The KC ENSO Dipole NINO3-NINO4 Signal: Why ENSO Geographic Structure Leads Arabica at Sixty Days

Why the NINO3 minus NINO4 SST anomaly, read as an ENSO geographic structure lens, delivers a daily Spearman information coefficient of plus 0.123 against Arabica forward 60-day returns on a 36-year sample.

David Stendahl · Market Lab Analytics · November 5, 2026

The signal with the limits stated upfront

Three things the reader must know before the rest of this brief lands.

First, the full-distribution daily Spearman information coefficient against Arabica forward 60-day returns is plus 0.123 at p-value 1.4e-31 on a sample of 8,947 daily observations spanning 1990 through 2026. Strongly significant on a 36-year window; this is one of the most statistically significant lead signals in the KC library.

Second, Phase +1 (EP Canonical) delivers plus 3.44 percentage points above baseline across 3,795 trading days (42.4 percent of sample) and Phase –1 (Modoki CP-warm) delivers minus 4.06 percentage points across 2,744 days (30.7 percent). 7.50 pp directional spread. The pattern is monotone and symmetric around baseline; this is a two-sided regime signal.

Third, the non-overlapping independence test at 60-day sampling is sign-consistent but borderline significant. Across 150 independent samples the Spearman is plus 0.143 with p-value 0.08. The signal is strong on daily sampling but the independence test does not strongly clear the 5 percent threshold.

The thesis: ENSO geographic structure

El Nino is not one phenomenon. Canonical EP-warm events center their sea-surface-temperature anomaly in the eastern Pacific and drive one set of global teleconnections; Modoki or central Pacific-warm events center their anomaly in the central Pacific and drive a very different set of teleconnections. Single-index measures like the Oceanic Nino Index lump these two regimes together and lose structural information.

The dipole captures that structure. When NINO3 SST anomaly is materially warmer than NINO4, the regime is canonical EP-warm. When NINO4 dominates, the regime is Modoki or CP-warm. Brazil-

ian coffee is sensitive to the difference because the Pacific-to-South-America teleconnection pattern shifts when the warming center shifts west or east.

The signal takes NINO3 anomaly minus NINO4 anomaly from NOAA Climate Prediction Center weekly ENSO updates, z-scores on a rolling window, and tanh-bounds. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Phase +1 at composite above +0.3, phase −1 below −0.3. Target: ICE US Coffee C first-nearby back-adjusted close.

Historical window: NOAA CPC ERSSTv5 weekly ENSO series from 1982; engine runs from 1990 onward with 504-bar warmup.

What the firings have actually done

Computed over 8,947 daily observations post-warmup from 1990 onward.

> **Baseline Arabica forward 60-day return:** mean plus 2.32 percent / median minus 0.96 percent across the live-window sample.
>
> **Daily Spearman IC (fwd 60d):** plus 0.123, p-value 1.4e-31, N equals 8,947. Strongly significant.
>
> **Non-overlap IC (60-day step):** plus 0.143, p-value 0.08, N equals 150. Sign-consistent, borderline significant.
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> **Phase-conditional forward 60-day Arabica returns:** Phase +1 (EP Canonical, 3,795 days / 42.4 pct): plus 5.76 percent, edge plus 3.44 pp. Phase 0 (On Trend, 2,408 days / 26.9 pct): plus 1.52 percent, edge minus 0.80 pp. Phase −1 (Modoki CP-warm, 2,744 days / 30.7 pct): minus 1.75 percent, edge minus 4.06 pp.
>
> 7.50 pp directional spread between Phase +1 and Phase −1; one of the widest in the KC library.

Three findings. The daily IC is strongly significant on a 36-year window. The phase pattern is monotone and symmetric around baseline, confirming the dipole is a real two-sided regime signal. The 7.50 pp spread is wide; the Phase +1 and Phase −1 tails both carry material forward-return information rather than one tail dominating.

Three cases that frame how to read the signal

The canonical anchors are the 2015-2016 strong EP El Nino, the 1997-1998 super El Nino, and the 2020-2021 Modoki hybrid regime.

Case 1: The 2015-2016 strong EP El Nino

EP Canonical firing anchored the 2015-2016 strong El Nino regime. NINO3 SST anomalies peaked near plus 3 degrees Celsius in late 2015 while NINO4 lagged. Composite held deep in Phase +1 territory through the event. Arabica delivered material forward returns through the regime consistent with the empirical Phase +1 edge.

Case 2: The 1997-1998 super El Nino

EP Canonical firing anchored the 1997-1998 super El Nino, the strongest EP-warm event in the modern observational record. NINO3 SST anomalies peaked above plus 3.5 degrees Celsius with a clear eastern

Pacific center. Composite held deep in Phase +1 territory through the full event and Arabica saw substantial directional moves consistent with the Phase +1 edge. Canonical anchor for the empirical pattern.

Case 3: The 2020-2021 Modoki hybrid regime

Modoki CP-warm firing anchored the 2020-2021 period. The regime was a hybrid with La Nina conditions overall but the cooling was concentrated in the eastern Pacific while central Pacific SST anomalies ran warmer than classical La Nina patterns. The dipole captured the structural anomaly and composite held in Phase −1 territory through the double-dip event, consistent with weaker Arabica forward returns.

How to use this signal today

Composite is currently reading minus 0.889 in the Modoki CP-warm band. The STRESS phase began May 2026, 130 trading days ago. The ENSO dipole has run deeply negative through 2026 with NINO4 warming dominating NINO3. Arabica forward 60-day returns historically run below baseline in this regime.

Pair with the following for stacked conviction: the ENSO dry season weight signal (ONI magnitude), Brazil CHIRPS rainfall (short-lead confirmation of the teleconnection), SPEI Minas Gerais drought (medium-lead), and Cecafe Brazil realized price year-over-year (transaction-derived tightness). This dipole signal gives the ENSO structural read; pair with magnitude and local-weather confirmation for full ENSO conviction.

Reader rule: EP Canonical firings flag regimes with historically bullish Arabica forward returns at 60 days. Modoki CP-warm firings flag regimes with historically bearish Arabica forward returns. On Trend readings sit near baseline.

Methodology

Data source: NOAA Climate Prediction Center weekly ENSO update, NINO3 SST anomaly and NINO4 SST anomaly series from the ERSSTv5 reanalysis. Computation: NINO3 anomaly minus NINO4 anomaly, z-scored on a rolling window, tanh-bounded to plus or minus one. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Phase +1 at composite above +0.3, phase −1 below −0.3. Target: ICE US Coffee C first-nearby back-adjusted close.

Historical window: NOAA CPC ERSSTv5 weekly series from 1982; engine runs from 1990 onward with a 504-bar warmup for the rolling z-score.

Validation computed on 8,947 post-warmup daily observations. Daily Spearman IC plus 0.123 at p-value 1.4e-31 across 8,947 observations, strongly significant on 36-year window. Phase +1 per-day forward return plus 5.76 percent (plus 3.44 pp above plus 2.32 percent baseline). Phase −1 per-day forward return minus 1.75 percent (minus 4.06 pp below baseline). 7.50 pp directional spread. Non-overlap IC at 60-day sampling plus 0.143 at p-value 0.08 across 150 samples, borderline significant.

What this signal does not cover

The signal does not capture ENSO magnitude (see Z6507 ENSO dry season weight). It does not cover La Nina magnitude separately from structure. It does not confirm the actual rainfall outcome in Brazilian coffee regions (see CHIRPS Brazil rainfall and SPEI Minas Gerais drought). Teleconnection pathways can shift with climate-regime drift; recent Modoki regimes have been more frequent than the historical average.

Disclaimer

This brief and the signal it describes are for informational purposes only and do not constitute investment, legal, tax, or trading advice. Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not been executed, the results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. The phase-conditional forward-return stats reported above are a full-sample unconditional measurement. Readers should consult a licensed financial professional before taking any trading action.

References

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