

BRICS COUNTRIES STOCK MARKET MOVEMENTS: AN EMPIRICAL ANALYSIS**¹Dileep, ²Dr. G V Kesava Rao**¹Assistant Professor, ²Adjunct Faculty¹Department of Finance, R. V Institute of Management Bangalore, India.²ICFAI Business School (IBS), Bangalore, India.**Abstract**

This study examines the stock market integration amongst BRICS nations and for the period of 19 years data. The main aim of this study is to check the natural associations between the stock markets for selected nations, to find integration among stock markets and to find out the causal relationship. Descriptive statistics reveals that, all the variables are moderately skewed and four variables data set are Platy kurtosis and China's data set are Leptokurtosis. The stationary check is done through Augmented Dickey Fuller Test for calculation of multiple regression analysis. In multiple regression analysis China and Russia stock market does not affects to Indian stock market where as Brazil and South Africa does affects. With the help of Johansen tests of Trace and Maximum Eigen value test found that all the selected variables are co-integrated. Further, with co-integration VECM adopted to check the short run causality.

Keywords: BRICS, Co-integration, Multiple regressions and Granger causality.

1. INTRODUCTION

Investor will have always dilemma for selecting better stocks to invest. Prior to this it is also important for them to know about different factors such as Economic factor, Political factor and International factors and so on. Further to this different stock analysis techniques such as Technical and Fundamental analysis. Based on investor's point of view this research is focused on, how BRICS nation's stock market are integrated, correlated and casing each other and helps the investors to take decision on their investment pattern. The better financial system of the country leads to strong growth for the stock market. Stock market plays a role of engine, the major development of the nations.

BRICS brings together five major emerging economies, comprising 43% of the world population, having 30% of the world GDP and 17% share in the world trade. The BRICS are the world's leading emerging economies. Especially in the last decade, they have been characterized by rapid economic growth and industrialization. Their role in world affairs is thus changing from that of developing countries who are recipients of aid to (again) significant donors of funds.

2. LITERATURE REVIEW

A group of studies prevalent, which emphasized that integration between Indian economy and other major Global economies, has increased with the passage of time. Kumar (2017)⁽²⁾ Researchers in his manuscript entitled- "Stock Market Movement of BRICS countries: An

Empirical Analysis" have made an effort to examine the stock markets movements and co-integration for BRICS nations. The sampling frame used for the same five is five countries for a period of 13 years. The research findings reveal that, there is linear symmetric relationship among various stock markets. Though the finding of the study is a significant, it failed to focus on multi-regression analysis¹.

Swetadri et al (2018)⁽⁴⁾ examines and considered Indian stock market and the established stock markets namely, Australia, Canada, France, Germany, India, UK and USA. It shows that there is Low correlation between Indian and France stock market that indicates the possible gains from international markets. The author finds the causality based on VECM.

Bhunia and Yaman (2017)⁽¹⁾ investigated whether there is any causal relationship between Asian stock markets and US stock market based on daily stock price indices between January 1991 and March 2016 using unit root test, VECM and co-integration analysis. They confirmed that there is an association and further identified which has a negative correlation with the US market, indicating opportunities for diversification by investors³.

Patel (2017)⁽³⁾ has examined the Co-movement of the 14 selected stock markets and have also tried to the relationship of long & short between 14 stock exchanges viz. BSE Sensex, HangSeng, MXX, FTSE-100, Nikkei, NASDAQ, JKSE, BVSP, KSE, KSE- Korea stock exchange, RTS, SSE, SSMI and TSEC. Found that, the return of BSE is depending on BVSP, FTSE-100 & MXX only, BVSP depends only on BSE, FTSE-100, Hang Seng

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and KSE only. The analysis of dependency can help in taking the investment in a better way⁴.

3. RESEARCH METHODOLOGY

- **Type of Research:** Descriptive research used for the study, with the characteristics of prices or index value of selected foreign and Indian indices.
- **Method of sampling:** Sampling technique followed is Convenience Sampling. Sample units chosen are two Indian Stock Markets and 4 major global stock markets which are associated with BRICS.
- **Sample Size:** The study covers six major foreign stock market and for a period of 19 years i.e., from January 2000 to January 2019.

Table 1: Ranks of Global Indices Based on their Market Capitalization

Ranking	Stock Exchange	Market Capitalization	Country
1	Shanghai Exchange	Stock \$4.27 trillion	China
2	National Exchange	Stock \$2.27 trillion	India
3	Bombay Exchange	Stock \$1.66 trillion	India
4	BOVLSPA Exchange	Stock \$837 billion	Brazil
5	MOEX	\$175.63 billion	Russia
6	JALSH	\$995.12 billion	South Africa

(Source: Stocks_To_Trade/Wiki_Stock_exchanges)

Research Technique: Different research techniques used for the study are:

Descriptive Statistics, Jarque-Bera test, Unit Root Test, Multiple-Regression Analysis, Granger Causality Test, Co-Integration and Vector Error Correction Model (VECM)

3.1 Objectives

- To assess the Interdependence of foreign stock markets and their impact on Indian stock exchange.
- To find out the relationship among major selected markets.
- To test the selected stock market associations.

3.2 Scope of The Study

The present study will help us to analyze the interdependence that exists between the six major foreign stock markets with special reference to India on the basis of monthly indices values. The scope is restricted to only selected six nation stock market and selected only one index from each country except India.

4. RESULTS, ANALYSIS AND DISCUSSION

Table 2 stock market identifies that, all the variables are moderately skewed since the values are between -1 to -0.5 and 0.5 to 1.

Four variables data set are Platy kurtosis and China's data set are Leptokurtosis. With the help of Jarque Bera Test identified the data set are normally distributed expect Brazil.

Table 2: Descriptive Statistics

	BRAZIL	CHINA	INDIA NSE	RUSSIA	INDIA BSE	SOUTH_AFRICA
Mean	49709.70	2512.410	5386.016	1389.684	17794.47	32814.22
Median	53352.00	2472.910	5253.800	1456.355	17496.29	30708.62
Maximum	97394.00	5954.765	11680.50	2521.100	38645.07	59772.83
Minimum	8623.00	1060.738	934.050	281.810	2949.320	7510.400
Std. Dev.	19402.70	924.3105	2837.098	561.5055	9324.884	15895.05
Skewness	0.365112	0.751772	0.274048	0.322691	0.218052	0.064538
Kurtosis	2.584544	3.965232	2.200365	2.361744	2.211002	1.736539
Jarque-Bera	5.881925	26.60263	7.831882	6.865731	6.772536	13.44162
Probability	0.052815*	0.000002**	0.019922**	0.032294**	0.033835**	0.001206**
Observations	200	200	200	200	200	200

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

* Accept the null hypothesis.

** Reject the null hypothesis.

4.1 Unit Root Test

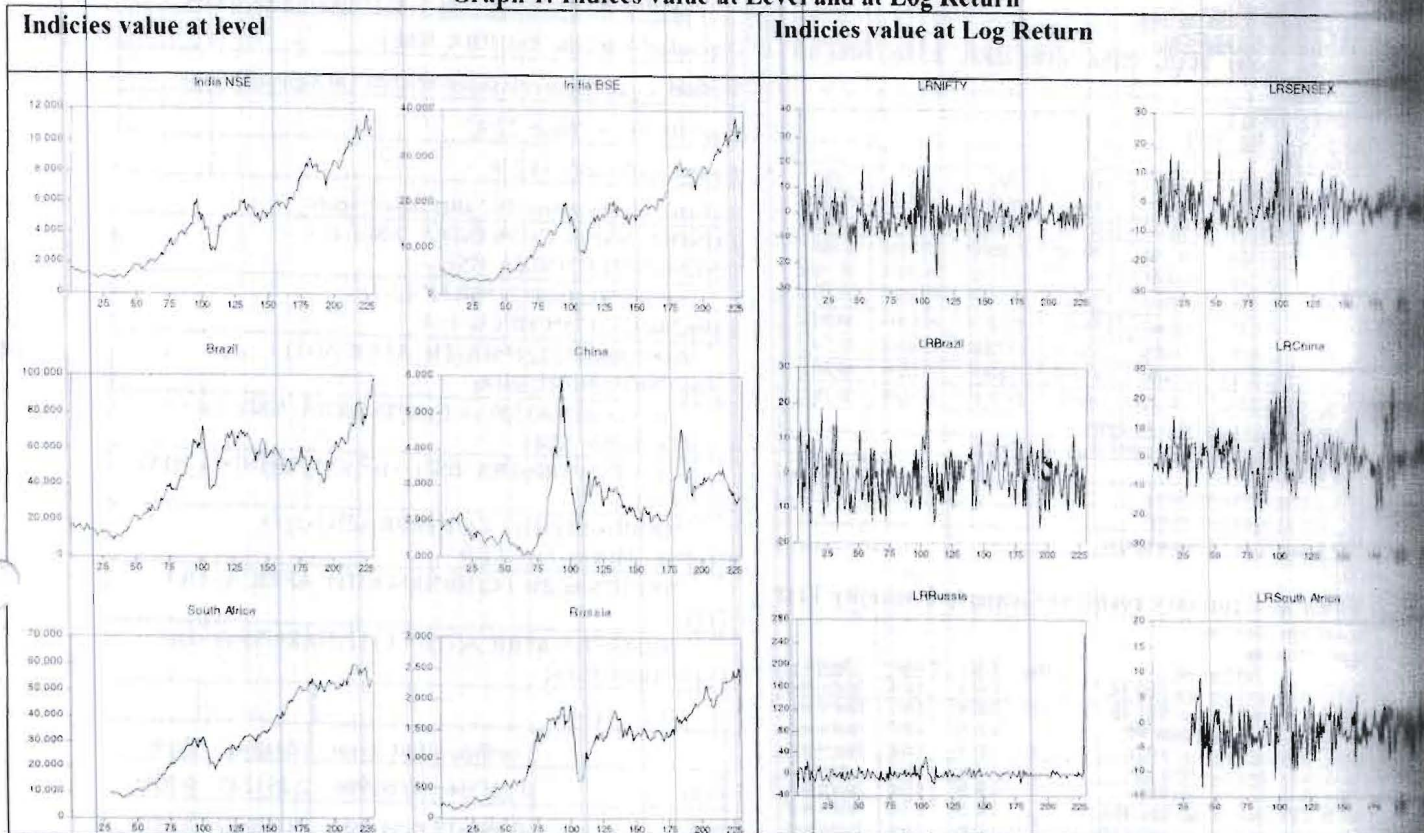
Table 4: ADF Test results for all selected Stock Exchanges at Level and at 1st Difference

Sl. No	Stock Exchanges	Level			First Difference		
		ADF T-Statistic	P-Value	Hypothesis	ADF T-Statistic	P-Value	Hypothesis
1	BRAZIL	2.1911	0.2102	Accepted H ₀	6.8826	<0.05	Rejected H ₀
2	CHINA	2.0432	0.2683	Accepted H ₀	8.2777	<0.05	Rejected H ₀
3	INDIA NSE	1.6846	0.4377	Accepted H ₀	15.4958	<0.05	Rejected H ₀
4	RUSSIA	1.2614	0.6476	Accepted H ₀	13.6656	<0.05	Rejected H ₀
5	INDIA BSE	1.7713	0.3941	Accepted H ₀	15.1351	<0.05	Rejected H ₀
6	SOUTH_AFRICA	0.3272	0.8819	Accepted H ₀	15.4753	<0.05	Rejected H ₀

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

With the help of table 4 identified that, all the selected stock exchanges will become stationary at first difference and critical values are less than ADF test statistics at 5% level of significance.

Graph 1: Indices value at Level and at Log Return



Multiple Regression Analysis:

H_0 = There is no significant impact between BRICS Nation's (foreign) stock exchange to Indian Stock Exchange.

exchange to Indian Stock Exchanges. But remaining two variables it rejects null that is for Brazil and South Africa nations.

Table 5: Multiple Regression Analysis of NSE India and Other four BRICS Countries

Dependent Variable: LRNIFTY				
Method: Least Squares				
Date: 02/18/19 Time: 16:16				
Sample (adjusted): 31 228				
Included observations: 198 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.320082	0.374653	-0.854342	0.3940
LRBRAZIL	0.347741	0.064285	5.407553	0.0000
LRCHINA	0.006289	0.048260	0.130309	0.8965
LRRUSSIA	-0.009593	0.053250	-0.180140	0.8572
LR SOUTH AFRICA	0.570168	0.098470	5.790275	0.0000
R-squared	0.405818	Mean dependent var		-1.224432
Adjusted R-squared	0.393503	S.D. dependent var		6.580689
S.E. of regression	5.124904	Akaike info criterion		6.131029
Sum squared resid	5069.075	Schwarz criterion		6.214066
Log likelihood	-601.9719	Hannan-Quinn criter.		6.164639
F-statistic	32.95401	Durbin-Watson stat		2.158114
Prob(F-statistic)	0.000000			

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

Table 6: Multiple Regression Analysis of BSE India and Other four BRICS Countries

Dependent Variable: LRSENSEX				
Method: Least Squares				
Date: 02/18/19 Time: 16:18				
Sample (adjusted): 31 228				
Included observations: 198 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.367152	0.363202	-1.010877	0.3133
LRBRAZIL	0.338000	0.062320	5.423615	0.0000
LRCHINA	0.020048	0.046785	0.428522	0.6687
LRRUSSIA	-0.004302	0.051623	-0.083327	0.9337
LR SOUTH AFRICA	0.560602	0.095460	5.872631	0.0000
R-squared	0.412472	Mean dependent var		-1.260675
Adjusted R-squared	0.400296	S.D. dependent var		6.415567
S.E. of regression	4.968253	Akaike info criterion		6.068942
Sum squared resid	4763.923	Schwarz criterion		6.151979
Log likelihood	-595.8252	Hannan-Quinn criter.		6.102552
F-statistic	33.87379	Durbin-Watson stat		2.000992
Prob(F-statistic)	0.000000			

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

The table 5 and 6 shown above reveals that, considering NSE and BSE as dependent variables and remaining four nations of the BRICS are independent variables. Based on the result the coefficient are negatives and Durbin Watson stat value is more than 2 which indicates the model fitness. Also the test reveals that, it accept the null hypothesis in the case of China and Russia since the probability value is less than 0.05 i.e. There is no significant impact between BRICS Nation's stock

4.2 Granger Causality Test

The table 7 which resulted to be considered the number of lags to take for Cause and effect test to run and majority of the methods suggest to consider 2 lag structure.

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Table 7 Selection of VAR Lag Order

VAR Lag Order Selection Criteria							
Endogenous variables: BRAZIL CHINA SOUTH AFRICA RUSSIA INDIA NSE INDIA BSE							
Exogenous variables: C							
Date: 02/18/19 Time: 16:38							
Sample: 1 230							
Lag	LogL	LR	FPE	AIC	SC	HQ	
0	-9873.922	NA	2.00e+37	102.9158	103.0176	102.9571	
1	-8421.370	2799.187	7.81e+30	88.16611	88.87269*	88.44871	
2	-8337.648	156.1068	4.76e+30*	87.66300*	88.98636	88.19897*	
3	-8312.460	45.39185	5.34e+30	87.77562	89.70976	88.55896	
4	-8273.682	67.45641	5.21e+30	87.74669	90.29161	88.77740	
5	-8235.479	64.07067	5.13e+30	87.72374	90.87944	89.00182	
6	-8199.965	57.34021	5.22e+30	87.72880	91.49528	89.25425	
7	-8172.560	42.53495	5.81e+30	87.81833	92.19559	89.59115	
8	-8128.651	65.40523*	5.48e+30	87.73595	92.72399	89.75615	
* indicates lag order selected by the criterion							
LR: sequential modified LR test statistic (each test at 5% level)							
FPE: Final prediction error							
AIC: Akaike information criterion							
SC: Schwarz information criterion							
HQ: Hannan-Quinn information criterion							

Table 8: Summary result of Granger Causality Test

Pairwise Granger Causality Tests				
Sample: 1 230 and Lags: 2				
Null Hypothesis	Obs.	F-Stat	P-Value	Decision
INDIA_NSE does not Granger Cause INDIA_BSE	227	0.45761	0.6334	Failed to reject
INDIA_BSE does not Granger Cause INDIA_NSE	227	0.87206	0.4195	Failed to reject
BRAZIL does not Granger Cause INDIA_BSE	227	0.22370	0.7997	Failed to reject
INDIA_BSE does not Granger Cause BRAZIL	227	2.90529	0.0568	Failed to reject
CHINA does not Granger Cause INDIA_BSE	227	15.4051	5.E-07	Rejected
INDIA_BSE does not Granger Cause CHINA	227	1.29266	0.2766	Failed to reject
SOUTH_AFRICA does not Granger Cause INDIA_BSE	227	2.28723	0.1043	Failed to reject
INDIA_BSE does not Granger Cause SOUTH_AFRICA	227	1.52095	0.2211	Failed to reject
RUSSIA does not Granger Cause INDIA_BSE	227	25.2682	1.E-10	Rejected
INDIA_BSE does not Granger Cause RUSSIA	227	2.41563	0.0917	Failed to reject
BRAZIL does not Granger Cause INDIA_NSE	227	0.43461	0.6481	Failed to reject
INDIA_NSE does not Granger Cause BRAZIL	227	0.32909	0.0504	Failed to reject
CHINA does not Granger Cause INDIA_NSE	227	15.4599	5.E-07	Rejected
INDIA_NSE does not Granger Cause CHINA	227	1.63535	0.1972	Failed to reject
SOUTH_AFRICA does not Granger Cause INDIA_NSE	227	2.41844	0.0918	Failed to reject
INDIA_NSE does not Granger Cause SOUTH_AFRICA	227	1.16552	0.3139	Failed to reject
RUSSIA does not Granger Cause INDIA_NSE	227	25.0775	2.E-10	Rejected
INDIA_NSE does not Granger Cause RUSSIA	227	2.34386	0.0983	Failed to reject
CHINA does not Granger Cause BRAZIL	227	18.8243	3.E-08	Rejected
BRAZIL does not Granger Cause CHINA	227	0.62791	0.5373	Failed to reject
SOUTH_AFRICA does not Granger Cause BRAZIL	227	0.64175	0.5275	Failed to reject
BRAZIL does not Granger Cause SOUTH_AFRICA	227	0.23938	0.7874	Failed to reject
RUSSIA does not Granger Cause BRAZIL	227	51.3841	4.E-19	Rejected
BRAZIL does not Granger Cause RUSSIA	227	2.68165	0.0707	Failed to reject
SOUTH_AFRICA does not Granger Cause CHINA	227	1.98830	0.1397	Failed to reject
CHINA does not Granger Cause SOUTH_AFRICA	227	11.3042	2.E-05	Rejected
RUSSIA does not Granger Cause CHINA	227	1.22462	0.2958	Failed to reject
CHINA does not Granger Cause RUSSIA	227	0.63366	0.5316	Failed to reject
RUSSIA does not Granger Cause SOUTH_AFRICA	227	30.1133	4.E-12	Rejected
SOUTH_AFRICA does not Granger Cause RUSSIA	227	1.10487	0.3333	Failed to reject

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

Table 9: Co-integration

Hypothesized Number of Co-integrating equations	Eigen Value	Trace Statistics	Critical Value at 5% (p-value)	Maximum Eigen Statistics	Critical Value at 5% (p-value)	Remarks
None	0.133	70.82	95.75(0.695)	28.01	40.08(0.561)	Accepted
At most 1	0.081	42.81	69.82(0.893)	16.71	33.88(0.932)	Accepted
At most 2	0.071	26.09	47.86(0.886)	14.41	27.58(0.793)	Accepted
At most 3	0.045	11.68	29.80(0.942)	9.157	21.13(0.819)	Accepted
At most 4	0.012	2.520	15.49(0.984)	2.320	14.26(0.981)	Accepted
At most 5	0.001	0.200	3.84(0.654)	0.200	3.84(0.654)	Accepted

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

The above test done based on 2 lag length criteria. The Johansen test of both the methods of test has been considered. The results found that, values are less than critical values and should fail to reject Ho and stock markets are co-integrated. Based on the result and has long run association it can be further test with VECM.

Table 9: Vector Error Correction Estimates

Dependent Variable: D(INDIA_NSE)				
Method: Least Squares (Gauss-Newton / Marquardt steps)				
Date: 03/19/19 Time: 22:47				
Sample (adjusted): 33 229				
Included observations: 197 after adjustments				
D(INDIA_NSE) = C(1)*D(INDIA_NSE(-1)) - 0.542062832132*INDIA_BSE(-1) + 0.0279029105871*BRAZIL(-1) - 0.0662489233175*CHINA(-1) + 0.0910980152224*SOUTH_AFRICA(-1) + 0.686778639156*RUSSIA(-1) - 910.415663229) + C(2)*D(INDIA_NSE(-1)) + C(3)*D(INDIA_NSE(-2)) + C(4)*D(INDIA_BSE(-1)) + C(5)*D(INDIA_BSE(-2)) + C(6) *D(BRAZIL(-1)) + C(7)*D(BRAZIL(-2)) + C(8)*D(CHINA(-1)) + C(9) *D(CHINA(-2)) + C(10)*D(SOUTH_AFRICA(-1)) + C(11) *D(SOUTH_AFRICA(-2)) + C(12)*D(RUSSIA(-1)) + C(13)*D(RUSSIA(-2)) + C(14)				
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.121356	0.053906	2.251245	0.0256
C(2)	-0.498632	0.541704	-0.920488	0.3585
C(3)	-0.410517	0.543647	-0.755116	0.4511
C(4)	0.157531	0.166089	0.948475	0.3441
C(5)	0.090266	0.166610	0.541778	0.5886
C(6)	0.004114	0.007875	0.522405	0.6020
C(7)	-0.005166	0.007250	-0.712568	0.4770
C(8)	0.336644	0.083475	4.032872	0.0001
C(9)	-0.016192	0.088042	-0.183910	0.8543
C(10)	-0.011736	0.020033	-0.585825	0.5587
C(11)	0.030667	0.019264	1.591936	0.1131
C(12)	1.268871	0.225921	5.616426	0.0000
C(13)	-0.440140	0.274743	-1.602006	0.1109
C(14)	39.42305	19.86409	1.984639	0.0487
R-squared	0.314808	Mean dependent var	49.84949	
Adjusted R-squared	0.266133	S.D. dependent var	311.4347	
S.E. of regression	266.7937	Akaike info criterion	14.07924	
Sum squared resid	13025734	Schwarz criterion	14.31257	
Log likelihood	-1372.805	Hannan-Quinn criter.	14.17369	
F-statistic	6.467574	Durbin-Watson stat	1.981516	
Prob(F-statistic)	0.000000			

The table identifies that, is there any long run or short run causality from BRICS stock exchanges. Since C1 is not negative but significant which indicates here is no long run causality and R squared 0.3148 is less than Durbin-Watson stat values 1.9815 also indicates that the model fitness.

Table 10: Results of VECM

Wald Test				
Equation: Untitled				
	F-statistic	Chi-square	Probability	Remarks
$C(6)=C(7)=0$	0.354411	0.708822	0.7016	There is no short run causality exist from Brazil to India
$C(8)=C(9)=0$	8.140401	16.28080	0.0003	There is a short run causality exist from China to India
$C(10)=C(11)=0$	1.864591	3.729181	0.1550	There is no short run causality exist from South Africa to India
$C(12)=C(13)=0$	17.34770	34.69541	<0.05	Short run causality exist from Russia to India

5. CONCLUSION

This study has tried to investigate the natural association between the stock exchanges from selected major stock exchanges from BRICS nations. In the process of investigation identified that, the errors are not normally distributed. ADF test finds that, selected data is non-stationary, it is also found that, there is association among the selected stocks and multiple regressions reveals that, Indian stock market is depending on Brazil and South Africa stock markets. Investor's point of view it is also important for them to see the international markets which will have impact on Indian stock market.

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*MBA Department, RNS Institute of Technology, Dr. Vishnuvardhan Road,
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