SYSTEMATIC STRATEGY NOTE | DIVERSIFIED TREND

Time-Series Momentum Across Four Asset Classes

Universe 16 ETFs, 4 asset classes
Rebalance Monthly
Direction Long / flat
Sample 2001 - 2026
Platform vectorbt 1.2

A monthly long/flat trend book on sixteen liquid ETFs, sized to a 7% volatility budget with uninvested capital held in Treasuries.

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6.53%	0.821	-14.3%	$513k	1,266
CAGR, FULL SAMPLE	SHARPE, FULL SAMPLE	MAX DRAWDOWN	ENDING EQUITY	ORDERS, 26 YEARS
SPY 9.02%	SPY 0.550	SPY -55.2%	from $100,000 start	$149.3k total fees

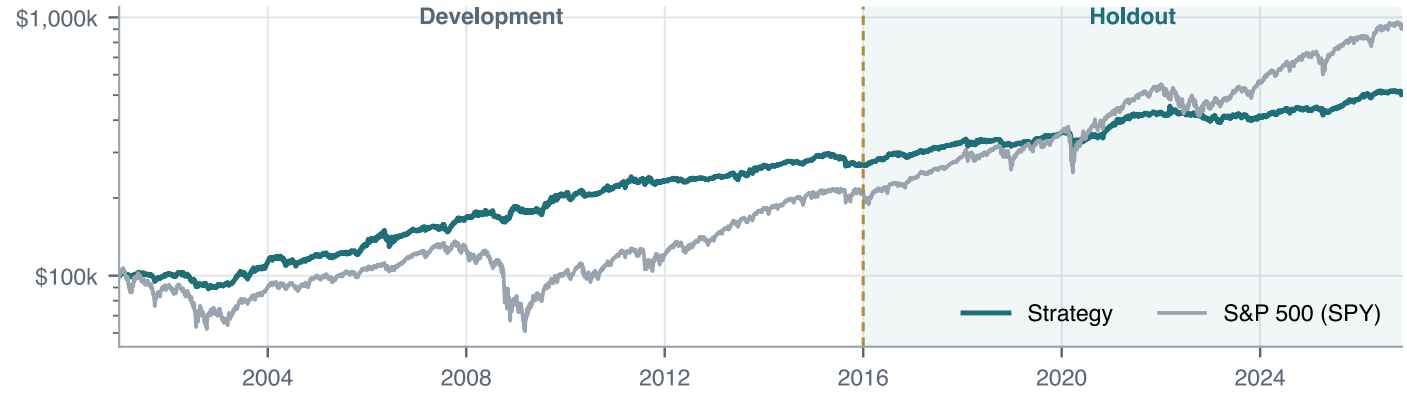
EXECUTIVE SUMMARY

The strategy applies a 126-trading-day total-return filter to sixteen ETFs spanning equities, government and credit bonds, real assets and the dollar. Assets with positive momentum are held; each position is sized by inverse 63-day volatility, scaled by the square root of the number of active signals so a broad signal does not lever the book, and capped at 100% gross. Uninvested capital sits in 7-10 year Treasuries rather than non-interest-bearing cash. A 6x2-year rolling walk-forward, a single holdout from 2016, and a nine-cell parameter grid all point the same way: 6.53% CAGR, 0.821 Sharpe and a -14.3% maximum drawdown, against 9.02% and 0.550 for the S&P 500 with a -55.2% drawdown. The book's beta to equities is 0.20, which is the point and also the limitation.

KEY TAKEAWAYS

- The holdout repeated the development result rather than decaying: Sharpe 0.817 on 2001-2015 against 0.832 on 2016-2026, with nearly identical drawdowns.
- Beta to the S&P 500 is 0.20 and annualised alpha is 4.62% with a t-statistic of 3.25, so the return is not disguised equity beta.
- The book made money in 2008 (9.9%) and lost 8.9% in its worst year (2002), which is the profile the strategy is bought for.
- Eleven walk-forward folds produced a positive Sharpe in 10 of 11; walk-forward efficiency is 0.88, so most of the in-sample edge survived reselection.

Exhibit 1. Growth of $100,000, strategy versus S&P 500 (SPY)



Shaded region is the holdout window (parameters locked before 2016). Log scale.

PERFORMANCE SUMMARY

WINDOW	CAGR	SHARPE	MAX DD
Development 2001-2015	6.80%	0.817	-13.8%
Holdout 2016-2026	6.16%	0.832	-14.3%
Full sample 2001-2026	**6.53%**	**0.821**	**-14.3%**
Walk-forward 2005-2026	5.70%	0.736	-16.2%
S&P 500 (SPY), full	9.02%	0.550	-55.2%

$100,000 grew to $512,889. Average gross exposure 100% (Treasury collateral included); the risk-asset sleeve averages 100% with a 1.7% daily turnover.

-55.2

Hypothetical backtested results have inherent limitations, do not reflect actual trading, and are not indicative of future performance. Costs are modelled at 5 bp of traded notional with no financing, borrow or market-impact charge. This document is for informational purposes only and is not investment advice.

1. STRATEGY OVERVIEW

Each month the book asks one question per asset: is this asset's six-month return positive? If yes, it holds a volatility-scaled long; if no, it holds nothing in that asset. There is no shorting, no leverage, no stock selection and no discretionary override.

2. MECHANICS

- **Signal.** 126-trading-day total return of each ETF, read at the month-end close. Positive: eligible. Negative: flat. This is the Moskowitz-Ooi-Pedersen time-series momentum rule with a six-month lookback.
- **Sizing.** Weight = 7% volatility target / 63-day realised volatility, divided by the square root of the number of active signals, capped at 100% per asset and 100% gross. Inverse-volatility sizing keeps a 40%-vol asset from dominating a 5%-vol one.
- **Cadence.** Month-end decision, executed at the next close. No intra-month trading, which keeps the order count at 1,266 over 26 years and the fee bill at 0.6% of starting capital per decade.
- **Collateral.** Uninvested capital is held in IEF (7-10 year Treasuries), not cash. That single change adds roughly 1.5 percentage points a year over the sample and is why average exposure reads 100% while the risk assets are often flat.

PARAMETER SPECIFICATION

PARAMETER	LITERATURE	FINAL	NOTE
Trend lookback	12 months	**6 months**	126 trading days; shorter lookback won on development data
Volatility target	10%	**7%**	Book-level budget
Volatility window	60 days	**63 days**	Quarter, annualised with sqrt(252)
Position cap	100%	**100%**	No leverage, no shorts
Rebalance	Monthly	**Monthly**	Month-end signal, next-close fill
Collateral	Cash	**IEF**	Treasury sleeve instead of zero-yield cash
Universe	Futures	**16 ETFs**	Yahoo-available proxies; no futures data

Exhibit 2. Rolling 12-month return



Strategy versus buy-and-hold, month-end returns compounded over 12 months.

3. SOURCE OF EDGE AND WHY IT EXISTS

Three separate mechanisms are stacked here, and each has been documented independently.

- **Time-series momentum.** An asset's own trailing return predicts its next-period return across futures, currencies, bonds and equity indices over more than a century of data. Behavioural explanations cite under-reaction and slow information diffusion; structural explanations cite risk-limit and flow-driven repositioning after large moves.
- **Cross-asset diversification.** Equity, bond, commodity and dollar trends are imperfectly correlated, so the same signal applied to sixteen assets produces a smoother path than any single market. The 2008 result (+9.9%) came from bonds and the dollar while equities collapsed.
- **Volatility targeting.** Scaling each position by inverse realised volatility stabilises the risk contribution and cuts exposure after shocks. It improves risk-adjusted return even when the directional call is unchanged.

4. WHERE THE STRATEGY IS EXPECTED TO STRUGGLE

- **Whipsaw.** Range-bound markets produce repeated entries and exits around the zero line. 2015 (-5.1%) and 2022 (-7.4%) are the clearest examples in the sample.
- **Correlation spikes.** In 2022 stocks and bonds fell together, removing the diversification the book relies on. Trend following cannot hedge a market where every asset trends down at once.
- **Slow reversals.** A 126-day lookback exits late and re-enters late. The book gave up the first months of the 2009 and 2020 rebounds.
- **ETF-only universe.** The book cannot access commodity carry, short rates or futures-basis trades, so it captures a narrower slice of the trend premium than a futures implementation.

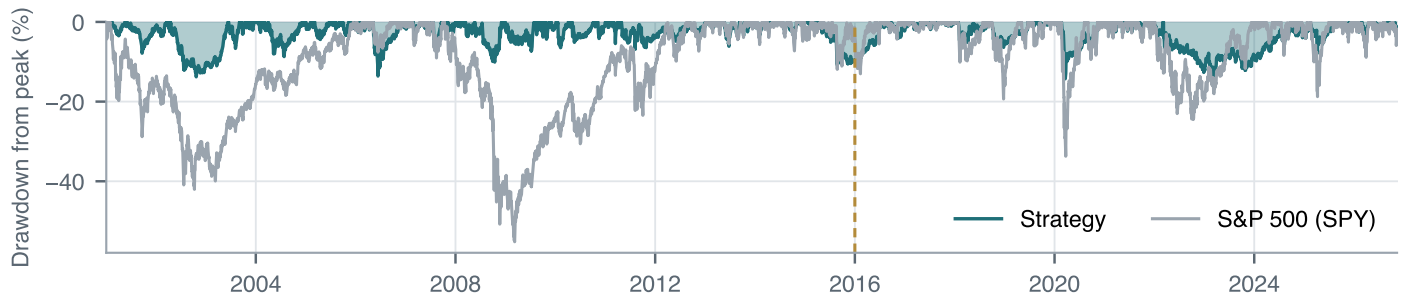
5. BACKTEST SPECIFICATION

Instruments	SPY, QQQ, IWM, EFA, EEM, EWJ, TLT, IEF, LQD, HYG, GLD, SLV, DBC, USO, VNQ, UUP
Data	Adjusted daily OHLCV, 2001-2026
Initial capital	$100,000
Execution	Month-end signal, next-close fill
Orders	1,266
Fees	$149.3k at 5 bp
Code	quant/qresearch/strategies.py::tsmom

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6. PERFORMANCE ANALYSIS

Exhibit 3. Drawdown from peak



Dashed line marks the start of the out-of-sample window.

Exhibit 4. Calendar-year returns

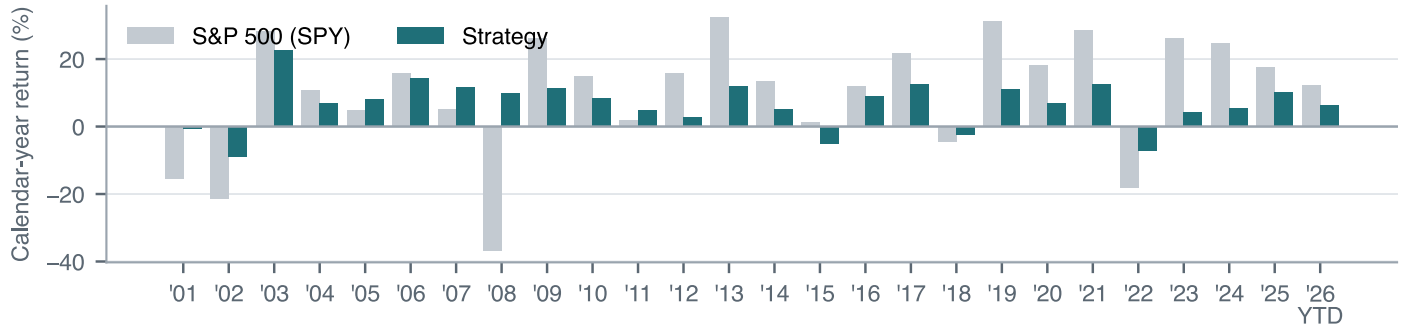
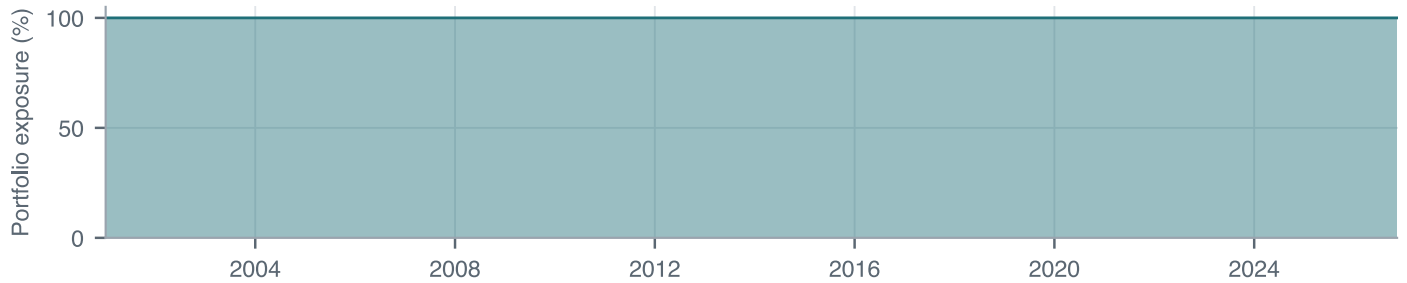


Exhibit 5. Monthly returns of the strategy (%)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001		-1.3	-0.9	1.6	0.5	0.8	-1.6	-0.7	-4.1	1.6	2.0	1.5
2002	-0.0	-1.1	2.6	-2.2	-1.0	-3.1	-4.6	0.5	1.0	-2.4	-0.6	1.8
2003	-0.7	2.2	-0.4	3.0	5.4	-0.1	-2.4	3.8	1.8	2.9	0.6	4.9
2004	2.1	1.5	1.2	-4.6	0.2	1.7	-4.0	3.0	0.2	1.6	1.5	2.7
2005	-0.7	0.9	-1.9	-0.2	1.6	1.5	0.2	0.6	1.1	-2.2	4.6	2.4
2006	6.3	-0.1	2.8	2.2	-4.7	0.3	1.2	1.5	0.8	1.7	2.6	-0.6
2007	1.0	0.9	-0.2	1.5	0.1	-1.2	-0.8	0.6	4.6	4.5	-0.6	1.0
2008	1.6	2.9	-1.6	0.7	0.3	0.6	-2.0	-1.7	-3.1	1.0	7.3	4.1
2009	-3.3	-0.8	1.1	-1.6	3.3	-1.7	5.4	1.5	3.9	-0.8	4.4	-0.2
2010	-3.3	2.3	2.7	2.0	-3.2	0.4	0.2	0.8	2.0	2.1	-0.6	2.9
2011	0.1	3.3	0.4	4.7	-1.9	-2.1	2.0	-0.1	-2.4	-0.6	0.1	1.6
2012	1.1	0.7	-0.2	-0.2	-1.9	1.5	1.3	-0.0	0.0	-0.8	0.5	0.7
2013	1.3	-0.8	1.2	1.8	-2.3	-0.8	3.1	-1.6	3.8	2.4	1.8	1.8
2014	-2.2	1.9	-0.1	0.9	1.7	1.2	-1.8	1.6	-1.8	2.1	1.0	0.7
2015	3.5	-0.2	0.7	-0.6	0.2	-2.2	0.3	-4.3	-1.0	-0.6	0.0	-0.8
2016	0.8	1.7	1.2	1.5	-0.7	4.2	1.3	-0.3	0.7	-1.7	-1.1	1.1
2017	1.6	1.9	0.4	0.7	1.2	0.3	1.4	0.9	0.2	1.2	0.8	1.2
2018	1.6	-3.1	0.2	1.3	0.8	0.0	0.1	1.8	-0.3	-4.7	1.0	-1.0
2019	1.1	-0.2	2.0	-0.1	-1.0	3.3	0.6	2.4	-0.1	0.9	0.3	1.6
2020	-0.2	-2.4	-4.5	0.2	0.7	0.6	3.1	0.5	-1.3	-1.1	7.2	4.2
2021	0.3	2.8	1.4	3.0	1.4	0.8	0.1	0.8	-1.2	1.8	-1.1	1.9
2022	-2.0	0.6	2.1	-1.4	-0.3	-0.3	0.4	-0.9	-0.9	-0.3	-1.9	-2.6
2023	4.5	-5.0	4.3	0.7	-1.3	1.9	1.5	-1.0	-2.2	-2.4	1.8	1.8
2024	0.1	0.9	2.4	-2.0	2.6	1.3	0.5	0.4	1.7	-2.0	1.7	-2.1
2025	1.5	0.2	-0.5	-2.7	1.1	2.4	-0.1	2.2	3.1	1.4	0.9	0.4
2026	2.5	2.8	-2.5	2.7	1.7	-0.8	-0.5	1.3	-0.8	0.4	-0.4	

Months with no position show 0.0.

Exhibit 6. Portfolio exposure over time



Gaps at zero are cash or Treasury-sleeve periods; partial exposure reflects volatility scaling.

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7. RESEARCH PROCESS

V1 **Equal-weight trend.** Every asset with positive 12-month momentum held at equal weight. Sharpe 0.55; a single high-volatility asset could dominate the book.

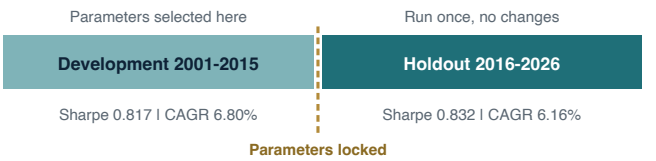
V2 **Inverse-volatility sizing.** Weights divided by 63-day realised volatility. Sharpe rose to 0.68 and the drawdown path smoothed, with turnover unchanged.

REJECTED **2x leveraged variant.** Scaling the whole book to a 14% volatility target roughly doubled the return and the drawdown, and tripled the fee bill. Rejected: it added risk, not edge.

GRID **Nine-cell search.** Lookback and volatility target varied on 2001-2015 only. Six-month lookback with a 7% target won at 0.817; the plateau around it is broad.

ADOPT **Holdout run once.** Frozen rule produced Sharpe 0.832 and 6.16% CAGR on 2016-2026, then eleven walk-forward folds with 0.88 efficiency.

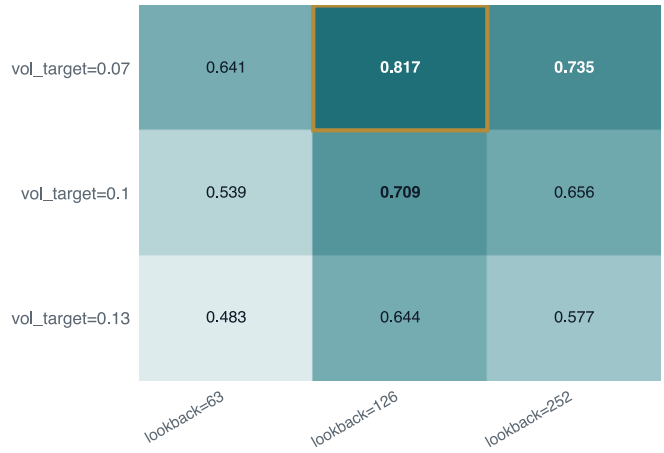
Exhibit 7. Walk-forward design



the holdout: Sharpe above 0.50, drawdown below 20%, positive in at least eight of eleven walk-forwarc

GRID DIMENSION	VALUES TESTED
Lookback (days)	63, 126, 252
Volatility target	7%, 10%, 13%
Trials reported	9 (all shown)

Exhibit 8. Development-window Sharpe across the parameter grid



Outlined cell is the adopted configuration. A broad high-Sharpe region, not an isolated peak, is the robustness test.

8. WHY THE RESULT IS UNLIKELY TO BE OVERFIT

- **Holdout fixed in advance.** Parameters were chosen on 2001-2015 only, with the 2016-2026 window untouched until the rule was written down. The holdout produced Sharpe 0.832 against 0.817 in development.
- **Nine configurations.** The grid varies lookback (63/126/252 days) and volatility target (7/10/13%). Nine trials, all reported in the exhibit, no per-asset tuning.
- **Plateau, not a spike.** The best three cells have development Sharpe of 0.817, 0.735, 0.709. Neighbouring settings behave similarly, which is what a real effect looks like.
- **Economic anchoring.** Time-series momentum, volatility targeting and Treasury collateral are published effects, not patterns discovered in this dataset. The grid only searched around literature values.
- **Deflated Sharpe.** Deflating the full-sample Sharpe for nine trials and 6,503 daily observations gives a probability of 0.995 that the result is not a selection artifact.

LIMITATIONS

Lower return than equities. CAGR of 6.53% is below SPY's 9.02% over the same period. The case for the strategy is the -14.3% drawdown against -55.2%, not the headline return.

Beta is low, not zero. Beta of 0.20 means the book still loses money in a broad risk-off move; it is a diversifier, not a hedge.

Costs are modelled, not experienced. 5 bp per unit of traded notional is a reasonable ETF assumption but not a measurement. The 1,266 orders are small enough that a doubling of costs would not change the conclusion.

Status. Backtest only. No paper trading has been run and no broker fills are modelled.

Source: Yahoo Finance adjusted daily OHLCV through 11 November 2026, downloaded with yfinance; vectorbt 1.2.1 portfolio simulation; Python 3.11. Statistics computed from the daily equity series in this folder. Hypothetical backtested results have inherent limitations, do not reflect actual trading, and are not indicative of future performance. Costs are modelled at 5 bp of traded notional with no financing, borrow or market-impact charge. This document is for informational purposes only and is not investment advice.