International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878, Volume-8 Issue-3, September 2019

# Stochastic Pattern of Major Indices of Bombay Stock Exchange

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***Abstract*: It is interesting to get inside and draw a meaningful inference by studying the movement of various stock indices. Portfolio managers, analysts, and investors are very keen to know about the technical pattern of indices. They consider the stock market is one of the economic barometers or market indicators of an economy. Indian financial market has undergone radical and vital change during the past few years. The purpose of this study is to check stochastic movements in selected indices and to signify nexus and interdependency among one another by the virtue of econometric analysis. The study comprises of daily closing value from 1st April 2014-1st April 2018, including major indices i.e. S&P-BSE 100; S&P-BSE-200, S&P BSE-500, S&P-BSE:Large cap, S&P-BSE:Mid-cap, S&P-BSE:small-cap, and BSE-SENSEX. Moreover, typical econometrics tool Augmented Dickey-Fuller Test, Granger Causality Test, and Johansen Co-integration Test were implemented to conclude the result. The study is one of its kinds to analyze the static and pair wise relationship among seven BSE indices along with the direction of their expected future movement that would help practitioners, policy makers and investors in anticipating the future movement of the indices. The Dickey-Fuller and Johanson test administered to analyze unit root and co-integration among the series in long run, followed by Granger causality test to observe the route of the short term relationship among various indices. The tests reveal uni-directional and in some cases bi-directional causality in selected indices. Further, it has been observed that due to co-integration, prices of different indices can't move far away from one another [1]. This stochastic study delves volatility pattern of some major indices of Bombay stock exchange with the help of econometric tools. It clearly delineates nexus of all the indices and provided an explanation to appreciate concrete conduct of one series into a mutual relationship. Hence, investors or analyst may predict the movements, interdependency and their relationship in a significant manner.***

***Keywords*: Econometrics, co-integration, indices, Granger causality, co-movement.**
***JEL Classification: C-53, C-58 & E-37***

Manuscript published on 30 September 2019
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## I. INTRODUCTION

The Indian equity markets have been one of the vibrant markets of the world which indicates well-built essentials and a growing economy. In the period of globalization and liberalization, capitalizing community, foreign investment (FIIs) and people of academic world are interested in investigating the association of a variety of price indices. During the current scenario, when stock markets of the world are facing major volatility, the researcher aims to study the behavior of one of the major stock indices of the India i.e. Bombay Stock Exchange(BSE). It is Asia's first & the far most Exchange in the domain with a speed of 6 microseconds. During the past 140 years, it has smoothed the progress of growth of the Indian business subdivision by providing it proficient capital-raising display place. It is a platform for a resourceful and translucent market for trading in debt, equity, mutual fund, derivatives, etc. BSE is the world's top rating exchange with around 5500 listed companies. The total market capitalization of BSE is around $2.2 trillion in April 2018 and thus making it 10th largest stock exchange across the globe. It also offers pool of services through its Central Depository Services Ltd. S&P-BSE SENSEX is a popular equity index of BSE, that is most widely trail stock market of India as a benchmark index (Source: World Federation of Exchanges). The major initiative of the research is to find out how the stock markets indices have responded to the changes that have happened in the markets. The stock markets are believed to be efficient when values are completely reflected in all existing information. Many researchers argued that there was a noteworthy and constructive association between stock market performance and development of the economy [2, 3, 4]. Further researchers have also studied the co-movement of BSE indices [5, 6]. This study delves insides of the co-movement between the selected series during 2010-15 and also offers an approach to compare individual performances of select indices of the BSE. It also underlined on the necessity of a framework that offered inter-linkage among Indian stock market indices as they operate under different cultural, institutional and regulatory functions as compared to developed nations. Other researches have concentrated to find the reason of less contribution of domestic investor in the stock market [7] A probable answer to this question might be that the erratic and unstructured return behaviors of Indian indices.

The absence of scientific study to provide a true estimation of set returns further compounds the problem. For investors, various indices are available at Indian stock exchanges including BSE and NSE but a technique of rational inference of these indices does not exist, which increases the risk factor [8, 9].

## II. REVIEW OF LITERATURE

Volatility of contemporary stock exchanges i.e. Dubai financial market, FSTE Index, APX Index, and S&P500 data were analysed and found that present unpredictability of DFM is significantly due to its individual stocks such as preceding date information based on ARCH and GARCH. The outcomes also showed that the unpredictability of FSTE do not underwrite to the volatility of DFM, while S&P-500 pay to the volatility of DFM which means that outside shocks can influence the volatility of DFM. In addition, APX affects Dubai Financial Market Index (DFM) [10].

Al-Zu'bi et al. studied the patterns of the stock price movement of various national and international stock exchanges and found that the price movements were very close during the subprime crisis. Moreover, volatility persists in every market [1].

Gali concluded that a short term diminishing in a market always followed by a significant increase in stock prices level for time being but in long run, there are various exogenous factors that has a profound effect on the general price movement of the stock market [11].

Vohra studied the mutual relationship of selected series at the BSE by determining the continuation and type of assimilation among them [12]. Bhunia and Pakira concluded that the Indian stock market is influenced by gold price and exchange rates in the long run [13]. In financial market shocks have a great impact on economic outcomes. Moreover, cyclical fluctuations in the trade have a significant role in determination of price movement of the stock market [13]. Further the monthly data for a period of 1990- 2014 of Nigeria market. It was found that the volatility in GDP, inflation and money supply were not found with regression analysis. Further only volatility in interest rate and in exchange rate are significantly linked with volatility in stock market prices [14].

Oluseyi coated that Nishimura and Men's study sturdy confirmation of short-term one-way volatility spillover effects from China to the United State, Germany, French, and UK stock markets. The finding delineated that Chinese investors were not rational and there was so much volatility followed by a speculative move in China's stock market during the period of 2006 [15]. A long run relationship in the stock-prices at US, Japan, and in the UK also displayed [16, 17, 18].

Chandra [19] and Kumar [9] analyzed the relationship between FII trade volumes and Indian stock market reactions. It was realized that FII investment pushed trade volume and increases the market cap of companies. Interestingly, in case of sharp rises in stock prices liquidity index decreases but when the market decreases sharply, volatility index shows a slow upwards index. The Chinese stock market performance was found strongly influenced by the performance of the American stock market. Moreover, the Chinese market was also found to be co-integrated with stock markets of Russia, Germany, Japan, South Korea, Mexico, and India [20].

Prasad and Verma explained that stock returns are different in different market and cannot be compared to their market level i.e. small or large of S&P CNX 500. It was found that returns of small stocks were quite similar with large stocks returns. Research manuscript established a co-integration between the small and large stock [21]. Seth and Sharma observed long run co-integration between Asian stock markets and stock markets of the USA [21, 22].

## III. RESEARCH METHODOLOGY

### 3.1 Data

Daily closing time series data of various indices of Bombay Stock Exchange were considered i.e. S&P-BSE:100, S&P-BSE:200, S&P-BSE:500, S&P-BSE: Large-cap, S&P:BSE-Mid-cap, S&P-BSE: small-cap and BSE-Sensex for the purport of this study.

### 3.2 Period of Study

The period considered for current-study was 1 April 2014 to 1 April 2018. The data selected for these years due to high volatility during that period and the same was taken for the purpose of the study.

Econometrics analysis can be performed on a series of stationary nature. In order to check the stationary character of all succession, line graph and unit root test were applied. For final verification, whether series are stationary or not the augmented Dickey-Fuller test has been performed. Afterward, with the stationary log series of all the selected variables, Granger's causality test has conceded out in order to comprehend: whether any selected indices or variable Granger causes other variables.

### 3.3 Augmented Dickey-Fuller Test

Usually long term time series of economic variables are non-stationary. Similarly, the universal behavior of stock indices of various stock markets is found to be non-stationary. So it is required to execute a pre-test to safeguard that an inactive association existed among the variables. This would evade difficulties of spurious regressions. To test for the presence of unit roots, the customary Augmented Dickey-Fuller (1981) test is performed. ADF test follows the below-stated model:

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \beta_t \quad \Delta Y_{t-1} + \ldots + \delta_p \Delta Y_{t-p} + \varepsilon_t$$

Here α is constant, $\beta$ =coefficient at a time trend and p=lag order of the autoregressive process. Impressive the constraints $\alpha = 0$ and $\beta = 0$ resembles to modeling a random walk and using the constraint $\beta = 0$ (corresponds to modeling a random walk with a drift). Together with lags of the order p, allows for developed order autoregressive-processes. It revealed that the lag distance p takes to be resolute when applying the test. To determine this it considered a 1 variable lag.

*Retrieval Number C6068098319/2019©BEIESP*
*DOI: 10.35940/ijrte.C6068.098319*
*Journal Website: www.ijrte.org*



*Published By:*
*Blue Eyes Intelligence Engineering*
*& Sciences Publication*

### 3.4 Granger Causality Test

Granger test of causality has been accepted to detect the route of the short term relationship among various indices. As per Granger causality test between two stock price indices $\chi_t$ and $Y_t$ were actioned and performed with the help of following two equations.

$$\Delta\chi_t = \alpha_x + \sum_{i=1}^{k} \beta_{x,i}\Delta\chi_{t-i} + \sum_{i=1}^{k} \gamma_{x,i}\Delta Y_{t-i} + \varepsilon_{x,t}$$

And

And

$$\Delta Y_t = \alpha_y + \sum_{i=1}^{k} \beta_{y,i}\Delta Y_{t-i} + \sum_{i=1}^{k} \gamma_{y,i}\Delta\chi_{t-i} + \varepsilon_{y,t}$$

In above $\Delta\chi_t$ and $\Delta Y_t$ are the initial variance in time series variable. Afterward, F-test is conducted for measuring joint unimportance of the coefficients.

### 3.5 Johansen Co-integration Test

Johansen and Juselius (1990) have established the performance for important vector of n potentially endogenous variables [23]. The stationery linear combination is generally known as the co-integrating equation. If the time series data are co-integrated which means the series, in the long run, will come into equilibrium [24]. Johansen propounds two different likelihood ratio to test the significance i.e. trace test and maximum eigen value. The study applies Johansen's technique to test co-integration among the selected indices [25]. This processes a maximum likelihood methods that regulates the number of cointegrating vectors in a non-stationary time series Vector Autoregression (VAR) with restrictions imposed, known as a vector error correction model (VEC)[26]. Johansen's estimation model is as follows:

Zt = AiZa−1+...+A K Zt−K + ΦDt + μet Zt=AiZa−1+...+AKZt − K+ΦDt + μet

To calculate this Ai = coefficients' conditions, μ=constant, Dt=seasonal dummies orthogonal to the constant term μ, further εt=an sovereign and identically distributed Gaussian process.

## IV. DATA ANALYSIS AND INTERPRETATION

4.1 Descriptive Statistics

Table 1 indicates descriptive statistics for the seven series of selected indices. For performing the econometric analysis, it is essential to make sure that the series should be stationary [27, 28]. At the outset, all the series converted from non-stationary to stationary with the help of statistical tests [29]. The table represents the mean that shows the return of each variable and standard deviation shows the inherent risk factor. The table also shows that the average daily return at BSE S&P 100, S&P 200, S&P 500, BSE low cap, BSE Mid-cap, BSE large-cap, and Sensex happens to 7690.70, 3156.47, 9859.66, 9910.12, 9476.44, 2943.83 and 26060.49.

**Table-I: Descriptive Statistics of Selected BSE Indices**

| Particular | S&P 100 | S&P 200 | S&P 500 | BSE S cap | BSE M cap | BSE L cap | Sensex |
|---|---|---|---|---|---|---|---|
| Mean | 7690.70 | 3156.47 | 9859.66 | 9910.12 | 9476.44 | 2943.83 | 26060.49 |
| Median | 8014.33 | 3318.20 | 10402.8 | 10901.4 | 10750.4 | 3069.32 | 26108.53 |
| Maximum | 9494.36 | 3991.85 | 12631.9 | 14433.8 | 14.96.65 | 3582.30 | 29681.77 |
| Minimum | 5272.96 | 2100.86 | 6476.55 | 5101.24 | 5224.13 | 2053.30 | 17905.91 |
| Std Dev. | 1113.27 | 500.65 | 1621.43 | 2549.90 | 2196.90 | 406.26 | 3237.592 |
| Skewness | -0.6042 | -0.5723 | -0.5695 | -0.6109 | -0.4700 | -0.6361 | -0.6731 |
| Kurtosis | 2.0334 | 1.9907 | 1.9947 | 2.0072 | 2.1639 | 2.0606 | 2.0909 |
| Jarque-Bera | 98.6902 | 95.9749 | 95.1092 | 102.130 | 65.2306 | 103.059 | 108.735 |
| Prob. | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Sum | 7606104. | 3121754. | 9751205. | 9801110. | 9372204. | 2911452 | 2478482 5. |
| Sum Sq. Dev | 1.22E+09 | 2.48E+08 | 2.60E+09 | 6.42E+09 | 4.77E+09 | 1.63E+08 | 1.04E+10 |
| Observation | 990 | 990 | 990 | 990 | 990 | 990 | 990 |

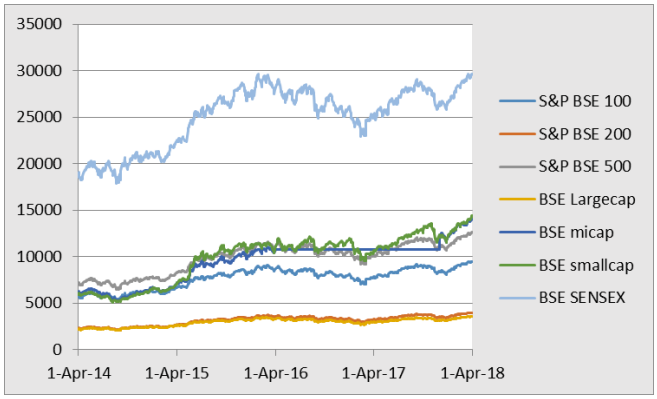


**Fig.1: BSE Indices**

The above Graph depicts consolidated trends of the annual volume of all selected indices (BSE S&P 100, S&P 200, S&P 500, BSE low cap, BSE mid-cap, BSE large-cap, and Sensex). It indicates that all the variables are not stationary in nature. Before applying the Granger causality test, it is imperative that a data series are stationary so as to draw some meaningful conclusions. ADF test discloses that errors have constant variance and are statistically independent [30]. ADF test has been performed at two different levels i.e. at level data & at 1st difference setting a Null Hypothesis that the variable series is non-stationary.

**Table-II: Unit Root Analysis (Aug.Dickey-Fuller Test)**

| Critical Values of ADF Test at Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | **Lag** | **t-statistics** | **Prob.** | **1%** | **5%** | **10%** | **D/W** |
| S&P 100 | 1 | -1.22729 | 0.6645 | -3.43675 | -2.86425 | -2.56826 | 1.984561 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| S&P 200 | 1 | -1.03027 | 0.7442 | -3.43675 | -2.86425 | -2.56826 | 1.985773 |
| S&P 500 | 1 | -0.93953 | 0.7757 | -3.93953 | -2.86425 | -2.56826 | 1.985818 |
| BSE Small-cap | 1 | -0.55494 | 0.8776 | -3.43675 | -2.86425 | -2.56826 | 1.990319 |
| BSE midcap | 0 | 0.35293 | 0.9809 | -3.43674 | -2.86425 | -2.56826 | 1.851010 |
| BSE large cap | 1 | -1.31851 | 0.6228 | -3.43675 | -2.86425 | -2.56826 | 1.983085 |
| Sensex | 1 | -1.54298 | 0.5115 | -3.43675 | -2.86425 | -2.56826 | 1.983908 |

Source: Eviews output

**Table-III: Unit Root Analysis (Augmented Dickey-Fuller Test)**

| Critical Values of ADF Test at 1st Difference | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Variables** | **Lag** | **t-statistics** | **Prob.** | **1%** | **5%** | **10%** | **D/W** |
| S&P 100 | 0 | -28.6414 | 0.000 | -3.43675 | -2.86425 | -2.56826 | 1.984601 |
| S&P 200 | 0 | -28.5192 | 0.000 | -3.43675 | -2.86425 | -2.56826 | 1.985789 |
| S&P 500 | 0 | -28.3324 | 0.000 | -3.43675 | -2.86425 | -2.56826 | 1.985827 |
| BSE Small-cap | 0 | -26.7547 | 0.000 | -3.43675 | -2.86425 | -2.56826 | 1.990279 |
| BSE mid-cap | 0 | -29.1379 | 0.000 | -3.43674 | -2.86424 | -2.56826 | 2.001382 |
| BSE large cap | 0 | -28.6156 | 0.000 | -3.43675 | -2.86425 | -2.56826 | 1.983137 |
| Sensex | 0 | -28.8021 | 0.000 | -3.43675 | -2.86425 | -2.56826 | 1.983985 |

When the test was applied on level data, it was found that p-values of all variables are more than the level of significance i.e. 0.05. Therefore, the ADF Unit root test was applied at 1st level differencing (see Table III). The results obtained outlined that p-value of all the variables close to zero. Hence, it pointed out the absence of unit root in the present data series & the data were found fully stationary and can be used for further research.

**Table-IV: Unrestricted Co-integration Rank Test (Trace)**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | Critical Value at 0.05 | Prob.** |
|---|---|---|---|---|
| None * | 0.159332 | 257.7284 | 125.5154 | 0.0000 |
| At most-1 | 0.033914 | 86.94660 | 95.65366 | 0.1729 |
| At most-2 | 0.021287 | 52.99651 | 69.71889 | 0.5054 |
| At most-3 | 0.016808 | 31.82358 | 47.75613 | 0.6219 |
| At most-4 | 0.008448 | 15.14368 | 29.69707 | 0.7707 |
| At most-5 | 0.006603 | 6.795207 | 15.39471 | 0.6016 |
| At most-6 | 0.000281 | 0.276776 | 3.741466 | 0.5988 |

**Trace test indicates 1 co-integrating at the 0.05 level**
*** denotes rejection of the hypothesis at the 0.05 level**
****MacKinnon-Haug-Michelis (1999) p-values**

**Table-V: Unrestricted Co-integration Rank Test (Maximum Eigen value)**

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | Critical Value at 0.05 | Prob.** |
|---|---|---|---|---|
| None* | 0.159332 | 170.7817 | 46.23142 | 0.0000 |
| At most-1 | 0.033914 | 33.95009 | 40.17757 | 0.2082 |
| At most-2 | 0.021287 | 21.17293 | 33.97687 | 0.6711 |
| At most-3 | 0.016808 | 16.67990 | 27.68434 | 0.6075 |
| At most-4 | 0.008448 | 8.348472 | 21.23162 | 0.8812 |
| At most-5 | 0.006603 | 6.518432 | 14.36460 | 0.5476 |
| At most-6 | 0.000281 | 0.276776 | 3.851466 | 0.5988 |

Max-eigen value test indicates 1 co-integrating at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

To test long run co-integration between all variable, the Johansen's Co-integration test along with maximum Eigen value (table V) has been conducted. This test deals with the mutual relationship among a group of variables [15, 18, 30]. The Trace test indicates the existence of seven co-integrating equations that are less than 5% level of significance and the same has also confirmed by the maximum Eigen value test. Thus, the null hypothesis can be rejected and the test confirms the existence of long-run co-integration or equilibrium relationship among them.

Table-VI: Pair wise Granger's Causality Test

For: BSE S&P 100, S&P 200, S&P 500, BSE Low cap, Mid-cap, Large cap, and Sensex

| Null Hypothesis: | Obs. | F-Stat. | Prob. |
|---|---|---|---|
| S&P BSE-500 does not Granger Cause SENSEX | 988 | 6988.62 | **0.0000** |
| SENSEX does not Granger Cause S&P BSE-500 | | 1.86107 | 0.1561 |
| S&P BSE-200 does not Granger Cause SENSEX | 988 | 9780.10 | **0.0000** |
| SENSEX does not Granger Cause S&P BSE-200 | | 2.11484 | 0.1212 |
| S&P BSE-100 does not Granger Cause SENSEX | 988 | 16913.1 | **0.0000** |
| SENSEX does not Granger Cause S&P BSE-100 | | 1.50973 | 0.2215 |
| BSE SMALLCAP does not Granger Cause SENSEX. | 988 | 588.753 | 1E-168 |
| SENSEX-does not Granger Cause BSE-SMALLCAP | | 1.07578 | 0.3414 |
| BSE-MICAP does not Granger Cause SENSEX. | 988 | 90.2157 | 1.E-36 |
| SENSEX does not Granger Cause BSE-MICAP | | 0.43786 | 0.6455 |
| BSE-LARGECAP does not Granger Cause SENSEX | 988 | 270.628 | 3.E-94 |
| SENSEX does not Granger Cause BSE-Large-cap | | 0.63398 | 0.5307 |
| S&P BSE-200 does not Granger Cause S&P BSE-500 | 988 | 1.30443 | 0.2718 |
| S&P BSE-500 does not Granger Cause S&P BSE-200 | | 1.44863 | 0.2354 |

| | | | |
|---|---|---|---|
| S&P BSE-100 does not Granger Cause S&P BSE-500 | 988 | 3.16725 | **0.0426** |
| S&P BSE-500 does not Granger Cause S&P BSE-100 | | 3.51722 | **0.0301** |
| BSE-SMALLCAP does not Granger Cause S&P BSE-500 | 988 | 1.96686 | 0.1404 |
| S&P BSE-500 does not Granger Cause BSE-SMALLCAP | | 0.81597 | 0.4425 |
| BSE-MICAP does not Granger Cause S&PBSE-500 | 988 | 0.34312 | 0.7096 |
| S&P BSE-500 does not Granger Cause BSE-MICAP | | 4.44243 | **0.0120** |
| BSE-LARGECAP does not Granger Cause S&P BSE-500 | 988 | 12.8503 | 3.E-06 |
| S&P BSE-500 does not Granger Cause BSE-Large-cap | | 2.82632 | 0.0597 |
| S&P BSE-100 does not Granger Cause S&P BSE-200 | 988 | 4.89164 | **0.0077** |
| S&P BSE-200 does not Granger Cause S&P BSE-100 | | 4.98046 | **0.0070** |
| BSE-SMALLCAP does not Granger Cause S&PBSE-200 | 988 | 2.19384 | 0.1120 |
| S&PBSE-200 does not Granger Cause BSE-SMALLCAP | | 0.78528 | 0.4563 |
| BSE-MICAP does not Granger Cause S&PBSE-200 | 988 | 0.36387 | 0.6951 |
| S&PBSE-200 does not Granger Cause BSE-MICAP | | 4.41017 | **0.0124** |
| BSE-LARGECAP does not Granger Cause S&PBSE-200 | 988 | 14.2704 | 8.E-07 |
| S&P BSE-200 does not Granger Cause BSE-Large-cap | | 2.63095 | 0.0725 |
| BSE-SMALLCAP does not Granger Cause S&PBSE-100 | 988 | 2.46619 | 0.0854 |
| S&P BSE-100 does not Granger Cause BSE-Small-cap | | 0.75079 | 0.4723 |
| BSE-MICAP does not Granger Cause S&PBSE-100 | 988 | 0.37123 | 0.6900 |
| S&P BSE-100 does not Granger Cause BSE-MICAP | | 4.29965 | **0.0138** |
| BSE-LARGECAP does not Granger Cause S&P BSE-100 | 988 | 15.5740 | 2.E-07 |
| S&P BSE-100 does not Granger Cause BSE-Large-cap | | 2.13689 | 0.1186 |
| BSE-MICAP does not Granger Cause BSE-Small-cap | 988 | 0.71453 | 0.4897 |
| BSE-SMALLCAP does not Granger Cause BSE-MICAP | | 3.10202 | **0.0454** |

4.2 Causality Test

A pair wise relationship is also significant to examine and verify the mutual or reciprocal relationship among the series. It provides an explanation to appreciate concrete conduct of one series into a mutual relationship. Further, this test can also help to overview of the impact of one series on another and vice-versa. Table VI depicts the findings of all the variables under study with 2 lags. It shows the f-statistic and probability value for a total of 38 items for the seven variables. Results of Granger-causality-test explained that there is no causal relationship found between the selected variables except few unidirectional relationships between S&P BSE-500 which does not Granger Cause Sensex, S&P BSE-200 does not Granger cause Sensex, S&P BSE-100 does not Granger Cause Sensex, S&P BSE-500 does not Granger cause BSE-MICAP, S&P BSE-200 does not Granger cause BSE-MICAP, S&P BSE-100 does not Granger cause BSE-MICAP. Moreover, some of the variable granger cause to each other in both direction like S&P BSE-100 does Granger cause S&P BSE-500 and S&P BSE-500 also Granger cause S&P BSE-100 and S&P BSE-100 too Granger cause S&P BSE-200, S&P BSE-200 Granger cause S&P BSE-100 at 0.0077 and 0.007 level. In due course, casual relationship should not be considered significant. Thus, the trends of these variables are utterly independent in nature.

## V. CONCLUSION

An attempt has been made in the present study to analyse the short run and long run co-movement and relationship among indices of Bombay stock exchange. The selected stock indices have obtained from their respective websites for the period 1 April 2014 to 1 April 2018. The data are arranged in proper form followed by Dicky Fuller test in order to check the presence of unit root and to confirm the stationarity of the stock index series [15,24, 16].

The study portrays a deeper understanding of the mutual relationship shared by selected series at BSE by determining the existence and type of integration among them. Econometrics based findings delineate an explanatory account of the underlying association among the stock indices of BSE for investors and user. The systematic observation of daily closing value of series based data analysis portrays the performance of the individual performances and the mutual dependency of one series on another at BSE. Granger causality test reveals unidirectional and in some case bidirectional causality in selected indices of BSE[1, 3, 27]. Further, Johansen Co-integration test clearly shows that there is a long run co-movement among selected series. Due to this co-integration, prices in different markets cannot move far away from one another. Hence, investors or analyst may diversify risk and gain returns by investing in the long run. Thus, the crux of this paper is to analyze static and pairwise relationship among seven BSE indices along with the direction of their expected future movement that would help practitioners, policy makers, and investors in anticipating the future movement of the indices [31]. Nevertheless, before investing, it is suggested investors have a close look of technical and fundamental understanding of stocks and the way stock market functions.

## VI. LIMITATIONS OF THE STUDY

Time series models that applied in this study are used to interpret & analyze the data to generalize the findings for the intact population. Thus, outcomes have got their limitations because there are many latent constraints and variables which were not part of this study. The collected daily closing data for selected indices for the past four years put a narrow range for concluding the results.

## REFERENCES

1. Al-Zu' bi, B., Salameh, M. and Abu Eid, M. (2016), "The impact of the global financial crisis, does it sustain?" Int. J. of Economics and Finance, Vol. 8, No. 10. pp. 82-91.
2. Levine, R., & Zervos, S. (1996), "Stock market development and long-run growth", The World Bank Economic Review, Vol. 10 (2), pp.323-339.

3. Sinha, D., & Macri, J. (2001), "Financial Development and Economic Growth: The case of eight Asian Countries", Economia Internazionale, Vol. 54(2), pp. 219-234.
4. Bhattacharya, K., Sarkar, N., & Mukhopadhyay, D. (2003), "Stability of the day of the week effect in return and in volatility at the Indian capital market: A GARCH approach with proper means specification", App. Financial Economics, Vol. 13, Issue 8, pp. 553-563.
5. Karmakar, M. (2007), "Asymmetric volatility and risk-return relationship in the Indian stock market", South Asia Economic Journal, Vol.8 (1). pp. 99-116.
6. Paramati, S. R., & Gupta, R. (2013), "An empirical analysis of stock market performance and economic growth evidence from India", DOI: http:/doi.org/10.2139/ssrn.2335996.
7. Mukherjee, P., Bose, S., & Coondoo, D. (2002), "Foreign institutional investment in the Indian equity market: An analysis of daily flows during January 1999 May 2002", Money & Finance, Vol. 9(10), pp .9-10.
8. Murhty, K. B., & Singh, A. K. (2013), "Do foreign institutional investors really drive the Indian stock market?" Asia Pacific J. of Management Research and Innovation, Vol. 9(1), pp. 45-53.
9. Kumar, S. (2012), "A first look at the properties of India's volatility index", Int. J. of Emerging Markets, Vol. 7, No. 2, pp. 160-176.
10. Salameh,M. H., and Alzubi, B. (2018), "An investigation of stock market volatility: evidence from Dubai financial market", J. of Economic and Administrative Sciences, Vol. 34, Issue: 1, pp.21-35, https://doi.org/10.1108/ JEAS-04-2017-0020
11. Gali, J. and Gambetti, L. (2015), "The effects of monetary policy on stock market bubbles: some evidence", American Economic J.: Macroeconomics, Vol. 7 No. 1, pp. 233-257
12. Vohra, S. P. (2016), "A Study of Co-movement among Indices of Bombay Stock Exchange", Indian J. of Finance, Vol. 9(5), pp. 11-29.
13. Bhunia, A., & Das, A. (2012), "Association between Gold Prices and Stock Market Returns: Empirical Evidence from NSE", J.of Exclusive Management Science, Vol. 1, No.5, pp. 1-7.
14. Caldara, D., Fuentes-Albero, C., Gilchrist, S. and Zakrajsek, E. (2016), "The macroeconomic impact of financial and uncertainty shocks", Working Paper No.- 22058, National Bureau of Economic Res.
15. Oluseyi, A. (2015), "An empirical investigation of the relationship between stock market prices volatility and macroeconomic variables' Volatility in Nigeria", European J. of Academic Essays, Vol. 2, No.11, pp.1-12.
16. Yusaku, N., & Ming, Men, (2010), "The paradox of China's international stock market co-movement: Evidence from volatility spillover effects between China and G5 stock markets", Journal of Chinese Economic and Foreign Trade Studies, Vol. 3 Iss.3, pp.235-253.
17. Karim, B., Kassim, M., & Arip, A. (2010), "The subprime crisis and Islamic stock markets integration", Int. J. of Islamic and Middle Eastern Finance and Management, Vol. 3, No. 4, pp.363-371.
18. Floros, C. (2005), "Price linkages between the US, Japan, and UK Stock Market", Financial Market and Portfolio Management, Vol.19, No.2, pp.169-178.
19. Chandra, A. (2012), "Cause and effect between FII trading behavior and stock market returns: The Indian experience", J. of Indian Business Research, Vol. 4, Issue 4, pp. 283-300.
20. Priscilla, L. (2013), "Decoupled or not? What drives Chinese stock markets: Domestic or global factors?" J. of Accounting and Finance, Vol. 13(4), pp. 40-54.
21. Prasad, S., & Verma, A. (2013), "Size and returns: A study of the Indian stock market", Indian J. of Finance, Vol. 7(5). pp. 5-13.
22. Seth, N. & Sharma, A. (2015), "International stock market efficiency and integration", J. of Advances in Management Research, Vol. 12(2), pp. 88-106.
23. Lee, C. C., Lee, J., & Lee, C. (2015), "Stock prices and the efficient market hypothesis: Evidence from a panel stationary test with structural breaks. Japan and the World Economy, Vol.22, No.1, pp.49–58.
24. Patel, R. (2016). An Empirical Study of Co-movement in Selected Stock Exchanges, Asia-Pacific J. of Management Research and Innovation, 12(1), 23-30
25. Hambly, G. (1974), "A Note on the Trade in Eunuchs in Mughal Bengal", J. of the American Oriental Society (hereafter JAOS), Vol.94, No.1, pp.125–29.
26. Bhole, M. (1998), "Financial institutions and markets", Second Edition, Tata McGraw Hill Publishing Company Limited, New Delhi (1998).
27. Masters, B. "The Origins of Western Economic Dominance in the Middle East: Mercantilism and the Islamic Economy in Aleppo, 1600–1750", New York, (1988).
28. Dadhich, G., Chotia, V., & Chaudhary, O. (2015), "Impact of foreign institutional investments on stock market volatility in India", Indian J. of Finance, Vol.9, No.10, pp. 22-25.
29. Damodar N Gujarathi, (2012), "Introduction to Basic Econometrics", Tata McGraw Hill Edition, New Delhi.
30. Jeyanthi, J and Pandian, P. (2008), "An Empirical study of Co-integration and correlation among Indian, Emerging and Developed Market", The IUP-Journal of Applied Finance, Vol.14, No.11, p. 35-47.
31. Subha, M. (2010), "A Study on Stationarity of Global Stock Market Indices", Journal of Contemporary Research in Management, Vol. 1(1), pp. 42-46.


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