



IMPACT OF EXCHANGE RATE AND CRUDE OIL PRICE ON INDIAN STOCK MARKET

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Abstract: Recently the Indian stock market has achieved an esteemed milestone in terms of its market capitalisation; it has touched \$3.3 trillion M-Cap and occupies world fifth largest market. The present study endeavours to study the impact of exchange rate and crude oil price on Indian stock market. During this ten year span the world has witnessed major events and catastrophe of gigantic proportion which halted the world economy. The de-dollarization initiatives, the war and pandemic have shaken the power index in the world polity. The study aspires to investigate cointegration relationships among Crude oil, Exchange rate in impacting the stock market. The study is based on the secondary data retrieved from various authentic sources such as CMIE, Prowese database, Yahoo finance etc. for the study period from 1st April 2013 to 30th September, 2022. In the course of analysis, we have employed various statistical and econometric tools such as ADF unit root test, Johansen cointegration analysis and Granger causality test. Johansen cointegration test result indicates that there exists no long-term relationship among the selected variables. Granger causality test result also failed to explain any causality among the variables.

Keywords: Crude Oil Price; Exchange Rates; Stock Price Indices; Johansen Cointegration Test, Granger Causality Test

1. INTRODUCTION

The impact of crude oil prices and exchange rates on the Indian stock market is a topic of significant interest and research. Both crude oil prices and exchange rates can have substantial effects on the performance of the Indian stock market. Researchers provide evidence of a negative impact of oil price shocks on economic growth (Hamilton, 1983) and stock market returns (Driesprong *et al.*, 2008). When crude oil prices rise, it can have a negative impact on

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the stock market, particularly for sectors that are sensitive to oil prices, such as energy, transportation, and manufacturing. Besides these, higher crude oil prices can lead to increased inflationary pressure, which can have a negative impact on the stock market as it affects consumer spending and corporate profitability. Historically, India is a net importer country of oil, a rise in crude oil prices can widen the country's current account deficit, which can negatively impact investors' sentiment and stock market performance. Similarly, exchange rate fluctuations impact the profitability of companies engaged in import and export activities. Oil price has always been considered as a leading indicator of exchange rate movements in the world economy (Amano & Norden, 1998). Exchange rate movements can influence foreign investor sentiment towards the Indian stock market. A depreciating currency can make Indian stocks more attractive for foreign investors, resulting in increased capital inflows and positive market performance. As per IEA's World Energy Outlook 2021, India's oil demand rises by almost 4 million barrels per day (mb/d) to reach 8.7 mb/d in 2040, the largest increase of any country. India has achieved the target of 10 percent ethanol blending in June 2022; the crude oil production during the year 2021-22 is at 29.69 Million Metric Tonnes (MMT) against production of 30.49 MMT in 2020-21, showing a decline of 2.6%. Therefore, it is amply clear that we need to depend heavily on imported oil and to finance this, government use its foreign exchange especially through US dollar, which is the preferred currency of international trade.

2. REVIEW OF LITERATURE

Rautava (2004) studied the role of real exchange rate and crude oil price in Russian economy on the quarterly data from 1995 to 2002 and found that oil price increase is associated with depreciation of the ruble. Using daily data from July 2007 to November 2008, Ghosh (2011) surveyed the crude oil price and exchange rate relationship for India. His study revealed a depreciation of Indian currency with increasing oil prices. Hussein Alzyoudet al. (2018) analysed the impact of crude oil prices (COP) on exchange rate and stock market returns in Canada over the period of 1986–2015. They suggested that there was no co integration among COP, exchange rate and stock market returns. Results of regression analysis show that COP and exchange rate, and their variations have a positive and significant impact on the Canadian stock market returns. Bhunia & Ganguly (2015) reported that there is significant long-term co integration unwavering relationships exist. They have also

observed that Indian stock market index is highly depended upon the price of international crude oil price, gold price, exchange rates and GDP growth based on the long term data from 1991 upto 2013 using ADF unit root test and Johansen cointegration test. Mukhuti & Bhunia (2013) observed that to diversify its basket of investment, investors prefer to have an alternative investment as market return is unpredictable and gold investment is found to be safe haven in times of general economic and financial crisis. Therefore, Gold has not yet lost its prime importance as a hedge against loss of wealth in times of crises [Bhunia & Das, 2012]. Coronado & Rojas (2016) has reported the co-movements between oil price, stock index, and exchange rate in the Mexican economy using a number of nonlinear tests, they have identified periods of non-linear dependence among the study variables. It is generally believed that crude oil is an alternative investment in the bearish or highly volatile stock market as most of the countries use crude oil as security against loans at the time of balance of payment difficulties. Chinni, N. et al. (2022), studied dynamic relationship between crude oil price and stock prices between April 2017 to March 2022 period to establish the relationship between the exchange rate and the stock market price, ADF test is employed to examine the stationary of data and Johansen co-integration test. They have also employed Granger causality test to establish causal & short-term relationship of the variables with the corresponding bi-directional of the causality among the variables. Sadorsky (2001) exhibited that stock returns of Canadian oil and gas companies are positive and sensitive to oil price increases using a multifactor market model. Miller and Ratti (2009) on the other, examined the long-run relationship between the world price of crude oil and international stock markets, and concluded that stock markets respond negatively to increases in the price of oil. There are two approaches for the negative relationship. First, oil being a major input for most firms, higher oil prices invariably, increases the production cost thereby can seriously impede future cash flows stream, earnings and dividends and consequently, stock returns. Second, higher oil prices can lead to an overestimation of expected inflation and higher nominal interest rates. Because interest rates are traditionally employed to discount expected future cash flows, which lead to depress earnings, dividends and, hence, stock returns (Kling, 1985; Jones and Kaul, 1996; Gjerde and Sættem, 1999; Sadorsky, 2008). Mishra (2004) examines the dynamic relationship between the Indian stock market and foreign exchange markets for the period April 1992 to March 2002. They reported that there is no Granger causality between the exchange

rate fluctuation and stock return. Bhunia (2013) investigated the cointegration relationships among crude oil price, domestic gold price and selected financial variables (exchange rates and stock price indices) in India. He observed that increase in crude oil prices will make the production process costly which will ultimately affect cash flow and will decrease stock prices. In the course of analysis, he has employed ADF unit root test, Johansen cointegration analysis and Granger causality test. He has exhibited that Johansen cointegration test result shows that there exists a long-term relationship among the selected variables. Granger causality test result also indicates that there must be either bidirectional or no causality among the variables. Katsamposakis et al. (2022) they investigate the interrelations between stock returns and crude oil prices for European oil-importing/exporting countries. They have employed a vector autoregression (VAR) model to estimate the significance of stock market responses to changes in oil prices during the pandemic period 2019–2021. They also applied Granger causality test to find out the direction and the intensity of the relation between crude oil and the indices of the European stock markets. Iqbal & Raziq (2018), they have studied the association between crude oil price and the Pakistani Rupee-US Dollar exchange. They have employed Asymmetric power autoregressive conditional heteroscedastic (APARCH) model to measure the influence of oil price on the nominal exchange rate using daily data of extreme oil price volatility (2006 – 2013). They reported that there exist a high degree of volatility persistence and leverage effect in returns. They have exhibited a positive association between currency exchange rate and oil price. Samanta and Ali (2012) examined the co-movements of selected macro-variables (gold price, stock price, real exchange rate and the crude oil price) based on data using econometric models for the periods from January 1989 to September 2009. The study exposes that there is a cointegration relationship between the variables. Jain & Biswal (2016) illustrated fall in gold prices and crude oil prices cause fall in the value of the Indian Rupee and the benchmark stock index i.e. Sensex. The findings of this study also support the emergence of gold as an investment asset class among the investors. They observed that to contain exchange rate fluctuations and stock market volatility gold price and oil price can be used as instruments.

RESEARCH GAP

The present study wishes to highlight the causal relationship between crude oil price, exchange rate represented by dollar and its association and impact on

Indian stock market, we have chosen the Sensex as the true representative of Indian stock market. Though many scholarly articles were written in this topic but not much study is undertaken recently especially in post covid scenario, given the time horizon of ten years this study wish to revisit this macroeconomic variable to make an objective assessment of the present situation.

RESEARCH QUESTION

Obviously the main research question is:

Are crude oil price and exchange rates significantly influence the stock market index in India?

OBJECTIVE OF THE STUDY

The present study is aspiring to examine the impact of crude oil price and exchange rates on Indian stock market.

DATA AND METHODOLOGY

The daily time-series data for the Indian stock markets represented by Sensex was obtained from the CMIE prowest database. The crude oil price database was also retrieved from CMIE-Prowess database and finally for exchange rates we gathered the series from Yahoo finance database. The study's sample period is 1st April 2013 to 30th September, 2022. It is worth to note that such type of analysis presumably, prone to suffer heteroscedasticity. Various sophisticated methods are usually employed to arrest this issue.

EMPIRICAL RESULTS AND ANALYSIS

This section provides the descriptive statistics for the sample and carries out a correlation analysis, unit root test and Johansen cointegration analysis. We have also employed Granger causality test to identify whether the variables have any causal relationship and the direction of that relationship.

Descriptive Statistics

We start by testing the distribution of the sample. Our null hypothesis is that the stock price indices are distributed normally. This is consistent with Fama (1965) and Aparicio and Estrada (1997) who argue that stock market prices are distributed normally if the indices follow the random walk theory. The Indian stock market represented by Sensex exhibited high standard deviation. The kurtosis is greater than the skewness in all the three variable of COP, ER and SX

across the entire sample, which shows that the distribution is platykurtic. The Jarque–Bera statistics also confirm that the series is not normally distributed. Therefore, the null hypothesis is rejected statistically, which means that all the three variable in this sample do not represent a normal distribution.

Table 1: Descriptive Statistics

	<i>Crude oil price</i>	<i>Exchange Rate</i>	<i>Sensex</i>
Mean	71.47984	89.954	35006.45
Median	68.62000	93.815	32740.30
Maximum	123.7000	103.290	61765.59
Minimum	-37.63000	72.930	17905.91
Std. Dev.	23.49694	8.3113	11377.60
Skewness	-0.029062	-0.3825	0.775508
Kurtosis	2.051645	1.5922	2.647345
Jarque-Bera	88.09395	250.508	246.8876
Probability	0.000000	0.000000	0.000000
Sum	167405.8	210673.1	81985101
Sum Sq. Dev.	1292480.	161713.6	3.03E+11
Observations	2342	2342	2342

Correlation Analysis

The efficient markets hypothesis mandated that stock market impounded all information and it is very difficult, if not by chance to earn abnormal profit under three forms of market, as suggested by Fama in his seminal article. (viz. weak, semi-strong, strong form). Since there are numerous factors that has serious implication in influencing international stock prices to the extent that these markets are efficient and follow a random walk model, the prices of the sample stock indices should be highly correlated. Thus, we hypothesize that the Indian stock markets are positively correlated with the crude oil price and exchange rate (here, it is US \$) Table 2 gives the correlation coefficients of the three variable along with their probability. The table shows that the Sensex is positively correlated with the international crude oil price and US foreign exchange during the study period. Interestingly, the Sensex is observed to be significantly correlated at 1% level of significance with respect to exchange rate. These findings support the hypothesis that the COP and ER and SX are highly integrated with each other.

We use correlation analysis to test the linear statistical interdependence between the variables to ascertain the existence of any stable long-run association,

we have used cointegration analysis to demonstrate this association, which gauges the correlation between two nonstationary variables in a stationary way along with its probability.

Table 2: Correlation analysis of stock index prices

<i>Correlation</i>			
<i>Probability</i>	<i>Crude Oil Price</i>	<i>Exchange Rate (\$)</i>	<i>Sensex</i>
Crude Oil Price	1.000000		

Exchange Rate (\$)	0.019109	1.000000	
	0.3553	-----	
Sensex	0.019702	0.762089	1.000000
	0.3406	0.0000	-----

Unit root test

In order to determine whether the time series is stationary or not or we have employed the most popular, Augmented Dickey-Fuller (ADF-1979) test method for this study. ADF test considered as an appropriate tool to check the stationarity of time series data. The time series is nonstationary if the critical value is lower than the calculated value, subsequently null hypothesis is rejected and series is decided to be stationary (Bhunia, 2013)

H0: Series is stationary.

H1: Series is non-stationary.

The necessary prerequisites for cointegration among the sample stock markets is that their data should be nonstationary and integrated of an order higher than 0. Following, Bhunia & Yaman (2017) We test stationarity using the augmented Dickey–Fuller (ADF) unit root tests before proceeding to the cointegration test.

Table 3: Unit root test results

<i>Variable</i>	<i>At level ADF- t stat</i>	<i>First differentiated ADF- t stat</i>
Crude oil price	0.054	-22.131
Exchange rate (\$)	-1.73	-52.97
Sensex	-2.14	-47.52

Johansen co-integration test

Co-integration tests provide a mean to determine whether a set of endogenous variables share a common long-run stochastic trend. A finding of co-integration indicates interdependence of the endogenous variables, which may be the result of economic linkages between the markets or arbitrage activity between investors. Hypothesis to be examined with Johansen co-integration test to be applied on the study has been presented below:

H_0 : There is no co-integration relationship between variables

H_1 : There is co-integration relationship between variables

The Johansen (1988) co-integration test relies on the relationship between the rank of a matrix and its characteristic roots, or eigenvalues. We employed Johansen cointegration test in our study to determine whether there is cointegration as well as the number of co-integrating relationships exist, specifically, to probe whether there are any long-term cointegration relationships between crude oil price, exchange rates and stock price indices of BSE exist or not. Following, Bhunia, (2013) we used two likelihood ratio tests, the Trace Test and the Maximum Eigen Value test, to determine the number of co-integrating vectors. The estimation for each series assumes linear deterministic trend unrestricted with intercepts and no trends. A lag of 1 to 4 (in 1st differences) is used for each series, based on the Swartz Information Criterion (SIC).

Table 4: Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

<i>Hypothesized</i>		<i>Trace</i>	<i>0.05</i>
<i>No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Statistic</i>	<i>Critical Value</i>
<i>None *</i>	0.467329	1448.635	29.79707
<i>At most 1</i>	0.002740	8.165879	15.49471
<i>At most 2</i>	0.000826	1.890835	3.841466

Table 5: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

<i>Hypothesized</i>		<i>Max-Eigen</i>	<i>0.05</i>	
<i>No. of CE(s)</i>	<i>Eigenvalue</i>	<i>Statistic</i>	<i>Critical Value</i>	<i>Prob. **</i>
<i>None *</i>	0.467329	1440.469	21.13162	1.0000
<i>At most 1</i>	0.002740	6.275045	14.26460	0.5782
<i>At most 2</i>	0.000826	1.890835	3.841466	0.1691
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 5 demonstrates the Johansen cointegration test result which does not indicate the long-term relationship among the selected variables. The result shows that the series is not cointegrated, as both the trace and the maximum eigenvalue tests fail to reject the null hypothesis of no cointegration suggesting that there are two significant co-integrating vectors in the model.

Pairwise Granger Causality Tests Results

The Granger causality test is a statistical proposition test for ascertaining whether the time series is helpful in forecasting another. To address this issue we have performed pairwise Granger causality test to search the direction of causation among the selected financial variables. Table-5 reveals that no causality exists between (i) crude oil price (COP) and exchange rates(ER), (ii) Sensex (SX) and exchange rates, (iii) exchange rates and Sensex, (iv) exchange rates crude oil price and (V) Sensex and crude oil price (vi) crude oil and Sensex. It is worth to note that the pronouncement of causality between the selected variables does not mean that movement in one variable actually causes movements in another variable.

Table 6: Pairwise Granger Causality Test

<i>Null Hypothesis:</i>	<i>Obs</i>	<i>F-Statistic</i>	<i>Prob.</i>
ER does not Granger Cause COP	2847	0.41705	0.6590
COP does not Granger Cause ER		2.14463	0.1173
SX does not Granger Cause COP	2332	0.77393	0.4613
COP does not Granger Cause SX		0.39179	0.6759
SX does not Granger Cause ER	2338	0.03170	0.9688
ER does not Granger Cause SX		1.43030	0.2394

CONCLUSION

The present study endeavours to examine the impact of crude oil price and exchange rates on Indian stock market. We have selected these three variable as there is a common perception in the mind of the investors and people in general that international crude oil price has played a dominant role in economic well-being of a nation like India, which is net importer country. Similarly, dollar has been the dominant international country and each country holds their foreign exchange reserve in dollar, therefore, any fluctuation vis-à-vis dollar with the resident country has some bearing in the stock market across the world. In order to address these issues we have embarked on this study. The principal conclusion of the empirical results is that the selected time series

exhibit stationary and hence provide no indication of long-term cointegration relationship. We have not able to reject the null hypothesis of unit root test in our study, the granger causality test results also failed to establish statistically significant results among the variables. Therefore, in the light of the present study we can conclude that there is no association between crude oil price, exchange rate in determining the movement of Sensex in India during the study period and there may be other reasons which need further study.

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