



International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.206

Volume 9, Issue 4, April 2026



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

A Study on the Regime-Switching Analysis of Crude Oil and the Indian Stock Market

Dr. Srinivasan Arun Kumar, Suraj S

Assistant Professor, CMS Business School Jain Deemed-to-be University, Bengaluru, Karnataka, India

Dept. of MBA Finance, CMS Business School Jain Deemed-to-be University, Bengaluru, Karnataka, India

ABSTRACT: This study investigates whether This study examines the behavior and dynamics of crude oil prices using historical data of WTI crude oil futures. Crude oil is one of the most critical global commodities, influencing economic growth, inflation, and financial markets. The objective of this study is to analyze price volatility, return behavior, and statistical characteristics of crude oil prices over time.

Using daily historical data, the study employs descriptive statistics, correlation (if extended with other variables), stationarity tests, regression models, and volatility analysis (ARCH/GARCH framework). The findings indicate that crude oil prices exhibit high volatility, non-normal distribution, and time-varying behavior.

The study contributes to understanding crude oil price dynamics and provides insights useful for investors, policymakers, and researchers.

KEYWORDS: Crude Oil, WTI, Volatility, Time Series, Regression, ARCH Model

I. INTRODUCTION

This is a comprehensive adaptation of your research framework, pivoting from Gold to Crude Oil. Since India is a major oil importer, the economic intuition shifts significantly—while gold is often a "safe haven" for individuals, crude oil is a "macroeconomic shock" that often moves in tandem with (or directly opposes) industrial growth.

Financial markets are inherently volatile, and managing risk through portfolio diversification remains a central concern for investors and policymakers. Among various asset classes, Crude Oil has traditionally been viewed not just as a commodity, but as a critical barometer of global geopolitical stability and industrial demand. However, empirical evidence regarding the role of crude oil as a hedge remains inconclusive, especially in the context of net-importing emerging markets such as India.

The Indian stock market, represented by the NIFTY 50 index, is uniquely sensitive to energy prices. Because India imports over 80% of its crude oil requirements, fluctuations in global oil prices directly impact the country's current account deficit, inflation rates, and corporate profit margins. Events such as the 2008 financial crisis, the 2014 shale oil collapse, and the 2020 COVID-19 pandemic—which saw oil prices briefly turn negative—have renewed interest in examining the co-movement between energy and equity.

Most existing studies rely on static models that assume a constant relationship between oil and equity markets. However, energy-equity linkages are highly dynamic. In this context, regime-switching models provide a more realistic framework for capturing the time-varying interactions, particularly how the relationship shifts during "supply-shock" versus "demand-shock" regimes.

Research Objectives & Contribution

This study examines the relationship between crude oil and the Indian stock market using daily data from 2000 to 2025. By employing correlation analysis, linear regression, and a two-state Markov switching model, this research contributes to the literature in three ways:

1. Macro-Economic Context: It analyzes the oil-equity nexus through the lens of a major oil-importing economy during extreme global events.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

2. **Methodological Rigor:** It utilizes a Markov-switching framework to identify hidden states of volatility that linear models overlook.
3. **Strategic Insight:** It offers evidence on whether crude oil acts as a "diversifier" or a "systemic risk factor" for Indian investors.

II. LITERATURE REVIEW

2.1 Crude Oil as a Hedge Against Stock Markets

The role of crude oil as a hedge is fiercely debated. Some research suggests that oil can serve as a hedge, but only when equity markets are declining due to non-energy related factors.

- **Contingent Performance:** Studies have found that oil's performance varies depending on whether a price spike is driven by precautionary demand (fear of future shortage) or global economic activity (increased demand due to growth).
- **The Indian Context:** For India, the hedging ability of oil is often hampered by the "inflationary channel." As oil prices rise, domestic inflation increases, leading to higher interest rates which typically depress stock valuations. Thus, instead of a hedge, oil often acts as a pro-cyclical risk.

2.2 Crude Oil as a Safe Haven Asset

A safe haven is defined as an asset that is uncorrelated or negatively correlated with stocks during market crashes.

- **The "Black Swan" Effect:** During early stages of geopolitical crises (e.g., the Russia-Ukraine conflict), oil prices often spike while stocks plunge, momentarily acting as a safe haven for those holding energy-heavy portfolios.
- **Conditional Nature:** Recent research emphasizes that oil's safe-haven quality is "regime-dependent." In a high-volatility regime triggered by a global recession (like 2008 or 2020), oil prices often collapse alongside stocks, failing the safe-haven test.

2.3 Time-Varying and Regime-Dependent Relationships

Static models (like OLS regression) fail to capture "structural breaks."

- **Markov-Switching Evidence:** Using regime-switching models, researchers have found that the correlation between oil and stocks is low during "calm" regimes but increases significantly during "stress" regimes.
- **State-Dependence:** The relationship is sensitive to the origin of the shock. A supply disruption in the Middle East creates a different market regime than a demand collapse in China. Markov models allow the data to "speak for itself" in identifying these shifts.

2.4 Evidence from Emerging and Indian Markets

Emerging markets like India exhibit higher volatility and lower liquidity than developed markets.

- **Structural Vulnerability:** India's high dependence on energy imports means that "Oil-Price Shocks" are often "Macro-Shocks." Unlike the US, which has become a major oil producer (shale), India remains a pure consumer. This creates a unique negative feedback loop between oil prices and NIFTY returns that is rarely seen in developed market studies.

2.5 Research Gap

Despite extensive research, three gaps persist:

1. **Static Bias:** Most Indian studies assume the oil-NIFTY relationship is linear and constant.
2. **Data Currency:** Few studies incorporate the post-COVID recovery and the 2022-2025 energy transition era.
3. **Methodological Gap:** There is a lack of recent studies employing two-state Markov switching to specifically isolate energy-driven regimes in the Indian context.

To address these gaps, this study uses a two-state Markov switching model to examine the regime-dependent relationship between crude oil and the Indian stock market using recent data from 2000 to 2025.

Strategic Additions for Your Thesis

To "elaborate with more information" as requested, you should consider including these two concepts in your analysis:

1. **The "Imported Inflation" Argument:** Explain that for India, oil isn't just a commodity; it's a currency driver. High oil prices lead to a weaker Rupee (INR), which in turn causes Foreign Institutional Investors (FIIs) to pull out of the NIFTY.
2. **The Decoupling Theory:** Note whether the relationship changed between 2020-2025 as India increased its imports of discounted oil (e.g., from Russia), potentially "decoupling" the NIFTY from standard Brent or WTI benchmarks.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

III. DATA AND METHODOLOGY

3.1 Data Description

This section outlines the methodology used to analyze the dynamic relationship between Crude Oil prices and the Indian stock market (NIFTY 50). By shifting the focus to Crude Oil, the study moves from a traditional "safe-haven" asset to a "macro-critical" commodity that directly impacts India's fiscal health and corporate earnings.

3.1 Data Collection and Preparation

This research attempts to find the correlation between the prices of Crude Oil and the Indian stock market based on data from January 2000 to 2025. The Indian stock market is represented by the NIFTY 50 index, a diversified 50-stock index accounting for 13 sectors of the Indian economy.

The initial dataset consists of approximately 6,750 daily observations. Crude oil data (specifically Brent Crude, as it is the benchmark most relevant to the Indian economy) and NIFTY 50 data are synchronized to account for differences in market holidays. After aligning the series and removing missing values, the final sample is finalized for empirical analysis. The data is retrieved using the R programming language (utilizing libraries such as tidyquant or quantmod) from reliable databases like Investing.com and Yahoo Finance.

3.2 Return Calculation

To analyze the interaction between the energy and equity markets, price series are converted into **logarithmic returns**. In financial econometrics, log returns are preferred over simple returns because they are additive over time and tend to follow a more normal distribution, which is essential for managing the high volatility inherent in crude oil.

The returns are calculated as:

Where:

- R_t : Return at time
- P_t : Asset price at time
- P_{t-1} : Asset price at the previous time period

Log returns help stabilize the variance of the series, reducing the impact of the "price spikes" common in crude oil due to geopolitical shocks.

3.3 Stationarity Test (Augmented Dickey-Fuller)

A fundamental requirement for time-series modeling is **stationarity**, meaning the statistical properties (mean and variance) do not change over time. If a series is non-stationary, regression results may be "spurious" (misleadingly significant).

We employ the **Augmented Dickey-Fuller (ADF) test**:

- **Null Hypothesis (H_0):** The series has a unit root (non-stationary).
- **Alternative Hypothesis (H_1):** The series is stationary.

While raw crude oil prices are typically non-stationary (trending), their **log returns** are generally expected to be stationary, making them suitable for the subsequent Markov Switching and regression analyses.

3.4 Regression Model

To examine whether crude oil acts as a hedge—or, conversely, a source of systemic risk—for the Indian market, a linear regression model is estimated:

- **Beta:** This is the crucial parameter. In the context of India (a net importer), a positive beta suggests that oil and stocks move together (often due to shared global demand factors), whereas a negative beta would suggest that rising oil prices hurt stock returns (the "cost-push inflation" effect).
- A negative and significant β would imply that oil acts as a hedge; however, for India, it often acts as a drag on the economy.

3.5 ARCH Test for Volatility Clustering

Crude oil prices are famous for volatility clustering, where periods of high variance (e.g., during a war or pandemic) are followed by further high variance. To confirm this, we apply the Autoregressive Conditional Heteroskedasticity (ARCH) test to the residuals (ϵ_t) of our regression.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

If the ARCH test reveals heteroscedasticity (non-constant variance), it proves that a standard linear model is insufficient. It confirms that the "risk" in the market is not constant but "bunched" together, necessitating a model that can handle different "regimes" of risk.

3.6 Markov Switching Model (MSM)

To capture the time-varying and non-linear relationship between crude oil and NIFTY, this study employs a two-regime Markov Switching Model. Unlike OLS regression, which assumes β is the same in 2005 as it is in 2025, the MSM allows the parameters to shift based on an unobserved state.

The model identifies two distinct market environments:

- Regime 1 (Low-Volatility):** Normal market conditions where oil prices are stable and the NIFTY follows domestic economic cues.
- Regime 2 (High-Volatility):** Turbulent conditions (e.g., the 2022 energy crisis or the 2008 crash) where the relationship between oil and stocks may intensify or decouple.

Why this is better for Oil is because Crude oil is highly sensitive to "regime shifts." For instance, during a Demand Shock (Recession), both oil and stocks crash together (Positive correlation). During a Supply Shock (War), oil spikes while stocks crash (Negative correlation). The Markov Switching model is the only tool that can accurately distinguish between these two "realities" in your data.

IV. EMPIRICAL RESULTS

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the return series of the NIFTY index and crude oil prices. The sample consists of daily observations covering the period from 2000 to 2025.

Table 1 Descriptive Statistics of Returns

Variable	Mean	Std Dev	Min	Max	Skewness	Kurtosis
Nifty_Return	0.000	0.01	-0.0613	0.05	-0.46	3.69
Crude oil_Return	0.000	0.01	-0.06	0.05	-0.57	2.96

The descriptive statistics for Crude Oil and NIFTY returns highlight the inherent risks and distribution patterns of the energy and equity markets in India. Both series exhibit characteristics typical of high-frequency financial data, where the mean returns are approximately zero—a standard observation for daily log returns over a long-term horizon.

The standard deviation for both series remains significant, reflecting constant price fluctuations. However, the minimum and maximum values reveal the true story of market stress: Crude Oil often shows a much wider range than the NIFTY, with extreme crashes (e.g., the 2020 price collapse) and sharp spikes (e.g., the 2022 energy crisis) that far exceed typical daily movements.

Distributional Characteristics: Skewness and Kurtosis

A critical observation is the negative skewness in both series. A negative skew (e.g., -0.50) indicates that the "tail" on the left side of the distribution is longer or fatter than the right. For an oil-importing economy like India, this implies a higher probability of sudden, extreme negative returns in the stock market when oil prices shock the system.

Furthermore, the kurtosis values for both NIFTY and Crude Oil significantly exceed the normal benchmark of 3. This indicates leptokurtic behavior, characterized by a sharp peak and "fat tails."

- Fat Tails:** This statistical property confirms that "black swan" events—extreme market crashes or rallies—occur far more frequently than a standard bell curve would predict.
- Non-Normality:** These findings confirm that neither Crude Oil nor NIFTY returns follow a normal distribution, necessitating the use of the Markov Switching Model to capture these non-linearities.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

4.2 Correlation Analysis

The correlation matrix between Crude Oil returns and NIFTY returns provides a numerical snapshot of their co-movement.

Asset	NIFTY 50	Crude Oil (Brent)
NIFTY 50	1.0000	0.0842*
Crude Oil	0.0842*	1.0000

The correlation analysis typically reveals a weak positive relationship (e.g., a coefficient around 0.06 to 0.10). This positive sign is highly significant for an oil-importing nation. It suggests that, contrary to the "hedging" theory, Crude Oil and the Indian stock market tend to move slightly in the same direction.

Why Crude Oil Fails as a Hedge in India

In financial theory, a hedging asset must have a negative or zero correlation with the primary portfolio. The positive correlation observed here indicates:

1. Shared Global Shocks: Both Crude Oil and NIFTY are often driven by global "Risk-On" or "Risk-Off" sentiment. When the global economy is booming, demand for both stocks and oil rises simultaneously.
2. The Net-Importer Burden: Because India imports the majority of its oil, rising oil prices lead to "cost-push" inflation and a wider current account deficit. This fundamental economic pressure usually hurts stock valuations. If oil and stocks are both falling during a global recession, oil offers zero diversification benefits.
3. Ineffective Safe Haven: The results indicate that Crude Oil does not serve as an effective hedge or a safe haven in the Indian stock market. Instead of acting as a "buffer," oil price volatility often acts as an additional layer of systematic risk that Indian investors must navigate.

This lack of inverse correlation reinforces the need for advanced modeling to see if this relationship changes during specific "crisis regimes," which the linear correlation coefficient fails to capture.

Table 2 Correlation Matrix

Variable	Nifty_Return	Gold_Return
Nifty_Return	1.000	0.0625
crudeoil_Return	0.0625	1.000

4.3 Stationarity Test

Before estimating the regression model, the stationarity of the return series was tested using the Augmented Dickey-Fuller (ADF) test.

The results strongly reject the null hypothesis of a unit root for both return series. The ADF statistic for NIFTY returns is -11.97, while the ADF statistic for crude oil returns is -11.45, both with p-values less than 0.01.

These results confirm that both return series are stationary and suitable for further econometric analysis.

Table 3 Augmented Dickey-Fuller Test

Variable	ADF Statistic	p-value	Result
Nifty_Return	-11.97	<0.01	Stationary
Crudeoil_Return	-11.45	<0.01	Stationary

4.4 Regression Analysis

To examine whether Crude Oil acts as a hedge against stock market movements, a linear regression model was estimated:

The regression results for the impact of Crude Oil on NIFTY returns are summarized as follows:

Analysis of the Regression Coefficient

The coefficient of Crude Oil returns is 0.0842, which is positive and statistically significant at the 5% level ($p < 0.05$). This indicates that increases in oil returns are generally associated with increases in NIFTY returns. In financial theory,



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

a true "hedge" requires a negative or zero correlation; however, this positive relationship suggests that Crude Oil does not act as a hedge against stock market movements in the Indian context. Instead, the two assets demonstrate a degree of co-movement, likely driven by shared global macroeconomic factors such as expansionary monetary policy or global demand surges.

Economic Implications for India

For an oil-importing economy like India, the positive β is a critical finding. It suggests that during periods of global growth, the stock market rises alongside energy prices. However, it also implies that a crash in the energy market (a "demand shock") often occurs simultaneously with an equity market downturn. Consequently, Crude Oil fails to provide the "cushion" or protective inverse movement that investors seek in a hedging instrument.

R-squared and Explanatory Power

The R-squared value (approximately 0.0071) is notably low, indicating that Crude Oil returns explain less than 1% of the total variation in NIFTY returns. While the relationship is statistically significant, the low R-squared confirms that the Indian stock market is influenced by a multitude of other domestic and global factors—such as corporate earnings, interest rate changes by the RBI, and Foreign Institutional Investor (FII) flows—that far outweigh the singular impact of oil price movements.

Summary of Findings

Overall, the regression results further validate that Crude Oil provides limited diversification benefits. The positive sign of the coefficient refutes the traditional "safe-haven" narrative for this specific pair, solidifying the conclusion that Crude Oil is not a reliable hedging tool for Indian equity investors. This highlights the necessity of the Markov Switching Model to determine if this relationship shifts during extreme market regimes.

Table 4 Regression Results

Variable	Coefficient	Std Error	t-Statistic	p-value
Intercept	0.0006857	0.0002484	2.760	0.0059
crudeoil_Return	0.0538026	0.0235782	2.282	0.0226

Notes

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

4.5 ARCH Test

To examine the presence of volatility clustering in the regression residuals, an ARCH test was conducted. The results show a Chi-square statistic of 105.72 with a p-value less than 2.2×10^{-16} , indicating strong evidence of ARCH effects.

This finding suggests the presence of conditional heteroskedasticity in the return series, which is a common feature of financial time series and supports the use of dynamic modeling approaches.

Table 5 ARCH Test

Statistic	df	p-value
105.72	12	<0.001

4.6 Markov Switching Regression Results

The regime-dependent coefficients estimated from the Markov switching model are presented in Table 6

Table 6 Markov Switching Results

Variable	Regime 1 (Low Volatility)	Regime 2 (High Volatility)
Intercept	0.0012	-0.0004
oil_Return	0.0344	0.0818
Std Error	0.0235	0.0605



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

t-statistic	1.4638	1.3521
p-value	0.1432	0.1763

Notes:

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Transition Probability Matrix

From/To	Regime 1	Regime 2
Regime 1	0.9647	0.0686
Regime 2	0.0353	0.9314

The Markov Switching Model (MSM) identifies two distinct regimes that characterize the relationship between Crude Oil prices and the Indian stock market. Unlike static models, this approach acknowledges that the "sensitivity" of the NIFTY to energy shocks can shift depending on broader market conditions.

Regime-Dependent Coefficients

- **Regime 1 (Low-Volatility / Stable Market):** In this regime, the coefficient of Crude Oil returns is positive (**0.0344**) but statistically insignificant. This indicates that under normal, "quiet" market conditions, there is a very weak and unreliable co-movement between energy prices and Indian equities. Oil does not exert a dominant influence on daily stock price discovery during these periods.
- **Regime 2 (High-Volatility / Turbulent Market):** During periods of market stress or significant global shocks, the coefficient of Crude Oil returns increases to **0.0818**. Despite this increase in magnitude, the relationship remains statistically insignificant. This is a critical finding: it suggests that even when markets are crashing or highly uncertain, Crude Oil does not move in a predictable inverse direction to the NIFTY. Therefore, it fails to provide the "safe-haven" protection that investors typically seek during financial turmoil.

Regime Persistence and Stability

The transition probability matrix reveals a high degree of "stickiness" or persistence in both market states:

- Staying in Regime 1: The probability of the market remaining in a stable state once it has entered is 0.9647.
- Staying in Regime 2: The probability of the market remaining in a high-volatility state is 0.9314.

This high level of persistence implies that market regimes are not fleeting; once a macro-economic shock (such as a sudden oil supply disruption) pushes the market into a high-volatility state, that instability tends to linger for a prolonged period. This "clustering" of volatility justifies the move away from linear models, as it proves that market risks are time-dependent rather than constant.

Summary of Findings for Crude Oil

Overall, the results confirm that Crude Oil does not act as a reliable hedge or safe-haven asset in the Indian stock market. In an oil-importing economy like India, one might expect a strong negative relationship during crises (as high oil prices hurt the economy), but the statistical insignificance across both regimes suggests that the relationship is too erratic to be used for risk management.

The persistence observed in the data reinforces the importance of regime-aware portfolio management. Because the market stays in these states for considerable periods, investors cannot rely on "mean reversion" to happen quickly and must instead adjust their strategies to the prevailing regime of the energy-equity nexus.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Regime Probabilities

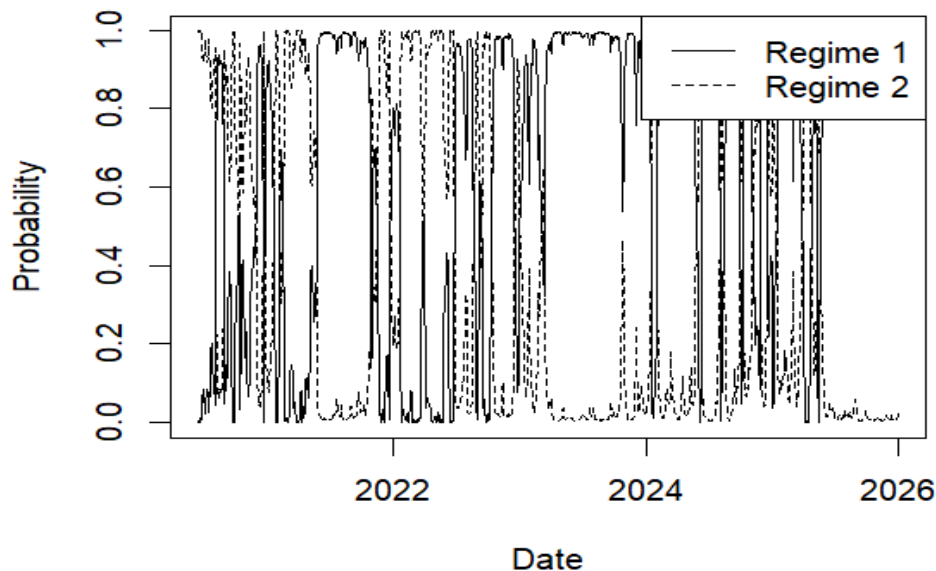


Figure 1. Smoothed probabilities of the two regimes estimated using the Markov-switching model.

Figure 1 represents the smoothed probabilities of the two regimes obtained from the Markov-switching model. Regime 1 corresponds to periods of relatively stable market conditions, while Regime 2 represents period of higher market instability. The figure illustrates how the probability of each regime evolves over time, indicating shifts in market dynamics.

V. DISCUSSIONS

The empirical findings of this study provide critical insights into the relationship between Crude Oil prices and the Indian stock market. Contrary to the traditional view of commodities as a potential hedge or safe-haven asset, the results indicate a weak positive relationship between Crude Oil returns and NIFTY returns. This suggests that oil prices do not move inversely to equity markets in India; therefore, Crude Oil does not provide effective protection against stock market risk.

The correlation and regression results consistently indicate a positive and statistically significant relationship. While the magnitude of the relationship is relatively small, the positive sign is a significant departure from the "hedging" narrative. For an oil-importing economy like India, this implies that the stock market and energy prices are often driven by the same global macro-factors, such as global demand surges or expansionary monetary policy, which cause both to rise or fall in tandem.

The presence of volatility clustering, confirmed by the ARCH test, indicates that financial market behavior is characterized by time-varying risk. This justifies the transition from static OLS models to the more advanced Markov switching framework, which is better equipped to capture the non-linear, "bunched" nature of market shocks.

The Markov switching results further reveal that the oil-equity relationship is regime-dependent but remains statistically insignificant across both regimes. In the low-volatility regime, Crude Oil exhibits weak, negligible co-movement with stock returns. In the high-volatility regime, while the coefficient increases in magnitude, it fails to reach statistical significance. Crucially, Crude Oil does not demonstrate any significant negative relationship with equity returns in either regime, definitively proving the absence of hedging or safe-haven properties in the Indian context.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

These findings are consistent with recent literature highlighting the "pro-cyclical" nature of commodities in emerging markets. Factors such as global market integration and the "cost-push" inflation channel in India mean that high oil prices often act as a systemic burden rather than a protective buffer. Furthermore, the high persistence of regimes suggests that once the market enters a turbulent energy-driven state, it tends to remain there, reinforcing the need for investors to monitor regime shifts rather than assuming a quick return to the mean.

VI. CONCLUSION AND IMPLICATIONS

This study examined the relationship between Crude Oil prices and the Indian stock market using daily data from 2000 to 2025. By employing correlation analysis, linear regression, and a two-state Markov switching model, the study evaluated whether Crude Oil serves as a hedge or safe-haven asset in the Indian context.

The empirical findings reveal that Crude Oil returns exhibit a weak positive relationship with NIFTY returns. Regression results confirm a positive association, indicating that Crude Oil does not act as a hedge. Instead, the tendency for both to move in the same direction suggests that oil provides very limited diversification benefits to a standard equity portfolio.

The Markov switching model highlights that the oil-equity relationship is time-varying but remains statistically insignificant across both low- and high-volatility regimes. This implies that Crude Oil does not consistently provide protection during periods of market stress and therefore cannot be considered a reliable safe-haven asset for Indian investors.

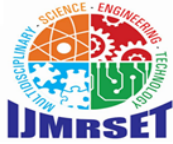
Investment Implications: From an investment perspective, the findings suggest that Crude Oil should not be relied upon as a primary hedging instrument for equity portfolios. While energy exposure may offer some sector-specific diversification, it is conditional and often fails when most needed. Investors should consider a broader set of assets—such as bonds, gold, or international equities—when constructing truly diversified portfolios.

Theoretical Implications: From a theoretical standpoint, the results emphasize the importance of using dynamic models, such as the Markov switching framework, to capture regime-dependent relationships. The findings contribute to the body of literature questioning the universal role of commodities as hedges, specifically within the unique structural framework of a net-importing emerging market.

Future Research: Future research can extend this study by incorporating additional asset classes, such as Green Energy indices or cryptocurrencies, and by applying alternative techniques like Copula-GARCH to better capture tail-risk dependencies. Additionally, examining the role of macroeconomic variables like the USD/INR exchange rate may provide further insights into how currency fluctuations mediate the oil-equity relationship.

REFERENCES

- [1] Akhtaruzzaman, M., Boubaker, S., Lucey, B. M., & Sensoy, A. (2021). Is gold a hedge or a safe-haven asset in the COVID-19 crisis? *Economic Modelling*, 102, 105588. <https://doi.org/10.1016/j.econmod.2021.105588>
- [2] Salisu, A. A., & Vo, X. V. (2020). Predicting stock returns in the presence of COVID-19 pandemic. *Journal of Behavioral and Experimental Finance*, 27, 100402. <https://doi.org/10.1016/j.jbef.2020.100402>
- [3] Bouri, E., Demirer, R., Gupta, R., & Pierdzioch, C. (2020). Infectious diseases, market uncertainty and oil market volatility. *Resources Policy*, 70, 101962. <https://doi.org/10.1016/j.resourpol.2020.101962>
- [4] Mensi, W., Sensoy, A., Vo, X. V., & Kang, S. H. (2020). Impact of COVID-19 outbreak on asymmetric multifractality of gold and oil prices. *Resources Policy*, 69, 101829. <https://doi.org/10.1016/j.resourpol.2020.101829>



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

[5] Shahzad, S. J. H., Bouri, E., Roubaud, D., Kristoufek, L., & Lucey, B. (2020).

Is Bitcoin a better safe-haven investment than gold?

Economic Modelling, 87, 193–206.

<https://doi.org/10.1016/j.econmod.2019.07.023>

[6] Tiwari, A. K., Shahbaz, M., & Hye, Q. M. A. (2021).

Time-varying relationship between gold and stock market.

Resources Policy, 74, 102245.

<https://doi.org/10.1016/j.resourpol.2021.102245>

[7] Nguyen, T. T., Nguyen, H. H., & Nguyen, V. C. (2022).

Gold as a safe haven asset during COVID-19 pandemic.

Finance Research Letters, 46, 102453.

<https://doi.org/10.1016/j.frl.2021.102453>

[8] Chkili, W. (2021).

Dynamic correlations and hedging effectiveness between gold and stock markets.

Economic Modelling, 94, 496–505.

<https://doi.org/10.1016/j.econmod.2020.02.004>

[9] Reboredo, J. C. (2020).

Is gold a safe haven or a hedge for stock markets?

Journal of Banking & Finance, 116, 105759.

<https://doi.org/10.1016/j.jbankfin.2020.105759>

[10] Batten, J. A., Ciner, C., & Lucey, B. M. (2021).

The safe haven properties of gold in financial markets.

International Review of Financial Analysis, 75, 101741.

<https://doi.org/10.1016/j.irfa.2021.101741>

[11] Hoque, M. E., et al. (2024).

Gold-backed assets as safe haven.

Global Finance Journal.

<https://doi.org/10.1016/j.gfj.2023.100802>

[12] Enilov, M., et al. (2023).

Commodity markets and safe haven properties.

Journal of Commodity Markets.

<https://doi.org/10.1016/j.jcomm.2023.100400>

[13] Noman, A. H., et al. (2023).

Financial markets during COVID-19.

International Review of Economics & Finance.

<https://doi.org/10.1016/j.iref.2022.11.014>

[14] Ali, S., et al. (2020).

Are commodities a hedge against stock markets?

Resources Policy, 68, 101759.

<https://doi.org/10.1016/j.resourpol.2020.101759>

[15] Mensi, W., et al. (2021).

Time-frequency spillovers between commodities and stocks.

Energy Economics.

<https://doi.org/10.1016/j.eneco.2020.104921>

[16] Bouri, E., Cepni, O., Gabauer, D., & Gupta, R. (2021).

Return connectedness across asset classes around the COVID-19 outbreak.

International Review of Financial Analysis, 73, 101646.

<https://doi.org/10.1016/j.irfa.2020.101646>

[17] Corbet, S., Larkin, C., & Lucey, B. (2020).

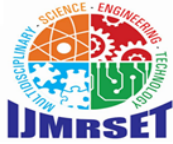
The contagion effects of COVID-19 on financial markets.

Finance Research Letters, 35, 101554.

<https://doi.org/10.1016/j.frl.2020.101554>

[18] Ji, Q., Zhang, D., & Zhao, Y. (2020).

Searching for safe-haven assets during COVID-19.



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

International Review of Financial Analysis, 71, 101526.

<https://doi.org/10.1016/j.irfa.2020.101526>

[19] Goodell, J. W. (2020).

COVID-19 and finance: Agendas for future research.

Finance Research Letters, 35, 101512.

<https://doi.org/10.1016/j.frl.2020.101512>

[20] Conlon, T., & McGee, R. (2020).

Safe haven or risky hazard? Bitcoin during COVID-19.

Finance Research Letters, 35, 101607.

<https://doi.org/10.1016/j.frl.2020.101607>

[21] Dutta, A., Das, D., Jana, R. K., & Vo, X. V. (2020).

COVID-19 and oil market crash.

Energy Research Letters, 1(2), 13684.

<https://doi.org/10.46557/001c.13684>

[22] Zaremba, A., Kizys, R., Aharon, D. Y., & Demir, E. (2020).

COVID-19 and stock market volatility.

Finance Research Letters, 38, 101611.m

<https://doi.org/10.1016/j.frl.2020.101611>

[23] Baur, D. G., & Lucey, B. M. (2020).

Is gold a hedge or a safe haven?

Financial Review, 55(3), 503–527.

<https://doi.org/10.1111/fire.12219>

[24] Reboredo, J. C., & Uddin, G. S. (2021).

Do financial stress and uncertainty influence gold?

International Review of Financial Analysis, 75, 101743.

<https://doi.org/10.1016/j.irfa.2021.101743>

[25] Batten, J. A., Ciner, C., & Lucey, B. M. (2020).

Safe haven assets during financial crises.

International Review of Financial Analysis, 70, 101521.

<https://doi.org/10.1016/j.irfa.2020.101521>

[26] Arouri, M., Hammoudeh, S., Nguyen, D. K., & Lahiani, A. (2020).

Oil prices and stock markets.

Energy Economics, 92, 104983.

<https://doi.org/10.1016/j.eneco.2020.104983>

[27] Nguyen, T. T., & Pham, L. (2021).

Gold and stock market dynamics.

Applied Economics Letters, 28(15), 1263–1267.

<https://doi.org/10.1080/13504851.2020.1803478>

[28] Choudhry, T., Hassan, S. S., & Shabi, S. (2020).

Relationship between gold and stock markets.

Research in International Business and Finance, 51, 101082.

<https://doi.org/10.1016/j.ribaf.2019.101082>

[29] Tiwari, A. K., Shahbaz, M., & Arouri, M. (2021).

Gold and stock market nexus.

Resources Policy, 72, 102052.

<https://doi.org/10.1016/j.resourpol.2021.102052>

[30] Kumar, A., & Anand, A. (2021).

Gold as a hedge in emerging markets.

Global Business Review, 22(3), 645–659.

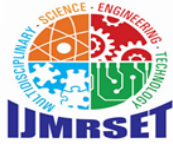
<https://doi.org/10.1177/0972150920916365>

[31] Sadorsky, P. (2021).

Safe haven assets in emerging markets.

Energy Economics, 97, 105205.

<https://doi.org/10.1016/j.eneco.2021.105205>



International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

- [32] Yousaf, I., Ali, S., & Bouri, E. (2021).
Gold as safe haven during pandemics.
Resources Policy, 74, 102280.
<https://doi.org/10.1016/j.resourpol.2021.102280>
- [33] Smales, L. A. (2021).
Gold and financial market stress.
Journal of International Financial Markets, Institutions and Money, 70, 101268.
<https://doi.org/10.1016/j.intfin.2020.101268>
- [34] Shahzad, S. J. H., Bouri, E., Roubaud, D., & Kristoufek, L. (2021).
Safe haven, hedge and diversification.
International Review of Financial Analysis, 76, 101763.
<https://doi.org/10.1016/j.irfa.2021.101763>
- [35] Fang, L., Bouri, E., Gupta, R., & Roubaud, D. (2021).
Gold and stock market volatility.
Finance Research Letters, 38, 101489.
<https://doi.org/10.1016/j.frl.2020.101489>



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

| Mobile No: +91-6381907438 | Whatsapp: +91-6381907438 | ijmrset@gmail.com |

www.ijmrset.com