International Journal of Education, Modern Management, Applied Science & Social Science (IJEMMASSS)
ISSN : 2581-9925, Impact Factor: 5.143, Volume 02, No. 02, April - June, 2020, pp.01-08

COVID-19 CRISIS AND ITS IMPACT ON BSE SENSEX INDEX AND FOREIGN EXCHANGE RATES

Dr. Kalapi Banerjee*

ABSTRACT

The world is facing one of the major global crises - the Covid-19 pandemic. In a strongly connected and integrated world, where all the major economic functions like consumption, production, exchange and investment are highly globalized, the impacts of the disease are widespread. Global financial markets have also been highly responsive to the changes. The most visible outcome of the COVID-19 crisis on financial markets was the effect in the global stock market. The present study attempts to understand the impact of the pandemic caused by the COVID-19 crisis on foreign exchange rates by understanding the Foreign Exchange Market with special reference to the Indian scenario, analysing S&P BSE index data in pre COVID-19 crisis period and during COVID-19 crisis period, analysing the Exchange rates in pre COVID-19 crisis period and during COVID-19 crisis period, drawing comparison between Pre COVID-19 crisis period and during COVID-19 crisis period in relation to S&P BSE Sensex (open value, lower value, higher value, and close value) and currency exchange rates (US Dollar, Pound Sterling, Euro and Japanese Yen), analysing the relation between variables of S&P BSE index (open value, lower value, higher value, and close value) and currency exchange rate (US Dollar, Pound Sterling, Euro and Japanese Yen) and analysing the effect of changes in BSE Sensex and currency exchange rates on the Indian stock market. The study is based on secondary data where comparison has been done by defining the time period of pre COVID-19 crisis period as January 2019 to January 2020 and during COVID-19 crisis period as February 2020 to April 2020. Quantitative analysis has been done through statistical tests such as normality test, Mann Whitney test and Spearman's rank correlation coefficient analysis using SPSS. It can be concluded from the present study that there is declining behaviour of the equity market as per S&P BSE Sensex index and higher currency exchange rate in terms of INR during COVID-19 crisis period. In other words, the Indian stock market is more affected by currency exchange rates in COVID-19 crisis period than Pre COVID-19 crisis period. The results may help the policy makers and investors in developing suitable financial solution to stabilize the present economic crisis condition due to COVID-19.This study will hopefully help in opening up new research areas on the impact of performance of stock market indices of the selected countries and BSE Sensex or FDI and FII with BSE Sensex in the Pre COVID-19 and during COVID-19 periods.

Keywords: *COVID-19, BSE Sensex, Exchange Rates, Financial Impact, SPSS*.

Introduction

The world is facing one of the major global crises - the Covid-19 pandemic. This crisis has inflicted two kinds of shocks on countries worldwide – primarily the health shock and secondarily the economic shock. The COVID-19 outbreak (previously 2019-nCoV) was caused by the SARS-CoV-2 virus. This outbreak was triggered in December 2019 in Wuhan city in Hubei province of China. COVID-19 continues to spread across the world. Initially the epicentre of the outbreak was China with reported cases either in China or being travellers from China. Amidst the significant public health risk COVID-19 poses to the world, the World Health Organization (WHO) had declared a public health emergency of international concern to coordinate international responses to the disease.

[G] Assistant Professor, Department of Commerce, The Bhawanipur Education Society College, Kolkata, West Bengal, India.

In a strongly connected and integrated world, where all the major economic functions like consumption, production, exchange and investment are highly globalized, the impacts of the disease are widespread. Amidst the slowing down of the Chinese economy with interruptions to production, the functioning of global supply chains has been disrupted. Companies across the world, irrespective of size, dependent upon inputs from China started experiencing contractions in production. Transportation among countries have been restricted which further slowed down the global economic activities. Most importantly, panic among consumers and firms have distorted usual consumption patterns and resulted in market irregularities. Global financial markets have also been highly responsive to the changes.

The most visible outcome of the COVID-19 crisis on financial markets was the effect in the global stock market. Global stock markets lost $6 trillion in value over six days from 23 to 28 February, according to S&P Dow Jones Indices. Between February 20 and March 19, the S&P 500 index fell by 28% (from 3,373 to 2,409), the FTSE 250 index fell by 41.3% (from 21,866 to 12,830), and the Nikkei fell by 29% (from 23,479 to 16,552). In the same period, large international banks witnessed a plunge in their share price, for example, Citigroup's share price fell by 49% (from US$78.22 to US$39.64), JP Morgan Chase's share price fell by 38% (from US$137.49 to US$85.30), and Barclays' share price fell by 52% (from £181.32 to £86.45). Although the oil price war, in which Russia and Saudi Arabia were driving down oil price by increasing oil production, played a role in the fall in stock markets indices, the subsequent fall in stock market indices during the crises was mainly due to investors' flight to safety during the coronavirus pandemic. In crises, the dollar generally tends to appreciate – especially against emerging market currencies – and dollar liquidity becomes scarce.The spread of COVID-19 has led to large foreign exchange (FX) moves, as past global crises have, but both the scale of the epidemic and the speed of its global spread make the current situation unique.

Objective of the Study

The present study attempts to understand the impact of the pandemic caused by the COVID-19 crisis on foreign exchange rates. For the purpose, the following objectives have been identified:

- Understanding the Foreign Exchange Market with special reference to the Indian scenario.
- Analysing S&P BSE index data in pre COVID-19 crisis period and during COVID-19 crisis period.
- Analysing the Exchange rates in pre COVID-19 crisis period and during COVID-19 crisis period.
- Drawing comparison between Pre COVID-19 crisis period and during COVID-19 crisis period in relation to S&P BSE Sensex (open value, lower value, higher value, and close value) and currency exchange rates (US Dollar, Pound Sterling, Euro and Japanese Yen).
- Analysing the relation between variables of S&P BSE index (open value, lower value, higher value, and close value) and currency exchange rate (US Dollar, Pound Sterling, Euro and Japanese Yen).
- Analysing the effect of changes in BSE Sensex and currency exchange rates on the Indian stock market.

Methodology of the Study

The study is based on secondary data which has been taken from BSE India (https://www.bseindia.com/Indices/IndexArchiveData.html) and Reserve Bank of India (HBS_Table_No._220_Daily_Exchange_Rate_of_the_Indian_Rupee) for April 2020. Analysis has also been done from the data of S&P (Standard and Poor) BSE index (data of lower, higher, open and close) and currency exchange rate of USD, Pound Sterling, Euro and Japanese Yen in relation to INR. The comparison has been done by defining the time period of pre COVID-19 crisis period as January 2019 to January 2020 and duringCOVID-19 crisis period as February 2020 to April 2020. Quantitative analysis has been done through statistical tests such as normality test, Mann Whitney test and Spearman's rank correlation coefficient analysis using SPSS (version 20) software.

The Foreign Exchange Market

The foreign exchange market is the generic term for the worldwide institutions that exist to exchange or trade currencies. Foreign exchange is often referred to as "forex" or "FX." The foreign exchange market is an over-the-counter (OTC) market, which means that there is no central exchange and clearinghouse where orders are matched (Lien, 2009).Foreign exchange rate is the value of a foreign currency relative to domestic currency. Understanding the foreign exchange rate movements is not only important for exporters and, importers but also for those who deals in currency markets regularly such as, commercial banks, brokers and central banks, traders and speculators, tourists and investors,

etc. The exchange of currencies is done in the foreign exchange market, which is one of the biggest financial markets having trading centres in each part of a single world on which the sun never sets (Krugman, Obstfeld, & Melitz, 2012).The Central bank intervenes in the foreign exchange market to achieve many objectives such to control inflation or maintain internal balance, to maintain external balance and prevent resource misallocation or preserve competitiveness and boost growth, to prevent or deal with disorderly markets or crises.

The Indian Scenario

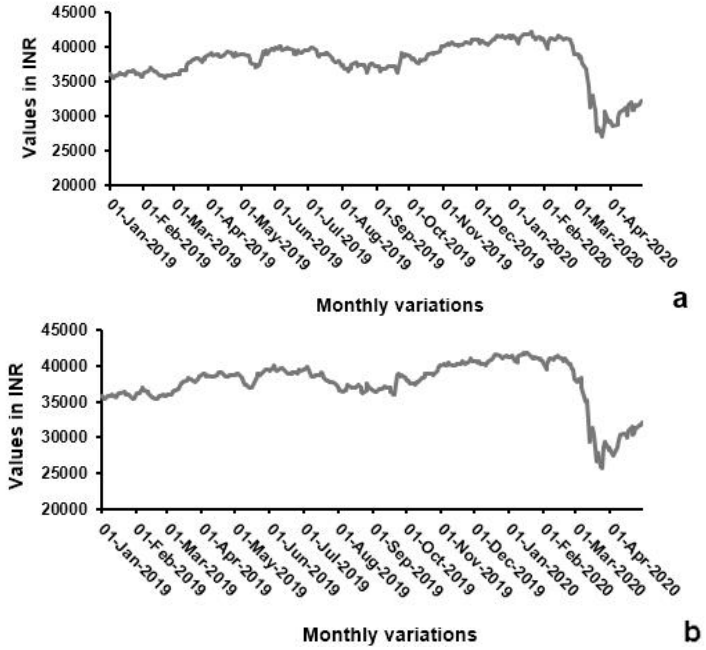
Foreign exchange transactions in India can be segmented as interbank market and retail market transactions. Market participants under these segments can trade in foreign currency through different ways like futures, options, spot, swaps and forwards. Currency futures (Indian Rupee and US Dollar) started trading at National Stock Exchange (NSE) in 2008. Only recognized exchanges permitted by Reserve Bank of India (RBI) can offer currency future contracts in four currency pairs i.e., USDINR, EURINR, GBPINR and JPYINR. SEBI and RBI permitted introduction of USDINR options on stock exchange from July 30, 2010. Currency options were introduced at NSE and USE from October 29, 2010. Currency derivatives at BSE started from November, 2013. Recognized exchanges permitted by RBI in for currency futures contracts are as follows:

- NSE Currency Derivatives
- BSE Currency Derivatives
- MCX'SX Currency Derivatives
- USE Currency Derivatives

United Stock Exchange of India Ltd. has stopped providing trading facilities to its members from 30th of December 2014.

Analysis and Findings

Since, the stock market is predominantly an emotion driven market which is ruled by hope and anticipation, the sudden shock of COVID-19 and its traumatic effect on business and economies worldwide lead to a sudden drop in the Sensex throughout the world. A decreasing trend has been found in all cases like open value, lower value, higher value, and close value in this study (Fig 1a-d). The study also indicates a steep fall in S&P BSE Sensex afterMarch 2020 and still shows a lower value till April 2020 in comparison to earlier period of COVID-19 crisis (January 2019 to January 2020). However, with the slackening of the lockdown norms in its second phase, markets have shown gradual trend towards improvement.



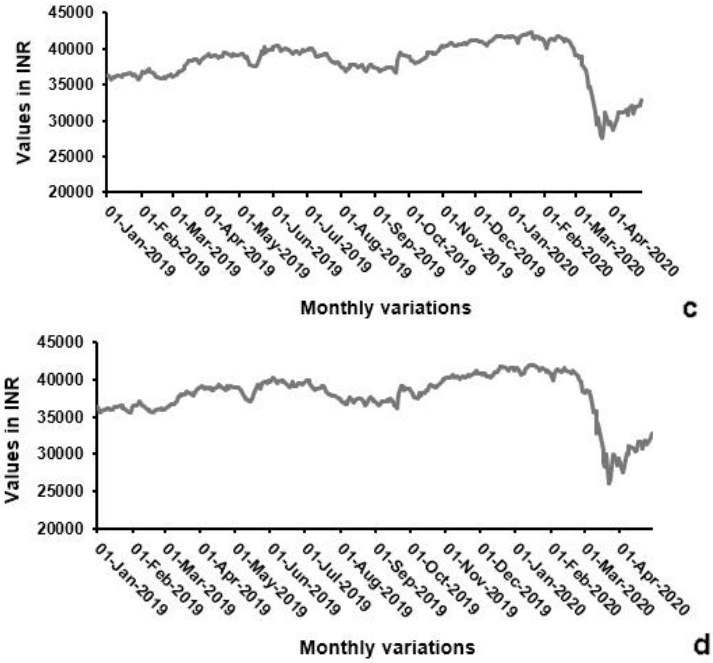


Fig 1: S&P BSE index data in preCOVID-19 crisis and duringCOVID-19 crisis
(a = open value; b = lower value; c = higher value and d = close value)

In respect to daily exchange rate (Fig 2a-d), the INR value has been found to show an increasing trend from March 2020 and had reached its maximum in April 2020 for the studied exchange rates of US Dollar, Pound Sterling, Euro and Japanese Yen. The comparison shows the pre COVID-19 crisis periodof January 2019 to January 2020 and during COVID-19 crisis period of February 2020 to April 2020.

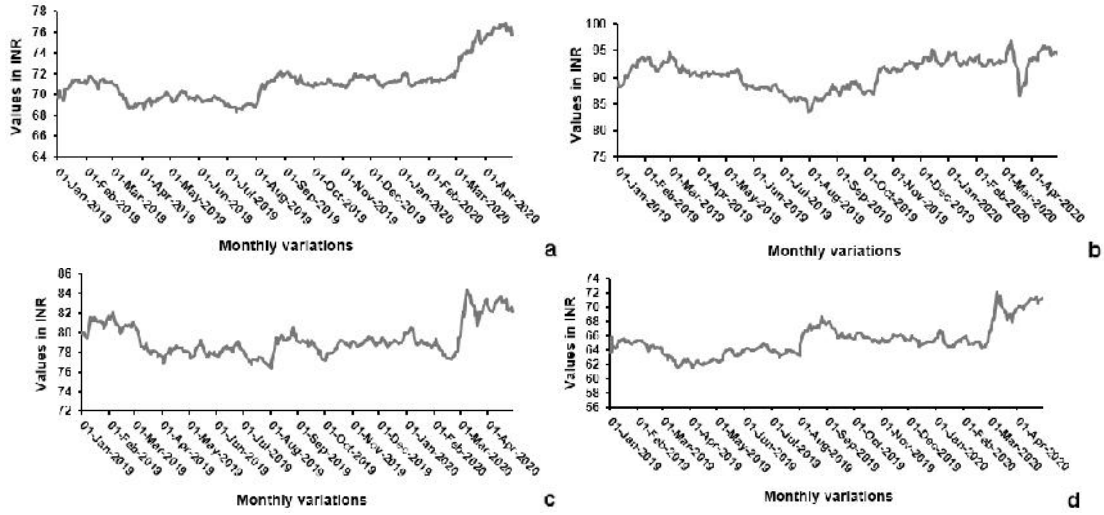


Fig 2: Exchange rate in pre COVID-19 crisisand duringCOVID-19 crisis
(a = US Dollar; b = Pound Sterling; c = Euro and d = Japanese Yen)

In any statistical test conducted, one of the important assumptions about the nature of the data is to know whether it is normally distributed. To understand the normal distribution of studied data in the present study, the normality test has been performed for both the data sets pertaining to the pre COVID-19 crisis period and during COVID-19 crisis period in relation to S&P BSE Sensex (open value, lower value, higher value, and close value) and currency exchange rates (US Dollar, Pound Sterling, Euro and

Japanese Yen) to determine the level of significance. The data indicates highly significant (P<0.01) value for Shapiro-Wilk test as shown in Table 1, the p value below the alpha level(0.05) i.e. the null hypothesis is rejected and the studied data tested are not normally distributed. Hence, non-parametric tests have been used for the statistical comparisons.

Table 1: Tests of normality for different currency exchange rates on pre and during COVID-19crisis situation

Parameters (Currency)	Period	Shapiro-Wilk		
		Statistic	p Value	Sig.
US Dollar	Pre COVID-19	0.922	265	<0.001
	During COVID-19	0.874	54	<0.001
Pound Sterling	Pre COVID-19	0.960	265	<0.001
	During COVID-19	0.915	54	0.001
Euro	Pre COVID-19	0.970	265	<0.001
	During COVID-19	0.861	54	<0.001
Japanese Yen	Pre COVID-19	0.989	265	0.048
	During COVID-19	0.871	54	<0.001
Open	Pre COVID-19	0.961	265	<0.001
	During COVID-19	0.864	54	<0.001
High	Pre COVID-19	0.963	265	<0.001
	During COVID-19	0.866	54	<0.001
Low	Pre COVID-19	0.960	265	<0.001
	During COVID-19	0.875	54	<0.001
Close	Pre COVID-19	0.964	265	<0.001
	During COVID-19	0.877	54	<0.001

Sig. = Significance

Table 2 evaluates the normality test for both the data sets such asPre COVID-19 crisis period and during COVID-19 crisis period in relation to change in S&P BSE Sensex (open value, lower value, higher value, and close value) and change in currency exchange rates (US Dollar, Pound Sterling, Euro and Japanese Yen) to determine level of significance. The data indicate significant (P<0.001, P<0.01 and P<0.05) value for Shapiro-Wilk test for few cases such as change in US Dollar, Euro and Japanese Yen and changes in open, high, low and close value in Pre COVID-19 crisis period dataset while only change in Japanese Yen and changes in open and close value in during COVID-19 crisis period dataset as shown in Table 2.Thus, the p value below the alpha level (0.05) i.e. the null hypothesis is rejected, and the studied significant data tested are not normally distributed.Hence, non-parametric tests have been used for the statistical comparisons.

Table 2: Tests of normality for changes different parameters on pre and during COVID-19 crisis period

Parameters	Period	Shapiro-Wilk		
		Statistic	df	p Value
Change in US Dollar	Pre COVID-19	0.986	264	0.010
	During COVID-19	0.974	54	0.294
Change in Pound Sterling	Pre COVID-19	0.992	264	0.161
	During COVID-19	0.962	54	0.084
Change in Euro	Pre COVID-19	0.979	264	0.001
	During COVID-19	0.979	54	0.478
Change in Japanese Yen	Pre COVID-19	0.912	264	<0.001
	During COVID-19	0.956	54	0.044
Change in Open	Pre COVID-19	0.896	264	<0.001
	During COVID-19	0.946	54	0.017
Change in High	Pre COVID-19	0.913	264	<0.001
	During COVID-19	0.976	54	0.350
Change in Low	Pre COVID-19	0.866	264	<0.001
	During COVID-19	0.963	54	0.089
Change in Close	Pre COVID-19	0.945	264	<0.001
	During COVID-19	0.946	54	0.016

In overall statistics, comparison between both the data sets such as Pre COVID-19 crisis period and during COVID-19 crisis period in relation to S&P BSE Sensex (open value, lower value, higher value, and close value) and currency exchange rates (US Dollar, Pound Sterling, Euro and Japanese Yen) indicate highly significant (P<0.001) value as shown in Table 3 using Mann Whitney test while the dataset of change in US Dollar, Pound Sterling, Euro and Japanese Yen as well as open value, lower value, higher value, and close value does not show any statistical differences. All the currency exchange rates moved adversely during the COVID-19 crisis period from their Pre COVID-19 crisis times and all of its S&P BSE Sensex values (open, lower, higher, and close) have gone down during the COVID-19 crisis period. (Table3).

Table 3: Overall Statistics for Different Currencies & Its Changes on Pre and during COVID-19 Crisis Situation

Parameters (currency)	Period						p Value	Significance
	Pre COVID-19			During COVID-19				
	Mean	Median	Std. Deviation	Mean	Median	Std. Deviation		
US Dollar	70.49	70.89	1.02	73.98	74.12	2.05	<0.001	Significant
Pound Sterling	90.20	90.79	2.66	93.06	93.14	2.13	<0.001	Significant
Euro	78.88	78.81	1.16	81.06	82.08	2.29	<0.001	Significant
Japanese Yen	64.68	64.85	1.46	68.31	69.05	2.57	<0.001	Significant
Open	38688.46	38813.48	1779.25	34908.16	32707.14	5035.89	<0.001	Significant
High	38845.19	38976.58	1763.58	35306.99	33787.87	4806.67	<0.001	Significant
Low	38425.38	38557.43	1791.30	34262.18	31916.50	5273.48	<0.001	Significant
Close	38625.09	38720.57	1770.97	34752.61	32749.15	5047.88	<0.001	Significant
Change in US Dollar	0.01	0.00	0.24	0.08	0.05	0.36	0.061	Not Significant
Change in Pound Sterling	0.02	-0.01	0.51	0.01	0.03	0.92	0.717	Not Significant
Change in Euro	0.00	0.01	0.32	0.06	-0.03	0.60	0.512	Not Significant
Change in Japanese Yen	0.01	-0.03	0.37	0.10	0.05	0.67	0.173	Not Significant
Change in Open	18.88	0.64	339.20	-163.62	-144.00	1015.57	0.249	Not Significant
Change in High	18.45	5.44	290.32	-152.91	-8.98	902.13	0.279	Not Significant
Change in Low	18.12	19.63	311.28	-157.40	-27.20	1085.63	0.649	Not Significant
Change in Close	16.93	12.67	328.63	-148.21	-137.24	1213.26	0.386	Not Significant

Table 4 describes correlation between variables of S&P BSE index (open value, lower value, higher value, and close value) and currency exchange rate (US Dollar, Pound Sterling, Euro and Japanese Yen). The present study analyses statistical test using Spearman's rank- correlation coefficient to determine the relationship between these two variables. Spearman's correlation analysis is a nonparametric approach to detect the relationship between the two above-mentioned variables. In Pre COVID-19 crisis period there was no significant correlation between USD/INR and Japanese Yen/INR exchange rates with the S&P BSE Sensex values. This reflects India was immune to exchange rate movements against these two currencies. With Pound Sterling/INR there was a significant positive correlation indicating that even though the Indian currency worsened against Pound Sterling yet the stock market continued to move up. But with Euro/INR there was a significant negative correlation indicating that devaluation of Indian currency against Euro had a significant negative impact on the stock market. During the COVID-19 crisis period Pound Sterling/INR continued to have no significant correlation with the S&P BSE Sensex values. This indicates Pound Sterling/INR does not affect the Indian stock market. However, US Dollar/INR, EURO/INR and Japanese Yen/INR had significant negative correlation with S&P BSE Sensex values. This indicates that devaluation of Indian currency against Euro had a significant negative impact on the stock market (Table 4).

Table 4.Non-Parametric Correlation Coefficient analysis between BSE Sensex and Currency Exchange Rate

Period				Open	High	Low	Close
Spearman's rho	Pre COVID-19	US Dollar	Correlation Coefficient	0.034	0.034	0.028	0.032
			p Value	0.585	0.578	0.656	0.599
		Pound Sterling	Correlation Coefficient	0.248	0.255	0.263	0.263
			p Value	<0.001	<0.001	<0.001	<0.001
		Euro	Correlation Coefficient	-0.286	-0.285	-0.278	-0.279
			p Value	<0.001	<0.001	<0.001	<0.001
		Japanese Yen	Correlation Coefficient	0.024	0.028	0.011	0.020
			p Value	0.701	0.655	0.860	0.741

	During COVID-19	US Dollar	Correlation Coefficient	-0.817	-0.836	-0.783	-0.804
			p Value	<0.001	<0.001	<0.001	<0.001
		Pound Sterling	Correlation Coefficient	-0.069	-0.096	-0.019	-0.044
			p Value	0.620	0.490	0.890	0.749
		Euro	Correlation Coefficient	-0.662	-0.672	-0.656	-0.656
			p Value	<0.001	<0.001	<0.001	<0.001
		Japanese Yen	Correlation Coefficient	-0.646	-0.655	-0.627	-0.635
			p Value	<0.001	<0.001	<0.001	<0.001

Table 5 describes correlation between changes in S&P BSE index (open value, lower value, higher value, and close value) and change in currency exchange rate (change in US Dollar, Pound Sterling, Euro and Japanese Yen). The present study analyses statistical test using Spearman's rank-correlation coefficient to determine the relationship between these two variables. Spearman's correlation analysis is a non-parametric approach to detect the relationship between the two above-mentioned variables. In Pre COVID-19 crisis period, there was highly significant (P<0.001) negative correlation between change in USD/INR and Japanese Yen/INR exchange rates with the S&P BSE Sensex values for high, low, and close values. With change in Pound Sterling/INR and Euro/INR there were also significant (P<0.01) negative correlation only for high value of S&P BSE index indicating higher is the devaluation more is the adverse effect on the stock market indices. Change in US Dollar and Change in Japanese Yen had more severe impact as compared to the other two currencies. During the COVID-19 crisis period similar trend continued for change in US Dollar, change in Euro and change in Japanese Yen. However, the impact got more severe as the correlation co-efficient was more negative in this period. But change in Pound Sterling/INR had no significant correlation with the S&P BSE Sensex values. This indicates change in Pound Sterling/INR did not affect the Indian stock market. However, US Dollar/INR, EURO/INR and Japanese Yen/INR had significant negative correlation with S&P BSE Sensex values. This indicates that devaluation of Indian currency against Pound Sterling had a significant negative impact on the stock market (Table 5).

Table 5: Non-parametric correlation coefficient analysis between changes BSE Sensex and currency exchange rate

Period				Change in Open	Change in High	Change in Low	Change in Close
Spearman's rho	Pre COVID-19	Change in US Dollar	Correlation Coefficient	-0.110	-0.262	-0.231	-0.236
			p Value	0.073	<0.001	<0.001	<0.001
		Change in Pound Sterling	Correlation Coefficient	-0.118	-0.176	-0.078	-0.099
			p Value	0.056	0.004	0.204	0.108
		Change in Euro	Correlation Coefficient	-0.156	-0.207	-0.091	-0.075
			p Value	0.011	0.001	0.142	0.227
		Change in Japanese Yen	Correlation Coefficient	-0.108	-0.271	-0.249	-0.249
			p Value	0.079	<0.001	<0.001	<0.001
	During COVID-19	Change in US Dollar	Correlation Coefficient	-0.342	-0.527	-0.419	-0.431
			p Value	0.011	<0.001	0.002	0.001
		Change in Pound Sterling	Correlation Coefficient	0.090	-0.038	-0.069	-0.246
			p Value	0.516	0.784	0.619	0.073
		Change in Euro	Correlation Coefficient	-0.191	-0.314	-0.306	-0.326
			p Value	0.167	0.021	0.024	0.016
		Change in Japanese Yen	Correlation Coefficient	-0.259	-0.405	-0.477	-0.572
			p Value	0.059	0.002	<0.001	<0.001

Conclusion

It can be concluded from the present study that there is declining behaviour of the equity market as per S&P BSE Sensex index and higher currency exchange rate in terms of INR during COVID-19 crisis period. In other words,the Indian stock market is more affected by currency exchange rates in COVID-19 crisis period than Pre COVID-19 crisis period. The study is based on a three-month period (February to April 2020) during COVID-19 crisis period compared the January 2019 to January 2020 period as Pre COVID-19 crisis period.The present study is supported by other researchin relation to significant effect on equity market index and currency exchange ratesin Malaysia during the COVID-19crisis period (Bakar and Rosbi, 2020). They observed negative values for both KLSE (Kuala Lumpur Stock Exchange) index and currency exchange rate for US Dollar/MYD (Malaysian Ringgit) during the period of COVID-19 crisis period mainly during the fourth week of March 2020. But in the Indian scenario, the decrement was observed for S&P BSE Sensex index and increasing INR value for currency

exchange rate from the first week of March 2020. The results for statistical tests especially normal distribution by Shapiro-Wilk test and Spearman's correlation coefficient analysis are supported by earlier research work (Bakar and Rosbi, 2020). Few reports have been documented on economic crisis due to COVID-19 pandemic (Bhatia and Bhattacharya, 2020; Nathan, 2020).

Thus, these results may help the policy makers and investors in developing suitable financial solution to stabilize the present economic crisis condition due to COVID-19. This study will hopefully help in opening up new research areas on the impact of performance of stock market indices of the selected countries and BSE Sensex or FDI and FII with BSE Sensex in the Pre COVID-19 and during COVID-19 periods.

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