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A STUDY ON THE DYNAMIC INTERPLAY BETWEEN STOCK MARKETS AND FOREX MARKETS IN INDIA

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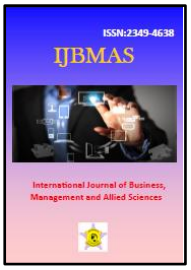

ABSTRACT

In the backdrop of liberalisation and market driven practices of the Indian Economy that are resulting in much expected integration of financial markets with other macroeconomic sectors, this study examines the dynamic relationship between Stock Markets and Forex Markets by considering weekly closing nifty fifty values with that of weekly closing prices of US Dollar rates from January 2012 to November 2017.The study was conducted by applying econometric tools such as ADF Test for Stationarity and Granger Causality Test and it was found that there is Unidirectional causality running from Stock Markets to Forex Markets in India

Key Words: Linear feedback, , Stationarity, ADF Test, Lead lag, Granger Causality Test

1. INTRODUCTION

Globalization and financial sector reforms in India have opened up a sea change in the financial performance of the economy. In the post liberalisation scenario, the influences of the financial markets and their inter relationships with other macro sectors have assumed significant importance. Since the inception of the financial sector reforms in the beginning of 1990's, the implementation of various reform measures have brought in a dramatic change in the functioning of the financial sector of the economy. Stock Markets, in any part of the world are susceptible to influences such as enterprise performance, dividends, stock prices of other countries, gross domestic product, exchange rates, interest rates, current account, money supply, employment, their information etc and are more dynamic to these factors in developing countries such as India.

Further the interdependence or causality as the case may be, between stock markets and exchange rates has recently preoccupied the minds of economists, for theoretical and empirical reasons, since they both play important roles in influencing the development of a country's economy. As per the theoretical perspectives, Exchange rate changes directly influence the international competitiveness of firms, given their impact on input and output price . Basically, foreign exchange rate changes influences the value of the firm since the future cash flows of the firm change with the fluctuations in the foreign exchange rates. Exchange rates can affect stock prices not only for

multinational and export-oriented firms but also for domestic firms. For a multinational company, changes in exchange rates will result in an immediate change in value of its foreign operations as well as a continuing change in the profitability of its foreign operations reflected in successive income statements. Therefore, the changes in economic value of firm's foreign operations may influence stock prices. (Agarwal et al 2010)

In Indian scenario, Stock Exchanges in India are fully automated, order driven and real time screen based system. The country has made rapid strides towards transparent and highly regulated yet effective delivery and settlement system with BSE and NSE taking the leading role in stock market operations and in the Exchange rate sector until 1973, the Indian rupee followed a fixed exchange rate regime wherein the rupee was pegged to the pound sterling. With the breakdown of the Bretton Woods system in the early 1970s, India switched over to a system of managed exchange rates. Liberalization has radically changed India's foreign exchange sector. Since 1991, the rigid four-decade old, fixed exchange rate system replete with severe import and foreign exchange controls and a thriving black market is being replaced with a less regulated, "market driven" arrangement. While the rupee is still far from being "fully floating", the nature of intervention and range of independence tolerated have both undergone significant changes. With an over-abundance of foreign exchange reserves, imports are no longer viewed with fear and scepticism. The Reserve Bank of India and its allies now intervene occasionally in the foreign exchange markets not always to support the rupee but often to avoid appreciation in its value

In this backdrop the present study is an attempt to analyze the causal or lead lag relationship between stock price movements and exchange rate fluctuations in India. The analysis on stock markets has come to the fore since this is the most sensitive segment of the economy and it is through this segment that the country's exposure to the outer world is most readily felt. This paper examines how changes in exchange rates and stock prices are related to each other over the period 02/01/2011 to 31/03/2017. The organization of the paper is done as follows: Section 2 contains a brief literature review. Methodology and empirical results are presented in Section 3 and 4 respectively. Concluding remarks take place in Section 5.

2. REVIEW OF LITERATURE

The dynamic linkage between exchange rate and stock prices has drawn the attention of researchers and practitioners since the early twentieth century. From an empirical perspective, a substantial academic and professional literature, especially in the developed and developing countries, explores the interaction between exchange rate and stock prices.

Murinde(1997) used data from 1985 to 1994, giving results for India, Korea and Pakistan that suggested exchange rates *Granger cause* stock prices. But, for the Philippines the stock prices lead the exchange rates. In 1998, Ajayi et al. investigated the causal relations for seven advanced markets from 1985 to 1991 and eight Asian emerging markets from 1987 to 1991 and supported unidirectional causality in all the advanced economies but no consistent causal relations in the emerging economies. They explained the different results by the differences in the structure and characteristics of financial markets between these groups.

Pan et al. (2007) employed data of seven East Asian countries over the period 1988 to 1998, proving bidirectional causal relation for Hong Kong before the 1997 Asian crises and unidirectional causal relation from exchange rates and stock prices for Japan, Malaysia, and Thailand and from stock prices to exchange rate for Korea and Singapore. During the Asian crises, only a causal relation from exchange rates to stock prices is seen for all countries except Malaysia. Contemporarily, Erbaykal and Okuyan studied 13 developing economies, using different time periods and indicated causality relations for eight economies-unidirectional from stock price to exchange rates in the five of them and bidirectional for the remaining three.

There are a lot of studies in Indian context as well. Most of the Indian studies find either no evidence or insignificant evidence of exchange rate influencing stock prices. Mishra (2004) examines

the dynamic relationship between the Indian stock market and foreign exchange markets for the period April 1992 to March 2002. The major findings of their study include that there is no Granger causality between the exchange rate fluctuation and stock return. Reddy and Sebastin (2008) make an attempt to study the interaction between the stock price and the foreign exchange markets in India by using daily data on Nifty and the exchange rate from November1995 to March 2007. The result reveals that there exist a low level of interaction between the stock prices and the forex markets of India Singh (2010), Naik (2013) and Naik and Padhi (2012) examine the relationships between the Indian stock prices and exchange rate and do not find any significant relationship between exchange rate and stock prices in India. Few studies have found co-integrating relationship

Similarly, the findings of Pal and Mittal (2011) and Sampath (2011) also reveal that exchange rate has a significant impact on stock prices in long-run as well as in short run. Padhan (2011) analyzed the determinants and stability of money demand functions, Unidirectional Granger causality was found from GDP and Stock Prices to monetary, new monetary as well as liquidity aggregates. Agarwal,Srivatsava and Srivatsav(2010) analyzed the relationship between Nifty returns and Indian rupee-US Dollar Exchange Rates from October, 2007 to March, 2009 using daily closing indices and examined the causal relationship between the two variables using Granger Causality test that highlighted unidirectional relationship between Nifty returns and Exchange Rates, running from the former towards the latter.

3. DATA & METHODOLOGY OF THE STUDY

The present study aims at exploring and analysing the causal relationship between stock markets and exchange markets in India

We have considered the index values of NIFTY FIFTY to be the representative of stock markets and US Dollar rate as shown in Indian Rupees as a proxy to Exchange markets. We have chosen the frequency of weekly closing prices of both NIFTY and US Dollars for a period of 7 years i..e from 01 January 2012 to 13 November 2017 and the same has been obtained from Data has been taken from Yahoo! Finance(www.yahoofinance.com) and Oanda, the currency site, (www.oanda.com/convert/fxhistory).

Further the Data has been converted into natural logarithm form and has been employed for the study Following Econometric tools are used to test the data under study and subsequently to draw inferences about the behaviour and dynamics of the two variables .These tests were conducted with the aid of Eviews software (version 7.0).

3.1 Unit Root Test

Broadly speaking a data series is said to be stationary if its mean and variance are constant (non-changing) over time and the value of covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed [Gujarati (2003)].

In order to test for the existence of unit roots, and to determine the degree of differencing necessary to induce stationarity, we have applied the *Augmented Dickey –Fuller test* (ADF Test).Given an observed time series $Y_1, Y_2, \ldots, Y_N$ Dickey and Fuller consider three differential-form autoregressive equations to detect the presence of a unit root:

$$(1) \qquad \Delta Y_t = \gamma Y_{t-1} + \sum_{j=1}^{p} \left(\delta_j \Delta Y_{t-j} \right) + e_t$$

$$(2) \qquad \Delta Y_t = \alpha + \gamma Y_{t-1} + \sum_{j=1}^{p} \left(\delta_j \Delta Y_{t-j} \right) + e_t$$

$$(3) \qquad \Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{j=1}^{p} \left(\delta_j \Delta Y_{t-j} \right) + e_t$$

where:

- t is the time index,

- α is an intercept constant called a drift,
- β is the coefficient on a time trend,
- γ (gamma) is the coefficient presenting process root, i.e. the focus of testing,
- p is the lag order of the first-differences autoregressive process,
- e_t is an independent identically distributed error/ residual term.

The difference between the three equations concerns the presence of the deterministic elements α (a drift term) and βt (a linear time trend). The focus of testing is whether the coefficient γ equals to zero, what means that the original $Y_1, Y_2, \dots, Y_N$ process has a unit root; hence, the null hypothesis of γ = 0 or ρ=1 (random walk process) is tested against the alternative hypothesis γ < 0 which signifies the given series is stationary.

3.2 Granger Causality Test

According to the concept of Granger's causality test (1969, 1988), a time series X_t Granger-causes another time series Yt if series Yt can be predicted with better accuracy by using past values of X_t rather than by not doing so, other information is being identical. If it can be shown, usually through a series of F-tests and considering AIC on lagged values of X_t (and with lagged values of Y_t also), that those X_t values provide statistically significant information about future values of Yt time series then X_t is said to Granger-cause Yt i.e. X_t can be used to forecast Yt. The pre-condition for applying Granger Causality test is to ascertain the stationarity of the variables in the pair. Engle and Granger (1987) show that if two non-stationary variables are co-integrated, a vector auto-regression in the first differences is unspecified. If the variables are co-integrated, an error-correcting model(VECM) must be constructed. In the present case, Granger causality test is applied at the first difference of the variables. The second requirement for the Granger Causality test is to find out the appropriate lag length for each pair of variables. For this purpose, we used the programme specified lag order given by Eviews.

Since the time series of stock index and exchange rates is non-stationary, they are converted into stationary form or I(0) from the ADF test,and then Granger Causality test is performed as follows:

$\Delta Ln\ USD_t = \sum_{i=1}^{n} \alpha \Delta\ LnUSD_{t-1} + \sum_{j=1}^{n} \beta_j\ \Delta Ln\ NF_{t-j} + u_t$ ..... (3.2.1)

$\Delta Ln\ NF_t = \sum_{i=1}^{n} \lambda \Delta Ln\ NF_{t-j} + \sum_{i=1}^{n} \delta\ \Delta\ LnUSD_{t-1} +$ .....(3.2.2)

Where n is a suitably chosen positive integer; j = 0, 1… k are parameters and α β λ δ's are constant; and Ut's are disturbance terms with zero means and finite variances.

($\Delta Ln\ NF$is the first difference at time t of NIFTY FIFTY and $\Delta Ln\ USD_t$ is the first difference of USD exchange rate)

4. PRESENTATION AND INTERPRETATION OF EMPIRICAL RESULTS

As discussed in the above section, as a first step Unit Root Test was done on the two variables and the results are as follows

4.1 ADF TEST ON LEVEL VARIABLES

Table 4.1.1

		Log NIFTY FIFTY		Log USD EX	
		t-Statistic	Prob.*	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.628813	0.8605	-1.07196	0.7273
Test critical values:	1% level	-3.455585			
	5% level	-2.872542			
	10% level	-2.572707			

*MacKinnon (1996) one-sided p-values.

4.2 ADF TEST ON FIRST DIFFERENCES

Table 4.2.1

		Log D (NIFTY FIFTY)		Log D(USD EX)	
		t-Statistic	Prob.*	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.28975	0.0000	-14.7053	0.0000
Test critical values:	1% level	-3.455585			
	5% level	-2.872542			
	10% level	-2.572707			

*MacKinnon (1996) one-sided p-values.

4.3 INTERPRETATION OF ADF TEST RESULTS

As it can be seen from Table 4.11 the Null Hypothesis for both the variables cannot be rejected as the test statistic value of-0.628813 for NIFTY and-1.071961 for USD EX is higher than the ADF test critical value -2.872545 at 5% level of significance

Therefore we can conclude that Nifty and USD EX series are Non-Stationary in their level form.

Further these variables were subjected to First Differences as shown in Table 4.2.1 and the Null Hypothesis for both the variables is rejected as ADF test statistic value -10.28975 for NIFTY and USD EX -14.70533 is lesser than the critical value -2.872545 at 5% level of significance.

Hence we conclude that the variables are stationary in their First Differences

4.4 GRANGER CAUSALITY TEST

In the next stage Granger Causality Test was applied for the Log Differenced Series of both variables by applying the above mentioned equation (3.2.1) and (3.2.2) respectively and found that there is Unidirectional Causality from NIFTY to USD EX as the Null Hypothesis that USD EX granger causing NIFTY cannot be rejected at 5% significance level and holds good and the result Null Hypothesis that NIFTY granger causing USD EX is rejected at 5% significance level and the result was further verified by applying the test year wise and individual results support the summary result of NIFTY granger causing USD EX .Therefore we can conclude that NIFTY granger causes USD EX and USD EX does not granger causes NIFTY.

Table 4.4.1

Sample: 1/03/2012 to 11/07/2017

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LD_USDEX_NA does not Granger Cause LD_NIFTYFIFTY_NA	256	1.12705	0.3256
LD_NIFTYFIFTY_NA does not Granger Cause LD_USDEX_NA		44.6053	3.E-17

Table 4.4.2

Sample: 1/03/2012 12/26/2012

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LD_USDEX_NA does not Granger Cause LD_NIFTYFIFTY_NA	50	1.00843	0.3729
LD_NIFTYFIFTY_NA does not Granger Cause LD_USDEX_NA		12.2040	6.E-05

Table 4.4.3
Sample: 1/02/2013 12/31/2013
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LD_USDEX_NA does not Granger Cause LD_NIFTYFIFTY_NA	53	0.69536	0.5039
LD_NIFTYFIFTY_NA does not Granger Cause LD_USDEX_NA		13.7110	2.E-05

Table 4.4.4
Sample: 1/07/2014 12/30/2014
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LD_USDEX_NA does not Granger Cause LD_NIFTYFIFTY_NA	52	1.23781	0.2993
LD_NIFTYFIFTY_NA does not Granger Cause LD_USDEX_NA		5.77532	0.0057

Table 4.4.5
Sample: 1/06/2015 12/29/2015
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LD_USDEX_NA does not Granger Cause LD_NIFTYFIFTY_NA	52	2.18439	0.1238
LD_NIFTYFIFTY_NA does not Granger Cause LD_USDEX_NA		8.04817	0.0010

Table 4.4.6
Sample: 1/05/2016 12/07/2016
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LD_USDEX_NA does not Granger Cause LD_NIFTYFIFTY_NA	48	2.88354	0.0668
LD_NIFTYFIFTY_NA does not Granger Cause LD_USDEX_NA		6.47700	0.0035

5. CONCLUSION

The present study focussed on the dynamic linkage between Stock Markets and Forex Markets in India. The estimated results indicate that there exists a Unidirectional linear feedback from Stock Markets to Forex Markets. Evidence of this study provides a comprehensive understanding of the relationship among the macroeconomic
variables in India and the informational efficiency of these two markets in India
This study is expected to offers some insights for financial regulators, and policy makers for formulating economic and financial policies. The sense of this inter-relationship is also useful to Academicians who can further probe the untapped areas of the study. The possible extension of this study is to consider the impact of Stock volatility on exchange rate along with modelling of the relationship which will definitely help in forecasting of the exchange rates on the basis of stock market volatility
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