Commodity - Equity Linkages: Evidence from Global Markets and Indian Equities

Personal Mini Project

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September, 2025

1. Executive Summary

India’s equity market is materially influenced by global commodity cycles through input costs, external balances, and investor risk appetite. This study evaluates eight internationally traded commodities (Brent crude, gasoline, natural gas, gold, silver, copper, wheat, aluminium) against the Nifty 50, using a fully reproducible pipeline that collects daily prices, aligns them to monthly frequency, and applies exploratory and econometric techniques. The objective is to identify which commodities most reliably relate to Indian equities, when they lead or lag, and how those relationships change across regimes.

Brent crude and copper consistently show the strongest linkages to Nifty. Oil captures energy cost and inflation channels; copper proxies global manufacturing demand. Lead - lag scans and Granger causality indicate that these series often precede Nifty by one to two months, providing tactical information. Gold behaves as a defensive asset that becomes relevant primarily during stress, rather than a continuous driver. Wheat and aluminium exhibit weaker and less consistent transmission into broad equities.

Sensitivity is not constant. During the COVID crisis and the Russia-Ukraine shock, rolling betas and abnormal return studies reveal sharper commodity-equity connections, especially via energy. We synthesize evidence into an indicator dashboard that ranks signals by timing strength, predictiveness, and time-varying sensitivity. Practical recommendations focus on monitoring Brent and copper as leading indicators, treating gold as a stress gauge, and revisiting sector exposures most affected by energy and industrial metals. The framework is designed for quarterly refresh to capture evolving market regimes with minimal overhead.

2. Problem Statement

Global commodity shocks can reprice Indian equities through costs, inflation, and currency effects. Market participants need a robust, auditable way to measure which commodities matter most for Nifty, whether they lead or lag, and how regime shifts alter these relationships.

3. Objectives

The study aims to build a transparent, end-to-end workflow that connects raw global commodity prices to actionable equity insights. Specific objectives include: collecting and aligning Big-8 commodity series and Nifty to monthly frequency; conducting exploratory analysis of prices and returns; quantifying timing with lead-lag scans and Granger causality; estimating time-varying equity sensitivity with rolling betas; attributing shocks using event studies; and consolidating all signals into a ranked indicator dashboard suitable for recurring monitoring and decision support.

4. Methodology

4.1 Data Sources and Frequency

Daily historical prices were pulled from Yahoo Finance using automated Python scripts and stored as raw CSV files. Series include Brent (BZ=F), gasoline (RB=F), natural gas (NG=F), gold (GC=F), silver (SI=F), copper (HG=F), wheat (ZW=F), aluminium (ALI=F), and Nifty 50 (^NSEI). Prices were resampled to end-of-month levels to match macro transmission horizons and reduce high-frequency noise.

4.2 Cleaning, Alignment, and Validation

We standardized column names, enforced a proper Date index, and selected adjusted close or close as the price field. Series

were resampled to monthly endpoints and merged into a single wide panel. Validation scripts check file existence, row counts, covered date ranges, duplicates, and missingness at both raw and processed layers. Outputs are saved under data/processed/ and reports/tables/ to ensure traceability.

4.3 Exploratory Analysis

We compute monthly returns and produce descriptive tables and visuals: price trajectories, return correlations, and rolling 12-month correlations. These contextualize co-movements and highlight potential channels such as energy costs and global demand.

4.4 Timing and Predictiveness

Lead-lag cross-correlations scan lags from minus twelve to plus twelve months to detect whether commodity returns precede or follow Nifty. Granger causality tests with short lags (one to six months) assess incremental predictive content beyond Nifty's own history. These methods provide complementary timing and predictiveness evidence.

4.5 Sensitivity and Shock Attribution

We estimate rolling 24-month betas from regressions of Nifty returns on each commodity's returns, revealing time-varying sensitivity. Event studies compute abnormal returns and cumulative abnormal returns around dated shocks, isolating departures from expected dynamics during crises

4.6 Modeling and Synthesis

Per-commodity best-lag regressions quantify effect sizes and significance. A parsimonious multivariate regression combines top non-collinear signals and is evaluated for multicollinearity and stability across regimes. Finally, we synthesize evidence into a dashboard that ranks commodities by lead-lag strength, Granger p-values, rolling beta peaks, and regression metrics. All figures and tables are generated programmatically to support

periodic refresh.

5. Regime Dependency and Key Events

Commodity - equity relationships strengthen in stress regimes. During March 2020's COVID shock, abnormal returns spiked and co-movements tightened. After February 2022, energy prices surged with the Russia–Ukraine conflict, amplifying equity sensitivity to oil. India's 2024 general election period coincided with elevated attention to macro risk and policy continuity; monitoring energy and industrial metals through that period provided relevant context for market expectations.

5.1 Events Timeline (reference)

Month	Event	Context for Linkages
Mar 2020	COVID market crash	Global demand collapse, funding stress, sharp commodity and
Feb 2022	Russia–Ukraine conflict	Energy supply shock, oil and gas spikes, inflation pressure, equity sensitivity rises
Apr - Jun 2024	India general election	Policy and macro continuity focus; monitoring oil and copper informed positioning

6. Results

6.1 Price Context

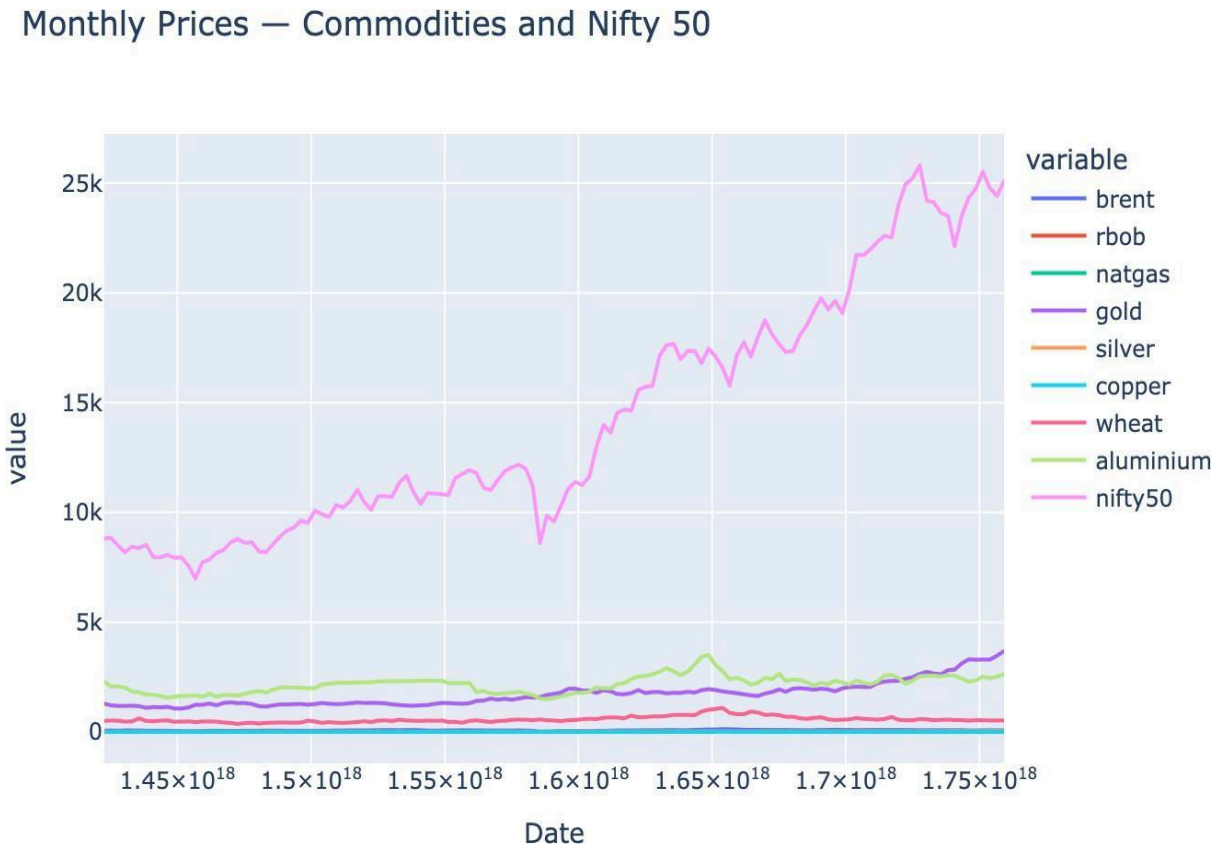

Figure 1: Monthly price levels for commodities and Nifty 50

Interpretation:

Commodity price cycles broadly align with Nifty's medium–term swings. Oil and copper co–move with growth phases, while gold often diverges in drawdowns as a defensive asset.

6.2 Return Correlations

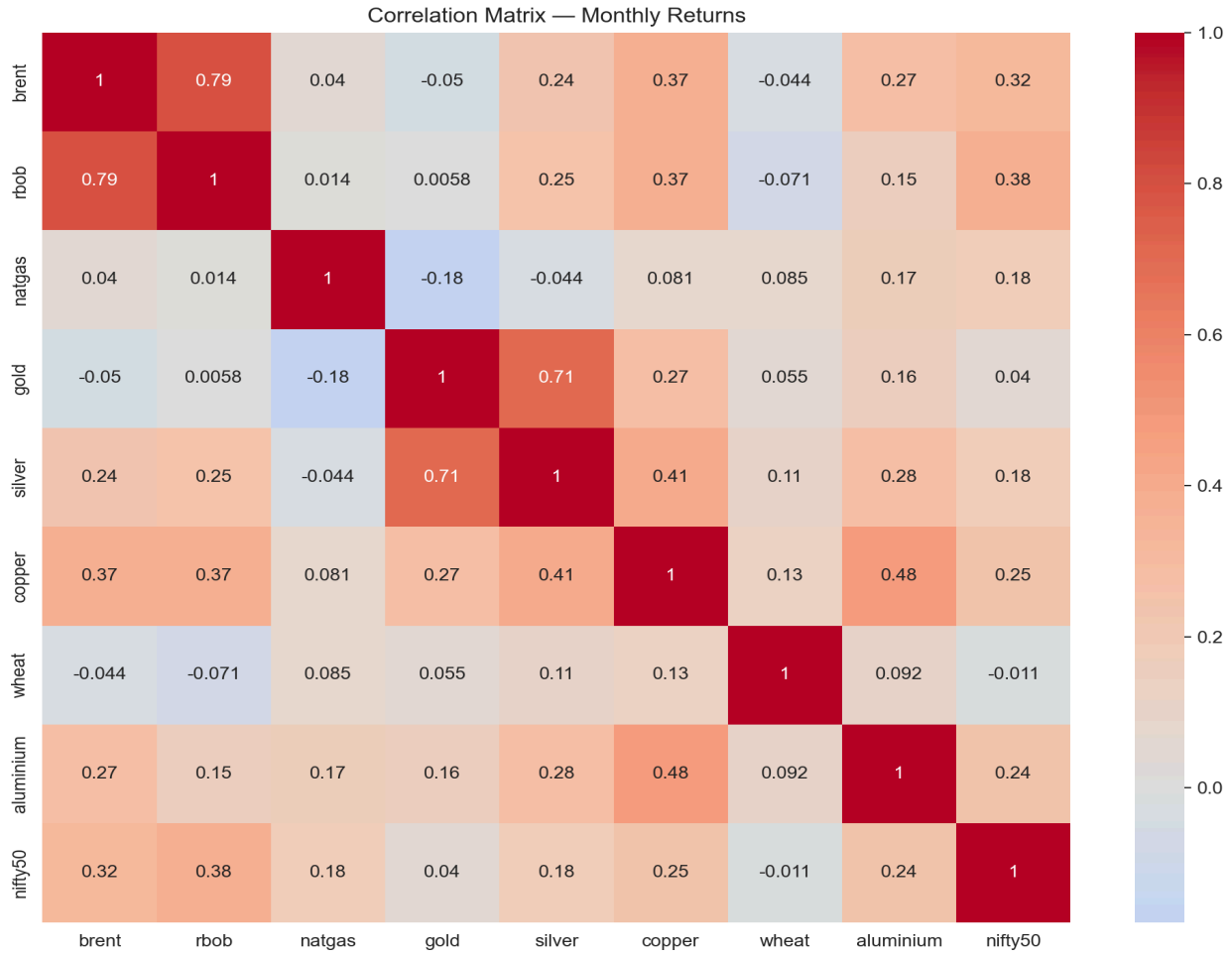

Figure 2: Correlation matrix of monthly returns

Interpretation:

Brent and copper exhibit the highest positive correlations with Nifty returns. Precious metals show weaker or countercyclical behavior

6.3 Rolling Betas

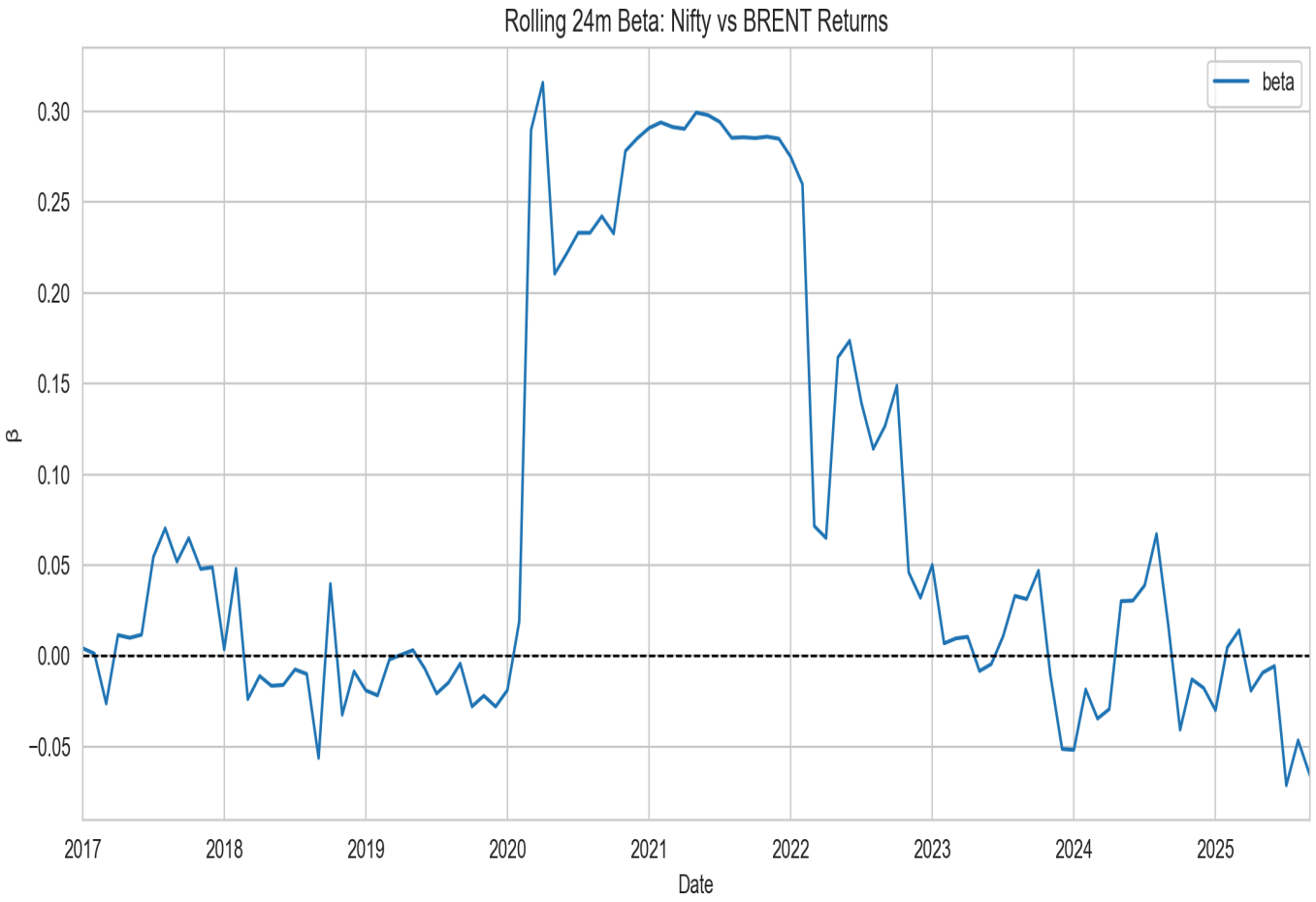

Figure 3: Rolling 24-month beta: Nifty returns on Brent return

Interpretation:

Equity sensitivity to oil rises in stress regimes, especially around energy supply shocks. Beta is not constant through time.

6.4 Rolling Betas

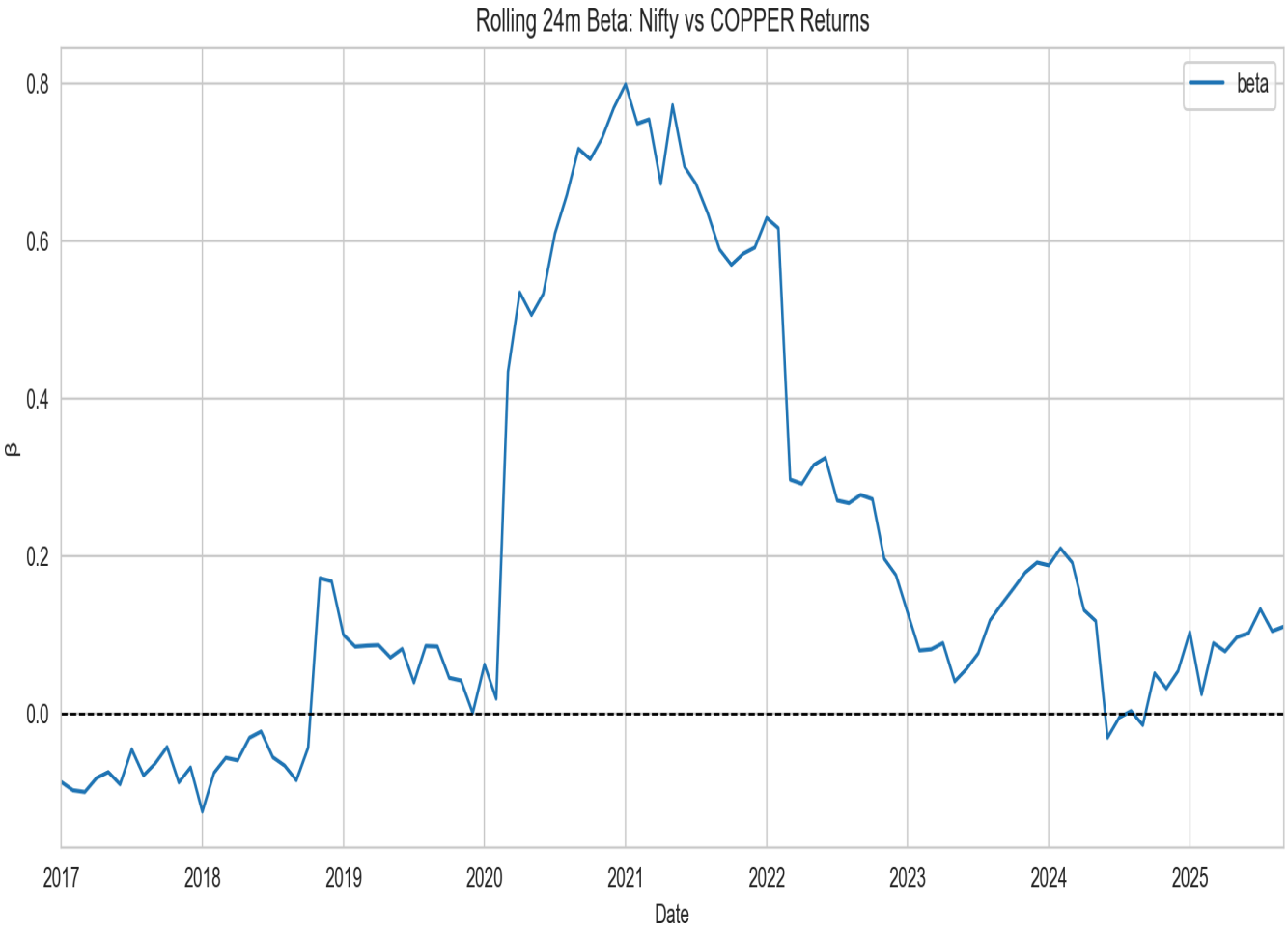

Figure 4: Rolling 24-month beta: Nifty returns on Copper returns

Interpretation:

Copper sensitivity tracks global industrial cycles, aligning with stronger growth phases in Indian equities.

6.5 Event Study - Covid Crash

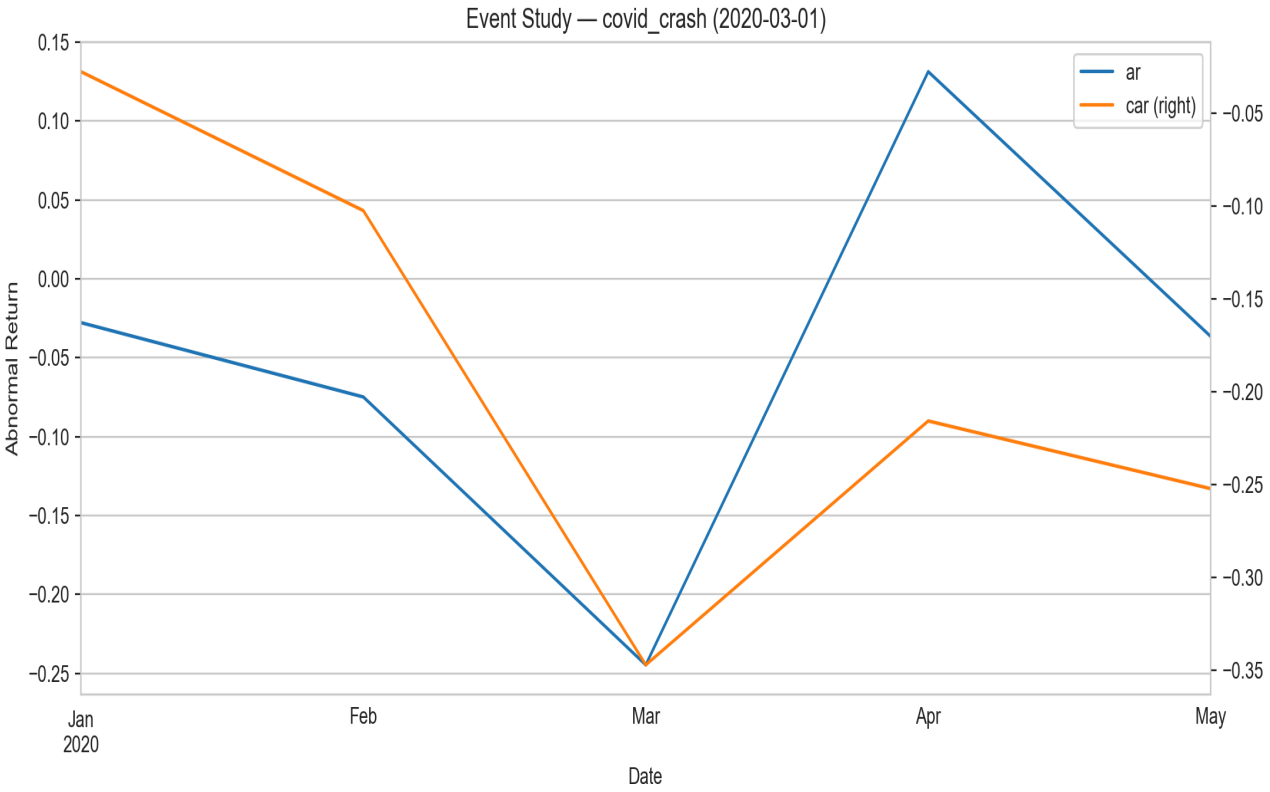

Figure 5: Event study: COVID shock (March 2020) abnormal and cumulative abnormal returns

Interpretation:

Abnormal returns were marked negative during the crash as commodity shocks propagated into equities. The path of cumulative abnormal returns confirms the depth of disruptions.

6.6 Event study - Ukraine Crisis

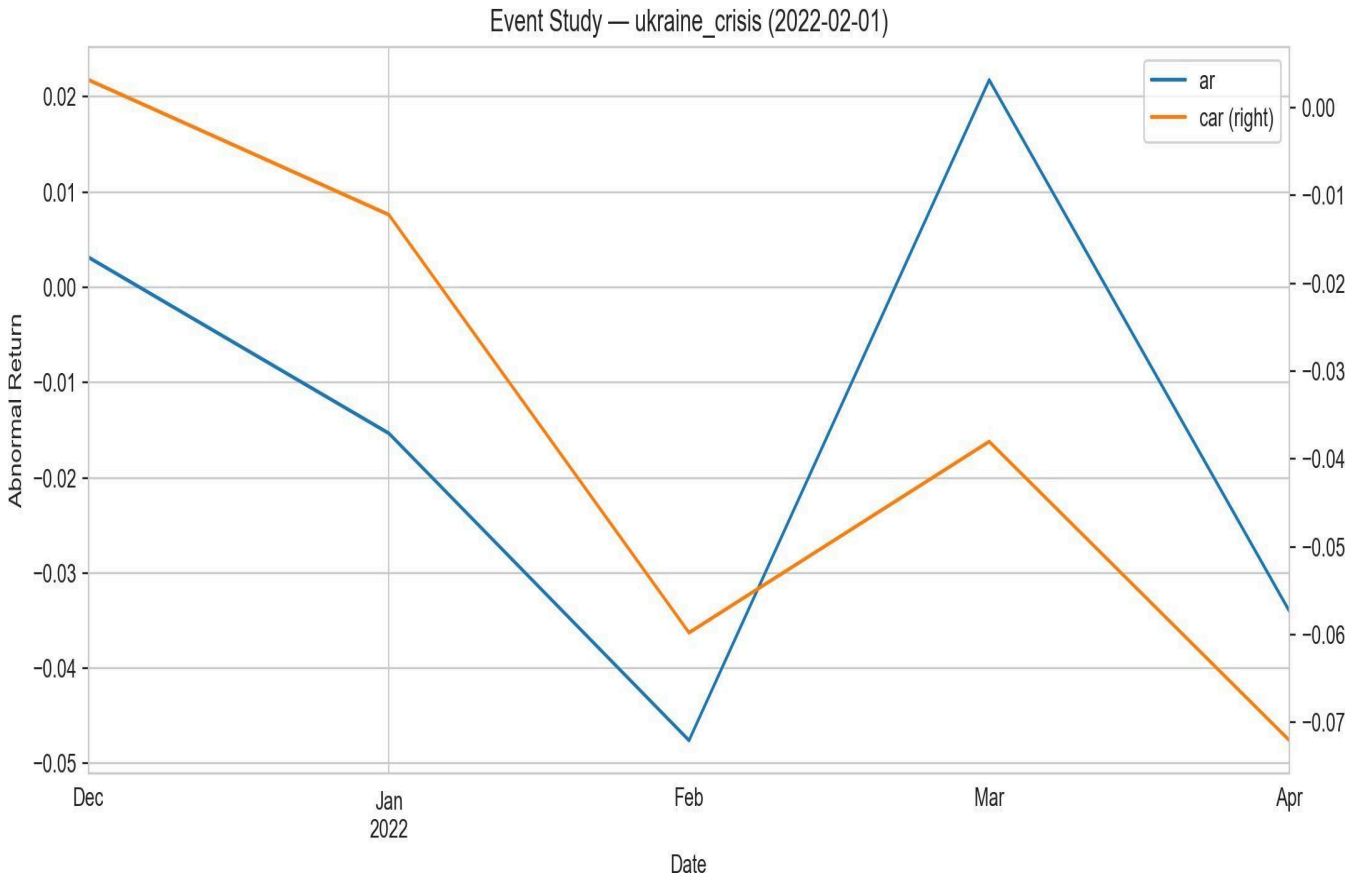

Figure 6: Event study: Russia-Ukraine shock (February 2022) abnormal and cumulative abnormal returns

Interpretation:

Energy price spikes following the conflict tightened the commodity–equity linkage, particularly through cost and inflation channels.

6.7 Indicator Dashboard

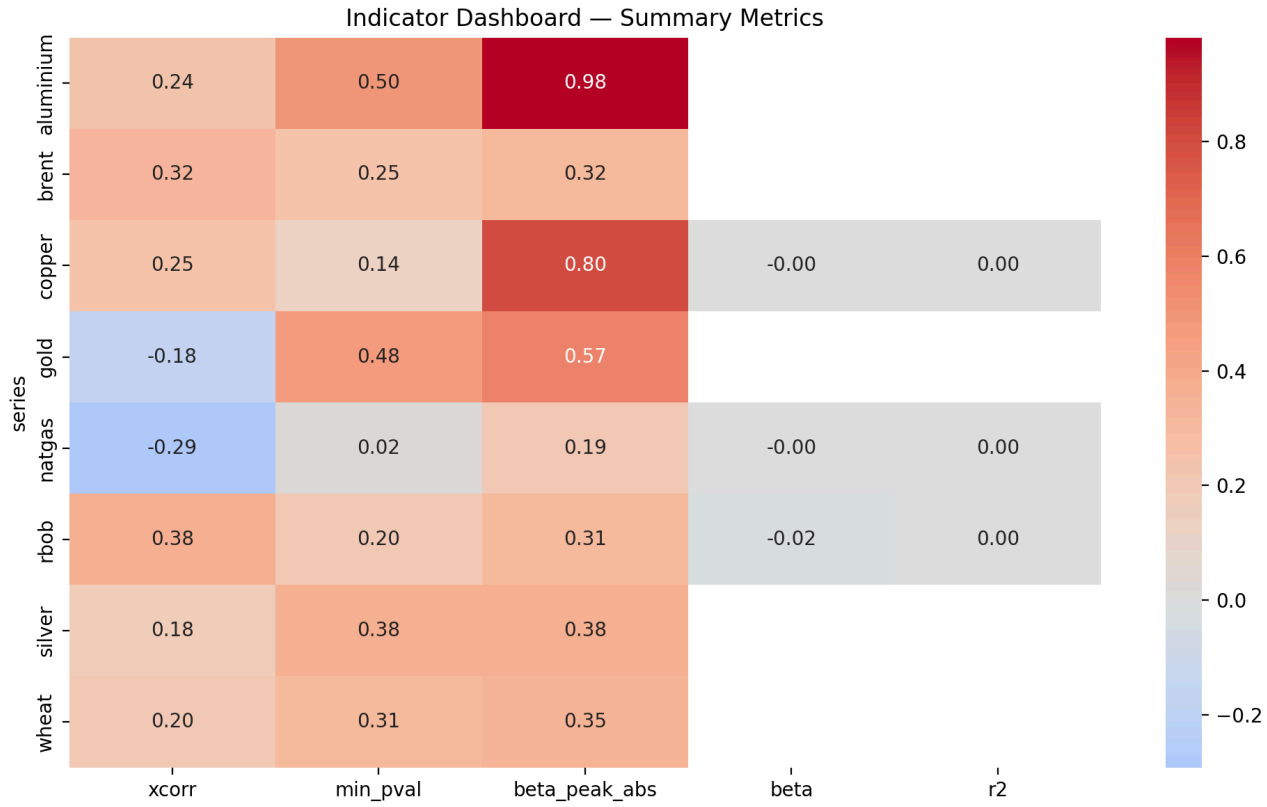

Figure 7: Indicator dashboard:lead-lag strength, Granger significance, rolling beta peaks, and regression metrics

Interpretation:

Brent and copper rank highest across timing, predictiveness, and sensitivity.

Gold is episodic and most relevant in stress regimes.

Wheat and aluminium show weaker and less consistent equity transmission.

7. Conclusion

This report builds an auditable bridge from global commodity markets to Indian equities, showing where and when external price dynamics carry information for Nifty. The framework integrates multiple perspectives. Price and return correlations establish broad co–movement patterns. Lead–lag scans and Granger causality quantify timing and predictive content. Rolling betas capture the time variation in equity sensitivity. Event studies isolate abnormal performance around major shocks. Together, these tools provide a robust, multi–lens view that moves beyond single–metric conclusions.

Across the Big–8 commodities, energy and industrial metals stand out. Brent crude consistently exerts influence through import costs, inflation expectations, and currency interactions. Copper reflects global manufacturing momentum and investment cycles. Both series repeatedly show leading behavior in the one to two month range, offering tactical signals. Precious metals, particularly gold, retain a role as defensive markers that become more informative during stress, rather than continuous drivers of broad equity moves. Wheat and aluminium present weaker, less stable linkages at the index level.

The analysis underscores regime dependency. During the COVID crash and the Russia–Ukraine conflict, linkages tightened and sensitivities rose, especially to energy. This validates the importance of a refreshable dashboard. Relationships shift with macro conditions, so a periodic rebuild captures changes early. The design of this pipeline, from data collection to synthesis, supports that goal. It is reproducible, transparent, and lean enough to run on a regular schedule. The evidence supports focused monitoring set. Emphasize Brent and copper for forward signals, keep gold as a stress gauge, and remain mindful that sector exposures mediate how commodity shocks transmit to equities. With disciplined updates and a clear decision workflow, this dashboard can inform tactical views and risk management in a consistent way.

8. Recommendations

- **Primary monitoring set:** Track Brent crude and copper as forward indicators; review their lead–lag signals monthly.

- **Stress gauge:** Use gold for crisis detection and validation of risk regimes rather than as a continuous driver.

- **Sector lens:** Map oil sensitivity to energy-intensive sectors and copper sensitivity to industrial and export–oriented baskets.

- **Quarterly refresh:** Rebuild the dashboard every quarter to capture shifts in sensitivity and lead–lag structure.

- **Event protocol:** On material macro or geopolitical shocks, rerun event study and update rolling betas to reassess exposure rapidly.

- **Extensions:** Consider adding INR, CPI, PMI, and sector sub-indices to refine attribution while preserving parsimony.

Appendix A: Data Metadata

Series	Ticker (Yahoo)	Frequency	Analytical Role
Brent crude	BZ=F	Daily (resampled monthly)	Global oil benchmark; energy cost and inflation channel
RBOB gasoline	RB=F	Daily (resampled monthly)	Downstream energy price pressures
Natural gas	NG=F	Daily (resampled monthly)	Energy input; volatility in tight markets
Gold	GC=F	Daily (resampled monthly)	Defensive hedge; stress indicator
Silver	SI=F	Daily (resampled monthly)	Precious/industrial hybrid; mixed signal
Copper	HG=F	Daily (resampled monthly)	Global manufacturing proxy; forward demand indicator
Wheat	ZW=F	Daily (resampled monthly)	Inflation channel; weak direct equity transmission
Aluminium	ALI=F	Daily (resampled monthly)	Industrial input; sector-specific effects
Nifty 50	^NSEI	Daily (resampled monthly)	Indian benchmark equity index