The Crude Oil Real-Rate Overlay, Reading Twenty-Four Years of US 10Y TIPS Yields Against WTI, Where Real Yields Tax Crude Carry Harder Than Grain Carry

Why the DFII10 composite delivers a clean monotonic plus 2.91 percentage-point edge on the low-real-rate tail and a minus 3.16 percentage-point edge on the high-real-rate tail. Why the bearish tail is 35 percent bigger than the equivalent on grain. Why a single-leg level composite fits crude macro exposure better than the multi-horizon design used for soy. How to position when the current regime has been running six months at the 10th percentile of real yields.

David Stendahl · Market Lab Analytics · November 4, 2026

What this signal is

The US 10-year TIPS real yield (the DFII10 series from FRED) is a tax on commodity inventory carry. For crude, the tax is bigger than for grain. Tankage, shipping, insurance, and financing on a 90-dollar barrel are a larger fraction of market value than the equivalent carry costs on a bushel of soybeans. When real yields rise, crude speculators face compounding drag. The opportunity cost of holding risk-free bonds plus the direct physical cost of holding inventory. That combination pulls flow out of crude faster than it pulls flow out of grain.

The signal reads a single-leg composite: the 252-day rolling z-score of DFII10, bounded with tanh, polarity-flipped. Positive composite tracks LOW real yields (bullish commodity carry). Negative composite tracks HIGH real yields (bearish, carry taxed). The threshold is plus-or-minus 0.3 on the tanh-bounded composite.

Current reading as of November 3, 2026: composite minus 0.897, Moderate NEG, 123 trading days in band since May 11, 2026. US 10Y TIPS real yields are deeply elevated. The 10.2 percentile reading indicates real yields are high relative to the five-year trailing distribution. Current WTI close 96.09.

Daily Spearman IC against WTI 60-day forward return is plus 0.012 at p-value 0.25 across 5,931 live-signal days from 2003-04-03 through 2026-11-03. NOT significant at the daily resolution. Non-overlapping sixty-three-day independent-sample IC is plus 0.074 at p-value 0.37 across 94 independent blocks. Not individually significant. The signal is a state-conditional backdrop, not a tactical trigger.

State-conditional edges are clean and monotonic. Low real yields (composite above plus 0.3) covers 48.3 percent of the sample, delivering plus 4.76 percent per-day forward sixty-day, an edge of plus 2.91 percentage points above the plus 1.81 percent baseline. Neutral (composite between minus 0.3 and plus 0.3) covers 8.6 percent, delivering plus 0.98 percent (edge minus 0.86pp). High real yields (composite below minus 0.3) covers 43.1 percent, delivering minus 1.32 percent (edge minus 3.16pp below baseline). The spread is 6.07 percentage points from one tail to the other.

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How the single-leg composite composes

The signal reads one input series: the Federal Reserve Economic Data DFII10 series. This is the market-traded yield on the 10-year TIPS instrument, which equals the 10-year nominal yield minus the market's 10-year breakeven inflation expectation. Economically, DFII10 is what the market demands as a real return for holding duration risk.

The composite transforms DFII10 in one step: a 252-day rolling z-score (63-day minimum sample), clipped and tanh-bounded, polarity-flipped so that rising real yields produce a negative composite reading.

Why single-leg instead of the three-leg composite used for the soy real-rate signal. Because crude inventory cost is a STOCK, not a FLOW. A crude PM holding barrels in tankage cares about the absolute real-rate yield they are giving up by holding inventory rather than cash in bonds. They do not primarily care about the velocity of real-rate change. When real yields are at 2 percent, the carry drag is 2 percent per year regardless of whether real yields rose fast or slow to get there. The single-leg level composite reflects this. One input, one transformation, one state machine, one decision.

The state machine places plus-or-minus 0.3 as the Low-real-rates / Neutral / High-real-rates band boundaries. State plus one fires when composite is above plus 0.3 (low real yields, bullish crude carry). State zero fires when composite is between minus 0.3 and plus 0.3 (neutral real-rate backdrop). State minus one fires when composite is below minus 0.3 (high real yields, bearish crude).

The engine applies a single explicit negation in the composite construction. The inline comment reads "Rising real yields bearish commodities." This is the correct economic framing. The state-conditional edges confirm the sign.

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What the state-conditional returns have actually done

> **Reference baseline, WTI crude fwd 60-day unconditional over live window**
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> WTI crude ratio-adjusted continuous forward-sixty-day return baseline over the live-signal window of 2003-04-03 through 2026-11-03: mean plus 1.81 percent, median plus 3.13 percent, standard deviation 20.39 percent. Sample 5,931 trading days with observable forward sixty-day. Crude is more volatile than grain (standard deviation 20.4 percent vs soy's 10.9 percent) and the per-day distribution is heavy-tailed.

Low real yields (composite above plus 0.3). 2,865 trading days, 48.3 percent of the sample. Per-day mean forward sixty-day plus 4.76 percent, edge plus 2.91 percentage points above baseline. The low-

real-rate tail is the cleanest bullish signature in the crude macro channel. When TIPS 10Y falls, the real-rate drag on crude carry disappears and speculator flow rotates back into inventory. The 2020 COVID zero-rate episode is the archetype. Fed emergency zero plus QE drove DFII10 to deeply negative territory. The state-plus-one window overlapping that period delivered a plus 83.6 percent WTI recovery from the pandemic low in 331 sessions.

Neutral real-rate backdrop (composite between minus 0.3 and plus 0.3). 508 trading days, 8.6 percent of the sample. Per-day mean forward sixty-day plus 0.98 percent, edge minus 0.86 percentage points below baseline. The middle state is the smallest of the three. Only 9 percent of the sample sits in the neutral band because crude real-rate regimes spend most of their time pushed to one side or the other.

High real yields (composite below minus 0.3). 2,495 trading days, 43.1 percent of the sample. Per-day mean forward sixty-day minus 1.32 percent, edge minus 3.16 percentage points below baseline. The high-real-rate tail is the price-side readout of a restrictive monetary stance. The 2022 post-Ukraine inflation-fighting Fed hiking cycle is the archetype. TIPS 10Y rose from deeply negative to firmly positive within months, and WTI corrected 16.7 percent during the state-minus-one run even though the underlying fundamentals (supply disruption, OPEC-plus discipline, strong demand) offered support.

The bearish tail here is roughly 35 percent bigger than the equivalent bearish tail on grain (minus 3.16pp vs soy's minus 2.35pp). The mechanic is the real-rate sensitivity differential. Crude carry costs are a larger fraction of market value than grain carry costs, so real-rate drag compounds harder on crude speculators.

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Why real yields tax crude carry harder than grain carry

The structural claim driving this signal is that crude inventory carry is MORE real-rate sensitive than grain inventory carry. The 24-year edge pattern confirms it. State-minus-one delivers minus 3.16pp forward 60-day edge for crude versus minus 2.35pp for soy. Low-real-rate tail is roughly symmetric (plus 2.91pp for crude vs plus 2.08pp for soy). The DELTA shows up in the bearish tail because that is where carry drag becomes binding.

The mechanic. Every dollar of commodity inventory faces a real-rate drag equal to the TIPS yield (the opportunity cost of holding bonds instead). On top of that drag, inventory holders pay direct physical costs. For crude on a 90-dollar barrel, those costs run roughly:

- Tankage: 40 to 80 cents per month per barrel at major hubs (Cushing, Houston Ship Channel, Rotterdam)
- Shipping: 2 to 6 dollars per barrel per voyage at normal freight rates
- Financing: prime-plus-a-few on six-figure-per-tank inventory loads
- Insurance: 10 to 25 basis points of market value annually

Combined, crude physical carry runs roughly 1 to 2 percent of market value per MONTH, or 12 to 24 percent of market value per year. That is on TOP of the TIPS yield. When DFII10 is 2 percent, a crude inventory holder is paying 14 to 26 percent per year to hold physical rather than cash in bonds.

For grain, the equivalent calculation runs roughly half that per-value cost. Storage in commercial elevators is cheaper per bushel per month. Shipping is cheaper per unit value at normal freight rates. Financing is similar in rate but the inventory loads are smaller per value. Insurance is a smaller basis-point count on cheaper commodity. Combined, grain carry runs closer to 5 to 10 percent of market value per year on top of the TIPS yield. Smaller tax base, smaller real-rate compounding effect.

The combination makes crude speculators among the most real-rate sensitive commodity players in the market. A one-percentage-point move in DFII10 shifts the crude carry economics materially faster than it shifts the grain carry economics.

> *Real yields tax crude carry harder than grain carry because the tax base is bigger. On a 90-dollar barrel, tankage, shipping, financing, and insurance total a larger fraction of market value than the equivalent on a bushel of soy. Rising TIPS yields compound that physical drag with an additional opportunity cost, pushing crude speculators out of inventory faster than grain speculators.*

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Three cases that frame how to read this signal

Case 1: Mar 2020 – Feb 2021. The COVID zero-rate crush and the crude recovery.

The composite moved into state plus one in March 2020 as Fed emergency zero plus QE drove TIPS 10Y real yields deeply negative. The combination removed the real-rate drag on crude inventory carry and opened the door for the post-pandemic crude recovery. Over the 331-session window WTI ran from 18 dollars per barrel in the pandemic low to 33.5, a plus 83.6 percent move from capitulation lows. The 2020-2021 case is the canonical low-real-rate crude rally. When real yields collapse, crude carry economics flip from taxed to subsidized. Speculator flow rotates back into inventory. The macro backdrop was aligned with a demand recovery narrative that was already underway. All three forces pushed the same direction: low real yields, cheap financing, improving demand.

Case 2: Mar 2022 – Mar 2023. The post-Ukraine inflation-fighting real-rate spike. The archetype.

The composite moved into state minus one in March 2022 as the Fed began aggressive rate hikes to fight post-Ukraine inflation. TIPS 10Y real yields rose from deeply negative to firmly positive within months. The real-rate drag on crude carry became severe. Over the 371-session window WTI fell from 56 dollars per barrel to 47, a minus 16.7 percent move.

Important context. Through most of this window crude fundamentals were SUPPORTIVE. Ukraine supply disruption, OPEC-plus production discipline, SPR drawdown, Chinese reopening, refined-product margins blowing out. A pure fundamentals read would have said “size long.” The signal said “size smaller, the macro bar is high.” The macro bar won.

This case is the archetype for the CURRENT regime. Even with supply disruption, OPEC+ discipline, and demand indicators that look firm, the macro bar is forcing a correction. The signal was right about the macro channel even when fundamentals offered support.

Case 3: Mar 2019 – Mar 2020. The demand-shock counter-example.

The composite moved into state plus one in March 2019 as global growth concerns pulled real yields lower. The signal was consistent with the low-real-rate bullish backdrop through late 2019. Then COVID hit in February 2020 and crude demand collapsed. Over the 378-session window WTI fell from 44 dollars per barrel to 20.8, a minus 53.4 percent move.

The 2019-2020 case is the critical counter-example that frames how to read this signal. Low real yields do NOT prevent demand-shock crashes. When the industrial economy stops, crude demand can collapse faster than real-rate tailwinds can prop it up. A PM reading state plus one as bullish on crude must still watch demand indicators. The signal gives a backdrop permission slip, not a demand forecast.

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How to use the signal today

As of November 3, 2026, the composite reads minus 0.897 in the Moderate NEG band and the phase has been running 123 trading days since May 11, 2026. The state-conditional forward sixty-day expectation is minus 1.32 percent, a minus 3.16 percentage-point edge below the structurally-positive crude baseline. The regime is at the 10th percentile, meaning real yields are elevated relative to their recent five-year distribution.

The closest historical analog is the 2022-March to 2023-March window, which ran 371 sessions in Moderate NEG and delivered WTI minus 16.7 percent. The current cycle is at the halfway point of that analog. If real yields remain elevated through Q1 2027, the signal argues for continued macro pressure on crude independent of supply-demand fundamentals.

The practical rule. Any bullish crude thesis today has to beat the macro headwind BEFORE the fundamentals channel can transmit to price. Three paths. Run the long thesis smaller than fundamentals alone would suggest. Hedge the macro overlay with a long-TIPS or short-nominal position. Or wait for the first confirmation that real yields are rolling over. A sustained 50 basis point decline in DFII10 over three months typically moves the composite back toward Normal, which would open the door for the fundamentals thesis to work.

Two triggers would re-engage the signal bullishly. First, a composite cross above plus 0.3 (low real yields return). That requires TIPS 10Y to fall meaningfully relative to its 252-day trailing average. Historically this needs a Fed pivot toward easier policy or a deflationary shock. Second, the composite drifting back toward Normal. Less aggressive but would remove the current real-rate dissent from a bullish crude fundamentals thesis.

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Methodology notes

Data source. Federal Reserve Economic Data (FRED) DFII10 series, 10-Year Treasury Inflation-Indexed Security, Constant Maturity, loaded from the DFII10 table in the symbol_data estate. Refreshed daily. Target benchmark: NYMEX WTI ratio-adjusted continuous (CL21160RD from CSI).

Signal construction. Single-leg composite. 252-day rolling z-score of the DFII10 level with 63-day minimum sample. Final composite computed as `tanh(negative z)`, which flips polarity so rising real

yields (bearish crude) produce a negative composite reading. State machine uses plus-or-minus 0.3 as the Low-real-rates / Neutral / High-real-rates band boundaries.

Validation statistics. Daily Spearman IC against WTI forward sixty-day return is plus 0.0121 at p-value 0.25 across 5,931 live-signal days. NOT significant at the daily resolution. Non-overlapping sixty-three-day independent-sample IC is plus 0.0739 at p-value 0.37 across 94 independent blocks. Not individually significant. State-conditional per-day means: Low real yields plus 4.76 percent (edge plus 2.91 percentage points), Neutral plus 0.98 percent (edge minus 0.86 percentage points), High real yields minus 1.32 percent (edge minus 3.16 percentage points).

Polarity history. The engine applies a single explicit negation in the composite construction. The inline comment reads “Rising real yields bearish commodities.” The negation is a POLARITY FLIP that aligns composite direction with forward-return direction. The state-conditional edges prove the sign is correct.

Benchmark construction. WTI 60-day forward return computed as `close.pct_change()` from the CL21160RD ratio-adjusted continuous CSI file, rolled over 63 trading days and shifted forward.

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What this signal does not cover

> **Blind spots a PM cares about before sizing**

First, the DFII10 series begins January 2003. The signal effective track record is 24 years, not the full 36-year NYMEX WTI history. The sample cannot speak to the pre-2003 real-rate regimes. Most notably the Volcker disinflation of the 1980s or the 1990s rate structure. A PM evaluating signal robustness should budget for the possibility that the 2003-2026 window is unrepresentative of the full historical real-rate distribution.

Second, the demand-destruction override risk. The 2019-2020 counter-example shows that low real yields do NOT prevent demand-shock crashes. When industrial activity collapses, crude demand can fall faster than any real-rate tailwind can prop it up. A PM running this signal on crude must overlay demand indicators (API/EIA weekly inventory flow, OPEC action, GDP forecasts, PMI readings). The signal gives a macro permission slip, not a demand forecast.

Third, oil-specific supply shocks can override the macro channel completely. OPEC-plus decisions, geopolitical events (Mideast conflict, Red Sea shipping disruption, Russia sanction regime changes), SPR releases, and refinery outages all move crude on timelines and magnitudes the 252-day real-rate z cannot anticipate. The signal does not read the oil-specific supply side. Pair with a dedicated crude supply signal (OPEC quota tracker, Cushing stocks, floating storage) for the full picture.

Fourth, the non-overlap 63-day IC of plus 0.074 is not significant at p=0.37 across 94 independent blocks. The signal has clean monotonic state edges but does not clear independent-sample significance on its own. Treat as corroborating evidence in a crude macro-plus-supply stack rather than as a standalone edge. Daily IC at plus 0.012 and p=0.25 is also not significant. This is a state-conditional backdrop, not a tactical trigger.

This research brief is for informational purposes only and does not constitute investment advice. Past performance is not indicative of future results. State-conditional statistics are computed through 2026-11-03 against NYMEX WTI ratio-adjusted continuous. The post-2003 effective sample, demand-destruction override risk, oil-specific supply-shock override, and insignificant IC on independent samples are explicitly disclosed. Data sources: FRED DFII10 10-Year TIPS Constant Maturity, CSI CL21160RD ratio-adjusted continuous target. Internal Phase 0 audit dated 2026-11-04.