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Stock Market Movement of BRICS countries: An Empirical Analysis

*Dr. Vijay Kumar

*Post-Doctoral Fellow (UGC), Centre for Economic Studies, Central University of Punjab, Bathinda (India)

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***Corresponding Author**
Email: vijay15488@gmail.com

ABSTRACT

The study is designed to analyze the stock market movement of BRICS nations. The abbreviation BRICS stands form Brazil, Russia, India, China and South Africa. Each country have their different stock market and their indices such as Brazil has BM&F Bovespa (bovespa), Russia has Moscow Exchange (RTS Index), India has Bombay Stock Exchange (Sensex Index), China has Shanghai Stock Exchange (SSE Index), South Africa has Johannesburg Stock Exchange (FTSE/JSE Index) respectively. These are the major stock exchange of their respective countries. Monthly data from May 2003 to August 2015 is used in the following research study. The result of Granger causality test is showing causality relationship among various stock market indices of various BRICS nations.The following research paper also indicates how these stock market indices are cointegrated with each other. Data of various market indices have been collected from the secondary sources such as from their original stock market websites and some other sources also i.e. investing.com, yahoo finance etc. to analyze the pattern of stock market movement of BRICS country..

INTRODUCTION

Background of the Study

A healthy financial system of any country works as a growth engine of that particular economy like an engine works in train. It boosts the economy. There are various components in financial systems. Stock market and investment are major components of any financial system whereas investment depends on the growth of financial resources which and stock market depends on various other factors. Investment in any market is done by various financial intermediaries therefore a financial market always plays an important role for the growth of investment. A financial market mayinclude various organizations, institutions and any individual too. Capital formation and their volume are the main factor which decides economic growth of any country and it makes financial system more strong (King & Levine 1993, Kizito 2012). It is an era of highly financially globalized world, a stock market movement and share price affects not only domestic economy but also affects other countries financial market. There are various studies has done in past to analyze the benefit of the international financial portfolios and the stock market movement such as Grubel (1968), Granger and Morgenstern (1970), Ripley (1973), Lissard (1974), Panton, Lissies and Joy (1976) and Hillard (1979).

With the highly diversified methodologies various studies found that there are various factorswhich affect stock return. Some studies suggest that correlation among stock return are low. Various studies clearly supported the interdependency of various stock markets on each other. Stock market movement not only affects common man day-to-day but also country's economic condition. Lowering in share price can lead to collapse whole financial market as it was occurred in 1929 in America which is known as a great depression of 1930. Stock market in a various positive and negative ways affects economy such as wealth effect, effects on pensions, consumer confidence, and bond market whereas for individuals it affects their investment, saving etc. A growth in stock market can be measure by its indices. An increase in indices indicates higher return and healthy market growth rate of stock market whereas decreasing in share prices indicates stock market decline.

Schumpeter (1911), Patrick (1966) study focuses on stock market vitality and its impact on economic development of the country. Stock markets are also closely related with the banks also. It is also an important source to raise capital for various organizations along with debt market. There are various countries which have adopted a policy of liberalization of stock market which allow any foreigner or investor to purchase and invest in stock market of that particular country. There are few models related to equity such as standard international asset pricing models suggest that cost of equity capital of any country depends on the government it can reduce also if government allow any foreign investor to invest their money in stock market thus both domestic and foreign investor has to take risk. (Stapleton and Subrahmanyan (1977), Errunza and Losq (1985), Eun and Janakiramanan (1986), Alexander, Eun, and Janakiramanan (1987), and Stulz (1999a, 1999b).

Economic growth of any countries leads to growth in the progress of any firm and their position in stock market. A healthy economic condition increase stock market price automatically otherwise stock market has to suffer.The ratio of high profit at per share attracts more investors (Pettinger T. 2016). Stock market or the share market is a physical place where sell and purchase of shares is done by various organizations of by an individual too. This place is an aggregation of various buyers and sellers of shares. Holding of shares of any company provides ownership rights to that buyer. In stock market both private and government organization issues their shares which increase saving by investors. An exchange listed various companies having similar stocks and thus these similar stocks grouped them together and make an index. The index of any stock market indicates the movement

of prices in the market. If indices are raising it indicates that there are best price return to the investors and decreasing in indices gives loss to investors.

The following study is focused on the stock market of developing economies group named BRICS which stands for Brazil, Russia, India, China and South Africa and their major stock exchanges are Brazil has BM&F Bovespa (bovespa), Moscow Exchange (RTS Index), India (BSE Sensex Index), Shanghai Stock Exchange (SSE Index), Johannesburg Stock Exchange (FTSE/JSE Index) respectively. BRICS after the induction of South Africa in 2010in BRICs gave its final structure of BRICS. This is a group of leading developing economies in the world and this regional group has a long term effects on global economic environment. BRICS comprises around 43% population of the world alone as per the report in 2015. BRICS also alone share 22% gross world product which is around US$ 16.6 trillion nominal GDP and foreign reserve around US$ 4 trillion. The World Bank estimated 5.3% growth rate in of BRICS countries in 2017. It also has 17% sharing in world trade.

Stock Market Movement in BRICS nations

1. Brazilian Stock Market - BM&F Bovespa

BM&F Bovespa is a Brazilian stock exchange in Sau Paulo city of Brazil. It was established in 1890. In 2011 it the 13th largest stock exchange of the world with the market capitalization of R$ 2.37 trillion and in 2015 it was recorded decline with R$2.21 trillion. As Shown in the graph mentioned below it is clearly mentioned that from 2003 to 2008 it increases with very high growth rate and in 2008 it was at its highest point. Later it starts declining till 2015 which was around 50,000 index value.

2. Russian Stock Market - Russian Trading System (RTS)

Moscow exchange is one of the largest stock exchanges in Moscow city of Russia established in 2011 by merging two largest exchange named Moscow Interbank Currency Exchange (MICEX) and Russian Trading System (RTS). These two exchanges were established in 1990. As clearly mentioned in graph that from 2003 till 2008 it reaches to its maximum point but later decline at very fast rate in 2009 and till 2015 again achieved positive growth rate.

3. Indian Stock Market – Bombay Stock Exchange (BSE)

Bombay Stock Exchange (BSE) is considered to be as a first stock exchange in Asia region established in 1875. It is situated in Mum city. It also comes in top fifteen stock exchanges at 11th position of the world having market capitalization of $ 1.43 trillion on 2016. There are around 5500 companies are listed in BSE. As shown in the graph below that BSE is consistently achieving its growth rate. If we compare BSE with other indices than we can clearly observe that in 2008 global economic slowdown BSE does not affect as much in compare to other stock exchange of BRICS nations and consistently showing positive growth line from 2003 to 2015.

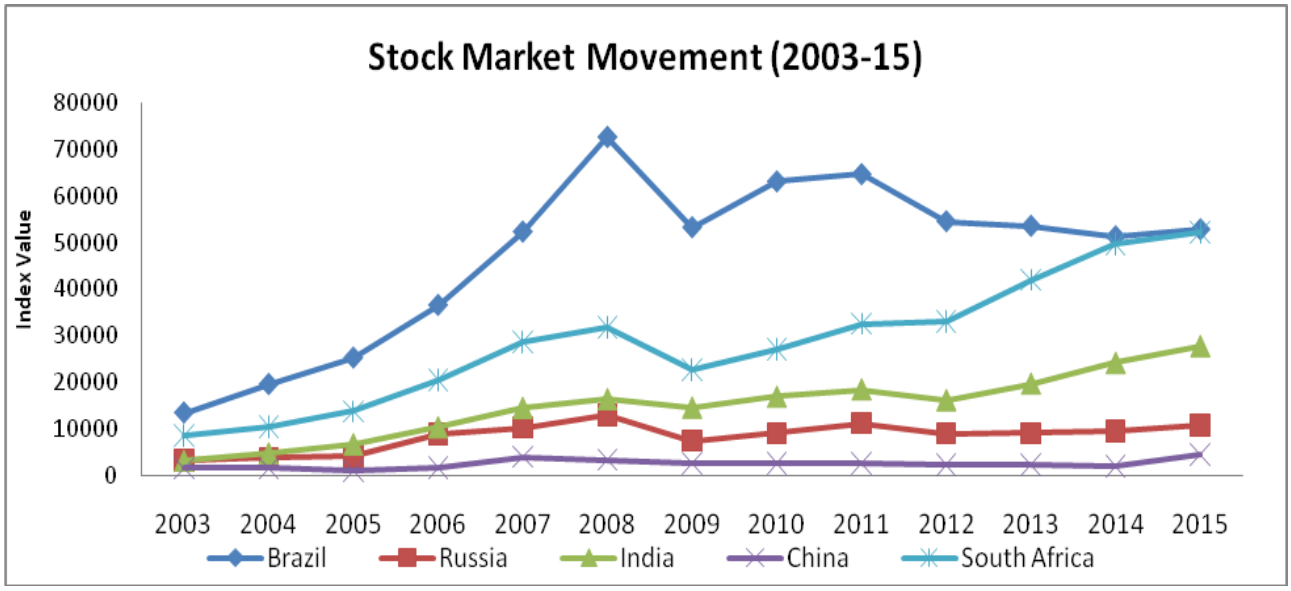
4. Chinese Stock Market - Shanghai Stock Exchange (SSE)

Shanghai Stock Exchange (SSE) is the world's 5th largest stock exchange established in 1990 in the city of Shanghai. It holds US$ 305 trillion market capitalization. It is clearly mentioned in the graph that there is high fluctuation in SSE in last 13 years from 2003 to 2015. The growth rate from 2003 to 2007 was constant and from 2007 to 2008 this rate was very high but after 2008 it declined till 2014 but again achieved its highest point at 2015.

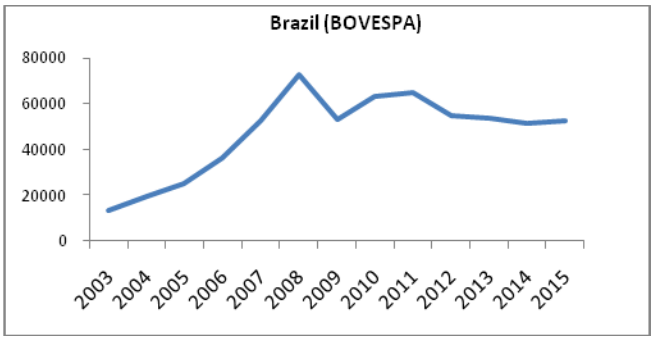
5. South African Stock Market - Johannesburg Stock Exchange (JSE)

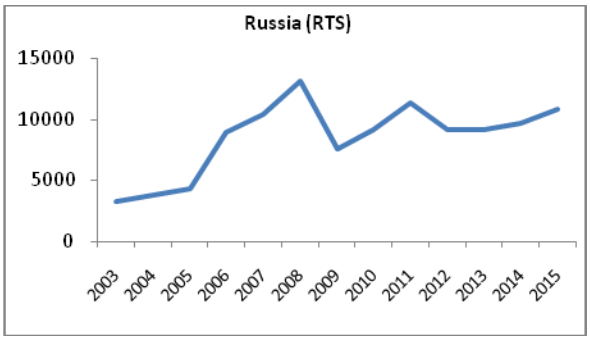
Johannesburg Stock Exchange (JSE) is a largest and oldest stock exchange in South Africa established in 1887. It holds around US$ 1 trillion market capitalization. It can be observed from the graph that from 2003 to 2005 it is consistently increasing. During Economic Slowdown in 2008 it declined till 2009 but after that consistently growing and achieved its highest point in 2015.

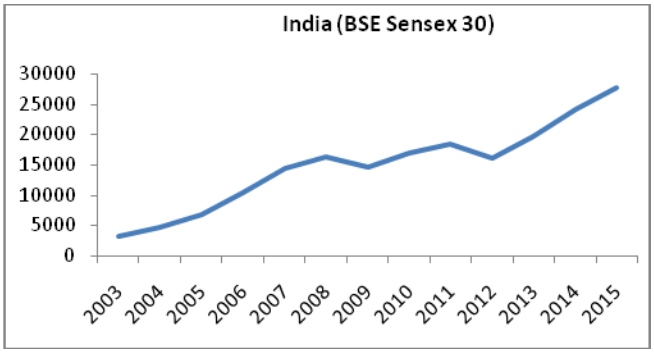
6. *Stock Market Movement of BRICS Nations (2003-2015)*

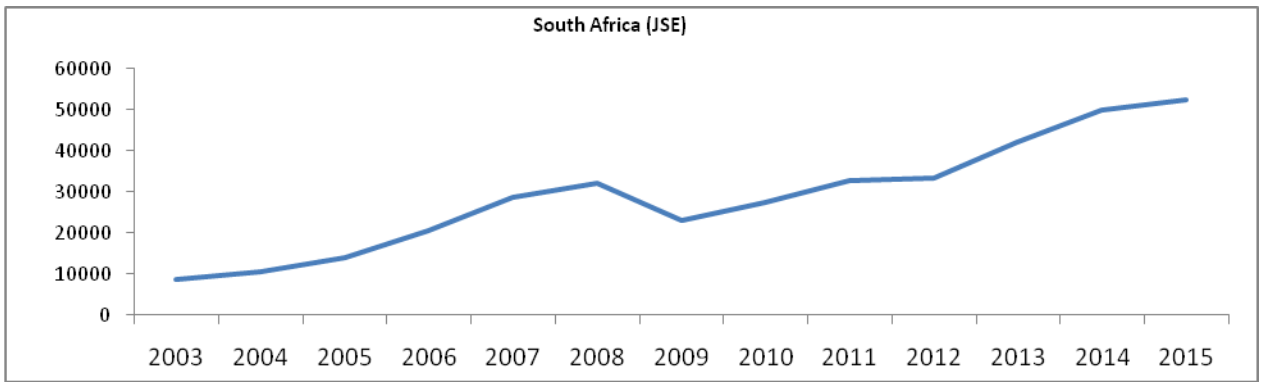


7. Stock Market Index of BRICS Nations (2003-2015)









RESEARCH OBJECTIVE

The research object which served as a guide for the following study are as follows:

1. To analyze the performance of various stock markets and their indices of BRICS nations.
2. To find out the correlation amongstock market indices of BRICS nations.
3. To check the causality relationship among stock market indices of BRICS nations.

SIGNIFICANCE OF THE STUDY

The following study will help to various investors who are seeking their money in that particular stock market of BRICS nations because this study is showing the movement pattern of various stock market indices. Apart from this, its finding is showing the causality relationship of one stock market indices to other indices. Thus this investigation can be helpful in adding prevailing in the present literature which will help various researchers to work on this topic and they can identify regular problems or up down in stock market.

RESEARCH METHODOLOGY

The study is based on the data of stock market indices of BRICS countries. BRICS is a group of five countries named Brazil, Russia, India, China and South Africa. It comprises around 43 per cent population of the world alone in 2015. BRICS is truly an emerging economic integrated group and it is significant in terms of development of developing countries. The following study includes the study of its stock market movement, volatility of indices and performance of selected stock market. This paper assumes various stock markets of respected five countries are the leading stock market exchanges. The data for this study have been gathered from various government agencies, stock market exchange websites and investing.com. The sample of the time period spans is from May 2003 to August 2015. The study applied series of various statistical and econometric techniques to test the relationship among selected variables. The test applied ranges from; Unit root test, Correlation analysis, Cointegration test and Granger causality test etc. over the sample period. Each technique is explained in both explicit and implicit term.

Unit Root Test

The very first step in time series analysis is to check the stationarity of the time series data. Unit root test helps to find out where data of particular time series is having the property of stationarity or the data is of non- stationarity nature. There are various test under Unit Root Test is used to check such property of the time series. Augmented-Dickey Fuller (ADF) test has been used in the following study which is an extended version of Dickey-Fuller (DF) Test (1979). It is an econometric test which is used to test the null hypothesis of any unit root in a time series and also used to check the property of stationarity of the data. Augmented-Dickey Fuller (ADF) test is generally used for the more complex set of time series. In ADF statistics, negative number is used in the test. The more negative value will give a strongest reason to reject the hypothesis which indicates unit root of the data at some level of confidence. In Augmented-Dickey Fuller (ADF) test data is check at level or 1st difference or 2nd difference. Augmented-Dickey Fuller (ADF) test can be expressed in following form:

$$\Delta yt = \alpha + \beta t + \Upsilon y_{t-1} + \delta_1 \Delta y_{t-1} + \ldots\ldots\ldots + \delta_{p-1} \Delta y_{t-p-1} + \varepsilon_t,$$

Where α is used to express constant, β expressing the coefficient on a time scale and p is used to express lag order of autoregressive process. In the following expression α=0, β =0corresponding to modeling in a random walk.

ADF test includes lags of the order p which allows higher order of autoregressive process. It should be noticed that lag of the p should be determined when ADF is being used. lag of p is determined by the t-values on coefficient. An alternative approach Schwarz Info Criterion (SIC) andAlkaike information criterion (AIC) is used in the following study.

Pearson Correlation coefficient

To check the linear and symmetrical relationship among various variables, the Pearson correlation coefficients were estimated. It is mostly widely used correlation statistical tool to measure the degree of relationship among various linearly related variables. The formula of Pearson correlation coefficient can be explain as

$$r = \frac{1}{n-1} \sum \frac{(x_i - \overline{X})(y_i - \overline{Y})}{s_x s_y}$$

; Where r denoting **correlation coefficient**. It has its ranges from -1.0 to +1.0 where closer r is to +1 or -1, the relationship among variables can be check with this value. If the value of r is more close to 0, it indicates that there is no relationship between the selected variables whereas if the value of r is positive it show that if one variable gets larger than the other variable will also gets larger but if the value of r is negative it show that one variable getting larger while other getting smaller known as 'inverse correlation'.

Cointegration Test

After the confirmation of unit root in the time series the next step is to check the relationship among the various variable in a long run time period. Johansens (1991) used VAR based cointegration test which is used in the following study. Considering a VAR of order p:

$$yt = A_1 y_{t-1} + \cdots + A_p y_{t-p} + B_{xt} + \varepsilon_t, \ldots\ldots \quad (1)$$

Here y_t is showing k – vector of non-stationary I (1) variables, xtis used to represent d– vector of deterministic variables,εtshowing vector of innovations,

We can express VAR as:

$$\Delta y_t = \Pi y_{t-1} \sum_{i=1}^{p-1} \Gamma_i \Delta y_t = \Pi y_{t-i} + BX_t + \varepsilon_t$$

Where,

$$\Pi = \sum_{i=1}^{p} A_i - I, \Gamma_i = -\sum_{j=i+1}^{p} A_j$$

According to Granger's representation theorem if the coefficient matrix Π reduced its rank $r<k$, then $k \times r$matricesα and β each with the rank r such that $\Pi = \alpha \beta'$ and $\beta' y_t$ is I *(0)*.Cointegration relationship can be shown by r number and column of β will show Cointegrating vector. There are two another statistics which is used in the Johansens cointegration. The first one is the trace test statistics and another is maximum eigenvalue test statistics.

1. Trace Test Statistics

Trace test statistics is used to test the rank of Matrix Π is r_0 or not. Here the null hypothesis is that rank (Π) = r_0 and alternative hypothesis is that r_0 <rank (Π) <n, where n represent maximum number of possible Cointegrating vector.

Trace test will succeed only when the null hypothesis will be rejected and the next null hypothesis is that rank (Π) = r_0 + 1 and alternative hypothesis is that r_0 +1<rank (Π) <n.Thus trace statistics test null hypothesis ofr Cointegrating relation against alternative ofk Cointegrating relation. krepresents number of endogenous variables, for r = 0, 1,…… k – 1.

Trace test statistics for null hypothesis or r Cointegrating relation can be computed as:

$$LR_{tr}(r|k) = -T \sum_{i=r+1}^{k} \log(1 - \lambda_i)$$

Here λ_i represent i^{th} largest eigenvalue of matrixΠ. T represent the number of observation and LR represents likelihood ratio statistics.

2. Maximum Eigen value Test

Maximum eigenvalue statistics is used to test null hypothesis of *r* Cointegrating relations against alternative of *r* + 1 cointegrating relation. It examines whether the largest eigenvalue is zero relative to alternative that next largest Eigen value is zero. Firstly it test whether rank of matrix Π is zero. The null hypothesis is that rank (Π) = 0 and alternative is that rank (Π) = 1 and further it tests null hypothesis is that rank (Π) = 1, 2, … and alternative hypothesis is that rank (Π) = 2, 3,……

The test of maximum eigenvalue is a likelihood ratio test which can be expressed in a following way:

$$LR (r_0, r_0 + 1) = -T \ln (1 - \lambda_{r0+1})$$

Where LR (r_0,r_0+ 1) is likelihood ratio test statistics which is used to test whether rank (Π) = r_0 versus alternate hypothesis that rank (Π) = r_0 + 1.

Selection of lag length is very important in Johansens cointegration test. Thus for suitable VAR model firstly selection of appropriate lag structure is very necessary. Appropriate lag structureselection is based onAkaike Information Criterion (AIC), Schwarz Criterions(SC) and Likelihood Ratio (LR).

EMPIRICAL ANALYSIS

Descriptive Statistics

Table 5.1 Results of Descriptive Statistics Analysis

Descriptive Statistics	Brazil	Russia	India	China	South Africa
Mean	47891.94426	8615.29723	15289.39568	2423.541	28713.72784
Median	52331.305	9580.49	16422.56	2280.87	28458.51
Standard Deviation	15783.11014	2770.986691	6595.343947	987.6381	12457.55445
Coefficient of Variation	32.95566798	32.16356461	43.13672095	40.75186	43.3853609
Minimum	12972.58	3109.79	3180.75	1060.74	8352.2
Maximum	72592.5	13090.91	29361.5	5954.77	54440.43

Sources: Computed by authors, and values are expressed in nominal terms.

Table 5.1 shows the descriptive statistics of the selected stock markets. The average stock value are highest in Brazil (47891) followed by South Africa (28713) and lowest in China having the average value of stock index is (2423). The standard deviation represents here as a proxy of raw data and its statistic explicates that Brazil (15783) is highly volatile market followed by the South Africa (12457) and least volatile stock market is China (987). The variation in the selected stock markets measured by Coefficient of Variation unveils that South Africa (43.38 per cent) remained a highly varied market followed by the India (43.13 percent), China (40.75 per cent), Brazil (32.95 per cent) and Russia (32.16 per cent). The maximum value of stock index was found in Brazil (72592.5) and the lowest in China(1060.74).

Correlation Test

Table 5.2 Results of Correlation Analysis

Brazil	Brazil	Russia	India	China	South Africa
	1				
Russia	0.845249105	1			
India	0.758626415	0.78517558	1		
China	0.658672115	0.682392002	0.580860448	1	
South Africa	0.660547431	0.725130777	0.962440447	0.464883	1

Sources: Computed by authors, and values are expressed in nominal terms.

The table 5.2 is showing linear and symmetric relationship among various stock market indices of various BRICS countries which was capture by estimating Pearson correlation coefficient mentioned above. The following table showing the result of correlation among various selected variables for the time period of 2003 to 2015. The result in the table showing correlation of various stock markets of various different countries of BRICS nations. The following table of correlation clearly showing that stock market of India is highly correlated with the stock market of South Africa whereas stock market of China is least correlated with the Stock market of South Africa.

Unit Root Test

Table 5.3Results of Unit Root Test - Augmented Dickey-Fuller (ADF) Test

Variable Name	Test Statistics	Critical Value at 5 %	P-value	Decision
Russia	-9.559310	-2.881260	0.0000	Rejected
Brazil	-3.241708	-2.881123	0.0196	Accepted
China	-2.802151	-2.881685	0.0605	Accepted
India	-2.759799	-2.881123	0.0667	Accepted
South Africa	-12.70725	-2.881260	0.0000	Accepted

Time series modeling always necessitated for checking the stationary of data keeping the fact in mind, to study conducted the ADF test to check the stationarity of underlying data series. The result explained that all the variables are stationary at their level.

All the hypothesis of the underlying series is accepted at their level and hence the data are stationary. The appropriate Lag-length criterion was choosing by following AIC criterion (Appendix 1.1)

Cointegration Test

Table 5.4Results of Johansen's Cointegration Test

Hypothesized Number of Cointegrating equations	Eigen Value	Trace Statistics	Critical Value at 5 % (p-value)	Maximum Eigen statistics	Critical Value at 5 % (p-value)	Remarks
None	0.346	102.911	69.818 (0.00)	60.732	33.876 (0.00)	Rejected
At Most 1	0.157	42.179	47.856 (0.15)	24.506	27.584 (0.11)	Accepted
At Most 2	0.077	17.672	29.797 (0.59)	11.574	21.131 (0.59)	Accepted
At Most 3	0.041	6.097	15.494 (0.68)	6.041	14.264 (0.60)	Accepted
At Most 4	0.000	0.056	3.841 (0.81)	0.056	03.841 (0.81)	Accepted

Sources: Computed by authors, and values are expressed in nominal terms.

The Johansens cointegration test is very sensitive to the lag length criteria. There is only one lag length is used as suggested by various lags length criteria such as Schwarz, Akaike and Hannan-Quinn information criteria. The Johansen cointegration method suggests basically two tests one is trace test and another is maximum Eigen value test which determine the number of cointegrating vectors. These both tests indicate that one cointegrating equation at 5 percent significance level as first null hypothesis. In the next step, Johansen's cointegration test has been tested for the selected variables with the help of Trace and Maximum Eigen value test. The table 5.4 is showing the result of these tests. The result indicating there is only one cointegration equation existing in the system which is representing by trace statistics and maximum Eigen statistics. Hence in the following equation there is only one equation is cointegrated.

Granger Causality Test

Table 5.5 Results of Granger Causality Test

Null Hypothesis	Observation	F-Statistic	Probability	Decision
China does not Granger Cause Brazil	146	0.99530	0.3201	Failed to reject
Brazil does not Granger Cause China		0.24494	0.6214	Failed to reject
Russia does not Granger Cause Brazil	146	2.08468	0.1510	Failed to reject
Brazil does not Granger Cause Russia		2.21331	0.1390	Failed to reject
South Africa does not Granger Cause Brazil	146	2.83004	0.0947	Failed to reject
Brazil does not Granger Cause South Africa		6.66351	0.0108	Rejected
India does not Granger Cause Brazil	146	0.00852	0.9266	Failed to reject
Brazil does not Granger Cause India		0.64534	0.4231	Failed to reject
Russia does not Granger Cause China	146	2.01806	0.1576	Failed to reject
China does not Granger Cause Russia		1.86389	0.1743	Failed to reject
South Africa does not Granger Cause China	146	0.16388	0.6862	Failed to reject
China does not Granger Cause South Africa		6.68379	0.0107	Rejected
India does not Granger Cause China	146	2.28062	0.1332	Failed to reject
China does not Granger Cause India		0.32702	0.5683	Failed to reject
South Africa does not Granger Cause Russia	146	4.05526	0.0459	Rejected
Russia does not Granger Cause South Africa		2.21999	0.1384	Failed to reject
India does not Granger Cause Russia	146	1.22449	0.2703	Failed to reject
Russia does not Granger Cause India		2.28702	0.1327	Failed to reject
India does not Granger Cause South Africa	146	4.43904	0.0369	Rejected
South Africa does not Granger Cause India		0.23010	0.6322	Failed to reject

Sources: Computed by authors, and values are expressed in nominal terms.

The result of granger causality test shown in table no. 5 indicating that somewhere null hypothesis is accepted where at some place it is failed to reject based on their F-statistics. In the result of following table it is mentioned that the null hypothesis for Brazil, China and does not granger cause South Africa, South Africa does not granger cause Russia is rejected while other null hypothesis are accepted.

FINDING AND CONCLUSION

This paper investigates long run growth of selected stock market over the sample period of June 2003 to August 2015. The descriptive statistic test result showing that Brazil has highest average value of stock index whereas South Africa has least average value of stock. Brazil (15783) is highly volatile market followed by the South Africa (12457) and least volatile stock market is China (987). The Coefficient of Variation result unveils that South Africa (43.38 per cent) remained a highly varied market followed by the India (43.13 per cent), China (40.75 per cent), Brazil (32.95 per cent) and Russia (32.16 per cent). There islinear and symmetric relationship among various stock market indices of various BRICS countries. The correlation analysis result clearly showing that stock market of India is highly correlated with South Africa whereas stock market of China is least correlated with the Stock market.The Johansens cointegration test indicates that one cointegrating equation at 5 percent significance level as first null hypothesis.The result indicating there is only one cointegration equation existing in the system which is representing by trace statistics and maximum Eigen statistics. Hence in the following

equation there is only one equation is cointegrated. Augmented Dickey fuller test result showing that all the hypothesis of the underlying series is accepted at their level and hence the data are stationary. The result of granger causality test showing that the null hypothesis for Brazil, China and does not granger cause South Africa and South Africa does not granger cause Russia is rejected while other null hypothesis are accepted.

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APPENDIX

Appendix (1.1) Lag-Length Table

Lag	LogL	LR	FPE	AIC	SC
0	369.1171	NA	3.65e-13	-5.239095	-5.133538
1	1059.014	1320.234	2.56e-13	-14.80595*	-14.17261*
2	1070.216	20.63108	3.12e-13	-14.60742	-13.44630
4	1106.404	33.92128	3.85e-13	-14.40870	-12.19201
5	1130.882	39.79848	3.92e-13	-14.40118	-11.65671
6	1159.901	45.09427*	3.76e-13	-14.45901	-11.18676
7	1183.854	35.49793	3.90e-13	-14.44394	-10.64390
8	1205.231	30.14363	4.23e-13	-14.39181	-10.06399