Impact of Exchange rates on Indian Stock returns

[*]Ajay Prasad Uniyal, [#]Dr. H.M. Singh

[*,#]Assistant Professor, Govt P.G. College New Tehri Tehri Garhwal(Uttarakhand), India.

Abstract - Stock market is an important segment of the financial system of a country as it plays crucial role in channelizing savings from surplus sector to deficit sector. It is believed that stock market is a proactive market as it reflects the true conditions of the economic health. However, doubts are expressed in many quarters whether the recent stock market exuberance has anything to do with economic reality of the country. As the world's financial system is becoming more and more integrated, the exchange rates emerges as an important variable affecting the stock prices. The objectives of the study is to investigate exchange rates relevance for stock market returns in our economy and to examine the efficiency of Indian stock market in terms of exchange rates information flow that the changes in stock prices cannot be predicted on the basis of past exchange rates information in Indian stock market. By applying the techniques of ADF Unit root, pair wise Granger causality test and vector auto regression the study tests the causality between the BSE Sensex and the Exchange rates. The monthly time series data for the period of January 1991 – December2018 has been used for analysis. The entire sample is divided into three sub sample viz 1991-1997, 1998-2008 and 2009-2018 On the basis of data the pair-wise Granger Causality test and vector auto regression show that there is no causality between Sensex returns and Exchange rates considering the lag 1 during sample period 1991 to 1997. While there exists the unidirectional causality running from exchange rates to Sensex returns considering the lag 1 during sample period 1998 to 2008, however the reverse is not true. During sample period 2009 to 2018 considering the lag 6 there is bidirectional or feedback causal relationship between the Sensex returns and Exchange rates. During entire study period 1991 to 2018 considering the lag 1 there exist unidirectional causality between Sensex returns and Exchange rates running from Exchange rates to Sensex return not Vice-versa..

Keywords: Exchange rates, Sensex returns, Granger causality, VAR, Unit root,

I. INTRODUCTION

Stock market is an important segment of the financial system of a country as it plays crucial role in channelizing savings from surplus sector to deficit sector. It is believed that stock market is a proactive market as it reflects the true conditions of the economic health. However, doubts are expressed in many quarters whether the recent stock market exuberance has anything to do with economic reality of the country. As the world's financial system is becoming more and more integrated, the exchange rates emerges as an important variable affecting the stock prices. A strong linkage between stock prices and exchange rates is a popular view in the finance literature. With financial liberalisation and globalisation, funds circulate not only between various nations but also across various markets. Through higher currency supplies and demands to connect stock returns and exchange rates, the relationship between two variables has become important for investors. Changes in the exchange rates can cause reallocation of resources across industries. The real element in the exchange rates can affect the domestic economy and hence domestic stock returns, because stock market price provide a signal of real activity. The impact that the exchange rates has on the stock market depends upon trade-flow elasticities. Both the demand-side and supply-side interpretation can be invoked to illustrate the role of the exchange rates as a valid economic force. On the demand side, the immediate impact of domestic currency depreciation relative to the currencies of a country's major trading partners causes upward pressure on inflation due to increased cost of imports. This, in turn, leads to a reduction in real income and domestic demand. The adverse impact on the real sector will adversely impact the stock market. In the long-run, this effect will dissipate while exchange rates chase purchasing power parity. Nonetheless, the demand-side story of currency depreciation in forceful enough to employ the real exchange rates as the relevant economic determinant of stock returns. Of course, there is also a supply-side story for the economic importance of deviations from purchasing power parity, although it may not be realized immediately. Currency depreciation could improve the position of typical domestic producer by encouraging exports or expansion of import substitution. This change has a potentially positive impact on stock prices. That is why the real exchange rate's impact depends upon the relative magnitude of trade elastic

 DOI : 10.18231/2454-9150.2019.0035

ties in the import and export sectors of the domestic economy. By the same token, multinational firms whose operations are diversified across currency regimes may be partially hedged against real exchange rates fluctuations. Thus, a reduction in the value of domestic currency against foreign currency is expected to favourably affect stock prices due to increased exports and domestic substitution for imported goods. Conversely a strengthening domestic currency against foreign currency is expected to result in declining stock prices.

In portfolio balance theory, the exchange rate is an important factor for balancing supply and demand because the value of financial assets is decided by the current value cash flows. Therefore, the expected currency price will induce the price of financial assets. A number of hypothesis also suggest a causal relation between stock prices and exchange rates. For example the goods market hypothesis suggests that changes in exchange rates affect the competitiveness of multinational firms and hence their earnings and stock prices. A depreciation of local currency makes exporting goods cheaper and may lead to an increase in foreign demand and sales. Consequently, the value of an exporting firm would benefit from a depreciation of its local currency. On the other hand, because of the decrease in foreign demand of an exporting firm's products when the local currency appreciates, the firm's profit will decline and so does its stock price. In contrast, for importing firms the sensitivity of firm value to exchange rates changes is just the opposite. An appreciation of the local currency leads to an increase in the firm value of importing firms. Additionally, variations in exchange rates affect a firm's transaction exposure. That is, exchange rate movements affect a firm's future payables denominated in foreign currency. For an exporter, an appreciation of the local currency reduces profits, while a depreciation of the local currency increases profits. Furthermore, stock prices could be affected by exchange rates movements because such movements will induce equity flows. Even domestic firms-firms that have minimal international activities can face exchange rate exposure if their input prices, output prices, or the demand of their products are affected by exchange rate movements. Therefore, on a macro basis, the impact of exchange rate fluctuations on stock prices seems to depend on both the importance of a country's international trades in its economy and the degree of the trade imbalance.

Conversely, stock price fluctuations can influence exchange rate movements. For instance, according to the portfolio balance approach, exchange rates like all commodities are determined by market mechanism. A blooming stock market would attract capital flows foreign investors and hence causes increases in the demand of a country's currency and vice versa. As a result, stock prices are related to an appreciation (depreciation) in exchange rates. Moreover, foreign investment in a country's equity securities could increase overtime due to the benefits of international diversification that foreign investors would gain. In addition to returns, capital flows can be induced by less risky investment climate of a country. An improvement in a country's investment climate will lead to capital inflows and a currency appreciation.

Furthermore, movements in stock prices may influence exchange rates since investors' wealth and money demand may depend on the performance of the stock market. For example during the time of a crisis, a sudden dislocation of assets demands may incur because of the herding behaviour investors or the loss of confidence in economic and political stability. This dislocation usually results in the shift of decrease in the demand of money. This will lead to a decrease in the domestic interest rate and in turn lead to a capital outflows. Consequently, the currency will depreciate. Although the theoretical literature suggests causal relations between stock prices and exchange rates, empirical evidence is rather weak. The knowledge of causal relations between the stock and currency markets and consequently the degree of their integration will potentially expand the information set available to international investors, multinational corporations and policy makers.

The study is organised as follows after the introduction, the next section consists of Literature review and research gap, in the third section objectives, data descriptions and methodology are explained. Finally, the last section consists of conclusion, suggestion and policy implication.

II. LITERATURE REVIEW

The relationship between Exchange rates and stock returns has been widely tested for various economies some key empirical findings are as follows:

Aggarwal (1981), using monthly data examines the relationship between US stock market indexes and trade-weighted value of the dollar for the period 1974- 1978. He finds that the stock prices and exchange rates are positively correlated.

Fama (1981), Mandelker and Tandon (1985) and Chen, Roll and Ross (1986) showed that equity prices are implicitly related to exchange rates through the economic activities.

Cornell (1983) and Wolf (1988) found a strong relation between exchange rates and the economic activities.

Solnik (1987) employs monthly and quarterly data for eight industrial countries from 1973 – 1983 to examine the relation between real stock return differentials and changes in real exchange rates and report a negative relation between real stock returns and real exchange rates for monthly and quarterly data over his sample space. However using monthly data over the 1979- 1983 sub period. He observes a weak positive relation between the two variables. In arriving at the above conclusions, he modeled

 DOI : 10.18231/2454-9150.2019.0035

the exchange rate as a function of interest rate and stock return differential.

Soenen and Hennigar (1988) using monthly data, report a strong negative correlation between US stock indices and a fifteen currency-weighted value of the dollar for the period 1980-1986. Their results remain the same for both strong and weak dollar cycles within their sample space.

Ma and Kao (1990) provide some insights into probable reasons for this different correlation between stock returns and exchange rates. They use monthly stock indexes and exchange rates of six industrial economies to investigate the impact of changes in currency values on stock prices. Their results suggest that for an export-dominant economy, currency appreciation has a negative effect on the stock market, while currency appreciation boosts the stock market for an import dominant economy.

Abdalla and Murinde (1997) document that a country's monthly exchange rates tend to lead the stock prices, but not the other way around.

Richard A. Ajayi, Joseph Friedman, Seyed M. Mehdian (1998) employ daily data to investigate causal relations between stock returns and changes in exchange rates for seven advanced markets- Taiwan, Korea, Philippines, Malaysia, Singapore, Hong Kong, Indonesia and Thailand from December 1987 to September 1991.Their findings provide evidence to indicate unidirectional causality, in the Granger sense, between the stock and currency markets in all the advanced economies. The empirical evidence also provides a strong support for contemporaneous determination of stock returns and changes in exchange rates in the advanced economies. Contemporaneous adjustments however, are found to be weak in the emerging economies. The over results provide evidence that the stock and currency markets are well integrated in the six advanced economies with exchange rates responding to innovations in the stock markets. In the case of the eight emerging economies, however, evidence of causal relations between the two markets is mixed.

Wu (2000) finds that Singapore- dollar exchange rates Granger cause stock prices. He also finds that the explanatory power of exchange rates on stock prices has increased over time.

Muhammed and Rasheed (2002) explore the interaction between stock prices and exchange rates for four South Asian countries; Bangladesh, Sri Lanka, India and Pakistan. They perform a cointegration test, error correction modelling and a Granger causality test for the time span between January 1994 and December 2000. However, they find no association between the variables for Pakistan and India while bidirectional long-run causality in the Bangladesh and Sri Lanka data is observed. They conclude that the variables are unrelated in the short-run for the countries that they selected.

Ming-Shiun Pan, Robert chi-Wing Fok, Y. Angela Liu (2007) examine dynamic linkages between exchange rates and stock prices for seven East Asian countries, including Hong Kong, Japan, Korea, Malaysia, Singapore, Taiwan and Thailand, for the period January 1988 to October 1998. Their findings show a significant causal relation from exchange rates to stock prices for Hong Kong, Japan, Malaysia and Thailand before the 1997 Asian financial crisis. They also find a causal relation from the equity market to the foreign exchange market for Hong Kong, Korea and Singapore. Further, while no country shows a significant causality from stock prices to exchange rates during the Asian crisis, a causal relation from exchange rates to stock prices is found for all countries except Malaysia. Their findings are roubust with respect to various testing method used, including Granger causality tests, a variance decomposition analysis, and an impulse response analysis.

Nath and Samanta (2003), employed the Granger causality test on daily Nifty and exchange rates data during the period March 1993 to December 2002 for India. The empirical findings of their study suggest that these two markets did not have any causal relationship. When the study extended its analysis to verify if liberalization in both the markets brought them together, it found no significant causal relationship between the exchange rate and stock price movements, except for the years 1993, 2001 and 2002 during when a unidirectional causal influence from stock index return to return in forex market is detected and a very mild causal influence in the reverse direction is found in some years such as 1997 and 2002.

Mishra Alok (2004), examine whether Indian stock market and foreign exchange markets are related to each other or not. The study uses Granger's Causality test and Vector Auto Regression technique on monthly stock return, exchange rate, interest rate and demand for money for the period April 1992 to March 2002. The findings of his study are there is no Granger's causality between the exchange rate return and stock return. Through Vector Auto Regression modeling, the study confirms that though stock return, exchange rate return, the demand for money and interest rate are related to each other but any consistent relationship doesn't exist between them.

Bhattacharya B. And Mukherjee J.(2006) investigates the nature of the causal relationship between stock prices and macroeconomic aggregates in the foreign sector in India. By applying the techniques of unit–root tests, cointegration and the long–run Granger non–causality test recently proposed by Toda and Yamamoto (1995), they test the causal relationships between the BSE Sensitive Index and the three macroeconomic variables, viz., exchange rate, foreign exchange reserves and value of trade balance using monthly data for the period 1990-91 to 2000-01. Their results suggest that there is no causal linkage between stock prices and the variables under consideration.

 DOI : 10.18231/2454-9150.2019.0035

Agrawal, Kumar Srivastav and Srivastava (2010) apply the Granger causality test to examine the dynamics between Nifty returns and the Indian Rupee-USD exchange rates, using daily data for the period between October 2007 to March 2009. Their results support unidirectional causality running from stock returns to exchange rates with a negative correlation.

III. Research Gap

It is evident from the above review that the relationship between stock returns and exchange rates is still ambiguous. Theory suggests that there must be a close tie-up between the changes in exchange rates and fluctuations in stock-prices. However, the empirical evidences are rather mixed and many times contradict to conceptual propositions. However, a clear understanding of dynamic interaction between the capital markets and the foreign exchange market is necessary for the formulation of suitable policies both for the exchange rates management and the management of the capital markets. Moreover, we may use the stock indices as robust indicator of economic health only if a strong interaction between these two variables exists. This study will investigate causal relations between Indian stock market returns and exchange rates against American dollar. The results of this study hold practical implications for regulators who are interested in the proper functioning of financial markets, and for financial institutions, multinational corporations, or individual investors who are interested in internationally-diversified portfolios and management of foreign exchange risks.

Objectives:

The study is motivated with two broad objectives in mind: first, it will examine the exchange rates relevance of stock market fluctuations and second, it will test the 'efficient market hypothesis' that the changes in stock prices cannot be predicted on the basis of past exchange rates information. The present study aims at the following:

1. To study the impact of exchange rates on stock returns. .

2. To study the direction of causality between exchange rates and stock- returns.

3. To evaluate the information efficiency of stock market with respect to exchange rates.

Hypothesis:

The basic null-hypothesis of this study is the non-causality between the exchange rates and aggregate stock prices. This hypothesis will be tested for both variables separately. The following hypotheses will be tested:

Ho: There is no influence of Exchange rates on the Stock returns.

Ha: There is an influence of Exchange rates on Stock returns.

Ho: There is no influence of Stock returns on the Exchange rates .

Ha: There is an influence of Stock returns on the Exchange rates

If we reject the Ho, then we accept the Ha, setting the significance level to 5% and 1% at Degree of Freedom = n-2.

IV. Methodology

Period of the Study- The study covers a period of more than 28 years from 1991 to 2018. I divided the entire sample period of twenty eight years into three non-overlapping sub sample periods, the first sub-period includes the first seven calendar years from 1991 to 1997, on account of 1997 Asian financial crisis, the second sub period includes the next eleven calendar years from 1998 to 2008due to global financial crisis 2008 and the third sub period includes the last ten calendar years from 2009 to 2018.

Data- In this study monthly exchange rates (rupee/US dollor) and BSE sensex data as a proxy of stock-prices in India have been used.

Sources of Data- Secondary data have been used in this study collected from different sources. The data on Exchange rates (rupee/US dollor) are obtained from the Hand Book of Indian Statistics published by the Reserve Bank of India while BSE SENSEX data are obtained from the website of BSE.

Analysis of Data- Since all the variables used in this study are time series, appropriate econometrics techniques used for time series analysis have been applied and EViews software has been used for data analysis. A general overview of these techniques has been presented in the following section.

Granger Causality Test-

A statistical approach proposed by Clive W Granger (1969) to infer cause and effect relationship between two (or more time series is known as Granger causality. Granger Causality is based on the simple logic that effect cannot precede cause.

It is important to note that the statement " x Granger causes y " does not imply that y is the effect or the result of x . Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term.

Procedure of Traditional Granger Non-Causality Test

In its original form it is based on following bi-variate regression model (there are some other procedures used for

 DOI : 10.18231/2454-9150.2019.0035

causality testing such as Sim's Causality test, Hasiao Causality Test etc.)

$$y_t = \alpha_0 + \sum_{i=1}^{l} \alpha_i y_{t-i} + \sum_{j=1}^{l} \beta_j x_{t-j} + \varepsilon_t$$

$$x_t = \omega + \sum_{i=1}^{l} \gamma_i x_{t-i} + \sum_{j=1}^{l} \theta_j y_{t-j} + \varepsilon_t$$

If all the coefficients of x in first regression equation of y, i.e. β_i for $i = 1......l$ are significant that the null hypothesis that x does not cause y. However, the significance of the coefficient cannot be evaluated based on usual t-statistic. For this purpose the following procedure of testing the nested models is used.

i. Estimate the model without including lagged values of variable x. Suppose the R^2 from this estimate is R^2_1.

ii. Now estimate the model including lagged values of variable x. Suppose the R^2 from this estimate is R^2_2.

iii. F-ratio for improvement in the model is worked out as follows:

$$F = \frac{\left(R^2{}_2 - R^2{}_1\right)/k^*}{(1 - R^2{}_2)/(n-k)}$$

Where k^* are the number of lag orders l of variable x, k is the total number of the parameters estimated and n is the number of observations. The null hypothesis of non-causality is rejected if F statistic is greater than its critical value at k^* and (n-k) degree of freedom. Econometric software packages such as Eviews routinely test Granger causality.

Similarly from the second equation above, we can test the null hypothesis that 'y does not cause x'. If only one of the two variables causes the second variable but the second variable does not cause the first variable it is called one-way causality. If both the variables cause each other it is called the feedback causality.

Vector Auto Regression Model- Vector Autoregressive (VAR) Models

(Note: This discussion covers only standard or unstructured VAR Models.)

VAR Models: Vector autoregressive models (VARs) popularized by Sims (1980) are used in this study. As a hybrid of univariate autoregressive models and simultaneous structural models, VARs are advanced because all the variables are endogenous and there is high flexibility for no restrictions. The vector auto regression (VAR) models are the natural extensions of the univariate ARMA models. Sims suggested the VAR as an alternative of dynamic simultaneous equation models which, according to him, involves too many arbitrary decisions.

The simplest VAR model, known as standard VAR, can be presented as the following Equation (1):

$$y_t = A_0 + A_1 y_{t-1} .... A_p y_{t-p} + \varepsilon_t$$

where, y_t is a vector of all the k variables included in the system, A_0 is k×1 vector of intercepts, $A_1 .... A_p$ are k×k matrix of coefficients and ε_t is the vector of error terms. In a standard VAR, all the variables are treated as endogenous and the regressors include only lagged values of these endogenous variables (these conditions are relaxed in some extensions of VAR model, such as VARX model and structured VAR model).Since the contemporaneous terms of the variables are not included in the list of independent variables, this model is based on the implicit assumption that the contemporaneous innovations in the variables are uncorrelated.

The standard VAR model of two variables x and y can be presented as follows:

$$\begin{bmatrix} x_t \\ y_t \end{bmatrix} = \begin{bmatrix} \lambda_{10} \\ \lambda_{20} \end{bmatrix} + \begin{bmatrix} \lambda_{11}{}^1 & \lambda_{12}{}^1 \\ \lambda_{21}{}^1 & \lambda_{22}{}^1 \end{bmatrix} \begin{bmatrix} x_{t-1} \\ y_{t-1} \end{bmatrix} + ... \begin{bmatrix} \lambda_{11}{}^p & \lambda_{12}{}^p \\ \lambda_{21}{}^p & \lambda_{22}{}^p \end{bmatrix} \begin{bmatrix} x_{t-p} \\ y_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

Before estimating above system of equations the order of VAR, p is to be decided. The information critera such as Akaiki Information Criterian (AIC) or Schwarz Bayesian Criterion (SBC) is used for this purpose. P value is selected to minimize the information criterion.

Where the equations of all the variables included in the model follow the same lag structure it is called a balanced VAR model. A balanced VAR model can be estimated using OLS estimator. However, we are required to use SUR procedure to estimate a unbalanced VAR.
However, sometimes the interpretation of individual lags-coefficients of VAR is rather difficult; therefore, summary statistics – block significance, innovation response and variance decomposition, are used for interpretations of VAR models.

Granger Causality (Block Exogenity) Test

In VAR model, the causality can be evaluated by examining the joint significance of lagged coefficients of one variable in the equation of another variable. This kind of significance testing is called the block significance test and it can be performed with the usual F-test or Wald-test used for evaluation of parameter restrictions. In context of the bivariate case presented above the causality can be

 DOI : 10.18231/2454-9150.2019.0035

examined by testing the following hypothesis using Wald test.

Hypothesis: 1

$$H0: \lambda_{12}^{\ 1} + \lambda_{12}^{\ 2} + \lambda_{12}^{\ 3} = 0$$: y does not cause x

$$H1: \lambda_{12}^{\ 1} + \lambda_{12}^{\ 2} + \lambda_{12}^{\ 3} \neq 0$$: y causes x

Hypothesis: 2

$$H0: \lambda_{21}^{\ 1} + \lambda_{21}^{\ 2} + \lambda_{21}^{\ 3} = 0$$: x does not cause y

$$H1: \lambda_{21}^{\ 1} + \lambda_{21}^{\ 2} + \lambda_{21}^{\ 3} \neq 0$$: x causes y

V. PROCESS OF DATA ANALYSIS

First, we transformed both the series Sensex and Exchange rates into their natural log to get lnsensex and lnexrate series. Second we employed ADF Unit Root Test to check the stationarity of both the series under consideration. Third we generated return series by taking log difference of both the series. Fourth on the basis of AIC we selected appropriate lag length for VAR Model. Fifth I estimated VAR Model. Sixth for causality inference we employed VAR Granger Causality/ Block Exogeniety Wald Test And Pair wise Traditional Granger Causality Test. The results of ADF Unit Root Test, VAR Granger Causality/ Block Exogeniety Wald Test And Pair wise Traditional Granger Causality Test are shown in the following table:

Table- 1 Augmented Dickey Fuller (ADF) Unit Root Test

	ADF Tests			
	At Level		At First Difference	
	t-test	Probability	t-test	Probability
Lnsensex 1991-1997	-2.7608	0.0685	-7.9356	0.000
1998-2008	-0.7319	0.8340	-10.6074	0.000
2009-2018	-2.2451	0.1917	-10.7548	0.0000
1991 – 2018	-1.5638	0.5000	-16.7703	0.0000
Lnexrate 1991 - 1997	-0.9295	0.7736	-7.7720	0.0000
1998 - 2008	-2.0391	0.2700	-8.1348	0.0000
2009 – 2018	-0.7131	0.8385	-8.2388	0.0000
1991 - 2018	-3.0341	0.0528	-14.3859	0.0000

On the basis of ADF test results shown in the above table it can be concluded that both the series log sensex and log exrate are non stationary at level but their first difference show stationarity across the entire four samples. The natural log of sensex and exchange rates represented as lnsensex and lnexrate Shows that these variables are non-stationary at level but show stationarity at first difference. The log-difference of the sensex and exchange rates are relative measure and it shows the logarithmic rate of return.

Table – 2.1 VAR Lag Order Selection Criteria

Endogenous variables: DLNEXRATE DLNSENSEX
Exogenous variables: C
Date: 01/16/19 Time: 18:55
Sample: 1991M01 1997M12
Included observations: 76

Lag	LogL	LR	FPE	AIC	SC
0	255.6970	NA	4.32e-06	-6.676237	-6.614902
1	265.6422	19.10520*	3.70e-06*	-6.832689*	-6.648683*
2	266.9358	2.416956	3.97e-06	-6.761467	-6.454792
3	267.8826	1.719343	4.30e-06	-6.681122	-6.251776
4	268.4147	0.938076	4.72e-06	-6.589860	-6.037844
5	271.7580	5.718875	4.81e-06	-6.572580	-5.897894
6	276.1682	7.311620	4.77e-06	-6.583374	-5.786018
7	281.0542	7.843289	4.68e-06	-6.606689	-5.686663

On the basis of AIC the appropriate lag length is 1.

Table – 2.2

Vector Autoregression Estimates
Date: 01/16/19 Time: 18:52
Sample (adjusted): 1991M03 1997M12
Included observations: 82 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	DLNEXRATE	DLNSENSEX
DLNEXRATE(-1)	0.091048	-0.732284
	(0.12323)	(0.40535)
	[0.73886]	[-1.80656]
DLNSENSEX(-1)	0.027213	0.230971
	(0.03552)	(0.11683)
	[0.76620]	[1.97700]
C	0.007707	0.016112
	(0.00343)	(0.01130)
	[2.24412]	[1.42624]
R-squared	0.023847	0.060532
Adj. R-squared	-0.000866	0.036748
Sum sq. Resids	0.070185	0.759415
S.E. equation	0.029806	0.098045
F-statistic	0.964976	2.545051
Log likelihood	173.2442	75.60600

 DOI : 10.18231/2454-9150.2019.0035

Akaike AIC	-4.152297	-1.770878
Schwarz SC	-4.064246	-1.682827
Mean dependent	0.008924	0.013390
S.D. dependent	0.029793	0.099898

Determinant resid covariance (dof adj.)	7.05E-06
Determinant resid covariance	6.54E-06
Log likelihood	256.7054
Akaike information criterion	-6.114765
Schwarz criterion	-5.938664

Table – 2.3

VAR Granger Causality/Block Exogeniety Wald Test

Sample: 1991M01 -1997 M12

Included Observations: 82

Null Hypothesis: DLNSENSEX does not cause DLNEXRATE

Dependent Variable: DLNEXRATE

Exclude	Chi-sq	Df	Probability
DLNSENSEX	0.587064	1	.4436
All	0.587064	1	.4436

Table – 2.4

Null Hypothesis: DLNEXRATE does not cause DLNSENSEX

Dependent Variable: DLNSENSEX

Exclude	Chi-sq	Df	Probability
DLNEXRATE	3.263648	1	.0708
All	3.263648	1	.0708

Since p value is greater than .05 in both the cases these are .4436 and .0708 respectively, we cannot reject the Null Hypothesis of non causality. Therefore it can be concluded that there is no causality between Sensex return and Exchange rates meaning that both the variables are independent from each other or nethier Sensex returns cause exchange rates nor Exchange rates cause Sensex returns during period1991- 1997.

Table – 2.5

Pair wise Granger causality Test

Sample 1991M01 – 1997M12

Lag: 1

Null Hypothesis	Observation	F – Statistics	Probability
DLNSENSEX does not Granger cause DLNEXRATE	82	0.58706	0.4458
DLNEXRATE does not Granger cause DLNSENSEX	82	3.26365	0.0746

Since p value is greater than .05 in both the cases these are .4458 and .0746 respectively, we cannot reject the Null Hypothesis of non causality. Therefore it can be concluded that there is no causality between Sensex return and Exchange rates meaning that both the variables are independent from each other or nethier Sensex returns cause exchange rates nor Exchange rates cause Sensex returns during period1991- 1997.

Table – 3.1

VAR Lag Order Selection Criteria
Endogenous variables: DLNEXRATE DLNSENSEX
Exogenous variables: C

Sample: 1998M01 2008M12
Included observations: 132

Lag	LogL	LR	FPE	AIC	SC	HQ
0	542.6141	NA	9.50e-07	-8.191122	-8.147443	-8.173373
1	554.6968	23.61630*	8.40e-07*	-8.313588*	-8.182552*	-8.260341*
2	555.7574	2.040770	8.79e-07	-8.269051	-8.050657	-8.180306
3	557.1063	2.554802	9.15e-07	-8.228884	-7.923132	-8.104640
4	559.8778	5.164946	9.32e-07	-8.210269	-7.817160	-8.050527
5	564.7573	8.945848	9.20e-07	-8.223596	-7.743129	-8.028356
6	566.6940	3.491914	9.50e-07	-8.192333	-7.624509	-7.961596
7	567.7346	1.844670	9.94e-07	-8.147494	-7.492311	-7.881258
8	571.1187	5.896546	1.00e-06	-8.138162	-7.395622	-7.836428

On the basis of AIC the appropriate lag length is 1

Table – 3.2

Vector Autoregression Estimates

Sample: 1998M01 2008M12
Included observations: 132
Standard errors in ( ) & t-statistics in [ ]

	DLNSENSEX	DLNEXRATE
DLNSENSEX(-1)	-0.059387	-0.001409
	(0.09392)	(0.01560)
	[-0.63231]	[-0.09031]
DLNEXRATE(-1)	-1.652536	0.369726
	(0.51672)	(0.08583)
	[-3.19814]	[4.30772]
C	0.011204	0.000872
	(0.00685)	(0.00114)
	[1.63600]	[0.76696]
R-squared	0.078081	0.152795
Adj. R-squared	0.063788	0.139660
Sum sq. resids	0.760862	0.020992
S.E. equation	0.076799	0.012757
F-statistic	5.462777	11.63268
Log likelihood	153.0031	389.9621
Akaike AIC	-2.272774	-5.863062
Schwarz SC	-2.207256	-5.797544
Mean dependent	0.007345	0.001632
S.D. dependent	0.079373	0.013753

 DOI : 10.18231/2454-9150.2019.0035

Determinant resid covariance (dof adj.)	8.04E-07
Determinant resid covariance	7.67E-07
Log likelihood	554.6968
Akaike information criterion	-8.313588
Schwarz criterion	-8.182552

Table – 3.3

VAR Granger Causality/Block Exogeniety Wald Test

Sample: 1998M01 - 2008M12

Included Observations:132

Null Hypothesis: DLNSENSEX does not cause DLNEXRATE

Dependent Variable: DLNEXRATE

Exclude	Chi-sq	Df	Probability
DLNSENSEX	.008157	1	.9280
All	.008157	1	.9280

Since p value is greater than .05 that is .9280, we cannot reject the Null Hypothesis of non causality. Therefore it can be concluded that there is no causality between Sensex return and Exchange rates meaning that Sensex returns does not cause exchange rates during period1998- 2008.

Table – 3.4

Null Hypothesis: DLNEXRATE does not cause DLNSENSEX

Dependent Variable: DLNSENSEX

Exclude	Chi-sq	Df	Probability
DLNEXRATE	10.22807	1	.0014
All	10.22807	1	.0014

Since p value is lesser than .05 that is .0014, we can reject the Null Hypothesis of non causality. Therefore it can be concluded that there is unidirectional causality between Exchange rates and Sensex returns running from Exchange rates to Sensex returns meaning that lagged Exchange rates information can be used to predict Sensex returns this conclusion is against stock market efficiency during period1998- 2008.

Table – 3.5

Pair wise Granger causality Test

Sample 1998M01 – 2008M12

Lag: 1

Null Hypothesis	Observation	F – Statistics	Probability
DLNSENSEX does not Granger cause DLNEXRATE	132	0.00816	0.9285
DLNEXRATE does not Granger cause DLNSENSEX	132	10.2281	0.0017

Pair wise Granger causality test also confirm the finding of Block Exogeniety Wald Test that there is uni directional causality between Exchange rates and Sensex returns running from Exchange rates to sensex returns not vice-versa during period 1998-2008.

Table – 4.1

VAR Lag Order Selection
Criteria
Endogenous variables: DLNEXRATE
DLNSENSEX
Exogenous variables: C
Date: 01/16/19 Time: 19:24
Sample: 2009M01 2018M12
Included observations: 120

Lag	LogL	LR	FPE	AIC	SC	HQ
0	497.1737	NA	8.93e-07	-8.252895	-8.206437	-8.234028
1	510.0953	25.19706	7.70e-07	-8.401588	-8.262213*	-8.344987*
2	513.5432	6.608486	7.77e-07	-8.392386	-8.160095	-8.298052
3	516.2434	5.085363	7.94e-07	-8.370723	-8.045515	-8.238655
4	519.8962	6.757697	7.99e-07	-8.364936	-7.946812	-8.195134
5	527.7393	14.24834	7.50e-07	-8.428988	-7.917948	-8.221453
6	534.7916	12.57655*	7.13e-07*	-8.479860*	-7.875903	-8.234590
7	535.7293	1.641021	7.51e-07	-8.428822	-7.731949	-8.145818
8	536.7395	1.734249	7.90e-07	-8.378992	-7.589203	-8.058255

Table – 4.2

Vector Autoregression Estimates

Sample: 2009M01 2018M12
Included observations: 120
Standard errors in ( ) & t-statistics in [ ]

	DLNEXRATE	DLNSENSEX
DLNEXRATE(-1)	0.287055	-0.540320
	(0.10223)	(0.30162)
	[2.80782]	[-1.79137]
DLNEXRATE(-2)	0.011166	0.306592
	(0.10103)	(0.29808)
	[0.11052]	[1.02857]
DLNEXRATE(-3)	-0.041525	0.307751
	(0.09883)	(0.29158)
	[-0.42016]	[1.05545]
DLNEXRATE(-4)	-0.322653	0.607654
	(0.09859)	(0.29087)
	[-3.27275]	[2.08912]
DLNEXRATE(-5)	0.197726	-1.149423
	(0.09982)	(0.29450)
	[1.98086]	[-3.90301]
DLNEXRATE(-6)	0.017465	0.417292
	(0.09091)	(0.26820)
	[0.19213]	[1.55588]

 DOI : 10.18231/2454-9150.2019.0035

DLNSENSEX(-1)	-0.094718	-0.006557
	(0.03286)	(0.09695)
	[-2.88242]	[-0.06763]
DLNSENSEX(-2)	0.092489	-0.104439
	(0.03287)	(0.09697)
	[2.81403]	[-1.07703]
DLNSENSEX(-3)	-0.037447	0.265234
	(0.03110)	(0.09176)
	[-1.20402]	[2.89047]
DLNSENSEX(-4)	-0.057545	0.094993
	(0.03146)	(0.09283)
	[-1.82890]	[1.02329]
DLNSENSEX(-5)	-0.041649	-0.164030
	(0.03187)	(0.09401)
	[-1.30703]	[-1.74473]
DLNSENSEX(-6)	0.026405	-0.228089
	(0.03270)	(0.09648)
	[0.80746]	[-2.36412]
C	0.003811	0.012216
	(0.00197)	(0.00580)
	[1.93716]	[2.10484]
R-squared	0.322776	0.216282
Adj. R-squared	0.246826	0.128388
Sum sq. resids	0.029339	0.255381
S.E. equation	0.016559	0.048854
F-statistic	4.249837	2.460726
Log likelihood	328.7071	198.8768
Akaike AIC	-5.261785	-3.097947
Schwarz SC	-4.959807	-2.795969
Mean dependent	0.003119	0.010989
S.D. dependent	0.019080	0.052329
Determinant resid covariance (dof adj.)		5.80E-07
Determinant resid covariance		4.61E-07
Log likelihood		534.7916
Akaike information criterion		-8.479860
Schwarz criterion		-7.875903

Table – 4.3

VAR Granger Causality/Block Exogeniety Wald Test

Sample: 2009M01 - 2018 M12

Included Observations: 120

Null Hypothesis: DLNSENSEX does not cause DLNEXRATE

Dependent Variable: DLNEXRATE

Exclude	Chi-sq	Df	Probability
DLNSENSEX	29.43917	6	.0001
All	29.43917	6	.0001

Table – 4.4

Null Hypothesis: DLNEXRATE does not cause DLNSENSEX

Dependent Variable: DLNSENSEX

Exclude	Chi-sq	Df	Probability
DLNEXRATE	21.50975	6	.0015
All	21.50975	6	.0015

Since p value is lesser than .05 in both the cases these are .0001 and .0015 respectively, we can reject the Null Hypothesis of non causality. Therefore it can be concluded that there is bi-directional causality between Sensex return and Exchange rates meaning that both the variables are dependent on each other or causality running from Sensex returns to Exchange rates and Exchange rates to Sensex returns during period 2009- 2018.

Table – 4.5

Pair wise Granger causality Test

Sample 2009M01 – 2018M12

Lag: 6

Null Hypothesis	Observation	F – Statistics	Probability
DLNSENSEX does not Granger cause DLNEXRATE	120	4.90653	0.002
DLNEXRATE does not Granger cause DLNSENSEX	120	3.58496	0.0028

Pair wise Granger causality test also confirm the finding of Block Exogeniety Wald Test that there is bi-directional causality between Sensex returns and Exchange rates running from Sensex returns to Exchange rates and vice-versa during period 2009 -2018.

Table – 5.1

VAR Lag Order Selection Criteria
Endogenous variables: DLNEXRATE DLNSENSEX
Exogenous variables: C
Date: 01/16/19 Time: 19:41
Sample: 1991M01 2018M12
Included observations: 327

Lag	LogL	LR	FPE	AIC	SC
0	1233.273	NA	1.84e-06	-7.530720	-7.507540
1	1250.157	33.45867	1.70e-06*	-7.609523*	-7.539982*
2	1253.955	7.480705	1.70e-06	-7.608290	-7.492389
3	1254.878	1.805341	1.73e-06	-7.589467	-7.427206
4	1256.785	3.710165	1.76e-06	-7.576669	-7.368048
5	1257.550	1.477460	1.79e-06	-7.556880	-7.301898
6	1262.799	10.08062	1.78e-06	-7.564519	-7.263177
7	1264.225	2.721435	1.81e-06	-7.548777	-7.201074
8	1274.713	19.88496*	1.74e-06	-7.588457	-7.194394

On the basis of AIC the appropriate lag length is 1.

Table –5.2

Vector Autoregression Estimates
Date: 01/16/19 Time: 19:44
Sample (adjusted): 1991M03 2018M12
Included observations: 334 after adjustments

 DOI : 10.18231/2454-9150.2019.0035

Standard errors in ( ) & t-statistics in [ ]

	DLNEXRATE	DLNSENSEX
DLNEXRATE(-1)	0.232965	-0.440476
	(0.05326)	(0.20108)
	[4.37450]	[-2.19059]
DLNSENSEX(-1)	-0.017515	0.092900
	(0.01424)	(0.05375)
	[-1.23042]	[1.72843]
C	0.003192	0.010939
	(0.00113)	(0.00428)
	[2.81297]	[2.55341]
R-squared	0.058870	0.023093
Adj. R-squared	0.053183	0.017190
Sum sq. resids	0.134413	1.916194
S.E. equation	0.020151	0.076086
F-statistic	10.35244	3.912228
Log likelihood	831.6767	387.9282
Akaike AIC	-4.962136	-2.304959
Schwarz SC	-4.927904	-2.270727
Mean dependent	0.003956	0.010138
S.D. dependent	0.020710	0.076749
Determinant resid covariance (dof adj.)		2.35E-06
Determinant resid covariance		2.31E-06
Log likelihood		1219.670
Akaike information criterion		-7.267486
Schwarz criterion		-7.199022

Table – 5.3

VAR Granger Causality/Block Exogeniety Wald Test

Sample: 1991M01 - 2018 M12

Included Observations: 334

Null Hypothesis: DLNSENSEX does not cause DLNEXRATE

Dependent Variable: DLNEXRATE

Exclude	Chi-sq	Df	Probability
DLNSENSEX	1.5139	1	.2185
All	1.5139	1	.2185

Since p value is greater than .05 that is .2185, we cannot reject the Null Hypothesis of non causality. Therefore it can be concluded that there is no causality between Sensex return and Exchange rates meaning that Sensex returns does not cause exchange rates during period1991- 2018.

Table – 5.4

Null Hypothesis: DLNEXRATE does not cause DLNSENSEX

Dependent Variable: DLNSENSEX

Exclude	Chi-sq	Df	Probability
DLNEXRATE	4.7987	1	.0285
All	4.7987	1	.0285

Since p value is lesser than .05 that is .0285, we can reject the Null Hypothesis of non causality. Therefore it can be concluded that there is unidirectional causality between Exchange rates and Sensex returns running from Exchange rates to Sensex returns meaning that lagged Exchange rates information can be used to predict Sensex returns this conclusion is against stock market efficiency during period1991- 2018.

Table – 5.5

Pair wise Granger causality Test

Sample 1991M01 – 2018M12

Lag: 1

Null Hypothesis	Observation	F – Statistics	Probability
DLNSENSEX does not Granger cause DLNEXRATE	334	1.51393	0.2194
DLNEXRATE does not Granger cause DLNSENSEX	334	4.79870	0.0292

Pair wise Granger causality test also confirm the finding of Block Exogeniety Wald Test that there is uni directional causality between Exchange rates and Sensex returns running from Exchange rates to Sensex returns not vice-versa during period 1991-2018.

VI. CONCLUSIONS AND SUGGESTIONS

Objectives of the Study

The objectives of the study were to investigate exchange rates relevance for stock market returns in our economy and to examine the efficiency of Indian stock market in terms of exchange rates information flow. For this purpose we have investigated dynamic interdependence between stock returns and exchange rates in Indian economy. More specifically, we examined the existence, the kind and the strength of potential one and/or bi-directional linkages, running from stock returns to exchange rates and/or from exchange rates to stock returns.

Methodology

In this study, monthly BSE SENSEX data and exchange rates data have been used. All the data are log-transformed and Augmented Dickey Fuller (ADF) unit root test have been used to check the stationarity of data. In order to study the lead lag relationship between Sensex return and Exchange rates, the vector auto regression model and pair wise traditional Granger causality test are applied on the data. The results indicate that there is no causality between Sensex returns and Exchange rates considering the lag 1 during sample period 1991 to 1997. While there exists the unidirectional causality running from exchange rates to the Sensex returns considering the lag 1 during sample period 1998 to 2008 however the reverse is not true. The results of

 DOI : 10.18231/2454-9150.2019.0035

Block Exogeneity Wald Test support the hypothesis that change in the exchange rates in Indian economy have a significant causal impact on Sensex returns. During sample period 2009 to 2018 considering the lag 6 there is bidirectional or feedback causal relationship between the Sensex returns and Exchange rates. During entire study period 1991 to 2018 considering the lag 1 there exist unidirectional causality between Sensex returns and Exchange rates running from Exchange rates to Sensex return however the reverse is not true.

Suggestion: The results of the study are not consistently stable with the results of the previous studies due to difference between the variables used, the period covered and the research methodology employed. further research may be enhanced by incprporating more financial variables that may potentially affect the indian stock market.

Policy Implications: The results suggest that the stock market is informationally inefficient with respect to exchange rates fluctuation. If stock market is informationally inefficient with respect to exchange rates, abnormal profit may be earned consistently by using information on the changes in exchange rates, rejecting the efficient market hypothesis in Indian context will suggest that certain policy measure should be taken to improve the performance of the Indian stock market.

The findings of these studies are important since informational inefficiency in stock market implies on the one hand, that market participants are able to develop profitable trading rules and thereby can consistently earn more than average market returns, and on the other hand, that the stock market is not likely to play an effective role in channeling financial resources to the most productive sectors of the economy.

REFERENCES

[1] Abdalla, I. S. A., &Murinde, V. (1997).“ Exchange rate and stock price interactions in emerging financial markets: Evidence on India, Korea, Pakistan, and Philippines”, Applied Financial Economics, Vol. 7, pp. 25−35.

[2] Aggarwal, R., (1981), “Exchange rates and stock prices: A study of the US capital markets under floating exchange rates”, Akron Business and Economic Review, Vol. 12, pp. 7-12.

[3] Ajayi, R.A., Friedman, J. and Mehdian, S.M.,(1998), “On the Relationship between Stock Returns and Exchange Rates: Tests of Granger Causality”, Global Finance Journal, Vol. 9, pp. 241-51.

[4] Cornell, B.(1983), “Money supply announcements and interest rates: another view” Journal of Business, Vol. 56, pp. 1-23.

[5] Ma, C. K., & Kao, G. W. (1990). “On exchange rate changes and stock price reactions”

[6] Journal of Business Finance and Accounting,Vol. 17, pp. 441−449.

[7] Ming-Shirun Pan, Robert Chi-wing Fok and Angela liu,Y. (2007), “dynamic linkage between exchange rates and stock prices: evidence from east Asian markets” International Review of Economics and Finance, Vol. 16, pp. 503-520.

[8] Mishra, AK. (2004),” Stock Market and Foreign Exchange Market in India: Are they Related?” South Asia Economic Journal, Vol. 5(2): pp.209-232.

[9] Muhammed, N., & A. Rasheed. (2002).” Stock Prices and Exchange Rates: Are they Related? Evidence from South Asian Countries”. The Pakistan Development Review, Vol. 41(4), pp.535-550.

[10] NATH, GOLAK C. and G.P. SAMANTA. (2003),”Dynamic Relation between Exchange Rate and Stock Prices—A Case for India”, http://www.nseindia.com/content/press/feb2003c.

[11] Soenen, L.A. and Hennigar, E.S., (1988), “An Analysis of Exchange Rates and Stock Prices: The US Experience between 1980 and 1986”, Akron Business and Economic Review, Vol. 19 pp. 71- 76.

[12] Solnik, (1987), “ Using financial prices to test exchange rate models: A note” Journal of Finance, Vol. 42(l), pp. 141-149.

[13] Wu, Y. (2000). “ Stock prices and exchange rates in a VEC model—The case of Singapore in the 1990s”, Journal of Economics and Finance, Vol.24, pp. 260−274.

[14] Agrawal, G., Srivastav, A.K., & A. Srivastava. (2010). “Study of Exchange Rates Movement and Stock Market Volatility”. International Journal of Business and Management, 5(12), 62 73.

[15] Bhattacharya, B. and Mukherjee, J. (2006), “An Analysis of Stock Market Efficiency in Light of Capital Flows and Exchange Rate Movements; The Indian Context”, Paper presented at Annual Conference on Money and Finance, Indira Gandhi Institute of Development and Research, Mumbai March, pp. 27-28.

Websites: www.rbi.org.in and www.bseindia.com

 DOI : 10.18231/2454-9150.2019.0035