# The China Hog-Belt Rain Signal, And Why Export-Pull Did Not Transmit The Way The Mechanism Expected

*Why daily CHIRPS precipitation across the North China Plain hog belt, inverted and tanh-bounded, has shown an empirical polarity opposite to the engine's a-priori call at both the deep-dry and deep-wet extremes.*

David Stendahl · Market Lab Analytics · October 30, 2026

## What this signal is

China produces and consumes approximately half the world's pork. The North China Plain is the densest production zone, running across Henan, Shandong, Hebei, Jiangsu, and Anhui provinces. Pre-African-Swine-Fever, Chinese pork production ran approximately fifty-four million metric tons annually and US pork exports to China ran approximately two hundred thousand metric tons. By ASF trough in 2020, Chinese production had fallen roughly thirteen million metric tons and US exports to China peaked at roughly seven hundred thousand metric tons.

This signal reads daily CHIRPS satellite precipitation across the North China Plain hog belt, takes a 30-day trailing mean, z-scores on a trailing five-year window, sign-flips so a dry read prints positive, and bounds the result from minus one to plus one. The engine's a-priori reading of positive values is bullish LH via the demand-pulse mechanism: NCP drought → Chinese production stress → import pull from US → bullish LH futures.

On December 18, 2020, during the ASF-COVID compound-shock environment, the composite at plus 0.64 preceded LH plus 44.9 percent fwd60d. On December 24, 2013, during a Chinese pork cycle expansion phase, the composite at plus 0.68 preceded LH plus 32.6 percent. On June 30, 2020, with abundant North China Plain rain and composite at minus 0.69, LH rose 102.5 percent through the summer rebalancing. On November 6, 2019, during the acute ASF phase, the composite at plus 0.52 preceded LH minus 25.7 percent as broader supply dynamics overrode the demand-pulse signal.

Today the composite reads plus 0.68 as of October 27, 2026. The deep-dry state has been running for 5 trading days as the North China Plain has been running dry through fall 2026.

Here is the honest finding. The engine's a-priori called positive composite bullish LH on the demand-pulse mechanism. The thirty-four-year back-test shows the EXTREME_POS state has

delivered mean fwd60d LH of minus 0.35 percent, 0.61 percentage points BELOW baseline. The EXTREME_NEG state has delivered plus 1.60 percent, 1.34 percentage points ABOVE baseline. The empirical polarity is inverted versus the engine's prior at both extremes. One probable reason: the ASF compound-shock era (2018-2020) distorts the sample with observations where Chinese production stress was already acute and the weather signal rode along rather than led. Another reason: the demand-pulse pathway is thinner than the engine's a-priori assumes because Chinese cold-storage reserves, MOFCOM import-license allocation, and currency effects all modulate the transmission from NCP weather to US pork export pull. Read on for three cases that frame how to read this signal with its empirical polarity, the state-conditional evidence, and the four caveats.

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## How the inputs compose

The CHIRPS satellite precipitation dataset provides daily global precipitation estimates from 1981 at approximately 5-kilometer resolution. The engine queries CHIRPS_REGIONAL_DAILY for the region CHINA_HOG_BELT_NCP, aggregating daily precipitation across the North China Plain hog belt.

The engine takes the daily precipitation series, computes a 30-day trailing mean, z-scores on a trailing 1,260-trading-day window with a 252-day minimum sample population, SIGN-FLIPS so a dry reading prints positive, and bounds by tanh.

The regime state machine maps the composite to five bands at the plus-or-minus 0.5 and plus-or-minus 0.2 thresholds. EXTREME_POS above plus 0.5 (38.3 percent of the sample). MODERATE_POS between plus 0.2 and plus 0.5 (22.3 percent). NORMAL between minus 0.2 and plus 0.2 (11.4 percent). MODERATE_NEG between minus 0.5 and minus 0.2 (6.6 percent). EXTREME_NEG below minus 0.5 (21.4 percent).

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## Three cases that frame how to read this signal

### Case 1: December 2020. Deep dry into ASF-era rally. The signal catches the compound shock.

Firing date: December 18, 2020 at composite plus 0.64. Forward 60-day LH return from entry: plus 44.9 percent.

Context: late 2020 was deep in the ASF-COVID compound shock. Chinese hog inventory had collapsed by approximately 40 percent from 2018 peaks. US pork export pull to China was at record highs. The NCP was running dry on seasonal cool-winter patterns, which the engine registered as deep-dry. The forward LH rally reflected the compound shock environment; the demand-pulse signal was along for the ride rather than leading.

### Case 2: December 2013. Deep dry into pre-ASF cycle expansion. The archetypal success case.

Firing date: December 24, 2013 at composite plus 0.68. Forward 60-day LH return from entry: plus 32.6 percent.

Context: late 2013 was mid-Chinese-pork cycle expansion. Chinese hog producer margins were strong; the cycle was approaching peak. NCP was running dry on seasonal patterns. The signal registered deep-dry. US pork exports to China through early 2014 were elevated. LH February and April 2014 contracts rallied through Q1 2014 on the combination of Chinese export pull and US-side cold-weather demand. The 2013 case is the archetype of what the engine's a-priori expected: dry NCP, Chinese stress, US export pull, LH rally.

### Case 3: November 2019. Deep dry into LH decline. The ASF-timing-mismatch case.

Firing date: November 6, 2019 at composite plus 0.52. Forward 60-day LH return from entry: minus 25.7 percent.

Context: November 2019 was the acute ASF phase in China. Chinese pork inventory was down approximately 40 percent; spot wholesale pork prices were at record highs. The NCP was running dry on seasonal cool-fall patterns. The signal registered deep-dry. But US pork exports to China had already front-loaded through Q3 2019; US WES shipments were elevated. The near-term demand pulse had passed. LH entered a Q4 correction phase on the realization that the surge was tapering.

The 2019 case teaches that the signal reads current NCP weather while the demand response is a timing variable that leads or lags.

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## What the state-conditional returns have actually done

The SPY forward-60-day return baseline (unconditional) is mean plus 2.31 percent, median plus 3.13 percent. Standard deviation 7.23 percent. Percent negative 29.8 percent. State-conditional means below are expressed as edges relative to this baseline.

> **Reference baseline (8,986 LH-aligned trading days from November 1990 through roughly July 2026)**
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> LH forward-60-day return baseline (unconditional): mean plus 0.26 percent, median minus 0.24 percent. Standard deviation 10.9 percent. Percent negative 51.7 percent. Phase 0 source: Z4245 engine parquet joined with LH back-adjusted continuous closes.

The signal's EXTREME_POS state (composite above plus 0.5), 3,439 trading days, delivered a mean forward 60-day LH return of minus 0.35 percent. That is minus 0.61 percentage points below baseline. The engine's a-priori called this bullish; the sample shows it mildly bearish.

The MODERATE_POS state (composite between plus 0.2 and plus 0.5), 2,004 days, delivered mean minus 0.21 percent, minus 0.47 pp below baseline.

The NORMAL state (composite between minus 0.2 and plus 0.2), 1,026 days, delivered mean plus 0.98 percent, plus 0.72 pp above baseline. The middle outperforms the extremes.

The MODERATE_NEG state (composite between minus 0.5 and minus 0.2), 596 days, delivered mean minus 0.18 percent, minus 0.44 pp below baseline.

The EXTREME_NEG state (composite below minus 0.5), 1,921 days, delivered mean plus 1.60 percent, plus 1.34 pp above baseline. The strongest state in the sample on mean, opposite to the engine's prior.

Spearman information coefficient of the composite against LH forward returns:

- h=20: minus 0.0509 ($p < 0.0001$), WRONG SIGN versus engine prior.
- h=60: minus 0.0093 ($p = 0.380$), not significant.
- h=125: minus 0.0378 ($p < 0.001$), WRONG SIGN versus engine prior.

The IC is weakly wrong-signed. The state-conditional panel confirms the direction at the extremes.

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## How to use the signal today

Three readings.

First, with the empirical polarity reframed. The engine's a-priori called positive composite bullish LH. The sample shows the opposite at both extremes. Readers consuming the raw engine output should apply the sign flip for the EXTREME_POS and EXTREME_NEG tails.

Second, as a pairing signal with the China heat THI signal. The LH China Hog Belt THI signal (same geographic region, demand-side via heat) delivers plus 0.078 IC. The China precipitation signal delivers minus 0.009 IC. The two measure different mechanisms. The heat signal catches physical hog stress (ADG compression, breeding failure); the precipitation signal was intended to catch feed-cost stress but the demand-pulse transmission has not held.

Third, as a research-stage artifact. The signal in its current construction does not deliver usable predictive content at 60-day horizons. Future work may filter to pre-ASF (1992-2017) and post-ASF-recovery (2022-present) separately to isolate the mechanism outside the compound-shock era.

Today's reading at plus 0.68, 5 trading days in EXTREME_POS, places the signal in the deep-dry zone per the engine convention. The historical pattern for EXTREME_POS entries has been mild downside bias.

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## Methodology notes

The signal's historical Spearman information coefficient against LH forward 60-day returns is minus 0.0093 ($n = 8{,}986$, $p = 0.380$), near-noise and not statistically significant at h=60. At h=20 IC is minus 0.051 (significant, wrong-signed); at h=125 IC is minus 0.038 (significant, wrong-signed).

The engine's polarity annotation reads: "Positive = bullish LH, Negative = bearish." The empirical direction is INVERTED at both extremes.

The regime state machine uses the plus-or-minus 0.5 and plus-or-minus 0.2 composite thresholds. Sample distribution: 38.3 percent in EXTREME_POS, 22.3 percent in MODERATE_POS, 11.4 percent in NORMAL, 6.6 percent in MODERATE_NEG, 21.4 percent in EXTREME_NEG.

The engine's identical sister (Z4331, same CHIRPS query, same transform) is in the library as a separate signal. Parent LH composites should NOT double-wire; the two are the same information.

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## What this signal does not cover

Four caveats, each stated plainly.

First, the engine's a-priori is empirically inverted at the extremes. Readers interpreting through the engine's "positive = bullish LH" prior will get the direction wrong.

Second, the ASF compound-shock era (2018-2020) distorts the state-conditional panel. Multiple outlier observations from this window should be understood as compound-shock artifacts.

Third, the signal is byte-identical to Z4331 in the library. Parent composites must not double-count.

Fourth, this is a slow-moving signal. Half-life approximately 60-90 trading days.

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*Not investment advice. The analysis in this brief is informational and educational. Signal readings, historical case figures, and empirical statistics are derived from publicly available data (CME Lean Hog settlement prices, USDA Foreign Agricultural Service Weekly Export Sales, CHIRPS satellite precipitation across the North China Plain hog belt) and are provided without warranty. The engine's a-priori polarity is empirically inverted at the extremes. Hypothetical performance results have inherent limitations. Readers should consult their own financial advisor before making any investment decision. (c) 2026 David Stendahl.*