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Relationship among Exchange Rate Fluctuations and stock Market Indices -An Empirical Analysis with Reference to S&P BSE Sensex

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Abstract: The present research work deals with the investigation of the causal relationship among foreign exchange rates and stock market indices (BSE-S&P) in India from January 2006 to December 2016 using the data of daily closing observations of the BSE S&P and the nominal Indian Rupee per US dollar exchange rates. The exchange rate of Indian rupee and US Dollar has been selected for the study, because, US dollar is an important currency for foreign trade. The unit root test, co-integration and granger causality Statistical tools are applied to study the relationship and dynamics of both the variable. The investigation also investigates the impact of both the time series mutually. The results of the study indicate both stock market indices and Exchange Rates are not co-integrated and it is found that there is bidirectional causal relationship among between exchange rate and BSE sensex S& P indices.

Keywords: Stock indices, Exchange rate, Unit root test, co integration and Augmented Dicker Fuller test, Granger causality test.

INTRODUCTION

Exchange rate is important macroeconomic variable for any economy. It affected the growth of economy and capital market. The Volatility in exchange rate affect the life of every citizen. Exchange rate fluctuations influence directly or indirectly many decisions of the organization, working in domestic as well as Global environment. Therefore, survival in global market without understanding the movement of exchange rate is hardly possible. It is important for individual organization for taking important decision to operating in global environment. The study of exchange rate act vital role in hedging decision, target market decisions, financing decisions, capital budgeting decision and earning assessment.

The empirical talk over the linkage among stock prices and exchange rates has been started few years ago. Since then a good number of research studies so far have been conducted to examine the relationship

among the variables. But the researchers have found mix results regarding the presence of relationship and the direction of relationship which has made the area perplex environs of finance literature. Some of the studies claim that there is a significant positive relationship among the variables, like as, Aggarwal (1981), Jorion and Giovannini (1987), and Roll (1992). But some of the studies oppose this argument and showed a significant negative relationship between the variables, such as, Hennigar and Soenen (1988). The other contributor find that there is no significant relationship between the variables, such as, Franck and Young (1972), Solnik (1987), Chow et al. (1997), and Mukherjeeand Bhattacharya (2003). Sohrabian and Bahmani-Oskooee (1992), Lee and Nieh (2001) found no long-run relationship between the variables. So there is no empirical consonance among the researchers regarding the linkage among stock prices and exchange rates which claim the need of more research in this area to accord to the literature.

LITERATURE SURVEY

This study has carried out an earlier literature survey on both developed and emerging economies; to examine on the relationship among exchange rates and stock price return. The literature surveyed can be divided into two categories.

- Research work for developed and other Asian countries
- Research work for the Indian capital Market

Research related with developed and other Asian countries:

Frank and Young (1972) conducted the research to investigate the relationship among exchange rate and stock market return. On the basis of their study they concluded that no relationship exist among two variables.

Aggarwal (1981)studied the linkage among in the United States share prices and the changes in the exchange rate of the US currency Dollar during the period 1974 to 1978 and observe that the share prices and the value of the US currency dollar were strongly positively correlated and the linkage was stronger in the short term than in the long term.

Solnik (1987) examined a negative correlation among real domestic stock price returns and real exchange rates for the duration 1973-1983 by taking eight industrialized countries. They take the various macro-economic variables like exchange rate, interest rate and inflation rate and observed a weak but positive relationship between the variables.

Hanniger and Soenen (1988) investigated the monthly data of share prices and it impact on exchange rate for the period from 1980 to 1986 and they observe a strongly negative association ship among the value of the currency US dollar and the change in stock prices.

Jorion (1991) observe a moderate relation with the rate of return in share prices of the US multinational companies and the rate of change in atrade weighted value of US currency. The study covered the duration between 1971 to 1987.

Libly Rittenberg (1993) applied Granger causality techniques to check the relation with exchange rate and share price levels changes in the country Turkey. He uses the causality test with lag selection under three methods, it was observed that causality runs from price level changes to exchange rates but not in reverse order.

Bodnor and Bartov (1994) conducted the research and concluded that consistent change in the US dollar have negligible power to explain the abnormal stock returns. They also observed that lagged changes in the dollar are negatively connected with abnormal stock returns.

Qiao, YU (1997) examined the causal relationship with stock prices and exchange rates in Tokyo, Hong Kong and Singapore stock market and found bi-directional causal association ship with stock prices and exchange rates for Tokyo stock market. But in Hong Kong market exchange rates changes caused changes in stock prices, no such interaction was found in Singapore market. They applied Granger causality test on daily data covering the duration 1983-1994.

Izan H Y and Li Lian Ong (1999), used non- linear least square method and observe that US share price returns fully affect information conveyed by fluctuations in both French Franc and Japanese Yen with a lag of one month. They observe that depreciation in a country's currency would affect its stock market returns to rise while an appreciation would have reverse effect.

Amare and Mohsin (2000)conducted the research toinvestigate the long run relationship between share prices and exchange rates for selected Asian countries like Taiwan, Singapore, Hong Kong, and japan, Philippines, Thailand, Korea, Indonesia and Malaysia. They use monthly share price from January 1980 to June 1988 and applied co- integration technique. They found long run relationship among share price and exchange rate for Singapore and Philippines.

RESEARCH RELATED ON THE INDIAN CAPITAL MARKET

Abdalla and Murinde (1997) in the year 1997 they investigated on the relationship among exchange rates and stock prices in countries like Korea, India, Pakistan, and Philippines by using Bi- variate Vector Autoregressive models on monthly data of stock price index and real effective exchange rate from the period from January 1985 to July 1994. The study found unidirectional short run causality from exchange rate to stock prices for Pakistan and Korea and a unidirectional long-run association ship for India and Philippines. For country like India it was from exchange rates to stock prices, but for Philippines it was opposite, from stock prices to exchange rates.

Naka et. al. (1998), investigated the relationship ships among macroeconomic variables and Indian stock market. To investigate the relationship among the variables, the fact and figure were analyzed by applying tool like Vector Error Correction Model. On the basis of the finding of this empirical research work researchers concluded that domestic inflation act vital role in Indian stock market performance.

Pathe and Karnik (2000) conducted research to investigate the interaction of Indian stock market and different macro-economic variables like prime lending rate, money supply and industrial production and they observe that there is no long-run stable association ship among stock prices and exchange rate.

Mohammed .N (2000) Investigated the long- run and short run relationship withstock- prices and exchange rates by taking data of four South Asian countries (India, Pakistan, Bangladesh and Sri Lanka) for the duration 1994 to 2000. The researcher applied the Co- integration and error correction model and Standard Granger Causality on monthly data. The study found that there is no long run relationship with stock prices and exchange rates for India and Pakistan. The Granger causality test analysisfound that no short run relationship with the variables.

Apte (2001) conducted the empirical research to examine the relation among volatility of the exchange rate of India by applying the EGARCH model on the daily closing price and exchange rate. The BSE Sensex and NIFTY are taken for the duration 1991 to 2000. The empirical work found an appearance of the spillover from the foreign exchange market to the stock market.

Battacharya et al. (2002) investigated the characteristics of causal associationamong share price, trade balance. Exchange rate and foreign exchange reserves with respect to India from the durationApril 1990 to March 2001 by using co-integration and long-run Granger causality test. The results concluded that there are no causal association among stock prices and the variables.

Nath and Samantha (2003) conducted the empirical research to investigate the casual relationship by using Granger causality test on daily data during the period March 1993 to December 2002. The empirical finding concluded that the two markets did not have any association ship. However, the detailed analysis of the research work did not find any positive association among exchange rate and stock price movements except for the year 1993, 2001 and 2002.

Ahmed (2008), tried to investigate the nature of causal association ship among stock prices and the economic variables. In this study, researchers use quarterly data of exports, Foreign direct investment, index of industrial production, exchange rate, money supply, interest rate, BSE-Sensex and NSE-Nifty in India. The tools like Johansen's Co-integration and Granger causality test were applied to explore the long-run. The study conclude that the fluctuations of stock prices was not only component of macroeconomic variables but it was also one of the reason of fluctuations in any economy.

Pal and Mittal (2011) investigated the association among the Indian stock markets and macroeconomic variables by using quarterly data for the duration January 1995 to December 2008. They applied Johansen's co-integration technique. Their analysis found that there was a long-run association exists among the stock market index and various macroeconomic variables. The research finding showed that inflation and exchange rate have a positive impact on BSE Sensex but interest rate and gross domestic saving were negative impact on sensex.

Dasgupta (2012), conduct an empirical research to investigate the long-run and short-run association among BSE-Sensex and macroeconomic element like Exchange Rate, Call Money Rate, Index of Industrial Production (IIP) and Wholesale Price Index (WPI). In this research work they investigate the association ship among various variables monthly data from April, 2007 to March, 2012. They used various tools for analyzing like descriptive statistics, ADF Test, Granger Causality Test and Johansen & Juselius Co-integration Test. They concluded that at least one Co-integration vector and long-run association among BSE-Sensex with call money and IIP. The Granger Causality Test show that no short-run unilateral or bilateral causal association among BSE Sensex and macroeconomic elements.

DATA AND METHODOLOGY

Research Objective

- To investigate whether any long relationship run exists between Exchange rate (USD/INR) and BSE (S&P) indices.

Research Hypothesis

To achieve the above objectives the following hypothesis is formulated.

H0: There is no significant impact of exchange rate fluctuations on the stock Market Indices.

H1: There is significant impact of exchange rate fluctuations on the stock Market Indices.

Research Design

- The Research work was undertaken to find out the long relationship run exists between Exchange rate (USD/INR) and BSE (S&P) indices. To achieve this objective two important economic variables like stock indices and exchange rates were taken as the subject of study.

Data collection

The research work use daily fact and figure of selected stock market NSE for the period of 10 years from January 2006 to December 2016.

TOOLS AND TECHNIQUES

Unit Root Test

The research work uses the unit root test such as augmented dicker fuller test to test whether the data contains unit root (non-stationary) or is a stationary process. A series is said to be stationary if the mean and auto co-variances of the series do not depend on the time factor.

The unit root test of stationarity is the following.

$$Y^{t} = \alpha + \rho Y t - 1 + ut$$

whereu $\tilde{t}$ I (0) and $-1 \leq p \leq 1$

Where p = 1, then the model became random walk and yt became non stationary or stochastic process.

$$Yt - Yt\text{-}1 = \alpha + \rho\, Yt\text{-}1 - Yt\text{-}1 + ut$$

$$= \alpha + (\rho - 1)\, Yt\text{-}1 + ut$$

it can be rewrite as $\Delta Yt = \alpha + \delta\, Yt\text{-}1 + ut$

Where Δ is the first difference and $\delta = (p\text{-}1)$

If we test the H0 hypothesis that $\delta = 0$ then p=1, it is case of unit root and time series is non stationary.

Augmented Dickey -Fuller Tests

The Augmented Dicker fuller test have three condition and its depend on whether the random walk process may have no drift or it may have drift or it may have drift and deterministic and stochastic trends.

1. without constant or Trent $\Delta Yt = \delta\, Yt\text{-}1 + ut$
2. With constant $\Delta Yt = \alpha + \delta\, Yt\text{-}1 + ut$
3. With constant and Trent $\Delta Yt = \alpha + \beta t + \delta\, Yt\text{-}1 + ut$

Where t is the time or Trent variable

This test is concluded by augmenting the above three equations by adding the lagged values of the dependent

Variable

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \theta_1 \sum_{i=1}^{p} \Delta Y_{t-1} + ut$$

p represent the lag determined. And hypothesis $\delta = 0$ is tested. The condition for unit root test are the following:

- If $|t| \leq$ ADF critical value this point the presence of unit root for the time series.
- If $t >$ ADF critical value this point the reject null hypothesis, it show that unit root does not exist.

Co- integration Test

Co-integration mean statistical property possessed by any time series data that is defined by the idea of stationarity and the order of integration of the time series. A stationary time series is one with a mean value which will not vary with the sampling period.

A series generated by the 1st difference is integrated of order 1 denoted as I(1). Thus, if a time series, is I(0), it is stationary, if it is I(1) then its change is stationary and its level is non- stationary.

Johansen (1988) developed a test for the econometric series to investigate for possible co-integration. The test based on three or more hypothesis depending on number of variables included. In our research work it would have two hypotheses as we have only two variables. The first hypothesis would check whether there is co-integration exists or not. The second would be the existence of at most one co-integrating vector. The possible rejection and acceptance would be depend on the result of Trace statics, Eigen critical values and their respective p-values. The co-integration equation of test is following:

$$A_t = \beta_0 + \sum_{i=1}^{n} \beta_j A_{t-j} + \mu_t$$

RESULT ANALYSIS AND INTERPRETATION

Unit root test

Unit root test to check the stationarity Level

Table 1
Unit root test at level, series with constant and trend

Period	*Variable*	*No of observation*	*ADF test*	*Critical value @ 5%*
Level	Exchange Rate	2704	-2.732111	-3.411352
	Sensex BSE S&P	2704	-2.938468	

The above table depict the test result of ADF test in which it can be observed that the ADF test value of statistics obtained from both variable exchange rate and sensex nifty are less than it critical value at 5% significance level. So it is clear that series are non-stationary at level.

Table 2
Unit root test at First difference, series with constant and trend

Period	*Variable*	*No of observation*	*ADF test*	*Critical value @ 5%*
Difference 1	Exchange Rate	2704	-15.14950	-2.862338
	Sensex BSE S&P	2704	-48.62711	

The result of the ADF test at difference 1 show that the calculated |t| > the critical value -2.862338 so time series for Exchange Rate and Sensex indices are stationary at their first difference and are found to be integrated of order one I (1).

Johansen's Co-integration Test

Johansen's Co-integration technique is used to determine if there is co integration relation among the variables. Two likelihood test are used, the trace test and the maximum Eigen value test, to find out whether the series are co integrating. The estimation for series assumed as linear deterministic trend. The lag selection for 1st difference is based on the Swartz information criterion.

Table 3
Johansen's Co-integration Test Result

Exchange rate/Nifty		*Sample: 4/08/2005 to 12/30/2016*		
Trend assumption:Linear deterministic trend (restricted) Observation: 2716				
		Unrestricted Co integration Rank Test (Trace)		
Hypothesized No. of CE(s)	*Eigen value*	*Trace Statistic (λ trace)*	*Critical Value @ 5%*	*Prob.***
None	0.002754	7.500143	15.49471	0.5203
At most 1	3.17E-06	0.008607	3.841461	0.9257
		Unrestricted Co-integration Rank Test (Maximum Eigenvalue)		
Hypothesized No. of CE(s)	*Eigen value*	*Maximum Eigenvalue*	*Critical Value @ 5%*	*Prob.***
None	0.002754	7.491536	14.26460	0.4327
At most 1	3.17E-06	0.008607	3.841466	0.9257

Interpretation

Table 3 show the results of the Johansen's Co-integration test. The Maximal Eigen statistic (ëmax) of 7.491536 is less than the 5 % critical value of 14.26460 and the trace test statistic (ëtrace) of is 7.500143 less than the critical value of 15.49471. According to rule of co-integration if Trace statistics is lower than

critical value it mean we cannot reject null hypothesis. On the other side the maximum Eigen value is less than critical value then we can't reject the null hypothesis. The p value of above test is0.5203 for trace test and 0.4327 is for maximum eigen value which show that it is more than 5% so we cannot reject the hypothesis.

Granger Causality Tests

Table 4
Pairwise Granger Causality Tests

Date: 02/05/17 *Sample: 1/02/2006 12/30/2016* *Lags: 2*

Null Hypothesis:	*observation*	*F-Statistic*	*Probability*
BSE Sensex does not Granger Cause exchange rate	2722	5.41113	0.0045
Exchange rate does not Granger Cause BSE sensex	2722	11.6180	9.E-06

Interpretation

The table 4 presents the results of granger causality test between exchanges rate and nifty. On interpreting the results, it can be inferred that the F-statistic value 5.41113 and 11.6180 are above the critical values of 0.0045 and 9.E-0.6 at 5% significance level. Hence the null hypothesis is rejected which show that there is a bidirectionalcausal relationship between exchange rate and BSE sensex S&P indices.

CONCLUSIONS

The research study was conducted to determine the relationship with exchange rate and stock price indices BSE S&P .The first step ADF unit root test is applied to investigate the stationarity of all the variables and observe the non-stationary at their levels, but becomes stationary at the first difference. The Johansen maximum likelihood test is conducted to determine whether exchange rate and nifty Index is co-integrated. The result shows very clearly there is no co-integration vector between the exchange rate and BSE sensex S&P indices. Then Granger causality test for the study period from January 2006 to December 2016 is performed as the next step. Granger causality test is applied to test the hypothesis of the study and it is observed that there is a bidirectional causal relationship between exchange rate and BSE sensex S&P Indices.

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