Nexus between Crude Oil Price, Exchange Rate and Stock Market: Evidence from Oil Exporting and Importing Economies

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***Abstract*—**The relationship between stock prices and macroeconomic variables like crude oil price, exchange rate, gold price, GDP, Inflation etc. have been widely studied in the context of developed countries and few studies on emerging and developing countries are also done. An attempt is made here to study specifically the impact of crude oil price volatility on stock prices and exchange rates on the basis of crude oil export and import volume. Monthly data from January 2004 to December 2015 has been collected for nine countries from the list of top 20 oil importing and exporting countries for stock prices, exchange rate of each country against US dollar. We use the Johansen Fisher Panel Cointegration Test to ensure the existence of long-run relation and Fully Modified OLS(FMOLS) to estimate the Cointegrating parameters. Results reveals that there is a long run equilibrium relationship among Stock price, Exchange rate and Oil price in the case of both panels of selected countries.

***Keywords*—**Crude Oil Price, Exchange Rate, Emerging Markets, FMOLS, Stock Market

I. Introduction

Crude oil consumption is rapidly increasing especially in the Asian and emerging markets. It is forecasted that around 30% of the total world oil consumption will be made by China and India by 2020 (US Energy Information and Administration Report,2015). India's demand for oil is growing at a blistering pace and is growing faster than anywhere else. It jumped from 4 million barrels a day in the first quarter of 2015, to 4.4 million barrels, accounting for almost 30 percent of the increase in worldwide consumption (International Energy Agency,2015).

The beginning of Year 2016 witnessed one of the biggest plunge in crude oil price. It reached as low as even the price of the barrel that is used to store the oil. Crude oil price has been continuously declining from the last quarter of the year 2015. Since then oil prices were falling drastically and during the second quarter of 2015 it marked a more than 50% fall. Experts point out many reasons like excess supply in the market and other factors like strengthening of the US Dollar, declining demand and the OPEC decision against cutting down of production.

It is important to study the impact of oil price on stock markets, especially the case of emerging countries like India and China which are showing a trend of rapidly growing consumption of oil and countries like Russia, Saudi Arabia which are producing the major chunk of international oil consumption in spite of the recent oil price down falls. Last few years were best and worst experiences for these oil importing and exporting countries who gets the advantages of oil price rises and falls. This justifies the selection of a panel of four exporting countries namely Saudi Arabia, Russia, Qatar and UAE and five oil importing countries namely China, India, Indonesia, Japan and South Korea.

The existing literatures like Hamilton (1983), Golub (1983), Corden (1984), Jones and Kaul (1996) have established that the theoretical relationship between oil prices and stock prices are, in general, negative in nature. Crude oil price rises will make the energy oriented industries production costlier and subsequently their profits will be affected and this in turn will be reflected in their stock prices negatively. And this relationship will be different for oil consuming and producing countries.

There is a vast line of studies on the relationship between stock price oil price exchange rate and such macroeconomic variables. However, few studies are there which combines all these three together. It is quite relevant to consider exchange rate while investigating the oil price stock market relation since the crude oil trade settlements are made in international market denominated by the U.S. dollar. And also the case of oil exporting and importing countries are studied only by a few authors. In addition, in the emerging market and Asian context only few studies are done so far due to several constraints. Under this given context we believe that investigating the nexus between oil price, exchange rate and stock market is particularly important.

The study is organized into four sections. Section 1 gives introduction and background of the study followed by Section 2 which reviews the existing related literature and Section 3 explains the data and methodology used and concludes with Section 4 discussing the results and findings of the study.

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II. Review of Literature

It was Hamilton who came up with the seminal study on the role of oil price through his eminent paper titled 'Oil and the Macro Economy Since World War II' in 1983. Hamilton (1983) points out that although oil price was not the only a reason but it was a contributing factor for almost all US recessions that occurred after the 1950's. Subsequently several

Manuscript received November15, 2016. This work was supported in part by the University Grand Commission(UGC-India) MHRD. Govt. of India

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studies analyzed the impact of oil price on macro economy as a whole and several individual variables like exchange rate, output, stock market etc. providing evidences for positive and negative impact of oil price.

Jones and Kaul (1996) have tested the stock market reactions to oil shocks in Canada, Japan, UK, and US using quarterly data in the post war period. They have found that strong relation between stock market returns and oil price shocks for Japan and UK, and that of Canada and US were not that strong.

Abdelaziz & Cipollini (2005) explains that it is important to understand the nexus between oil price, Exchange rate and Stock market for various reasons. The link between stock market and forex market can be used by multinational corporations to avoid their exchange rate exposure risk. and portfolio managers can use this knowledge about the link between currency rates and other assets in a portfolio for the performance of their funds. Further they have pointed out that this study could be used to take forecast and take corrective measures against depressive trends in the economy.

Basher and Sadorsky (2006) using an international multi factor model investigates the relationship between oil price risk and the emerging stock market returns and found strong evidence for the impact of oil price on stock market returns. They found that excess stock market returns are impacted by oil price increases for daily and monthly data, and have a positive impact on stock market returns and for weekly data, emerging markets are positively and significantly impacted.

Aziz (2009) points that the theoretical relation between crude oil prices and exchange rates are that countries which are exporting oil may experience exchange rate appreciation (fall in exchange rates) when oil price rise and depreciation (increase in exchange rates) when they fall (see Golub 1983, Corden 1984). The studies in this line are mainly in the context of developed markets.

Arouri and Rault (2009) studied the oil price fluctuations impact on Gulf Corporation Council (GCC) countries using granger causality tests. They found consistent evidence for bi-directional relationship for Saudi Arabia and is absent in other countries. in the other GCC member countries stock price movements do not Granger cause oil price movements.

Filis et. al (2011) reports that economic crises invoke a significant negative nexus between oil and stock prices and whereas economic booms cause a stronger positive link between them. Hence, precautionary demand shocks are causing negative correlation between oil and stock market prices, whereas aggregate demand-side shocks are causing a positive relationship. They also found that shocks from the supply-side do not cause the relationship among oil and stock prices.

Asteriou et. al (2013) studied the impact of oil price fluctuations on the stock markets and the interest rates for oil importing and exporting countries and they find that the oil price stock market relation is much stronger than with the interest rates and stock market in the short and in the long-run. They further reports that for oil importing countries the impact is more significant than on oil exporting countries.

III. Data and Methodology

III.a Data

We have selected nine countries from the list of top 20 oil importing and exporting countries. Considering the availability of data, we included China, India, Indonesia and South Korea in the list of Importing countries and Four exporting countries namely Saudi Arabia, Russia, UAE and Qatar as exporting countries.

Monthly data from January 2004 to December 2015 has been collected on the variables such as stock prices, exchange rate of each country against US dollar, WTI spot prices of crude oil as a proxy for crude oil price. All data sets except crude oil prices have been extracted from the Bloomberg data base. WTI spot prices of crude oil have been taken from the US Energy Information and Administration website (EIA).

III.b Methodology

We have used the Panel Cointegration and FMOLS to test the long run relationship between Stock prices, Exchange rate and Oil Price.

Panel cointegration test

After testing the stationarity properties of all variables in the model, we use the Johansen Fisher Panel Cointegration Test to ensure the existence of long-run relation between variables using panel data.

Since the Levin, Lin & Chu unit root test results have shown that the variables are integrated of order one, I(1), it is to be tested whether there exists at least one linear combination I(0) of these variables to know that a stable and non-spurious relationship exist among variables The Johansen Fisher combined co-integration method was applied to determine the number of co-integrated vectors.

III.c Fully Modified Ordinary Least Square (FMOLS)

The Ordinary Least Squares (OLS) estimates if applied will produce biased estimates The FMOLS method suggested by Pedroni (2000) gives unbiased estimates by allowing for heterogeneity across individual items of the panel, corrects serially correlated errors and removes the endogeneity issues.

Basic model used in the study is as follows:

$$lsp_{it}=\alpha+\beta ler_{it}+\lambda lop_{it}+u_{it}$$

Where, LSP= log value of Stock prices
LER= Log value of Exchange Rates in US Dollars
LOP= Log value of Oil Price

IV. Empirical Results and Interpretation

Levin, Lin & Chu Unit Root Test**.**

We first test the stationarity properties of the data by employing the Levin, Lin & Chu unit root test which is commonly used in the case of panel data analysis. Results given in Table.1 shows that all the three variables for both exporting and importing countries are having unit root at level and all the series are stationary at first difference.

TABLE I: UNIT ROOT TEST RESULTS (LEVIN, LIN & CHU)

Variables	**Exporting Panel**		**Importing Panel**	
	Level	First Difference	Level	First Difference
SP	0.72000 (0.2358)	23.6359 (0.0000)*	1.42558 (0.9230)	22.4773 (0.0000)*
ER	4.21665 (1.0000)	-24.9440 (0.0000)*	4.21665 (1.0000)	-24.9440 (0.0000)*
OP	2.23110 (0.9872)	-23.0061 (0.0000)*	2.23110 (0.9872)	-23.0061 (0.0000)*

Note: p-values given in parenthesis. * denotes significance at 1% level

TABLE 2.1 JOHANSEN FISHER COMBINED PANEL CO-INTEGRATION TEST RESULTS - EXPORTING COUNTRIES.

Hypothesized No. of CE(s)	Fisher Stat. (trace test)	Prob.	Fisher Stat. (max-eigen test)	Prob.
None	17.35	0.0267	21.10	0.0069* *
At most 1	3.458	0.9024	3.870	0.8686
At most 2	4.602	0.7991	4.602	0.7991

Note: **denotes acceptance at 5% significance level

TABLE 2.2 JOHANSEN FISHER COMBINED PANEL CO-INTEGRATION TEST RESULTS - IMPORTING COUNTRIES.

Hypothesized No. of CE(s)	Fisher Stat. (trace test)	Prob.	Fisher Stat.* (max-eigen test)	Prob.
None	57.12	0.0000	54.24	0.0000*
At most 1	13.59	0.0930	13.94	0.0833
At most 2	8.217	0.4125	8.217	0.4125

Note: *denotes acceptance at 1% significance level

Trace statistics and Maximum Eigen value statistics rejects the null hypothesis of no cointegration and shows that there is one cointegration equation for both importing as well as exporting panel. Hence there is a long run equilibrium relationship among Stock price, Exchange rate and Oil price in the case of both panels of selected countries.

Fully Modified Ordinary Least Square (FMOLS) RESULTS

The estimates of cointegrating parameters obtained from FMOLS method are presented in Table 4.

TABLE 4. FMOLS RESULTS

Variables	**Exporting Country**		**Importing Country**	
	Coefficient	P-Value	Coefficient	P-Value
LOP	0.125472	0.2364	0.881520	0.0000*
LER	-1.072696	0.0002*	1.317224	0.0000*

Note: *denotes acceptance at 1% significance level

The coefficients derived from the FMOLS estimation reveals that with a 1% increase in oil price the stock prices in the exporting countries will be increased by 0.13%(0.125472). This increase is due to the increased revenue from oil exports which are the main source of revenue for these oil rich economies. Similarly Considering the exchange rate, 1% appreciation in domestic currency will boost the stock prices by 1.07%(-1.072696).

In the case of Importing countries, a 1% rise in the oil price pushes the stock prices by 0.89% while 1% appreciation of the domestic currency in terms of US Dollar will decrease the stock prices by 1.32%. (1.317224)

V. CONCLUSION

Our results are in line with the studies like Hamilton (1983), Jones and Kaul (1993), Basher and Sadorsky (2006), Aziz (2009) and some other similar studies. The oil exporting countries will get the advantage of more foreign exchange earnings and better profits by the oil companies and increased revenue for the government which in turn positively reflect in the exchange rate and stock prices.

The case of net oil importing countries are just inverse. Crude oil price hikes are negatively impacting the stock performance of the companies in these countries and foreign exchange rates get depreciated due to excess demand made for the foreign currencies which is usually the US dollar used for petro trade settlements.

The study may have implications for policy makers in emerging markets and both local and global investors in the forex market and the oil market efficient investment decisions. Further study will be useful for the central banks and stock market regulators in controlling the exchange rate movements and taking remedial measures during oil price shocks and exchange rate crisis periods. We could have further tested the long run and short run speed of adjustment by performing an Error Correction model and Wald test. We leave this scope for future studies.

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