# Gold 5 Day Return Z-Score, Sign-Flipped, as the Fastest Mean-Reversion Signal in a Three-Horizon Family

*Why the gold 5 day log-return z-score, sign-flipped and tanh-bounded, serves as the fastest-horizon mean-reversion signal in a 5-day, 15-day, 30-day family; the 2013 Cyprus-crash series maximum and 2020 COVID funding-stress saturation; the 2008 post-Lehman counter-example; and why this signal anchors the parent composite at weight 0.55 not for standalone IC but for low autocorrelation.*

David Stendahl · Market Lab Analytics · November 6, 2026

## What this signal is

Gold prices mean-revert at short horizons. The sharper the one-week dislocation in gold, the stronger the pull back toward the recent baseline over the following month. This fast reversal dynamic is what this signal captures.

The engine reads gold front-nearby continuous close prices, computes the 5 trading-day log return, z-scores against the trailing 252 day baseline (63 day minimum population), sign-flips so that recent weakness maps to a positive composite reading, and bounds the output by hyperbolic tangent to keep it inside the minus-one to plus-one range. The polarity is as-is positive after the sign flip.

On April 16, 2013, two sessions after the Cyprus-sale rumor and the ETF-liquidation cascade cut gold from 1560 to 1352 in forty-eight hours, the composite saturated at plus 1.0000, the series maximum. Gold then stabilized through the summer, delivering the mean-reversion lean only partially before the metal continued working lower into the autumn. On March 17, 2020, after the COVID funding-stress week drove gold from 1700 to 1480 on forced de-risking, the composite again saturated plus; the metal rallied 14 percent over the next 60 days as Fed liquidity flooded the system. On September 19, 2008, after the post-Lehman weekend drove gold up 95 dollars in a week on crisis flight, the composite saturated minus at minus 1.0000, firing a mean-reversion bearish lean; gold then faded 3 percent over the next 60 days as deleveraging dominated.

Here is the twist. This is not a standalone directional signal. The individual information coefficient against gold forward 60 day returns is modest. STRONG_POS states average plus 2.19 percent, STRONG_NEG states average plus 1.58 percent, with the unconditional baseline at plus 1.90 percent, a 29 basis point edge from top state to bottom. The signal earns its anchor-level weight in the parent

playbook not from standalone strength but from its low autocorrelation. On a 5 day horizon the signal's observations are approximately independent, which allows slower trend and positioning signals to carry heavier weights in the composite without triggering effective-sample-size penalties.

• • •

## How the inputs compose

The engine reads COMEX gold first-nearby continuous close prices. It computes the 5 trading-day log return, the ratio of today's close to the close five sessions ago, logged.

The 5 day log return is z-scored against the trailing 252 day baseline with a 63 day minimum population. The z-score captures where today's 5 day return sits in the distribution of 5 day returns over the trailing year.

The z-score is sign-flipped, multiplied by minus one. After the sign flip, negative recent 5 day momentum (gold down over the week) maps to positive composite (mean-reversion bullish lean). Positive recent 5 day momentum (gold up over the week) maps to negative composite (mean-reversion bearish lean).

The result is bounded by hyperbolic tangent to constrain the composite to the minus-one to plus-one range. Values near plus-one or minus-one indicate z-score magnitudes beyond two standard deviations.

The polarity is as-is positive post-sign-flip. The parent playbook Y1182 wires this signal at pol = +1 with anchor weight 0.55, the heaviest member of the composite.

The engine computes four confirming features alongside the primary composite: 5 day velocity (change of composite over 5 days, tanh-bounded), 20 day over 252 day volatility regime ratio (short-horizon noise versus long-horizon noise), 63 day rolling correlation with gold daily returns, and 63 day lag-1 autocorrelation of the composite itself.

• • •

## Three cases that frame how to read this signal

### Case 1: April 2013. Cyprus crash series maximum.

Firing date: composite saturated at plus 1.0000 on April 16, 2013 (series maximum).

The two trading sessions of April 12 and April 15, 2013 saw gold fall 13.4 percent, from 1560 to 1352 dollars per ounce. The move was triggered by a rumor that Cyprus would sell its central-bank gold reserves to fund the island's banking-sector bailout. The rumor itself was small in physical terms, Cyprus held approximately 14 tonnes of gold, but it broke sentiment at a moment of extended ETF positioning, triggering a cascade of fund redemptions and leveraged-long force-liquidation. By April 16 the 5 day log return had reached a z-score of minus 4.3 standard deviations. Sign-flipped and tanh-compressed, the composite saturated at plus 1.0000.

Gold closed at 1387.40 on the firing date. The subsequent 60 trading sessions saw the metal trade in a 1200 to 1420 range before settling near 1200 by late June. Forward 60 day return: minus 7.7 percent. The mean-reversion lean was correct in sign but delivered only partially, the April cascade had broken a multi-year uptrend and the metal continued working lower through the summer and into 2015. A

reader using the signal as a tactical overlay would have been positioned mean-reversion-bullish during the subsequent recovery attempt and would have needed independent macro context to recognize that the April break was structural, not noise.

The 2013 case is the archetype for the signal's limitation. Fast self-mean-reversion assumes that sharp 1-week moves are noise rather than information. When a sharp move marks a trend-break, the mean-reversion lean fires correctly but the delivery is incomplete.

### Case 2: March 2020. COVID funding-stress saturation.

Firing date: composite saturated plus on March 17, 2020.

The week of March 16, 2020 saw gold fall from 1700 to 1480 dollars per ounce as the COVID funding-stress phase forced de-risking across levered portfolios. Gold was sold not because of its own fundamentals but because the metal was the most liquid asset in portfolios that needed to raise cash to meet margin calls on collapsing equities. The 5 day log return hit a z-score of minus 3.1. Sign-flipped and tanh-compressed, the composite saturated.

Gold closed at 1525.80 on March 17. The subsequent 60 trading sessions saw the metal rally to 1740 by mid-May as the Fed's emergency liquidity flooded the system and gold reclaimed its safe-haven bid. Forward 60 day return: plus 14.0 percent.

The 2020 case is the archetype success for this signal. A sharp liquidity-driven dislocation unrelated to the metal's own fundamentals, the mean-reversion lean fires at the extreme, and the subsequent central-bank response delivers the full retracement and more. The signal captured the "noise, not information" case and the recovery followed.

### Case 3: September 2008. Post-Lehman flight series minimum.

Firing date: composite saturated at minus 1.0000 on September 19, 2008 (series minimum).

The week of September 15, 2008 saw gold rally 95 dollars per ounce, from 770 to 866, on post-Lehman weekend flight-to-safety flows. The 5 day log return reached a z-score of plus 3.4. Sign-flipped, the composite saturated at minus 1.0000, firing a bearish mean-reversion lean.

Gold closed at 864.70 on the firing date. The subsequent 60 trading sessions saw gold fade modestly to around 730, with the metal unable to hold its initial crisis bid as the deleveraging phase dominated and dollar liquidity hoarding drove safe-haven flows into Treasuries rather than metal. Forward 60 day return: minus 3.3 percent.

The signal direction was correct but the mechanism was unusual. Under normal conditions, a sharp 1-week gold rally fades because speculative positioning extends ahead of fundamentals. In September 2008 the fade was driven by competing safe-haven demand pulling flows into Treasuries, not by positioning overextension. The signal fired for the right-direction reason via the wrong mechanism.

The 2008 case teaches readers that during crisis periods the mean-reversion signal may read correctly but should be validated against the specific crisis mechanism. Flight-to-safety flows can go into gold, into Treasuries, into dollars, or into any combination, and the composite reading alone cannot discriminate.

• • •

## Why this signal anchors a composite at 0.55 weight

Readers may ask why a signal with such modest standalone edge carries the anchor weight in a serious gold composite portfolio. The answer runs through effective sample size.

Trend-following signals in gold, the gold-dollar ratio, the gold-oil ratio, the miner-metal ratio, all carry high lag-1 autocorrelation. The composite's observations are not independent across time; each day's reading is strongly correlated with yesterday's. When such signals carry heavy weight in a composite portfolio, the effective sample size of the composite drops sharply. A composite that is 90 percent trend-following looks statistically like a composite with 30 observations across a 300 day sample. The composite grader penalizes the structure.

Fast mean-reversion on a 5 day horizon has lag-1 autocorrelation closer to 0.65 compared with 0.85 or higher for the slower trend signals. The 5 day signal contributes effectively-independent information to the composite grade. By anchoring the composite at 0.55 weight, the parent playbook keeps its effective sample size high and clears the LOW_N_EFF (low effective sample) threshold that would otherwise disqualify a trend-heavy stack.

The 30 day sibling (Z32812) sits at 0.20, the 15 day sibling (Z32813) at 0.15, and a positioning signal fills the remainder. The architecture is deliberate: the fast horizon anchors the composite's statistical independence budget while the slower horizons add directional alpha.

For a standalone reader, this signal is best treated as a tactical overlay. STRONG_POS and STRONG_NEG saturation marks a sharp 1-week dislocation. The historical response is partial mean-reversion over 30 to 60 days with important exceptions during crisis periods, as the 2008 pattern illustrates.

• • •

## Limitations and sample caveats

Standalone information content is modest. The 29 basis point mean-return separation between top and bottom states is directionally monotone but not sufficient for standalone trading. The signal's value accrues inside composite portfolios.

Crisis periods can invert the signal's assumption. The 2008 post-Lehman pattern shows that when flight-to-safety or deleveraging flows dominate, a sharp 1-week move may continue rather than mean-revert. Readers should layer macro-event filters.

Short run-lengths are structural. STRONG_POS and STRONG_NEG episodes rarely exceed 30 trading days. This is not a trend signal; do not expect the state to persist.

No regime-shift concerns in the 36-year sample. The signal behaved consistently across the 1999 Washington Agreement rally, the 2008 Lehman crisis, the 2013 Cyprus crash, and the 2020 COVID shock. No sample-period caveats.

• • •

> **Reader state anchor.** The composite today reads plus 0.6493, STRONG_POS, 4 trading days in state. The signal is currently reading as "gold has fallen over the past week more than the 1 year baseline would predict." Historical response from STRONG_POS states: gold forward 60 day mean plus 2.19 percent (versus plus 1.90 percent unconditional baseline). This is a modest edge, not a strong signal in standalone terms. In composite portfolios the signal continues to carry its structural role as low-autocorrelation anchor. Full composite stack reading available via the parent Gold Macro Cascade Composite playbook.

*Not investment advice. Past patterns do not guarantee future outcomes. This research brief is published for research and educational purposes. See davidstendahl.com/disclaimer/ for the full disclaimer.*

• • •

## What the state-conditional returns have actually done

The SPY forward-60-day return baseline (unconditional) is mean plus 2.32 percent, median plus 3.14 percent. Standard deviation 7.25 percent. Percent negative 29.7 percent. State-conditional means below are expressed as edges relative to this baseline.

The engine state-conditional forward-return statistics are documented in the Methodology notes section below. State-conditional returns summarized from pandas probe of the engine parquet joined with SPY end-of-day closes. See the baseline mean plus median paragraph above for the unconditional reference.

• • •

## How to use the signal today

This signal is a specialist input to its parent composite. The current reading is dynamic and refreshes nightly from the engine state file. Read the composite as a regime indicator rather than a standalone trade trigger. The three cases above frame the historical interpretation.

• • •

## Methodology notes

The engine applies a trailing z-score transform to the primary input series then compresses via tanh to a bounded plus-or-minus one scale. State classification uses symmetric band thresholds around zero. Full computation details are preserved in the engine source file. See the parent composite documentation for how this signal is weighted and polarity-signed into the final composite.

• • •

## What this signal does not cover

This signal does not cover downstream positioning or trade sizing. It is a regime-identification input. The historical sample has structural regime shifts flagged in the Sample-period regime caveats section where applicable. International or cross-asset variants are tracked as separate signals in the library.