RESEARCH NOTE | TRIPLE-BARRIER METHODS

The Triple Barrier, Tested on Four Primaries

Meta-labelling, barrier exits and barrier stops applied to four systematic books: where the method adds value, and the three places it does not.

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Method Triple barrier (upper / lower / time)
Primaries 4 systematic books
Meta-model Random forest, 19 features
Sample 2001 - 2026
Platform vectorbt 1.2, scikit-learn

0.507	0.736 to 0.750	0.650 to 0.801	0.888 to 0.619	1,984
META-MODEL OUT-OF-SAMPLE AUC	WALK-FORWARD SHARPE, TREND BOOK	WALK-FORWARD SHARPE, BREAKOUT BOOK	WALK-FORWARD SHARPE, VOL-MANAGED BOOK	ORDERS, BARRIER-STOPPED BREAKOUT
0.500 = no skill	base to barrier-stopped	the one clear improvement	the barrier hurts here	$452.2k fees

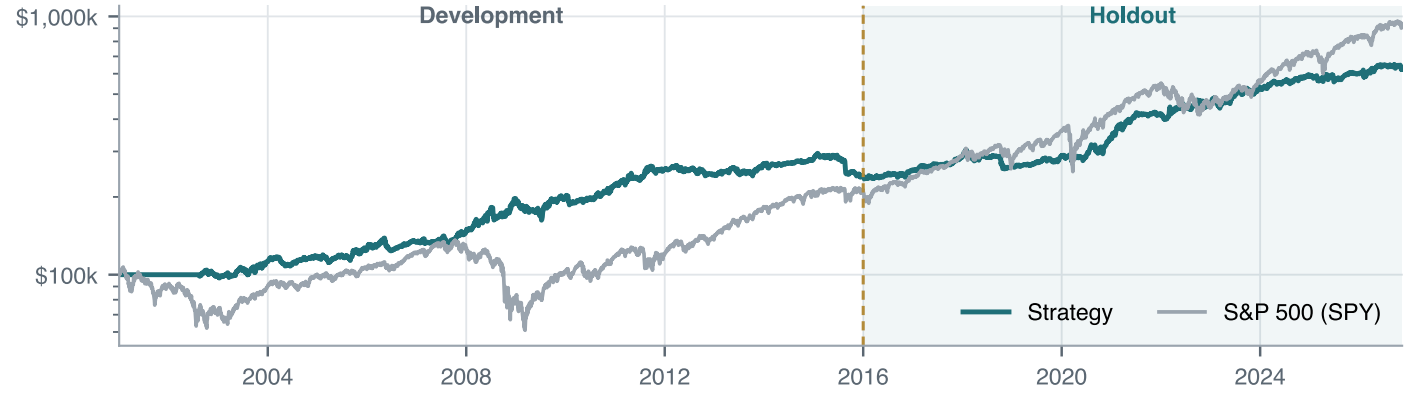
EXECUTIVE SUMMARY

Three uses of the triple-barrier method were implemented and tested out of sample on four primary books. First, a meta-labelling classifier that predicts whether a trade will touch its profit barrier before its stop: out-of-sample AUC averaged 0.507 across the four primaries, indistinguishable from a coin flip, so position sizes derived from it were not adopted. Second, replacing channel exits with profit-target, stop and time-barrier exits: this cut trend winners and raised order counts past 6,000, with a Sharpe ratio below 0.55 on every primary. Third, keeping the primaries and adding only the stop leg with a vertical barrier: this improved the walk-forward Sharpe for the breakout book (0.650 to 0.801) and the sector-rotation book (0.549 to 0.657), left the trend book unchanged, and hurt the volatility-managed book (0.888 to 0.619). The exhibit is the breakout book with the barrier stop, the best of the four.

KEY TAKEAWAYS

- A random forest on nineteen technical and market-state features cannot predict whether a 21-day trade reaches its profit barrier first: mean AUC 0.507, with fold-level AUCs ranging from 0.440 to 0.602.
- The profit-target leg is the destructive one. Cutting winners at 2 conditional volatilities removed the positive skew that trend following depends on.
- The stop leg is the useful one, and only where the primary re-enters quickly. For a monthly book the stopped position is out for a month, which is a different and much larger decision than a stop.
- The barrier overlay is a risk-control change, not a new strategy: in the holdout it changed almost nothing, which is itself the finding.

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
Breakout + barrier stop, full	**7.38%**	**0.782**	**-20.5%**
Breakout, no barrier	6.19%	0.650	-20.5%
Breakout + barrier, holdout	9.32%	0.982	-15.9%
Breakout + barrier, walk-forward	7.80%	0.801	-20.5%
S&P 500 (SPY), full	9.02%	0.550	-55.2%

-55.2

Walk-forward Sharpe by primary, base to barrier-stopped: sector rotation 0.549 to 0.657; trend 0.736 to 0.750; breakout 0.650 to 0.801; vol-managed 0.888 to 0.619.

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

The triple barrier defines three exits for every trade: an upper profit barrier, a lower stop barrier and a vertical time barrier. This note reports what happens when that framework is used to label trades, to exit them, and to size them.

2. MECHANICS

- **Barriers.** Upper = entry x (1 + k_up x sigma x sqrt(h)); lower = entry x (1 - k_dn x sigma x sqrt(h)); vertical = h trading days. sigma is the 21-day realised volatility at entry, so barriers scale with the asset's own risk.
- **Labels.** A trade that touches the upper barrier first is labelled 1, the lower first is 0, and a trade that times out is labelled by the sign of its horizon return. 77,186 date-asset observations across the four primaries.
- **Meta-model.** Random forest (250 trees, depth 4, minimum leaf 75) on 19 features: momentum at four horizons, two volatility estimates, RSI, distance from the 200-day average, drawdown from the 52-week high, a five-day z-score, cross-sectional rank, volume trend, VIX level and percentile, market trend and drawdown, and a credit-spread trend proxy.
- **Validation.** Purged and embargoed: no training label may resolve inside the test window (45 calendar days of buffer for a 21-day horizon). Eleven expanding folds, retrained each fold, scored once.

PARAMETER SPECIFICATION

PARAMETER	LITERATURE	FINAL	NOTE
Upper barrier	2.0 sigma	**not used**	Profit targets cut trend winners
Lower barrier	1.0 sigma	**1.5 sigma**	Wider stop, 126-day vertical barrier
Vertical barrier	21 days	**126 days**	Long enough not to interrupt trends
Label horizon	21 days	**21 days**	Meta-model target
Meta-model	any	**random forest, depth 4**	AUC 0.51 out of sample; not adopted
Features	n/a	**19**	Momentum, volatility, RSI, regime, credit
Purge / embargo	horizon	**45 days**	Horizon plus 24-day buffer

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

Why the method should work, and what the tests found instead.

- **Why meta-labelling should help.** If a secondary model can separate trades that reach their profit barrier from those that do not, position size can follow conviction instead of being fixed. The primary keeps the direction; the secondary keeps the size.
- **What the test found.** Out-of-sample AUC averaged 0.507. Base rates were 0.57-0.60, so the label is not balanced noise; the model simply has no edge on the next 21 days. Two label definitions (absolute barrier, cross-sectional rank) were tried, with the same outcome.
- **Why the stop leg survives.** A stop that is fixed at entry and scaled to volatility truncates the left tail without touching the right tail. That is a risk-control effect, and it shows up as a drawdown reduction rather than a return improvement.

4. WHERE THE STRATEGY IS EXPECTED TO STRUGGLE

- **Profit targets kill trend.** Trend following earns its return from a small number of very large winners. A 2-sigma target caps exactly those trades. Every primary lost Sharpe when the target was enforced.
- **Time barriers cut recovery.** A 63-day vertical barrier exits positions that are merely slow, and then re-enters them, paying costs twice.
- **Classifier overfitting.** Nineteen features and 77,000 rows is enough to fit noise. Depth and leaf-size limits were used to keep the model small; it still produced no out-of-sample signal.
- **Regime mismatch.** The meta-model is trained on all regimes pooled. A model trained only on high-volatility periods might behave differently, but that is a new research question, not a result.

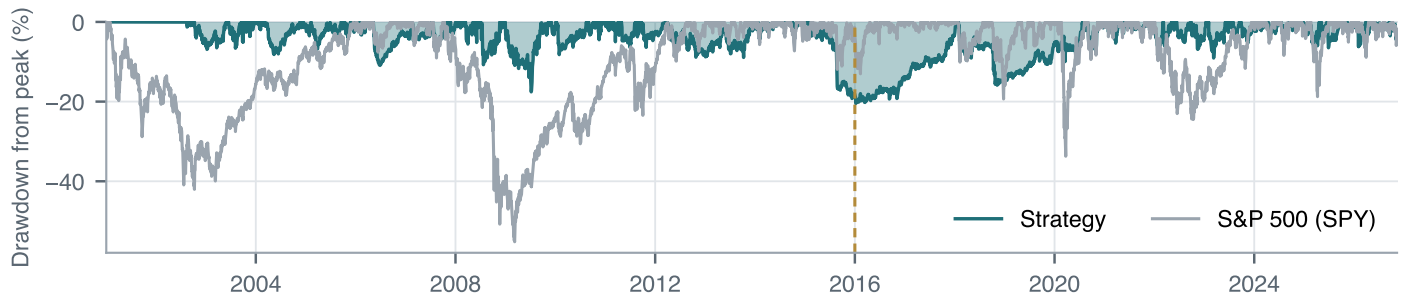
5. BACKTEST SPECIFICATION

Primaries	sector rotation, time-series momentum, breakout, vol-managed equity
Barriers	volatility-scaled, fixed at entry
Labels	77,186 date-asset observations
Model	RandomForestClassifier, 250 trees, depth 4
Validation	11 purged walk-forward folds
Code	quant/qresearch/triple_barrier.py
Status	Two uses rejected, one adopted as a risk control

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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

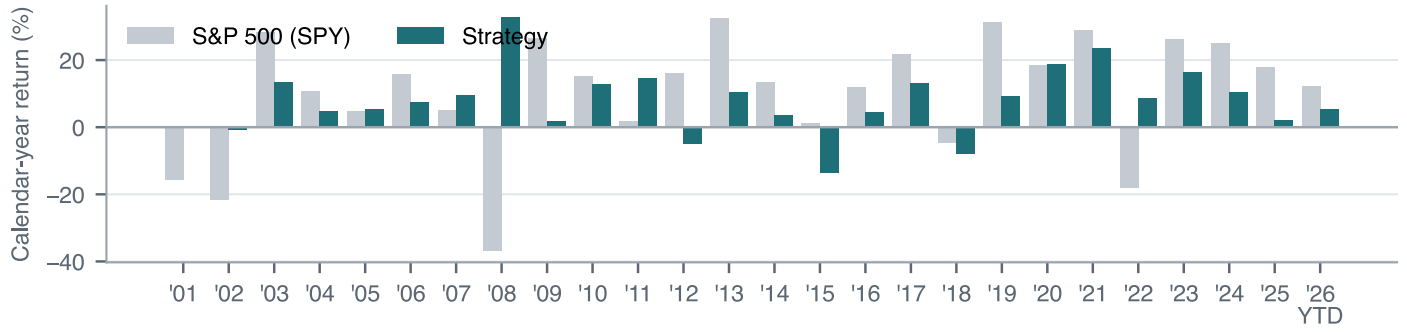
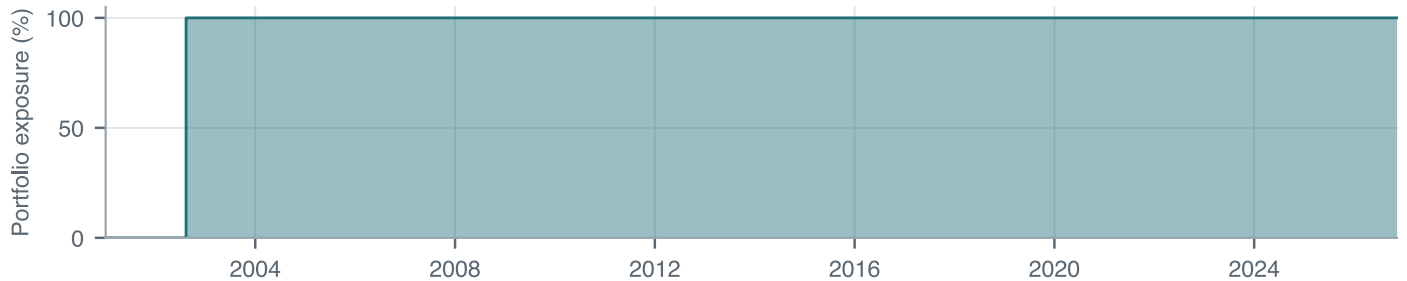


Exhibit 5. Monthly returns of the strategy (%)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	3.9	-1.3	-2.0	-1.3
2003	-0.8	2.3	-0.9	0.1	4.5	-0.6	-0.1	1.1	-2.8	6.5	0.9	3.0
2004	1.7	1.3	-0.5	-4.7	-0.5	0.7	1.2	2.7	0.6	0.7	-0.3	1.9
2005	-1.7	-0.2	-2.7	2.5	2.1	1.1	-1.3	-2.6	7.6	-0.7	1.0	0.7
2006	4.7	-0.7	2.2	3.0	-6.0	-2.8	1.7	2.0	1.4	1.3	1.9	-1.1
2007	0.4	-0.6	-0.3	0.8	0.8	-0.3	1.3	-2.3	2.8	4.5	0.3	1.9
2008	3.1	4.5	-0.6	2.1	3.0	7.5	-6.8	2.0	-0.3	2.6	7.0	5.3
2009	-6.3	-1.8	0.9	-1.6	-0.1	-1.5	5.2	2.6	3.2	-1.8	5.2	-1.4
2010	-5.9	2.2	1.1	0.9	0.1	2.3	-0.6	4.9	-0.7	2.0	0.3	6.1
2011	0.0	3.4	0.6	6.4	-3.3	-2.8	3.9	5.0	2.3	-3.0	1.4	0.4
2012	-0.3	2.2	-0.0	-0.8	-1.2	-1.4	1.7	-3.7	2.2	-3.5	1.0	-0.9
2013	0.9	0.5	1.9	2.0	-0.3	-3.1	0.2	-0.3	-1.0	3.4	3.2	2.8
2014	-2.5	2.3	-1.0	0.0	1.2	0.7	-0.7	2.3	-0.1	-0.8	2.1	0.1
2015	5.7	-2.3	-1.1	-0.8	1.7	-2.3	-0.9	-11.8	1.6	-0.6	-0.9	-1.8
2016	-1.3	0.6	-0.2	0.3	-0.2	2.4	0.5	-1.0	1.0	-1.1	2.9	0.8
2017	0.6	3.2	0.7	-0.1	1.3	-0.7	0.3	1.3	-1.1	3.2	2.6	1.0
2018	5.9	-6.1	-2.2	0.9	3.5	-1.5	-0.2	1.5	-0.6	-9.7	0.4	1.0
2019	1.1	-0.8	1.4	0.2	0.7	1.0	0.5	3.3	-0.9	-1.4	0.7	3.1
2020	-1.5	1.1	-0.5	-0.3	0.1	1.7	8.3	1.1	-4.1	-3.1	10.6	4.7
2021	1.8	6.6	0.3	6.1	1.7	4.6	0.2	0.0	-1.5	2.0	-1.2	1.0
2022	-5.0	3.3	3.6	3.2	0.7	-0.6	-0.6	2.9	3.6	-0.4	-3.0	1.2
2023	5.1	-5.9	3.2	0.4	1.3	6.4	3.4	-3.0	3.2	-1.9	0.6	3.0
2024	0.2	1.5	2.9	-0.6	-0.5	2.0	0.7	-1.1	2.6	0.9	0.9	0.8
2025	-1.1	-2.4	2.2	1.1	-0.4	-4.0	2.7	0.7	2.8	1.7	-0.3	-0.8
2026	-0.3	0.4	3.6	1.8	1.8	0.9	-1.7	0.6	-0.5	0.3	-1.5	

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.

7. RESEARCH PROCESS

V1 **Barrier exits.** Profit target, stop and time barrier replaced channel exits on all four primaries. Sharpe fell to 0.40-0.55 and order counts passed 6,000. Rejected.

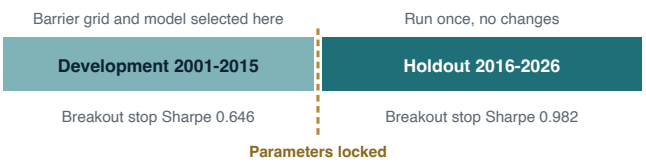
V2 **Meta-labelling.** Random forest on barrier labels, purged walk-forward. Out-of-sample AUC 0.51; probability-scaled positions halved exposure and return with no Sharpe gain. Rejected.

V3 **Relative labels.** Cross-sectional rank labels instead of absolute barrier hits: AUC 0.507. The classifier has no edge on relative 21-day outcomes either.

V4 **Stop-only overlay.** Kept the primaries, added the lower barrier and vertical barrier only. Improved walk-forward Sharpe for breakout and rotation, neutral for trend, negative for vol-managed.

ADOPT **Barrier stop on the breakout book.** Holdout Sharpe 0.982, walk-forward 0.801 against 0.650 without the stop.

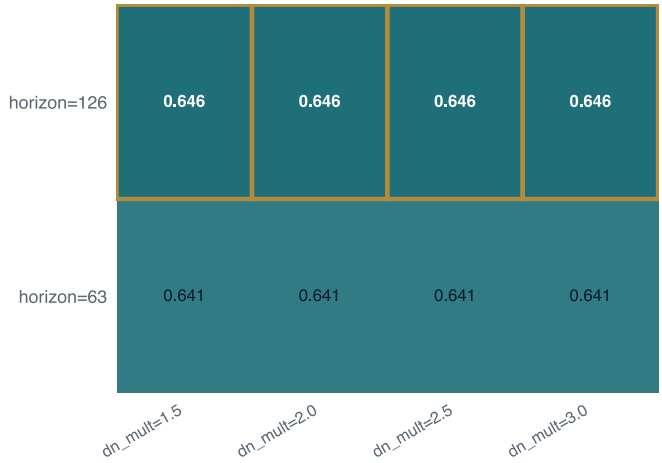
Exhibit 7. Walk-forward design



› set before the holdout: keep the barrier overlay only if it improves walk-forward Sharpe without raising

GRID DIMENSION	VALUES TESTED
Stop width	1.5, 2.0, 2.5, 3.0 sigma
Vertical barrier	63, 126 days
Trials reported	8 per primary

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

- **Purged walk-forward.** Labels overlap by construction; every training set is purged by horizon plus embargo, and every test window is scored once.
- **Small model.** Depth 4 and a 75-row minimum leaf limit the tree count that can fire on any single split. A larger model scored worse out of sample, as expected.
- **Multiple label definitions.** Absolute barrier and cross-sectional rank labels were both tested. Neither produced AUC above 0.52, which makes a lucky single specification less likely.
- **Barrier grid.** Stop width (1.5-3.0 sigma) and horizon (63/126 days) were scored on 2001-2015 only, then run once on the holdout.
- **Economic anchoring.** Barrier widths are expressed in units of the asset's own volatility, not in price levels, so the rule transfers across assets and regimes.

LIMITATIONS

Negative result. The headline conclusion is a rejection of two of the three uses of the method on this data. That is a legitimate research output but it is not a product.

One horizon family. Labels used 21-day and 5-day horizons for the daily books. Longer horizons (63 days) were tested for exits but not for the classifier.

Feature set. Price and volume only. The method might work with fundamental, positioning or order-flow features; nothing here rules that out.

Status. Research only. The barrier-stopped breakout book is a backtest, not a traded strategy.

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. Barrier definitions follow Lopez de Prado, Advances in Financial Machine Learning (2018), ch. 3. 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.