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# Nexus between Indian Stock Indices and Foreign Exchange Rate during Covid-19 Pandemic: An Empirical Study

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**Abstract**

In the paper we attempts to examine whether the nexus exist between the Indian stock indices and foreign exchange rate during COVID- 19 period. We take the data of Nifty, Sensex and Exchange Rate on daily basis from 1[st]January 2020, to 10th June, 2021 during which there is too much volatility in stock indices and exchange rate. We want to find out whether the volatility between both is caused by each other or independent of one another. The different statistical tools have been applied to analyze the data. We establish adverse and moderate correlation between stock indices and exchange rate. Further through Granger Casual Test we check for casual relationship between the series and found that the indices granger causes exchange rate and no other way round. On the other hand, we found the significant and negative association between the stock indices and exchange rate in regression analysis but the variation in the indices due to exchange rate is very low.
Keywords: Nifty, Sensex, Exchange Rate, Normality Test, Correlation, Granger Causality Test, Regression Analysis.

## I. Introduction

In the 1990's when the Indian economy adopted the regime of liberalization, globalization and privatization (LPG), the financial working of the economy changed significantly. The major change was the integration of the domestic and global financial markets by elimination of foreign exchange controls; the introduction of floating exchange rate, decrease in custom duties, and the introduction of screen based transactions in the stock market. The insertion of improvements in the financial working of the economy as the result of economic liberalization has open new opportunities for direct and indirect investments in India. The direct investment in the form of FDI and indirect investment in the form of FII's results the changes in the foreign exchange market and the stock market. The Indian foreign exchange market and stock market have been getting cohesive with the markets all over the world. Whatever change happens in the foreign exchange market, it affects the stock prices two ways. Firstly, the change in the Indian FX market, affects FDI and FII's and ultimately impacts stock prices. Secondly, there is a direct effect of FX by multinational firms and indirect effect on stock prices by domestic firms. Whenever any change in the FX occurs, it impacts the demand of the products of multinational firm in the foreign market, which impacts its earnings in the balance sheet. When the financial results are declared, it impacts stock prices. In the case of domestic firm the currency devaluation impact on stock prices relies on the operations of the firm. If the domestic firm is engaged in exports, the currency devaluation upsurges the demand of its product in the global market. The higher sales will result higher profits and ultimately rise in stock prices. If the domestic firm is the

client of trade in inputs, the currency depreciation will increase the cost of manufacturing and results decrease in profits. Subsequently, the stock prices of firm will decrease. The foreign exchange and stock market are related to each other.

Therefore, it was an utmost important for those related to financial system either as researchers or as an investors to understand the functioning of the foreign exchange market and the stock market. The foreign exchange market and the stock market are well-thought-out as the indicator of the economic development because these markets are showing the exposure of country to the external world. Our study is also an endeavor in this path. The foremost step before establishing any relationship between the Indian foreign exchange market and the stock market is to apprehend the views regarding which market is the cause and which is effect. There are two different views regarding this. One viewpoint known as the" Flow Oriented Model" given by Dornbusch and Fischer (1980) show that whatever deviations occur in currency affects the balance of trade (imports and exports), which try to affects the profitability and the stock prices. The another viewpoint known as the "Stock Oriented Model" given by Branson and Frankel (1983) shows that if any improvements take place in the stock market then more and more investors will start investing in it. The rising stock prices boost capital inflows and thereby increase the demand of domestic currency and ultimately the domestic currency appreciated. From time to time various research works were piloted by different researchers to confirm the association between exchange rate and stock prices which provide dissimilar results. Studies from Rahman (2009); and Zhao (2010) establish narrow relationship between exchange rate and stock prices; while Pan, Fok & Liu (2007); Jayasinghe & Tsui ( 2008); and Yau & Nieh (2009) establish noteworthy association and also show that exchange rate fluctuations influences stock prices. Remarkably, Lin (2012) establishes that during emergency, the strait of flow drives from stock prices to exchange rates. Such unsettled indication put forward that additional investigation is desirable to throw light on this subject particularly in the emergency period of COVID -19.

At the beginning of 2020, in the month of January when India was COVID free, Nifty and Sensex were showing encouraging stock market conditions by hitting heights of 12,362 and 42,273 respectively. The first case of COVID was testified in India on 30th January 2020 in the state of Kerala. An overall 658 cases of COVID-19 were stated by 24th March, 2020, Out of which 12 were departed and the total of 7 recuperated people. ("COVID-19 India",2020). As a result the national lockdown was announced on 25th March, 2020, which was lasted till the end of May after going through the process of completion in four stages. The stock market did not remain free from the fear in the environment due to outbreak of COVID -19 and as a result the Sensex and Nifty fell by almost 36%. There was 26% loss in the stock market in contrast to the beginning of the year 2020. The stock of some sectors like hospitality, tourism and entertainment had been plunged by more than 40% because these sectors were badly affected due to movement constraints during lockdown period. Investors suffered losses due to fear and uncertainty. The stock markets over reacted to COVID -19 tremor but for a very short span. The stock markets in India bounce back in May even though economic conditions were not favorable due to lockdown. This unusual rally was surprising for stock market analysts.

The USD to INR average exchange rate was 71.44 for 155 days during 7th October, 2019 to 10th March, 2020. But after affirmation of Coronavirus as pandemic by WHO the average exchange rate became 74.74 and after the announcement of lockdown 1.0 it was further increased to 75.94. There was a fall in the everyday  growing rate of exchange rate  by .21% and further by .01% after

Dr. Kamini Bhutani[a,] Dr. Rajni[b]

improvement in the value of Indian Rupee during post lockdown1.0. Overall the financial year 2020-21 has been the period full of swings for the Indian rupee due to COVID-19. The rupee reached record low of 76.90 during the uncertain period of pandemic. However, easing of lockdown restrictions, hopefulness over vaccines, and introduction of various stimulators by governments and central banks in India motivated the investors, the stock market investment increased; it reached new heights and the rupee jumped back to the 72 level.

A second wave beginning in March 2021 was much larger than the first but the impact on stock market and exchange rate was not too much. Being Asia's third-largest economy, India is slowly recovering from the impact of the deadly coronavirus second wave. As per the trends, India's stocks and shares are standing at par with their global peers. According to sources, Indian companies have had a good earnings season (Q4, 2021), which will result fresh energy into the Indian stock market leading to a continuous surge in stock market trading in India. If India's coronavirus cases continue to drop further, India's stock market will see more growth and a steady rise in the next couple of months.

The study by Banerjee and Bhattacharyya (2020) establish that when the COVID -19 cases were rising in India, the average exchange rate increased while the stock indices started declining. As well, there is robust adverse correlation between the exchange rate and the stock market index, indicating that when there is depreciation in the value of currency the stock exchange also plunged.

The one more study was done by Baker & Rosbi(2020), to investigate the relationship between Kuala Lumpur Stock Exchange(KLSE) and Malaysian currency exchange rate(MYR) after the occurrence of COVID-19 cases. They stated that after the eruption of COVID-19, the investors in the stock market became anxious and there was a substantial effect on stock market and the exchange rate. In line of the above articles, this research was carried on to explore the relationship between the Indian foreign exchange market and stock market during COVID- 19 period from 1[st]January 2020, to 10th June, 2021.

The organization of paper is as follows. Section II is of literature review where we provide a brief review of theoretical foundation associated with the relationship between exchange rate and stock indices. Section III states the data and methodology although Section IV presents empirical analysis and discourses the results. To end with, Section V abridges the study and Section VI make available the shortcomings of the study and put forward opportunities for further research work.

## II. Literature Review

The large number of research work has been carried out around the world to study the relationship between the exchange rate and the stock market. The different studies have used different sets of data like monthly, weekly or daily as well as different methodologies like granger causality, vector autoregressive (VAR), regression analysis to establish association between the exchange rate and the stock market.

Deepti Gulati and Monika Kakhani (2012) investigated the daily data of Indian  stock indicies and the forex rate from 1st April2004 to 31st March 2012 and found that an exceptionally low level of  positive correlation exist between the two variables. The granger cause results suggested that there was no relationship between exchange rate and stock market over the period of eight years.

Razvan and Stefanescu and Ramona Dumitriu (2013) studied the foreign exchange rates and stock market returns for a span of 12 years (January 2000-December 2012) from the Romanian capital market to analyze the impact of foreign exchange rate variations on stock market volatility. It was concluded that there are various factors like capital inflows, international market changes which are responsible for the effect of foreign exchange rates variation on the stock returns.

Zakir Bello(2013) investigated the effect of the euro, the pound, the Yua and the yen ( the currencies of four trading partners of the U.S.) on daily stock returns of ten sectors listed in Nasdaq from 2000 to 2012. The results revealed that the Japanese yen and U.S. stock have significant and negative association while pound and euro have significant but negative association. The U.S. stocks were positively but insignificantly associated with Chinese yuan. According to them different currencies have different relationship with U.S. stock.

Suriani, Dileep Kumar and Saqib Muneer (2014) inspected the relationship between the stock market index of Pakistan (KSE 100) and Pak Rupee US Dollar exchange rate on the basis of monthly data for a period of five years and found no substantial association between these two variables. They found that these two variables are independent to each other.

Aruna Polisetty, D. Prasanna Kumar and Jikku Kurian (2016) examined the relationship between the Indian stock prices and exchange rate by using monthly figures from for a period of 10 years from 2005 to 2014. They found that there is no substantial cause and effect relationship between the two variables and if any relationship happened that were due to a chance factor.

Sugiharti and Emi Wardati(2019) studied the effect of inflation, interest rate and exchange rate on the stock returns of manufacturing companies registered on the Indonesia stock exchange over a period of ten years. They found that individually these variables have no impact upon stock returns but collectively influences stock returns.

We can conclude from the literature review that no study has been conducted so far to analyze the impact of  COVID -19 on two important variables of financial system i.e. exchange rate and stock indices. The reason might be that it is a newly found virus. Consequently, this paper attempts to satisfy the gap by looking at the effect of COVID-19 to the Indian stock prices and currency exchange rate. As a whole we  realize that during this period the stock market volatility and movement in the exchange rate was extremely high, we attempted to see if  there is any noteworthy relationship and nexus exist  between these two markets during COVID-19 period or not.

## III DATA AND METHODOLOGY

Dr. Kamini Bhutani[a,] Dr. Rajni[b]

In the paper we tried to inspect the association between stock market indices and exchange rate during the COVID-19 period. For this purpose we study NSE 50 index (Nifty), BSE 30 (Sensex) and US Dollar/Rupees exchange rate because US dollar is the most prominent currency. We take the data of Nifty, Sensex and Exchange Rate on daily basis from 1st January 2020, to 10th June, 2021 during which there is too much volatility in stock indices and exchange rate. The daily returns are considered more precise and can provide superior outcomes of Nifty index, Sensex and USD/Rupees exchange rate. The 05 days in a week closing prices of Nifty index, Sensex and ratio of USD-Rupees are taken. Data has been taken from www.nseindia.com and www.bseindia.com and www.investingindia.com

After studying the prevailing works in this area, the following hypothesis have been articulated to achieve the objective :

**Null Hypothesis (H$_0$): N**o significant relationship between stock market indices and Exchange Rate during the COVID-19 period.

A**lternate Hypothesis (H$_1$): S**ignificant relationship between stock market indices and exchange rate during the COVID -19 period.

**Methodology**

The above hypothesis can be checked by using different statistical tools on EViews Version 11.  We took the following tests to examine the association between Nifty index, Sensex and exchange rate:

The unit root test is the recommended test to check stationary or non-stationary nature of time series. If  mean and variance of the series remain persistent over a period of time then it is said to be stationary. The unit root test on stock indices (Nifty/ Sensex) and Exchange rate is carried out by Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test. To conclude whether the series is stationary or not the t-Statistics values of variables under study are compared with their critical values.

In both the ADF and PP test, the null hypothesis regarding the series is that the series is non-stationary or in other words it has a unit root. If the obtained value is smaller than the critical value and p value is more than .05 then we accepts the null hypothesis that there is unit root or non-stationary. If this happens then we take test at first difference to check whether it is stationary or not.

Afterwards we carried out correlation test in order to pattern out the type of correlation between stock indices (Nifty and Sensex) and exchange rate. The correlation may be positive or negative, weaker, moderate or stronger.

When the correlation was established, we checked whether any causal relationship exists between stock indices (Nifty/ Sensex) and exchange rate or not.  The Granger Casuality test can be  applied to check the causality and the integration between the variables only when the time series is stationary. We have done the Granger Causality test on the first difference of the variable to see the causal relationship between the stock indices and exchange rate. After the causality analysis, the regression analysis test was applied to check the validity of the results. For regression analysis the least square method was used in which the dependent variables are stock indices and exchange rate is an independent variable.

Nexus between Indian Stock Indices and Foreign Exchange Rate   during Covid-19 Pandemic: An Empirical Study

The equation of least square regression analysis is as follows:

Y(Stock Indices)  = a + bX(Exchange Rate) + error

## IV Empirical Analysis and Results

For study all the variables are taken in the log form to partially address the problem of skewness and to get the sensitivity (elasticity) of exchange rate to the stock price index. The Table 1 presents the  results of the unit root test. The table displays the t test statistics obtained by using the ADF test as well as PP test. The critical values at different level of significance of the t statistic are given below the table**.** The table value indicates all the values are smaller than critical value at 5% level of significance at level and more than critical value at first difference. So, the null hypothesis regarding the non- stationary nature of time series is accepted at level form. But at first difference the null hypothesis is rejected and the series are found to be stationary.

The results of ADF Test and PP Test are presented in the Table 1. Both the test confirms that all variables are Non-Stationary in level structure. All the variables are Stationary at first difference. Accordingly, all variables are Independent (1).

**Table 1: Unit Root Test**

|  | Level | | | | First Difference | | | |
|  | ADF test | | PP test | | ADF test | | PP test | |
|  | t-Statistics | Prob* | t-Statistics | Prob* | t-Statistics | Prob* | t-Statistics | Prob* |
|---|---|---|---|---|---|---|---|---|
| **LNIFTY** | -.724320 | 0.8378 | -.536861 | 0.8807 | -5.75149 | 0.0000 | -20.9252 | 0.0000 |
| **LSENSEX** | -.517155 | 0.8847 | -.616238 | 0.8638 | -5.89544 | 0.0000 | -20.8378 | 0.0000 |
| **LEXNRate** | -2.22371 | 0.1983 | -2.19095 | 0.2101 | -19.5510 | 0.0000 | -19.5514 | 0.0000 |

Test critical Value @ 1% = -3.453652, @5%= -2.871693,@10%= -2.572253* Significant at 5% level

In next step, we have done correlation analysis to see the association between Nifty, Sensex and exchange rates. The correlation between Sensex and Exchange rate is (-0.610058) and between Nifty and Exchange rate is (-0.601689). It shows a negative correlation between the stock indices and the exchange rate.  The degree of association is also moderate, it indicates that nifty and exchange rate affects each other but in the opposite direction. The results are consistent with the result of Solnik, 2000, he additionally found the negative and critical correlation between stock market (KSE) and exchange rate.

**Table 2: Correlation Result**

|  | **LBSE** | **LEXN** | **LNSE** |
|---|---|---|---|
| **LBSE** | 1.000000 | -0.610058 | 0.999261 |
| **LEXN** | -0.610058 | 1.000000 | -0.601689 |
| **LNSE** | 0.999261 | -0.601689 | 1.000000 |

Dr. Kamini Bhutani[a,] Dr. Rajni[b]

**Granger Causality Test**

The result of the granger causality test demonstrate that the stock indices (nifty and Sensex) cause the exchange rate. The Granger Causality test was applied to decide if both the variables are self-governing or influence one another. The outcomes of Granger Causality test are presented in the Table 3 i.e., one of the financial variables which is stock indices causes the exchange rate. The causality does not continue the other way from exchange rate to stock indices (Sensex and Nifty). We can say that relationship exists between stock indices and the exchange. The result shows that the stock indices influence the exchange rate during the period under study and there is interaction between them. By and large we came across studies where casuality moves from exchange rate to stock indices with the exception of Lin (2012) found that during emergency, the channel of overflows goes from stock prices to exchange rates. Our study also has a place with the emergency period of Coronavirus-19.

### Table 3: Granger Causality Tests results of Exchange Rate (US$/Rs.) and Stock Prices (at first difference)

| Null Hypothesis | Lags | F-Statistics | Probability |
|---|---|---|---|
| ΔLBSE do not granger cause ΔLEXN | 2 | 12.6196 | 5E-06 |
| ΔLEXN do not granger cause ΔLBSE | 2 | 0.63205 | 0.5321 |
| ΔLBSE do not granger cause ΔLEXN | 2 | 11.4488 | 2E-05 |
| ΔLEXN do not granger cause ΔLBSE | 2 | 0.57574 | 0.5628 |

**Regression Analysis Result (Least Square Method)**

As per our Granger Causality test results stock indices cause exchange rate, which are exceptional due to the crisis period. But regression analysis is done by taking indices as dependent variable and exchange rate as an independent variable.

The regression analysis is done with the help of least square method. The result of the regression analysis indicates that the DW statistic is 2.33. So there is a problem of autocorrelation. We remove the autocorrelation by adding the lagged variable of the dependent variable on the equation. The result of the regression analysis is as follow

$$\Delta LNIFTY = C + \beta\, \Delta LEXN + \beta_1 \Delta LNIFTY(-1) + \varepsilon$$

$$= 0.000786 - 0.989903 * \Delta\, LEXN + (-154427) * \Delta LNSE(-1)$$

$$(0.831410)\quad (-3.847466)\quad\quad (-2.879984)$$

R-Square= 0.051639     Adjusted R- square = 0.046204     F Statistic=9.501572   DW= 2.005228

The results of the regression analysis indicate that the coefficient of log exchange rate is negative and significant at 1% level of significance. The R-square value indicates that 5% of variation in log nifty is explained by log exchange rate. When we have taken log of SENSEX, the result of the regression analysis are as follow

Nexus between Indian Stock Indices and Foreign Exchange Rate   during Covid-19 Pandemic: An Empirical Study

$$\Delta LSENSEX= \quad C \qquad + \quad \beta \ \Delta LEXN \quad + \quad \beta_1 \ \Delta LSENSEX + \varepsilon$$

$$= 0.000716* \quad - 0.983043* \ (\Delta LEXN) \ -0.152674* \ \Delta LBSE(-1)$$

$$(21.06371) \quad (-14.50655) \qquad (-2.832862)$$

R-Square= 0.048589     Adjusted R- square = 0.043137     F Statistic=8.911861   DW= 2.009469

* indicate significance at 1% level of significance, t values are in parenthesis

The result of the regression analysis indicates that log of exchange rate is having negative and significant relationship with Sensex. The R square value indicate that  4.8% variation in stock indices is caused by exchange rate movement. The results support the findings of the Granger causality test that there is nexus between the exchange rate and the stock indices (Sensex and Nifty) during the period under study. But the interaction and relationship is not strong due to the reason as only 5% variation in stock indices is explained by exchange rate only. So there are many others factors which impact the stock exchange such as FII's investment, fiscal policy, interest rate and international market conditions and so on.
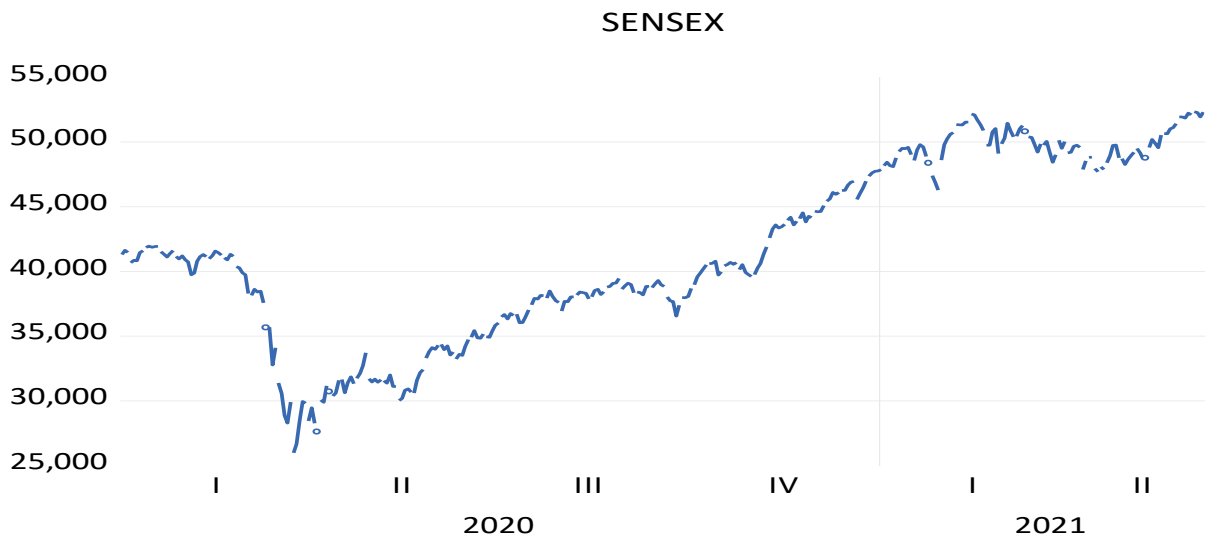


**Figure -1 Graphical presentation of the SENSEX fluctuation during COVID-19**
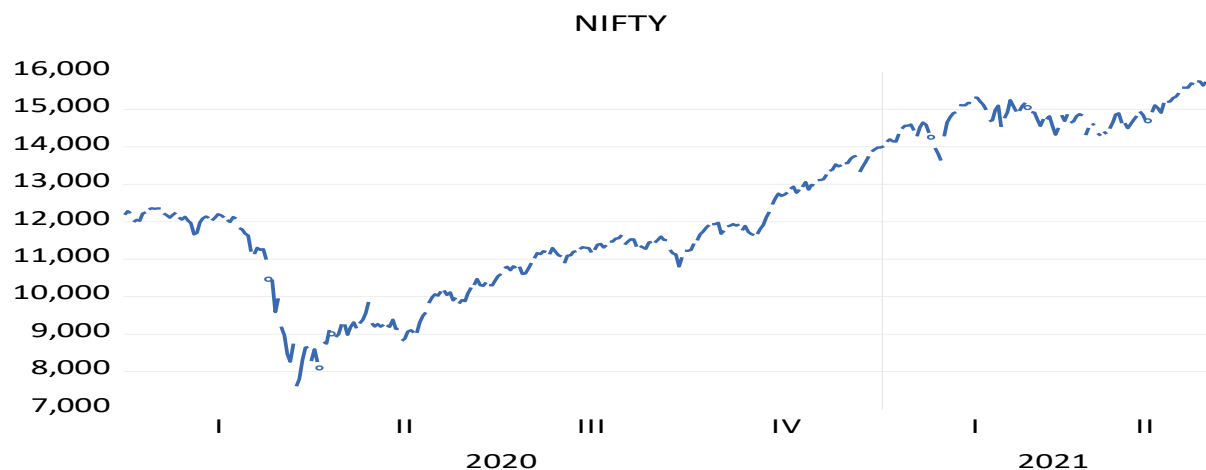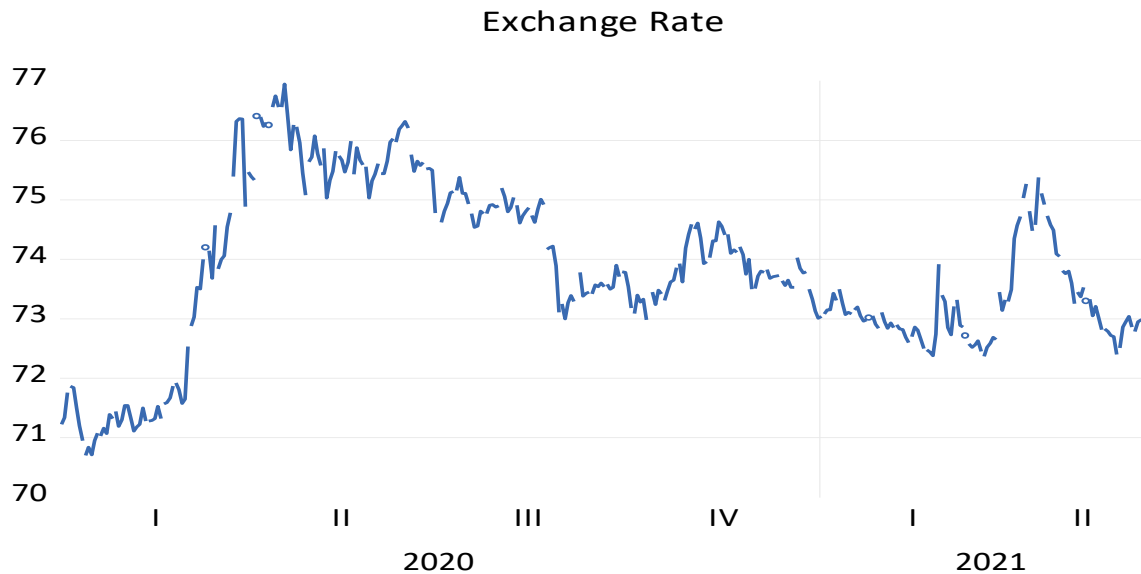
Dr. Kamini Bhutani[a,] Dr. Rajni[b]

**Figure -2   Graphical presentation of the Nifty fluctuation during COVID-19**



Exchange Rate

**Figure-3 Graphical presentation of the Nifty fluctuation during COVID-19**

From the graphical presentation of the exchange rate and nifty we can clearly say that the movements of exchange rate and stock indices are in the reverse way. When the Indian stock market crashed in March because of the news of the COVID-19 cases in India, the stock market respond to it adversely however then again we tracked down that the exchange rate ascends during that period. Even when the stock market improves because of the market sentiments then the graph of the exchange rates shows decline during that period.

**V Conclusion**

The objective of this study was to examine the relationship between exchange rate and stock indices (Nifty and Sensex). We have used the daily data from Jan, 2020 to June 2021 to contemplate the relationship between exchange rate and stock indices during the COVID- 19 period. The result of the correlation analysis indicates that there is a moderate but adverse association between exchange rate and stock indices.  It basically indicates that when the rupee depreciates it negatively influences the stock prices. The result of the Unit root test is non-stationary at level, but it is stationary at first difference. The results of the Granger causality tests are surprising because in our study the causality flow from the stock market indices to the exchange rate. Hence, we are accepting the hypothesis that the relationship between the exchange rate and stock indices exist. When the regression analysis is performed we find that the exchange rate has negative and significant effect on the stock market, but the amount of variation explained is very less. So we can conclude that apart from the exchange rate, the Sensex and Nifty are influenced by so many other factors despite the fact that the two markets are highly integrated. As we all knows that the forex market is incredibly unstable, so any effect upon the stock market will in general slack. At the point when the companies release its earnings report, it is beyond the realm of imagination to foresee how much currency

movements affect their operations and share prices. From our analysis we can say that in spite of the fact of existence of   correlation between foreign exchange rate and stock market, it will be hard to utilize it as a pointer for the movements in stock indices as the extent of contact between two is very low. The variations in the demand and supply of stock regulate their price; exchange rate as one of the factor may influence the demand and supply of the stock and eventually its price however not really emphatically. So, we can reject the null hypothesis that there is no relationship between exchange rate and stock indices but also we cannot accept alternate hypothesis in entirety because of moderate relationship between exchange rate and stock indices.

## VI Limitations and Suggestions

In the study the effect of exchange rate on the stock indices was not felt much because we take into consideration only single variable. In the real world, stock indices and exchange rate are influenced by an enormous number of elements like money supply, interest rates, BOP and so on. Assuming more independent variables are thought of, a study would be more comprehensive. The one more explanation of moderate relationship is that the companies in the index may have less exposure to foreign exchange as compared to other companies listed in the stock market. There is a scope for studying the relationship between exchange rate and stock prices of those companies who have much exposure to foreign exchange.

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