

14 Alpha Families for Systematic Equity Research

A practical research map covering trend, reversal, relative value, volatility, defensive anomalies, calendar effects and regime adaptation - with a common institutional validation standard.

ALPHA FAMILIES

14

HORIZON RANGE

1-252d

PRIMARY EVIDENCE

OOS

END GOAL

Multi-alpha

RESEARCH PARTNERS

Roberto Cocco & Amin Hydar Ali

Publication standard

This roadmap is a research framework, not a claim that every anomaly is profitable. Each family must survive causal execution, realistic costs, out-of-sample testing, multiple-testing control, parameter stability and eventually true forward observation.

Why diversify alpha mechanisms, not just parameters

The objective is to discover several independent return drivers. A portfolio of robust, low-correlated alphas can be more valuable than a single optimized strategy with a higher in-sample Sharpe.

Alpha-family diversification map



The map is conceptual rather than empirical: correlation must ultimately be measured on synchronized out-of-sample return streams. The key idea is that the families differ in economic mechanism and time horizon.

Family	Core idea	Horizon	Expected relationship to momentum	Priority
Cross-sectional momentum	Buy relative winners	1-12 months	Baseline / high	3/5 - already developed
Short-term mean reversion	Buy recent losers / fade winners	1-10 days	Low or negative	5/5
Residual mean reversion	Fade stock-specific residuals	2-20 days	Low	5/5
Pairs / stat-arb	Trade temporary relative-value divergence	2-30 days	Very low	5/5
Gap reversal	Fade abnormal overnight dislocations	Intraday-5d	Low	4/5
Breakout / trend following	Trade new highs and range expansion	Weeks-months	Moderate/high	4/5
Momentum acceleration	Trade changes in momentum	Weeks-months	Medium	4/5
Volatility expansion	Compression followed by expansion	Days-weeks	Medium-low	4/5
Low-vol / defensive	Favor stable, low-risk equities	Months	Low-medium	4/5
Trend quality	Prefer smooth, efficient trends	Months	Medium	4/5
Seasonality	Calendar-dependent return effects	Days-months	Very low	3/5
Overnight vs intraday	Exploit return decomposition	1-5 days	Very low	4/5
Pairs hybrid	Switch pair logic between MR and continuation	Days-weeks	Adaptive	5/5
Regime switching	Change alpha family by market state	Variable	Potentially low	5/5

One validation framework across all 14 families

Comparability matters. Every family should be judged with the same execution timing, cost model, OOS discipline and reporting standard wherever its market microstructure permits.



Control	Standard
Point-in-time universe	Use historical eligibility and liquidity; avoid selecting securities with future information.
Causal signals	Signal formed with information available at Close T; trade no earlier than the next executable event.
Realistic implementation	Model turnover, commissions, spreads/slippage, borrow for shorts and capacity/impact where relevant.
Walk-forward OOS	Repeated train -> embargo -> future test windows. Final ranking should emphasize pooled fixed-candidate OOS evidence.
Multiple testing	Holm/BH, deflated-Sharpe-style diagnostics, Reality Check / PBO where practical.
Robustness	Parameter neighborhoods, cost stress, subperiods, volatility regimes, bull/bear markets and Monte Carlo.
Locked holdout	Do not use the final holdout to choose parameters. Viewing it repeatedly destroys its independence.
Forward OOS	The strongest evidence is data that did not exist when the strategy was frozen.
Research governance advice Do not use the same historical holdout repeatedly to redesign 14 strategy families. Either maintain family-specific locked holdouts or treat the last historical holdout as diagnostic only and reserve a future-date cutoff as the truly independent test across the entire research program.	

Cross-Sectional Momentum

Ranks stocks against one another and owns the strongest trends. This is the directional benchmark against which the rest of the research program should diversify.

1-12 mo	HIGH	3/5	DONE
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Persistent relative winners may continue to outperform because information diffuses gradually, investor herding persists, and institutional positioning adjusts slowly.

Core signal concept

Conceptual signal

Score_i = rank(Return over medium/long horizon), optionally adjusted for recent skip, volatility, gaps, trend quality or market regime.

Experiments to run

- Lookbacks: 63 / 126 / 189 / 252 / 378 trading days; test recent-skip windows such as 5 / 21 days.
- Single-horizon versus multi-horizon momentum; equal-weight versus weighted combinations.
- Raw momentum versus volatility-adjusted, downside-adjusted, residual and trend-quality scores.
- Top-N concentration, long-only versus market-neutral long/short, monthly versus 4-8 week rebalance.
- Risk overlays: market regime, breadth, volatility targeting, drawdown glide, correlation/crowding.

Portfolio constructions

- Long-only Top-N winners.
- Long-short winners versus losers with gross/net limits.
- Sector-neutral or beta-neutral momentum.
- Rank-weighted or inverse-volatility-weighted books.

Where it may work

Broad trending markets, persistent dispersion, stable leadership and environments where cross-sectional information diffuses gradually.

Main failure modes / bias traps

- Survivorship bias in today's universe.
- Hidden look-ahead from reconstituted index membership.
- Over-optimizing lookback and rebalance frequency.
- High correlation to equity beta in long-only form.
- Turnover and crash risk in abrupt reversals.

Diagnostics that matter most

- OOS Sharpe/CAGR and MaxDD.
- Momentum crash periods and downside beta.
- Turnover, crowding and correlation to SPY.
- Stability across adjacent lookbacks and Top-N choices.

Expert view

Keep this as the benchmark, not the entire research program. The next strategies should be chosen partly for low OOS correlation to this return stream.

Short-Term Mean Reversion

Fades recent winners and buys recent losers over 1-10 day horizons.

1-10 d	LOW/NEG.	5/5	ACTIVE
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Very short-horizon price moves may overshoot because of liquidity shocks, temporary order imbalance, forced flows and behavioral overreaction.

Core signal concept

Conceptual signal

Score_i = -Return_i(h), or a normalized variant such as -Return_i(h) / Vol_i, where h is typically 1-10 days.

Experiments to run

- Raw reversal across 1 / 2 / 3 / 5 / 7 / 10 days.
- Volatility-normalized, ATR-normalized and downside-volatility-normalized reversal.
- Market-relative and sector-relative reversal.
- Return z-scores, RSI, Bollinger z-score, SMA distance, range position and drawdown reversal.
- Volume-confirmed, low-volatility and trend-conditioned pullback variants.
- Top-N 5-30; rebalance every 1-5 sessions; long-only versus dollar-neutral/beta-balanced L/S.

Portfolio constructions

- Long-only recent losers.
- Dollar-neutral losers versus recent winners.
- Beta-balanced long/short reversal.
- Trend-pullback hybrid: buy short-term weakness only inside long-term uptrends.

Where it may work

Liquid stocks, temporary dislocations, choppy markets and environments where moves are flow-driven rather than information-driven.

Main failure modes / bias traps

- Trading costs can consume gross alpha.
- Falling-knife exposure during genuine information events.
- Using same-day close for execution.
- Short availability/borrow assumptions.
- Overfitting one exact reversal horizon.

Diagnostics that matter most

- Net Sharpe after 2x-5x cost stress.
- Decay curve by holding horizon.
- Performance around earnings/news days versus normal days.
- Long-side and short-side attribution separately.
- Family-level robustness, not only the best configuration.

Expert view

This is one of the best complements to your momentum work because the economic mechanism and holding period are very different. I would prioritize residual and trend-conditioned variants over blindly fading every loser.

Residual Mean Reversion

Removes market or sector movement and trades the stock-specific residual.

2-20 d	LOW	5/5	NEXT
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Temporary idiosyncratic deviations may revert even when the market or sector move itself is justified.

Core signal concept

Conceptual signal

$R_i = \alpha + \beta * R_{\text{market}} + \epsilon_i$. Trade negative residual extremes long and positive residual extremes short, usually after standardization.

Experiments to run

- Market-beta residuals with rolling beta windows 20 / 60 / 120 days.
- Sector-relative residuals and market+sector two-factor residuals.
- PCA residuals with 3 / 5 / 10 latent factors.
- Residual z-score windows 10 / 20 / 40 / 60 days.
- Entry $|z|$ 1 / 1.5 / 2 / 2.5; exit near 0 / 0.5; time stops 5-20 days.
- Residual-volatility normalization and half-life filters.

Portfolio constructions

- Dollar-neutral L/S.
- Beta-neutral L/S.
- Sector-neutral residual book.
- PCA factor-neutral stat-arb approximation.

Where it may work

Markets where common factors explain much of broad movement but individual names temporarily deviate because of flows or microstructure.

Main failure modes / bias traps

- Re-estimating beta with future observations.
- Sector classification that is not point-in-time.
- Unstable residual distributions.
- Residuals contaminated by earnings/news jumps.
- Factor models that are too complex for available history.

Diagnostics that matter most

- Residual autocorrelation / half-life.
- OOS market beta and sector exposure.
- Performance excluding event days.
- Parameter stability across beta and z-score windows.
- Cross-sectional breadth of profitable names.

Expert view

If raw mean reversion works but residual mean reversion works better, that is stronger evidence of genuine stock-specific alpha rather than a disguised market-timing effect.

Pairs / Statistical Arbitrage

Trades temporary divergence between economically or statistically related securities.

2-30 d	VERY LOW	5/5	ACTIVE
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Two related securities can share a stable long-run relationship while temporarily diverging because of idiosyncratic flows, liquidity or timing differences.

Core signal concept

Conceptual signal

$\text{Spread}_t = \log(P_A) - \alpha - \beta \log(P_B)$; trade standardized deviations from the formation-period relationship.

Experiments to run

- Normalized-price distance pairs.
- High-correlation pairs.
- Residual-correlation pairs.
- Engle-Granger cointegration pairs.
- ADF-stationary OLS spreads.
- TLS/symmetric hedge-ratio spreads.
- Log price-ratio stationarity.
- Hurst/half-life/zero-crossing quality filters.
- Sector-peer diagnostic pairs and hybrid quality ranking.

Portfolio constructions

- Disjoint pair portfolio.
- Overlapping pairs with per-name caps.
- Equal-dollar legs.
- Return-beta, cointegration-beta or market-beta hedged legs.

Where it may work

Stable industries and comparable businesses with recurrent relative-value dislocations and enough liquidity for frequent rebalancing.

Main failure modes / bias traps

- Pair selection using full-sample relationships.
- Re-estimating an open trade with future data.
- Spurious correlation without stationarity.
- Structural breaks and mergers.
- Short-borrow and capacity constraints.
- Using current sector labels as if historical.

Diagnostics that matter most

- Cointegration/ADF stability.
- Hedge-ratio stability.
- Spread half-life and zero-crossing rate.
- Actual portfolio beta, not merely dollar neutrality.
- Pair-level PnL concentration and capacity.

Expert view

Treat pair discovery and pair trading as separate research problems. The most interesting result is not the best pair; it is which formation statistics predict future mean-reversion profitability.

Gap Reversal / Gap Fade

Trades abnormal overnight gaps that may partially reverse after the open.

0-5 d	LOW	4/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Some overnight price jumps reflect temporary imbalance or overreaction, especially when the move is large relative to normal overnight volatility and not confirmed by broader information.

Core signal concept

Conceptual signal

$\text{Gap}_t = \text{Open}_t / \text{Close}_{(t-1)} - 1$. Rank or z-score the gap, then test fade versus continuation conditional on context.

Experiments to run

- Gap magnitude thresholds: 1 / 2 / 3 / 5 standard deviations.
- Raw gap versus gap normalized by overnight-volatility history.
- Gap-up fade and gap-down rebound separately.
- Market-relative and sector-relative gaps.
- Volume confirmation and opening-range confirmation.
- Trend-conditioned gaps: fade against trend versus continuation with trend.
- Event filters: exclude or isolate earnings/news days.
- Exit at close, next close, 2-5 day holding periods.

Portfolio constructions

- Long gap-down reversals.
- Short gap-up reversals.
- Dollar-neutral top/bottom gap book.
- Conditional switch: fade ordinary gaps but follow high-information gaps.

Where it may work

Liquid names where opening imbalances mean-revert and where the gap is not a permanent repricing event.

Main failure modes / bias traps

- Daily data cannot model opening-auction queue or intraday path.
- Earnings gaps can be fundamentally different from liquidity gaps.
- Using today's volume to decide today's open trade.
- Large slippage at the open.
- Asymmetric behavior of gap-up versus gap-down events.

Diagnostics that matter most

- Open-to-close PnL and close-to-close PnL separately.
- Earnings vs non-earnings performance.
- Gap size deciles.
- Cost sensitivity and fill assumptions.
- Market/sector-adjusted gap attribution.

Expert view

I would split this immediately into 'information gaps' and 'non-information gaps'. A single universal gap-fade rule is unlikely to be robust.

Breakout / Trend Following

Buys new highs or range breakouts and exits when the trend weakens.

Weeks-mo	MED/HIGH	4/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Large price moves can persist because trends reflect gradual information diffusion, institutional flows and behavioral underreaction.

Core signal concept

Conceptual signal

Breakout_t = Price_t / rolling_high_(t-1,N) - 1, with entry only after the level is exceeded using information known at Close T.

Experiments to run

- 20 / 55 / 126 / 252-day price breakouts.
- Donchian channel breakouts and moving-average crossovers.
- ATR-normalized breakout distance.
- Volume-confirmed breakout.
- Breakout after volatility compression.
- Breakout breadth: individual versus sector/market confirmation.
- Trailing-stop, time-stop and channel-exit rules.
- Long-only versus symmetric long/short breakout books.

Portfolio constructions

- Long-only trend following.
- Long/short independent breakout signals.
- Sector-neutral breakout ranking.
- Volatility-scaled positions.

Where it may work

Persistent directional regimes, broad leadership and markets where breakouts attract follow-on demand.

Main failure modes / bias traps

- Breakout level must exclude today's future high/close when determining earlier execution.
- Whipsaw in sideways markets.
- Duplicating cross-sectional momentum under a new name.
- Volume look-ahead.
- Optimizing stop widths to historical noise.

Diagnostics that matter most

- Breakout success rate by horizon.
- Average winner/loser asymmetry.
- Time-under-water and whipsaw rate.
- Correlation to momentum benchmark.
- Performance after compression versus ordinary breakout.

Expert view

Use this primarily to test whether absolute price structure adds information beyond relative momentum. If correlation is extremely high and OOS improvement is small, it may not deserve a separate sleeve.

Momentum Acceleration

Trades the change in momentum rather than the level of momentum.

Weeks-mo	MEDIUM	4/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

A stock whose return trend is strengthening may contain fresher information than a stock that simply has high trailing momentum.

Core signal concept

Conceptual signal

Acceleration = Momentum_short - Momentum_long, or slope/change of momentum across nested horizons.

Experiments to run

- 1m-6m, 3m-12m and 6m-12m acceleration spreads.
- Linear slope across 1/3/6/12 month momentum points.
- Acceleration with positive long-term trend filter.
- Acceleration versus deceleration ranking.
- Volatility-adjusted acceleration.
- Sector-relative acceleration.
- Entry only when both momentum level and acceleration agree versus pure acceleration.

Portfolio constructions

- Long-only accelerating winners.
- Long/short acceleration versus deceleration.
- Momentum-level + acceleration composite.
- Sector-neutral acceleration.

Where it may work

Leadership transitions, early stages of new trends and environments where recent information is becoming progressively more important.

Main failure modes / bias traps

- Very high overlap with standard momentum if defined poorly.
- Short horizon noise masquerading as acceleration.
- Over-optimizing horizon combinations.
- Strong turnover increase versus 12-month momentum.

Diagnostics that matter most

- Incremental OOS alpha after controlling for normal momentum.
- Turnover-adjusted improvement.
- Correlation to existing momentum strategy.
- Performance around leadership rotations.

Expert view

This is worth testing only as an incremental information question: 'Does acceleration add value beyond momentum level?' If not, keep the simpler model.

Volatility Expansion

Looks for quiet stocks entering a new expansion regime, often combined with breakout confirmation.

Days-weeks	MED-LOW	4/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Volatility clusters. Extremely compressed volatility can precede large directional moves when new information or demand arrives.

Core signal concept

Conceptual signal

$\text{VolRatio} = \text{short_vol} / \text{long_vol}$. Identify compression, then trade subsequent price/range expansion rather than predicting direction during the quiet period.

Experiments to run

- Volatility ratios 5/20, 10/60, 20/126.
- Compression thresholds by absolute ratio or historical percentile.
- Breakout confirmation using 10 / 20 / 55-day highs/lows.
- Volume expansion thresholds.
- ATR / Bollinger bandwidth compression.
- Inside-day / narrow-range pattern variants.
- Directional trend filter versus direction-agnostic expansion.
- Holding 3 / 5 / 10 / 20 / 40 days.

Portfolio constructions

- Directional breakout after compression.
- Long/short symmetric expansion.
- Cross-sectional ranking of strongest expansion.
- Risk-scaled positions by expected volatility.

Where it may work

Transitions from quiet consolidation to information-rich directional movement.

Main failure modes / bias traps

- Entering during compression without direction can become a volatility bet rather than alpha.
- Using future volatility to label the compression.
- Large gap risk around catalysts.
- Breakout and volatility signals may duplicate trend following.

Diagnostics that matter most

- Conditional return after compression deciles.
- Breakout vs non-breakout controls.
- Skew of winners/losers.
- Volatility regime dependence.
- Incremental correlation versus momentum/breakout.

Expert view

One of the strongest research directions for diversification: the key is to condition on the transition from compression to expansion, not merely buy low-volatility stocks.

Low-Volatility / Defensive

Favors lower-risk equities and avoids unstable names.

Months	LOW-MED	4/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Low-risk stocks can deliver surprisingly strong risk-adjusted returns because leverage constraints and preference for lottery-like stocks can distort pricing.

Core signal concept

Conceptual signal

Score_i = -Volatility_i, -Beta_i, or a composite of low volatility, low downside risk and stable trend.

Experiments to run

- 20 / 60 / 126 / 252-day realized volatility.
- Market beta and downside beta.
- Idiosyncratic volatility after removing market/sector factors.
- Maximum drawdown and downside deviation.
- Low-vol + positive trend.
- Low-vol + quality-of-trend composite.
- Sector-neutral low-vol versus unconstrained low-vol.
- Volatility-weighted versus equal-weight portfolios.

Portfolio constructions

- Long-only defensive portfolio.
- Long low-vol / short high-vol anomaly.
- Sector-neutral defensive book.
- Low-vol sleeve combined with momentum.

Where it may work

Risk-off markets, slow-growth environments and periods where high-beta/speculative names are overvalued.

Main failure modes / bias traps

- Sector concentration can dominate results.
- Low-vol can become a bond proxy.
- Historical beta instability.
- Crowding and valuation risk.
- Long-only performance partly driven by market exposure.

Diagnostics that matter most

- Beta/downside beta.
- Sector attribution.
- Performance in rate shocks and bear markets.
- Valuation/crowding diagnostics if fundamentals later become available.
- Correlation to momentum and SPY.

Expert view

This is less exciting as a pure alpha hunt but potentially very valuable as a portfolio stabilizer. Judge it on risk-adjusted contribution and drawdown diversification, not only CAGR.

Quality of Trend

Prefers smooth, efficient trends over noisy price appreciation.

Months	MEDIUM	4/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Two stocks can have identical 12-month returns but very different paths. Smooth, persistent trends may contain more durable information than jumpy, mean-reverting gains.

Core signal concept

Conceptual signal

Efficiency = $|P_t - P_{(t-N)}| / \text{sum}(|\text{daily price changes}|)$. Combine efficiency with momentum level, trend t-stat or consistency.

Experiments to run

- Efficiency ratio windows 63 / 126 / 252.
- Trend t-stat and log-return slope.
- Fraction of positive days/months.
- Drawdown-adjusted momentum.
- High-proximity-to-52-week-high with low path noise.
- Trend quality + volume confirmation.
- Trend quality + low gap-instability.
- Different weighting between return level and path quality.

Portfolio constructions

- Long-only smooth trends.
- Long/short high-quality versus noisy trends.
- Composite with momentum.
- Sector-neutral trend-quality ranking.

Where it may work

Persistent institutional accumulation and steady information diffusion.

Main failure modes / bias traps

- It can become a disguised low-vol strategy.
- Path-smoothness metrics may reward stale prices or illiquidity.
- Too many overlapping trend metrics create data-mining risk.
- Quality filters can reduce breadth excessively.

Diagnostics that matter most

- Incremental alpha over raw momentum.
- Liquidity/staleness diagnostics.
- Parameter monotonicity.
- Correlation with low-vol and momentum sleeves.

Expert view

This is particularly useful as a refinement of your existing momentum program. Demand clear incremental OOS benefit; otherwise keep the simpler momentum signal.

Seasonality

Tests recurring calendar patterns that may reflect institutional schedules, tax effects, flows or behavioral routines.

Days-mo	VERY LOW	3/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Returns and flows may differ systematically around month-end, quarter-end, turn-of-month, earnings seasons, holidays or specific weekdays.

Core signal concept

Conceptual signal

Calendar indicator -> estimate historically conditioned return -> trade only when the effect is pre-specified and has enough repeated observations.

Experiments to run

- Turn-of-month: last 3 / first 3 trading days.
- Month-of-year effects.
- Day-of-week effects.
- Quarter-end and year-end windows.
- Pre/post-holiday effects.
- Index-rebalance or option-expiry calendar diagnostics if dates are known point-in-time.
- Cross-sectional seasonality: a stock's own same-month historical tendency.
- Combine seasonality with momentum or mean reversion only after validating the standalone effect.

Portfolio constructions

- Market timing overlay.
- Cross-sectional seasonal ranking.
- Conditional exposure scaling.
- Seasonal filter on another alpha family.

Where it may work

Stable institutional flow cycles and recurring calendar mechanics.

Main failure modes / bias traps

- Tiny sample counts create false confidence.
- Calendar definitions can be data-mined heavily.
- Holiday/rebalance calendars may change over time.
- Effect can disappear after publication/arbitrage.
- Multiple-testing burden is extreme.

Diagnostics that matter most

- Number of independent occurrences.
- Effect size with confidence intervals.
- Subperiod stability.
- Leave-one-year-out testing.
- Multiple-testing correction across all calendar variants.

Expert view

I would keep this lower priority. Calendar research is easy to overfit because the number of possible partitions is huge relative to the number of independent repetitions.

Overnight vs Intraday Anomaly

Separates close-to-open returns from open-to-close returns instead of treating the daily bar as one process.

1-5 d	VERY LOW	4/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Overnight and intraday returns can reflect different information, liquidity and participant groups; one component may predict or offset the other.

Core signal concept

Conceptual signal

Overnight_t = Open_t / Close_(t-1) - 1; Intraday_t = Close_t / Open_t - 1. Test cross-sectional and time-series interactions.

Experiments to run

- Extreme overnight move -> intraday reversal.
- Extreme overnight move -> multi-day continuation.
- Prior intraday move -> next overnight effect.
- Separate gap-up and gap-down behavior.
- Market-adjusted overnight residual.
- Overnight z-score by stock-specific history.
- Interaction with volume, volatility, trend and market gap.
- Open-to-close exits versus 1-5 day holding periods.

Portfolio constructions

- Intraday long/short book entered at open.
- Multi-day overnight-reversal portfolio.
- Conditional filter for gap strategies.
- Market-neutral cross-sectional overnight anomaly.

Where it may work

Markets where information incorporation differs between overnight and regular sessions.

Main failure modes / bias traps

- Daily bars cannot model intraday path or auction slippage.
- Using close-T information to trade the same close.
- Open-price quality varies on illiquid names.
- Corporate actions can distort overnight returns.

Diagnostics that matter most

- Overnight and intraday PnL attribution separately.
- Open slippage sensitivity.
- Liquidity buckets.
- Event versus non-event days.
- Cross-sectional correlation with gap-fade research.

Expert view

Keep this distinct from generic gap fading: the richer question is whether the decomposition itself contains predictive structure.

Pairs Momentum / Reversal Hybrid

Allows a relative-value spread to mean-revert in some states and continue trending in others.

Days-weeks	ADAPTIVE	5/5	PLANNED
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

Not every pair divergence should be faded. A widening spread caused by a structural break may continue, while a liquidity-driven divergence may revert.

Core signal concept

Conceptual signal

Estimate spread state. Use mean reversion when spread dynamics are stationary/low-dispersion; use continuation when dispersion, volatility or structural-break evidence rises.

Experiments to run

- Regime based on spread ADF/Hurst/half-life.
- Change in pair correlation or hedge-ratio stability.
- Spread volatility ratio: short-term versus long-term.
- Trend strength of the spread.
- Breakout of historical spread range.
- Mean-reversion entry for stable regime; continuation entry for unstable/trending regime.
- Transition models: rules, HMM or Bayesian regime probability.
- Pairs selected by cointegration but traded with adaptive MR/trend logic.

Portfolio constructions

- State-dependent pair book.
- Separate MR and continuation sub-sleeves.
- Probability-weighted blend rather than hard switch.
- Disjoint-pair portfolio with regime-specific risk budgets.

Where it may work

Relative-value relationships that alternate between temporary dislocation and genuine repricing.

Main failure modes / bias traps

- Regime detector can overfit the same spread history.
- Switching rules may simply chase recent PnL.
- Structural breaks are hard to identify in real time.
- Complexity can overwhelm limited trade counts.

Diagnostics that matter most

- State-conditioned hit rate.
- Transition-lag sensitivity.
- Performance around relationship breakdowns.
- Comparison against always-MR and always-trend controls.
- OOS stability of the regime classifier itself.

Expert view

This is high-value research after a plain pairs engine exists. First prove each base behavior separately; only then test whether a regime switch adds incremental OOS value.

Regime-Switching Alpha

Changes the active alpha family according to the market environment.

Variable	LOW POT.	5/5	LATER
TYPICAL HORIZON	CORR. VS MOMENTUM	RESEARCH PRIORITY	STATUS

Research hypothesis

No single anomaly dominates in every market state. Momentum, mean reversion, relative value and defensive signals may have different expected returns under different volatility, trend, breadth and correlation regimes.

Core signal concept

Conceptual signal

$State_t = f(\text{trend, volatility, breadth, dispersion, correlation, liquidity})$. Allocate across pre-validated alpha sleeves using only state information available at time t .

Experiments to run

- Simple rule states: SPY trend x volatility regime.
- Breadth and cross-sectional dispersion states.
- Average stock correlation / crowding states.
- HMM with 2 / 3 / 4 latent regimes.
- Bayesian regime probability rather than hard labels.
- State-specific alpha expected-return estimates.
- Risk-budget switch versus full alpha-family switch.
- Ensemble allocation with shrinkage toward equal weights.
- Meta-model trained only on OOS sleeve returns, not raw in-sample backtests.

Portfolio constructions

- Hard regime switch.
- Probability-weighted blend.
- Risk-budget modulation.
- Always-on diversified alpha portfolio as the control.

Where it may work

Markets where alpha payoffs genuinely vary by state and those states can be identified with enough persistence before they end.

Main failure modes / bias traps

- The meta-model can overfit more easily than the underlying strategies.
- Using in-sample sleeve returns to train the allocator.
- Regime labels that depend on future data.
- Too many states with too few observations.
- Switching costs and delayed detection.

Diagnostics that matter most

- Incremental OOS improvement versus equal-weight alpha blend.
- Regime persistence and transition lag.
- Turnover caused by switching.
- Sensitivity to state definition.
- PBO/DSR across meta-model choices.

Expert view

Do this last, not first. A regime switcher cannot manufacture alpha from weak base strategies. Freeze robust underlying sleeves first, then ask whether state information improves their combination.

CROSS-FAMILY DESIGN

What to vary across the entire research program

A common taxonomy makes results comparable and helps identify whether performance comes from the alpha idea or from portfolio/execution choices.

Dimension	Examples	What it tests
Signal horizon	1d to 12m depending on family	Alpha decay / persistence
Normalization	Raw, volatility, ATR, downside vol, residual vol	Cross-stock comparability
Conditioning	Trend, volume, breadth, volatility, regime	When the anomaly should be active
Neutralization	None, market beta, sector, PCA factors	Remove unwanted systematic exposure
Portfolio breadth	5 / 10 / 20 / 30 / broader	Concentration versus diversification
Weighting	Equal, rank, inverse vol, signal strength, capped	Translate signal into risk
Rebalance / hold	Daily through monthly	Alpha decay versus turnover
Stops / exits	Mean reversion, trend break, time, volatility	Risk and path dependence
Risk scaling	Fixed gross, vol target, drawdown throttle	Portfolio risk architecture
Costs	1x / 2x / 3x or 5-50 bps	Implementation robustness

Important discipline

Do not vary every dimension in every family from day one. Start with the alpha mechanism and a simple portfolio. Add weighting, overlays and meta-models only after the base signal shows OOS evidence.

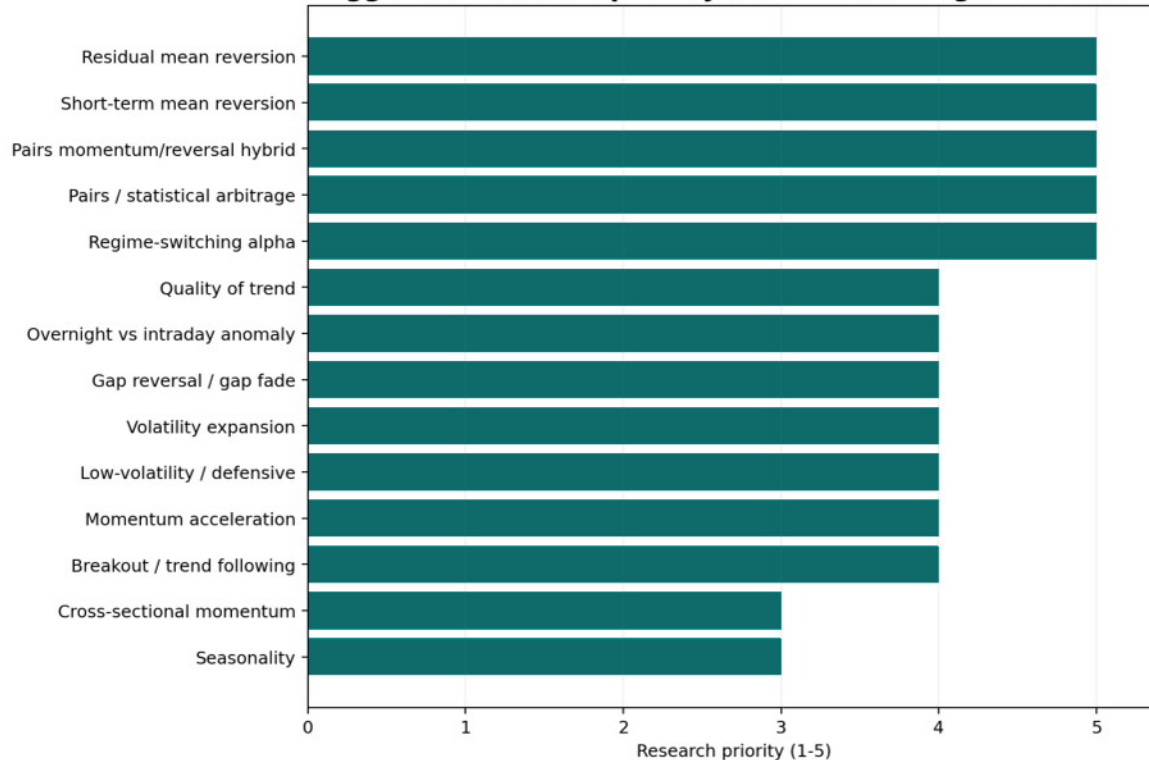
How every family should be classified and judged

Evaluation layer	Required evidence
Primary OOS performance	Sharpe, CAGR, Sortino, MaxDD, Calmar, hit rate, average winner/loser, turnover
Consistency	Positive fold rate, median fold Sharpe, worst fold, yearly table, time below high-water mark
Benchmark relation	SPY beta/correlation, downside beta, upside/downside capture, correlation to existing alpha sleeves
Implementation	Turnover, commissions, spread/slippage, borrow, capacity/ADV participation, fill assumptions
Statistical controls	Naive p, Holm/BH, deflated-Sharpe-style probability, Reality Check, PBO/CPCV where practical
Stability	Parameter neighbors, family medians, monotonic relationships, no isolated needle optimum
Regimes	Bull/bear, high/low vol, high/low breadth, high/low correlation, crisis windows
Resampling	Moving-block Monte Carlo / bootstrap to preserve serial dependence
Holdout	One-shot locked diagnostic holdout after development freeze
True forward	Only observations after the freeze date count as genuinely unseen future evidence
What I would publish Publish the family distribution, not only the champion. Show how many configurations were profitable OOS, the median family Sharpe, parameter heatmaps, cost break-even, regime behavior and the final frozen model. This communicates research quality much better than a single equity curve.	

What I would test next, in order

Because cross-sectional momentum already exists, the next projects should maximize diversification of mechanism before adding more trend variants.

Suggested research priority after an existing momentum engine



Phase	Research family	Why now
Phase 1	Short-term mean reversion	Fast opposite-horizon alpha; already developed.
Phase 1	Residual mean reversion	Tests whether stock-specific dislocation is stronger than raw reversal.
Phase 1	Pairs / stat-arb	Low directional beta and independent relative-value engine.
Phase 2	Gap / overnight-intraday	Different microstructure and execution horizon.
Phase 2	Volatility compression / expansion	Different information source: state transition rather than return rank.
Phase 2	Low-vol / defensive	Potential portfolio stabilizer.
Phase 3	Trend quality + acceleration	Incremental refinements of the existing momentum engine.
Phase 3	Seasonality	Lower priority because independent sample counts are small.
Phase 4	Pairs hybrid	Adaptive relative-value once base pairs evidence exists.
Phase 4	Regime-switching alpha	Meta-layer only after multiple sleeves are frozen and forward-tested.

My preferred end state

A small portfolio of 4-7 robust alpha sleeves with demonstrably low OOS correlation: e.g. momentum, short-term reversal, residual stat-arb, pairs, volatility expansion and a defensive sleeve. Only after those return streams exist should a regime allocator be tested.

The end goal is a portfolio of alphas, not a leaderboard

Once each family has a frozen OOS return stream, build the strategy-level correlation matrix on synchronized dates. The portfolio allocator should operate on those OOS sleeve returns rather than on the original in-sample backtests.

Allocator	Use
Equal risk contribution	Simple, robust baseline when expected-return estimates are noisy.
Inverse-volatility sleeve weights	Useful control; easy to interpret.
Shrinkage covariance / risk parity	Stabilizes correlations across alpha sleeves.
Constrained mean-variance	Only after strong shrinkage and tight caps; expected returns are very noisy.
Volatility target	Scale the multi-alpha portfolio, not individual winners independently.
Drawdown throttle	Portfolio-level risk control with hysteresis; avoid repeatedly optimizing sleeve-specific stops.

What I would avoid

- Optimizing all 14 strategies and portfolio weights simultaneously.
- Selecting sleeves on full-sample Sharpe and then calling the combination diversified.
- Using the historical holdout repeatedly to choose which strategy family to keep.
- Assuming zero correlation because the economic stories sound different; measure it OOS.
- Levering the highest-Sharpe sleeve until it dominates portfolio risk.

Portfolio criterion

A strategy deserves capital because of its marginal contribution to the total portfolio: expected OOS return, diversification, drawdown behavior, capacity and implementation reliability. Standalone Sharpe is only one part of that decision.

How to turn each project into a credible article on your personal site

Article section	What readers should see
1. Hypothesis	Explain the economic or behavioral reason before showing results.
2. Data & universe	State data source, security selection, dates and survivorship limitations.
3. Signal family	Describe formulas and economic meaning, not only parameter values.
4. Experiment space	Report how many variants were tested and how the grid was structured.
5. Execution	State exactly when the signal is known and when the trade occurs.
6. Costs	Show base costs and stress assumptions.
7. OOS protocol	Describe walk-forward, embargo, holdout and forward cutoff.
8. Family evidence	Show median / distribution across variants, not only the winner.
9. Robustness	Cost stress, parameter neighbors, regimes, Monte Carlo and multiple testing.
10. Limitations	Be explicit about what the data cannot reproduce.
11. Frozen conclusion	State what was frozen before holdout/forward observation.
12. Future update	Publish forward-OOS updates without changing the frozen rules.
Editorial advice Your strongest differentiator can be transparency. Publishing losing families, unstable parameter regions and limitations makes the research more credible than presenting every backtest as a success.	

The research program in one sentence

Do not search for one perfect strategy. Search for several independently plausible alpha mechanisms, validate each under identical institutional standards, freeze the survivors, and combine them only after their out-of-sample correlations are known.

Recommended core research stack

- Directional persistence: cross-sectional momentum / breakout / trend quality.
- Short-horizon reversal: raw mean reversion / gap / overnight-intraday.
- Stock-specific relative value: residual mean reversion / PCA residual.
- Two-name relative value: pairs / cointegration / stationary spreads.
- State transitions: volatility compression -> expansion.
- Defensive anomaly: low-volatility / low-beta.
- Adaptive layer: pairs hybrid and regime-switching only after base sleeves are frozen.

Research philosophy

The real edge is not the number of experiments. It is the discipline used to distinguish repeatable structure from search luck.

Disclosure

This document describes quantitative research concepts and simulated-testing methodology. It is not investment advice, an offer, a recommendation, or a representation that any strategy will achieve similar results in live trading.