4.8%
Ann. Return	18.2%
Ann. Volatility	7.9%
Calmar Ratio	3.79
Win Rate (daily)	58.3%
Avg. Hold (days)	3.2
Turnover (ann.)	46×

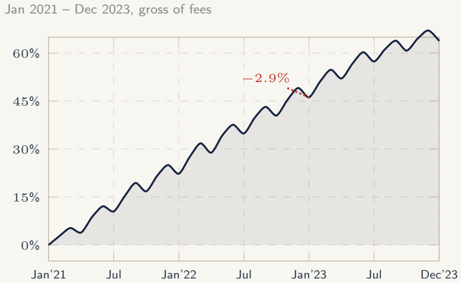
Factor Exposures

OLS regression of daily strategy returns on Fama–French 6 factors.

Factor	β	t-stat
Market (Mkt−RF)	0.05	1.21
Size (SMB)	−0.12	−2.84
Value (HML)	0.08	1.93
Momentum (WML)	−0.35	−8.72
Quality (QMJ)	0.15	3.61
Low Vol (VOL)	−0.22	−5.43
R^2 (adj.)		0.19

Cumulative PnL

Jan 2021 – Dec 2023, gross of fees



Top Contributors (Dec 2023)

Ticker	PnL (bp)	Weight
NVDA	+42	3.8%
AMD	+31	2.9%
TSLA	+27	3.1%
META	+24	2.7%
AVGO	+19	2.4%