The Variance-Ratio Predictability Signal, Market-Microstructure Overlay on Live Cattle

Why the rolling Lo-MacKinlay variance-ratio statistic on CME Live Cattle, signed by 20-day direction, captures regime of exploitable serial predictability – Grade C+ market-microstructure overlay distinct from Hawkes jump-cluster and peer-complex signals.

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What this signal is, with the limits stated upfront

The Lo-MacKinlay variance-ratio (VR) test is a classical measure of market predictability. VR(2) compares the ratio of 2-period return variance to twice the 1-period return variance. In a random-walk market, VR equals 1; in a momentum-rich market, VR exceeds 1; in a mean-reverting market, VR falls below 1. The departure from 1 quantifies exploitable serial structure in returns.

Chow-Denning tests reject the martingale-difference-sequence hypothesis for CME Live Cattle (Truth LC_T051), confirming that LC returns exhibit non-random-walk behavior. This signal operationalises that empirical finding as an actionable directional signal.

This signal computes a rolling 252-day Lo-MacKinlay VR(2) statistic on CME Live Cattle, subtracts 1 (to center on random-walk expectation), z-scores, and multiplies by the sign of the 20-day cumulative return. The result captures DIRECTIONAL predictability – when VR deviates significantly from 1 AND the market has been trending, the signal amplifies in the direction of the trend. Z-score on 504-day rolling window. Tanh-bounded to [−1, +1]. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Daily release cadence.

Daily Spearman IC against LC fwd60d is minus 0.038 at p-value 3.6e-4 across 9,049 trading days – marginal. Non-overlapping (every-60-day) IC is minus 0.131 at p-value 0.11 – marginal (close to the 0.1 significance threshold). Phase −1 (Negative Momentum-Predictability) delivers +1.60 percent fwd60d at 61 percent hit rate, +0.58 pp above the +1.02 percent baseline. Phase +1 (Positive Momentum-Predictability) delivers +0.67 percent fwd60d at 56 percent hit rate, −0.35 pp below baseline. Phase 0 (Random Walk) delivers +0.51 percent – below baseline.

This is a Grade C+ market-microstructure predictability overlay. The directional edge is modest but the regime read is informative – the signal captures when LC has exploitable serial-correlation structure.

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How the variance-ratio mechanism composes

The Lo-MacKinlay VR test decomposes observed return variance into contributions from different time scales. For a true random walk, consecutive-period variance scales linearly: 2-period variance equals twice the 1-period variance. When returns have positive autocorrelation (momentum), the 2-period variance exceeds twice the 1-period – VR > 1. When returns have negative autocorrelation (mean reversion), VR < 1.

The signed version (VR x 20-day direction) adds directionality: a VR deviation combined with recent upward direction produces a positive composite; a VR deviation combined with recent downward direction produces a negative composite.

Phase +1 (Positive composite): VR deviates from 1 AND 20-day direction is positive. Momentum-predictability regime active in positive direction. Historical pattern: modestly below baseline (-0.35 pp) – the signal fires in momentum regimes but doesn't guarantee continuation.

Phase –1 (Negative composite): VR deviates from 1 AND 20-day direction is negative. Momentum-predictability regime active in negative direction. Historical pattern: ABOVE baseline (+0.58 pp) – captures mean-reversion recovery dynamics well.

Phase 0 (Random Walk): VR is near 1 (no predictability). Historical pattern: below baseline (-0.51 pp).

This signal is DISTINCT from other LC microstructure signals:

- **Hawkes Jump-Cluster (Z32615)**: endogeneity branching ratio (self-exciting process).
- **Peer-Complex Co-Movement (Z32645)**: cross-market common-factor regime.
- **Z32620**: variance-ratio predictability (serial-correlation structure).

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What the state-conditional returns have actually done

> **Reference baseline – LC fwd60d (unconditional)**
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> CME Live Cattle back-adjusted continuous (LC20040BD) forward-60-day return baseline (unconditional): mean plus 1.02 percent, median plus 1.74 percent, standard deviation 8.01 percent, percent negative 41.8 percent. Sample window 1990-11-29 through 2026-10-30.

Phase plus 1 (Positive Momentum-Predictability, composite greater than plus 0.3) covers 4,149 trading days – 45.9 percent of the sample. Per-day mean fwd60d is plus 0.67 percent, hit rate 56 percent. Edge below baseline: minus 0.35 pp.

Phase 0 (Random Walk, composite between plus and minus 0.3) covers 1,237 trading days – 13.7 percent of the sample. Mean fwd60d is plus 0.51 percent, hit rate 52 percent. UNDERPERFORMS baseline by 0.51 pp.

Phase minus 1 (Negative Momentum-Predictability, composite less than minus 0.3) covers 3,663 trading days – 40.5 percent of the sample. Per-day mean fwd60d is plus 1.60 percent, hit rate 61 percent. Edge above baseline: plus 0.58 pp.

Phase –1 is the stronger regime. Phase +1 is modestly below baseline – the signal captures momentum regimes but doesn't guarantee forward continuation.

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Three cases that frame how to read this signal

Case 1: October 2016. Negative Pred – 2016 Q4 mean-reversion recovery.

Firing date: October 13, 2016 at composite minus 0.88. Forward 60-day LC return: plus 26.55 percent.

Context: LC had been in a mean-reverting regime through 2016 with 20-day direction negative, producing a deeply negative composite. Live cattle were at $94. Forward LC rallied 27 percent as the mean-reversion dynamics resolved into a strong recovery. Canonical Negative Pred anchor.

Case 2: January 2020. Positive Pred – pre-COVID momentum regime break.

Firing date: January 9, 2020 at composite plus 0.90. Forward 60-day LC return: minus 33.85 percent.

Context: LC had been in a momentum regime through 2019 with direction positive, producing positive composite. BUT the trade then reversed abruptly – live cattle fell 34 percent as COVID broke the momentum. This 2020 case documents the risk of momentum-predictability signals during regime inflection.

Case 3: October 2003. Positive Pred – 2003 pre-BSE momentum break.

Firing window: October 2003 at composite near plus 0.80. LC was in a momentum regime running into the December BSE discovery that abruptly broke the trend. Forward LC fell as the exogenous shock dominated the microstructure signal.

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How to use the signal today

As of November 1, 2026, the composite reads plus 0.661 – Positive Momentum-Predictability EXTREME POS firing, 15 trading days running. The LC rolling VR x 20-day direction composite is deeply positive. CME Live Cattle trades the $220-230 range.

The current reading is in the Phase +1 band in the EXTREME POS sub-band (above +0.5). Historical Phase +1 delivers –0.35 pp below baseline at 56 percent hit rate – not high-conviction constructive.

Pair with four confirming reads:

- **LC-Corn Ratio Signal (Z15201)**. Grade A LC fundamental anchor.
- **LC Term Structure Curve (Z3260)**. Strongest-IC directional signal.
- **LC Hawkes Jump-Cluster (Z32615)**. Microstructure overlay (complement).
- **LC Peer-Complex Co-Movement (Z32645)**. Systematic common-factor overlay.

Variance-ratio predictability is a microstructure overlay distinct from fundamentals – it captures when LC returns have exploitable serial-correlation structure. The historical pattern suggests Phase +1 (momentum regimes) are NOT reliably bullish for forward 60 days; Phase –1 (mean-reversion regimes) have been stronger.

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Methodology notes

Data source. CME Live Cattle back-adjusted continuous returns (LC20040BD).

Signal construction. Rolling 252-day Lo-MacKinlay VR(2) statistic, subtracts 1 to center on random-walk expectation, z-scores, and multiplies by the sign of 20-day cumulative return. Operationalises Truth LC_T051/T046/T052 microstructure findings. Z-score on 504-day rolling window with 60-day minimum sample. Tanh-bounded to [−1, +1]. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Phase +1 above +0.3, phase −1 below −0.3.

Validation statistics. Daily Spearman IC against LC fwd60d is −0.038 at p = 3.6e-4 (n = 9,049) – marginal. Phase −1 (Negative Pred) state-conditional per-day mean fwd60d plus 1.60 percent (+0.58 pp above baseline). Phase 0 (Random Walk) mean plus 0.51 percent (-0.51 pp below). Phase +1 (Positive Pred) per-day mean plus 0.67 percent (-0.35 pp below baseline).

Independence test. Non-overlapping (every-60d) sampling yields Spearman IC −0.131 at p-value 0.11 – marginal (close to the 0.1 significance threshold).

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What this signal does not cover

First, both daily IC and non-overlap are marginal. The directional edge is modest and the Phase +1 bullish empirical is only slightly below baseline on average – not a strong directional read.

Second, VR estimates depend on rolling-window parameters (252-day window chosen based on Truth-series calibration). Longer or shorter windows would give different predictability indicators.

Third, momentum-predictability regimes can give way to abrupt regime breaks (as in 2003 pre-BSE and 2020 pre-COVID cases). The signal cannot predict regime inflections.

Broader caveat: Grade C+ microstructure predictability overlay. Pair with Hawkes jump-cluster and peer-complex signals for the full microstructure stack; pair with fundamentals for directional reads.

This research brief is for informational purposes only and does not constitute investment advice. Past performance is not indicative of future results. Signal reads reflect historical state-conditional statistics; any decision to act on signal readings is the reader's responsibility. Data sources: CME Live Cattle back-adjusted continuous (LC20040BD) daily returns. State-conditional statistics computed through 2026-10-30.