

INVESTIGATING CAUSALITY BETWEEN STOCK RETURN, COMMODITY MARKET, CRUDE OIL PRICES AND FOREIGN EXCHANGE RATE

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Abstract

Oil is one such commodity that holds a leading position in the economy of almost every country. India is the fourth largest consumer of crude oil in the world. Crude Oil and Coal collectively account for about 2/3rd of India's total energy consumption. Thus, crude oil is among the major import list of India and a slight change in prices of these products can affect the direction of economy upwards or downwards.

This paper has empirically tried to examine the relationship between Indian Capital Market, Crude Oil Prices, Indian Commodity Market and Foreign Exchange Rate. The data has been collected for a period ranging from January 2008 to June 2016. ADF Unit Root Test, Johansen Cointegration Test and Granger Causality Test have been applied. All the variables are found to be non-stationary at level but become stationary after first differentiation. No long term relationship was found between the variables. Further only Crude oil Prices and Energy Future Index; Stock Return and Foreign Exchange Rate are found to Granger Cause each other.

Keywords: Foreign Exchange Rate; Commodity Market; Granger Causality; ADF Unit Root Test; Commodity Market.

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1. Introduction (10pt)

Oil is one such commodity that holds a leading position in the economy of almost every country. Even, the wealthiest nations in the world hold their positions because of their contribution in the world economy in terms of oil production. Moreover, oil has become one of the most necessitated worldwide required commodity as every country want either crude oil or other forms of oil for their development. More than 60% of current energy need of the world is met with the help of crude oil alone. Crude oil reserve which is estimated to be approximately 1 trillion barrels is majorly found in Africa, Central America, Eastern Europe, and Middle East. Along with this, the consumption of crude oil worldwide is estimated to be 76 million barrel per day. India is not among the major producers of crude oil and that is why we depend on import of oil from other countries. India is the fourth largest consumer of crude oil in the world. Crude Oil and Coal collectively account for about 2/3rd of India's total energy consumption. Thus, crude oil is among the major import list of India. Our Country is importing more than 100 million tons of crude oil and its other products, and are spending huge amount of foreign exchange on it. And thus a slight change in prices of these products can affect the direction of economy upwards or downwards.

Commodity Market and Stock Market of India is said to be greatly affected by two factors namely Crude oil prices and Exchange Rate. This paper tries to examine the relationship between change in crude oil prices and Exchange rate on Indian Stock Market and Commodity Market. As a proxy of Indian Stock Market, Composite Index CNX Stock Return has been chosen, while as a proxy of commodity market Energy Index Future has been selected as our study relates to energy sector.

This paper is divided into 5 segments. First Segment, provides the introduction of the topic and its importance; Segment 2, describes in brief the available literature on the relationship between Crude Oil Prices, Exchange Rate, Stock Market and Commodity market; Segment 3, discusses in details the methodology used for the study; Fourth Segment, shows the Analysis of data and its interpretation; and the last Segment, i.e. Segment 5, is dedicated to Conclusion

Considerable amount of researches have already been conducted investigating the causality between stock return and other macroeconomic variables. Some of the important studies are:

Hidayathulla A. and Rafee B. Mahammad (2015) analyzed the impact of change in crude oil prices on foreign exchange (USD-INR). The data used cover a period from 1972 to 2013. To meet the above mentioned objective, multiple linear regression models were used and the result suggested that the import figures for crude oil rise up when the crude oil future price increase.

Bhunia Amalendu (2013) tried to investigate the cointegration relationship between crude oil prices, domestic gold prices, exchange rate and Stock Market Indices. The study was based on secondary data collected from January 1991 to October 2012. ADF unit root test, Johansen cointegration test and Granger causality test were applied and the study concluded that there exists a long-term relationship among the variables and no causality among the variables.

Nasibeh Aghaei, Saeed Shirkavand, and Saeed Mirzamohammadi (2013) investigated the relationship between Crude Oil and Gold prices at global level and foreign exchange rates on Stock Index of Tehran. The authors used daily data series for a period ranging from January 2002 to January 2009. Econometric tools like GARCH, ADF, DF-GLS, Engle and Granger Co-integration test and Johansen Juselius test were used for the analysis. The results demonstrated a negative and significant correlation between Tehran stock exchange price index and global gold price index, while Correlation between the price index of Tehran Stock Exchange, Foreign Exchange Rate and Crude Oil price Index was found to be positive.

Chittedi Reddy Krishna (2012) investigated the long run relationship between crude oil prices, and stock prices for India. The data used was for a period from April 2000 to June 2011, Using Auto Regressive Distributed Lag (ARDL) the author concluded that volatility in Indian Stock market has a significant impact on the volatility of oil price but not vice versa.

Hea Yanan, Wangb Shouyang, and Laic Keung Kin (2010) endeavored to investigate relationship between crude oil prices and global economic activity. The study found that futures prices of crude oil are cointegrated with the economic index and US dollar index (trade

weighted). The study further concluded that the crude oil prices are influenced by fluctuations in the Kilian economic index

Narayan Kumar Paresh, and Narayan Seema (2009) tried to examine the integration between crude oil prices and stock prices in Vietnam. The study covered a time period of 8 years from 2000 to 2008 and used cointegration model. As an additional determinant of stock price, foreign exchange data was also used. The study concluded that the stock prices, oil prices and foreign exchange rates are cointegrated, and oil prices have a positive and statistically significant impact on stock prices.

Objectives of the Study

The main objective of the study is to analyze the relationship between Stock Return, Crude Oil prices, Energy Future Index and Foreign Exchange Rate. To achieve the above mentioned objectives, the following sub objectives have been chosen:

1. To check the individual data series for data stationarity
2. To find out whether there exist any long term relationship between crude oil prices, Stock Market Index, Energy Future Index and Foreign Exchange Rate.
3. To find out the extent to which values of a data series are explained by lag values of other data series.

2. Research Method

Data

For the purpose of this study, daily data has been collected for a period ranging from 1st January 2008 to 30th June 2016. The data for the purpose of calculating stock return has been collected from the official website of NSE India. Exchange rate data has been collected from official website of RBI (Reserve Bank of India) and Data of Crude oil prices and Energy Future Index has been collected from the official website of MCX India.

Research Tool:

The study focuses on investigating the relationship between Energy Future, Stock Return, Crude Oil Prices and Foreign Exchange Rate data. To check the stationarity of data Augmented

Dickey-Fuller Test (Unit Root test) has been applied. Johansen Co-Integration test has been applied to check whether there exists any long term relationship between the variables or not. Further, to find out the extent to which the value of one variable is explained by other variable Granger Causality test has been conducted.

3. Results and Analysis

UNIT ROOT TEST

This test is used to find out whether the variables of time series are stationary or non-stationary using an autoregressive model. It is used for large samples which uses the existence of a unit root as a null hypothesis.

TABLE 1- AUGMENTED DICKEY-FULLER TEST (ADF TEST)

Series Energy Future Index, Crude Oil Price, Stock Return, Exchange Rate

SYMBOL	LEVEL			FIRST DIFFERENCE		
	LAG LENGTH	ADF STATISTICS	P-VALUE	LAG LENGTH	ADF STATISTICS	P-VALUE
Crude Oil	2	-1.459986	0.5539	1	-32.74315	0.0000
STOCK RETURN	0	-0.872538	0.7973	0	-48.99541	0.0001
Exchange Rate	0	-0.756439	0.8304	0	-49.94645	0.0001
Energy Future	0	-1.407000	0.5804	0	-48.35747	0.0001

Exogenous: Constant, Lag Length: Automatic based on SIC, MAXLAG=26

***MacKinnon (1996) one-sided p-values.**

Deterministic Terms: Intercept

ADF statistics in Table 1 strongly suggests acceptance of null hypothesis at level since the probability values are above the threshold limit of 5%. Thus, the variable values are non-stationary in nature at level. However, ADF statistics rejects the null hypothesis of non-stationarity after first differentiation. And the variables are found to be integrated of order 1.

JOHANSEN CO-INTEGRATION TEST

Cointegration is a statistical property of time series variables. It is the test for determining whether there exists any long term relationship between the variables or not. The trace statistics here will determine the number of equations which shows the existence or non-existence of co-integration.

Table 2- Johansen Co-integration Test

Unrestricted Co integration Rank Test (Trace)

Series Energy Future, Crude Oil Price, Stock Return, Exchange Rate

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None	0.010116	39.85157	47.85613	0.2279
At most 1	0.004469	14.79873	29.79707	0.7930
At most 2	0.001474	3.762046	15.49471	0.9218
At most 3	5,16E-05	0.127128	3.841466	0.7214

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

Analysis of the trace statistics in the above table shows strong acceptance of null hypothesis that the variables under consideration are not cointegrated at 5% level. Thus, there exists no long term relationship between the variables

GRANGER CAUSALITY TEST:

Causality test helps in understanding and estimating the values of a data series. This test is conducted to find out the extent to which value of one variable is caused by lagged values another variable. Granger causality test is conducted when no co-integration is found between the variables under consideration. The results of this test are shown in below mentioned table:

Table 3- Pairwise Granger Causality Test

Series Energy Future, Crude Oil Price

Null Hypothesis	Independent Variable	F-Statistic	Probability
Dependent Variable:			
Crude Oil Prices*	Energy Future	15.8964	1.E-07
Energy Future*	Crude Oil Prices	250.145	1.E-99
Crude Oil Prices	Exchange Rate	0.58765	0.5557
Exchange Rate	Crude Oil Prices	1.23717	0.2904
Crude Oil Prices	Stock Return	0.90045	0.4065
Stock Return	Crude Oil Prices	2.72767	0.0656
Energy Future	Exchange Rate	0.61181	0.5425
Exchange Rate	Energy Future	2.43974	0.0874
Energy Future	Stock Return	0.62856	0.5334
Stock Return	Energy Future	1.40002	0.2468
Exchange Rate*	Stock Return	13.9907	9.E-07
Stock Return*	Exchange Rate	4.64770	0.0037

***Rejection of Null Hypothesis**

The empirical results listed in Table 3 reveal no causality from the first difference of Exchange rate to the first difference of Crude Oil Prices and Energy Future Index in our sample at 5% level of significance. Same way, no causality was found between Crude oil prices and stock return; and Energy Future Index and Stock Return. But the result shows a positive two way Granger Causality between Crude Oil Prices and Energy Future Index; and Exchange Rate and Stock Return.

4. Conclusion

India is a major importer of Crude Oil and thus, the fluctuating prices of crude oil is said to fluctuate the Indian Capital Market and Commodity Market. This paper tries to analyze the relationship between Stock Return, Commodity Market, Crude Oil Prices and Foreign Exchange Rate. At first, the data was checked for its stationarity and all the variables were found to be non-stationary in nature at level, but after first differentiation all variables became stationary. After that, an attempt was made to find out long term relationship between the variables using Johansen Cointegration test and the result showed no cointegration between the variables. Further, since the variables were not found to be cointegrated, Granger Causality test was used to see the extent to which value of a variable is explained by other variable. The result shows a two way Granger Causality between Crude Oil Prices and Commodity Market. The same result was found between Stock Return and Foreign Exchange Rate. No Granger Causality was found between the remaining variables.

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