



## INTERDEPENDENCE OF FINANCIAL MARKETS IN INDIA: EMPIRICAL EVIDENCE

**Dr. P. Sri Ram**

Assistant Professor, Faculty of Commerce & Management, Goa University – Goa.

### ABSTRACT

*The present study is used to examine the interdependence of financial markets in India. Efficient financial systems are indispensable for speedy economic development. The financial system of a country is a conglomeration of sub market, viz. Capital, Commodity, Forex and Government Securities market. The flow of funds in these markets is multi directional depending upon liquidity, risk profile, yield pattern, interest rate differential or arbitrage opportunities, regulatory restrictions etc. This study considers daily data encircling the closing stock price index of NSE (NIFTY 50), Gold price (Rs.), Exchange rates (\$) and Treasury bill rate. The study is based enormously on secondary data acquired from RBI database, NSE database and World Gold Council database for the period from January 3, 2005 to December 31, 2015. For this purpose, this paper seeks to examine in this context whether there is impact between of NSE (NIFTY 50), Gold price (Rs.), Exchange rates (\$) and Treasury bill rate with the help of tools like Unit root Test, Correlation, Descriptive Statistics, Multiple regression Test and Granger causality Test. It is found that there is positive correlation between Gold price and US dollar and also between US dollar and Treasury bill. Empirical results provide the support of feedback causality between Exchange rate (US dollar) and Nifty50 and also Nifty50 Granger causes US dollar in India. Although there is unidirectional Granger cause between Nifty50 and Treasury bill rate, the study does not show any Granger cause between Treasury bill rate and Nifty 50. As the Government*

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*securities market in India is still in the developing stage, it was not found to be integrated with the domestic market. Indians have started considering gold not only as jewellery but also an important mode of investment like investment in bonds and equities.*

**Keywords:** Nifty, Gold Price, Exchange Rate, Treasury Bill, Causality

## **Introduction**

One of the most important national policy decisions during the late twentieth century and forepart of this century has been the financial liberalization of equity markets across the world. Equity market liberalization gives foreign investors the opportunity to invest in domestic equity markets and domestic investors the right to transact in foreign equity market. However, it is important to distinguish between the concepts of liberalization and integration. For example, a country might pass a law that seemingly drops all barriers to foreign participation in domestic capital markets. This is liberalization, but it may not be an effective liberalization that results in market integration. A financial system is a system that allows the exchange of funds between lenders, investors and borrowers. Financial systems operate at national, global, and firm-specific levels. They consist of complex, closely related services, markets, and institutions used to provide an efficient and regular linkage between investors and depositors.

Money, credit, and finance are used as media of exchange in financial systems. They serve as a medium of known value for which goods and services can be exchanged as an alternative to bartering. A modern financial system may include banks (operated by the government or private sector), financial markets, financial instruments, and financial services. Financial systems allow funds to be allocated, invested, or moved between economic sectors. They enable individuals and companies to share the associated risks. In economics, typically, the term market means the aggregate of possible buyers and sellers of a certain good or service and the transactions between them. One of the most important national policy decisions during the late twentieth century and forepart of this century has been the financial liberalization of equity markets across the world. Equity market liberalization gives foreign investors the opportunity to invest in domestic equity markets and domestic investors the right to transact in foreign equity market. An important aspect of reform has been to develop the various segments of the financial markets into an integrated one, so that their inter-linkages can reduce arbitrage opportunities, help achieve a higher level of efficiency in market operation and increase the effectiveness of monetary policy in the economy.

The prices for Treasury bills (T-bills) can have a significant impact on the risk premium charged by investors across Commodity, Capital, Forex. T-bill prices have a large influence on the relative levels of risk investors are comfortable taking. High T-bill prices drive investors into longer-term bonds, lower-grade bonds, equities or derivatives. This is true of institutional investors and individual investors. In effect, the price and yield of T-bills and other Treasuries helps inform the fundamentals of nearly every other investment class on the market.

Indian stock market counting NSE is very much prejudiced through few serious features, that is, Indian gold price and exchange rates (dollar and rupee). The impact of the rise in international gold prices is reflected in its domestic prices as well. Despite the sharp recent price rise, in India, demand for gold has sustained, not only as a component of safe savings but also due to its social and cultural importance. The role of a liberalized and developed gold market in the interest of consumers is being increasingly realized and efforts are underway for integrating the gold market with financial markets.

There exists a relationship between four variables (i.e. Gold price, Exchange rate, Treasury bill and Nifty50). So, to assess the relationship between these variables, the following study is carried out.

### **Literature Review**

**(BHUNIA & PAKIRA, 2014)**, “Investigating the impact of Gold price and Exchange rates on Sensex: An evidence of India” This paper investigates the affiliation between three financial variables of gold price, exchange rates and Sensex between 1991 and 2013 using daily data with the application of unit root test, Johansen co integration test and Granger causality test. Johansen co integration test result indicates that there exists a long-term relationship among the selected variables. Granger causality test result shows that there must be either bidirectional or no causality among the variables.

**(Nair, Choudhary, & Purohit, 2015)**, “The Relationship between Gold Prices and Exchange Value of US Dollar in India” Examined the impact of recession of 2008 on relationship between exchange rate of US dollar in INR and gold prices in India using Spot prices of gold from Multi Commodity Exchange Limited (MCX), INR- US Dollar exchange rate from International Monetary Fund (IMF). The study period has been defined after the study of course of event for global financial crisis. The study uses Johansen Co- Integration test, Granger Causality Test, The Augmented Dickey Fuller Test. The study hence concludes that

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exchange value of US Dollar is an important factor in fluctuations in gold prices in India like in case of South Africa.

**(Narang & Singh),** "Causal Relationship between Gold Price and Sensex: A Study in Indian Context" This paper aims at investigating the dynamic relationship between gold prices and stock market returns in India for the period 2002 to 2012, study is based on secondary data collected from the database on Indian economy maintained by RBI and Bombay Bullion Association, monthly data on domestic gold prices and stock market returns. The results of Augmented Dickey- Fuller test conclude that there is a positive correlation between stock returns and gold price from 2002 to 2007 but due to economic crisis in USA in 2008 and 2011 this correlation seems to be fading, Johansen's co-integration test that there is no relation between gold prices and stock returns Granger causality test reveals that returns of Sensex index does not lead to increase in gold price and rise in gold price does not lead to increase in Sensex.

**(Bhunia & Das, 2012),** " Association between Gold prices and Stock market returns: Empirical evidence from NSE" This study examines 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 investigates the Granger causality in the Vector Error Correction Model, Augmented Dickey-Fuller Unit Root Test. The Augmented Dickey-Fuller test shows that the time series data used for the study are stationary and all integrated of order one. The Johansen's co-integration test reveals that there exists long run equilibrium relation between gold prices and stock market returns in India. The Granger causality test in the vector error correction model suggests the evidence of feedback causality running between the gold prices and Nifty based stock returns in India. Thus, each variable contains some significant information so that one can be used to predict the other.

**(Sharma & Mahendru),** " Impact of Macro-Economic variables on stock prices in India" This paper provides the study is to determine the lead and lag inter relationships between the stock price and macroeconomic variables. Multiple regression model is employed to test for the effects of macroeconomic factors on stock. data set consist of macroeconomic factors such as inflation rate, foreign exchange reserve, exchange rate and gold price In this study only Secondary data is used. A multiple regression model result reveals that exchange rate, and gold price to affect the entire BSE Stock price. There is 88.9%

correlation of exchange rate with stock price and gold price has 90.2% correlation with stock price.

(Srinivasan , 2014),” Gold Price, Stock Price and Exchange rate Nexus: The Case of India”The paper investigates the causal nexus between gold price, stock price and exchange rate in India through the Autoregressive Distributed Lag (ARDL) bounds testing approach and Granger Causality test. Using monthly time series data, the empirical analysis is carried out for the period from June 1990 to April2014. Analysis reveals that gold price and stock price tend to have long-run relationship with exchange rate in India. Granger Causality test that there exists no causality runs from gold price to stock price or vice versa in the short-run. It can be concluded that domestic gold price does not contain any significant information to forecast stock prices in India.

## **Research Methodology**

### **Objectives**

1. To study the gold price volatility of gold price, exchange rate, Treasury bill and Nifty50 in financial market.
2. To evaluate the relationbetween gold price, exchange rate, Treasury bill and Nifty50 in the financial market system over a decade.
3. To investigate the cause and effect relationship between gold price, exchange rate, Treasury bill and Nifty50 in the financial market system over a decade

## **Data Collection**

The study is based enormously on secondary data acquired from RBI database (Exchange Rate & Treasury Bill rate), NSE (Nifty 50 Index Close Prices) and World Gold Council database (Gold Prices) for the period from January 3, 2005 to December 31, 2015.

## **Sources**

This study considers daily data encircling the closing stock price index of NSE, the daily Indian gold price, exchange rates between dollar and rupee and daily price of Treasury bill

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rate. After appropriate fitting the data, there are 2655 observations. Eviews 8 package program has been used for arranging the data and execution of econometric analysis.

### **Statistical tools and techniques**

In the course of analysis of the present study, only econometric tools like Unit root tests, Descriptive Statistics, Augmented Dickey Fuller (ADF), Correlation and Granger causality test have been used.

#### **A. Unit root**

The stationarity or otherwise of a series can strongly influence its behavior and properties e.g. persistence of shocks will be infinite for nonstationary series. Once there exist any causal connection between variables, the next step is to evaluate if there exists any long run relationship between them. Even if, two variables depart in the short run, there may be a co-movement of these variables in the long run. The short-run deviation or disequilibrium may be corrected in the long-run. It implies that the variables are co-integrated in the long run. The testing of co-integration between variables starts from the unit root tests.

#### **B. Descriptive Statistics**

In addition to the mean and median of concerned variables such as Exchange rate, Treasury bill, Nifty50 and Gold price the Skewness and Kurtosis statistics are estimated. Skewness is a measure of asymmetry of the distribution of the series around its mean. Kurtosis measures the peakedness or flatness of the distribution of the series.

#### **C. Correlation**

Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. Although this correlation is fairly obvious that data may contain unsuspected correlations. That may also suspect there are correlations, but don't know which are the strongest. An intelligent correlation analysis can lead to a greater understanding of the data.

#### **D. Granger Causality Test:**

Granger (1969) proposed a time-series data based approach in order to determine causality. In the Granger-sense  $x$  is a cause of  $y$  if it is useful in forecasting  $y^1$ . In this framework "useful" means that  $x$  is able to increase the accuracy of the prediction of  $y$  with respect to a forecast, considering only past values of  $y$ .

**Fig: 1**

**Trend of Gold Price from 2005 to 2015**



Fig 1 depicts the volatility changes in gold price from the year 2005 to 2015. The trend shows the volatility started in 2008 (due to financial crisis), after crisis the fluctuation gold prices showed upward trend. In 2012 the gold prices were at its peak and later from 2013 it started a downward trend.

**Fig: 2**

**Trend of Nifty 50 from 2005 to 2015**

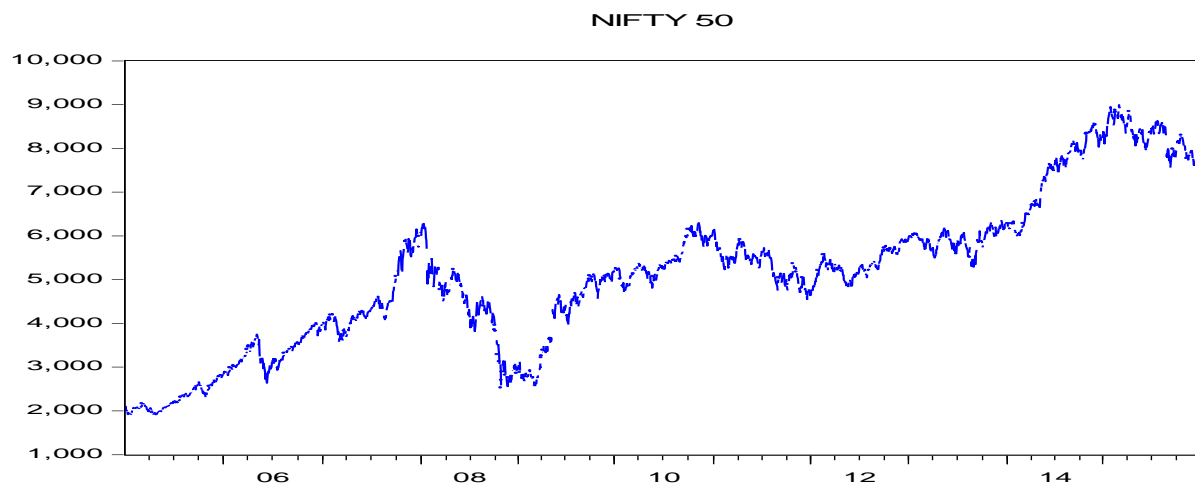


Fig: 2 reveals upward movement in 2006. In 2008 trend showed steep fall due to financial crisis prices. In the succeeding year 2009 showed a rise in the prices. In 2012 the same pattern has been continued as that of 2009-10 followed by constant change in 2013. In 2014 it rises further to its peak followed by down trend.

**Fig.3**

**Trend of Treasury bill from 2005 to 2015**

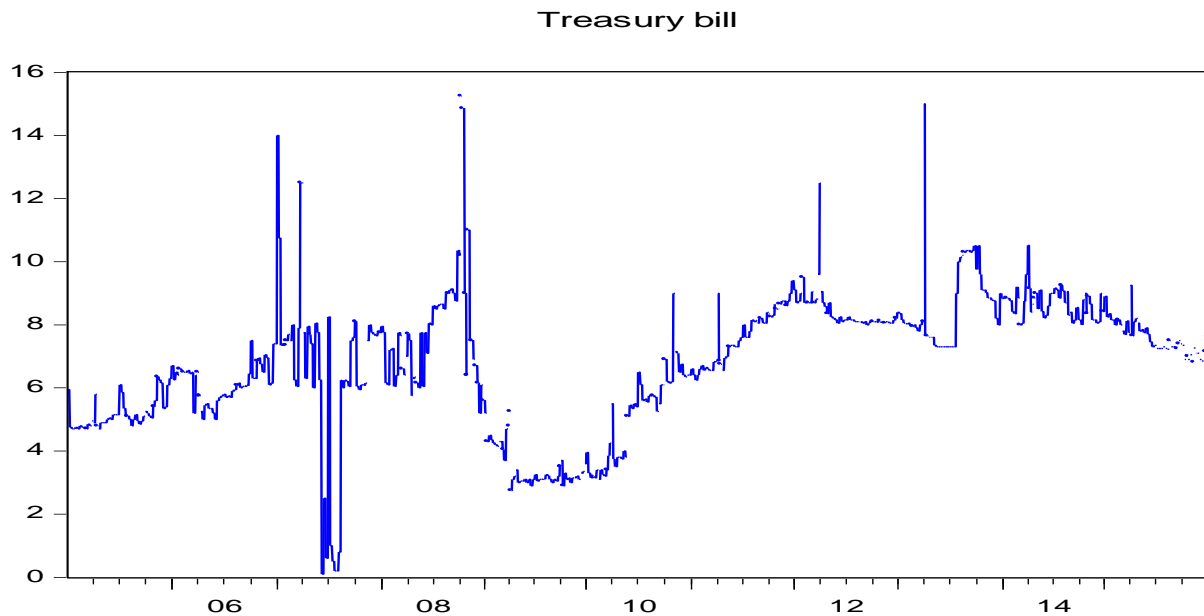


Fig: 3 indicates there is a high fluctuation in the year 2006 and 2008. From 2008 to 2010 the Treasury bill has shown a continuous fall in the rate, followed by constant fluctuation. Later from 2014 the treasury bills rates showed a downward trend.

**Fig: 4**

**Trend of Exchange rate (US dollar) from 2005 to 2015**



## US Dollar

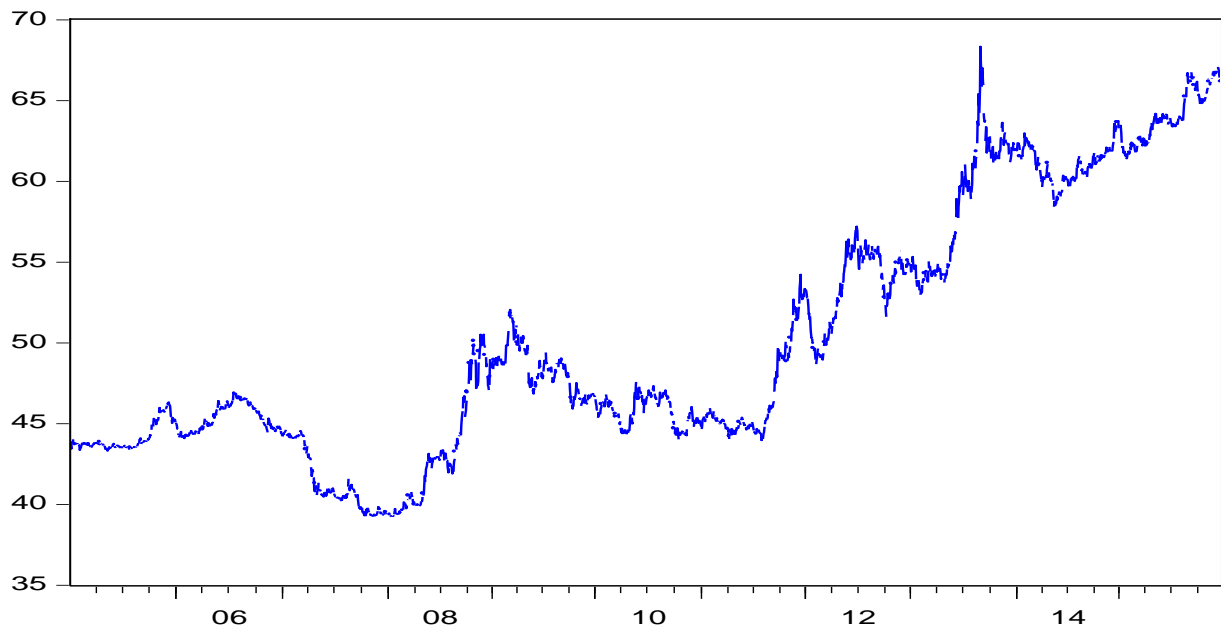


Fig: 4 reveal a constant rate of US dollar. And later in 2007 it shows fall in US dollar rate till 2008 followed by a continuous rise of US dollar from 2008 to mid-2009, after a point trend shows constant fluctuation occurs till 2011, later subsequently a stable rise in the gold prices in 2015

### **Stationarity of Variables: (Unit Root Test)**

Co-integration test technique is greatly supportive to detect the co integration association between the two variables in the long period and it is realistic if the two variables are stationary in any case. In the present research paper, four indicators, namely, Indian gold price, Treasury bill, nifty 50 and exchange rates. For the purpose of stationarity test, the present study ADF unit root test, both at levels and at 1st differences (intercept without trend and intercept with trend) in hypothesis-1 above (Dickey and Fuller, 1981).

**H<sub>0</sub>: Has a unit root (i.e. data is non-stationary)**

**H<sub>1</sub>: Has a no unit root (i.e. data is stationary)**

**Table 1****Results of stationarity using ADF test**

<b>US_DOLLAR</b>			
	intercept	Trend & Intercept	None
Level	-1.887370	-0.965380	1.962115
	(0.3386)	(0.9468)	(0.9886)
1 <sup>st</sup> different	-38.61713	-38.67471	-38.52688
	(0.0000)	(0.0000)	(0.0000)
<b>NIFTY_50</b>			
Level	-1.854364	-2.689841	1.472066
	(0.3543)	(0.2409)	(0.9655)
1 <sup>st</sup> different	-48.16474	-48.16418	-48.12685
	(0.0001)	(0.0000)	(0.0001)
<b>TREASURY_BILL</b>			
Level	-4.997503	-	-
	(0.0000)	-	-
1 <sup>st</sup> different	-	-	-

*Source: Author's compilation*

<b>GOLD_PRICE</b>			
	intercept	Trend & Intercept	None
Level	-1.887370	-0.965380	1.962115
	(0.3386)	(0.9468)	(0.9886)
1 <sup>st</sup> different	-38.61713	-38.67471	-38.52688
	(0.0000)	(0.0000)	(0.0000)

*Source: Author's compilation*

The ADF test results at level and at 1<sup>st</sup> difference where it authenticates that Treasury bill is stationary at levels [I (0)] and Gold PRICE, NIFTY50 & USDOLLAR are stationary at 1st difference [I (1)] as shown in table 4.1 above, because test statistics are less than critical value at 1% level of significant both in the intercept without trend and intercept with trend.

**\*Hence reject null Hypothesis (Ho) and accept the alternative Hypothesis (H1)**

- (a) Lag selection for ADF test is automatic based on SIC (Schwartz Information Criterion)
- (b) MacKinnon (1996) one-sided p values are less than 0.05 i.e. significant for rejection of Hypothesis of unit root.
- (c) Test t values are more than 1.96 i.e. significant at for 1%, 5% and 10%.

### Descriptive Statistics

The arithmetic average measures the central tendency. The purpose of computing an average value for a set of observations is to obtain a single value, which is representative of all the items. It measures the total risk from the average return. It depicts the 'quality rating' of an average Correlation.

**Table 2**  
**Descriptive Statistics**

Markets	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	kurtosis
Government Securities (Treasury bill)	6.825864	7.300000	15.25000	0.100000	2.070669	-0.261647	4.223549
Commodity Market(Gold Price)	0.000497	0.000463	0.071273	-0.094954	0.012473	-0.395667	7.839444
Equity Market (NIFTY 50)	0.000498	0.000820	0.163343	-0.130142	0.015495	0.010060	11.88727
Forex Market (USD Exchange rate)	0.000157	0.000000	0.040200	-0.030065	0.005103	0.202720	8.000144

Author's Compilation

Table 2 shows all the selected variables i.e. Nifty 50, Treasury bill, Exchange rate and Gold price have shown a positive mean over the period of study. The mean of the selected variables varies between 0.00015 percent to 6.8258 percent. Variables have registered a minimum mean positive growth of 0.00015 percent and Treasury bill has depicted a highest mean positive growth of 6.8258 percent. It is observed that the standard deviation i.e. risk of the Treasury bill, Gold price, Nifty 50 and US exchange rate ranges between 0.0051 and 2.0706. Analysis reveals that total risk is highest for Treasury bill (2.0706) followed by Nifty 50 (0.0154), whereas it is very little standard deviation for US dollar (0.0051). Hence, on the basis of standard deviation of the selected variables, it is observed that Treasury bill is most volatile and US dollar is least volatile among the selected variables. Treasury bill and Gold

price are both negatively skewed as seen in the table on the other hand; Nifty50 and US dollar are positively skewed. All the variables depicts the distribution is peaked relative to the normal therefore it is leptokurtic.

### Correlation

Is any statistical relationship between two random variables or two sets of data. Correlation refers to any of a broad class of statistical relationships involving dependence, though in common usage it most often refers to the extent to which two variables have a linear relationship with each other.

H<sub>0</sub>: Gold price, exchange rates, Treasury bill and Nifty50 are not correlated in the long period.

H<sub>1</sub>: Gold price, exchange rates, Treasury bill and Nifty50 are correlated in the long period.

**Table 3**

### Correlation matrix

Probability	DLNGOLD_PRICE	DLNNIFTY_50	DLNUS_DOLLAR	TREASURY_BILL
DLNGOLD_PRICE	1.000000 -----			
DLNNIFTY_50	-0.042874 (0.0272)	1.000000 -----		
DLNUS_DOLLAR	0.098208 (0.0000)	-0.304589 (0.0000)	1.000000 -----	
TREASURY_BILL	-0.032100 (0.0982)	-0.040715 (0.0359)	0.031313 (0.1067)	1.000000 -----

Source: Authors Compilation

Table 3 depicts the correlation between Nifty 50, Treasury bill, Exchange rate and Gold Price. It is noted that there is high positive Correlation between the US Dollar and Treasury bill ( $r = 0.1067$ ). There is least correlation between US dollar and Gold price ( $r = 0.0000$ ) and US dollar and Nifty 50 ( $r = 0.0000$ ). Above table indicates there is negative correlation between Gold price and Nifty 50 ( $-0.04287$ ) as well as between Gold price and Treasury bill ( $-0.03210$ ). There is positive correlation between Gold price and US dollar ( $0.09820$ ) There is

negative correlation between US dollar and Nifty 50 (-0.3045) as well as between Treasury bill and Nifty 50 (-0.04071). There is positive correlation between US dollar and Treasury bill (0.0313).

### Granger Causality Test

The procedure for testing statistical causality between exchange rates, Nifty 50, Treasury bill and Gold prices a direct “Granger-causality” test proposed by C. J. Granger in 1969. Granger causality may have more to do with precedence, or prediction, than with causation in the usual sense. It suggests that while the past can cause/predict the future, the future cannot cause/predict the past.

**Table 4**

### Granger Causality Test

Null Hypothesis	F- Stats	Probability	Decision
DLNNIFTY_50 does not Granger Cause DLNGOLD_PRICE	0.91505	0.4828	Accepted
DLNGOLD_PRICE does not Granger Cause DLNNIFTY_50	2.28139	0.0336*	Rejected
DLNUS_DOLLAR does not Granger Cause DLNGOLD_PRICE	1.49864	0.1745	Accepted
DLNGOLD_PRICE does not Granger Cause DLNUS_DOLLAR	3.83140	0.0008*	Rejected
TREASURY_BILL does not Granger Cause DLNGOLD_PRICE	1.08417	0.3694	Accepted
DLNGOLD_PRICE does not Granger Cause TREASURY_BILL	1.58065	0.1486	Accepted
DLNUS_DOLLAR does not Granger Cause DLNNIFTY_50	2.10963	0.0492*	Rejected
DLNNIFTY_50 does not Granger Cause DLNUS_DOLLAR	24.4693	2.E-28*	Rejected
TREASURY_BILL does not Granger Cause DLNNIFTY_50	1.70087	0.1167	Accepted
DLNNIFTY_50 does not Granger Cause TREASURY_BILL	3.23120	0.0036*	Rejected
TREASURY_BILL does not Granger Cause DLNUS_DOLLAR	1.27514	0.2652	Accepted
DLNUS_DOLLAR does not Granger Cause TREASURY_BILL	1.82997	0.0895	Accepted

\*Denotes significant at 5 % level of significance

Source: Author’s compilation

Table 4 reveals the results from the granger causality test. The results and decision of granger causality test. The null hypotheses are rejected in case the p values are less than 0.05. On the other hand, in case the p values are more than 0.05, the null hypothesis is accepted. The test is done making the variables stationary using ADF test at difference. To find the cause and effect relationship between the variables. Gold price granger cause on Nifty 50 as results shows significant (p- 0.0336) but Nifty 50 does not granger cause Gold price. Gold price granger cause US dollar as results shows highly significant (p-0.0008) but US dollar do not granger cause Gold price. US dollar granger cause Nifty 50 as results shows significant (0.0492) and also Nifty50 granger causes US dollar and it is highly significant (0.0000). Nifty 50 granger cause Treasury bill as results shows significant (0.0036) but Treasury bill do not granger cause Nifty 50.

## CONCLUSION

India is one of the emerging economies, which have witnessed significant development in the stock markets during the recent periods due to the liberalization policy initiated by the government. This study makes an approach to examine whether there is any integration of Capital Market, Commodity Market, Government Securities Market and Forex Market.

As per results shown in trend analysis, which represents that among four financial variable i.e. Nifty50, Treasury bill, US dollar and Gold price. Treasury bill depicts highly volatile pattern and in case of Nifty 50, gold price and Exchange rate (US dollar) it depicts increasing volatility trend.

The primary finding of the present study is that selected four financial market variables i.e. Nifty50, Gold price and US dollar are stationary time series data at I (1) and in case of Treasury bill it is stationary time series data at I (0).

According to descriptive statistics Gold and dollar are positively related, when dollar price increases, the gold price appreciates. Nifty50 and Gold are negatively related, when Nifty 50 price increases Gold price decreases. As in case of Treasury bill rate it has inverse relation with Gold price i.e. if the Treasury bill rate increases Gold price decreases. Nifty 50 has negative relation with US dollar and Treasury bill, which means if Nifty50 price increases US dollar and Treasury will decrease. US dollar and Treasury bill have positive relationship.

From the results of Granger Causality Test it is concluded that there is cause and effect relationship among the variable, Gold price to Nifty 50 and US dollar this shows there is unidirectional cause and effect. Between Exchange rate (US dollar) and Nifty50 there is bidirectional cause and effect. There is unidirectional cause and effect in cause between Nifty50 and Treasury bill rate. This indicates that Treasury bill rate is not having any cause and effect relation with other market i.e. Capital market (Nifty50), Commodity Market (Gold price), Forex Market (US dollar).

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