



# STOCK MARKET SENSITIVITY TO CRUDE OIL AND FOREX PRICE MOVEMENTS A STUDY ON NIFTY 50 INDEX

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Article DOI: <https://doi.org/10.36713/epra15600>

DOI No: 10.36713/epra15600

## ABSTRACT

*This study examines the impact of the USD/INR Exchange rate, and the per-barrel prices of WTI Crude oil in rupees on the Nifty 50 index, utilizing monthly data spanning from January 1, 2010, to September 30, 2023. The analysis primarily involves the utilization of the closing returns of the nifty index, the West Texas Intermediate (WTI) oil price per barrel in dollars, and exchange rates. The classical OLS method is used to analyse the relationship between Nifty, crude oil, and crude oil prices over 166 months. The results reveal that exchange rates have a negative coefficient, suggesting that an increase in exchange rates is associated with a decrease in Nifty50 returns. In addition, the CUSUM test confirms the stability and consistency of our model over time, supporting the absence of structural breaks. This study underscores the dynamic nature of financial markets and highlights the importance of continuous monitoring and risk management strategies.*

**KEY WORDS:** Nifty 50, Crude Oil, Exchange Rate

## INTRODUCTION

Investing in the stock market entails inherent risks due to its volatility, marked by unpredictable price fluctuations and future uncertainties in financial instrument values, which can result in significant investment risk in stock prices (Mishra et al, 2021). Stock prices are influenced by various factors, including interest rates, company performance, and political conditions, but exchange rates receive heightened attention due to the growing interconnection between domestic capital markets and foreign exchange markets. Changes in a country's currency exchange rates often lead to substantial fluctuations in stock prices (Wenki, 2021). Fluctuations in the USD-INR exchange rate also have a significant impact on various economic indicators, including stock market returns, prompting an investigation into their causal relationship (Vijaykumar, 2021).

Crude oil (as represented by oil prices), as one of the most influential physical commodities globally, serves as a crucial macroeconomic indicator, impacting stock markets, aggregate demand, and economic growth in both developed and developing nations (Abdalla, 2013). Crude oil appears to be a determinant of stock market returns, as it has both long-term and short-term effects, with a negative short-term impact during the oil price crisis (Ayman, 2023). Fluctuations in crude oil prices have a significant and multifaceted impact on the Indian economy, with the stock market being a prominent factor influenced by these changes. The relationship between exchange rates and crude oil prices plays a crucial role in shaping the macroeconomic conditions of importing countries, making it essential for understanding a nation's stock market dynamics (Raju et al., 2020).

## LITERATURE REVIEW

The dynamic relationship between Crude Oil, Exchange Rates, and Stock Prices has been a subject of consistent interest for researchers and academics since the late 1990s in India after the globalization took place in India. (Friebert et. al, 1999) finds that in economies that are more open, the correlation between stock market returns and exchange rates is more pronounced and positive. (Mahapatra & Bhaduri, 2019) suggests that Indian investors are now increasingly demanding a higher return on their investments due to the additional risk associated with fluctuations in exchange rates as in recent four years, the factor of exchange rate risk has gained significant importance in influencing stock returns. Similarly (Sikarwar, 2014) found that Indian industries can either benefit or incur losses due to the rise or fall in the value of the rupee compared to foreign currencies, showing a stronger reaction to changes in the real exchange rate. (Delgado et. al, 2018) suggests that when the exchange rate goes up



(appreciates), it has a notable and adverse impact on the stock market index, meaning that a stronger exchange rate is associated with a decrease in the stock market index. (Badhani, 2009) suggests that, when viewed independently, an increase in the rupee's exchange rate tends to have a favourable effect on overall stock prices. (Manish kumar et. al, 2010) The authors discovered indications of a two-way connection between stock market indices and currency exchange rates in India. This implies that authorities should consider developments in both markets to foster stability and economic advancement. (Kumar et. al, 2019) finds that exchange rate changes impacts the stock market by affecting the revenue which in turn decline the stock return.

Whereas (Mohanty et. al, 2021) explained that Exchange rate fluctuations influence stock market volatility, but their net effects depend on various macroeconomic factors, resulting in variations across sectors, organizations, and countries. (Sahu et al., 2014) also observed that relationship between oil prices and stock indices is not due to the impact of exchange rate fluctuations as the exchange rate change did not have a significant impact on oil prices or stock prices in India during the study period. Contrary to other studies (Chikli et. al, 2014) finds from Markov switching VAR models that stock markets play a significant role in affecting exchange rates, whether the economic environment is characterized by low or high volatility.

(Sathyanarayana, 2018) using linear regression shows that changes in crude oil prices have an impact on Sensex. (Sheng et. al, 2023) reveal positive correlations between the crude oil market and stock markets. Similarly (Akçağlayan et al., 2023) support the existence of cointegration between the stock market and oil prices. (Nguyen et al. 2023) study presents positive volatility transmission from crude oil prices toward these emerging equity markets. (Kathiravan et al., 2023) discovered a strong bi-directional Granger causality effect of Dubai crude oil prices on exchange rates, as well as a bi-directional Granger influence of exchange rates on WTI crude oil prices. (Tanod et al., 2013) Study both crude oil and gold price impact on stock market but found only crude oil have significant impact on stock prices. (Tom & Thomas, 2019) The impact of crude oil price and exchange rate volatility significantly negative contribution to the performance of Indian stock market.

## METHODOLOGY

The research objective is to examine the impact of the USD/INR Exchange rate, and the per-barrel prices of WTI Crude oil in rupees on the Nifty Index, utilizing monthly data spanning from January 1, 2010, to September 30, 2023. The analysis primarily involves the utilization of the closing returns of the Nifty Index, the West Texas Intermediate (WTI) oil price per barrel in dollars, and the USD/INR Exchange rate. The secondary data for the study is collected from the investing.com official website. The classical OLS method is used to analyse the impact of exchange rate and crude oil on the nifty 50 index. The statistical software E-views is used for the analysis of the monthly data.

## HYPOTHEISIS

Ho - There is no significant impact of Crude oil and Exchange rate returns on the Nifty 50.

H1 - There is significant impact of Crude oil and Exchange rate returns on the Nifty 50.

**Table -1 Variables and Definitions**

Nifty 50	Dependent Variable	Index of National Stock Exchange which constitute by the top 50 companies of India, In terms of Market Capitalization.
Exchange Rate	Independent Variable	It is the Rate at which the two currencies are exchanged with each other.
Crude oil	Independent Variable	It is a global commodity which traded on various markets of the world as derivatives.

**UNIT ROOT TEST RESULTS (ADF)**

Null Hypothesis: the variable has a unit root

		At Level		
		NIFTY_50	CRUDE_OIL	USD_INR
With Constant	t-Statistic	-13.7496	-10.2752	-13.1729
	<b>Prob.</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>
		***	***	***
With Constant & Trend	t-Statistic	-13.7383	-10.2912	-13.1459
	<b>Prob.</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>
		***	***	***
Without Constant & Trend	t-Statistic	-13.2728	-10.1937	-12.8389
	<b>Prob.</b>	<b>0.0000</b>	<b>0.0000</b>	<b>0.0000</b>
		***	***	***

A p-value of 0.000 (or very close to 0) in a unit root test indicates strong evidence against the null hypothesis that the time series data has a unit root, which implies that the data is non-stationary. In the context of unit root tests, the null hypothesis typically assumes the presence of a unit root, while the alternative hypothesis suggests that the data is stationary (i.e., it does not have a unit root). Stationary data is often preferred for time series analysis and modelling because it simplifies the modelling process and makes the results more interpretable.

**Table-2 Assumptions of OLS**

Assumption Tests	Value	Interpretation
Heteroskedasticity Test	P Value – 0.509	No heteroskedasticity
Multi-collinearity Test	VIF – 1.0233	No multicollinearity
Serial Correlation Test	DW Value – 1.98	No Serial Correlation
Normality test	P Value – 0.490	Normal Distribution of errors

A Variance Inflation Factor (VIF) of 1 suggests that there is no multicollinearity between the independent variables in a multiple regression analysis. In multiple regression, VIF is used to measure the extent to which the variance of the estimated coefficients is inflated due to multicollinearity. A p-value of 0.509 for a Breusch-Pagan heteroskedasticity test indicates that there is no statistically significant evidence of heteroskedasticity in the regression model at a conventional significance level (e.g.,  $\alpha = 0.05$ ). In other words, it fails to reject the null hypothesis, which suggests that the error variance is constant across different levels of the independent variables in the regression model. Heteroskedasticity refers to a situation in which the variance of the error terms in a regression model is not constant across all levels of the independent variables. A Durbin-Watson (DW) value of 1.98 is very close to 2, and it is often considered to be in the "no autocorrelation". Jarque Bera p-value of 0.409, it suggests that there is no strong evidence to reject the null hypothesis that the data follows a normal distribution. This means that the error data tested with the Jarque-Bera test appears to be approximately normally distributed.

**Table -3 OLS Result**

Dependent Variable: NIFTY\_50

Method: Least Squares

Sample (adjusted): 1 166

Included observations: 166 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRUDE_OIL	0.055537	0.024480	2.268705	0.0000
USD_INR	-1.350160	0.135688	-9.950506	0.0000
C	0.013712	0.003041	4.509704	0.0000
R-squared	0.781834	Mean dependent var		0.009263
Adjusted R-squared	0.774249	S.D. dependent var		0.048702
S.E. of regression	0.038526	Akaike info criterion		-3.657075



Sum squared resid	0.241930	Schwarz criterion	-3.600834
Log likelihood	306.5372	Hannan-Quinn criter.	-3.634247
F-statistic	50.34152	Durbin-Watson stat	1.984367
Prob(F-statistic)	0.000000		

P-value of 0.000 for both crude oil and exchange rate indicates that these variables are statistically significant in explaining the variability in the Nifty 50 index. In other words, these variables are likely to have a strong impact on Nifty 50 returns. A coefficient value of 0.000 suggests that these independent variables are indeed having an impact on Nifty 50, and the direction of impact (positive or negative) would be reflected in the signs of the coefficients. F-statistic p-value of 0.000 indicates that the overall regression model is statistically significant. In other words, the combination of independent variables in the model is jointly affecting the dependent variable, Nifty 50. An R-Square of 0.78 suggests that approximately 78% of the variance in Nifty 50 can be explained by the independent variables included in the model. This is a relatively high R-Square, indicating a good fit for the model. The adjusted R-Square, which is 0.77, considers the number of independent variables in the model. It is very close to the R-Square, indicating that the additional variables do not contribute significantly to the explanation of variance in Nifty 50. The log likelihood value is 306. This value is often used in maximum likelihood estimation and model comparison. A higher log likelihood indicates a better fit of the model to the data.

Figure -1 CUSUM Test

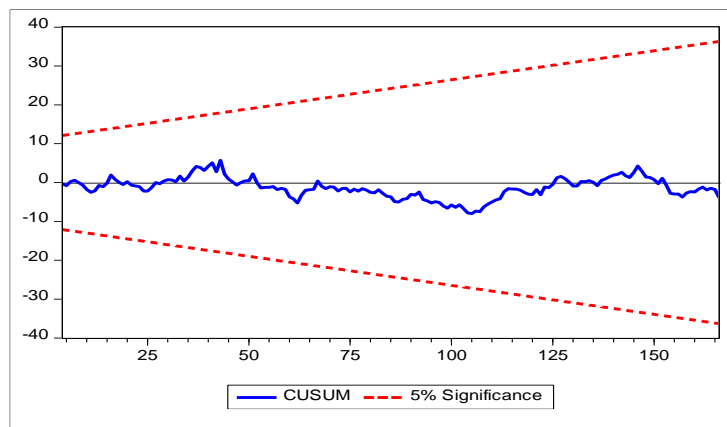
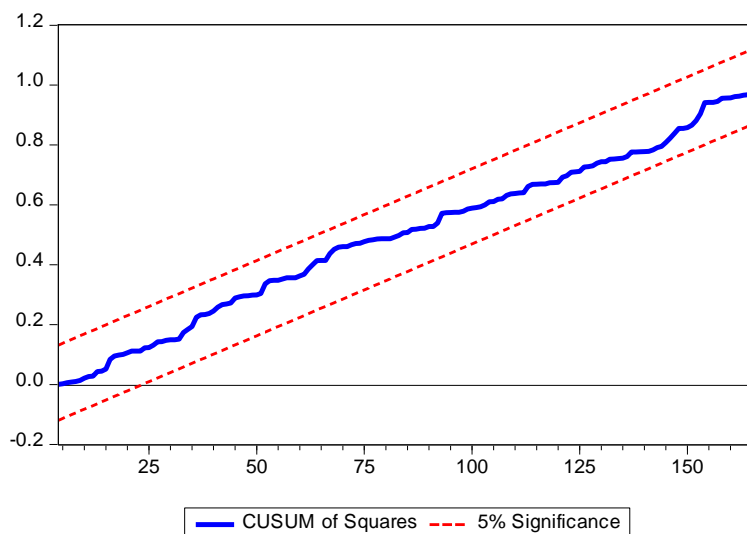


Figure – 2 CUSUMQ Test



The CUSUM test is often used to detect structural breaks or shifts in a time series or regression model. When the CUSUM line remains within the level of significance, it suggests that the model parameters or relationships have remained stable over the observed time. The CUSUM Q test is a related test that checks for overall stability in a time series or regression model. When the CUSUM Q line stays within the significance level, it indicates that the model's parameters are consistent and there is no compelling reason to believe that there has been a structural



change over time. the fact that both CUSUM and CUSUM Q test lines remain within the level of significance is reassuring. It suggests that the relationships and parameters for the study remained stable and consistent over time.

## FINDINGS

The study explored the relationship between Nifty 50, crude oil prices, and exchange rates over 166 months. All the assumptions of ordinary least squares (OLS) regression have been satisfied, which enhances the reliability of the analysis. The F-statistic with a p-value of 0.000 indicates the overall significance of the model, thus the null hypothesis is rejected, emphasizing the collective influence of crude oil and exchange rates on Nifty 50. my findings reveal that exchange rates have a negative coefficient, suggesting that an increase in exchange rates is associated with a decrease in Nifty 50 returns. Conversely, crude oil prices have a positive coefficient, indicating that higher oil prices are linked to higher Nifty 50 returns. Furthermore, the CUSUM and CUSUM Q tests confirm the stability and consistency of the model over time, supporting the absence of structural breaks.

## CONCLUSION

This research provides compelling evidence against the null hypothesis, demonstrating a significant impact of both crude oil prices and exchange rates on the Nifty 50 index. These findings imply that movements in exchange rates and crude oil prices hold valuable predictive power for Nifty 50 returns. As such, market participants and policymakers should consider these factors when making investment and economic decisions. This study underscores the dynamic nature of financial markets and highlights the importance of continuous monitoring and risk management strategies. It is crucial for stakeholders to adapt to changing economic conditions, as fluctuations in exchange rates and oil prices can significantly affect the Indian stock market, as represented by the Nifty 50.

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