

Brexit Referendum: Impact on NIFTY 50 & FTSE 100 Volatility

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Abstract

Financial Markets throughout the world are interlinked and interconnected. The global announcement of United Kingdom (UK) leaving the European Union (EU) in June 2016 i.e. Brexit Referendum has impacted the economy and financial markets globally. To understand the potential impact of Brexit on Indian and UK's Financial Markets, an empirical study has been conducted to look over the possible impact of Brexit Referendum on Nifty 50 India's stock market index and FTSE 100 UK's stock market index. For the study the data has been collected for the period of July 2013 to June 2019 which has been further divided in to two-time phases: Pre Brexit-Announcement Period (July 2013 – June 2016) and Post Brexit Announcement Period (July 2016- June 2019). The data is analysed by taking 1443 (720+723) observations of daily closing prices of each FTSE 100 & NIFTY 50 Indices using ARCH LM and GARCH (1,1) Model to test the volatility clustering in both the time phases (pre and post) for both the stock markets. The results indicate that there is more volatility in Pre Brexit period for FTSE 100 returns due to the fear of uncertainty about the upcoming announcement of Brexit and its probable impact on economy and for Nifty 50 the volatility seems to be very high for both the periods and with slight high variation in the Pre Brexit announcement period.

Keywords: Nifty 50, FTSE 100, Brexit, ARCH LM, Garch, Volatility, Announcement, UK, EU, Financial Markets

Introduction

Sending shockwaves across markets globally, on 23rd June 2016 the UK decided to opt out of European Union (EU) which was formed for the social and economic benefits of European Nations after World War II. This exit would affect not just the free trade and labour mobility across Eurozone nations and members of European Union but also the financial markets. To determine any economy's strength, stock markets always stand as a major player as financial market movements aggregates the effect of goods, labour, foreign exchange, interest rates, and capital and

these markets are affected by numerous macro and micro economic factors. For many economists, the event is similar to the global financial crisis in 2008 as the historic decision of one European member exiting the union is somehow an uncommon event and send waves that effected financial markets globally. The financial industry contributes 12% to the UK's total GDP and is one of the highly influenced sectors due to Brexit among other hard-hit sectors like automobile, airline and pharmaceutical sectors. Being UK the largest export market for India there is a concern of negative impact among investors as India's major investment is in UK as compared to other rest of the Europe together. There is a chance of weakening of the rupee because of outflow in foreign portfolio investment and 23.7% of rupees' effective exchange rate is accounted by both UK and EU.

On 23rd June 2016, Pound sterling has seen its maximum fall in the last 31 years. This has given a huge shock to British economy and this increased the fear of economic slowdown in UK and have slumped the entire American, European and Asian financial markets worldwide. Globally stock lost around \$ 2.1 Trillion in value. The FTSE 100 index declined around 9%, NASDAQ around 4% in value, S&P 500 and Dow Jones indices down by approximately 3.5%.

By using the evidences from stock markets of UK and India, an attempt has been made to investigate the volatility in the stock markets before and after the announcement by estimating GARCH Model and in financial markets do volatility clustering has any impact regarding Brexit. Such an analysis will be helpful in answering an important question that how Eurozone and EU inclusion (and non-inclusion) affects equity market movements among developed and developing economies.

The Financial Times Stock Exchange 100 Index, popularly known as FTSE 100 is a stock index of the largest 100 qualifying UK corporations having uppermost market capitalizations. These 100 corporations are enumerated on the London Stock Exchange (LSE) and they represent the specific sectors of UK including travel & leisure, Financial Services, mining, Oil & Gas production and food producers and captures 81% of the entire market capitalization of

LSE. The Nifty 50 is a share index which refers to the stock index of the National Stock Exchange, consisting of 50 stocks that represent 13 sectors including Banking, Automobile, Financial Services, Telecommunication, Energy, Oil & Gas, Pharmaceuticals, Cement, Information Technology, Metals, Consumer goods, Construction, Food Processing of the Indian Economy. These two stock market indices are considered for the study.

Literature Review

Academicians, policy makers, investors, commission agents are always interested in studying the impact of global events, announcements on trade flow and movements in financial markets across globe. One such major announcement is Brexit referendum that continually attracted the attention of numerous researchers and policy makers in the last 5 years on identifying the different reasons behind the Britain's exit from European Union and consequences of same on different sectors, trade, FDIs and global stock markets.

Goodwin & Heath (2016); Hobolt (2016) identified the factors like education, immigration, ethnic diversity and age as common reason for the Britain vote to exit EU. The people who are older and poorer, have less education and have issues about immigration had more concerns towards it. Panic in the industries was quite expected because of unpreparedness of industries across UK. Ziv et al. (2018) identified main consequences of Britain's decision of exiting EU for UK energy, water and food demand, the Fuzzy Cognitive Mapping (FCM) approach has been developed and applied. Compared to other services demand showed decline with GDP and water & food demand were more related to population size. Across all concepts there was a threefold change. Madhavi & Reddy (2018) analysed the effect of Brexit on specific seven Indian sectors by using the data of CNX Nifty specific sectoral indices from June 2014 to May 2018. For the study ARCH & GARCH were used and the results reflected that Brexit referendum announcement created uncertainty which increased the volatility of stock market like any other important news.

The frictionless trade arrangement enjoyed by UK with EU may come to halt and raised various questions regarding

trade with EU and other Non- EU countries. As estimated by Dhingra et.al (2016a) the unknown nature of new economic relationship between EU and UK has definitely led to fall in GDP of UK by £26 billion to £55 billion more than double the loss in income of the rest of the EU combined. To generate predictions, they used computable general equilibrium analysis which stated the lower trade and reduced productivity leading to 6.5percent to 9.5percent of loss in GDP. Dhingra et.al (2016b) estimated the consequences of Brexit on Foreign Direct Investment and suggested that it would possibly decline 22percent of FDI which would subsequently reduce the real income and lower trade of 1.3percent to 2.6percent. McGrattan & Waddle (2020) estimated how Brexit will impact the FDI from various countries and highlighted that it is dependent more on UK that whether it acts unilaterally or jointly with EU Nations to block EU Flows and impose cross-border barriers on each other.

The lowest level of pound in past thirty years panicked the investors and the international markets as the fall in the pound value was even twice the amount it fell during the UK's 2008 recession. Ramiah et al., (2017) investigated that financial sector was a major hit with the Brexit referendum by estimating cumulative abnormal returns across industries. Davies & Studnicka (2018) using simulation analysed the potential expectations in price movements of stock market and concluded that if compared to investor's expectations the level of heterogeneity was very high. Raddant (2016) analyzed the Brexit impact on few European Stock Market Indices by estimating univariate GARCH and identified that immediately after the Brexit vote, there had been an increase in volatility but seen that volatility dropped towards pre-vote levels. Sathyanarayana & Gargsha (2016) conducted event study and investigated the influence of Brexit referendum on Indian Stock market indices. They calculated variation of excess returns over expected returns of Indian Stock Market to capture the historical volatility.

Raja & Selvam (2011) determined that dynamic fluctuations in stock prices are depicted by financial market volatility. Reddy et al. (2019) using GARCH model analysed the impact of six important macro-economic

variables namely Index of Industrial Production, Inflation, Gross Domestic Product, Fiscal Deficit, RBI monetary rate and Balance of trade well known announcements on volatility of financial markets including stock market, commodity market and foreign exchange market. Model results proved that announcement related to GDP increased the commodity market volatility but decreased the volatility in stock and foreign exchange market. Index of Industrial Production and Fiscal Deficit announcement increased the foreign exchange market volatility and Inflation related announcement reduced the foreign exchange market volatility.

Objective of the study

Various aspects of impact of Brexit referendum on UK and other European Nations goods trade, immigration, GDP, FDI movements and stock markets have already been unfolded but no study is yet been conducted on Asian Stock markets specifically in reference to Indian Stock Market. Whatever work has been done yet regarding Indian Stock market is centred on event window methodology wherein the impact for very short duration has been studied. So, an attempt has been made to investigate the volatility in the Indian and UK Stock Markets before and after the Brexit referendum considering a total period of 6 years.

Rationale of the study

Considering Indian Economy as whole, then various spheres ranging from GDP, FDI, Currency markets, trade relations, Financial markets, all are vital and a dynamic impact can be expected in short run as well as long run due to BREXIT. Any change be it political or economic across globe attracts India's attention. No country can work in isolation and same applies to India as well. UK being gateway to EU for India, its decision to leave EU will definitely have an effect which neither be avoided nor ignored. The kneejerk was witnessed at the time of announcement but its long-run association could be a study matter for all the financial analysts and stakeholders involved. The study analysis will be helpful in answering an important question that how Eurozone and EU inclusion (and non-inclusion) affects equity market movements among developed and developing economies.

Research methodology

For the purpose of stock market volatility analysis, the daily closing prices of Nifty 50 and FTSE 100 for Indian and UK's Share Market Indices are taken. The data has been collected from July 2013 to June 2019. A total of 1443 observations has been taken after eliminating unmatched dates of both the stock markets. The total study time frame has been divided into two phases: one is the Pre-Brexit announcement period named Period I commencing from 1st July 2013- 30th June 2016 and another one is the Post-Brexit announcement period commencing from 1st July 2016 - 30th June 2019 named Period II. The data has been obtained from the web portal of Investing.com Database, Yahoo Finance and official website of NSE.

From closing prices of FTSE 100 index and Nifty 50 index, Returns has been calculated using the below mentioned formula: $R_t = \log(\text{Price } t / \text{price } t-1) * 100$

Both the closing prices and return series of FTSE 100 and Nifty 50 indices are plotted on graphs to ascertain the trend of the data series in both the time phases Pre and Post Brexit periods. Further the normality of the data is tested using the descriptive statistics. The stationarity of data is tested by application of unit root test the Augmented Dickey Fuller test (ADF)

To study the volatility changes in the stock market returns, GARCH (1,1) Model is applied and to represent the volatility clustering the residual graphs are plotted to depict the high and low fluctuations and variations in the returns of both the share indices.

ARCH model computes the variance for next day's return on the basis of the weighted average of squared residuals of previous month's return. Assigning equal weights to all days of previous month's return is inappropriate. ARCH Model introduced by Engle (1982) administered the use of appropriate weights to recent days is more relevant in forecasting the variance. Bollerslev (1986) introduced the generalization of this model as GARCH parameterization which assigns declining weights to past squared residuals and then taking their weighted average. To predict the conditional variances GARCH Model is one of the best predictor. The GARCH (1, 1) model is a model developed to predict the financial instruments in context of recent information and assigning more weights to the recent news to gauge the volatility prevailing in the markets. As per GARCH (1, 1) model, the existence of volatility clustering depicts high fluctuation in the market return beyond expectations which further represents the inefficiency of the financial markets.

The specification of GARCH (1,1) model can be represented as:

The general equation of Mean: $R_t = \mu + e_t$

The equation for variance: $\sigma_t^2 = \omega + \alpha e_{t-1}^2 + \beta \sigma_{t-1}^2$

Where e_{t-1}^2 measures the volatility from news of one period before and, σ_{t-1}^2 is the variance which is to be forecasted from the previous period ($\alpha + \beta$), identifies the persistence prevailing in the stock markets. If the value is close to one it means that the market is responding beyond the expected returns

Analysis & Results

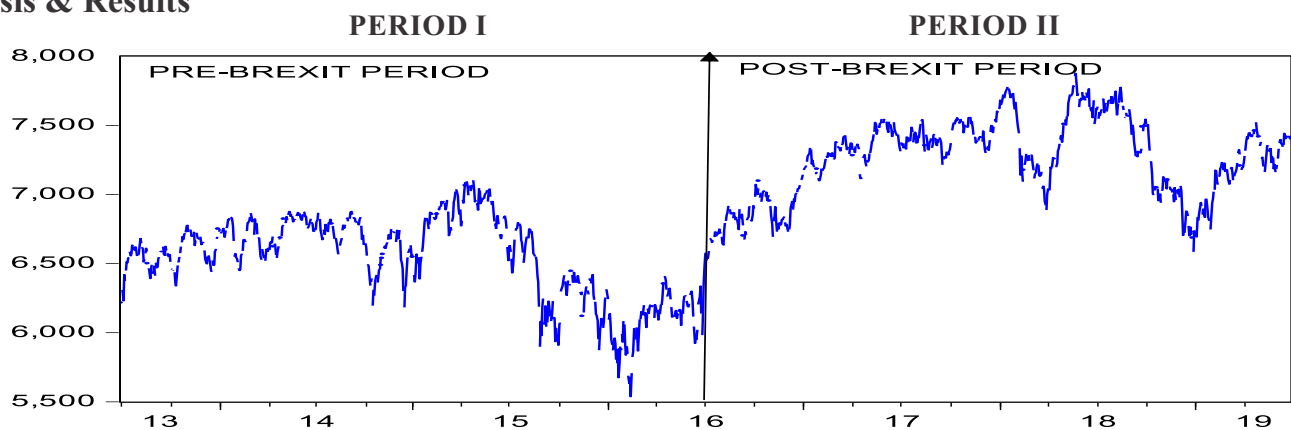


FIGURE 1: DAILY CLOSING PRICES OF FTSE 100 INDEX

(Source: Author's Own Compilation)

Daily closing prices of FTSE 100 from the period 2013 to 2019 plotted on graphs shown in figure 1 represents that FTSE 100 followed an upward trend after Brexit referendum. But in the year 2015 and 2016 i.e. during Pre Brexit announcement period i.e. period I there seems to be sharp dip and decline in the index values showing increased

market uncertainties. Similarly Figure 2 also represents the plotted returns of FTSE 100 during period I and Period II. Figure clearly reflects that the volatility during Pre Brexit announcement period in the FTSE return series is greater as compared to volatility in the Post Brexit announcement period.

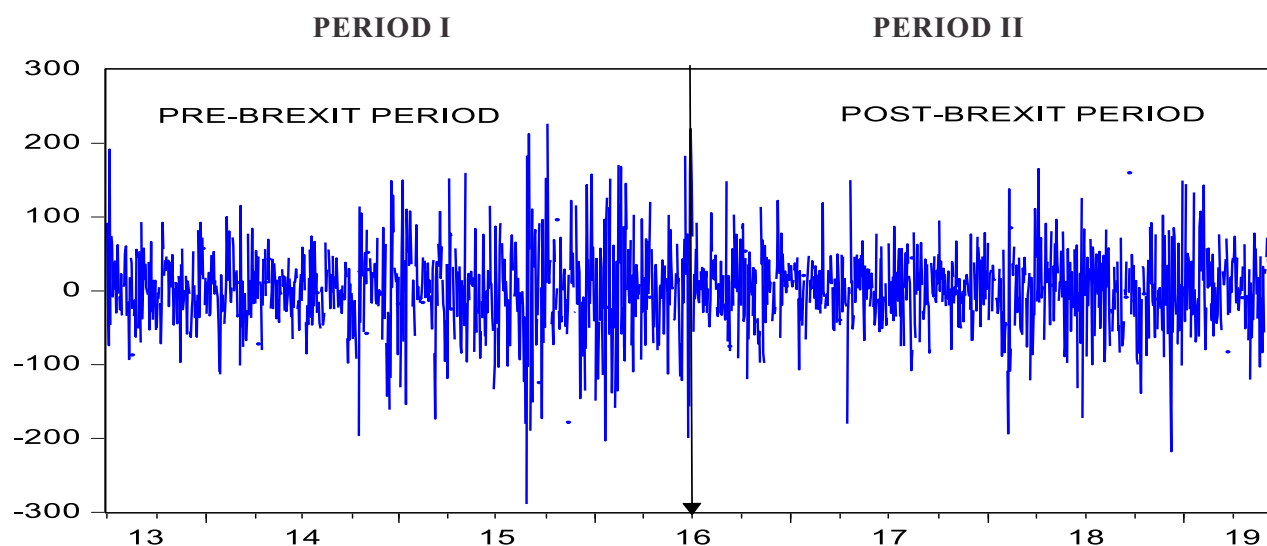


FIGURE 2: DAILY RETURNS OF FTSE 100 INDEX

(Source: Author's Own Compilation)

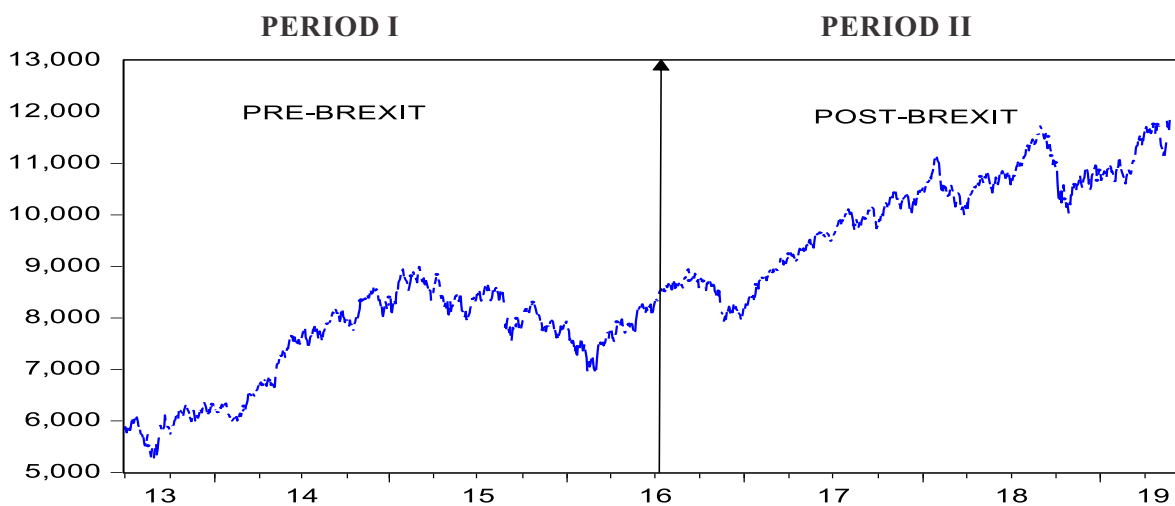


FIGURE 3: DAILY CLOSING PRICES OF NIFTY 50 INDEX

(Source: Author's Own Compilation)

Figure 3 clearly reflects that daily closing prices of NIFTY 50 index follows the upward trend during both the sample periods I and II i.e. Pre and Post Brexit. There seems a sharp

decline in the year 2015-16 and as well in the year 2016-17 indicating increased uncertainties in the financial market before and after Brexit referendum.

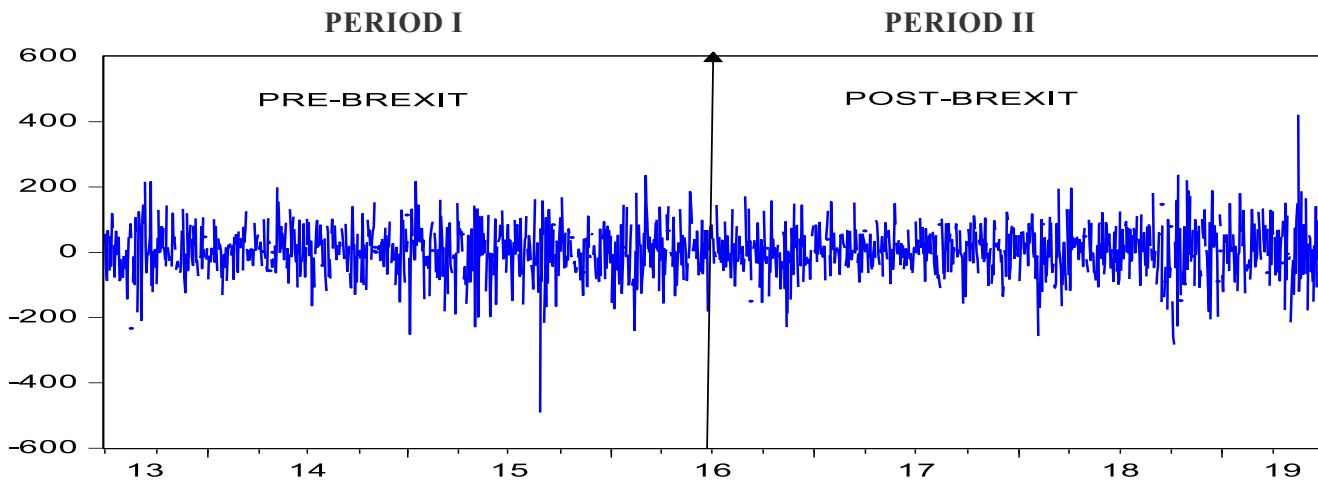


FIGURE 4: DAILY RETURNS OF NIFTY 50 INDEX

(Source: Author's Own Compilation)

It is observed from the figure 5 that fluctuations in the Nifty 50 returns shows several ups and down during both the sample periods (Pre and Post Brexit announcement periods).

Table 1: Basic Statistics of London Stock Exchange (Ftse 100 Market Returns)

STATISTIC	PERIOD I	PERIOD II
MEAN	0.011239	0.020776
ST. DEV.	0.992648	0.697068
SKEWNESS	-0.039163	-0.091590
KURTOSIS	5.118911	4.348382
JARQUE-BERA	134.6902(0.000000)	55.70500(0.000000)
SUM	8.080999	15.00051
SUM SQ. DEV	707.4819	350.3363
OBSERVATIONS	719	722

Descriptive statistics of FTSE 100 market returns reported in Table 1 reflects that the average return of FTSE 100 in Period I i.e. Pre Brexit period is lesser as compared to Period II (Post Brexit period). Non-zero skewness of the

series and kurtosis values higher than 3 during both the periods represent that FTSE return series does not follow normal distribution. High JarqueBera statistics also indicates the same.

Table 2: Basic Statistics Of Indian Stock Exchange (Nifty 50 Market Returns)

STATISTIC	PERIOD I	PERIOD II
MEAN	0.054007	0.051579
ST. DEV.	1.035092	0.743693
SKEWNESS	-0.375025	-0.064749
KURTOSIS	5.315354	4.359920
JARQUE-BERA	177.4564 (0.000000)	56.14004(0.000000)
SUM	38.83086	37.23984
SUM SQ. DEV	769.2762	398.7699
OBSERVATIONS	719	722

Table 2 exhibits the values of descriptive statistics of Nifty 50 market returns. Average returns of Nifty 50 for both the periods are almost nearby and same. In Pre Brexit period average returns reflected by mean value is 0.054007 and in post Brexit it is 0.051579. JarqueBera statistics values for both the periods rejected the hypothesis of normal

distribution of Nifty 50 market returns series. In Pre-Brexit period Kurtosis value is 5.315354 and in post Brexit period the value is 4.359920. Both values are greater than 3 that further reflects that series is leptokurtic and have heavier tail in comparison to normal distribution.

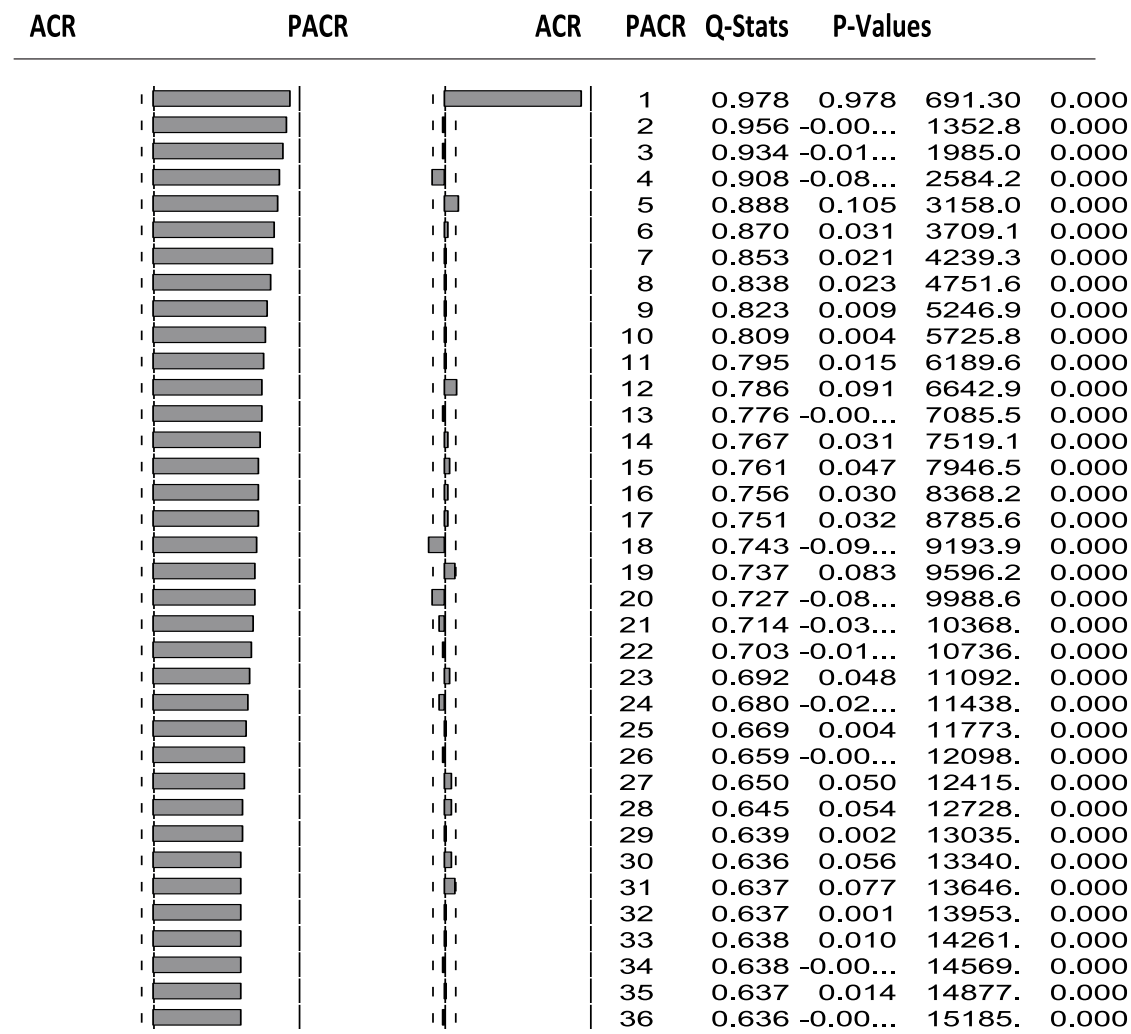
Table 3: Augmented Dickey Fuller Test(Adf)

	PERIOD I		PERIOD II	
	t-statistics	Probability	t-statistics	Probability
FTSE 100 RETURNS	-6.833611	0.0000	-27.93930	0.0000
NIFTY 50 RETURNS	-14.26348	0.0000	-25.84530	0.0000

(Source: Author's Own Compilation)

Table 3 presents the results of Augmented Dickey Fuller Test that are applied on FTSE 100 return series and Nifty 50 return series for both the periods i.e. Period I and Period II. Hypothesis that both the return series have unit root i.e. they

are non-stationary for both the sample periods taken is clearly rejected that further indicates that both the series during both the periods are stationary and further analysis can be done on these return series.

**FIGURE 5: AUTOCORRELATION FOR FTSE 100 DURING PERIOD I**

(Source: Author's Own Compilation)

ACR	PACR	ACR	PACR	Q-Stats	P-Values
				1	0.994 0.994 714.73 0.000
				2	0.988 -0.02... 1421.8 0.000
				3	0.983 0.027 2121.7 0.000
				4	0.976 -0.03... 2813.9 0.000
				5	0.971 0.045 3499.2 0.000
				6	0.965 -0.02... 4177.4 0.000
				7	0.959 -0.01... 4848.2 0.000
				8	0.954 0.020 5512.1 0.000
				9	0.948 0.010 6169.3 0.000
				10	0.943 0.030 6820.3 0.000
				11	0.938 0.026 7465.7 0.000
				12	0.933 -0.00... 8105.4 0.000
				13	0.929 -0.01... 8739.3 0.000
				14	0.924 0.005 9367.5 0.000
				15	0.919 0.011 9990.4 0.000
				16	0.915 0.017 10608. 0.000
				17	0.910 0.007 11221. 0.000
				18	0.906 -0.01... 11829. 0.000
				19	0.901 -0.00... 12431. 0.000
				20	0.896 -0.03... 13028. 0.000
				21	0.891 0.002 13618. 0.000
				22	0.887 0.005 14204. 0.000
				23	0.881 -0.02... 14783. 0.000
				24	0.876 -0.01... 15357. 0.000
				25	0.871 -0.00... 15924. 0.000
				26	0.866 0.017 16485. 0.000
				27	0.861 0.012 17041. 0.000
				28	0.855 -0.03... 17591. 0.000
				29	0.850 0.010 18135. 0.000
				30	0.845 -0.02... 18672. 0.000
				31	0.840 0.034 19204. 0.000
				32	0.835 0.019 19731. 0.000
				33	0.830 0.011 20253. 0.000
				34	0.825 -0.06... 20769. 0.000
				35	0.819 -0.03... 21278. 0.000
				36	0.814 0.024 21781. 0.000

FIGURE 6: AUTOCORRELATION FOR NIFTY 50 DURING PERIOD I

(Source: Author's Own Compilation)

ACR	PACR	ACR	PACR	Q-Stats	P-Values
				1	0.980 0.980 697.79 0.000
				2	0.963 0.043 1371.7 0.000
				3	0.944 -0.03... 2020.6 0.000
				4	0.926 -0.00... 2645.1 0.000
				5	0.907 0.002 3246.3 0.000
				6	0.890 0.009 3825.3 0.000
				7	0.875 0.057 4385.9 0.000
				8	0.859 -0.03... 4926.6 0.000
				9	0.842 -0.03... 5447.0 0.000
				10	0.824 -0.02... 5946.5 0.000
				11	0.808 0.034 6427.4 0.000
				12	0.792 -0.02... 6889.3 0.000
				13	0.776 0.011 7333.4 0.000
				14	0.761 0.015 7761.2 0.000
				15	0.745 -0.03... 8171.7 0.000
				16	0.730 0.011 8566.4 0.000
				17	0.714 -0.00... 8945.1 0.000
				18	0.699 -0.01... 9308.1 0.000
				19	0.685 0.044 9657.8 0.000
				20	0.670 -0.04... 9992.8 0.000
				21	0.656 0.008 10314. 0.000
				22	0.643 0.010 10623. 0.000
				23	0.628 -0.03... 10919. 0.000
				24	0.613 -0.02... 11200. 0.000
				25	0.599 0.032 11470. 0.000
				26	0.587 0.047 11729. 0.000
				27	0.576 0.000 11978. 0.000
				28	0.563 -0.03... 12218. 0.000
				29	0.551 0.008 12447. 0.000
				30	0.542 0.048 12669. 0.000
				31	0.532 0.018 12884. 0.000
				32	0.523 -0.00... 13091. 0.000
				33	0.514 -0.00... 13291. 0.000
				34	0.504 -0.01... 13485. 0.000
				35	0.496 0.022 13672. 0.000
				36	0.487 -0.00... 13853. 0.000

FIGURE7: AUTOCORRELATION FOR FTSE 100 DURING PERIOD II

(Source: Author's Own Compilation)

ACR	PACR	ACR	PACR	Q-Stats	P-Values
				1	0.994 0.994 716.78 0.000
				2	0.987 -0.02... 1425.0 0.000
				3	0.980 -0.01... 2124.5 0.000
				4	0.974 0.010 2815.7 0.000
				5	0.967 0.011 3498.7 0.000
				6	0.961 -0.01... 4173.6 0.000
				7	0.955 0.037 4841.1 0.000
				8	0.949 0.037 5501.9 0.000
				9	0.944 0.004 6156.3 0.000
				10	0.939 0.002 6804.3 0.000
				11	0.933 -0.07... 7444.8 0.000
				12	0.926 -0.01... 8077.5 0.000
				13	0.920 -0.03... 8701.9 0.000
				14	0.913 0.016 9318.1 0.000
				15	0.907 0.005 9926.5 0.000
				16	0.900 0.013 10527. 0.000
				17	0.894 0.007 11121. 0.000
				18	0.888 -0.04... 11707. 0.000
				19	0.881 0.004 12285. 0.000
				20	0.875 0.009 12855. 0.000
				21	0.869 -0.00... 13419. 0.000
				22	0.863 0.023 13975. 0.000
				23	0.856 -0.02... 14524. 0.000
				24	0.850 0.007 15065. 0.000
				25	0.844 0.037 15600. 0.000
				26	0.838 0.002 16129. 0.000
				27	0.833 0.009 16652. 0.000
				28	0.827 -0.01... 17168. 0.000
				29	0.822 0.060 17679. 0.000
				30	0.818 0.025 18184. 0.000
				31	0.813 0.021 18686. 0.000
				32	0.809 -0.03... 19182. 0.000
				33	0.804 -0.00... 19673. 0.000
				34	0.799 -0.04... 20159. 0.000
				35	0.794 0.020 20639. 0.000
				36	0.789 0.005 21114. 0.000

FIGURE 8: AUTOCORRELATION FOR NIFTY 50 DURING PERIOD II

(Source: Author's Own Compilation)

Figure 5 to 8 represents the correlograms for FTSE 100 return series and Nifty 50 return series for Pre and Post Brexit periods both at 36 lags for testing the autocorrelations in the returns. All these figures show the

autocorrelation, Q - statistics, and p – values for FTSE 100 return series and Nifty 50 return series for Pre and Post Brexit periods which indicates the ARCH effect existence in returns' residuals. Hence, it further requires estimation of GARCH modelling.

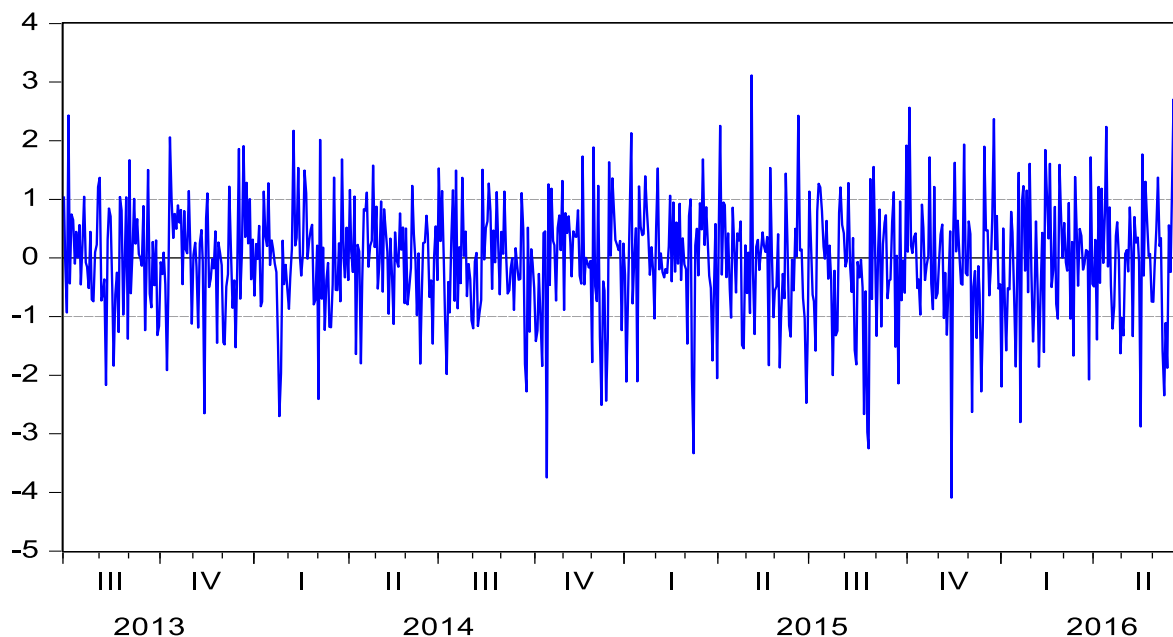


FIGURE 9: VOLATILITY CLUSTERING OF FTSE 100 RETURNS DURING PERIOD I

(Source: Author's Own Compilation)

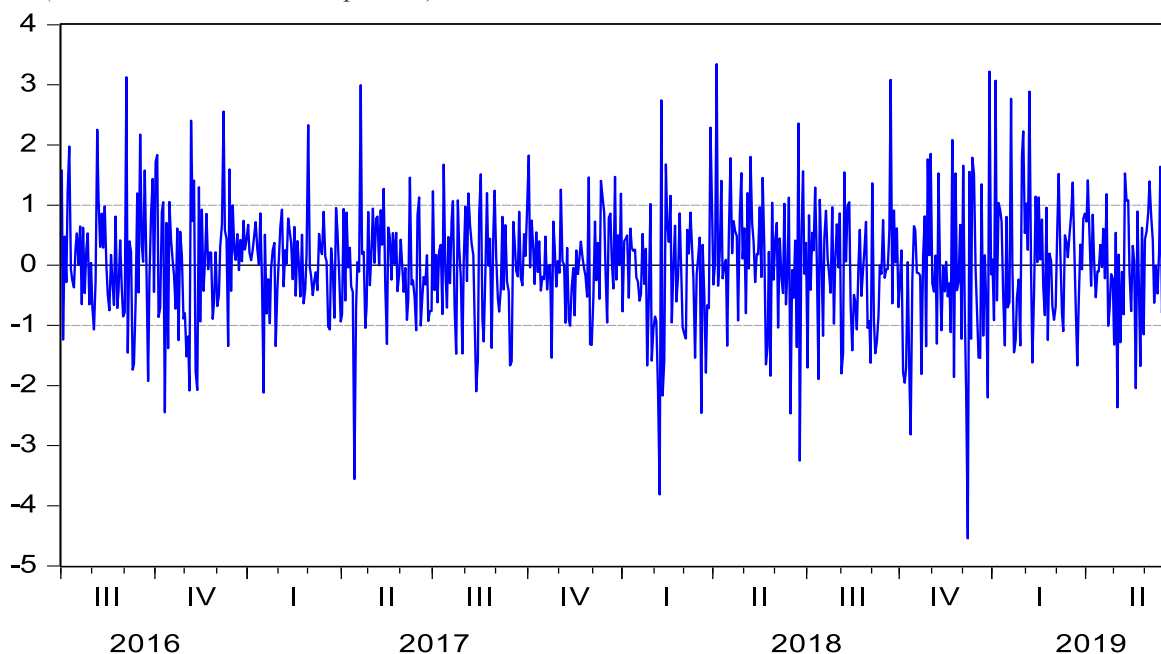


FIGURE 10: VOLATILITY CLUSTERING OF FTSE 100 RETURNS DURING PERIOD II

(Source: Author's Own Compilation)

Figures 9 and 10 exhibit the residual series of FTSE 100 returns during the Period I and Period II respectively. Both figures display that there are different time periods where the volatility is high and less which further indicates that

there is volatility clustering and ARCH effects during both the sample periods. It is also apparent that volatility clustering in FTSE 100 return series during Period I is relatively higher than the Period II.

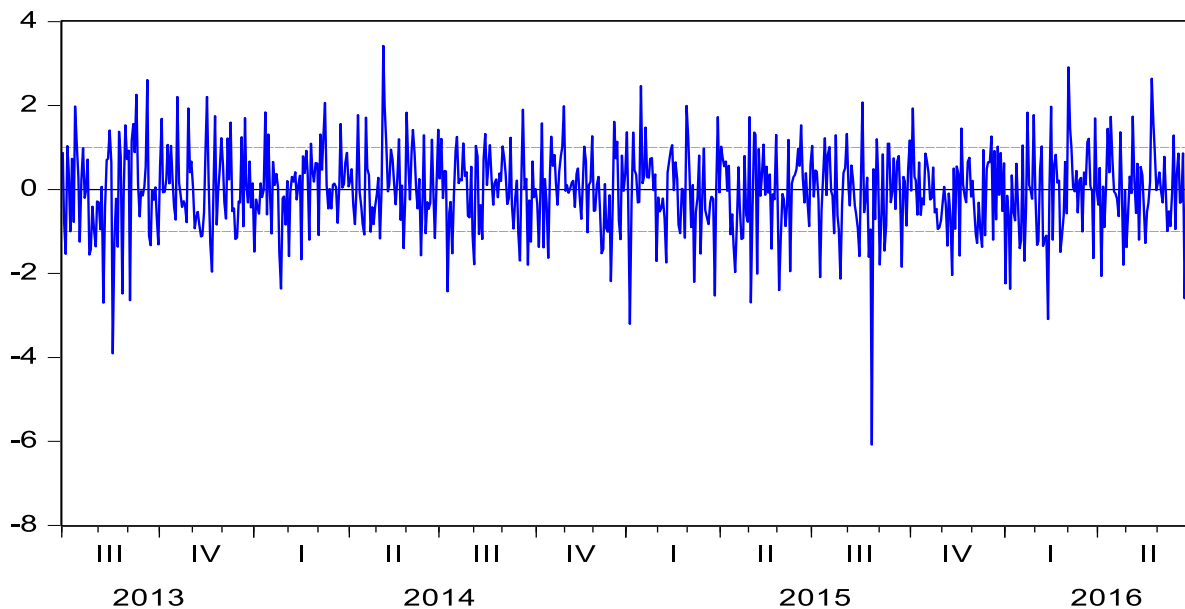


FIGURE 11: VOLATILITY CLUSTERING OF NIFTY 50 RETURNS DURING PERIOD I

(Source: Author's Own Compilation)

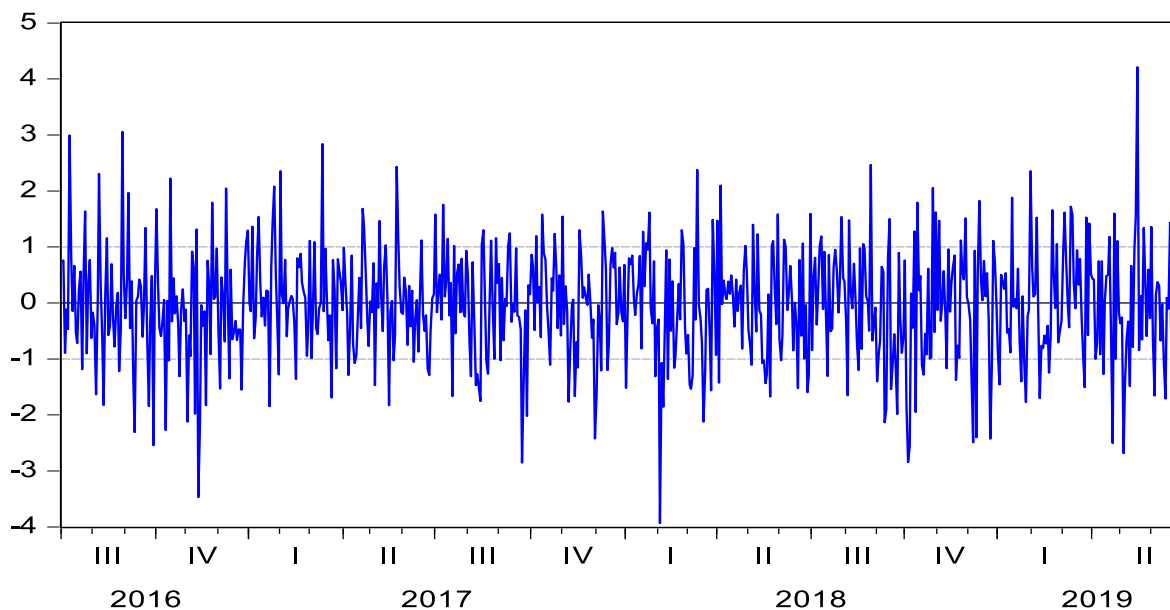


FIGURE 12: VOLATILITY CLUSTERING OF NIFTY 50 RETURNS DURING PERIOD II

(Source: Author's Own Compilation)

Residual series of NIFTY 50 returns during the Period I and Period II are displayed in figure 11 and 12 respectively. Both the figures show different time phases of ups and

down and presence of ARCH effect and volatility clustering in the return series and hence it requires estimation of GARCH model.

TABLE 4: GARCH (1,1) MODEL FOR FTSE RETURNS DURING PERIOD I

VARIABLE	Coefficient	St. Error	Z- Statistics	Probability
C	0.036733	0.012479	2.943528	0.0032
RESID(-1)^2	0.159839	0.025538	6.258985	0.0000
GARCH(-1)	0.810021	0.028666	28.25766	0.0000

(Source: Author's Own Compilation)

TABLE 5: GARCH (1,1) MODEL FOR FTSE RETURNS DURING PERIOD II

VARIABLE	Coefficient	St. Error	Z- Statistics	Probability
C	0.068782	0.025390	2.709047	0.0067
RESID(-1)^2	0.107431	0.027752	3.871097	0.0001
GARCH(-1)	0.751025	0.072582	10.34725	0.0000

(Source: Author's Own Compilation)

Estimates of GARCH model for FTSE 100 returns during Period I and Period II i.e. Pre-Brexit and Post-Brexit periods reported in Table 4 and 5 respectively clearly indicate that volatility in both the sample periods are persistent as sum of alpha and beta values are close to one. During Period I i.e. Pre Brexit period the sum of alpha value

(0.159839) and beta value (0.810021) is 0.96986 and during Period II i.e. Post Brexit period alpha value is 0.107431 and beta value is 0.751025 and their sum is 0.858456.

Beta and alpha coefficient values are greater in Pre Brexit period indicating that volatility in that period is higher, persistent and reaction to announcements are quite penetrating.

TABLE 6: GARCH (1,1) MODEL FOR NIFTY RETURNS DURING PERIOD I

VARIABLE	Coefficient	St. Error	Z- Statistics	Probability
C	0.063774	0.026162	2.437697	0.0148
RESID(-1)^2	0.060785	0.020398	2.979911	0.0029
GARCH(-1)	0.878897	0.040052	21.94409	0.0000

(Source: Author's Own Compilation)

TABLE 7: GARCH (1,1) MODEL FOR NIFTY RETURNS DURING PERIOD II

VARIABLE	Coefficient	St. Error	Z- Statistics	Probability
C	0.031934	0.016135	1.979227	0.0478
RESID(-1)^2	0.077410	0.023039	3.360019	0.0008
GARCH(-1)	0.864609	0.048794	17.71958	0.0000

(Source: Author's Own Compilation)

Table 6 and 7 reported the results of GARCH model employed on NIFTY 50 return during Period I and period II i.e. Pre and Post Brexit both. In Pre Brexit period the sum of alpha and beta coefficient is 0.939682 and same in Post

Brexit period is 0.942019. Both values are very close to one which further demonstrate the existence of high and persistent volatility in NIFTY 50 returns both Pre and Post Brexit periods.

Conclusion

With the vote of Britain leaving European Union, global financial markets volatility is expected. In that vote of Brexit, Britain doesn't spell out their specific plan regarding their relationship in future with the EU and other countries within the EU. This raised various queries regarding inflows and outflows of goods, capital and labour among countries which ended up increasing uncertainties in the integrated and interlinked financial and stock markets. Study also ended up with this result that there is more volatility in Pre Brexit period for FTSE 100 returns as the sum of alpha value and beta value is 0.96986 which is very close to one. Volatility in London Stock Exchange index in Period I is more due to the fear of uncertainty about the upcoming announcement of Brexit and its probable impact on economy.

Brexit is viewed as major economic catastrophe giving shock to entire world economy and Indian economy is one among them as Indian exports and capital flows will greatly be affected because of this. But several economists contradict this view and believe that this poses great opportunities for India and impact on Indian economy especially in capital markets and currency will be for shorter duration of time as post Brexit India will develop strong trade relations with UK. Our results proved that Indian stock market index Nifty 50 had high volatility in both the periods Pre and Post Brexit periods which is similar to the results presented by Madhavi&Reddy (2018). This is further indicated by high Beta coefficient values in both the sample periods slightly higher in Pre Brexit period as tested by GARCH (1, 1) model for Nifty 50. This result is in contrast to the results of Sathyanarayana, &Gargesha(2016).

Discussion

Brexit is not an event. It's a start of a long term process. Right now the direction it's going to take nobody is clear. Britain will have to negotiate separate trade and industrial agreements covering a large number of segments. UK will give priority to not only creating such negotiations with US and China but it will also look to India with its rising economic powers and 'Open doors' investment policies. Financial markets including currency trading was affected

only for short run because of Britain's decision to exit European Union. So India should not panic regarding the fluctuations and volatility in the financial markets. India was worried as Indian investment in Britain is more compared to its collective investment in the rest of the European Union collectively. Britain was providing doorway to other European Union member countries for investment, import and export in Indian companies and currently the companies of member countries of EU are anticipated to move their activities to other countries of EU. The automobile, pharmaceuticals, banking and IT sectors are the mostly affected sectors because of downfall, devaluation and depreciation of Pound against other major currencies of the world. IT sector revenues and exports were badly hampered in the short run as India was having trade surplus with United Kingdom.

Numerous Indian companies are working in United Kingdom which produces considerable revenues from European Union especially from UK. Tata Motors (35 percent), Bharat Forge (40 percent), Motherson Sumi (55 percent), Mahindra (CIE) and Tata Steel (30 percent). Likewise, several Indian exports to the UK engender a hefty volume of income: Balakrishna Inds (55 percent), Cummins India (4 percent), and VA Tech Wabag (32 percent). Definitely the sales and income of the above mentioned companies will be greatly affected. Another stressing factor for Indian securities markets is surge in global risk factors affecting the FIIs inflows. As indicated by a nation brief by the Ministry of External Affairs, Britain's exit from EU would be risky for Foreign investment in United Kingdom as the sales, exports, revenues and incomes of the companies will be greatly hampered so does their activities.

There could be flourishing economic ties possible between India and Britain depending on the EU's relations with both the countries. India being rapidly growing economy is definitely one of the wish list country to trade with as UK manages to call off the EU's yoke. To trigger the all round relationship both countries (India & UK) can work on bilateral ties which could be in form of innovation shared, projects for research taken up together and gearing up investments from both the sides. Agreed technology partnership between UK and India in 2018 can undoubtedly surge the growth both in terms of trade and investment, and

technology sector can play a major role in it. For Britain biggest export they have is financial services out of London and is also looking forth on areas like green finance, cyber security, insurance and fintech. Maybe the two countries will be able to do a deal on services. As far as manufacturing is concerned, manufacturing has collapsed in UK and has become a very small part of its economy. So if India wishes to enter it might not face big objections.

For more fruitful investment relations, the future depends completely on future EU-UK relationship and India-EU relationship. Nothing can be forecasted in isolation. A survey conducted by FICCI (Federation of Indian Chamber of Commerce and Industries) of 45 Indian companies existing in business with UK, 48percent agreed that UK is not just an access to whole EU market and it is traded as an individual market as well with great potential for future prospects as well individually. The textile is one such example where UK takes biggest share of all exports to EU and EU being largest export apparel market for India. Brexit will possibly lead to various economic ties between India and UK trade so further sectoral studies can be conducted from Infrastructure to Health care to Fintech and many more to analyse the trade patterns between the two countries.

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