Do Global Oil Price Changes Affect Indian Stock Market Returns?

Saif Siddiqui

Centre of Management Studies, Jamia Millia Islamia, New Delhi, India
E-mail: drsaifsiddiqui@gmail.com

Neha Seth

School of Commerce and Management, Central University of Rajasthan, India
E-mail: neha_seth01@yahoo.com

Abstract

The present research work analyzes whether changes in oil prices at global level affect the stock market returns in Indian market. Daily closing stock market price data from National Stock Exchange (NSE) and daily oil prices, for the period beginning from January 2010 to December 2014, are taken into consideration. VAR model of co-integration is used to test the relation between the two variables. It is found that there is no long term integration between oil price and Indian stock index series. Apart from long term, these series do not even cause each other in short run. Very weak correlation, about 3.21 percent, was observed in the series that may be due to recent fall in crude oil prices at global level. Individual/ institutional investors, portfolio managers, corporate executives, policy makers and practitioners may draw meaningful conclusions from the findings of the present study while operating in stock markets. Research like this may help diverse stakeholders in management of their existing portfolios as their portfolio management strategies may be, up to some extent, dependent upon such research work. This paper is an attempt to fill the research gap that exists for Indian stock market in terms of its relationship with global oil prices.

Keywords: NSE, oil prices, India, co-integration

Introduction

In Indian context, global crude oil prices are one of the most important factors which impact the overall Inflation of the country. To a large extent, the RBI monetary policy is guided by prevailing global crude oil prices. It is an established fact that India is a net importer of crude oil and any decline in global crude oil prices should have a positive impact on India's current account deficit and also the inflationary trends in the country.

The recent sharp decline in global crude oil prices is a big boon for the country which has drastically brought down the Wholesale Price Index (WPI) and Consumer Price Index (CPI) inflation numbers, thereby giving a big cushion to the RBI Governor to start the interest rate reduction cycle and provide the necessary impetus to overall economic growth.

However, in today's open economy, where a large chunk of investments in Indian stock markets constitute foreign inflows in the form of Foreign Institutional Investors (FII) and Foreign Direct Index (FDI), a positive event for India can be a negative event for another country. For instance a sharp decline in crude oil prices is negative for crude oil exporting countries like Russia and other OPEC nations. It is also a well-known fact that India has a strong trade relation with Russia and it is regarded as India's strategic international partner. So it becomes all the more important to study the relation between Indian stock market performance and crude oil prices.

The organization of rest of the paper would be as follows. In the next section, review of the existing literature is provided. In section three, an explanation of the data and models used is given. Section four discusses the empirical findings and section five concludes the paper.

Review of Literature
The review of literature forms the base for any research. So, the papers based on oil prices and stock markets are searched and quoted to find the gap in research which forms the basis of this research work. Select papers relating to the similar work are listed in Table 1.

Table 1: Literature based on Oil Pricing and Stock Markets

S.No	Title of Paper	Authors and Year	Country	Type of Paper	Indexes and time period* considered	Data and Methodology Used	Conclusions- Comments
1	Oil Price Risk and the Australian Stock Market	Faff and Brailsford, 1999	Australia	Research Paper	24 Australian industry equity returns, 14 years	Arbitrage Pricing Theory(APT), Capital Asset Pricing Model (CAPM)	It was found that the oil price factor effects the Australian industrial market
2	Oil Price Shocks and Emerging Stock Markets: A Generalized VAR Approach	Maghyereh, 2004	Jordan	Research Paper	22 emerging countries, 6 years	VAR model	By applying VAR model, it was concluded that the stock market in these economies do not effect crude oil markets
3	Oil Price Risk and Emerging Stock Markets	Basher and Sadorsky, 2006	Canada	Research Paper	Argentina, Brazil, Chile, Colombia, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, South Africa, Sri Lanka, Taiwan, Thailand, Turkey and Venezuela, 11 years	Capital Asset Pricing Model (CAPM)	Strong evidences were found that shows the impact of oil price changes on stock price returns in emerging markets
4	Oil Prices and the	Henriques	Canada	Research	Algeria, Indonesia,	Vector Auto-	It was noticed that

	Stock Prices of Alternative Energy Companies	and Sadorsky, 2007		Paper	Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, and, Venezuela, 7 years	regression (VAR)	the stock prices and oil prices Granger cause the stock prices of alternative energy companies
5	Short-term Predictability of Crude Oil Markets: A Detrended Fluctuation Analysis Approach	Ramirez, Alvarez and Rodriguez, 2008	Mexico	Research Paper	International crude oil prices, 20 years	Auto-regressive Fractionally Integrated Moving Average (ARFIMA)	Crude oil prices were efficient in log run but were in short run, inefficiency was found.
6	Crude Oil and Stock Markets: Stability, Instability, and Bubbles	Miller and Ratti, 2008	Columbia	Research Paper	Canada, France, Germany, Italy, U.K. and U.S., 37 years	Vector Error Correction Model (VECM)	Long run relationship was found between the stock prices of OECD countries and world oil prices
7	Relationships between Oil Price Shocks and Stock Market: An Empirical Analysis from China	Cong, Wei, Jiao and Fan, 2008	China	Research Paper	China, 10 years	Multivariate Vector Auto-regression	The oil prices have not shown any effect on Chinese stock market
8	The Impact of Oil Price Shocks on the U.S. Stock Market	Kilian and Park, 2009	USA	Research Paper	US stock market, 34 years	VAR model	The results shown that the US stock market return effects the oil price changes
9	Dynamic correlation between stock market and oil	Filis, Degiannakis and	United Kingdom	Research Paper	Canada, Mexico, Brazil, USA, Germany,	GARCH model	Oil prices have significant impact on stock market prices,

	prices: The case of oil-importing and oil-exporting countries	Floros, 2009			Netherlands, 22 years		only exception was 2008, year of global financial crisis, wherein oil prices displayed positive correlation with stock markets
10	The Effects of Crude Oil Shocks on Stock Market Shifts Behavior: A Regime Switching Approach	Aloui and Jammazi, 2009	Tunisia	Research Paper	UK, France and Japan, 19 years	Markov-switching EGARCH model	The results depicted that rises in oil price had significant role in determining both the volatility of stock returns and probability of transition across regimes.
11	Crude oil shocks and stock markets: A panel threshold co-integration approach	Zhu, Li and Yu, 2011	China	Research Paper	Norway, Sweden, Poland, Turkey, Brazil, India, Chile, China, Israel, Slovenia and South Africa, USA, UK, Mexico, 14 years	Threshold co-integration, threshold VAR and Granger Causality model	Co-integration, error correction and bidirectional causality was found between crude oil prices and stock returns
12	Does crude oil move stock markets in Europe? A sector investigation	Arouri, 2011	France	Research Paper	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg,	GARCH model and the quasi-maximum likelihood (QML) method	The results suggested that the strength of relationship between oil and stock prices varies greatly across sectors

				the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, UK, India, 10 years		
13	Association between Crude Price and Stock Indices: Empirical Evidence from Bombay Stock Exchange	Bhunia, 2012	India	Research Paper		Johansen's Co-integration test and VECM	The results shows that the three indexes from BSE and crude oil prices are co-integrated but having only one way causality from all indexes to crude oil prices.
14	Crude Oil Price Velocity and Stock Market Ripple: A Comparative Study Of BSE With NYSE and LSE	Sharma and Khanna, 2012	India	Research Paper	US, India and UK, 10 years	correlation, regression and coefficient of determination	It was concluded that the oil price changes have significant effect on performance of stock returns.
15	Nonlinear Analysis among Crude Oil Prices, Stock Markets' Return and Macroeconomic Variables	Naifar and Dohaiman, 2013	Saudi Arabia	Research Paper	OPEC Oil markets and Gulf Cooperation Council (GCC) Countries, 7 Years	Markov Switching Models and Copula Models	The relationship between GCC stock market returns and OPEC oil market volatility was found to be regime dependent, inflation rate and short term interest rates were also dependent on crude oil prices

16	The Impact of Oil Price Shocks on the Stock Market Return and Volatility Relationship	Kang, Ratti and Yoon, 2014	USA	Working Paper	USA, 14 years	GARCH (1,1) model and structural VAR model	Oil prices were found to be associated with the stock market returns and volatility
17	Modelling dynamic dependence between crude oil prices and Asia-Pacific stock market returns.	Zhu, Li and Li, 2014	China	Research Paper	Asia Pacific region, 12 years	AR(p)-GARCH (1, 1)-t model	Weak relation was found between crude oil prices and Asia-pacific stock markets
18	Co-movement of International Crude Oil Price and Indian Stock Market: Evidences from Nonlinear Cointegration Tests	Ghosh and Kanjilal, 2014	India	Research Paper	India, 8 years	VAR model	The results show that the movement of international crude oil prices had impact on stock prices
19	Forecasting excess Stock Returns with Crude Oil Market Data	Liu, Ma and Wang, 2014	China	Research Paper	USA, 37 years	Time-varying Parameter (TVP)	Oil prices effects the forecasting of stock market prices apart from traditional predictors

*Time period is taken as nearest round figure.

Most of the studies quoted above indices inter-relation between oil prices and stock market returns but at the same time there exists certain studies that have shown no-relation between oil prices and stock market returns. This forms the gap for the present research. Implicitly, in the light of above discussion, the present paper would be an effort to examine the relation between international oil prices and Indian stock market returns.

Data and Research Methodology

The present study is based on secondary data, which covers the most recent period beginning from 01/01/2010 to 31/12/2014. The daily closing prices of CNX Nifty are taken from NSE website, used to represent Indian stock market and daily oil prices are taken from moneycontrol.com

The following methods are used to test correlation, co-integration and causalities between the oil prices and stock returns. Computations as listed in Table 2 in present study are aided by use of Eviews 6.0:

Table 2: Tools used for Statistical Testing

Test	Purpose
Pearson Correlation Test	To find correlation between the index returns
Unit Root Test- Augmented Dickey- Fuller (ADF) and Phillips-Perron (PP) methods	To test stationarity of index prices
Johansen Co-integration test	To test co-integration among index prices
Granger Causality test	To test the causality for index series

Daily return has been calculated as follows by taking the logarithm of the daily closing prices.

$$R_t = \ln (P_t) - \ln (P_{t-1})$$

Analysis & Findings

***Descriptive Statistics*:** Table 3 provides summary statistics about oil returns and index return, namely means, minimums, maximums, medians, standard deviations (SD), skewness, kurtosis and the Jarque-Bera.

Table 3: Descriptive Statistics

	OIL	NSE
Mean	0.000370	-0.000342
Std. Dev.	0.010638	0.016834
Skewness	-0.035864	-0.120660
Jarque-Bera	41.86147	400.0699
Probability	0.000000	0.000000
Observations	1243	1243

It can be seen from Table 3 above that the oil returns are showing positive mean whereas NSE is showing negative average return. NSE is more volatile as compared to oil returns because standard deviation is higher for NSE when compared to oil movements. Both series are not normal in nature, which is depicted from skewness figures. Jarque-Bera statistic also confirms the same.

Correlation: Table 4 shows the return correlations between oil returns and stock returns.

Table 4: Correlations of Oil Returns and Stock Returns

	OIL	NSE
OIL	1.000000	0.032179
NSE	0.032179	1.000000

From Table 4, it is seen that oil returns and NSE returns are positively correlated but has very small degree of correlation i.e. 3.2179% only. This positive correlation may be due to fall in crude oil prices in recent past otherwise; it may also be possible that oil prices and stock returns be negatively correlated.

Unit Root Tests: A unit root test is used to test a time series for stationarity. The most appropriate and widely used tests are the ADF and PP, which uses the existence of a unit root as the null hypothesis. Results of the Unit Root Test are contained in tables 5A and 5B for ADF and PP test respectively.

Table 5A: Unit Root Test (Augmented Dickey-Fuller)

Symbol	Level			First Difference		
	Lag Length	ADF Statistic	P-value	Lag Length	ADF Statistic	P-value
OIL	0	-1.197046	0.6778	0	-35.78473	0.0000
NSE	1	0.022070	0.9594	0	-32.39986	0.0000

Exogenous: Constant
Lag Length: Automatic based on SIC, MAXLAG=22
*MacKinnon (1996) one-sided p-values
Deterministic terms: Intercept

Table 5B: Unit Root Test (Phillips-Perron)

Symbol	Level			First Difference		
	Bandwidth	Adj. t-Statistic	P-value	Bandwidth	Adj. t-Statistic	P-value
OIL	3	-1.169975	0.6893	1	-35.78474	0.0000
NSE	3	0.103298	0.9659	0	-32.39986	0.0000

Exogenous: Constant
*MacKinnon (1996) one-sided p-values.
Deterministic terms: Intercept

It can be inferred from Table 5A that the null hypothesis about the existence of a unit root cannot be rejected for all the variables using intercept terms in the test equation at the level

form. However, for the first differences of all the variables the null hypothesis of a unit root is strongly rejected. So it can be said that all the indices are non-stationary in their level forms, but stationary in their first differenced forms for ADF test. The results are verified using PP test, shown in Table 5B, and the similar trend was found for oil and index series.

Co-integration Test: Co-integration is an econometric property of the time series. If two or more series are themselves non-stationary, but a linear combination of them is stationary, then the series are said to be co-integrated. It tests the null hypothesis, that there exists none co-integrating equations.

Table 6A: Co-integration Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.008010	10.10021	15.49471	0.2731
At most 1	0.000110	0.136127	3.841466	0.7122

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

Table 6B: Co-integration Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.008010	9.964081	14.2640	0.2143
At most 1	0.000110	0.136127	3.841466	0.7122

Max-eigenvalue test indicates no co-integration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

First part of the co-integration test (Table 6A), the trace test, indicates that that there exists no co-integrating vector at 5% level for both oil and index series. The null hypothesis is also accepted, that there exists none co-integrating equations. The results of second part of co-integration test i.e. the Maximum Eigen value test, also indicates the same results. Thus, oil and index series doesn't have shown any sign of co-integration.

Pair-wise Granger Causality Tests: This test involves examining whether lagged values of one series have significant explanatory power for another series. They have null hypotheses of no granger causality. The results of this test are summarized in Table 7, and it indicates whether there exists significant Granger Causality and if it exists, then in which direction such causality exists between oil returns and stock returns.

Table 7: Pair-wise Granger Causality Tests

Null Hypothesis	Obs	F-Statistic	Prob.
OIL does not Granger Cause NSE		3.19742	0.0071*
NSE does not Granger Cause OIL	1239	3.30002	0.0058*

* represents rejection of null hypothesis at 5% level of confidence

The above tables elucidate that null hypothesis is rejected for oil and index series as Oil and CNX Nifty index does not Granger Cause each other, which is even short-term causality does not exist between oil and index series.

Summary and Concluding Thoughts
The study is a continuation of research on the issue of interrelation between the oil prices and stock indexes. Interdependency between global crude oil prices and stock market returns is studied primarily through descriptive statistics, Pearson's correlation, Unit Root test, Johansen's co-integration test and Granger causality test.

It was observed from the empirical results that stock returns have negative mean return while crude oil prices have positive average returns. Index series is found to be more volatile when compared to crude oil series. Very weak correlation, about 3.21 percent, was observed in the series that may be due to recent fall in crude oil prices in global prices. Since, unit root test is the basic requirement for conducting the co-integration test so it was conducted and found that both series are non-stationary at level but stationary at first difference. Then, Johansen's co-integration test concluded that there is no long term integration between index and oil series. Since there in no co-integration between these series, the requirement conducting error correction test is ruled out. Thereafter, Granger causality test was applied and it was found that market are not integrated only in long run but these series do not even cause each other in short run.

Individual/ institutional investors, portfolio managers, corporate executives, policy makers and practitioners may draw meaningful conclusions from the findings of the present study while operating in stock markets. Research like this may help diverse stakeholders in management of their existing portfolios as their portfolio management strategies may be, up to some extent, dependent upon such research work.

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