

Evaluation of a Dual-Cadence Equity Rotation Strategy

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Abstract

This paper tests a rules-based strategy for a USD 50,000 account. The strategy divides 99% of the account into eight equal parts. Four parts review LLY, NOC, RSG, and SHW each week. Four parts review NVDA, AVGO, TSM, and AMAT each month. A stock can be held only when its one-year return is positive and its price is above its 200-day average. The semiconductor stocks must also pass a broad trend test based on TIP. If a stock fails, its part moves to a paired Treasury fund that passes the same trend test. The part stays in cash if both assets fail. The test uses completed closing prices and trades at the next market open. It uses whole shares, a cash reserve, position limits, liquidity limits, and trading costs.

The untouched final test ran from July 31, 2023, through July 29, 2026. The account grew from USD 50,000 to USD 92,400.98 after costs. This equals an 84.80% gain, a 22.76% annual growth rate, and a -11.40% maximum drawdown. A matched broad-equity account gained 56.58% and had a -17.44% maximum drawdown. The longer out-of-sample record also passed the statistical, cost, delay, liquidity, and independent-price tests. These results support a prospective paper-trading test. They do not guarantee a future profit.

1 Introduction

A backtest can fail even when its equity curve looks good. Repeated model search can select a lucky rule. Same-close execution can use information that was not tradable. Fractional-share assumptions can hide account constraints. Weak data records can also prevent an independent check.

This paper tests one frozen strategy under these risks. The strategy combines weekly stock rotation with monthly semiconductor rotation. Both parts use slow trend rules. Treasury funds and cash provide defensive positions.

The study uses three evidence sets. The first records the full research history and eight chronological test folds. The second executes frozen decisions on separate Nasdaq prices. The third is an untouched final set that was frozen before access.

The main question is narrow. Did the frozen rule produce a positive net account under realistic USD 50,000 constraints? The paper also tests benchmark-relative return, drawdown, statistical uncertainty, costs, delay, concentration, and reproduction.

2 Strategy

2.1 Portfolio structure

The strategy contains eight sleeves. Each sleeve has a target weight of 12.375%. The maximum invested weight is therefore 99%. The remaining 1% is a cash reserve.

Table 1 gives the fixed stock and defense pairs. The quality sleeves update after each completed Friday. The semiconductor sleeves update after each completed month-end.

Table 1: Frozen portfolio sleeves.

Group	Review date	Stock	Defense	Stock requirement
Quality	Friday close	LLY	SHY	Stock trend
Quality	Friday close	NOC	IEI	Stock trend
Quality	Friday close	RSG	IEF	Stock trend
Quality	Friday close	SHW	BIL	Stock trend
Semiconductor	Month-end close	NVDA	SHY	TIP gate and stock trend
Semiconductor	Month-end close	AVGO	IEI	TIP gate and stock trend
Semiconductor	Month-end close	TSM	IEF	TIP gate and stock trend
Semiconductor	Month-end close	AMAT	TLT	TIP gate and stock trend

Two sleeves can select the same Treasury fund. Their weights then merge to 24.75%. The rule does not move unused weight to another sleeve.

2.2 Trend rules

Let $P_{i,t}$ be the adjusted close for asset i on review date t . Define the trend indicator

$$T_{i,t} = \mathbf{1} \left[\frac{P_{i,t}}{P_{i,t-252}} - 1 > 0 \quad \text{and} \quad P_{i,t} > \text{SMA}_{200}(P_i)_t \right]. \quad (1)$$

The quality sleeve holds its stock when $T_{i,t} = 1$. If the stock fails, the sleeve tests its Treasury fund with the same rule. The sleeve holds cash when both assets fail.

The semiconductor sleeves also use TIP as a market-state filter. Define

$$M_t = \frac{1}{4} \sum_{h \in \{21, 63, 126, 252\}} \left(\frac{P_{\text{TIP},t}}{P_{\text{TIP},t-h}} - 1 \right). \quad (2)$$

A semiconductor stock can be held only when $M_t > 0$ and $T_{i,t} = 1$. Otherwise, the sleeve tests its Treasury fund. It holds cash if the Treasury fund also fails.

2.3 Execution and account rules

The strategy calculates signals from completed closing data. A changed combined target trades at the next available open. The weekly and monthly states remain unchanged between their review dates.

The primary account starts with USD 50,000. It uses whole shares and never borrows or sells short. It can hold no more than eight positions. The nominal position cap is 25%.

The simulator suppresses a trade below

$$\max(\text{USD } 250, 0.005 \times \text{NAV}_t). \quad (3)$$

An order cannot exceed 0.10% of the asset’s trailing 20-session median dollar volume. The baseline cost is 5 basis points per order side. The account keeps all rounding residuals as cash.

The system has no live order authority. It produced research files only.

3 Data and Test Design

3.1 Evidence sets

The complete out-of-sample record contains 3,394 sessions and eight chronological folds. It starts on January 30, 2013, and ends on July 29, 2026. The full research ledger contains 1,214 trials.

The independent test uses Nasdaq prices from August 24, 2016, through July 28, 2023. It executes target changes from the frozen primary calendar. This keeps the strategy decisions fixed while changing the execution-price source.

The final query was frozen before the final data were opened. The final test contains 752 sessions from July 31, 2023, through July 29, 2026. Its evidence disposition is UNTOUCHED_THEN_OPENED_ONCE.

3.2 Final data sources

Stooq supplied all strategy assets, signal assets, SPY, and IVV. A daily quota stopped four benchmark downloads. A frozen transport amendment then allowed Yahoo Chart data for VOO, VTI, DIA, and RSP.

The four fallback assets affect only the benchmark. They do not affect a strategy signal, target, or order. All final instruments share 1,146 sessions from January 3, 2022, through July 29, 2026.

The simulator treats Stooq OHLC prices as corporate-action adjusted. It therefore does not add separate dividend or split flows. The Fama-French daily factor file ends on May 29, 2026. The final five-factor regression uses 711 matched observations.

3.3 Benchmark

The benchmark assigns 16.5% to each of SPY, IVV, VOO, VTI, DIA, and RSP. It keeps the same 1% cash reserve. It uses whole shares and the baseline cost model.

These funds overlap. The benchmark is a broad U.S. equity comparison, not six independent tests.

3.4 Statistical tests

The study estimates CAPM alpha from

$$r_{p,t} - r_{f,t} = \alpha + \beta(r_{b,t} - r_{f,t}) + \epsilon_t. \quad (4)$$

It also estimates Fama-French five-factor alpha:

$$r_{p,t} - r_{f,t} = \alpha + \beta_M \text{MKT}_t + \beta_S \text{SMB}_t + \beta_H \text{HML}_t + \beta_R \text{RMW}_t + \beta_C \text{CMA}_t + \epsilon_t. \quad (5)$$

Both regressions use heteroskedasticity- and autocorrelation-consistent standard errors [5].

A paired circular block bootstrap tests whether mean CAPM alpha is positive. The test uses 2,000 samples. The Deflated Sharpe Ratio uses all 1,214 trials and adjusts for non-normal returns [1]. White’s Reality Check uses a circular block bootstrap of excess returns [6].

The final-stage PBO value is zero because only one frozen candidate entered the final stage. This value does not measure all earlier research choices. The Deflated Sharpe calculation supplies the main correction for the larger search history.

4 Results

4.1 Untouched final test

The strategy ended with \$92,400.98. The benchmark ended with \$78,288.91.

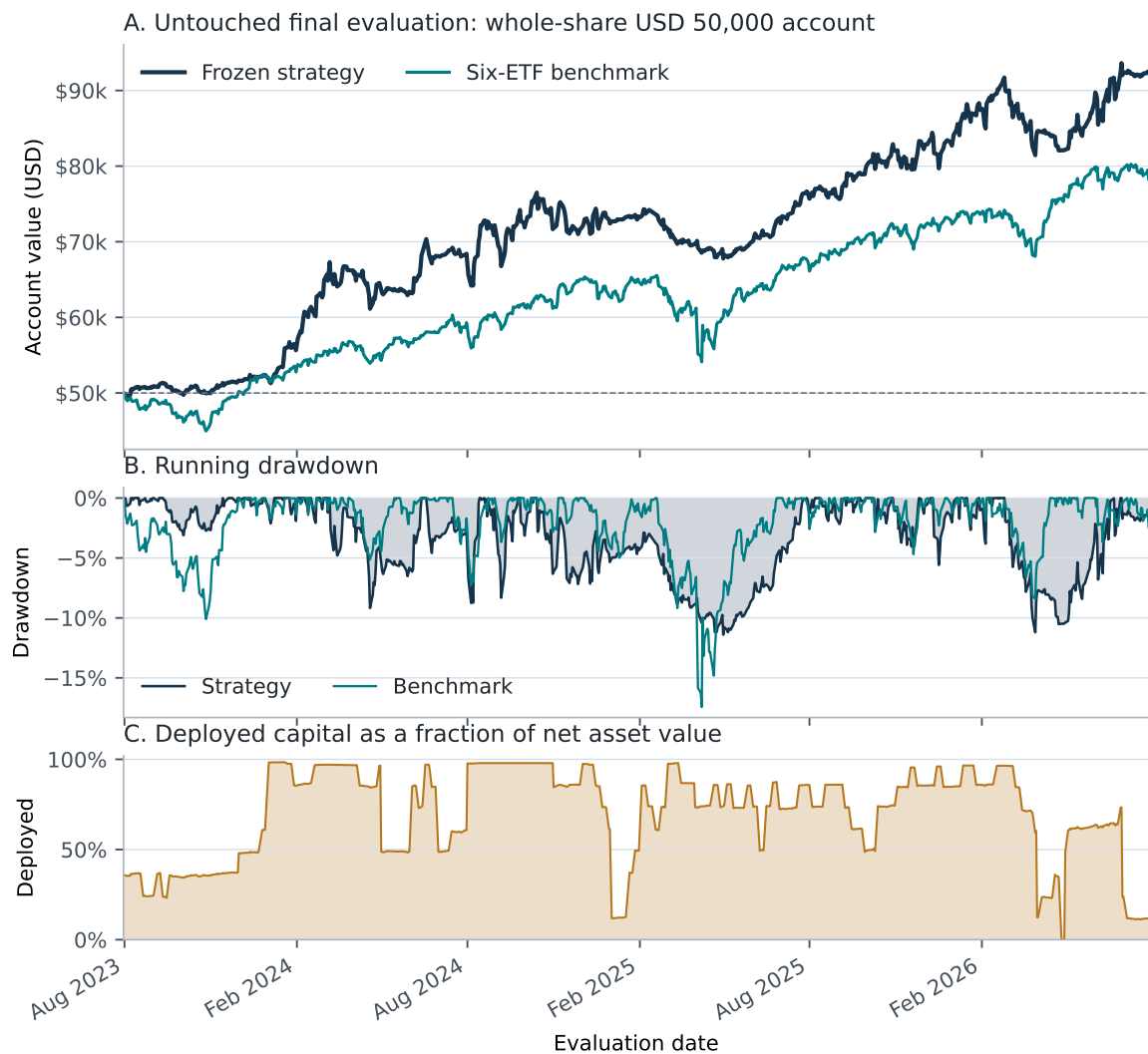
Table 2: Untouched final performance.

Measure	Strategy	Benchmark
Starting value	USD 50,000.00	USD 50,000.00
Ending value	USD 92,400.98	USD 78,288.91
Cumulative return	84.80%	56.58%
Annual growth rate	22.76%	16.15%
Annual volatility	15.16%	13.89%
Sharpe ratio	1.43	1.15
Sortino ratio	2.18	1.69
Maximum drawdown	-11.40%	-17.44%

The strategy executed 303 orders and suppressed 139 small orders. It rejected no orders. Total modeled cost was USD 787.45. The account never had negative cash.

The account held at most eight positions. Its maximum closing position weight was 25.46%. It recorded no liquidity breach and no missing-liquidity event.

Average residual cash was USD 20,989.28. This value reflects inactive sleeves, the reserve, and whole-share rounding. It does not represent a separate loss.



Source: frozen final evidence ledger. Strategy NAV includes modeled costs and whole-share execution.

Figure 1: Untouched final account from July 31, 2023, through July 29, 2026. Strategy values include costs and whole-share execution.

4.2 Alpha and long-sample results

Table 3 separates the short final test from the longer record. The final alpha estimates are positive but imprecise. The complete out-of-sample estimates have t -statistics above 2.

Table 3: Benchmark-relative alpha estimates.

Sample and model	Alpha	t	p	95% annual interval
Final CAPM	12.54%	1.77	0.0774	[-1.38%, 26.46%]
Final five-factor	7.89%	1.11	0.2669	[-6.04%, 21.82%]
Complete CAPM	12.09%	4.38	0.0000118	[6.68%, 17.50%]
Complete five-factor	10.33%	3.81	0.0001375	[5.02%, 15.64%]
Independent CAPM	12.92%	3.28	0.00104	[5.20%, 20.65%]
Independent five-factor	9.16%	2.36	0.0183	[1.55%, 16.76%]

The complete record gained 1,112.26%. Its annual growth rate was 20.31%. Its Sharpe ratio was 1.43, and its maximum drawdown was -22.45%.

The Deflated Sharpe confidence was 97.05%. The calculation used all 1,214 trials. White's Reality Check returned $p = 0.02699$. The complete bootstrap placed a 100% estimated probability on positive mean CAPM alpha.

4.3 Chronological folds

All eight folds earned a positive return. Fold 4 had the lowest Sharpe ratio. Fold 5 had the largest drawdown.

Table 4: Chronological out-of-sample folds.

Fold	Dates	Return	Sharpe	Drawdown	CAPM t
1	2013-01-30 to 2014-10-06	13.22%	1.35	-4.95%	0.78
2	2014-10-07 to 2016-06-14	39.27%	1.85	-6.53%	2.69
3	2016-06-15 to 2018-02-20	52.10%	2.02	-9.80%	1.32
4	2018-02-21 to 2019-10-25	11.52%	0.78	-7.45%	0.65
5	2019-10-28 to 2021-07-02	72.72%	1.57	-22.45%	2.01
6	2021-07-06 to 2023-03-10	19.89%	0.93	-14.31%	1.62
7	2023-03-13 to 2024-11-14	72.64%	2.22	-9.17%	1.55
8	2024-11-15 to 2026-07-29	26.78%	1.05	-11.20%	1.15

Only two folds had alpha t -statistics above 2. Each fold has about 424 sessions. The fold test therefore shows return consistency more clearly than statistical significance.

5 Independent and Stress Tests

5.1 Independent-price test

The independent Nasdaq account grew from \$50,000 to \$174,625.45. This equals a 249.25% gain over 1,743 sessions. The Sharpe ratio was 1.29. The maximum drawdown was -22.58%.

The target replay passed. It used 118 frozen target changes after the Nasdaq data had enough liquidity history. It placed no nonzero target before the ready date.

A second diagnostic rebuilt the signals from Nasdaq data. Its exact target weights matched 49.51% of common review dates. The test failed.

The failed diagnostic shows that adjusted histories differ by provider. The passed replay shows that frozen decisions stayed profitable on separate execution prices. A live research test must fix one signal-data source and its adjustment rules.

5.2 Costs, delay, and account size

All specified operating tests remained profitable.

Table 5: Final-period stress tests.

Test	Initial value	Ending value	Return
Baseline costs	USD 50,000	USD 92,400.98	84.80%
Moderate costs	USD 50,000	USD 91,065.16	82.13%
Severe costs	USD 50,000	USD 88,727.73	77.46%
One extra session delay	USD 50,000	USD 97,204.34	94.41%
Smaller account	USD 25,000	USD 46,022.41	84.09%
Larger account	USD 100,000	USD 185,212.52	85.21%

Moderate costs were 10 basis points plus USD 1 per order. Severe costs were 20 basis points plus USD 2 per order. No stress test had a liquidity breach or account rejection.

Profit concentration was 24.10% by asset and 6.92% by trade. It was 3.83% by month and 19.64% by year. Each value was below the 35% limit.

Removing NVDA still left a 524.19% gain in the complete record. Removing the best month left a 970.66% gain. Removing the best year left a 677.40% gain.

6 Limitations

The final test covers about three years. Its alpha estimates are positive, but their standalone t -statistics are below 2. The longer record provides the stronger statistical result.

The research ledger contains 1,214 trials. The Deflated Sharpe test adjusts for this search, but it cannot model every human choice.

The eight stocks do not come from a recorded point-in-time universe. The study does not include delisted alternatives. The test can therefore contain security-selection or survivorship bias.

The strategy assumes that Stooq OHLC prices include corporate actions. A different adjustment rule can change both signals and returns.

Nasdaq signal reconstruction matched only 49.51% of shared target states. This result makes the signal-data contract part of the strategy definition.

Historical opening prices do not guarantee live fills. The cost model does not include changing spreads, market impact, halts, or broker outages.

The benchmark contains overlapping U.S. equity funds. A different benchmark can change the alpha estimate.

The study does not include taxes. It also does not test capital above USD 100,000. Most importantly, it has no prospective trading record.

7 Reproduction and Conclusion

The candidate is frozen at Git commit f5ed1d11cb2106ba9aff174a2b9df6174b517564. Its identity hash is fd5a1f3e78cb1551a621b4ece2353a8699301c5bdd56838a24ff31df5bf1c4d4.

The clean verification command is

```
scripts/verify_candidate.sh--clean-checkout.
```

The check reproduced the strategy and verified the frozen file hashes. Fifteen service tests also passed. The machine-readable record reports all ten top-level gates and all 42 detailed gates as true.

The strategy met its historical objective. It produced a positive net account under whole-share, cost, cash, position, and liquidity constraints. It also passed the specified statistical, stress, and independent-price tests.

These results justify a prospective paper-trading test. They do not justify a claim of certain profit. A prospective test should publish each target before the next open. It should fix the data provider, stock list, parameters, and stop rules before results arrive.

A Verification Gates

The ten top-level gates were causal execution, cost treatment, Deflated Sharpe, independent reproduction, final-stage PBO, positive net equity, Reality Check, stress tests, statistical evidence, and the USD 50,000 whole-share account. All ten passed.

The following 42 detailed gates also passed. Their exact Boolean values are stored in report s/final/verification.json.

- asset_profit_concentration_at_most_35_percent
- block_bootstrap_positive_alpha_at_least_95_percent
- capital_25000_and_100000_positive
- complete_capm_alpha_t_at_least_2
- complete_ff5_alpha_t_at_least_2
- deflated_sharpe_confidence_at_least_95_percent
- delayed_positive_final_and_complete
- development_all_preliminary_gates
- drawdown_not_materially_worse_than_benchmark
- final_calmar_at_least_0_50
- final_capm_alpha_positive
- final_ff5_alpha_nonnegative
- final_holdout_positive
- final_max_drawdown_at_most_25_percent
- final_sharpe_at_least_0_80
- final_sortino_at_least_1_00
- independent_development_capm_t_at_least_2
- independent_development_ff5_t_at_least_2
- independent_development_positive
- independent_target_replay_passed
- moderate_cost_positive_final_and_complete

- month_profit_concentration_at_most_35_percent
- no_executed_liquidity_breach
- no_insufficient_liquidity_history
- no_position_count_rejection
- operational_neighbors_at_least_70_percent_positive
- positive_rolling_12m_fraction_at_least_60_percent
- positive_without_best_month
- positive_without_best_symbol
- positive_without_best_year
- profitable_folds_at_least_75_percent
- severe_cost_positive_and_terminal_at_least_90_percent
- single_candidate_pbo
- stooq_final_evidence_opened_once
- stress_alpha_nonnegative
- target_cash_reserve_and_caps
- trade_profit_concentration_at_most_35_percent
- white_reality_check_p_at_most_5_percent
- whole_share_account_at_most_eight_positions
- whole_share_account_close_weight_at_most_30_percent
- whole_share_account_never_negative_cash
- year_profit_concentration_at_most_35_percent

References

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