Bollinger Bands and RSI · Apple

Strategy evaluated · Development · Sample 2014-01-30 14:30:00+00:00 to 2018-12-31 14:30:00+00:00

N/A marks an undefined or missing value. Return and risk fractions are shown as percentages. The JSON evidence preserves the original precision of the results.

Assessment limits

Survivorship bias. Not assessed. Evidence on historical universe membership is missing.

Look-ahead bias. Not assessed. The report does not verify when signals became available.

Multiple testing. DSR and PBO cannot be assessed from the evidence supplied.

Costs and execution. Gross and net returns were reconciled with recorded costs. Cost sensitivity and actual execution were not assessed.

Use of AI. The engine computes the metrics. Use of AI in strategy development was not assessed.

Advice. This report does not constitute investment advice.

Performance and risk

Absolute performance · Strategy and benchmark

Metric	Strategy	Benchmark
Annualized arithmetic return `annual_return_arithmetic`	10.4472%	4.24157%
Annualized volatility `annual_volatility`	16.1316%	15.1982%
Periods per year `annualization`	252	252
Annualized compound return (CAGR) `cagr`	9.60524%	3.12931%
Calmar `calmar`	0.4797185	0.1477048
Excess kurtosis `excess_kurtosis`	73.69731	7.17415
Alias for the share of positive periods `hit_rate`	13.8015%	52.3002%
Maximum drawdown `max_drawdown`	-20.0226%	-21.1862%
Periods from the previous peak to recovery `max_drawdown_recovery_periods`	266	444
Periods to the maximum drawdown trough `max_drawdown_underwater_periods`	132	185
Observations `n_obs`	1239	1239
Share of positive periods `positive_period_rate`	13.8015%	52.3002%
Annual risk-free rate `risk_free_annual`	0%	0%
Sharpe `sharpe`	0.6476214	0.2790846
Skewness `skewness`	3.430252	-0.7778644

Absolute performance · Strategy and benchmark

Metric	Strategy	Benchmark
Sortino `sortino`	1.047264	0.3810646
Cumulative return `total_return`	56.9774%	16.3577%

Active performance · Strategy versus benchmark

Field	Value
Annualized active return `active_return_annual`	6.20562%
Periods per year `annualization`	252
Benchmark Sharpe ratio `benchmark_sharpe`	0.2790846
Beta `beta`	0.3545834
Correlation with the benchmark `correlation`	0.3340652
Information ratio `information_ratio`	0.3429578
Annualized Jensen alpha `jensen_alpha_annual`	8.9432%
Observations `n_obs`	1239
Annualized regression alpha `regression_alpha_annual`	8.9432%
Annual risk-free rate `risk_free_annual`	0%
Strategy Sharpe ratio `strategy_sharpe`	0.6476214
Annualized tracking error `tracking_error_annual`	18.0944%

Statistical uncertainty

Strategy · Sharpe ratio interval · block bootstrap

Field	Value
Replications attempted `attempted_repetitions`	1000
Block length `block_length`	5
Lower interval bound `ci_lower`	-0.2750739
Upper interval bound `ci_upper`	1.392204
Confidence level `confidence`	95%
Lower-tail probability `lower_probability`	2.5%
Observations `n_obs`	1239
Point estimate `point_estimate`	0.6476214

Strategy · Sharpe ratio interval · block bootstrap	
Field	**Value**
Replications `repetitions`	1000
Seed `seed`	20261116
Standard error `standard_error`	0.4232691
Status `status`	evaluated
Replications with no defined estimate `undefined_repetitions`	0
Upper-tail probability `upper_probability`	97.5%
Valid replications `valid_repetitions`	1000

Strategy · Mean excess return · HAC	
Field	**Value**
Annualized estimate `annualized_estimate`	10.4472%
Annualized standard error `annualized_standard_error`	7.06484%
Estimate per period `estimate`	0.0414571%
Weighting kernel `kernel`	bartlett
Lags `lags`	6
Observations `n_obs`	1239
Two-sided p-value (normal) `p_value_two_sided_normal`	0.1392052
Standard error `standard_error`	0.0280351%
Status `status`	evaluated
t-statistic `t_stat`	1.478757

Benchmark · No uncertainty estimate supplied.

Active performance · Information ratio interval · block bootstrap	
Field	**Value**
Replications attempted `attempted_repetitions`	1000
Block length `block_length`	5
Lower interval bound `ci_lower`	-0.6306932
Upper interval bound `ci_upper`	1.140184
Confidence level `confidence`	95%

Active performance · Information ratio interval · block bootstrap	
Field	**Value**
Lower-tail probability `lower_probability`	2.5%
Observations `n_obs`	1239
Point estimate `point_estimate`	0.3429578
Replications `repetitions`	1000
Seed `seed`	20261116
Standard error `standard_error`	0.4455835
Status `status`	evaluated
Replications with no defined estimate `undefined_repetitions`	0
Upper-tail probability `upper_probability`	97.5%
Valid replications `valid_repetitions`	1000

Active performance · Mean active return · HAC	
Field	**Value**
Annualized estimate `annualized_estimate`	6.20562%
Annualized standard error `annualized_standard_error`	8.26341%
Estimate per period `estimate`	0.0246255%
Weighting kernel `kernel`	bartlett
Lags `lags`	6
Observations `n_obs`	1239
Two-sided p-value (normal) `p_value_two_sided_normal`	0.4526673
Standard error `standard_error`	0.0327913%
Status `status`	evaluated
t-statistic `t_stat`	0.7509756

Subperiods and robustness

Additional metrics · No evidence supplied.

Verification and configuration

Engine checks	
Field	**Value**
Schemas valid `schema_valid`	Yes
Evidence hash valid `hash_valid`	Yes
Signature verified `signature_verified`	No
Confirmatory provenance verified `confirmatory_provenance_verified`	No
`reconciliation.tolerance`	1e-09
Status `reconciliation.status`	reconciled
Metric paths checked `reconciliation.checkedPathCount`	96
Hash bindings valid `hash_bindings_valid`	Yes
Metrics reconciled `metrics_reconciled`	Yes
Simulations reproduced `simulations_reproduced`	Yes
`kernelVersion`	1.1.0

Decision thresholds · No evidence supplied.

Engine configuration	
Field	**Value**
`allowPositional`	No
Periods per year `annualization`	252
Annualization method `annualizationMethod`	declared by StrategyTrace.frequency.periodsPerYear
`calendar`	NASDAQ
Annual risk-free rate `riskFreeAnnual`	0%
`timezone`	UTC
Block length `uncertainty.blockLength`	5
Confidence level `uncertainty.confidence`	95%
`uncertainty.hacLagPolicy.kind`	sample-size-bartlett-v1
Replications `uncertainty.repetitions`	1000
Seed `uncertainty.seed`	20261116
Expected calendar hash `uncertainty.timeBasis.expectedEndsHash`	`ea29aeb3214e614d92ba95297d18012b1e489b2a128bd2da2e0c0be54d461311`
`uncertainty.timeBasis.kind`	session-grid

Monte Carlo

Observed path

Field	Value
Longest losing streak (periods) `longestLosingStreak`	6
Longest stretch below the peak (periods) `longestUnderwaterStreakPeriods`	265
Maximum drawdown magnitude `maximumDrawdown`	20.0226%
Ruin threshold reached `ruined`	No
Terminal wealth (multiple) `terminalWealth`	1.569774
Share of periods below the peak `timeUnderWaterFraction`	41.2429%
Cumulative return `totalReturn`	56.9774%

Circular block bootstrap

Metric	Minimum	Mean	Maximum	Quantiles
Longest losing streak (periods) `longestLosingStreak`	3	4.942	11	5% = 3 · 50% = 5 · 95% = 7
Longest stretch below the peak (periods) `longestUnderwaterStreakPeriods`	93	495.118	1236	5% = 185.9 · 50% = 429 · 95% = 1067
Maximum drawdown magnitude `maximumDrawdown`	7.16207%	22.5882%	54.3417%	5% = 12.847% · 50% = 21.312% · 95% = 37.6134%
Probability of reaching the ruin threshold `ruinProbability`		0%		
Terminal wealth (multiple) `terminalWealth`	0.5268669	1.638926	4.101607	5% = 0.8966119 · 50% = 1.558842 · 95% = 2.6968
Share of periods below the peak `timeUnderWaterFraction`	55.0444%	84.1216%	99.8386%	5% = 69.6449% · 50% = 84.3019% · 95% = 96.7756%
Cumulative return `totalReturn`	-47.3133%	63.8926%	310.161%	5% = -10.3388% · 50% = 55.8842% · 95% = 169.68%

Return-order permutation

Metric	Minimum	Mean	Maximum	Quantiles
Longest losing streak (periods) `longestLosingStreak`	2	3.089	6	5% = 2 · 50% = 3 · 95% = 4
Longest stretch below the peak (periods) `longestUnderwaterStreakPeriods`	130	455.908	1050	5% = 226.9 · 50% = 433 · 95% = 797.5
Maximum drawdown magnitude `maximumDrawdown`	11.7823%	21.6762%	43.2788%	5% = 14.7309% · 50% = 20.9357% · 95% = 31.0812%
Probability of reaching the ruin threshold `ruinProbability`		0%		
Share of periods below the peak `timeUnderWaterFraction`	76.1905%	87.5475%	95.5609%	5% = 82.4818% · 50% = 87.7724% · 95% = 92.0097%

Simulation settings and bindings

Field	Value
`simulationSchemaVersion`	strateva-simulation-evidence/v2

Simulation settings and bindings	
Field	**Value**
`engineVersion`	0.9.0
`kernelVersion`	1.1.0
`observationCount`	1239
`strategyTraceHash`	`4436004d1b7965b1d34582faad0254dfb5fdbf1bf9134771ddc44197a0a5e725`
`contentHash`	`4fcdf06797a568470c4afdac10994eb88451f0b44e02c7294b8fd2f5b6518005`
Block length `configuration.blockLength`	5
Initial wealth `configuration.initialWealth`	1
`configuration.quantiles`	5% · 50% · 95%
Replications `configuration.repetitions`	1000
Ruin threshold (share of initial wealth) `configuration.ruinWealthFraction`	50%
Seed `configuration.seed`	20261116
`classic.method`	CIRCULAR_MOVING_BLOCK_BOOTSTRAP
`classic.sampling`	WITH_REPLACEMENT
`permuted.method`	FISHER_YATES_RETURN_ORDER_PERMUTATION
`permuted.sampling`	WITHOUT_REPLACEMENT
Terminal wealth (multiple) `permuted.terminalWealth`	1.569774
Terminal wealth invariant `permuted.terminalWealthInvariant`	Yes

Provenance and traceability

Evidence and input hashes	
Field	**Value**
`bundleSchemaVersion`	strateva-evidence-bundle/v3
`artifactId`	`urn:strateva:strategy-trace:4436004d1b7965b1d34582faad0254dfb5fdbf1bf9134771ddc44197a0a5e725`
`engineVersion`	0.9.0
`kernelVersion`	1.1.0
`generatedAt`	2026-11-17T13:09:48Z
`contentHash`	`e6cee34e1a6f2aac4d16c7fdfc48debd33dd6e64ae0a2d384b00e36c421ddec3`
Benchmark return series hash `inputHashes.benchmarkReturns`	88b618dbab611c8190158432442c6b5bcf15d042b89e815158390b63b5009e20
Strategy return series hash `inputHashes.strategyReturns`	79455dc0c0aa96c0b3d412120c28c916489865a77035806b07d142dfab102209

Evidence and input hashes	
Field	**Value**
`lineage`	strategyTrace:4436004d1b7965b1d34582faad0254dfb5fdbf1bf9134771ddc44197a0a5e725 · scope:8d601397ea1417c0fc268adbe7b2fc4bd030c3d504068083688c15ad5536d036 · artifact:4c47d48634b9477bf3a0cb4d3bf93622cb9e51aaba5b1f6eb0c7117312a03ef5 · data:15474dc68e11aea7674988ad965b088cbf246bf673c184d43b3cadda5edb30ba

Provenance statement	
Field	**Value**
`claim`	development
`containerImageDigest`	N/A
`engineCommit`	N/A
`freezeHash`	N/A
`runId`	N/A

Evidence signature · No evidence supplied.

StrategyTrace · Identity, frequency, conventions and benchmark	
Field	**Value**
`traceSchemaVersion`	strateva-strategy-trace/v1
`engagementId`	eng-00000001
`runId`	quant-strategies-bollinger-rsi-docker-20261117
`generatedAt`	2026-11-17T13:09:48Z
`scopeContentHash`	`8d601397ea1417c0fc268adbe7b2fc4bd030c3d504068083688c15ad5536d036`
`artifactContentHash`	`4c47d48634b9477bf3a0cb4d3bf93622cb9e51aaba5b1f6eb0c7117312a03ef5`
`dataContentHash`	`15474dc68e11aea7674988ad965b088cbf246bf673c184d43b3cadda5edb30ba`
`frequency.barInterval`	1d
Periods per year `frequency.periodsPerYear`	252
`frequency.calendar`	NASDAQ
`frequency.sourceTimezone`	America/New_York
`conventions.returnType`	SIMPLE
`conventions.returnUnit`	FRACTION
`conventions.timestampMeaning`	UTC_PERIOD_END
`conventions.turnover`	SUM_ABSOLUTE_POSITION_CHANGES
`conventions.exposure`	FRACTION_OF_EQUITY
`conventions.costs`	RETURN_FRACTION
`benchmark.kind`	SERIES
`benchmark.symbol`	URTH
`contentHash`	`4436004d1b7965b1d34582faad0254dfb5fdbf1bf9134771ddc44197a0a5e725`

Notes included in the evidence	
Field	**Value**
`disclosures`	The engine recomputed the metrics from verified StrategyTrace net returns. · Monte Carlo has its own hash. It affects criteria only if preregistered for that purpose.