Article

A Study on Dynamic Relationship Between Oil, Gold, Forex and Stock Markets in Indian Context

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Abstract

Indian economy in the recent past had experienced a volatile situation in its financial markets. Forex markets witnessed continuous weakening of rupee against dollar, followed by rise in crude oil prices, gold prices, inflation rate which made RBI to interfere with its hike in policy rates to curb the inflation. Effect of one market on another market is not a new thing, but the variations in the degree of impact and co-movements between the markets need to be examined. The main objective of this article is to study the causal relationship between oil, gold, forex and stock markets, for a period ranging from January 2005 till July 2015. This study employs the Granger causality test. The results indicate that the existence of only unidirectional relationship among the variables. The Granger causality test reveals that oil prices contribute towards development and forecasting of exchange rate and gold prices, whereas fluctuations in oil prices are granger caused by Sensex.

Keywords

Granger causality, devaluation, exchange rate, macro economics

Introduction

Indian financial and commodity markets have been experiencing volatile situations in the recent past. Foreign Exchange markets witnessed continuous weakening of rupee against dollar, followed by volatility in crude oil prices, gold prices and stock index prices, and rise in inflation rate which made RBI to interfere with its hike in policy rates to curb the inflation. Effect of one market on another market is not a new thing, but the variations in the degree of impact and co-movements between the markets need to be examined. Understanding the dependencies between the financial asset classes is of great importance

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mainly due to two reasons. First, it can be debated that portfolio strategies are sensitive to the correlation structure of market participants between financial assets. Secondly, this is of interest to policy-makers to determine the full impact of their decision, if information spills over across asset classes, financial and economic decisions will likely have cross-market influences. The article tries to study the causal linkages between gold, oil, stock and foreign exchange markets. No doubt, many papers examine similar questions in the prior work.

Literature Review

Most of the past literature had concentrated on studying the relationship between stock market and foreign exchange market. Studies have proved the existence of two types of approaches in understanding the relationship between the markets. For instance, 'goods market approaches' (Dornbusch & Fischer, 1980) suggest that fluctuations in a firm's earnings is caused due to variation in the exchange rate, as most of them either trade internationally or borrow funds from international markets, thereby affecting stock market prices. Another approach is where a booming stock market attracts international investors thereby creating a demand for domestic currency and vice versa, this is termed as 'Portfolio Balance approach'. Former approach suggests a negative relationship between the two markets when exchange rate is the leading variable and latter supports the positive relationship between the said markets when stock market is the leading variable.

Studies by Kakhani (2012) and Rahman (2011) showed no causal relationship between stock and foreign exchange markets but confirmed an existence of positive relationship between the two markets. On the contrary, Murinde (1997) and Samanta (2003) debated that there exists a causal relationship between the said markets. Another relationship study was carried out by Morales (2008) and Apte (2001) who studied volatility relationship between stock market and foreign exchange markets using generalized autoregressive conditional heteroskedastic (GARCH) models, thereby agreeing that there exists volatility spillover between the markets.

Stock market is not only influenced by changes in exchange rates but also changes in gold and oil prices. There are barely studies done on analyzing the relationship between stock market and oil prices alone. They are normally combined with other variables like gold, exchange rate, interest rate or other commodities. Oil prices have an impact on the cost of factor inputs for many companies leading to change in profits and thereby changes in stock prices. Faff and Brailsford (1999) examined that oil affects stock prices of oil and gas, and diversified resources industries positively, while it will have a negative impact on the stock prices of paper and packaging and transport industries. Gold that is considered to be a safe haven during the times of turbulences in the market. Chohan (2011) studied the existence of negative relationship between stock prices and gold prices, whereas the study by Dirk and Baur (2010) confirmed that gold acts as a safe haven for most developed countries during the peak of financial crisis.

A study by Simakova (2011) revealed that there exists a long-term relationship between gold and oil prices. Understanding the relationship between gold and oil prices began first in the Middle East when gold was exchanged for crude oil. Today, gold and oil are pre-dominantly quoted in US Dollars and as there is significant volatility in their price levels, a common trend can be seen in their price developments. Both gold and oil prices share a relationship with exchange rate. Commodities that are traded in international markets continuously, a change in exchange rate will have an impact on the prices of those commodities. For instance, Sjaastad (2008) found that change in exchange rate has an impact on the gold prices and Harri, Nalley and Hudson (2009) examined that exchange rates do play a role in influencing the price changes in oil and other commodity prices. To understand the relationship between all the four

variables namely, oil, gold, exchange rate and stock market, numerous studies have been directed in this area. Ciner, Gurdgiev and Lucey (2013) investigated the return relationship between stocks, bonds, gold, oil and exchange rate. The analysis arrived at provides evidence on whether asset classes can be considered as safe haven for each other, and gold is regarded as safe haven against exchange rates. Christner and Dicle (2012), Kumar (2011) and Basher and Sadorsky (2006) studied a causal relationship between gold, oil, stock and exchange rate. These studies revealed oil prices have a negative impact on stock market as well as on exchange rate. Exchange rate is highly affected by changes in variables. However, stock market has a limited role in affecting exchange rate. On the contrary, Mu-Lan, Ching-Ping and Tzu-Ying (2010) and Samanta and Zadeh (2012) studied co-movement between the gold, oil, exchange rate and stock markets and concluded that there exists a long-run relationship between the said markets.

Considerable amount of research is done in this area but literature gives mixed views about the relationship between gold, oil, exchange rate and stock market. Reasons for these results may be due to time period of study and time series modelling techniques used in the studies.

The article tries to validate this linkage between oil prices, gold prices, exchange rate and stock market using the Granger causality test. This will enable the investors and portfolio managers to make informed investment decisions and diversification of portfolios.

Methodology

The main objective of this article is to study the causal relationship between oil, gold, exchange rate and stock markets. Variables considered under the study are daily spot prices of gold in dollars terms from World Gold Council, daily spot oil prices in dollar terms from OPEC website, and exchange rate (rupee/dollar) as given by the RBI data source and closing prices of stock index (Sensex) from BSE website for a period ranging from January 2005 till July 2015. The study employs Correlation Matrix and Granger causality test. We have taken the log normal returns of all the variables using the following formula:

$$R_t = \text{Log}\,(P_t/P_{t-1}) * 100$$

where R_t = Logarithmic returns for period t
P_t = Index price on day t
P_{t-1} = Index price on day t-1
Log = Natural Log
Augmented Dickey–Fuller Test is employed to assess the stationary or the presence of Unit Root problem in the data. Using a stationary data is a necessary condition for employing Granger causality test. The Granger causality test is used for determining whether one time series is useful in forecasting another.

Findings and Analysis

In order to test the relationship among these variables, several methods are available. In this study emphasis is given to test the relationship between gold, oil, stock and exchange rate by using (a) descriptive statistics, (b) correlation matrix and (c) Granger causality test.

It is evident from Table 1 that Sensex has a high return (mean value) followed by gold, crude oil and exchange rate. Sensex also depicts high fluctuation (high standard deviation) in returns compared to

Table 1. Descriptive Statistics

	Crude Oil	Exchange Rate	Gold	Sensex
Mean	0.000234	0.00015	0.000405	0.000552
Std dev.	0.015314	0.005154	0.012543	0.015522
Skewness	–0.291561	0.202114	–0.431114	0.09073
Kurtosis	7.991073	7.937876	7.852847	11.16447
Jarque–Bera	2694.475	2619.265	2592.326	7116.531
Probability	0	0	0	0

Source: Authors' calculation.

other variables. All the variables are asymmetrical in nature while two variables namely crude oil and gold are negatively skewed, and exchange rate and Sensex variables are positively skewed. The value of the kurtosis indicates that all variables are high peaked than the normal distribution and hence follow leptokurtic distribution. From the Jarque–Bera test statistics, it can be said that none of the variables are normally distributed.

Figure 1 shows the log normal returns of the crude oil, exchange rate, gold and Sensex closing prices. It can be seen from Figure 1 that there is fluctuations in returns of all the variables during the period 2008–2009. Sensex showed the stability in returns on an average post-2009 period. Slight fluctuations in returns are seen in 2012–2013 with respect to exchange rate and gold prices.

Correlation Analysis

Correlations indicate predictive relationship between variables. Correlation coefficient ranges between –1 and +1. A positive correlation implies that as one variable moves up and down, the other variable also moves in the same direction. Alternatively, negative correlation implies that if one variable moves in either direction, then the other variable moves in opposite direction. If the correlation coefficient is zero, the movements of variables are said to have no correlation, they are completely random.

The result of correlation analysis for the said variables under the study indicates that all variables are positively correlated with each other. Gold and oil are highly correlated followed by a high correlation between exchange rate and stock price index and also between gold and stock price index. Furthermore, exchange rate and gold are moderately correlated followed by a strong correlation between oil and stock price index. It can also be perceived from the Table 2 that there exists a low correlation between oil and exchange rate.

Unit Root Test

To conduct Granger causality test, variables need to be stationary. The unit root test has been used to examine stationarity of the time series. This test is based on the Null Hypothesis H_0: Y_t is not I(0). If the calculated ADF statistic is less than the critical value (and *p*-value is less than 0.05) then the Null Hypothesis is rejected, otherwise accepted.

From Table 3, it can be inferred that, all the four variables get stationary at first difference and not at levels. Therefore, differenced time series data of the said variables is used for testing causality among the variables.

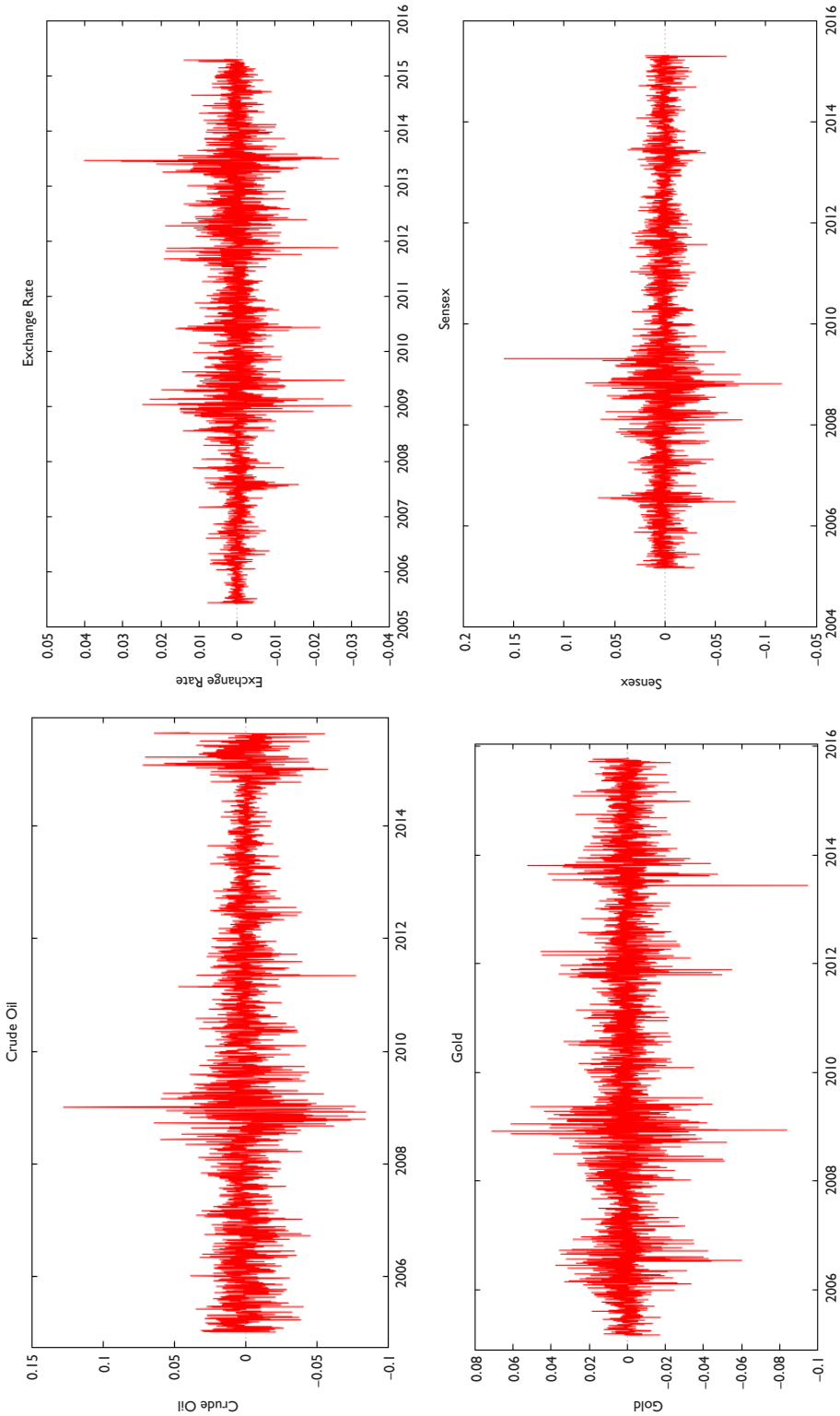

Figure 1. Returns of Variables
Source: Authors' own.

Table 2. Correlation Analysis

	Gold	Oil	Sensex	US Dollar
Gold	1.000000	0.731919	0.631358	0.514196
Oil	0.731919	1.000000	0.417264	0.220352
Sensex	0.631358	0.417264	1.000000	0.666165
US Dollar	0.514196	0.220352	0.666165	1.000000

Source: Authors' calculation.

Table 3. Augmented Dickey–Fuller Test (Unit Root Test)

	Levels	*p*-value	First Difference	*p*-value
Sensex	–0.959676	0.7693	–47.07526	0.0001
Gold	–1.631479	0.4663	–51.66762	0.0001
Oil	–1.876121	0.3439	–39.74670	0.0000
US Dollar	–0.093004	0.9484	–51.64895	0.0001

Source: Author calculated.

Table 4. Granger Causality Test

Null Hypothesis	F-Statistic	Prob.
GOLD does not Granger Cause CRUDE_OIL	2.87913	0.0564
CRUDE_OIL does not Granger Cause GOLD	79.5703	0.0000*
SENSEX does not Granger Cause CRUDE_OIL	8.76733	0.0002*
CRUDE_OIL does not Granger Cause SENSEX	1.84541	0.1582
EXCHANGE_RATE does not Granger Cause CRUDE_OIL	0.73570	0.4793
CRUDE_OIL does not Granger Cause EXCHANGE_RATE	5.11898	0.0060*
SENSEX does not Granger Cause GOLD	10.4962	0.0000*
GOLD does not Granger Cause SENSEX	1.53344	0.216
EXCHANGE_RATE does not Granger Cause GOLD	24.6065	0.0000*
GOLD does not Granger Cause EXCHANGE_RATE	1.47867	0.2281
EXCHANGE_RATE does not Granger Cause SENSEX	0.35613	0.7004
SENSEX does not Granger Cause EXCHANGE_RATE	63.1410	0.0000*

Source: Authors' calculations.

Notes: (1) DG—gold, D0—oil, DU—exchange rate and DS—stock price index (Sensex)
(2) * significant at 5 per cent level of significance.
(3) The number of lags taken to test the causality between the variables is 2. The results are tested at 5 per cent significance level.

Granger Causality Test

Granger Causality is used to test whether the lags of one variable enter into the equation of another variable. Hence, Granger causality actually measures whether current and past values of 'Y_t' help to forecast future values of 'Z_t'. Null Hypothesis H_0 – 'Y_t'does not Granger Cause 'Z_t' gets rejected when *p*-value is less than 0.05.

Results of Granger causality reveal that oil prices contribute towards development and forecasting of exchange rate and gold prices, whereas fluctuations in oil prices are Granger caused by stock price index (Sensex). Stock price index does not only Granger causes oil price changes but also contributes towards development and forecasting of gold prices as well as exchange rate. Exchange rate does not act as a contributor to price fluctuations in either of the markets, but is affected by changes in oil price and stock price index.

Conclusion

The main aim of the study was to analyze the causal relationship between oil, gold, exchange rate and stock market in India. Results reveal that gold and stock price index are positively, highly correlated, this implies that gold does not act as a safe haven for investment. People of India do not buy gold only for investment purpose but they buy gold in the form of jewellery. Therefore, when the stock market is performing well, signalling growth of the economy, gold prices too increase simultaneously as growing economy gives more wealth in the hands of people to invest or buy gold and vice versa. This makes stock price index the leading variable to cause fluctuations in gold prices. Oil is one of the main factors in causing variations in Stock prices, exchange rate and gold prices. Countries experiencing rapid growth in the economy are the ones most likely to increase their demand for oil dramatically. As India is the fastest growing economy in the world, the demand for oil consumption increases drastically. Stock market as the indicator for economic growth acts as the leading variable for increase in oil prices thereby creating a positive relationship between the two. Increasing demand for oil leads to increase in demand for exchange rate even when price of oil is on the rise. Therefore, a positive causal relationship exists from oil to exchange rate. Oil price increase also has a positive impact on gold price increase, the underlying factor being inflation. A rise in oil price leads to an augment in inflation rate and this leads to an increase in gold prices as well. Stock price index has a positive relationship with exchange rate; this is the case when stock price index acts as the leading variable by attracting more FDI and FII inflows into the economy and creating more demand for Rupee. Portfolio managers should avoid investing in gold during the times of high volatility in other financial markets as gold does not act as a safe haven. But when oil prices are decreasing they have to invest in securities of the companies that are not producing energy resources and vice versa when there is an increase in oil prices. Understanding of these linkages between the variables is important for portfolio managers as they need to be cautious while diversifying their portfolio.

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Authors' bio-sketch

Y.V Reddy is the Dean of Faculty of Commerce and Management, at Goa University. He has more than 28 years of teaching experience. His areas of interest include Accounting and Finance, Derivative Markets, Financial Management, Cost and Management Accounting. He has published 70 research papers in both national and international journals and presented more than 45 research papers at national and international conferences. He has guided 12 doctoral works for the award of PhD and is presently guiding 8 doctoral students in the department. He is actively involved in academic and administrative committees constituted by Goa University as chairman and member.

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