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Changing Dynamics of the Indian Stock Market in Response to Crude Oil Price Shocks Arising from Geopolitical Conflicts and U.S. Sanctions

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Abstract

This study analyzes the impact of crude oil price shocks on the Indian stock market (NIFTY 50), focusing on both short-run and long-run relationships and the influence of geopolitical events. Using time series data and econometric techniques such as ADF, cointegration, Granger causality, regression, and volatility tests, the study finds a weak but statistically significant positive relationship between oil and stock returns, with no long-run equilibrium or strong predictive causality. Volatility clustering is observed, and structural break analysis shows that major global crises, including COVID-19 and the Russia–Ukraine conflict, significantly affect market dynamics, while isolated geopolitical events have limited impact. Overall, crude oil prices influence the Indian stock market primarily in the short run, offering important insights for investors and policymakers.

Keywords: Crude Oil Prices, NIFTY 50, Stock Market Returns, Structural Breaks, Geopolitical Events

INTRODUCTION

The global economy is highly sensitive to crude oil price fluctuations, which arise from supply disruptions, geopolitical tensions, and policy decisions. These changes significantly influence stock markets by affecting corporate profitability, inflation, and investor sentiment. In recent years, geopolitical conflicts and U.S. sanctions have become major drivers of oil price volatility.

India, as a major oil-importing economy, is particularly vulnerable to such fluctuations due to its heavy dependence on crude oil imports. Changes in oil prices directly impact production costs, inflation, exchange rates, and overall economic performance, thereby influencing stock market behavior. While rising oil prices tend to increase costs and market volatility, falling prices may improve corporate profitability and investor sentiment.

The Indian stock market, represented by indices such as the NIFTY 50 and BSE Sensex, reflects these macroeconomic linkages across key sectors. Geopolitical events—such as Middle East tensions, sanctions on oil-exporting countries, and the Russia–Ukraine conflict—have intensified uncertainty in global oil markets, creating ripple effects in financial systems, particularly in emerging economies like India.

This study examines the impact of crude oil price shocks on the Indian stock market, focusing on both short-run and long-run relationships. It also investigates the role of geopolitical conflicts and U.S. sanctions in amplifying market volatility and identifies structural breaks during major global events using time-series econometric techniques.

REVIEW OF LITERATURE

Oil Price Dynamics and Macroeconomic Impact

Studies such as Lutz Kilian (2014) highlight that oil prices are endogenous to global economic conditions and must be analyzed through supply- and demand-driven shocks. Wen et al. (2019) find that oil price increases boost short-run growth and inflation, though effects vary in the long run. Similarly, Fueki et al. (2021) show that both current and expected future demand–supply shocks influence oil price movements.

Nature of Oil Shocks

Economou and Agnolucci (2016) distinguish between exogenous (geopolitical) and endogenous (market-driven) shocks, noting a shift toward market-driven factors after 2000. Kilian and Park (2009) emphasize that stock market responses depend on the type of oil shock, largely transmitted through domestic demand.

Evidence from India

Empirical findings for India are mixed. Sahu et al. (2014) report a long-run relationship but no short-run causality. In contrast, Sharma et al. (2018) find no long-run relationship, though sectoral impacts exist. Sathyanarayana et al. (2018) confirm that oil price volatility affects stock returns, while Siddiqui and Seth (2015) find only weak or insignificant relationships.

Geopolitical Risk and Financial Markets

Recent studies stress the importance of geopolitical risk. Zhang et al. (2023) and Hossain et al. (2024) show that geopolitical tensions increase market volatility and reduce returns, especially in emerging economies. Agyei (2023) finds stronger effects during crisis periods.

Oil Markets, Sanctions, and Geopolitics

Geopolitical events significantly influence oil prices. Mignon and Saadaoui (2024) and Zhang et al. (2023) highlight supply disruptions and speculation. Studies by Bollino et al. (2019) and Babina et al. (2023) show that sanctions reshape global oil trade and pricing.

Volatility and Structural Breaks

Ewing and Malik (2016) and Monge et al. (2017) emphasize volatility clustering and structural breaks around geopolitical events. Tawfeeq et al. (2019) confirm both long-run relationships and short-run causality in oil-dependent regions.

RESEARCH GAP

Existing literature widely examines the relationship between crude oil prices and stock markets; however, findings—especially in the Indian context—remain mixed and inconclusive. While prior studies consider oil price volatility and macroeconomic factors, several important gaps persist:

1. Limited distinction between geopolitical-driven oil shocks and normal market fluctuations.
2. Insufficient focus on sanctions-induced oil price shocks, particularly for emerging economies like India.
3. Lack of studies analyzing structural breaks caused by major geopolitical events (e.g., Russia–Ukraine conflict).
4. Underrepresentation of recent data (2016–2026) reflecting evolving geopolitical dynamics.

5. Limited evidence on short-run vs. long-run impacts of geopolitical oil shocks on the Indian stock market.

Therefore, this study addresses these gaps by examining the impact of geopolitical conflict- and sanctions-driven oil price shocks on the NIFTY 50, incorporating structural breaks and both short- and long-run dynamics using time-series econometric techniques.

RESEARCH HYPOTHESIS

Main Hypothesis

H1: Crude oil price shocks significantly affect Indian stock market returns.

Sub-Hypotheses

- **H1a:** Oil price increases significantly influence NIFTY 50 returns.
- **H1b:** Oil price shocks lead to volatility clustering in stock returns.
- **H1c:** Geopolitical conflicts amplify the impact of oil shocks.
- **H1d:** Structural breaks occur during major geopolitical crises.
- **H1e:** A short-run relationship exists between oil prices and stock returns.
- **H1f:** A long-run relationship exists between oil prices and stock returns.

RESEARCH METHODOLOGY

Research Design

The study adopts a quantitative time-series research design to examine the relationship between crude oil price shocks and the performance of the Indian stock market, particularly during periods of geopolitical conflicts and economic sanctions. It uses monthly secondary data on West Texas Intermediate (WTI) crude oil prices and the NIFTY 50 index for the period April 2016 to March 2026.

Crude oil prices are treated as the independent variable, while NIFTY 50 returns represent the dependent variable. The design enables analysis of both short-run and long-run dynamics using econometric techniques.

Data Collection and Variables

The study is based on secondary data obtained from reliable financial and economic databases. WTI crude oil prices are used as a global benchmark, while the NIFTY 50 index represents Indian stock market performance.

The dataset consists of monthly observations to capture medium-term fluctuations and includes major geopolitical events within the study period.

Variables used:

Techniques for Data Analysis

The study employs time-series econometric methods to analyze the relationship between crude oil prices and stock market performance.

- ADF Unit Root Test: Tests stationarity of variables to avoid spurious results.
- Johansen Cointegration Test: Examines long-run equilibrium relationships.
- Vector Autoregression (VAR): Captures dynamic interactions between variables.
- Granger Causality Test: Identifies direction of causality.
- Impulse Response & Variance Decomposition: Analyze the

magnitude and persistence of oil price shocks.

- GARCH Model: Examines volatility clustering in stock returns.
- Structural Break Tests (Chow/CUSUM): Detect changes during geopolitical events and sanctions.

Hypothesis Testing Methods

Hypotheses are tested using the above econometric techniques.

- Stationarity (ADF) ensures valid time-series modeling.
- Cointegration tests long-run relationships (H1f).
- VAR & Granger causality examine short-run dynamics and predictive relationships (H1e).
- GARCH model evaluates volatility clustering (H1b).
- Structural break tests assess the impact of geopolitical crises (H1d).

These methods collectively determine whether crude oil price shocks significantly influence Indian stock market returns and whether geopolitical events amplify this relationship.

DATA ANALYSIS

Trend Analysis

Crude oil prices exhibit significant volatility over the study period. A sharp decline is observed around 2020 due to global economic disruptions, followed by a strong recovery and moderate fluctuations in later years. This highlights the sensitivity of oil prices to geopolitical tensions, demand shocks, and supply disruptions.

Crude oil returns fluctuate around a constant mean, indicating stationarity. Periods of high volatility are evident during major global events such as the COVID-19 pandemic and the Russia–Ukraine conflict.

The NIFTY 50 shows an overall upward trend, reflecting long-term market growth. A significant dip occurs in 2020, followed by a strong recovery and continued growth with moderate fluctuations.

NIFTY 50 returns are stationary and less volatile compared to crude oil returns. A noticeable spike in volatility is observed during the COVID-19 period, indicating temporary market instability.

Descriptive Statistics

The mean return of NIFTY 50 (0.9611) is higher than crude oil (0.3666), indicating better average stock market performance. Crude oil returns show extreme volatility (std. dev. 12.4997) compared to NIFTY 50 (4.6098).

Both series exhibit negative skewness, indicating higher probability of extreme negative returns, and high kurtosis, suggesting fat-tailed distributions. The Jarque–Bera test confirms non-normality in both series ($p < 0.05$).

Overall, crude oil is significantly more volatile than stock market returns, justifying advanced econometric analysis.

Correlation Analysis

The correlation coefficient (0.3265) indicates a weak to moderate positive relationship between crude oil returns and NIFTY 50 returns. This suggests that oil price movements have some influence on the Indian stock market, though the relationship is not strong.

The scatter plot shows a positive but weak relationship with dispersed observations, confirming the correlation results.

Stationarity Test (ADF Test)

For both crude oil returns and NIFTY 50 returns, the ADF test statistics are significant ($p < 0.05$), leading to rejection of the null hypothesis of a unit root.

Thus, both return series are stationary at level and suitable for further analysis.

Cointegration Test

Both crude oil prices and NIFTY 50 index are non-stationary at level but stationary at first difference, indicating they are integrated of order I(1).

The Johansen cointegration test shows no long-run relationship ($p > 0.05$). Therefore, crude oil prices and the Indian stock market do not share a long-term equilibrium relationship.

Granger Causality Test

The results indicate no causality between crude oil returns and NIFTY 50 returns at the 5% significance level.

- Oil → Stock Market: Not significant ($p = 0.3709$)
- Stock Market → Oil: Not significant at 5%, weak at 10% ($p = 0.0927$)

Thus, no short-run predictive relationship exists between the variables.

Regression Analysis

Regression results show a statistically significant relationship ($p = 0.0003$) between crude oil returns and NIFTY 50 returns.

Model:

NIFTY50_R

= 0.917 + 0.120(CRUDE_OIL_R)

A 1% increase in crude oil returns leads to a 0.12% increase in stock returns. However, the explanatory power is low ($R^2 = 0.1066$), indicating other factors influence stock market performance.

The model is statistically valid (F-stat significant) and free from autocorrelation (Durbin–Watson = 2.17).

ARCH Test

The ARCH test confirms volatility clustering ($p < 0.05$), indicating that market volatility changes over time and tends to persist in the short run.

GARCH Test

The GARCH model confirms significant short-term volatility effects (ARCH term significant), but long-term volatility persistence is weak (GARCH term insignificant).

This suggests that shocks impact volatility temporarily rather than permanently.

Model Stability

The model is stable, as the CUSUMSQ plot remains within critical bounds, indicating no structural instability.

Chow Breakpoint Test

The test identifies structural breaks only during major global crises:

- No structural break:

This indicates that large-scale global crises significantly alter the relationship between crude oil and stock market returns, while isolated geopolitical events do not.

Overall the findings indicate a statistically significant but weak relationship between crude oil prices and the Indian stock market. There is no long-run equilibrium or strong short-run causality between the variables.

However, volatility clustering and structural breaks during major crises suggest that extreme global events amplify the impact of oil price shocks on the stock market.

The results imply that while crude oil prices influence the Indian stock market, other macroeconomic and domestic factors play a more dominant role.

FINDINGS AND DISCUSSION

The analysis begins with examining the correlation between crude oil returns and NIFTY 50 returns. The results indicate a positive but weak to moderate relationship, suggesting that both variables tend to move in the same direction, but the strength of this association is limited. This implies that while crude oil price increases may coincide with stock market gains, they are not a dominant factor influencing market movements.

To further investigate this relationship, regression analysis was conducted. The findings reveal that crude oil returns have a statistically significant positive impact on NIFTY 50 returns ($p < 0.05$). This suggests that increases in crude oil returns are associated with increases in stock market returns. Although this may appear counterintuitive for an oil-importing country like India, it can be explained by broader global economic expansion, where rising oil prices often signal improved economic activity and investor confidence.

However, the low R-squared value indicates that crude oil prices explain only a small portion of stock market variations, highlighting the influence of other macroeconomic factors such as interest rates, inflation, and global financial conditions. Therefore, the null hypothesis of no significant relationship is rejected, fulfilling the first objective of the study.

The short-run dynamics were examined using the Granger causality test. The results show no significant causality from crude oil returns to NIFTY 50 returns at the 5% significance level, indicating that oil price changes do not predict stock market movements in the short run. Similarly, reverse causality is not statistically significant, although weak evidence exists at the 10% level. Overall, this suggests the absence of a strong directional relationship, leading to the rejection of H1e.

For the long-run relationship, the Johansen cointegration test was applied after confirming both series are integrated of order I(1) using the ADF test. The results indicate no cointegration between crude oil prices and the NIFTY 50 index ($p > 0.05$). This implies that the variables do not share a stable long-term equilibrium relationship. Therefore, H1f is not supported, and the second objective of the study is achieved.

Volatility behavior was analyzed using the ARCH test, which confirms the presence of volatility clustering ($p < 0.05$). This indicates that periods of high volatility are followed by further high volatility, reflecting market uncertainty and investor reactions to new information. The findings suggest that crude oil price shocks influence not only stock returns but also market risk. Hence, the null hypothesis of no volatility effect is rejected, supporting the third objective.

The structural stability of the relationship was examined using the Chow breakpoint test across major geopolitical events. The results show that events such as the Iran sanctions, Saudi Aramco attack, and the oil price war did not produce significant structural breaks, indicating resilience of the Indian stock market to short-term disruptions.

However, significant structural changes were observed during the COVID-19 pandemic and the Russia–Ukraine conflict ($p < 0.05$). These events were characterized by large-scale economic disruptions and heightened uncertainty, which significantly altered the relationship between crude oil prices and stock market returns. This provides empirical support for H1c and fulfills the fourth objective of the study.

Overall, the findings suggest that crude oil price shocks have a statistically significant but limited impact on the Indian stock market. There is no strong short-run causality or long-run equilibrium relationship between the variables. However, volatility clustering and structural breaks during major global crises highlight the importance of uncertainty and external shocks in shaping market dynamics.

These results provide important insights into investor behavior in India. Investors appear to respond to crude oil price movements as part of broader macroeconomic signals rather than as a primary determinant of stock market performance. The persistence of volatility indicates the need for caution during uncertain periods, while the structural break findings emphasize that large-scale global crises significantly influence market behavior.

From a policy perspective, the findings highlight the importance of monitoring global energy market developments and mitigating the impact of external shocks on financial stability. These insights collectively fulfill the fifth objective of the study.

RECOMMENDATIONS AND IMPLICATIONS

The findings of this study provide important theoretical and practical insights into the relationship between crude oil prices and the Indian stock market. The results indicate a statistically significant but weak relationship, suggesting that while crude oil prices influence stock market returns, they are not a dominant factor. This partially supports traditional economic theories of cost and inflation transmission, while also highlighting that stock market performance in emerging economies is driven by a broader set of macroeconomic variables.

The absence of a long-run cointegrating relationship further suggests that crude oil prices and stock market performance do not move together over time, challenging classical assumptions of long-term equilibrium. This reinforces the view that emerging markets are dynamic and subject to structural changes, policy interventions, and external shocks.

Additionally, the lack of strong Granger causality implies that crude oil price movements have limited predictive power for stock market returns, aligning with the Efficient Market Hypothesis. The presence of volatility clustering confirms that market risk is time-varying and persistent, supporting modern volatility models such as ARCH and GARCH. Furthermore, the structural break analysis reveals that only major global crises significantly alter market relationships, emphasizing the role of large-scale shocks in shaping investor behavior and market dynamics.

From a practical perspective, the findings suggest that investors and portfolio managers should not rely solely on crude oil price movements when making investment decisions. Instead, a diversified approach incorporating multiple macroeconomic indicators is essential. The absence of a long-run relationship also indicates that long-term investment strategies should focus more on fundamentals rather than external commodity trends.

The evidence of volatility clustering highlights the importance of effective risk management through diversification, hedging, and the use of advanced volatility forecasting models. Moreover, the identification of structural breaks during major global crises suggests that both investors and policymakers should adopt cautious and adaptive strategies during periods of heightened uncertainty. Policymakers, in particular, should monitor global energy market developments and implement timely measures to maintain financial stability.

Overall, the study emphasizes the need for flexible, risk-aware, and adaptive decision-making. It highlights that the relationship between crude oil prices and stock market performance is complex, dynamic, and influenced by broader economic conditions, thereby requiring continuous monitoring and strategic adjustment by market participants.

LIMITATIONS OF THE STUDY

This study has several limitations that should be considered when interpreting the results. Firstly, the analysis is limited to crude oil prices and NIFTY 50 returns, while stock market movements are influenced by various macroeconomic factors such as interest rates, inflation, exchange rates, foreign investment flows, and government policies, leading to possible omitted variable bias. Secondly, the use of the aggregate NIFTY 50 index does not capture sector-specific variations, as different industries may respond differently to crude oil price changes. Thirdly, the study relies on linear econometric models, which may oversimplify the complex and potentially non-linear relationship between oil prices and stock market returns. Although volatility was examined using the GARCH model, more advanced models such as EGARCH or TGARCH were not applied, which may limit the ability to capture asymmetric volatility effects; additionally, the use of monthly data may affect volatility estimates. The findings are also sensitive to the selected sample period, and different time frames may yield different results. Furthermore, the structural break analysis involves some subjectivity in selecting geopolitical events and may not capture gradual or unknown structural changes. The study is confined to the Indian stock market, limiting the generalizability of the findings to other economies. Finally, the analysis is based on historical data and assumes that past relationships will persist, which may not hold true in the face of evolving global economic conditions and policy changes.

CONCLUSION

This study examined the impact of crude oil price shocks on the Indian stock market, represented by the NIFTY 50 index, using various econometric techniques. The findings indicate a statistically significant but weak positive relationship between crude oil returns and stock market returns. While regression results confirm that crude oil price movements influence the stock market, the low explanatory power suggests that other macroeconomic factors also play a major role.

The analysis further reveals the absence of strong short-run causality and no long-run equilibrium relationship between the variables. This implies that crude oil prices do not consistently predict stock market movements, nor do they share a stable long-term association.

The presence of volatility clustering highlights that market risk is time-varying and tends to persist, especially during periods of uncertainty. Additionally, structural break analysis shows that only major global crises, such as the COVID-19 pandemic and the Russia–Ukraine conflict, significantly alter the relationship between crude oil prices and stock market performance, while isolated geopolitical events have limited impact.

Overall, the study concludes that crude oil prices have a significant but limited influence on the Indian stock market, primarily in the short run. The market demonstrates resilience to moderate oil price shocks but remains sensitive to large-scale global disruptions.

In terms of hypotheses, the study confirms a significant relationship between the variables, finds no evidence of long-run integration, identifies volatility effects, and shows that structural changes occur mainly during periods of extreme global uncertainty.

In conclusion, the relationship between crude oil prices and the Indian stock market is complex and dynamic, influenced by broader economic conditions and external shocks. These findings provide valuable insights for investors, policymakers, and researchers in understanding market behavior under changing global conditions.

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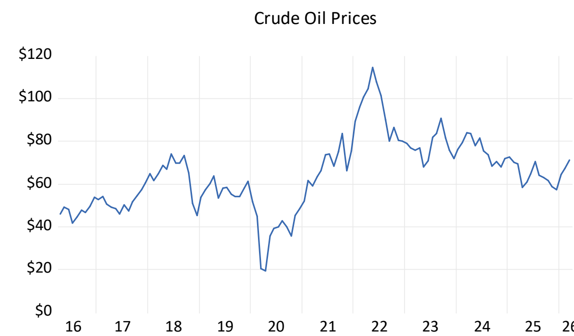
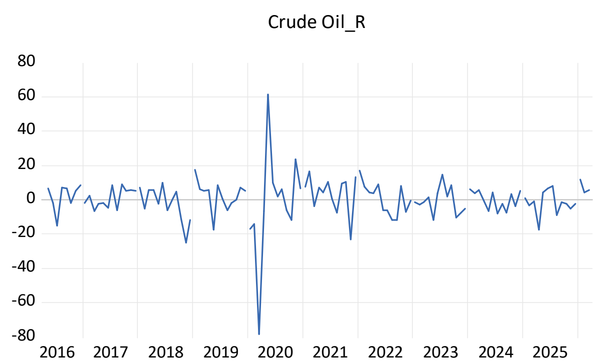
Variable Type	Variable
Dependent	Stock Market Returns (NIFTY 50)
Independent	Crude Oil Price
Control	Exchange rate, Inflation
Event Variable	Geopolitical conflict dummy
Volatility Variable	Conditional variance (from GARCH)

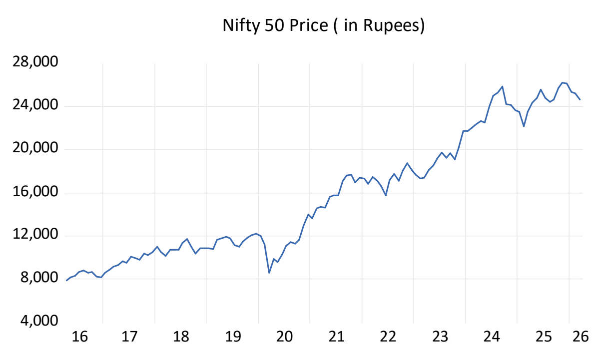
Graph 1: Crude Oil Prices (April 2016 – March 2026)



Graph 2: Crude Oil Returns



Graph 3: NIFTY 50 Index (April 2016 – March 2026)



Graph 4: NIFTY 50 Returns

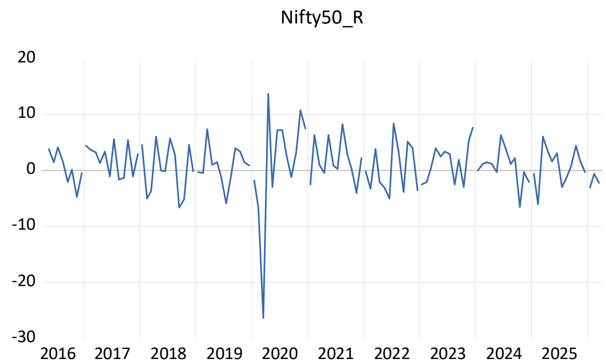
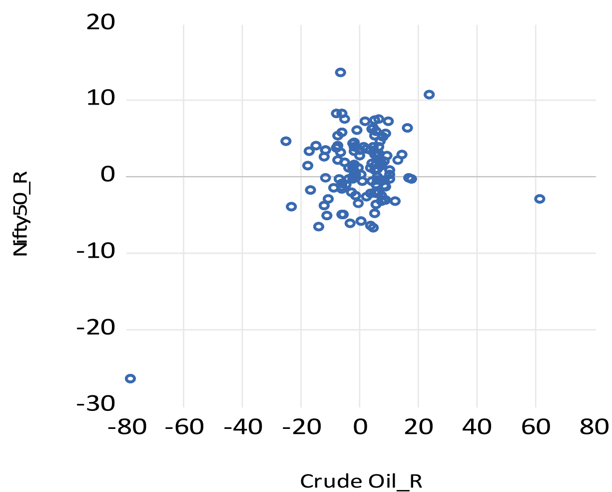


Table 1: Descriptive Statistics of Returns

	CRUDE_OIL_R	NIFTY50_R
Mean	0.366641	0.961130
Median	1.443026	1.105766
Maximum	61.50310	13.69755
Minimum	-78.19650	-26.45695
Std. Dev.	12.49968	4.609750
Skewness	-1.224935	-1.533445
Kurtosis	18.94739	12.24126
Jarque-Bera	1290.759	470.0832
Probability	0.000000	0.000000
Sum	43.63027	114.3745
Sum Sq. Dev.	18436.55	2507.476
Observations	119	119

Graph 5: Scatter Plot



Null Hypothesis: CRUDE_OIL_R has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.067257	0.0000
Test critical values:	1% level	-4.038365	
	5% level	-3.448681	
	10% level	-3.149521	

Null Hypothesis: NIFTY50_R has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=12)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.09735	0.0000
Test critical values:	1% level	-4.037668	
	5% level	-3.448348	
	10% level	-3.149326	

Sample (adjusted): 1/09/2016 1/03/2026
Included observations: 115 after adjustments
Trend assumption: Linear deterministic trend
Series: NIFTY_50_PRICES CRUDE_OIL_PRICES
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.039212	4.604667	15.49471	0.8493
At most 1	3.96E-05	0.004552	3.841465	0.9453

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.039212	4.600115	14.26460	0.7912
At most 1	3.96E-05	0.004552	3.841465	0.9453

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Pairwise Granger Causality Tests
Date: 03/12/26 Time: 17:10
Sample: 1/04/2016 1/03/2026
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CRUDE_OIL_R does not Granger Cause NIFTY50_R	117	1.00056	0.3709
NIFTY50_R does not Granger Cause CRUDE_OIL_R		2.42999	0.0927

Dependent Variable: NIFTY50_R
Method: Least Squares
Date: 03/12/26 Time: 17:45
Sample (adjusted): 1/05/2016 1/03/2026
Included observations: 119 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.916982	0.401293	2.285069	0.0241
CRUDE_OIL_R	0.120412	0.032226	3.736488	0.0003

R-squared	0.106607	Mean dependent var	0.961130
Adjusted R-squared	0.098971	S.D. dependent var	4.609750
S.E. of regression	4.375693	Akaike info criterion	5.806671
Sum squared resid	2240.163	Schwarz criterion	5.853379
Log likelihood	-343.4969	Hannan-Quinn criter.	5.825637
F-statistic	13.96134	Durbin-Watson stat	2.171163
Prob(F-statistic)	0.000290		

Heteroskedasticity Test: ARCH

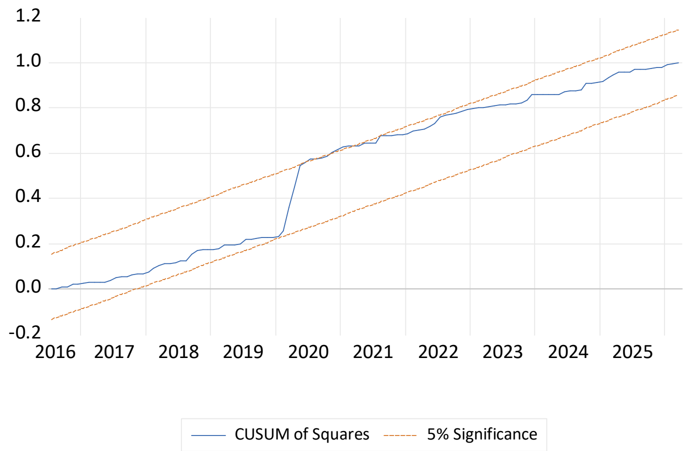
F-statistic	31.58634	Prob. F(1,116)	0.0000
Obs*R-squared	25.25429	Prob. Chi-Square(1)	0.0000

Dependent Variable: NIFTY50_R
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
Date: 04/07/26 Time: 09:24
Sample (adjusted): 1/05/2016 1/03/2026
Included observations: 119 after adjustments
Convergence achieved after 26 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.011095	0.361937	2.793569	0.0052
CRUDE_OIL_R	0.063533	0.034529	1.839975	0.0658
Variance Equation				
C	13.97699	6.453326	2.165859	0.0303
RESID(-1)^2	0.486605	0.175171	2.777890	0.0055
GARCH(-1)	-0.187963	0.313010	-0.600503	0.5482

R-squared	0.082564	Mean dependent var	0.961130
Adjusted R-squared	0.074723	S.D. dependent var	4.609750
S.E. of regression	4.434180	Akaike info criterion	5.727736
Sum squared resid	2300.449	Schwarz criterion	5.844506
Log likelihood	-335.8003	Hannan-Quinn criter.	5.775153
Durbin-Watson stat	2.125472		

Graph 6: CUSUM of Squares Test



- Iran Sanctions (2018)

Chow Breakpoint Test: 1/05/2018
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1/05/2016 1/03/2026

F-statistic	0.335460	Prob. F(2,115)	0.7157
Log likelihood ratio	0.692240	Prob. Chi-Square(2)	0.7074
Wald Statistic	0.670921	Prob. Chi-Square(2)	0.7150

- Saudi Aramco Attack (2019)

Chow Breakpoint Test: 1/09/2019
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1/05/2016 1/03/2026

F-statistic	1.971951	Prob. F(2,115)	0.1439
Log likelihood ratio	4.012661	Prob. Chi-Square(2)	0.1345
Wald Statistic	3.943901	Prob. Chi-Square(2)	0.1392

- Oil Price War (2020)

Chow Breakpoint Test: 1/03/2020
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1/05/2016 1/03/2026

F-statistic	1.138727	Prob. F(2,115)	0.3238
Log likelihood ratio	2.333639	Prob. Chi-Square(2)	0.3114
Wald Statistic	2.277455	Prob. Chi-Square(2)	0.3202

- Significant structural break:
    - COVID-19 Pandemic (2020)

Chow Breakpoint Test: 1/04/2020
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1/05/2016 1/03/2026

F-statistic	7.917532	Prob. F(2,115)	0.0006
Log likelihood ratio	15.35164	Prob. Chi-Square(2)	0.0005
Wald Statistic	15.83506	Prob. Chi-Square(2)	0.0004

- Russia–Ukraine Conflict (2022)

Chow Breakpoint Test: 1/01/2022
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1/05/2016 1/03/2026

F-statistic	3.140074	Prob. F(2,115)	0.0470
Log likelihood ratio	6.327351	Prob. Chi-Square(2)	0.0423
Wald Statistic	6.280149	Prob. Chi-Square(2)	0.0433