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RELATIONSHIP BETWEEN OIL PRICES, EXCHANGE RATES AND STOCK INDICES

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ABSTRACT

This research examines the connections between oil prices, exchange rates, and stock indices in India. It examines correlations and causal effects between these key financial variables. The Granger causality tests fail to detect any significant causal effects between exchange rate returns and either crude oil returns or stock returns. These findings are valuable for long-term decision-making, and further research is needed to fully understand the impact of oil prices on stocks. This study adds to our knowledge of these relationships in the Indian market.

Keywords: Oil prices, exchange rates, market, relationships, stock indices

INTRODUCTION

The relationship between oil prices, exchange rates, and stock indices is crucial in today's economic discussions. These factors are closely connected, and changes in one can have significant effects on the others and the global economy as a whole. It is essential for policymakers, investors, and researchers to understand this relationship. They are closely linked and play a vital role in the global economy. Oil prices can affect various aspects such as production costs, transportation, and energy expenses. Exchange rates determine the competitiveness of countries in the international market and financial sector. Stock indices provide insights into the economic well-being and affect individuals' financial status. The interaction between these variables is intricate and constantly changing, differing across countries and time periods.

Extensive research has been conducted to analyse these relationships using various approaches and datasets, focusing on the interconnected nature of these factors. Factors such as geopolitical events, economic policies, and technological advancements further add complexity to this dynamic interplay. The COVID-19 pandemic shows how interconnected different aspects of the economy are, affecting oil demand, currency values, and stock markets. It is important to recognize these interconnections to make well-informed decisions and develop effective economic strategies.

2.LITERATURE REVIEW

Am and Shanmugasundaram (2017) investigated how macroeconomic variables impact stock prices in emerging and developing economies. Their study focused on the effects of crude oil price volatility on stock prices and exchange rates, considering crude oil exports and imports. They studied nine countries from the top 20 oil importers and exporters between January 2004 and December 2015, analyzing stock prices and foreign exchange rates with the US Dollar as the base currency. By using the Johansen Fisher Panel Cointegration Test, the research confirms that there is a long-term connection between the different variables. Afterward, the Fully Modified Ordinary Least Squares (FMOLS) method is used to identify the long-term parameters. The results show a significant lasting equilibrium connection between stock prices, exchange rates, and oil prices in the chosen countries. This connection highlights the complex relationships between stock market trends and key economic indicators like crude oil prices, exchange rates, gold prices, GDP, and inflation, which have been extensively examined in developed economies. However, there are only a few studies that have looked into these dynamics in emerging markets. The study looks at how changes in crude oil prices affect stock prices and exchange rates, particularly in relation to the amount of crude oil that these countries import and export. Data on stock prices and currency exchange rates from the biggest oil-importing and exporting countries were gathered for the same time frame. Through the use of the Johansen Fisher Panel Cointegration Test and FMOLS, the research confirms that there is a stable relationship over the long term between stock prices, exchange rates, and oil prices in these nations. This detailed investigation contributes to the scholarly discussion on how stock prices are affected by macroeconomic factors in lesser-known economies. It also presents a thorough framework for understanding the economic consequences of fluctuations in crude oil prices. **Akbulaev and Rahimli (2020)** conducted a detailed study exploring the relationship between market indices and the oil sector, examining the benefits and drawbacks of fluctuations in global indices and oil prices. Despite the challenges of directly connecting market indices with the oil sector, the researchers used statistical methods to discover correlations. Their research was based on a comprehensive review of existing

literature, including theoretical frameworks, and resulted in the creation of a statistical analysis model. This model underwent rigorous testing with data from the Moscow Stock Exchange to clarify the correlation between oil prices. This research is important because it can help international organizations create strategies to improve market outcomes and global stability. The study shows how the uneven distribution of oil production and consumption affects different industries in countries. It also highlights the crucial role of global oil trade in the economy and industry markets around the world. Akbulaev and Rahimli used advanced statistical techniques like regression and correlation analysis to show how industry indices and energy prices are connected. Their results indicate a complex relationship with both positive and negative effects linked to changes in sales, oil prices, and global indices. Although it is difficult to conclusively link industry index levels to changes in the oil market, their statistical method effectively reveals important connections. Akbulaev and Rahimli's article delves into the connection between oil prices and industry index prices using thorough statistical analysis. The study aims to evaluate current methods of analysing the relationship between oil prices and market indices, explore the theory behind this connection, and test a unique statistical model using data from the Moscow Stock Exchange. This research not only enhances our comprehension of how oil prices and market indices interact economically but also provides a practical approach for anticipating and managing the impact of oil price fluctuations on industry markets. **Kapusuzoğlu (2011)** conducted a study on the relationship between oil price shocks in the United States and their impact on the stock market. The study emphasized the importance of volatility and oil prices in affecting stock returns. Using various econometric techniques, the research analysed the short-term and long-term interactions between the global Brent oil price and two key indices of the Istanbul Stock Exchange (ISE) - the National 30 and National 50 indices. The study covered a span of 2437 days, from April 1, 2000, to April 1, 2010, with the goal of uncovering the independent connections between these indices and oil prices. The Johansen cointegration test showed that each index had a close connection with oil prices, suggesting a strong long-term relationship. Additionally, Granger causality analysis revealed that changes in oil prices directly impact the stock market indices, demonstrating the significant influence of oil prices on the stock market without a two-way relationship. The study used statistical methods to examine the connections between the global Brent oil price and the ISE's National 100, National 50, and National 30 indices from 2000 to 2010. It found a strong relationship between oil prices and the exchange rate, showing that higher oil prices led to an increase in the exchange rate. The research also showed that these effects decreased over time, as seen in the impulse-response functions analysis. This academic study highlights the importance of energy investments in developed countries and how changes in oil prices can have a significant impact on key economic factors. The

research explores the connections between the National 100, National 50, and National 30 Index of the Istanbul Stock Exchange and the global Brent oil price, using various statistical methods. The results of the Johansen cointegration test confirmed a long-term relationship between each index and oil prices, while the Granger causality analysis showed a one-way influence from the stock exchange indices to oil prices, clearly establishing oil price as a driver rather than a result of stock market movements. **Delgado, Delgado, and Saucedo (2018)** conducted a thorough investigation on how oil prices, the exchange rate, and the stock market index interplay in the Mexican economy. By analysing monthly data from January 1992 to June 2017, they used variables such as the nominal exchange rate, Mexican stock market index, consumer price index, and oil prices in a Vector Autoregressive Model (VAR). Their results show a significant negative correlation between the exchange rate and the stock market index, suggesting that a stronger exchange rate corresponds to a higher stock market index. Additionally, the research found that the consumer price index has a positive impact on the exchange rate but a negative effect on the stock market index. This detailed examination provides a better understanding of how economic indicators interact in Mexico, providing valuable information on their relationships and consequences. **Reboredo, Rivera-Castro, and Zebende (2014)** studied the relationship between oil prices and the US dollar exchange rate using detrended cross-correlation analysis. They found that there is a weak, negative correlation between oil prices and currency rates, which becomes stronger over time. Their research uncovered insights into how the oil price-exchange rate relationship plays out across different currencies before and after the global financial crisis. The study revealed a stronger connection between oil prices and the US dollar after the global financial crisis, indicating a shared impact and exchange of impacts between these markets. By using detrended cross-correlation analysis, this research improved our understanding of the relationship between oil prices and exchange rates at different time scales. This method was chosen to better comprehend the complexities of how oil prices and exchange rates interact over various time periods, serving different investor viewpoints and risk assessment approaches. The analysis showed how the relationship between oil and currency markets changed over time, especially after the financial crisis. This highlights how external events like financial crises can affect the connection between these markets. The increased negative correlation implies that during times of market instability, oil prices and the US dollar tend to move together more closely. The practical implications of these findings are significant for various groups, such as risk managers, asset allocators, and policymakers. It is essential to grasp how the relationship between oil prices and exchange rates is changing in order to make informed decisions about asset allocation, risk management, and economic policies. The detailed analysis conducted in this study can help guide decision-making in navigating the complexities of global financial

markets and improving processes related to asset management, risk assessment, and policymaking. **Jain and Biswal (2016)** conducted a study to investigate how government interventions such as taxes and regulations can impact the exchange rate, which in turn affects the nation's economy by looking at the import of gold and crude oil. This impact is often seen in the stock market index. The research focuses on understanding how global prices of gold, crude oil, the USD-INR exchange rate, and the Indian stock market are connected. By using DCC-GARCH models and Non-Linear Causality tests, the study explores the relationships between these variables. The results show that a reduction in gold and crude oil prices leads to a decrease in the Indian Rupee value and the Sensex stock index. Additionally, the findings suggest that gold is becoming a preferred investment option for investors. This study highlights the importance of implementing proactive policies in India to address exchange rate fluctuations and stock market volatility by using gold and oil prices as strategic tools. The research shows that there is a direct link between the decrease in crude oil and gold prices and the resulting depreciation of the Indian Rupee (USD-INR exchange rate) as well as the decline in the Sensex. The fluctuations in global commodity prices, particularly in gold and crude oil, have a significant impact on India's stock market behaviour and currency value. Investors are showing an increasing interest in gold as an investment option, highlighting the growing importance of gold price changes as indicators for stock market and foreign exchange rate movements. It is crucial to consider traditional financial market trends and gold price fluctuations when devising investment strategies and making policy decisions. The study suggests that policymakers in India should adapt their policies to effectively deal with fluctuations in exchange rates and stock markets. By using gold and oil prices as tools to adjust for these changes, policymakers can help stabilize the economy and mitigate the negative impacts of external shocks on financial markets. Jain and Biswal's research sheds light on how international commodity prices, currency rates, and the Indian stock markets are interconnected, offering useful insights for economists, investors, and policymakers. By conducting thorough research and using new analytical approaches, this study helps us better comprehend the complex factors influencing the Indian economy and financial markets in a worldwide perspective. **Kumar (2019)** explored the complex connections between oil prices, exchange rates, and stock prices in India by using the Hiemstra and Jones nonlinear Granger causality and nonlinear ARDL tests. The results showed strong evidence of a mutually causal relationship between oil prices and exchange rates, as well as between oil prices and stock prices. Additionally, the study uncovered a significant one-way causal relationship from exchange rates to stock prices. The recent NARDL test showed that changes in oil prices from the month before had significant effects on exchange rates and stock prices. Interestingly, positive changes had a bigger impact than negative changes, highlighting the unequal influence of oil prices on these financial

indicators. To tackle the issue of volatility in oil prices, exchange rates, and stock prices, residuals from a GARCH (1, 1) model were examined, adding strength to the study's results. The relationship between oil prices, stock prices, and exchange rates is interconnected and dynamic. Changes in one variable can have a significant impact on the others. In the Indian context, it is observed that exchange rates have a strong influence on stock prices. The NARDL test provided more insight into how changes in oil prices impact exchange rates and stock prices. Negative shocks to oil prices had a negative impact on exchange rates, while positive shocks led to a significant increase in exchange rates. Likewise, positive shocks in oil prices had a large positive effect on stock prices, while negative shocks had a smaller impact. This shows that there are nonlinear and asymmetric effects to be considered when studying the relationship between these variables. This study highlights the importance of recognizing the interconnections between stock prices, exchange rates, and oil prices in India. It emphasizes the need to consider nonlinear and asymmetric impacts when analysing these variables. Policymakers, investors, and financial analysts operating in the Indian financial markets should take note of these findings to make better-informed decisions. **Sukcharoen et. al. (2014)** analysed the connection between oil prices and stock market indices in multiple countries from 1982 to 2007. To avoid any biases from direct connections, they excluded oil and gas companies from the stock indices. They also converted oil price data into local currency to address exchange rate impacts. Using the copula method, the research revealed the interdependence between stock returns and oil price returns. According to the research, there is a weak connection between oil prices and stock indices in general, just like previous studies have shown. However, certain countries like the United States and Canada seem to have a strong reliance on oil prices when it comes to their stock index returns. The introduction of the Euro in 1999 had a significant impact on the relationship between oil prices and stock returns. In addition, the researchers used a copula approach to analyse the relationship between oil prices and stock returns in a thorough manner. This method helped to uncover any asymmetrical or non-linear connections between the two variables, providing a detailed and flexible exploration of their interaction. In summary, this study offers important information on the relationship between oil prices and stock market indices. It has significant implications for investors, policymakers, and financial analysts, providing a holistic view of how energy and financial markets interact, taking into account their potential complexities and nonlinearities. **Turhan, Sensoy, and Hacihasanoglu (2014)** conducted a detailed study using the cDCC model to explore how oil prices and exchange rates interacted in G20 countries. They aimed to understand how these relationships changed over time. Their research uncovered a stronger negative connection between oil prices and exchange rates in the last ten years, with key events such as the US invasion of Iraq in 2003 and the 2008 global financial crisis leading to shifts in these correlations.

The researchers used the cDCC model to analyse how oil prices and exchange rates are related in G20 countries. They found that internal factors have caused changes in these relationships. The results show that there has been a noticeable increase in the negative correlation between currency rates and oil prices in all G20 countries over the past ten years, indicating a stronger connection between energy and currency markets. The study highlighted two key events that had an impact on the connections between oil prices and exchange rates. Initially, within the more advanced G20 countries, the US invasion of Iraq in 2003 brought about a noticeable shift in the relationships, leading to geopolitical instability and increased volatility in oil markets. Subsequently, the worldwide financial crisis in 2008 altered the dynamics between oil prices and exchange rates across all G20 nations, causing significant changes due to heightened volatility and uncertainty in financial markets. The recent discovery of stronger negative correlations between oil prices and exchange rates provides advantages for diversifying risks and targeting inflation. Policymakers and investors can use this knowledge of the changing relationships between these factors to better handle the risks related to fluctuations in oil and exchange rates, and to develop economic policies that support stability and growth. Overall, this study offers important insights into how oil prices and currency rates interact within G20 member countries. The findings have implications for financial markets and macroeconomic policy, providing a thorough understanding of the changing dynamics between energy and currency markets. By using the cDCC model and analysing the effects of significant events on these relationships, the research sheds light on this complex relationship. **Beckmann, Czudaj, and Arora (2020)** conducted a thorough analysis of the relationship between oil prices and exchange rates, examining both theoretical frameworks and empirical evidence. They noted that various factors such as methodology, country selection, and analytical approach can influence the findings of observational research. Despite these variations, certain trends were identified: strong long-term correlations between exchange rates and oil prices are frequently observed, and in the short term, changes in either exchange rates or oil prices can act as important indicators for the other variable, though the effects may change dynamically over time. The research thoroughly examines various theories and real-world studies on how exchange rates and oil prices are connected. It looks closely at the different ways in which changes in one can impact the other, including through trade balances, inflation, and government policies. This analysis highlights the complex and ever-changing relationship between oil prices and exchange rates. The relationship between oil prices and exchange rates is complex and influenced by various factors. While theoretical frameworks suggest a bidirectional causality and empirical data show varying levels of correlation, the nature and intensity of these interactions depend on contextual factors and temporal dynamics. The paper highlights key areas for future research, such as studying how specific financial

instruments impact the relationship, investigating the effects of market interventions and policy measures, and analysing the impacts of structural changes and global economic trends on these important variables. Additionally, this research deepens our knowledge of how oil prices and exchange rates are connected. It adds valuable insights to the ongoing conversations among academics and policymakers by summarizing current research and suggesting new directions for future studies. **Bigerna (2024)** examined the interesting phenomenon in the Middle East and North Africa (MENA) region. They used a VARX model to study monthly data from 2010 to 2022 in 11 major countries in the MENA region. The model included asymmetrical effects, contagion analysis, and spillover analysis as important factors. The main goal of the study was to create a specific oil portfolio for each country, analyse the impact of oil shocks and contagion from a different perspective, and measure the overall impact of spillover effects. The study revealed different impacts caused by particular changes in oil prices, with the effects varying depending on the direction and duration of the price movements. The analysis highlighted the importance of policy implications related to interconnectedness, especially in light of the post-COVID period. Creating a customized oil portfolio for each country in the MENA region was crucial for understanding how fluctuations in oil prices would affect each nation, which was a key objective of the research. Furthermore, the study sought to examine how the outcomes of oil price fluctuations vary based on the direction and duration of the changes using an asymmetric approach. In addition, the research explored the idea of "contagion effects," which explain how shocks spread between countries in the region. By studying the dynamics of contagion, the researchers aimed to understand how economic shocks from one MENA country can affect nearby nations. The findings of the study highlighted the different effects of various oil price changes on the MENA region, showing that the impact of an oil shock depends on its direction and length. Additionally, the examination of contagion and spillover effects emphasized the interconnectedness of regional economies and stressed the significance of taking regional dynamics into account when planning economic policies. The study gives important information about how oil prices and economic conditions are connected in the Middle East and North Africa (MENA) region. It emphasizes the importance of policymakers considering regional dynamics and spillover effects when developing economic strategies in the MENA region, especially after the COVID-19 pandemic.

OBJECTIVES

- To examine the correlation between oil prices, exchange rates, and stock indices
- To assess the causal relationships between oil prices, exchange rates, and stock indices

RESEARCH METHODOLOGY

This study encompassing data of crude oil prices, the exchange rate (USD to INR), and stock returns (specifically NIFTY 50). Furthermore, it calculated the daily log return to analyse the time series properties of three financial datasets: crude oil return, exchange rate return, and stock return, on daily basis spanning from December 2003 to April 2022 (4540 observations after adjustments). The data has taken from the website of NSE, Yahoo Finance and Trading Economics, further it has gone pre-processing (in excel using short and filter) to ensure its suitability for analysis. To measure the linear connection between two variables that are on the same interval or ratio scale, Pearson correlation coefficient has been used and sometimes also referred to as the Pearson product-moment correlation coefficient. A number that ranges from -1 to +1 represents the degree and direction of the relationship between two continuous variables. The two variables move in the same direction when the correlation coefficient is +1, which denotes perfect positive correlation. A perfect negative correlation, or one in which the two variables decrease as the one grows, is represented by a value of -1. A correlation of 0 means there is none. An econometric test called Granger causality is used to confirm if one variable may accurately predict another. It is predicated on the idea that a variable is said to be Granger-caused by another if it can be demonstrated that, in addition to the information already provided by the second variable's past values, the past values of the first variable provide statistically significant information about the future values of the second variable. A statistical hypothesis test called the Granger causality test entails regressing the dependent variable on the lagged values of the independent and dependent variables, followed by a test of the hypothesis that the lagged independent variables' coefficients are equal to zero

RESULT AND INTERPRETATION

1. Karl Pearson Correlation of Coefficients

$$r = \frac{\Sigma(X-\overline{X})(Y-\overline{Y})}{\sqrt{\Sigma(X-\overline{X})^2}\sqrt{(Y-\overline{Y})^2}}$$

Where, $\overline{X}$ = mean of X variable
$\overline{Y}$ = mean of Y variable

Table 1.1. Karl Pearson Correlation of Coefficients

Correlations

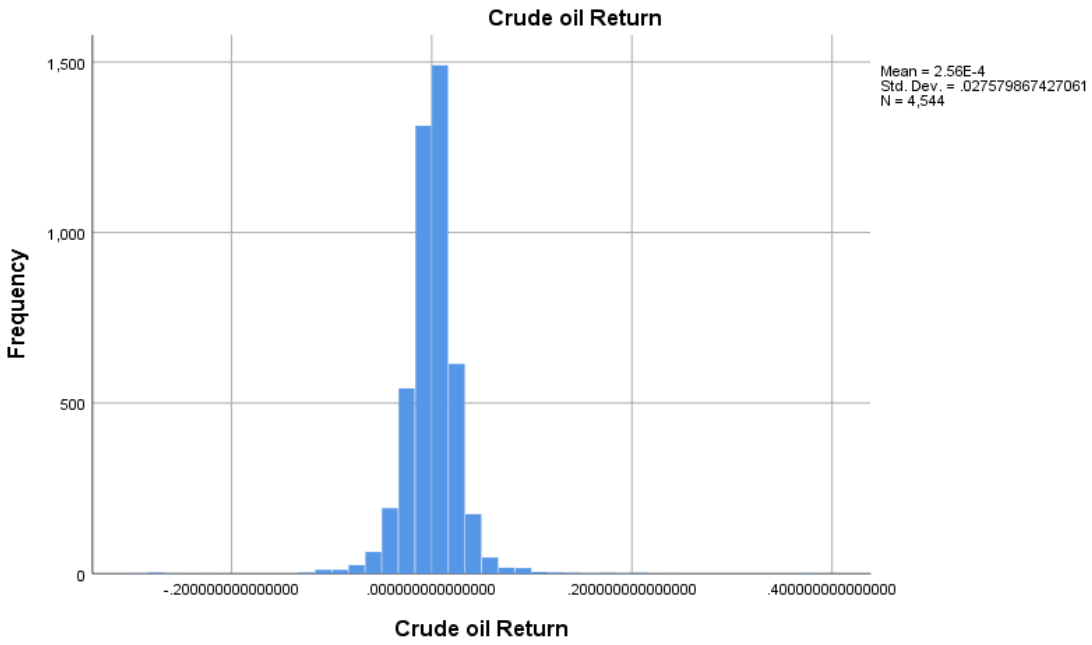
		Crude oil Return	Exchange Rate return	Stock return
Crude oil Return	Pearson Correlation	1	-.009	-.004
	Sig. (2-tailed)		.541	.778
	N	4544	4544	4544
Exchange Rate return	Pearson Correlation	-.009	1	-.020
	Sig. (2-tailed)	.541		.178
	N	4544	4544	4544
Stock return	Pearson Correlation	-.004	-.020	1
	Sig. (2-tailed)	.778	.178	
	N	4544	4544	4544

Source: Authors' Calculations

The correlation between Crude Oil Return and itself is 1, as expected, with 4544 observations. It has a correlation of -0.009 with Exchange Rate return and -0.004 with Stock return, both of which are not considered significant based on the 2-tailed values of .541 and .778, respectively. Exchange Rate return has a correlation of -0.009 with Crude Oil Return and 1 with itself. It also has a correlation of -0.020 with Stock return, which is not significant (2-tailed value = .178). The number of observations for Exchange Rate return is also 4544. Stock return has a correlation of -0.004 with Crude Oil Return and -0.020 with Exchange Rate return, with significance levels.

Figure 1.1

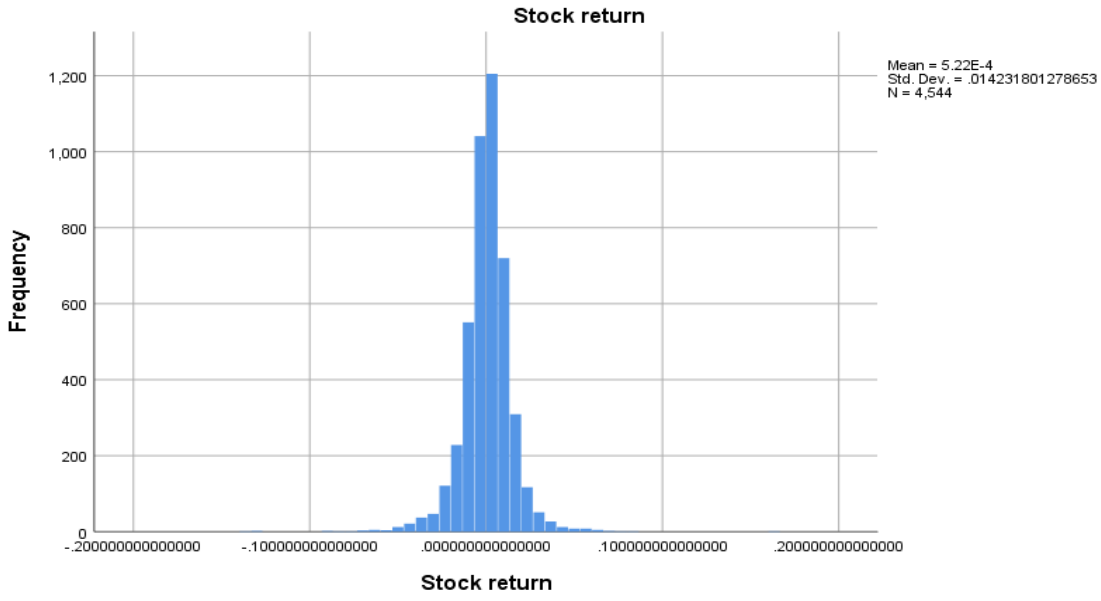
Source: Authors'



Calculations

The analysis shows that the average return is close to zero, meaning there wasn't much change in returns overall. The standard deviation of around 0.0275 indicates moderate volatility in returns. With 5,464 observations in the dataset, the histogram depicts a distribution centered around the average, with fewer outliers. However, there are some bars at the ends of the graph, indicating a few extreme positive and negative returns in the data set.

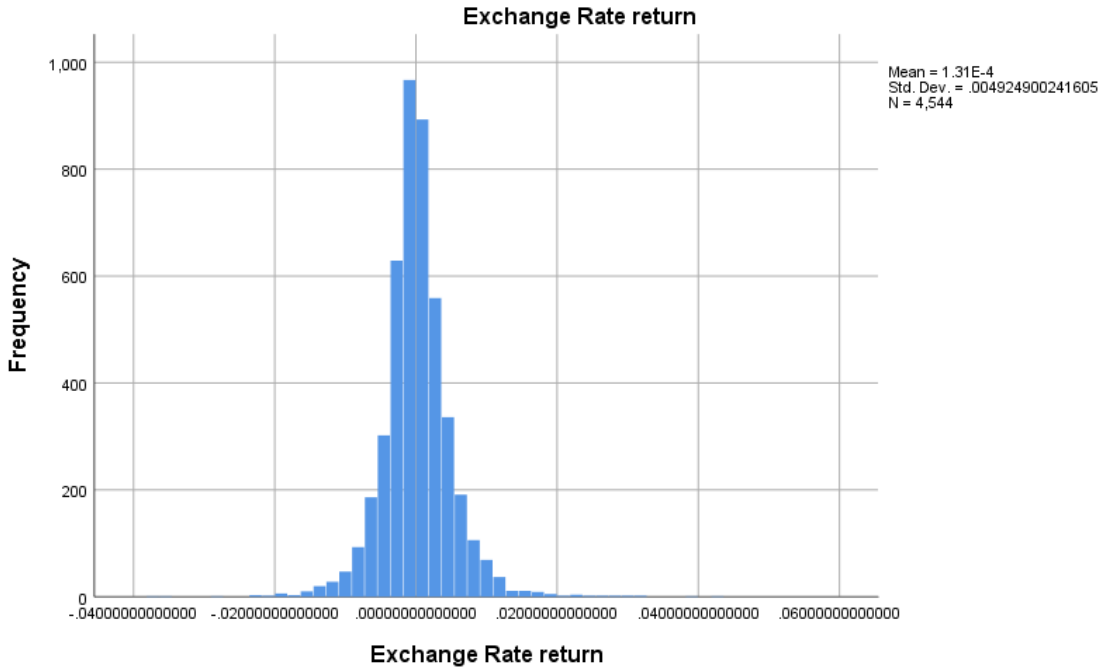
Figure 1.2



Source: Authors' Calculations

The bar graph shows that most of the stock returns in the data are centered around zero, with the highest bar right at zero. The distribution seems to be somewhat even on both sides of zero, hinting at a potential normal distribution pattern, but more information is needed to confirm this. These numbers give us quantitative details about the data: the average return is near zero, meaning there are not many high or low returns on average, and the standard deviation shows us how much the returns vary, with a bigger standard deviation indicating more variability. The total number of data points tells us how big the dataset is and how many individual stock returns are being analysed.

Figure 1.3



Source: Authors' Calculations

The bar graph shows that most stock returns are centered around zero, with the tallest bar at zero. The distribution seems to be symmetrical around zero, suggesting a potential normal distribution pattern. The average return is near zero, indicating little fluctuation in returns, while the standard deviation gives an idea of the range of variability, with a higher standard deviation indicating more spread. The total number of data points reflects the dataset's size and the quantity of individual stock returns examined.

2. Granger Causality Test

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$$Y_t = \sum_{i=1}^{n} \alpha_i Y_{t-i} + \sum_{j=1}^{n} \beta_j X_{t-j} + u_{1t}$$

$$X_t = \sum_{i=1}^{n} \lambda_i Y_{t-i} + \sum_{j=1}^{n} \sigma_j X_{t-j} + u_{2t}$$

Table 2.1 *Granger Causality Test*

Pairwise Granger Causality Tests
Date: 04/07/24 Time: 14:26
Sample: 12/02/2003 4/08/2022
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
CRUDE_OIL_RETURN does not Granger Cause EXCHANGE_RATE_RETURN	4543	2.16011	0.1417
EXCHANGE_RATE_RETURN does not Granger Cause CRUDE_OIL_RETURN		0.01830	0.8924
STOCK_RETURN does not Granger Cause EXCHANGE_RATE_RETURN	4543	0.30915	0.5782
EXCHANGE_RATE_RETURN does not Granger Cause STOCK_RETURN		0.78626	0.3753
STOCK_RETURN does not Granger Cause CRUDE_OIL_RETURN	4543	4.69159	0.0304
CRUDE_OIL_RETURN does not Granger Cause STOCK_RETURN		2.59495	0.1073

Source: Authors' Compilation

The Granger causality test did not find any significant causal relationships between exchange rates, crude oil returns, and stock returns. There is no evidence to support the idea that changes in one variable can forecast changes in another. For exchange rates and stock returns, both F-statistics and p-values indicated a lack of influence going in either direction. Similarly, there was no causal link between crude oil returns and exchange rates. However, the relationship between stock returns and crude oil returns was more complex. While stock returns did not predict crude oil returns (high p-value), there may be a weak effect of crude oil returns on stock returns (p-value approaching the significance level of 0.05). In general, the analysis implies that these markets operate independently.

FINDINGS

The research looked into how oil prices, exchange rates, and stock indices are related and affect each other. The study used statistical analysis to find correlations and causal connections between these factors. The results revealed that there were weak and not significant correlations among all three variables. Additionally, the Granger Causality Test did not show any important causal relationships between them. There was one potential exception, where there might be a minor impact of crude oil prices on stock returns, with a p-value close to the 0.05 significance level. Overall, though, the findings suggest that oil prices, exchange rates, and stock indices function independently during the time period examined.

CONCLUSION

The study looked at how oil prices, exchange rates, and stock indices are related in India. The results showed weak and not very significant correlations between these factors, indicating that there is no strong linear relationship in the short term. The Granger causality test did not find any significant causation. However, there is a possibility of oil prices having a small impact on stock returns.

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