Impact of Crude Oil on the INR/USD exchange rate: An Empirical Study

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Abstract

The paper examinations the effect of crude oil prices on the exchange rates movement in setting to the Indian market in comparison with the USD. Many research papers in this field have indicated repudiating results and not many have been directed in a developing market particularly India. The paper adopts Pearson's correlation coefficient along with Granger Causality test to gauge any noteworthy effect and causality of Crude oil prices with exchange rates of USD/INR. The outcome depicts that there was a negative relationship of Crude oil variable with INR/USD exchange rate variable and on the other hand none of the factors had a causality impact on one another.

Keywords:- Crude Oil, USD/INR, Exchange Rate, Correlation, Granger Causality.

1. Introduction

Worldwide raw petroleum costs have been influencing the exchange rates of the nations around the world. Oil is one of the main variables which influence the whole economy of the nation. India as a nation depends a ton on raw petroleum and in this manner, changes in raw petroleum costs influence the market by an expansive degree. Numerous examinations of numerous nations has been directed by different specialists to decide the connection between oil value changes and foreign exchange volatility. Distinctive ends have been acquired by different specialists. Some state reason that changes in oil costs and exchange rates have opposite relationship anyway a few scientists finish up that the exchange rate shift with the reasons in view of which the unrefined petroleum costs changes.

Some state that oil costs impacts affect exchange rates relying upon the kind of nation it is, i.e., oil-trading nation or an oil-bringing in nation. Therefore, there have been diverse ends made by various analysts. Notwithstanding, the fundamental truth is that raw petroleum costs do affect the exchange rate developments and the economy of a nation. This exploration will discover the kind of connection betweenunrefined petroleum costs and exchange ratein setting of the Indian currency (Rupee) and US(Dollar).

2. Literature Review

Hashemi et al., (2017) The purpose of this paper was to analyze and study that exists between the USD exchange rates and the crude oil prices. The data used was post-2000 era. The paper used sample countries like Japan, Mexico, Australia. The results of the paper showcased that in the long run , in the case of all countries taken as sample oil prices adjust back to the equilibrium and then the USD rates leads the adjustment.

Akram, Econometrics, & Vol, (2004)This paper follows a pathway which is in contrast with the past research done in this field. The paper tries to explore the possibility of a non-linear relationship between oil prices and the Norwegian exchange rate. This model proved to be more substantial in comparison to the model that used linear movement of oil prices.

J. C. Journal, Vol, & Jun, (2012)The paper uses two tools: correlation and copulas to document the two main objectives or findings. Based on the tests carried out the paper concludes the results in the following way. The dependence of oil price exchange rate is generally weak, but a substantial hike was seen in the aftermath period of the financial crises that took place. Also the paper states that there is no severe market dependence between the two variables i.e. oil prices & exchange rate. Along with this the paper also states that these variables can be used for managing risks, creating monetary policy and also to control oil inflationary pressure in the economy of any oil importing or exporting country.

S. V. N. Journal & Vol, (1998) The entire paper resolves around solving one problem question, i.e. to determine the relative importance of real vs. monetary shocks in determining the exchange rate movements. This paper has used various empirical methods and tools to answer this question and to find if there exists a link or not between the two variables. The research found out that there exists a stable link between the two variables. The data that was used was post-Bretton woods period. The paper also suggests that changes in oil prices can be considered as a dominant source of persistent change in the exchange rates of US.

Le, (2017)The entire motive is to study the inter-temporal relationship between the two variables i.e. crude oil prices and exchange rate which is taken in the weighted form in this paper. The data was collected on a daily basis and the researcher has found a time varying conditional covariance and correlation between the two variables under study. The paper suggests that if one day there was a change in the USD oil price it was due to the change in the exchange rate of USD and the next day if there was change in the USD exchange rate it was because of the changes in the global oil prices.

Reboredo & Rivera-Castro, (2013)This paper analysis the variables: crude oil and USD exchange rates, it uses a wavelet multi-resolution analysis. They have categorized the oil price and exchange rate relationship for different time periods. For a range of currencies and crude oil prices they have shown

that in the pre crises period there was no dependency in the pre-crisis era, but after the onset of the crisis there was a negative dependency between both the variables in account. These studies can also be used for risk management, monetary policy preparation, oil price inflationary pressure.

Lodha, (2017)This study was carried out to analyse the relationship between the long-run and short-run interdependence between INR/USD exchange rates, gold prices and crude oil. The study has used 2 tests known as Johansen co-integration test, VAR model and Granger causality test. The results of the study portrays that there exists no long-term relationship between the variables, but there exists a bi-directional relationship exists between crude oil and the exchange rate in the short-run.

Kaushik, Nag, & Upadhyaya, (2016)The paper studies the impact of oil prices on the exchange rate between the Indian Rupee and U.S. dollar. For the purpose of the study a model was prepared and to account for the error an error correction model was incorporated in the research. The results of the paper showed that the change in oil prices have no impact on the real exchange rate between the Indian Rupee and U.S. dollar.

Tiwari, Dar, & Bhanja, (2013)In this paper the author has used both linear and non-linear Granger causalities to measure the relationship between the effective exchange rate of India and oil prices. The author also used the wavelet methodology to derive relationship between the two variable, but the results showed that there exists no relationship between the two variables at lower time scales, i.e. in the short-run, but there exists a relationship between the two variables at higher scales, i.e. in the long-run.

Zhang, Fan, Tsai, & Wei, (2008)This paper studies the relationship between USD and crude oil prices. The author has used various econometric techniques like VAR model, ARCH model and Granger causalities test was used. The results of the paper showed that there exists a long-term co-integrating relationship between the two variables. On the other hand in the short-term the relationship between the two variables is very limited and in-significant.

Jiranyakul, (2014)The purpose of this study was to analyse the factors for the change in exchange rate of Pakistan and also to see if any relationship exists between the oil prices and the exchange rate of Pakistan. The author has used various econometric tools like Johansen Co- integration and Vector Error Correction Model has been used for short run and long run analysis respectively. In this paper the result derived was that there is a long-term relationship between all the variables and in the short-term period there is no significant relationship between the variable.

Amano & van Norden, (1998)researches the link that exists between the US real effective exchange rates and oil price shocks over the post-Bretton Woods period. The research constitutes of various

empirical techniques and also states that the oil prices prevailing in the market can be considered as one of the major reasons for exchange rates volatility in the US economy.

2.1 Research Gap

A plethora of research has been done around in this field, anyway the discoveries of the different researchers have differed to a degree and along these lines, there has been no clarity of the outcomes. Some presume that changes in oil costs and exchange rates have converse relationship on the contrary a few specialists reason that the exchange rate fluctuates because of reasons other than that of crude oil. Some state that oil costs changes affect the exchange rate of a particular country relying upon the kind ofnation it is, i.e., oil-sending out nation or an oil-bringing in nation or relying upon the sort of pattern present in the entire exchange market of the country. Likewise, not many researches have been directed to study this impact of crude oil prices in specific to developing countries like India.

3. Objective

1. To determine the relation between crude oil price changes to the USD/INR exchange rate.
2. To analyse the causal effect of crude oil on the USD/INR exchange rate.

4.Methodology

4.1 Research Design & Hypothesis:

Causal Research Design is utilized in the research where the goal is to recognize the variables and break down the cause and effect relationship existing among the variables. If, there exists any relationship the research focuses on quantifying the extent of impact and check if, there exists any causality between the two variables

Hypothesis

H_{01}= There is no significant relationship between crude oil and USD/INR exchange rate

H_{11}= There exists significant relationship between crude oil and USD/INR exchange rate

H_{02}= There is no causal effect of crude oil on the USD/INR exchange rate

H_{12}=There exists causal effect of crude oil on the USD/INR exchange rate

4.2 Sampling Design

The population considered for the study is the values of crude oil and values of currency exchange rates of USD/INR. Non-probability sampling design is adopted to select a sample from the population historical data of Crude Oil, Currency Exchange Rate.

4.3 Research Methodology

Pearson's product moment correlation coefficient r symbolizes the coefficient's estimate of linear association based on sampling data. This study uses correlation coefficient to express the relationship between Commodities & the exchange rate values. Also Granger Causality test is used to identify the causality between variables (Crude Oil, USD/INR exchange rate),

Helping us know whether one of the variables causes the other or if one can be predicted by the other variable.

5. Analysis & Interpretation

5.1 Descriptive Statistics

The entire motive of carrying out descriptive statistics is to analyse and study the basic characteristics of the data and also gain simple summaries about the sample used.

Table 5.1

	USD/INR	CRUDE
Mean	56.6724	75.3605
Median	59.3505	76.0100
Maximum	74.3875	145.1800
Minimum	39.2700	26.2100
Std. Dev.	9.9193	23.8849
Skewness	-0.1654	0.1119
Kurtosis	1.6292	2.1096
Jarque-Bera	216.1620	91.6319
Probability	0.0000	0.0000
Sum	147858.4	196615.7
Sum Sq. Dev.	220413.0	1487842
Observations	2609	2609

5.2 Correlation Test

This test is being carried out to see if there exists a relationship between both the variables and also it is to analyse the type of relation i.e. positive or negative.

Table 5.2

		Crude	USD/INR exchange
Crude	Pearson Correlation	1	-.112**
	Sig. (1-tailed)		.000
	N	2609	2609
USD/INR exchange	Pearson Correlation	-.112**	1
	Sig. (1-tailed)	.000	
	N	2609	2609

**. Correlation is significant at the 0.01 level (1-tailed).

The above table indicates a negative correlation coefficient of -0.11 between crude oil values & exchange rate values for the period Jan 2008 to Dec 2018. There is a significance level at 1% one tailed test. In this case we reject the null hypothesis.

5.3 Stationarity Test

Table 5.3

Stationarity for Returns

Group unit root test: Summary
Series: CRUDE_OIL_RETURNS, USD_RETURNS
Date: 03/13/19 Time: 12:06
Sample: 1/04/2008 12/31/2018
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-101.229	0.0000	2	5216
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-84.0003	0.0000	2	5216
ADF - Fisher Chi-square	36.8414	0.0000	2	5216
PP - Fisher Chi-square	36.8414	0.0000	2	5216

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

In table 5.3 we can see that the probability that we achieved is less than 0.05 and hence we are now able to reject the null hypothesis and accept the alternative hypothesis. Since our data is stationary in nature now we can go ahead with the research and perform the remaining tests and interpretations.

5.4 Granger Causality Test

In Granger Causality test for i=0, we use returns as the variable. The test is carried out to see if one variable causes a change on the other variable.

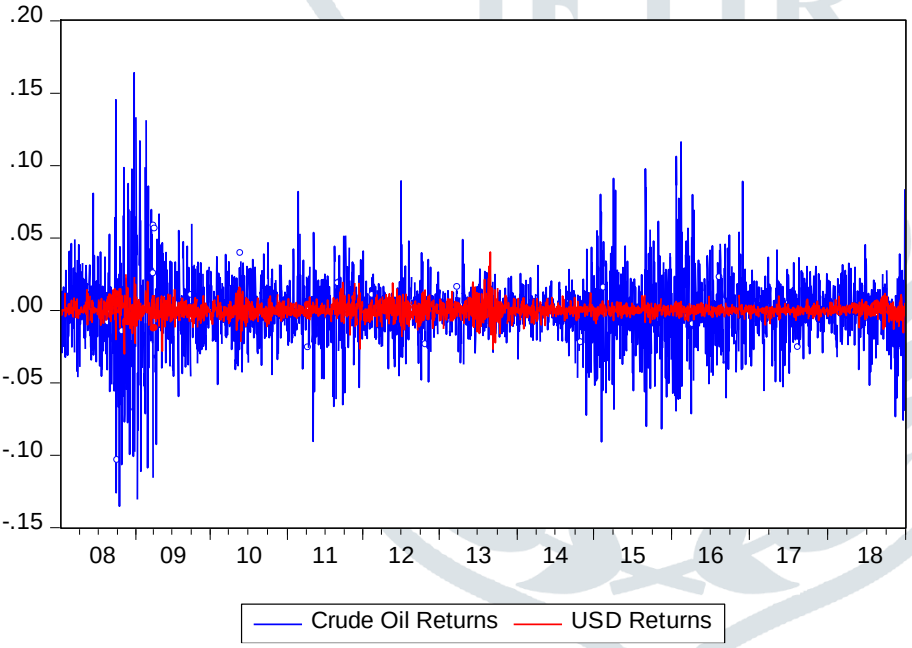
Table 5.5

Granger Causality Test between Crude Oil and USD/INR exchange rate

Pairwise Granger Causality Tests
Date: 03/11/19 Time: 12:12
Sample: 1/04/2008 12/31/2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
USD_RETURNS does not Granger Cause CRUDE_OIL_RETURNS	2607	0.45172	0.6366
CRUDE_OIL_RETURNS does not Granger Cause USD_RETURNS		13.4822	1.E-06

From the above table 5.5 we can that the probability of all the values is more than 0.05 or 5% and so we are not able to reject and hence we can say that there exists a bivariate granger causality test between the pair under study.



6. Conclusion

The entire research was for the time duration of Jan 2008 to Dec 2018. The year was selected based on the availability of data and various events that took place in both the crude oil industry as well as the crude oil industry. The topic was selected because there was an urgency and need to identify if there exists any relationship between the commodity market and the exchange rate market in Indian context. To undertake the following research the two variable were used and Correlation and Granger Causality were performed on Crude oil historic data and exchange rate values historic data.

The tests carried out revealed to us that there exists statistical independence between the two variables, i.e. Crude Oil prices and USD/INR exchange rate. Both the variable showed a high rate of negative correlation among them. From this we can also say that USD/INR is inversely correlated with Crude oil and vice-versa. Also the Granger Causality Test which was carried out portrays that there exists no causality between the variables.

From the above analysis and interpretations we can derive that there exists a significant level of relationship between crude oil and the USD/INR exchange rate

6.1 Scope for further Study

1. The relationship is determined only for one exchange rate i.e. INR/USD, and only one aspect i.e. crude oil is taken. So further studies can be carried to analyse the same for various other currencies and exchange rates
2. The research only gives an overall relationship impact, but not the specific impact. The entire impact of the commodity market on the exchange rate can also be studied which will make the entire research more effective.

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