S&P 500 Long-Only Strategy Backtest

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1 Executive Summary

This report presents the backtest results of a long-only investment strategy applied to SPY (S&P 500) starting from 1993. The strategy employs a quantitative approach designed to reduce the volatility and drawdown of SPY while increasing returns by dynamically switching between a fully invested long position and cash positions based on prevailing market conditions.

2 Investment Strategy

2.1 Regime-Detection Rules

Each trading day, the strategy classifies the market into one of two regimes—*favorable* or *unfavorable*—based on a proprietary quantitative signal that captures prevailing trend and risk conditions. In a *favorable* regime, full equity exposure is maintained; in an *unfavorable* regime, the portfolio shifts entirely to cash to preserve capital. The signal is updated daily, and transitions are designed to avoid excessive turnover and whipsaw effects by embedding basic smoothing and minimum-hold constraints.

2.2 Trading Rules

- **Enter:** On a favorable signal, allocate 100% to SPY at current close.
- **Exit:** On an unfavorable signal, liquidate SPY and hold in cash.

2.3 Assumptions

This strategy is purely statistical and systematic, with no machine-learning component. Execution is assumed at current-day close prices; commissions are modeled as fixed 0.015%.

3 Backtest Methodology

3.1 Data Universe

Historical daily prices for SPY from January 29, 1993 through May 31, 2025.

4 Results

We report the following risk and return metrics comparing the strategy with the SPY benchmark:

Metric	**Strategy**	**Benchmark**
Trades	302	—
Win Rate	62.58%	—
Compound Annual Growth Rate (CAGR)	13.20%	10.40%
Annualized Volatility	17.03%	18.73%
Sharpe Ratio	0.81	0.62
Sortino Ratio	1.07	0.79
Calmar Ratio	0.31	0.19
Maximum Drawdown	–42.34%	–55.19%

Table 1: Performance Metrics Comparison: Strategy vs. Benchmark

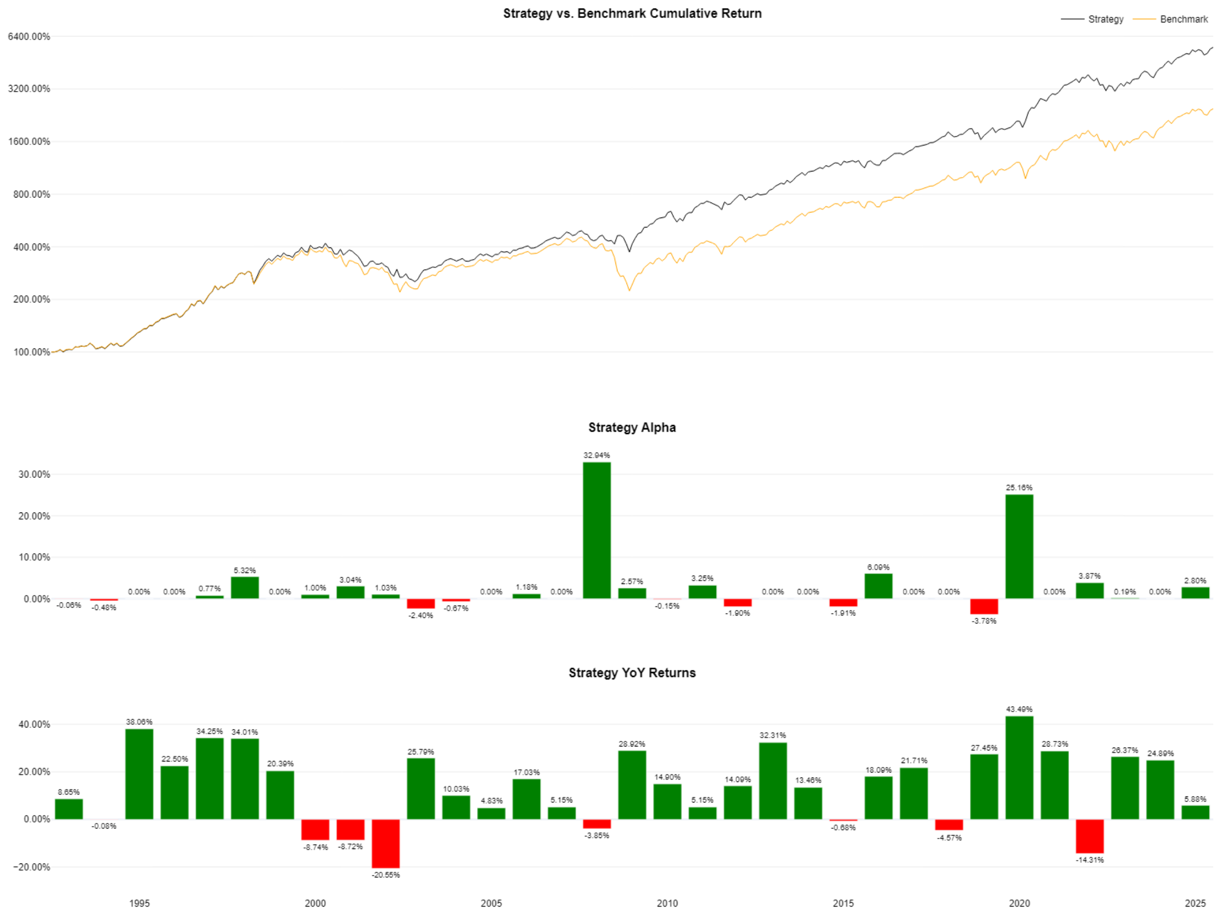


Figure 1: Cumulative performance: strategy vs. SPY benchmark.

Figure 2: Strategy trades.

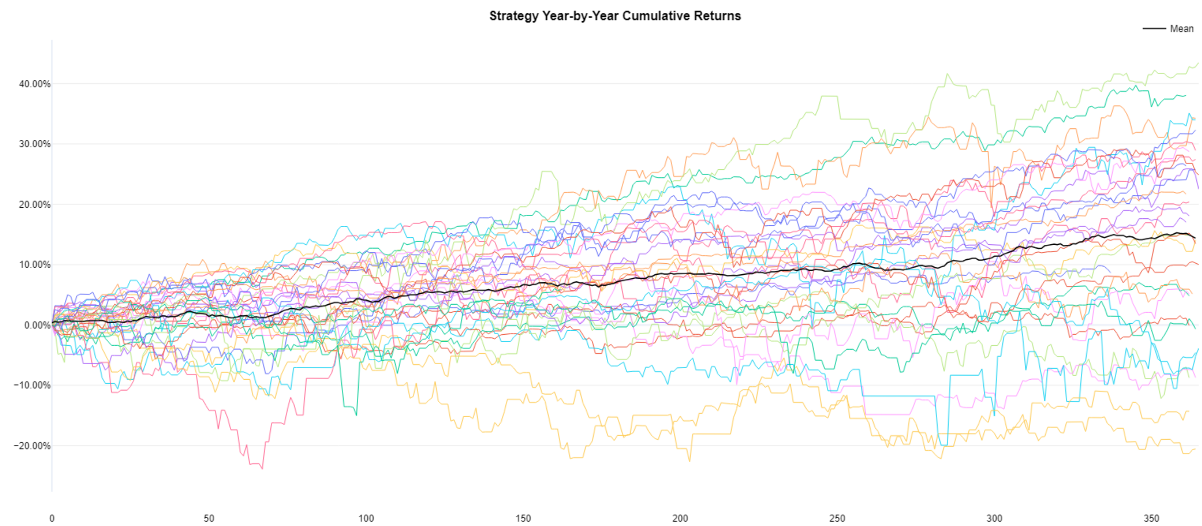


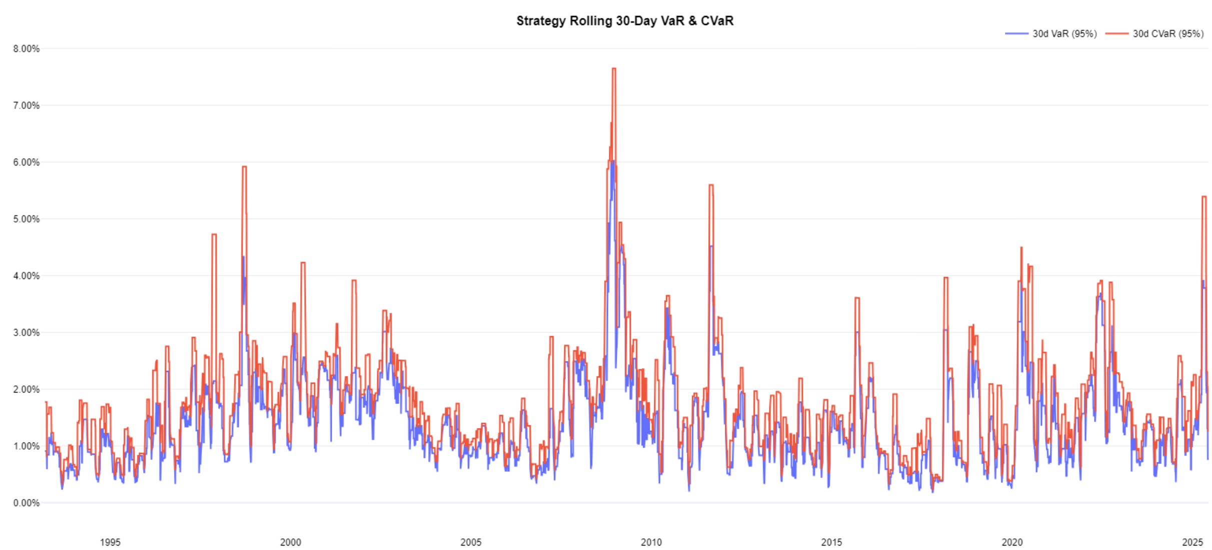
Figure 3: Year-by-year cumulative returns for each calendar year.

Month-by-Month Returns

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean	Total	Benchmark	Alpha
1993	0.00%	1.07%	2.10%	-3.12%	2.75%	0.58%	-0.27%	3.70%	-0.13%	1.20%	-0.25%	0.87%	0.71%	8.65%	8.71%	-0.06%
1994	3.33%	-3.23%	-4.19%	1.12%	1.59%	-2.29%	3.23%	3.81%	-2.53%	2.84%	-3.98%	0.73%	0.04%	-0.08%	0.40%	-0.48%
1995	3.36%	4.08%	2.79%	2.96%	3.97%	2.02%	3.22%	0.45%	4.24%	-0.29%	4.45%	1.57%	2.73%	38.06%	38.06%	0.00%
1996	3.56%	0.32%	1.72%	1.09%	2.27%	0.88%	-4.49%	1.93%	5.59%	3.23%	7.30%	-2.38%	1.75%	22.50%	22.50%	0.00%
1997	6.18%	0.96%	-4.41%	6.26%	6.32%	4.11%	7.93%	-5.18%	4.81%	-2.45%	3.87%	2.50%	2.57%	34.25%	33.48%	0.77%
1998	1.29%	6.93%	4.88%	1.28%	-2.08%	4.26%	-1.35%	-14.12%	9.72%	9.13%	5.57%	6.54%	2.67%	34.01%	28.69%	5.32%
1999	3.52%	-3.21%	4.15%	3.80%	-2.29%	5.54%	-3.10%	-0.52%	-2.23%	6.41%	1.67%	5.71%	1.62%	20.39%	20.39%	0.00%
2000	-4.98%	-1.52%	9.69%	-4.09%	0.12%	1.97%	-1.57%	6.53%	-5.49%	-0.47%	-7.47%	-0.52%	-0.65%	-8.74%	-9.74%	1.00%
2001	6.59%	-7.32%	3.17%	3.63%	-1.51%	-3.32%	-3.50%	-5.70%	-6.95%	1.06%	5.45%	0.59%	-0.65%	-8.72%	-11.76%	3.04%
2002	-3.84%	-0.10%	1.75%	-3.99%	-1.84%	-8.01%	-3.32%	9.55%	-10.09%	0.43%	4.44%	-6.14%	-1.76%	-20.55%	-21.58%	1.03%
2003	-1.47%	-2.57%	2.81%	7.44%	5.34%	0.70%	1.98%	1.44%	-0.47%	2.60%	0.81%	5.01%	1.97%	25.79%	28.18%	-2.40%
2004	1.98%	1.36%	-1.32%	-1.89%	1.71%	1.68%	-3.22%	-0.33%	1.52%	0.91%	4.45%	3.01%	0.82%	10.03%	10.70%	-0.67%
2005	-2.24%	2.09%	-1.83%	-1.87%	3.22%	0.15%	3.83%	-0.94%	0.80%	-2.37%	4.40%	-0.19%	0.42%	4.83%	4.83%	0.00%
2006	2.40%	0.57%	1.65%	1.26%	-3.01%	0.26%	1.47%	2.18%	2.70%	3.15%	1.99%	1.34%	1.33%	17.03%	15.85%	1.18%
2007	1.50%	-1.96%	1.16%	4.43%	3.39%	-1.46%	-3.13%	1.28%	3.87%	1.36%	-3.87%	-1.13%	0.45%	5.15%	5.15%	0.00%
2008	-6.05%	-1.82%	1.09%	4.77%	1.51%	-5.68%	-1.79%	0.74%	-4.66%	11.77%	0.30%	-2.79%	-0.22%	-3.85%	-36.79%	32.94%
2009	-8.15%	-10.06%	11.35%	7.79%	6.27%	1.40%	6.96%	0.36%	3.95%	1.03%	5.01%	1.91%	2.32%	28.92%	26.35%	2.57%
2010	0.90%	0.77%	6.18%	1.55%	-7.95%	-5.66%	4.81%	-3.12%	8.41%	2.76%	-0.00%	6.69%	1.28%	14.90%	15.06%	-0.15%
2011	2.33%	3.47%	0.01%	2.90%	-1.12%	-1.69%	-2.00%	-1.85%	-4.44%	10.76%	-3.30%	0.82%	0.49%	5.15%	1.89%	3.25%
2012	4.64%	4.34%	3.22%	-0.67%	-6.01%	4.06%	-0.47%	2.51%	2.54%	-1.82%	0.57%	0.89%	1.15%	14.09%	15.99%	-1.90%
2013	5.12%	1.28%	3.80%	1.92%	2.36%	-1.33%	5.17%	-3.00%	3.16%	4.63%	2.96%	2.59%	2.39%	32.31%	32.31%	0.00%
2014	-3.52%	4.55%	0.83%	0.70%	2.32%	2.06%	-1.34%	3.95%	-1.38%	2.36%	2.75%	-0.25%	1.08%	13.46%	13.46%	0.00%
2015	-2.96%	5.62%	-1.57%	0.98%	1.29%	-2.03%	2.26%	-6.09%	-3.21%	8.21%	1.31%	-3.57%	0.02%	-0.68%	1.23%	-1.91%
2016	-2.02%	-0.06%	6.22%	0.26%	2.81%	2.76%	3.61%	0.28%	0.01%	-1.73%	2.90%	2.03%	1.42%	18.09%	12.00%	6.09%
2017	1.79%	3.93%	0.12%	0.99%	1.41%	0.64%	2.06%	0.29%	2.01%	2.36%	3.06%	1.21%	1.66%	21.71%	21.71%	0.00%
2018	5.64%	-3.64%	-2.74%	0.52%	2.43%	0.58%	3.70%	3.19%	0.59%	-6.91%	1.85%	-8.80%	-0.30%	-4.57%	-4.57%	0.00%
2019	5.24%	3.24%	3.43%	4.20%	-6.38%	3.83%	1.50%	-1.21%	1.32%	1.60%	3.63%	4.68%	2.09%	27.45%	31.22%	-3.78%
2020	-0.04%	-7.92%	8.93%	12.70%	5.82%	-0.69%	5.89%	7.14%	-1.46%	-1.83%	6.37%	3.51%	3.20%	43.49%	18.33%	25.16%
2021	-1.02%	2.78%	4.54%	5.29%	0.66%	2.24%	2.44%	2.98%	-4.66%	7.02%	-0.80%	4.62%	2.17%	28.73%	28.73%	0.00%
2022	-5.27%	-2.95%	3.76%	-8.78%	0.76%	-7.78%	7.11%	-1.21%	-6.22%	6.23%	4.50%	-3.79%	-1.14%	-14.31%	-18.18%	3.87%
2023	5.76%	-2.19%	5.43%	1.11%	0.34%	7.04%	3.14%	-1.63%	-4.74%	-2.17%	7.93%	4.57%	2.05%	26.37%	26.18%	0.19%
2024	1.59%	5.22%	3.27%	-4.03%	5.06%	3.53%	1.21%	2.34%	2.10%	-0.89%	5.96%	-2.41%	1.91%	24.89%	24.89%	0.00%
2025	2.69%	-1.27%	-5.57%	2.03%	6.06%	2.19%	-	-	-	-	-	-	1.02%	5.88%	3.08%	2.80%

Figure 4: Monthly return heatmap by calendar year.

(a) 30-day rolling volatility, beta and correlation.



(b) 30-day rolling VaR & CVaR.

Figure 5: Rolling metrics.

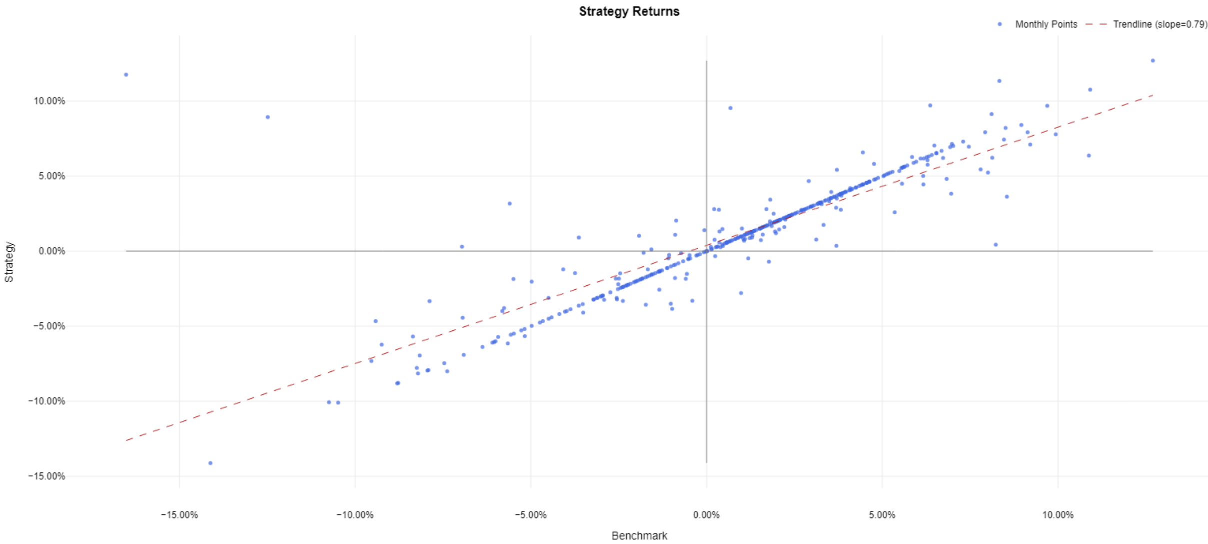
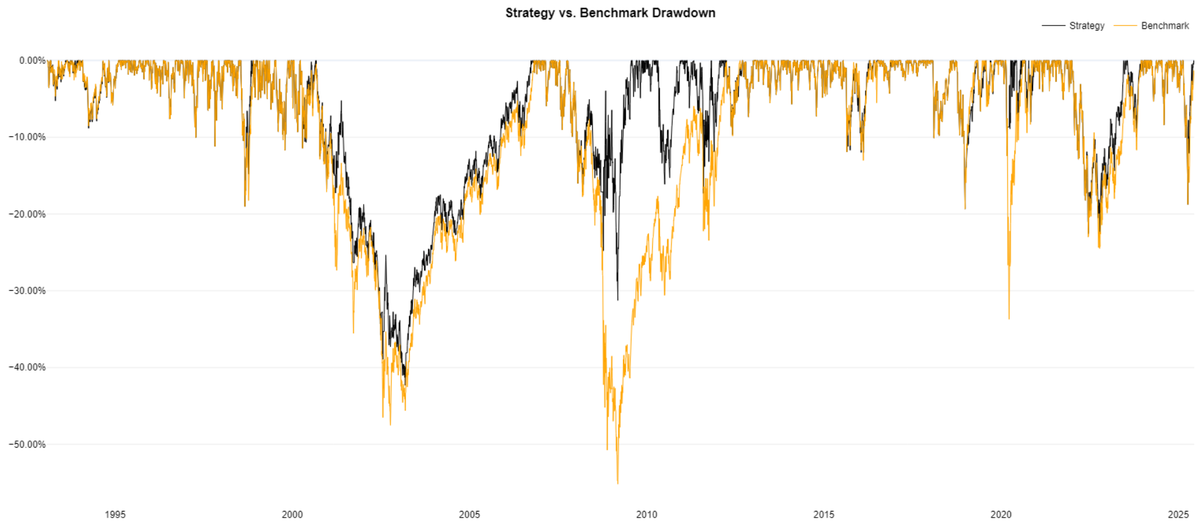
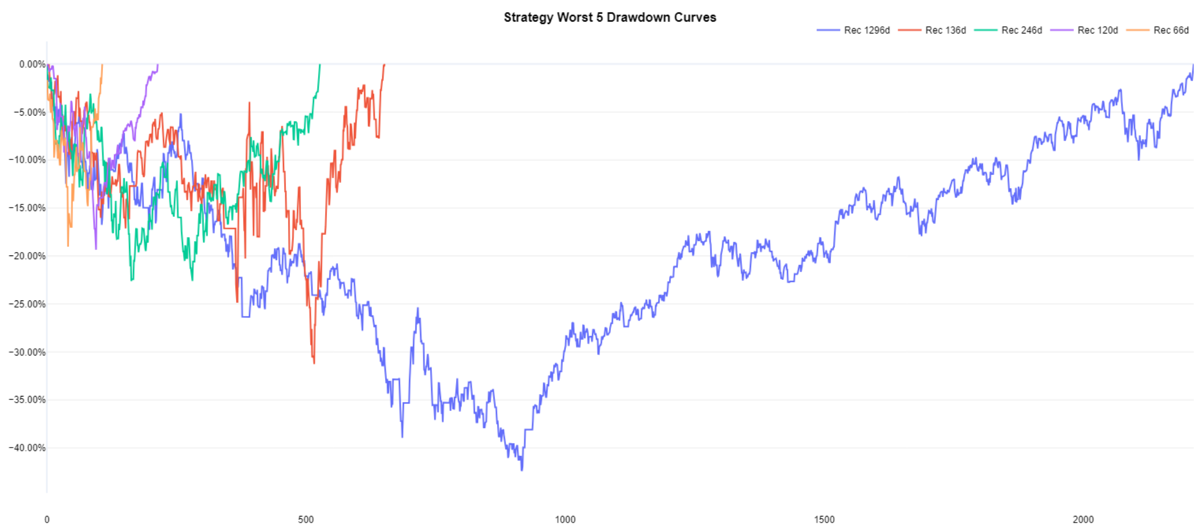


Figure 6: Linear regression of strategy returns against SPY benchmark.



(a) Overall drawdown profile.



(b) Worst 5 drawdown recovery curves.

Figure 7: Drawdown and recovery analysis.