Relationship of Indian Gold Market and Stock Market

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ABSTRACT

The present study investigates the relationship between Indian gold price and Indian stock market Index Sensex for the period of January 2010 to December 2015 using daily time series data with the help of Unit Root Augmented Dickey Fuller test, Phillips-Perron, Johanson Co-integration and Granger Causality test to measure the long run relationship. The results of the analysis show that there is no causality between the gold price and Sensex.

Keywords: Causality, Cointegration, Stationarity, Lead-Lag.

INTRODUCTION:

Gold is always considered as a safest investment. In earlier times it was used as a medium of exchange and jewellery item. But now people use it as a store of wealth, investment and security against financial transactions. It has some unique properties and is a precious yellow metal. It is considered as an asset of last resort. It offers security, liquidity and diversification in investment. For the past many years gold prices are continuously increasing due to its heavy demand in India. Historical trends show that when stock markets are volatile and investors tend to move out of risky assets such as stocks and start investing in gold. It has been noticed that the trend of gold price is always higher during the period of stock market slump. But in India investment in gold is not considered as an alternative to stocks. Gold is purchased due to social and psychological reasons. Moreover the culture of investing in stock market is not as developed in India as in other developed countries of the world. Gold has not yet lost its prime importance as a hedge against loss of wealth in times of crisis (Bhunia and Das, 2012). Keeping this in view, the present study examines the relationship between Indian stock market Index and Indian gold prices for the period from Jan1, 2010 to Dec 31, 2015. The rest of the paper is organised as follows: Section II reviews the relevant literature, Section III explains the data and methodology, Section IV includes the analysis and Section V concludes.

REVIEW OF LITERATURE:

A number of studies have examined the impact of gold prices on macroeconomic variables like interest rates and employment effects. But there have been very few studies on how the Indian gold market is affected by Indian stock market. Narang and Singh (2012) examined the causal relationship between Sensex and gold price by using monthly data. They applied ADF and Johansen's co-integration test to find out stationarity and integration of order one. They found positive correlation between stock returns and gold price from 2002 to 2007 but due to economic crisis in USA in 2008 and 2011, no long term relationship was found. Granger causality test revealed that returns of Sensex does not lead to increase in gold returns and vice-versa. On the other hand, Bhunia and Das (2012) found co-movement in gold prices and stock prices. They examined the gold price volatility and the causal relationship between gold prices and stock market returns in India. Taking into consideration the domestic gold prices and stock market returns based on NSE, the study investigated the Granger Causality in the Vector Error Correction Model for the period from April 2001 to March 2011.

Empirical results indicated that the gold prices granger causes stock market returns and stock market returns also granger causes the gold prices in India during the study period. The results indicated that the co-movement of gold prices and stock prices even during financial crisis and thereafter. It is so because gold is not just jewellery but also an important mode of investment. On the contrary, Bilal et al. (2013) found no long term relationship between monthly average gold prices and KSE 100 index, but indicated that BSE has no long term relation with average gold prices. But granger causality test explored no causal relationship among average gold prices, BSE and KSE-100 Index. Findings of the study provided significant insights for academic researchers and for local and international business investors specifically who are interested to invest in sub-continent capital markets for prudent decision making. Irshad et al. (2014) aimed to explore the relationship among oil prices, gold prices and equity prices in Pakistan. Results of the study showed that in Pakistani equity market, oil market and gold market, there is no existence of long run relationship. They used monthly stock price data of Karachi stock market gold prices and oil prices from 2002 to 2010.

Mukhuti and Bhunia (2013) investigated the relationship between Indian gold price and Indian stock market Index (Sensex and Nifty) for the period of January 1991 to August 2012 using daily time series data with the application of bivariate and multivariate cointegration test. Test results specified that there was no cointegration relationship between gold price and two stock market indices. But multivariate cointegration results showed the presence of steady cointegration relationship between the gold price and two stock market indices in India. On the other hand Bhunia (2013) while studying the relationship between the world crude prices, Indian gold price and Sensex found that there is bi-directional causal connection present between Sensex and two commodity indicators in the study. Sreekanth and Krishna (2014) examined the casual relationship between gold prices and National Stock Exchange (NSE) of India from 2005 to 2013. ADF and PP tests have proved that the data is stationary at level. The results of Cointegration test disclosed that the gold prices and NIFTY are cointegrated in long run. In further analysis VECM, Wald's Coefficient Diagnosis, Residual Analysis revealed that gold prices and NIFTY are in equilibrium in short run and long run, indicating that gold prices are sufficient to explain the moments of NIFTY in short run and long run. Finally, the results of Granger Causality test confirmed that the long run causality flows from gold prices to NIFTY.

Banumathy and Azhagaiah (2014) studied to assess the causality between Sensex and gold price in India with the help of the monthly data over the period of 10 years from January 2004 to December 2013. The results of ADF test revealed that the series are stationary (first difference) and also integrated. Sensex and gold are cointegrated implying the existence of long-run relationship between the two as confirmed by Johansen cointegration tests. The result of Granger Causality test revealed that there exists a causal relationship between Sensex and gold. The study also confirmed the presence of uni-directional causality which runs from Sensex to gold for the study period. In nutshell, it can be said there is no consensus among the researchers about the relationship between the two markets. Hence, the need for the present study.

DATA AND METHODOLOGY:

The present study is based on the secondary data obtained from websites of BSE and MCX. Daily closing prices of the Sensex and Gold are considered for the period of Jan 1, 2010 to Dec 31, 2015. After matching the dates of both the markets, 1678 observations are included in the study. Eviews 9.0 package program has been used for analysing the data. Econometric techniques of Augmented Dickey-Fuller (ADF), Phillips-Perron Test, Johansen's Cointegration Test and Granger causality test are used for the purpose of analysis. The Augmented Dickey-Fuller and Phillips-Perron unit root test has been used to examine the stationarity of the time series data used for the study and to find the order of integration between them. To achieve the objectives of the study following set of hypotheses have been tested.

H_{01}: Gold prices and Sensex values are not stationary
H_{02}: Gold prices and Sensex values are not cointegrated
H_{03}: There is no causal relationship between gold and Sensex returns

Log values of both the price series have been used for the study purpose, because if the values are to be differenced for applying econometric models the first difference of log values is the continuous return. Thus the return has been calculated as: Return= Ln(Pt/Pt-1)
Where Ln is the Natural log of, Pt is the price for period t and Pt-1is the price for period t-1.

ANALYSIS OF RESULTS:

Graphical Presentation of Data:
Data for the natural log values of gold prices, log values of Sensex, gold return and Sensex return has been

presented graphically to test whether the data series are stationary or not. It is clear from the following graphs that series in level form: log gold prices and log Sensex are not stationary but the series are stationary after first differencing i.e. gold return and Sensex return are stationary.

Fig 1: Log Values of Gold Price Series

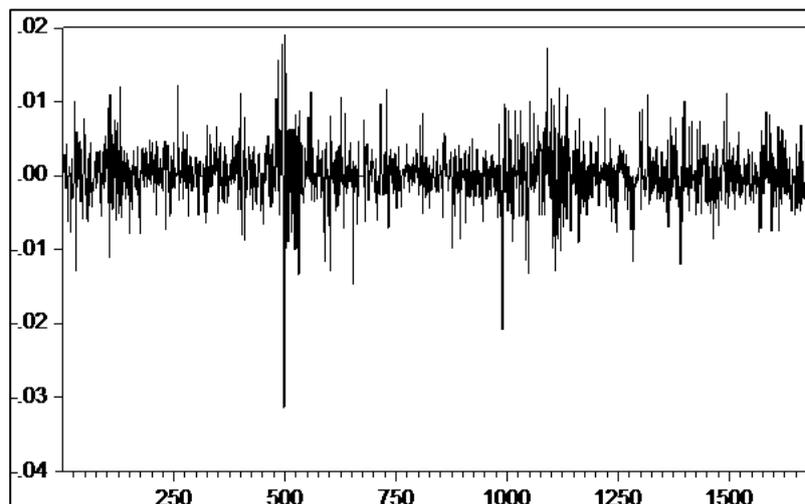**Fig 2: Log values of Sensex series**
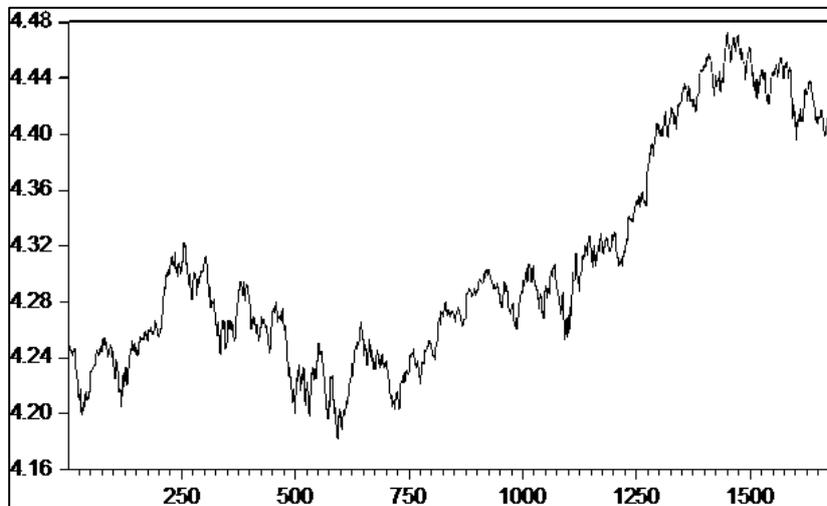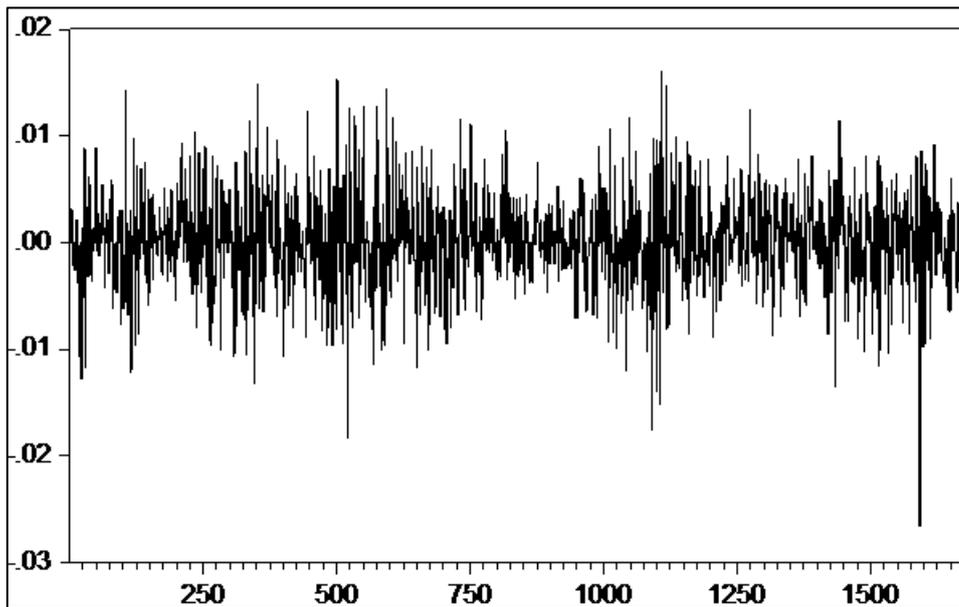

Fig 3: Gold Returns

Fig 4: Sensex Returns

Results of Augmented Dickey-Fuller test have been shown in the following table.

Table 1: Unit Root Test

Series Name	ADF Level	ADF First Diff.	PP Level	PP First Diff.
LGold	-1.144567 (0.9198)	-41.67029 (0.0000)	-2.256034 (0.1867)	-41.78708 (0.0000)
LSensex	-2.051432 (0.5720)	-39.34165 (0.0000)	-2.093131 (0.5487)	-39.33543 (0.0000)

Results of ADF and PP test confirm the results of above graphs showing that the series in level form i.e. loggold and logsensex are not stationary. Because the null hypothesis of having a unit root can not be rejected (probability= 0.9198, 0.5720 for ADF and probability= 0.1867, 0.5487 for PP) but the series are stationary after the first difference because the null hypothesis of having unit root has been rejected (probability= 0.0000, 0.0000 for ADF and probability= 0.0000, 0.0000 for PP). (Gold return and Sensex return are the first difference of the loggold and logsensex).

Johansen's Cointegration Test:
From the above discussion it is clear that the series of loggold and logsensex are not stationary whereas both these series are stationary at first difference. So both the series are I[1]. These two I[1] series may be cointegrated. To test the null hypothesis that these series are not cointegrated, Johansen's Cointegration test has been applied. The test has been applied on the series of loggold and logsensex because this test is applied on the data in level form. The results have been shown in Table 3.

Table 3: Johansen's Cointegration Test

Hypothesized No. of CEs	Eigen Value	Trace Statistics	0.05 Critical Value	Probability **
None	0.004511	10.27915	20.26184	0.6124
At most 1	0.001622	2.715054	9.164546	0.6352

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4: Unrestricted Co-integration (Max Eigen Value Test)

Hypothesized No. of CEs	Eigen Value	Trace Statistics	0.05 Critical Value	Probability **
None	0.004511	7.564094	15.89210	0.6004
At most 1	0.001622	2.715054	9.164546	0.6352

Trace test indicates no cointegrating eqn(s) at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

It is clear from the table 3 that there is no cointegration equation in these variables because null hypothesis of none cointegration equation cannot be rejected (probability= 0.6124). Besides Max-Eigen value Statistics test was employed to authenticate the outcomes of co-integration Trace Statistics analysis. It further ensures no cointegrating equations have any level of significance. Cointegration provides us the evidence of existence or non-existence of long run relationship among different time series. It provides us the evidence just about the relationship existence but it does not identify that which market leads the other market. Results of the cointegration test reported the absence of any long run relationship.

Granger Causality Test:
To further test the absence or presence of short run relationship, Causality test may be applied to the series of data. Granger Causality test is always applied on stationary data. So the test in the present study has been applied on gold return and Sensex return. From table 2 it is clear that series of loggold and logsensex are not stationary whereas series of gold return and Sensex return are stationary. Results of Granger Causality test have been shown in the table given below:

Table 5: Pairwise Granger Causality Test

Null Hypothesis	Observations	F-Statistic	Probability
Sensexreturn does not Granger Cause Goldreturn	1675	0.47676	0.6209
Goldreturn does not Granger Cause Sensexreturn	1675	1.03188	.3566

From the results of pairwise Granger Causality test it can be concluded that there is absence of causality from any series to the other series. It means that gold return does not cause and affect Sensex return nor does the Sensex return cause and affect the gold return.

CONCLUSION:

In this paper, the causal relationship has been examined between gold price and Sensex. The study has used daily data collected from website of BSE and MCX. The results of the Augmented Dickey-Fuller test and Phillip-Perron test conclude that series are stationary and integrated of order one. But Johansen's co-integration test shows that there is no long-run association between gold prices and Sensex values. The results of the Granger Causality test also refute any causal relationship between gold returns and Sensex returns. The results suggest that changes in gold prices and Sensex returns do not co-vary and hence investors can allocate their funds in both sectors.

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