The Relationship between Exchange Rate & Stock Prices: Evidence from the Indian Market

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Abstract

The study investigates the relation between exchange rate Rs/$ and stock prices in India. S and P Bombay Stock Exchange 500 index is considered as an indicator for Stock Exchange while average exchange rate returns of Indian Rupee versus Dollar is taken as proxy for Exchange rate. Johansen's co-integration and Granger causality test have been used to identify the long-run and short-run equilibrium relationship between the exchange rate and the stock price from 2007-2017. The study reveals that there is no long term co-integrated relationship between the two financial variables. However, the causality runs from the stock market to exchange rate confirming the portfolio approach. This relation between the exchange rates and stock prices corroborates that volatility of exchange rate in Foreign exchange market is caused by the inflow and out flow of foreign portfolio investment in India. Economic effect of the volatility of exchange rate is borne by the private corporate having foreign exposure in terms of erosion of Firm value.

Keywords: *Exchange rate, Stock Prices, Granger causality, Johansen Co-integration.*

Introduction

Researchers on international finance and macro-economics have given a lot of importance to the linkage between stock price and exchange rate. From the research outlook the study becomes important as the interdependence between the two financial markets has strengthened in the context of globalization. Asian financial crisis (1997-98) and the subprime crisis (2007-2009) have made a strong ground for studying the dynamic relation between the exchange rate and the stock price. During these periods of crises, the emerging markets collapsed due to a fall in stock prices and depreciation of their respective exchange rates (in terms of US$). Resultant unstable economic environment, there was huge out flow of portfolio funds from emerging market leading to further crash of the exchange rate

triggering global economic crisis.

Indian Stock market has evolved after the financial sector reforms of 1993. Unified exchange rate system was introduced in India (1993) with decontrolling the exchange rate India in 1994. Over the years India has achieved current account convertibility and slowly moving toward capital account convertibility. The introduction of American Depository Receipts (ADR's) or General Depository Receipts (GDR's) has facilitated overseas investment. In this background, this study attempts to re- examining the relationship between foreign exchange of Indian Rupee vis-a-vis Dollar and stock market price index in India from 2007-2010.

Theoretical Frame work

Exchange rate fluctuation results in uncertainty of cash flows to the firm. The firm value is the present value of future cash flow; thus when the cash flow is variable, firm value can not be stable. Foreign Exchange exposure increases the sensitivity of the

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firm value with respect to the exchange rate changes. Economic exposure arises when a firm's earning and cost are denominated in foreign currency (Alder & Dumas, 1984). Economic currency exposure includes both translation exposure and Transaction Exposure. Accounting based translation exposure arises when firms have foreign operations. At the time of consolidation of assets, the balance sheet is affected by the fluctuation in exchange rate. Fluctuation in the value of contract arising due to exchange rate movements is referred to as Transaction exposure.

There are two approaches which link the two financial variables-Exchange rate and stock prices. The traditional approach or the flow model (Dornbush & Fischer, 1980) is based on the perspective that exchange rate is affected by the country's current account balance or trade balance. If the domestic currency depreciates, the local firm becomes more competitive making the export cheaper in the international trade. High export leads to higher profit of the company thereby increasing the value of stock. Alternatively, appreciation of the domestic currency makes the domestic product expensive. As a result, the foreign demand of the product falls down. This leads to fall in the value of stock prices. On the contrary, according to Stock approach the causality runs from the stock market to Exchange rate. A consistent increase in stock price will attract inflow of foreign capital. This leads to the excess demand of home currency thereby leading to the appreciation of home currency. However a fall in the stock prices leads to decrease in the wealth of the domestic investor. The demand of domestic currency falls leading to decrease in interest rate. This further causes outflow of funds from the country resulting in the depreciation of the home currency.

Review of Literature

Mohsen & Sohrabian (1992) used the co-integration and causality test on S and P 500 index and effective exchange rate dollar in US. Data from 1973-1988 were analysed to prove the interactive relationship between Stock Prices and Exchange rate in short run. However, the study fails to establish any long run relation between the two variables. Ratner (1993) studied the US world market from 1973- 1989. Monthly data for Stock market index and exchange rate for France, Canada, West Germany, Italy, Japan and UK were used for regression and co-integration tests on the residuals of regression coefficients to prove that US stock price and foreign exchange rate were not connected. Granger, Huang, & Yang(2000) Studied on the basis of data on Asian Flu for the period (1986-1998) to understand the Granger relation between the exchange rate and stock price. Using daily data on Gregory and Hansen co-integration test, the authors documented that there was no co-integration between exchange rate and stock prices in the long run. Ibrahim (2000) applied monthly data from 1990 to 1996 to bivariate and multivariate co-integration and causality procedure on the real exchange rate, Nominal exchange rate and RM/US$ of Malaysia and Stock Market Index. The test revealed that there was no long run relation between the exchange rate and the Stock Prices. Studying the equilibrium relation between Stock prices and Exchange rate in Singapore asset market, Wu (2000) used Weekly data (1991-200) on VECM. The study revealed that asymmetry relationship existed between the two variables. The study founds support in traditional theory where appreciation of Singapore's currency against Us $ and Malaysian ringgit, depreciation against Japanese yen and Indonesian Rupiah had positive long run effect on the Stock Market. Srinivasan (2011) explored the relation between NSE Nifty share price index and important macro-economic variables like industrial production, exchange rate, money supply, interest rate, consumer price index, and US stock price index. Using quarterly data from 1991-2010 on

Johansen and Juselius multivariate co-integration technique and causality test, the study pointed out that NSE nifty share price index has a negative relation with exchange rate changes.

Research Objective & Methodology:

Augmented Dickey-Fuller (1979), (ADF), is used to check the properties of time series data. This test checks the stationarity of data. It points out the order of integration of each variable. It helps us to avoid spurious result which may arise due to non-stationarity of data by testing for a stochastic trend. ADF-Augmented Dickey fuller Test is used to detect if a particular variable has a unit root or not.

1. $\Delta Yt = B1 + zYt\text{-}1 + \alpha i + et$ –Intercept only

2. $\Delta Yt = B1 + B2t + zYt\text{-}1 + \alpha i + et\text{-}$ – Trend and Intercept

3. $\Delta Yt = zYt\text{-}1 + \alpha i + et$ - no trend and no intercept.

Where $Y_{t\text{-}1}$ is a macro variable like exchange rate or stock prices.t is a trend variable and et is a white noise term. The null hypothesis is that variable is non-stationary or has a unit root. H0: $\rho=1$. The null hypothesis is rejected if the probability is less than 5%. Hence we accept the alternative hypothesis. The alternative hypothesis is that variable is stationary or it does not have a unit root. H0:$\rho\neq1$

Causality: The short term association between the two variables is checked through (Granger C.J., 1969) Xt series is said to Granger-cause Y_t series if Y_t can be predicted with greater precision using past values of X_t.

The following equation is used to check the casual relationship between X_t and Y_t series.

$$Y_t = \alpha_0 + \sum_{k=1}^{p} a_k Y_{t\text{-}k} + \sum_{k=1}^{p} \beta_k X_{t\text{-}k} + u_t$$

$$X_t = \varphi_0 + \sum_{k=1}^{p} \varphi_k Y_{t\text{-}k} + \sum_{k=1}^{p} \Phi_k X_{t\text{-}k} + v_t$$

$\alpha 0$, αk and $ßk$ are constants; and ut and vt usual orthogonal disturbance terms with zero means and finite variances NIID(0,1). If the Σ $ßk = 0$ then it can be concluded that null hypothesis is accepted. i.e Xt does not Granger-cause Yt is accepted. Similarly Yt does not granger cause X is accepted if Σ $\varphi =0$.

Please note that the Granger Causality test can only be applied to stationary data. If the, underlying data are non-stationary, it has to be transformed into stationary series by taking its first difference. The causality test may then be applied to the transformed series.

Under Johansen's co-integration test Maximum likelihood procedure is used to check the presence of the co-integrating vectors. Maximum eigenvalue statistic and the trace statistic are compared with the critical values. If the maximum eigenvalue statistic and the trace statistic are greater than the critical values, co-integration is present .Also if the probability is greater than 5% the null hypothesis -that there is no co-integrating equation is accepted. However the the null hypothesis is rejected if the probability is less than 5%.

Data and Analysis

Data for Indian stock indices (BSE) and the INR-USD exchange rate is analyzed from 1st April 2004 to Dec 2017. Monthly observations of Bombay Stock Exchange are collected from www.nseindia.com, www.bseindia.com. While historical data on INR-US dollar exchange rate is collected from the RBI site. We have used monthly data of S and P 500 Bombay Stock Exchange and the exchange rate (expressed in Indian Rupee per U.S. dollar for the period April 2004 to December 2017. SE is used as an abbreviation for chosen stock price index and ER for exchange rate respectively. Returns on both stocks and Exchange rate are defined as differences between price of previous year and the current year(Pt-1–Pt, Pi stands for price of the ith year.)

Preliminary Analysis

The Granger Causality test requires data to be stationary otherwise the conclusions from the F-statistic might be spurious because the test statistics will have nonstandard distributions. Thus in order to check the stationarity of the series ADF test is used.

Data Interpretation & Analysis

Table 1 (in Appendix) shows the basic statistics that helps us to define the monthly data of Bombay Stock Exchange and Exchange rate for a period of April 2007 to Dec 2017. The descriptive statistics reveal that the average value of dollar for the period under study is Rs. 54.33751. The highest value that the dollar has attained in the given period is Rs. 68.23770 with the lowest of Rs,39.37370. The range between which the dollar has moved is 28.864. The difference between the maximum and minimum value indicating a high level of fluctuation in the exchange rate series. Similarly the average price of BSE is 8245.351. The range over which stock prices varied, is 11770.62 (15002.73-3232.110).This indicates a large fluctuations in the stock market. Skewness measures the asymmetrical distribution of data. Zero Skewness value indicates distribution is normal. The above analysis indicates that dollar value is negatively skewed which means there is a greater tendency of dollar to fall. On the contrary stock market is positively skewed which reveal that there is a tendency of the stock market value to increase.

Table2 (in Appendix) check the stationarity of data. ADF test reveals that that both the financial variables exchange rate and stock prices are non-stationary at level. However, when the test is applied at the first level, the variables are found to be stationary. This level of data is then used to check the long run relation between the variables using Johansen Co-integration Test. The Eigen value and the trance value suggest that Stock exchange and Exchange rate are not co-integrated in the long run. The Granger causality test reveals a unidirectional flow of information from the stock market to the exchange rate there by confirming the portfolio approach. It confirms to the fact that India attracts a lot of Foreign Investment including Foreign Institutional investment and Foreign Portfolio Investment. Thus it is this injection and withdrawal of investment in the Indian economy which causes fluctuation in the exchange rate.

Conclusion

In this study, we examine the dynamic linkages between the foreign exchange and stock markets for India. Our study confirms the theoretical relationship between two variables. It was found that causality runs from S and P 500 Bombay Stock Exchange to exchange rate there by confirming the portfolio approach. Due to financial market reforms, expansion of private corporate sector and their participation in the stock market, India has been attracting substantial Foreign Portfolio Investment. Whenever there is influx of investment in the stock market, the exchange rate appreciates while when there is a withdrawal of investment, the exchange rate depreciates. Moreover, there is a lot of volatility in the foreign investment in India. The net Foreign Portfolio investment in 2016-2017 April to January (-2933$ million). However during 2017-2018 April to January India witnessed a net inflow of 23,347$ million. This volatility in exchange rate caused by stock price index has further implication on current account balance, money supply, inflation and growth. While for investors, the return on their portfolio is dependent upon the correlation between Exchange rate and Stock prices. For the firm the exposure of firm value to exchange rate uncertainty remains uncertain. This is one of the key issues in International Finance that the private corporate with foreign market exposure needs to take into consideration.

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Appendix

Table 1: Descriptive Statistics

	Rupees (Rs) Per US $	Stock Market (S and P BSE index)
Mean	54.33751	8245.351
Median	54.37570	7385.250
Maximum	68.23770	15002.73
Minimum	39.37370	3232.110
Standard deviation	9.281093	2642.994
Skewness	-0.019090	0.536540
Kurtosis	1.536448	2.661022
J-B	11.52101	6.806930
Probability	0.003150	0.033258
Sum	7009.539	1063650
Square Deviation	11025.75	8.94E+08
Observation	129	129

Table 2: Unit Root test of Exchange Rate-ADF

Dollar	Difference	Critical value at 5%	t-statistics	Probability
ADF (No Trend)	Level	-2.884291	-1.224163	0.6627
ADF (No Trend)	First Difference	-2.884291	-8.581407	0
ADF (With Trend)	Level	-3.445590	-2.328586	0.4153
ADF (With Trend)	Level	-3.445590	-8.565241	0

Table 3: Unit Root test of Stock Exchange-ADF

Stock Market	Difference	Critical value at 5%	Statistics	Probability
ADF (No Trend)	Level	-2.884291	0.333644	0.9792
ADF (No Trend)	First Difference	-2.884291	-10.67811	0
ADF (With Trend)	Level	-3.445590	-1.500635	0.8246
ADF (With Trend)	Level	-3.445590	-12.13529	0

Table 4: Johansen Co-integration test

Co-integration Test	Eigen value	Trance	Critical Values	Probability
None	0.061961	8.113594	15.49471	0.4533
At most 1	0.001468	0.182123	3.8411466	0.6696

Table 5: Causality Test

Granger causality	Observation	F statistics	Probability
Stock does not causes dollar	126	3.58250	0.0308
Dollar does not cause stock	126	0.89919	0.4096

Figure 1: Monthly Volatility of returns on Exchange rate (Rupees per US Dollar)
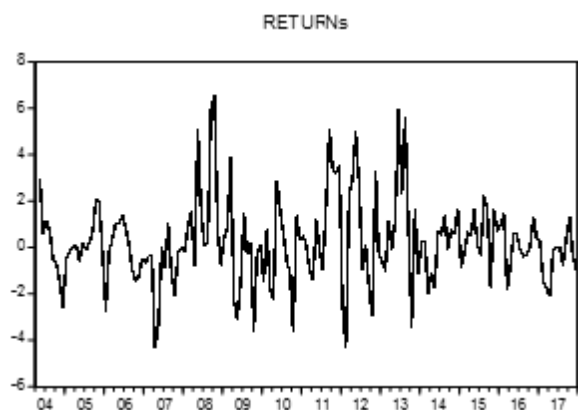

Figure 1: Returns on Exchange rate Series

Figure 2: Monthly Volatility returns of S and P BSE 500 index
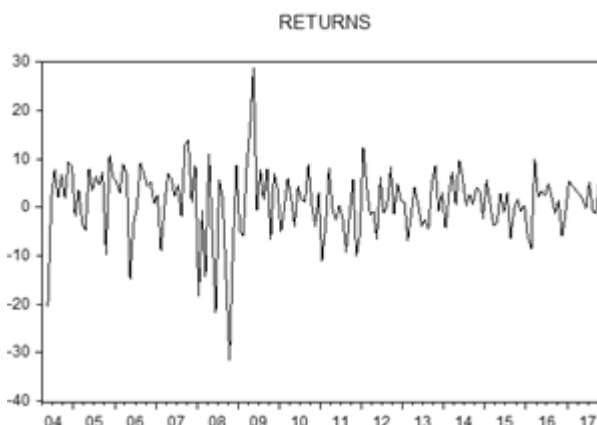
Figure 2: Return on Bombay Stock Exchange