

Relationship between Crude oil price and Rupee, Dollar Exchange Rate: An Empirical Analysis

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Abstract: Oil is one of the most important forms of energy. It has been widely accepted that oil is the most significant and crucial determinant of global economic performance. Its price fluctuations can have a major impact on the world economy. In this paper, we tried to examine the effect of oil price fluctuations on the Indian economy. We have taken time-series data from 1984-85 till 2019-20 to find the impact of oil prices fluctuations on the Indian exchange rate against the U.S. dollar. We have used a linear regression model to study the impact of oil prices on the Indian exchange rate. The results suggest that the imports of crude oil increase with an increase in crude oil prices. Therefore, oil imports are the important determinant of the dollar's rising demand in India's foreign exchange market. This rising demand for the U.S. dollar results in strengthening the dollar against the Indian rupee, among other factors. The findings of this paper will be of great contribution to the Indian government in policymaking, which will help control petroleum prices to avoid rupee depreciation against the U.S. dollar.

Keywords: Crude oil prices, Exchange rate, Imports of crude oil. Linear regression

Introduction

Oil is one of the most important forms of energy. Crude oil, in the same way as other primary commodities, is a significant contributor to the production process of an economy. It is formed naturally and is a non-renewable resource of energy, which is used for making nearly everything, including aluminum, steel, plastics, rubber, fabrics and fertilizers. In addition, it has a comparative advantage and is regarded as a key strategic resource. It has been widely accepted that oil is the most significant and crucial determinant of global economic performance. Its price fluctuations can have a major impact on the world economy. After observing the historical trends, we can see that crude oil volatility has been a regular phenomenon. The rising prices of crude oil can increase production and services, which can result in increased price levels. The unpredictability in oil prices may diminish total aggregate output temporarily, as it defers business investments by raising vulnerability or by instigating costly sectoral resource allocation Guo & Kliesen (2005). Besides, oil prices can set economic trends by influencing gross domestic product growth (GDP). Economic theory has several channels that contribute to an inverse relationship between oil prices and economic activities. According to Brown and Yucel (2002), these channels include aggregated demand effect and income transfers, role of monetary policy, real balance effect, inflation effect and sector adjustment

effect. Anticipations about likely increases in crude oil prices will lead to uncertainty and negative sentiments in the financial markets. The expected inflation will hurt the equity values.

According to Rafiq et al. (2009), the previous literature has provided an excellent explanation about the role of oil, which revealed that (1) oil has a direct relation with the production process (2) oil price volatility have a very significant impact on output, employment, inflation, interest rate, investment, terms of trade and exchange rate and (3) impact of oil price fluctuations on the economy is asymmetric. The oil price shocks play a major and most significant role in explaining exchange rate movements. An oil price increase will also affect a country's wealth by a transfer of income from oil importing to oil-exporting countries through a shift in terms of trade thus, inevitably, exchange rates are also expected to change Turhan et al. (2013). From a theoretical point of view, the fluctuations in oil prices can be transferred to the exchange rate through two main channels, i.e. the terms of trade and wealth effect Bodenstein et al. (2012). For the energy-dependent economies, Oil imports represent a significant fraction of the trade balance. In the case of small open economies with the floating exchange rate, the oil price volatility is in small open economies with floating exchange rates. The variability in oil prices is anticipated to greatly impact the relative value of the currency Dawson (2007).

There is extensive literature on the relationship between the international price of oil and countries' exchange rate. In the pioneer works of Hamilton (1983), the information transmission between exchange rate and oil prices has been discussed particularly, and the linkages between oil prices and macroeconomic fundamentals have been investigated in detail. Chaudhuri and Daniel (1998) conclude that the volatile nature of real oil price is the major reason behind the fluctuations in the U.S. dollar real exchange rates. To explain the theoretical linkage between oil prices and exchange rate Amano and van Norden (1998) propose a two-sector model for tradable (oil) and non-tradable (labour) goods. Golub (1983) and Krugman (1983) had worked together to theoretically established the link between the oil prices and exchange rate. When the oil prices rise or fall, an oil-exporting and oil-importing country may experience exchange rate appreciation and depreciation. Askari and Krichene (2010), by using quarterly data for the sample period 1970–2009, studied the empirical relationship between oil prices and monetary policy. They tried to emphasize the relationship between the U.S. dollar's nominal effective exchange rate and oil prices.

According to them, the U.S. dollar depreciation results in higher oil prices. Similarly, Blomberg and Harris (1995), by the law of one price for tradable good, tried to explain the potential impact of exchange rates on oil prices. According to them, since oil is homogeneous, internationally traded, and USD priced commodity, the depreciation in the U.S. dollar results in enhanced purchasing power of foreigners, leading to increased oil demand, and an increased oil demand pushes up the crude oil price. A second strand of the literature Krugman (1980) focuses on the balance of payments, hence on the tradable sector and international portfolio choices. Darby (1982) argued that the oil price increases could simultaneously lead to a rise and fall in aggregate prices and output. With rising inflation, there are fair chances that the domestic interest rate will also rise to counteract inflation. In response to the rise in the domestic interest rate, there would likely be an inflow of foreign capital, causing an appreciation of the domestic currency. Chen and Chen (2007) explain that a real oil price rise may lead to an increase in the prices of tradable goods in the home country by a larger extent than in the foreign country if the dependence of the home country is more on imported oil, and causing a real depreciation of the home currency. The domestic currency will further depreciate when to remain in the competition; the home country would raise the nominal exchange rates to improve the worsening terms of trade due to oil price volatility. Appreciation of exchange rate due to oil price volatility has been established empirically in Nigeria Olomola & Adejumo (2006), China Huang & Feng (2007) and Benassy-Quere et al. (2007), Fiji Narayan et al. (2008), US Amano & Van Norden (1998). In contrast, in G7

countries, depreciation of the exchange rates must be noticed by Darby (1982) and Kazakhstan Kutan & Wyzan(2005). The recently spotted volatility in oil prices is transmitted to the financial markets and real economy through exchange rates vis-à-vis United States (U.S.) dollar.

In case of a strong U.S. dollar, it is expected that crude oil-importing countries (except the U.S.) have adverse effects (and vice versa), or we can say the increased U.S. dollar exchange rate volatility will create a more unpredictable environment for the crude oil-exporting countries in terms of global purchasing power (Zhang et al., 2008). Ghosh (2009) empirically establishes that crude oil in international markets does not influence the import demand for crude oil in India. According to him, the government still controls the retail price of petroleum products in India. Therefore, international oil price volatility; an increase in international oil price has not generally altered the price of petroleum products in domestic markets. Akram (2009) presents evidence that the main reason behind the higher oil prices is the weaker U.S. dollar. There is a significant relationship between U.S. dollar shocks and oil price fluctuations, i.e. the shocks in the U.S. dollar increase oil price fluctuations.

In contrast to the above findings, Cifarelli and Paladino (2010), concerning volatility, conduct a trivariate GARCH-M model including oil prices, stock prices, and dollar exchange rates. Their findings provide strong evidence that there exists a negative relationship between oil price shifts and exchange rate changes. Basher et al. (2012) also examined the relationship between oil prices, exchange rates and stock prices in emerging markets. They used structural VAR models for establishing the relationship and take the period from 1988–2008. Their findings offer limited support for the relationship between oil prices and exchange rates.

From the above literature, it has been apparent that the oil price and exchange rate has a significant relation. Although many studies have empirically supported that the oil prices and exchange rate are co-integrated. Moreover, alternative energy sources are greatly promoted, but the importance of oil prices and exchange rate in explaining changes in each other has not been declined.

Research Methodology

In the given research, the following hypotheses and the research methodology are used to analyze the research problem.

Objective

To examine the effects of oil prices on the Indian exchange rate against the U.S. dollar.

Hypotheses

There is no significant relationship between the imports of crude oil by India and Crude oil prices.

There is no significant relationship between the Indian exchange rate and the imports of crude oil by India.

Crude oil prices data (Crude oil, WTI, \$/bbl) has been downloaded from Bloomberg, Energy intelligence group (EIG). The exchange rate data has been downloaded from RBI Publication (Handbook of Indian Statistics, 2018-19), and imports of Crude oil data has been downloaded from the Ministry of Petroleum and Natural Gas, Govt. of India (PPAC). The study has chosen three variables and employs empirical analysis. The chosen variables are crude oil prices in U.S. Dollars, imports of crude oil in a million metric tonnes and exchange rate of a rupee per \$1 U.S. Dollar. We have used time-series data from 1984-85 to 2019-20 for all three variables. Two separate model equations are constructed to examine the relationships between the

variables. The relationship between imports of crude oil and the future price of crude oil is examined using the following equation:

$$\log \text{ICO}_t = \beta_0 + \beta_1 \log \text{WCOP}_t + U \dots \dots \dots (1)$$

Where $\log \text{WCOP}_t$ = Crude oil prices (West Texas Intermediate Future price per barrel) for the time period t

$\log \text{ICO}_t$ = Oil Imports (in million metric tonnes) for the time period t

In order to analyze the relationship between exchange rate of Indian rupee Vs Dollar and imports of crude oil the following model is constructed:

$$\log \text{ER}_t = \beta_0 + \beta_1 \log \text{ICO}_t + U \dots \dots \dots (2)$$

$\log \text{ER}_t$ = Exchange rate of Indian Rupee against Us Dollar for time period t

$\log \text{ICO}_t$ = Oil Imports (in million metric tonnes) for the time period t

The oil marketing companies (OMC's) purchase crude oil by buying the future contract and taking delivery. Therefore, we have chosen the future price as one of our explanatory variables. However, future prices don't directly affect the exchange rate of India. The crude oil imports by India are the crucial variable that influences the exchange rate. Thus, we used two separate equations to analyze the relationship between these variables.

Empirical Results

The future prices of the oil are determined by the Investment decisions of oil derivative investors. After making speculations about the price changes, the investors take the investment decisions. The financial market decisions drive the real market prices. It is clear from the results that in both the regressions, the probability value is below .05% level of significance; thus, we can say that both the independent variables have a significant impact on the dependent variable in each regression. We can see that there is a continuous rise in the import of crude oil, when the crude oil prices increases. Hence we can say that there is a positive relationship between imports of crude oil and the crude oil prices. Therefore, oil imports have become a substantial source of demand for the Dollar in India's foreign exchange market. Thus, the strong demand for U.S. Dollar contributes to strengthening dollar's position against the Indian rupee in the international market, among other factors. The estimated equation shows that along with a one dollar increase in crude oil prices, the imports of crude oil in India will rises upto .38 million metric tonnes, i.e. one unit increase in the prices of crude, which leads to a 38% increased demand of crude oil imports in India. The second equation throws light on the fact that every one million metric tonnes of crude oil imports strengthens the U.S. Dollar by .59 against the Indian rupee, i.e. 59% dollar strengthens with every unit increase in crude oil imports in India.

	Dependent variable	Independent variable	R^2	β_0 Constant	β_1 Value	Significance	F	t
1	Oil Imports	Oil Prices	.67	3.50	.38	0.000	71.40	8.45
2	Exchange Rate	Oil Imports	.78	7.18	.59	0.000	83.245	5.7

Conclusion

This paper examined the effects of oil price on the exchange rate of the Indian rupee against the dollar using time series data from 1984-85 to 2019-20. There has been a continuous rise in crude oil prices and the imports of crude oil by India. This, in turn, pushes the demand for the Dollar in India that strengthens the dollar against the Indian rupee causing the Indian rupee to depreciate. This erodes the purchasing power of Indian currency in the international market. The domestic oil supply augmentation and control over oil demand seems to be a viable policy option to overcome exchange rate depreciation and its consequences.

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