# Beef as the Slow Demand Pull Under Pork

*Why the year-over-year rate of change in live cattle futures, z-scored over two years, has delivered a modestly significant forward-return pattern in lean hogs across 34 years, three cattle cycles, and the limits of retail protein substitution.*

David Stendahl · Market Lab Analytics · October 30, 2026

## What this signal is

When beef prices rise sharply year over year, retail buyers at the grocery counter, the restaurant chain, and the Mexican import warehouse quietly shift toward pork at the margin. The retail cross-price elasticity between beef and pork sits around 0.15 to 0.30 in the USDA elasticity work. Not high. Enough to matter.

This signal reads that substitution cycle. It takes the live cattle first-nearby back-adjusted continuous close, computes the 252-day percent change, z-scores on a trailing 504-day window with a 126-day minimum, applies tanh. A positive composite reads expensive beef year over year. A negative composite reads cheap beef year over year.

On May 16, 2022, as the US cattle supply tightened and front-nearby live cattle rallied through 143 cents per pound into mid-year, the composite entered its expensive-beef regime at plus 0.563 and lean hogs rose 38.4 percent over the next 60 trading days as the retail demand pull compounded with the pork-export recovery. On March 9, 2021, as the post-pandemic beef cycle extension resumed and the composite registered plus 0.585, lean hogs rose 37.1 percent over the next 60 days as the classical substitution pull reasserted itself.

Today the composite reads minus 0.9416 as of October 27, 2026, in Moderate-Negative state 84 trading days running. Live cattle's year-over-year rate of change has moderated materially after the 2025 breakout, and the signal reads this as a reduced-substitution-pull regime. The 84-day persistence crosses the stability threshold.

Here is the twist. This signal is directionally correct but modest in magnitude. The expensive-beef state (composite above plus 0.5) has delivered mean lean hog forward 60-day returns of plus 0.58 percent, which is only 0.33 pp above the long-run baseline. The cheap-beef state has delivered plus 0.15 percent, essentially flat to baseline. The two middle-bearish states deliver small negative edges. Retail protein substitution is a real mechanism, but it is weak at the futures-price level because feed-cost shocks hit both markets simultaneously and retail pass-through is slow. Read on for three cases

that frame how to read this signal, the state-conditional evidence that back-tests the modest edge, and the four caveats including why the 2020 pandemic readings should be set aside.

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## How the inputs compose

CME live cattle futures front-nearby settle in cents per pound, quoted on the 400-pound finished-cattle convention. The signal reads the vendor-archive back-adjusted continuous close daily. It computes the trailing 252-day percent change (one year of trading days). It z-scores that annual rate of change on a trailing 504-day window (two years) with a 126-day minimum sample population. It applies tanh to bound the result into a scale from minus one to plus one. No sign flip. A high positive composite means beef is expensive year over year; a high negative composite means beef is cheap year over year.

The engine computes four confirming features alongside the primary composite. Five-day composite velocity. Volatility regime via the 20-day over 252-day composite volatility ratio. 63-day rolling correlation between the composite and lean hog daily returns. 63-day lag-1 autocorrelation.

The regime state machine maps the composite to five bands at the plus-or-minus 0.5 and plus-or-minus 0.2 thresholds. Expensive Beef above plus 0.5 (35.5 percent of the sample). Moderate-Positive between plus 0.2 and plus 0.5 (10.9 percent). Normal between minus 0.2 and plus 0.2 (9.8 percent). Moderate-Negative between minus 0.5 and minus 0.2 (8.1 percent). Cheap Beef below minus 0.5 (35.6 percent). The sample distribution is strongly bimodal: 71 percent of all trading days are in one of the two extreme states. The cattle year-over-year rate of change rarely sits at equilibrium.

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## Three cases that frame how to read this signal

### Case 1: May 2022. Expensive beef into cattle-cycle tightening.

Firing: Expensive Beef state entry on May 16, 2022 at composite plus 0.563. Forward 60-day lean hog return from entry: plus 38.4 percent.

Through 2021 and the first half of 2022, the US cattle cycle tightened. Beef cow slaughter stayed elevated from the 2021 drought liquidation; feeder supply shrank; front-nearby live cattle rallied through 143 cents per pound by mid-year 2022. The year-over-year rate of change in live cattle moved sharply positive and the signal entered Expensive Beef state in May. Simultaneously, pork export demand was recovering on the Mexico-destined order book and the post-pandemic retail protein substitution was running. Front-nearby lean hogs rose 38.4 percent over the next 60 trading days.

The 2022 case anchors the modern-era Expensive Beef pattern. Cattle supply tightening drove beef prices up; retail protein buyers shifted toward pork at the margin; the pork market priced the demand pull.

### Case 2: March 2021. Post-pandemic normalization.

Firing: Expensive Beef state entry on March 9, 2021 at composite plus 0.585. Forward 60-day lean hog return from entry: plus 37.1 percent.

Through winter 2020-21 the cattle market was recovering from the pandemic plant-shutdown period. By March 2021, front-nearby live cattle was trading near 123 cents per pound, up roughly 20

percent from the April 2020 low. The year-over-year rate of change was sharply positive. The signal entered Expensive Beef state and lean hog futures rallied 37.1 percent over the next 60 days as retail demand normalized and the beef-pork substitution reasserted.

The 2021 case illustrates the classical substitution pull in a non-crisis regime. The 2020 pandemic distortions had faded; the macro backdrop was recovering; the price signal was clean.

### Case 3: July-August 2020. The pandemic distortions.

Firing: Expensive Beef state entry on August 14, 2020 at composite plus 0.502. Forward 60-day lean hog return from entry: plus 63.1 percent. The paired Cheap Beef entry on July 21, 2020 at composite minus 0.552 delivered forward 60-day return of plus 107.6 percent.

Through summer 2020, both the beef and pork markets were in deep distortion. Plant-shutdown effects had cleared, cattle backlogs had moved through the system, and both front-nearby markets were recovering from the April lows. The signal registered Cheap Beef in late July (reading from the depressed year-over-year LC comparison off the April LC crash). It then flipped to Expensive Beef by mid-August as the LC price recovery hit the one-year anniversary of the pandemic shock. Both readings delivered extreme forward 60-day returns because lean hogs themselves were in the recovery phase from the April cash hog collapse.

The 2020 case teaches an important limit. Readings during pandemic-era anniversary periods are not representative of the signal's long-run behavior. The year-over-year comparison inherits the distortion of the previous year's extreme period. Both the Cheap Beef and Expensive Beef entries during that window delivered multi-decade-rare forward returns, and those entries should be set aside when calibrating the signal's long-run edge.

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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 3.14 percent. Standard deviation 7.23 percent. Percent negative 29.8 percent. State-conditional means below are expressed as edges relative to this baseline.

The lean hog back-adjusted continuous forward 60-day return baseline over 8,646 aligned trading days from March 1992 through August 2026 is mean plus 0.26 percent, median minus 0.30 percent. Standard deviation 12.27 percent. Percent negative 51.4 percent.

> **Reference baseline (8,646 LH-aligned trading days, March 1992 through August 2026)**
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> Lean hog forward 60-day return baseline (unconditional): mean plus 0.26 percent, median minus 0.30 percent. Standard deviation 12.27 percent. Percent negative 51.4 percent. Phase 0 source: Z3297 engine parquet joined with CME Lean Hogs back-adjusted continuous closes.

The Expensive Beef state (composite above plus 0.5), 3,072 trading days (35.5 percent of the sample), delivered mean forward 60-day lean hog return of plus 0.58 percent, which is 0.33 pp above baseline. Naive t-statistic plus 1.93, borderline significant. Median plus 0.59 percent. Percent negative 46.5 percent.

The Moderate-Positive state (composite between plus 0.2 and plus 0.5), 947 days, delivered mean minus 0.47 percent, 0.73 pp below baseline. Naive t minus 2.12.

The Normal state (composite between minus 0.2 and plus 0.2), 846 days, delivered mean plus 0.89 percent, 0.63 pp above baseline. Naive t plus 1.50.

The Moderate-Negative state (composite between minus 0.5 and minus 0.2), 700 days, delivered mean minus 0.51 percent, 0.76 pp below baseline. Naive t minus 1.37.

The Cheap Beef state (composite below minus 0.5), 3,081 days (35.6 percent of the sample), delivered mean plus 0.15 percent, essentially flat at 0.10 pp below baseline. Naive t minus 0.40. Median minus 1.52 percent. Percent negative 56.2 percent.

The empirical pattern is weakly monotone in direction but modest in magnitude. The Expensive Beef state delivers the best edge (plus 0.33 pp) and that edge is borderline statistically significant on its own. The Cheap Beef state is flat to baseline, which is weaker than the directional thesis would predict and is consistent with the mechanism being contaminated by the shared feed-cost structure. The two middle-bearish states (Moderate-Positive and Moderate-Negative) deliver below-baseline readings; the two middle states combined form a weak-signal signature where the information in the composite is low. Spearman information coefficient of the composite against lean hog forward 60-day returns is plus 0.0890 (p = 1.1e-16, n = 8,646). The information is directionally real and statistically well-identified at the full-sample level, but the state-conditional stratification is noisy.

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## How to use the signal today

This is a slow substitution-pull overlay, not a tactical trigger.

Three best uses.

First, as a cross-protein cycle lens. When beef is expensive year over year, the signal says “expect modest demand pull on pork.” When beef is cheap, the signal says “expect modest demand headwind on pork.” Each regime shifts the pork export outlook by a quarter or two.

Second, as one of several inputs to a lean hog composite. On its own, the state-conditional edges are small and the signal should not drive sizing. In combination with faster inputs (basis, term structure, positioning, feed-economics) the signal adds a modest cross-protein overlay.

Third, as a persistence check. The current MODERATE_NEG duration of 84 trading days crosses the stability threshold. This is a durable regime, not a transient dip. Readers should treat the current reading as a slow neutral-to-slightly-bearish backdrop until the LC year-over-year rate of change turns.

The current reading at minus 0.94 in Moderate-Negative state is a durable slow neutral-to-slightly-bearish backdrop. Watch for a live cattle cycle inflection (cattle cycle bottoming or extending the current correction) as the catalyst that would move the signal toward Normal and eventually Expensive Beef.

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## Methodology notes

The signal reads the live cattle first-nearby back-adjusted continuous close, computes trailing 252-day percent change, z-scores on a trailing 504-day window with 126-day minimum, applies tanh. No sign flip. Positive composite reads expensive beef year over year; negative composite reads cheap beef.

Spearman information coefficient against lean hog forward 60-day returns is plus 0.0890 (n = 8,646, p = 1.1e-16), modestly significant and aligned with the engine's declared polarity. The information is directionally monotone but the state-conditional magnitudes are small.

The parent LH Truthsayer composite assigns this signal a polarity sign of plus one with weight 0.1412 (second-largest weight in the composite). The parent sign aligns with the empirical IC sign.

The regime state machine uses the plus-or-minus 0.5 and plus-or-minus 0.2 composite thresholds. The sample distribution is strongly bimodal: 71 percent of all trading days are in one of the two extreme states. The cattle year-over-year rate of change rarely sits at equilibrium because the cattle cycle produces multi-year arcs rather than mean-reverting oscillations.

Three complete sample episodes anchor the Expensive Beef calibration: 2014-H2 (record cattle highs), 2022-H1 (post-drought cattle supply tightening), and 2025-H1 (cattle breakout). The 2020 pandemic-era entries should be set aside as regime-specific anomalies that inherit the year-over-year distortion from the April 2020 LC crash.

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## What this signal does not cover

Four caveats on the signal's reach.

First, the signal does not capture retail-level price pass-through. The futures-price year-over-year read is a proxy for retail beef pricing; the actual retail cross-price elasticity between beef and pork is weak (0.15 to 0.30) and the pass-through from futures to retail is slow and partial. A retail-beef-price index (BLS CPI beef and veal) overlay would be more precise.

Second, feed-cost shocks hit both the cattle and hog markets simultaneously. A corn-price spike that drives up LC also drives up LH; the pure substitution signal is contaminated by the shared cost structure. During feed-shock periods (2012 drought, 2022 Russia-Ukraine), the signal's directional read is less informative.

Third, the 2020 pandemic-era readings are regime-specific anomalies. The paired Cheap Beef (July 2020, +107.6% fwd60d) and Expensive Beef (August 2020, +63.1% fwd60d) entries both delivered multi-decade-rare forward returns because lean hogs themselves were in the recovery phase from the April cash hog collapse. These entries should be set aside when calibrating the signal's long-run edge.

Fourth, this is a modest signal in magnitude. The best state-conditional edge is 0.33 pp above baseline, borderline statistically significant. The signal is useful as a slow background overlay but should not drive position sizing on its own. Combine with faster inputs for tactical decisions.

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*Not investment advice. The analysis in this brief is informational and educational. Signal readings and historical statistics are derived from publicly available data (CME Live Cattle settlement prices for 1992 to 2026; CME Lean Hogs settlement prices) and are*

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