

Index Arbitrage: Post-Announcement Momentum Trading Strategy Analysis

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Abstract

This paper examines post-announcement momentum trading strategy, within the broader category of index arbitrage strategies which focuses on capturing price movements around index inclusion events for S&P indices. Using data from January 2020 to October 2024, post-announcement momentum analysis across the S&P 500, S&P MidCap 400, and S&P SmallCap 600 indices is conducted. Findings indicate that a one-day post-announcement momentum strategy targeting S&P 500 corporate actions yields the strongest risk-adjusted returns, with a Sharpe ratio of 5.866 and an annualized return of 42.20%. The study accounts for practical implementation constraints including transaction costs, market impact, and position sizing limits, providing insights into the real-world applicability of index arbitrage strategies in modern markets.

Introduction

Index inclusion events represent significant moments in a company's market presence, often accompanied by substantial price movements and trading volume increases. These events create potential arbitrage opportunities due to temporary price pressures and structural market inefficiencies. This research examines a primary trading strategy designed to capture value from these market movements known as post-announcement momentum.

Analysis focuses on three major S&P indices (S&P 500, S&P MidCap 400, and S&P SmallCap 600) and considers both corporate actions and index reviews as catalysts for inclusion events. The study period from January 2020 to October 2024 encompasses various market conditions, providing a robust testing ground for strategy evaluation.

The research employs data collection methods, including web scraping of S&P Global press releases, historical price data from Yahoo Finance, and SOFR rates for financing calculations. Implementation includes realistic trading constraints such as position limits, transaction costs, and market impact models to ensure practical applicability to the findings.

Methodology

This study examines post-announcement momentum trading strategy, within the broader category of index arbitrage strategies, testing them across various subsets of eligible stocks and holding periods within their respective trading windows.

Trading Strategy

Post-Announcement Momentum Strategy This strategy capitalizes on price momentum following index inclusion announcements:

- Entry: Open position at the first available trading price (opening price on the day after announcement)
- Exit: Close position on or before the index effective date
- Rationale: Capture the price appreciation typically observed after index inclusion announcements
- Key Feature: Trades occur after the initial price gap, focusing on subsequent momentum

Data Collection and Preprocessing

Data Quality Issues Initial review of the source data revealed several critical issues requiring remediation:

- Announcement date discrepancies
- Incorrect effective dates
- Inconsistent ticker formatting
- Missing ticker change history
- Incomplete stock population
- Missing data points

Rather than correcting individual errors, a complete rebuild of the dataset using primary sources was done.

Data Sources

1. S&P Global Press Releases **Collection Method:** Custom web scraper analyzing press releases from S&P Global's official website

- URL Structure:
`https://press.spglobal.com/index.php?s=2429&l=100&year={year}&keywords=%22Set%2Bto%2BJoin%22`
- Parameters:
 - Section ID: 2429 (press release section)
 - Results per page: 100
 - Search keyword: "Set to Join"

Dataset Parameters:

- Time Period: January 1, 2020 - October 25, 2024
- Event Types:
 - Index Reviews (Quarterly Rebalances)
 - Corporate Actions (Individual Additions)
- Indices Covered: S&P 500, S&P MidCap 400, S&P SmallCap 600

Data Structure:

Column Name	Description	Data Type
Announced	Press release date	Date

Column Name	Description	Data Type
Effective Date	Index change implementation date	Date
Index	Target index identifier	String
Action	Addition/Deletion indicator	String
Company Name	Entity name	String
Ticker	Trading symbol	String
GICS Sector	Industry classification	String
Event_Type	Review type identifier	String
N days	Announcement to effective date duration	Numeric

2. Price and Volume Data (Yahoo Finance) Stock Data Collection:

- Source: Yahoo Finance API (yfinance)
- Coverage: All addition events identified in press releases
- Frequency: Daily observations
- Time Window:
 - Start: T-30 trading days from announcement
 - End: T+30 trading days from effective date
- Variables: Open, High, Low, Close, Volume

ETF Data Collection:

- Purpose: Provide liquid hedging instruments
- Coverage:

Index	ETF Ticker	Description
S&P 500	SPY	SPDR S&P 500 ETF Trust
S&P 400	IJH	iShares Core S&P Mid-Cap ETF
S&P 600	IJR	iShares Core S&P Small-Cap ETF

- Time Window: January 1, 2020 - October 25, 2024
- Frequency: Daily
- Variables: Open, High, Low, Close, Volume

3. Financing Rates

- Source: SOFR (Secured Overnight Financing Rate)
 - Retrieved from FRED database: ‘<https://fred.stlouisfed.org/series/SOFR>’
- Application: Daily financing costs for position holding
- Time Period: January 1, 2020 - October 25, 2024
- Frequency: Daily observations
- Usage: Preferred over Fed Funds Rate due to current market convention

Mathematical Foundations

Core Metrics and Calculations

Return Calculations Standard Daily Returns

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

where:

- R_t = Return for day t
- P_t = Closing price on day t
- P_{t-1} = Closing price on day t-1

First Day Post-Announcement Return

Since announcements occur after market close, the first trading opportunity is the following day's open:

$$R_1 = \frac{Close_{t=1} - Open_{t=1}}{Open_{t=1}}$$

Risk and Volume Metrics 20-Day Rolling Volatility

$$\sigma_t = \sqrt{\frac{\sum_{i=t-19}^t (R_i - \bar{R})^2}{19}}$$

where:

- σ_t = Volatility estimate for day t
- R_i = Daily return for day i
- \bar{R} = Mean return over the 20-day window

20-Day Average Daily Volume (ADV20)

$$ADV20_t = \frac{1}{20} \sum_{i=t-19}^t V_i$$

where:

- V_i = Trading volume for day i

Strategy-Specific Calculations

Trading Window Parameters

$$n_t = (t_e - t_{a+1} + 1)$$

where:

- t_{a+1} = Day after announcement
- t_e = Effective date of index change
- n_t = Number of trading days in window
- $t \in [t_{a+1}, t_e]$

Return Metrics Daily Strategy Return

$$R_{s,t} = \frac{P_t - P_{t-1}}{P_{t-1}}$$

for $t \in [t_{a+1}, t_e]$

Multi-day Average Return

$$R_{md,t} = \frac{1}{n_t} \left(\frac{P_t - P_0}{P_0} \right)$$

where:

- P_0 = Opening price on t_{a+1}
- n_t = Days from t_{a+1} to current day t
- $t \in [t_{a+1}, t_e]$

Strategy Implementation

Universe Segmentation The strategy evaluates returns across multiple dimensions to identify optimal trading opportunities. The data pulled provided 335 additions to the in-scope S&P Global indices.

1. Index Categories

- S&P 50
- S&P MidCap 400
- S&P SmallCap 600

2. Event Classifications

- Index Review (Quarterly Rebalances)
- Corporate Action (Individual Additions)

3. Sector Coverage

- Industrials
- Consumer Discretionary
- Financials
- Information Technology
- Real Estate
- Health Care
- Materials
- Energy
- Consumer Staples
- Communication Services
- Utilities
- Others

4. Holding Periods

- Minimum: 1 day (open to close)
- Maximum: 11 trading days
- Increment: 1 day

Performance Evaluation Metrics Each strategy subset is evaluated using distribution metrics:

Metric	Description
Count	Number of trades in subset
Mean Return	Arithmetic average of returns (non-compounded)
Median Return	50th percentile of return distribution
Min/Max Returns	Return boundaries
Standard Deviation	Return dispersion measure
Percentile Analysis	5th, 25th, 50th, 75th, 95th percentiles

Selected Strategy Variants

1. All-Cap Corporate Action Strategy (Strat_1_CA1D)

- Universe: All three S&P indices
- Events: Corporate actions only
- Holding Period: 1 day (post-announcement day open to close)

2. S&P 500 Corporate Action Strategy (Strat_1_SP500_CA1D)

- Universe: S&P 500 only
- Events: Corporate actions only
- Holding Period: 1 day (post-announcement day open to close)

3. Small-Cap All Inclusion Events Strategy (Strat_1_SP600_1D)

- Universe: S&P SmallCap 600 only
- Events: Both corporate actions and index reviews
- Holding Period: 1 day (post-announcement day open to close)

Backtesting Framework

The backtesting analysis was conducted on the three selected strategy variants under realistic trading constraints and cost considerations.

This backtesting framework incorporates:

- Realistic position sizing constraints
- Multi-layered cost structure
- Market impact modeling
- Financing considerations
- Trade-level and portfolio-level performance tracking

Portfolio Constraints

1. Position Limits

- **Maximum Portfolio Exposure:** \$5,000,000 per trade
- **Volume Constraints:** Limited to 1% of 20-day ADV

For each security i on day t :

$$Q_{i,t} = \min(0.01 * ADV20_{i,t}, V_{i,t})$$

where:

- $Q_{i,t}$ = Trade quantity
- $ADV20_{i,t}$ = 20-day average daily volume
- $V_{i,t}$ = Available volume

2. Position Scaling When multiple trades on the same day cause total exposure to exceed the portfolio cap:

$$\lambda_t = \frac{CAP_{portfolio}}{\sum P_{i,t}}$$

$$Q_{i,t}^{hat} = \lambda_t * Q_{i,t}$$

where:

- λ_t = Scaling factor
- $Q_{i,t}^{hat}$ = Adjusted trade quantity

3. Position Value

$$P_{i,t} = Q_{i,t} * O_{i,t}$$

where:

- $O_{i,t}$ = Opening price

Cost Models

1. Transaction Costs Fixed cost of \$0.01 per side (\$0.02 round-trip):

$$TC_{i,t} = 2 * Q_{i,t} * 0.01$$

2. Market Impact (Slippage) Measures price impact from large order execution:

$$SI_{i,t} = \alpha * \left(\frac{Q_{i,t}}{ADV20_{i,t}} \right)^\beta * P_{i,t} * \sigma_{i,t}$$

where:

- $\sigma_{i,t}$ = Price volatility
- $\alpha = 0.2$ = Baseline impact parameter
- Conservative estimate for market impact
- Lower values typically observed in liquid stocks
- $\beta = 0.7$ = Impact decay parameter
- Models non-linear relationship between trade size and price impact
- Conservative estimate based on market microstructure research
- Impact calculated separately for entry and exit

3. Financing Costs Overnight holding costs based on SOFR plus spread:

$$r_{daily} = (SOFR_t + 0.015) * \frac{1}{365}$$

$$FC_t = r_{daily} * \sum P_{i,t}$$

Note: No short selling costs included as strategy variants are long-only.

Performance Measurement

1. Trade-Level Metrics Realized Gain/Loss per Trade

$$RGL_{i,t} = Q_{i,t} * (C_{i,t} - O_{i,t})$$

where:

- $C_{i,t}$ = Closing price
- $O_{i,t}$ = Opening price

2. Portfolio-Level Metrics Daily Net Profit/Loss

$$NPL_t = \sum RGL_{i,t} - \sum TC_{i,t} - \sum SI_{i,t} - FC_t$$

Cumulative Performance

$$CNPL_t = \sum_{s=1}^t NPL_s$$

All calculations are performed on a daily basis, with costs netted against gross returns to provide accurate performance assessment.

Risk Management

Systematic Risk Controls

1. Position-Level Controls

- Maximum position size: \$5,000,000 per trade
- Volume participation limits: 1% of 20-day ADV
- Pro-rata allocation for multiple concurrent trades
- Automated trade scheduling to manage market impact

2. Portfolio-Level Constraints

- Sector exposure limits to prevent concentration
- Event type diversification requirements
- Market capitalization distribution targets
- Maximum portfolio leverage limits

Strategy-Specific Risk Mitigation

1. Event Risk Management *Sources of Risk:*

- Index rebalance timing uncertainty
- Corporate action cancellation potential
- Announcement interpretation errors
- Implementation timing mismatches

Mitigation Techniques:

- Real-time announcement monitoring systems
- Multi-source data verification protocols
- Event probability assessment framework
- Automated execution timing controls

2. Market Risk Controls *Sources of Risk:*

- Short-term price volatility
- Gap risk between announcement and execution
- Market regime changes
- Sector rotation effects

Mitigation Techniques:

- Short holding periods (primarily one day)
- Event-driven stock selection criteria
- Market-neutral position construction
- Dynamic position sizing based on volatility

3. Liquidity Risk Management *Sources of Risk:*

- Execution slippage
- Market impact costs
- Limited trading volume
- Bid-ask spread widening

Mitigation Techniques:

- Conservative ADV participation limits
- Custom market impact modeling
- Smart order routing algorithms
- Liquidity-based position sizing

Risk Monitoring Framework

1. Pre-Trade Risk Assessment

- Historical volatility analysis
- Liquidity profile evaluation
- Event probability scoring
- Market impact estimation

2. Real-Time Monitoring

- Position limit tracking
- Exposure aggregation
- Performance attribution
- Risk factor decomposition

3. Post-Trade Analysis

- Transaction cost analysis
- Implementation shortfall measurement
- Strategy performance attribution
- Risk factor contribution analysis

Strategy-Specific Risk Considerations

1. All-Cap Strategy (Strat_1_CA1D) *Primary Risks:*

- Cross-capitalization exposure
- Varied liquidity profiles
- Diverse event types
- Market regime sensitivity

Control Mechanisms:

- Capitalization-weighted position sizing
- Event type diversification requirements
- Multi-factor risk decomposition
- Dynamic reallocation protocols

2. S&P 500 Strategy (Strat_1_SP500_CA1D) *Primary Risks:*

- Concentration risk
- Event timing dependency
- Limited diversification
- Higher per-trade exposure

Control Mechanisms:

- Enhanced event verification
- Strict position size limits
- Corporate action probability assessment
- Sophisticated execution algorithms

3. Small-Cap Strategy (Strat_1_SP600_1D) *Primary Risks:*

- Elevated liquidity risk
- Higher volatility exposure
- Information asymmetry
- Market regime sensitivity

Control Mechanisms:

- Conservative volume participation
- Enhanced liquidity buffers
- Due diligence requirements
- Strict position size limits

Risk Infrastructure Requirements

1. Technology Infrastructure

- Real-time monitoring systems
- Automated execution platforms
- Risk analytics engines
- Market data integration

2. Operational Controls

- Multiple approval levels
- Automated compliance checks
- Position reconciliation
- Performance attribution

3. Reporting Framework

- Real-time risk dashboards
 - Daily position reports
 - Performance attribution analysis
 - Risk factor exposure analysis
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Results

Performance Evaluation Framework

Evaluated the performance of each strategy variant using a set of risk-adjusted return metrics, efficiency measures, and portfolio characteristics.

Risk-Adjusted Return Metrics

1. Information Ratio (IR) Measures excess return per unit of risk:

$$IR = \frac{E[R_d]}{\sigma(R_d)}$$

where:

- $E[R_d]$ = Mean daily profit/loss
- $\sigma(R_d)$ = Standard deviation of daily profit/loss

The IR provides insight into the consistency of returns relative to their volatility, with higher values indicating more stable performance.

2. Sharpe Ratio (SR) Annualized measure of risk-adjusted performance:

$$SR = IR \times \sqrt{252}$$

where:

- 252 = Number of trading days per year
- $\sqrt{252}$ = Annualization factor for daily returns

The Sharpe Ratio allows comparison with other investment strategies on an annualized basis.

Portfolio Risk Metrics

1. Maximum Drawdown (MDD) Measures the largest peak-to-trough decline:

$$MDD = \frac{\min(R_d)}{\bar{P}}$$

where:

- R_d = Daily profit/loss
- \bar{P} = Average position size

MDD helps assess downside risk and capital preservation capabilities.

2. Annualized Return (AR) Standardized measure of strategy performance:

$$AR = \frac{R_{total}}{P_{total}} \times \frac{252}{N}$$

where:

- R_{total} = Total profit/loss
- P_{total} = Total position value
- N = Number of trading days

Portfolio Efficiency Metrics

1. Margin Ratio (M) Measures return on deployed capital:

$$M = \frac{R_{total}}{P_{total}}$$

This ratio indicates how efficiently the strategy generates returns relative to the capital employed.

2. Turnover Ratio (T) Indicates portfolio rotation frequency:

$$T = \frac{\bar{P}}{P_{total}}$$

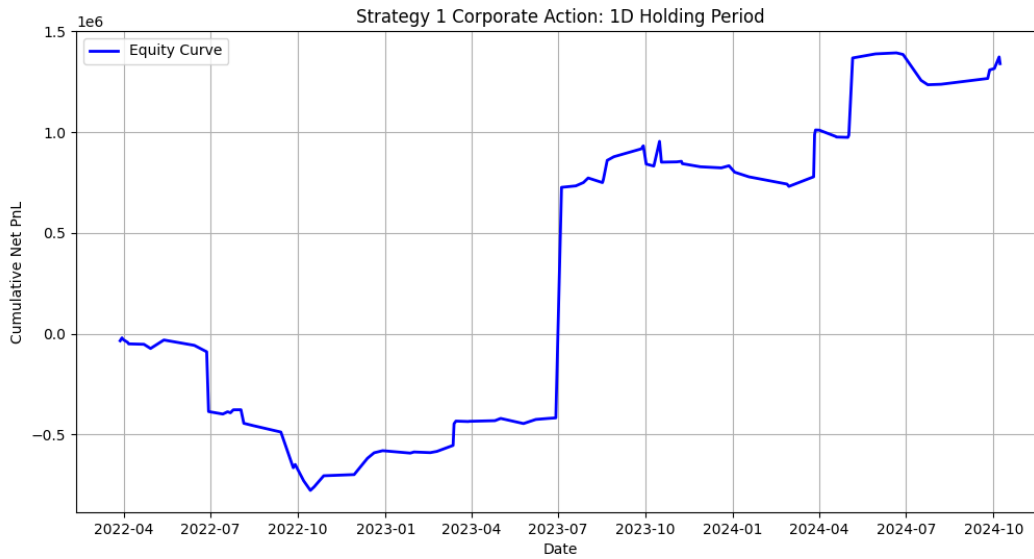
Lower turnover typically indicates more efficient capital utilization and lower transaction costs.

These metrics provide a multi-dimensional view of strategy performance:

- Risk-adjusted return quality (IR, SR)
- Downside risk management (MDD)
- Absolute performance (AR)
- Capital efficiency (M, T)

Strategy Performance Analysis

1. All-Cap Corporate Action Strategy (Strat_1_CA1D)



Metric	Value	Interpretation
Information Ratio	0.108	Modest risk-adjusted return
Sharpe Ratio	1.718	Strong risk-adjusted performance
Max Drawdown	-19.56%	Moderate downside risk
Annualized Return	2.87%	Positive but modest return
Margin	1.00%	Thin profitability per trade
Turnover	1.14%	Low portfolio rotation
Total Open/Close Trades	171	Moderate trade frequency

The strategy's returns are primarily derived from systematic exploitation of price movements following index inclusion announcements. This event-driven arbitrage approach capitalizes on predictable trading patterns that emerge when stocks are added to major indices.

The portfolio maintains limited exposure to broad market risk factors through two key design elements:

1. Short holding periods that minimize exposure to market directional movements
2. Event-driven stock selection that focuses on company-specific catalysts rather than market factors

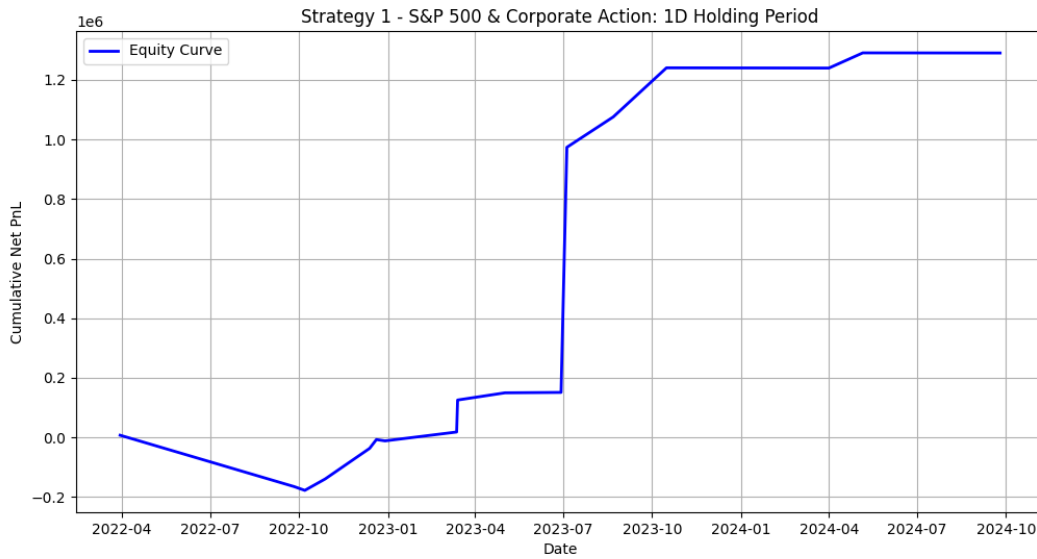
However, some residual market volatility exposure remains unavoidable, as evidenced by enhanced strategy performance during favorable market conditions. The primary risk factors stem from two sources:

1. Event timing risk - uncertainty around index rebalance implementation
2. Corporate action risk - potential changes or cancellations of announced corporate events

The strategy exhibits notable return variation, highlighting the importance of robust risk management protocols. Successful implementation requires sophisticated infrastructure:

- Automated execution systems capable of rapid trade deployment
- Real-time monitoring of index-related announcements
- Advanced order management to minimize market impact
- Integrated risk controls to manage position exposure

2. S&P 500 Corporate Action Strategy (Strat_1_SP500_CA1D)



Metric	Value	Interpretation
Information Ratio	0.369	High risk-adjusted return
Sharpe Ratio	5.866	Very strong risk-adjusted performance
Max Drawdown	-6.47%	Low downside risk
Annualized Return	42.20%	High return
Margin	2.85%	Moderate profitability per trade
Turnover	5.88%	Low portfolio turnover
Total Trades	21	Low trade frequency

Sector	Weight
Industrials	23.8%
Health Care	19.0%
Consumer Discretionary	9.5%
Energy	9.5%
Utilities	9.5%
Others	28.7%

While sharing the fundamental event-driven risk characteristics of the broader strategy, this S&P 500-focused approach operates within a more concentrated universe. The narrower scope results in larger individual trade allocations, with an average position size of \$2.6MM, amplifying both inclusion impact and event-specific risks.

The strategy benefits from several structural advantages inherent to S&P 500 constituents:

Market Quality Characteristics:

- Superior liquidity compared to mid and small-cap indices
- Tighter bid-ask spreads enabling more efficient execution
- More robust price discovery mechanisms
- Negligible slippage costs despite larger position sizes

Risk Profile Advantages:

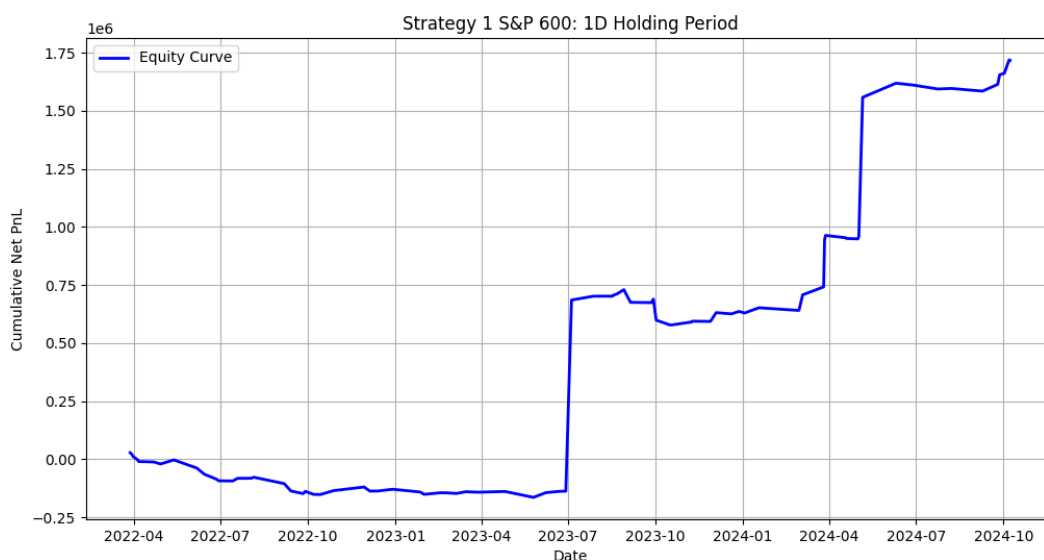
- Higher quality underlying securities reducing idiosyncratic risk
- Greater certainty in corporate action outcomes
- Lower stock-specific risk due to extensive institutional coverage
- More stable trading patterns around index events

These characteristics lead to more predictable trading outcomes, albeit with potentially smaller price movements compared to mid and small-cap indices. The enhanced market quality metrics and reduced execution friction make the strategy particularly attractive from an implementation perspective, despite the increased position concentration risk.

The focus on high-quality, large-cap names provides an additional layer of risk mitigation through:

- More transparent corporate governance
- Higher analyst coverage reducing information asymmetry
- Greater market making capacity
- More reliable execution outcomes

3. Small-Cap All Inclusion Events Strategy (Strat_1_SP600_1D)



Metric	Value	Interpretation
Information Ratio	0.182	Modest risk-adjusted return
Sharpe Ratio	2.897	Strong risk-adjusted performance
Max Drawdown	-9.23%	Low downside risk
Annualized Return	6.73%	Positive moderate return
Margin	2.16%	Thin profitability per trade
Turnover	1.23%	Low portfolio rotation
Total Open/Close Trades	182	Moderate trade frequency

Sector	Weight
Information Technology	18.4%
Financials	16.0%
Consumer Discretionary	14.4%
Industrials	12.8%
Health Care	12.0%
Others	26.4%

While maintaining the core event-driven risk profile common to index arbitrage strategies, this Small-Cap approach operates across a broader universe of opportunities. The expanded opportunity set results in smaller average position sizes of \$0.9MM per trade, a natural consequence of lower liquidity in S&P SmallCap 600 constituents compared to their S&P 500 counterparts. This reduced position sizing helps mitigate both inclusion impact and event-specific risks.

The strategy's diversification benefits from dual catalysts:

1. Corporate action-driven inclusions
2. Regular index review additions

Market Structure Advantages:

- Broader opportunity set enabling natural portfolio diversification
- Greater pricing inefficiencies due to reduced market scrutiny
- Enhanced arbitrage potential from information asymmetry
- More frequent trading opportunities across varied market conditions

However, these opportunities come with distinct challenges and risk considerations:

Structural Challenges:

- Limited analyst coverage requiring deeper proprietary research
- Lower trading volumes necessitating careful liquidity management
- Higher bid-ask spreads impacting transaction costs
- More complex execution requirements

Risk Factor Exposure:

- Elevated small-cap factor sensitivity
- Increased liquidity risk during market stress
- Strong correlation to size premium dynamics
- Greater vulnerability to changing market regimes
- Higher stock-specific risk due to reduced information flow

The strategy's success relies on balancing these enhanced opportunity sets against their associated risks through:

- Sophisticated liquidity analysis
- Conservative position sizing
- Robust risk monitoring systems
- Careful attention to execution quality
- Enhanced due diligence on individual names

Conclusion

The analysis demonstrates that index arbitrage strategies continue to offer profitable opportunities in modern markets, particularly when focused on specific market segments and event types. The S&P 500 corporate action strategy shows exceptional risk-adjusted returns, suggesting that larger, more liquid stocks provide more reliable arbitrage opportunities despite tighter spreads and higher efficiency.

Key findings include:

1. The S&P 500 corporate action strategy significantly outperforms broader market approaches, with superior risk-adjusted returns and lower drawdowns.
2. Small-cap strategies offer more frequent trading opportunities but require careful management of liquidity constraints and higher volatility.
3. One-day holding periods consistently outperform longer horizons, suggesting rapid price adjustment to index inclusion announcements.