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Relationship between Oil Prices and Exchange Rate of Major Asian Economies

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Abstract – This Paper studies the relationship between oil prices and exchange rate of three major Asian economies, namely- JAPAN, INDIA and CHINA. Study applies ADF test to check the stationary of time series and the all the series under study stationary at level. Further, Study applies Johansen co integration technique to on time series data ranging from March 2011 to December 2017 to check the short term and long term relationship respectively. Results of Johansen Co integration indicate the significant long term relationship between the oil prices and exchange rate of three major Asian economies.

Keywords – Oil Prices, Exchange Rate, Johansen Co Integration, Emerging Economies

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INTRODUCTION

Impact of oil prices on the economic variables is well known phenomena. Oil price rises affect macroeconomic flows: inflation, savings, current-account balances, and overall economic growth of a country (Pretorius, 2002; Hamilton, 1983; and Burbidge and Harrison (1984). This in turn can also impact the exchange rate, due to asset allocation. Among the macro economic variables, the role of oil prices in impacting exchange rate have also attracted the researchers in recent times due to volatile nature of oil prices For example due to rise is oil prices, an oil exporting country can have surplus current account, while an oil importing country can be impacted negatively. This relationship has drawn the attention of policy makers, academician and general public alike. In most of the cases this relationship has been confirmed as well, such as Ozturk (2008), Nikbakht (2009). The literature, since then, was extended to the oil price-exchange rate nexus (Krugman 1983; Golub 1983; Rogoff 1991), especially that crude oil markets are mostly invoiced by the US dollar.

Though literature is available on the relationship between oil prices and exchange rate, there is research gap in exploring this relationship in emerging Asian economies. This paper tries to explore the impact of oil prices on the exchange rate of these countries and fill the research gap and contribute to knowledge of the field.

Further in this study, section 2 explores the brief literature review, followed by research methodology in section 3. Section 4 and 5 discuss the results and conclusion respectively.

LITERATURE REVIEW

Hussain et al. (2017) studied the co-movement between the oil price and exchange rate of Asian countries by applying the Detrended cross-correlation approach. Study measure the relationship on two scales, long and short scale. Further study highlights the problem of unit root in time series. Results of the study indicate the co movement between the oil price and exchange rate. Further results indicate that cross – correlation is negative in case of most of the Asian countries.

Narayan (2013) explored the relationship between the oil prices and exchange rate in 14 Asian countries by applying the GLS estimator on the time series data of oil prices and exchange rate. Findings of the study indicate that high oil price predicts the appreciations for Bangladesh, Hong Kong and Cambodia, whereas higher oil price predicts the depreciations for Vietnam.

Benassy-Quere et. al. (2007) studies the relationship between real oil price and real price of dollar in China by applying co integration and causality tests, for the period January 1974 to November 2004. The findings shows that real oil price and dollar real effective exchange rate are co-integrated and causality runs from oil to dollar. Their analysis shows that oil price increase leads to a dollar appreciation in China for the period investigated.

Huang Ying, Guo Feng (2007) Analyzed the role and extent of oil price shocks trend movement of china's real exchange rate, by constructing a four dimensional structural VAR model. The findings suggest that real oil price shocks have lower impact

on the RMB basket peg regime. The real shocks have higher impact as compare to nominal shocks in variations of exchange rate.

Zalduendo, J. (2006) Analyzed the determinants of Venezuela's Equilibrium real exchange rate by applying the vector error correction model. Findings of the paper show that oil prices play a significant role in time varying equilibrium exchange rate, which is in accordance that Venezuela is a oil dependent country for its Income.

Rautava (2004) uses co integration and Vector autoregressive (VAR) analysis to study the effects between oil prices and exchange rate in Russian economy. Quarterly data from 1995 first quarter to 2002 last quarter is used in the model. Analysis shows that increase in oil prices have positive impact on Russia's GDP and permanent appreciation of exchange rate reduces GDP thus effect of oil price changes can be balanced by changes in exchange rate .

Akram (2003) Studied the relationship between oil prices and exchange rate in Norway. By using the OLS(Ordinary least square) technique. The variables of the study were oil prices and Norwegian Krone. Results and findings of the study show negative correlation between the variables.

Zhang (2003). Examines the long term relationship between the oil and the real effective exchange rate of US dollar by allowing structural breaks. The study uses monthly data, finds that there is no significant long term relationship exists, unless the structural breaks in past are controlled for.

RESEARCH METHODOLOGY

ADF Test

Augmented Dickey fuller test is used to check the unit root in time series which signifies the non-stationary of the time series. A non-stationary time series can produce spurious regression results. It is necessary for a time series to be stationary- which means that the statistical properties of a process generating a time series do not change over time. . A non-stationary time series can produce unpredictable results in the time series. Null hypothesis (H_0) of the adf test is – there is unit in the series, which is to be rejected

Equation of the ADF Test is - $\Delta Yt=\beta 1+\beta 2t+\delta Yt-1+\Sigma\alpha\Delta Yt-1+\varepsilon t\ mi=0$

Econometrics estimations based on the non stationary time series produce spurious regression. Their statistics may not show true relationship between the variables (Granger and Newbold,1974). ADF (Augmented dickey fuller) test has been used to avoid spurious regression between the variables of the time series.

6.2 Johansen Co integration test

Co-integration is long term relationship between more than two variables. Mathematically the relationship is linear. General equation of the Johansen co-integration test is-

$$X_t=\mu+A_1X_{t-1}+.....A_pX_{t-p}+W_t$$

Where μ is mean of the series, A_i are the coefficients of each lag and wt is multivariate Gausian noise term with zero mean. Johansen co-integration test decompose the Eigen value and trace statistics of the multiple time series and sequentially tests to check whether r is equal to zero, one or more through r=n-1,where n is no of time series. In results r=0 means there is no co-integration between the series, whereas r>0 implies co-integrating relationship between the time series.

To analyze the long-term relationship between the variables of time series, Johansen Co-integration approach (Johansen, 1988, Johansen and Juselius,1990) is used. Results are analysed by trace statistics and Eigen value statistics.

Descriptive Statistics

	OP	EXCHN	EXJPN	EXIND
Mean	-0.029	-0.0001	-0.017	0.0199
Median	0.0000	0.0000	-0.010	0.0000
Max.	10.416	9.832	3.1396	6.097
Min	-8.857	-9.290	-3.7572	-6.097
Stand. D	1.864	0.379	0.611	0.559
Skewness	0.146	1.541	-0.135	-0.069
Kurtosis	6.588	458.55	6.422	31.862

Descriptive statistics of data indicate negative mean return for oil prices, exchange rate of China, Japan, whereas returns are positive for India. Standard deviation of oil prices is highest indicating the volatile nature of oil prices in general. Similarly skewness of exchange rate of china is highest positive further indicating the direction of outliers. Further Kurtosis is of highest in exchange rate of China. Other variables under study also show high Kurtosis. Variable notations OP, EXCHN, EXIND, and EXJPN indicate the oil prices, Chinese exchange rate, Indian exchange rate and Exchange rate of Japan respectively.

RESULTS AND DISCUSSION

Table 1 - ADF Test Results

ADF TEST	Oil Prices	EX Rate India	Ex Rate China	Ex Rate Japan
P value I(0)	0.0000	0.0000	0.0000	0.0000

ADF results show that series are stationary at level, which is I(0), Time series data of variable should be stationary to apply long term relationship techniques,

such as Johansen co integration and ARDL. It is necessary to avoid spurious regression.

Johansen Co Integration Results

Table 2 - Oil prices and Yuan Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.005 Critical Value	Prob.**
None	0.176	659.77	15.494	0.0001
At most 1*	0.161	311.00	3.8414	0.0000

*Trace value statistics indicates two co integrating equations at 0.05 level

Table 3 Rank Test Eigen Value

Hypothesized No. of CE(s)	Eigen Value	Max-Eigen Statistics	0.005 Critical Value	Prob.**
None	0.176	348.10	14.26	0.0001
At most 1*	0.161	311.66	3.841	0.0000

*Max Eigen value indicates two co-integrating equations at 0.05 level

As per the results shown in the table, Johansen co integration test indicate the significant long term relationship between the oil price and Japanese Yuan. Trace statistics at r=0 and r=1 are higher than the critical values at 5 per cent significant level. Similarly Eigen value statistics are higher than the critical values at 5 per cent significance level. Both, the Trace and Eigen value statistics indicate the indicate 2 co-integrating equations, signifying the significant long term relationship. The above findings confirm the oil dependence of Japan as it is among the largest importer of oil, thereby the dominant role of it in determining the exchange rate.

Table 4 Oil Price and INDIA Trace Test

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.005 Critical Value	Prob.**
None	0.167	626.36	15.49	0.0001
At most 1*	0.156	301.10	3.8414	0.0000

*Trace value statistics indicates two co-integrating equations at 0.05 level

Table 5 Rank Test Eigen Value

Hypothesized No. of CE(s)	Eigen Value	Max-Eigen Statistics	0.005 Critical Value	Prob.**
None	0.167	325.28	14.26	0.0001
At most 1*	0.156	301.10	3.841	0.0000

*Max Eigen value indicates two co integrating equations at 0.05 level

The Trace statistics of Johansen co integration are higher than the critical values at r=0 and r=1, indicating the two co integrating equations between the oil prices and exchange rate of India. Similarly the Eigen value test also indicate two co integrating equation at 1 per cent significant level. India too import its more than 80 per cent of oil requirement, impacting the forex reserves dearly.

Table 6 Oil Price and CHINA exchange rate (Trace Test)

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.005 Critical Value	Prob.**
None	0.242	816.69	15.49	0.0001
At most 1*	0.167	325.12	3.8414	0.0000

*Trace value statistics indicates two co integrating equations at 0.05 level

Table 7 Rank Test Eigen Value

Hypothesized No. of CE(s)	Eigen Value	Max-Eigen Statistics	0.005 Critical Value	Prob.**
None	0.242	491.57	14.26	0.0001
At most 1*	0.167	325.12	3.841	0.0000

*Max Eigen value indicates two co integrating equations at 0.05 level

Further in Johansen Co integration analysis, relationship between oil prices and exchange rate of Chinese currency shows long term relationship. The trace and Eigen value statistics are higher than the critical values at 5 per cent significant level. Further results show that there are two co integrating equations at 5 per cent significant level. It is of interest that, Renmibi despite being carefully managed shows significant long term relationship with the oil prices.

CONCLUSION

This paper explored the relationship between oil price and exchange rate of three Asian economies, namely India, China and Japan. Though all three economies are emerging economies, they are also hugely oil dependent countries. Study uses daily time series data from 2011 to 2017 and applies ADF test to check the stationary before applying the Johansen Co integration test to Study long term relationship between the oil price and exchange rate of studied countries. Trace and Eigen value statistics of Johansen co integration indicate significant long term relationship between the oil prices and exchange rate at 5 per cent significant level. Further in the results of Johansen co integration all the pairs of exchange rate and oil prices show two co integrating equations, confirming the association of oil price and exchange rate of studied countries in the long run. Findings of study can have implications for the investors and

policy makers and managers concerned with portfolio and risk management.

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