

## **Economic Integration of India with Brazil, Russia, China and South Africa**

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**Abstract:** *An event in one country does not impact the country alone. Its impact may be felt in economies all over the world. In this study, the linkages between Nifty 50 (India) with Brazil, Russia, China, and South Africa are considered together by utilizing the technique of the Unit Root Test followed by Johansen Juselius Cointegration test. A high degree of correlations of daily indices of the Nifty 50 observed with all the stock markets. This suggests a strengthening of the integration of India's stock market with the BRICS Countries. The study has concluded that integrated relationships between economies are of great importance for policymakers, investors, and academicians, as equity markets of different countries appear to be closely related and, any uncertainty in one market can be transmitted to other interdependent markets.*

**Keywords:** *BRICS; Economies; Stock Markets; Correlation; Cointegration; Investment; Uncertainties; Portfolio*

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### **I. Introduction**

The past few decades have been characterised by the processes of globalization, liberalization, deregulation and advancement in information technology that have pervaded the overall global economy. These changes have led to an increase in the uncertainty, volatility, and complexity of the world's financial environment. There is, therefore, a need of international diversification of securities for investors seeking optimum portfolio performance.

An event in one country does not impact the country alone; its impact may be felt in economies all over the world. The factors underlying such linkages in different economies need to be studied. The impacts of the October 1987 Stock Market Crash, 1997 Asian Financial Crisis and 2007 Subprime Crisis have therefore drawn much attention among economists and financial practitioners towards the study of linkages among stock markets of various countries.

The most important issue in the area of financial econometrics is perhaps to check the long run association relationships or cointegration or integration between stock markets of different countries. Choudhary and Siag (2015) defined stock market integration as "a condition in which stock markets in different countries trend together and depict same expected risk adjusted returns". If cointegration or long run association relationship exists between two or more countries, international investors from one of those countries derive no benefit through diversification of their investments in the other country. International diversification enables investors to choose securities from a bigger basket of foreign securities. The concept of stock market integration encompasses that for similar risk factors, markets are open and therefore, share common risk premium (Ahlgren and Antell, 2002). The co-movements or cointegration of stock prices not only reflect the market globalization but also reflect the globalization of capital resources (Meric et al., 2012).

Bose (2005) opined that as stock markets become more integrated, investment barriers are removed allowing risk sharing between foreign and domestic (India in case of the present study) agents, decreasing thereby the cost of capital. Investment barriers like legal and tax differences, information availability, risk associated with exchange rate and foreign ownership restrictions, etc. can avert markets from integrating. Financial integration of stock markets amongst different economies drives the development of best-in-class trading mechanisms and efficient institutions. Effective price discovery is driven by the integration of stock markets, contributing to higher savings, investment and economic progress (Saxena and Chadha, 2015). A cointegration model not only distinguishes between the nature of long-run and short-run linkages among financial markets, but also captures the interaction between them (Dhal, 2009).

The benefits of financial integration can be witnessed in any region through greater degree of risk diversification, efficient allocation of capital, a lower probability of asymmetric shocks, and a more sound market framework (Pauer, 2005). However, intensified financial linkages in a world of high capital mobility may also lead to more rapid transmission of financial instability in one country to neighbouring countries.

Policy makers are duly benefitted by such financial integrations while framing suitable policies for the economy, and while addressing issues related to crises moving from other markets to their own domestic market. A comprehensive study on stock market integration will carry a lot of importance in the present day situation (Gambhir and Bhandari, 2012).

The study of integration relationships between economies is also of great importance for policymakers, investors, and academicians, since if equity markets of different countries appear to be closely related, there is a chance that any uncertainty in one market can be transmit to other interdependent markets.

Various financial institutions, foreign portfolio investments (FPI), foreign institutional investors (FII), and mutual fund companies optimize their returns by investing in different countries. Such global investors can make more rational decisions by studying the strength of interdependencies and inter-linkages among stock markets of different countries. In last few years, investments made by FIIs or foreign investors have been of significant quantum in India, so there is a need to check whether they will be benefitted by investing in India.

**Table 1: List of the major stock markets of select developed and emerging countries and their Indices**

SN	Country	Categorization	Exchange	Index (Symbol) used in the study
1.	India	Emerging	National Stock Exchange	Nifty 50 (Nifty 50)
2.	Brazil	Emerging	Sao Paulo Stock Exchange	The Bovespa Index (IBOVESPA)
3.	Russia	Emerging	Moscow Exchange	Moscow Interbank Currency Exchange (MICEX)
4.	China	Emerging	Shanghai Stock Exchange	Shanghai Stock Exchange Composite Index (SHCOMP)
5.	South Africa	Emerging	Johannesburg StockExchange	Johannesburg All Share Index (JALSH)

## II. Brief Description of Developed and Emerging Countries Stock Markets

Detailed descriptions of all the developed and emerging stock market indices are presented in this section. Index base value; composition, type of market capitalization used in computation, etc., are described herein.

### **IBOVESPA (Brazil)**

“It is a gross total return index weighted by free float market cap and is comprised of the most liquid stocks traded on the Sao Paulo Stock Exchange. It has been divided 10 times by a factor of 10 since Jan 1, 1985:12/02/85, 08/29/88, 04/14/89, 01/12/90, 05/28/91, 01/21/92, 01/26/93, 08/27/93, 02/10/94, and 03/03/97”. (Source: <https://www.bloomberg.com/quote/IBOV>)

### **Nifty 50 (India)**

“The Nifty 50 is the flagship index on the NSE, computed using a float-adjusted, market capitalization weighted methodology. The Index tracks the behaviour of a portfolio of blue chip companies, the largest and most liquid Indian securities domiciled in India and listed on the National Stock Exchange.” (Source: <https://www.bloomberg.com/quote/NIFTY>)

### **MICEX (Russia)**

“MICEX Index is cap-weighted composite index calculated based on prices of the 50 most liquid Russian stocks of the largest and dynamically developing Russian issuers presented on the Moscow Exchange. MICEX Index was launched on September 22, 1997 at base value 100. The MICEX Index is calculated in real time and denominated by Moscow Exchange in Russian rubles”. (Source: <https://www.bloomberg.com/quote/IMOEX>)

### **JALSH (South Africa)**

“South Africa's FTSE/JSE Africa All Shares Index is a market capitalization weighted index. Companies included in this index make up the top 99% of the market capitalization of all listed companies on the Johannesburg Stock Exchange” (Source: <https://www.bloomberg.com/quote/JALSH>)

### **SHCOMP (China)**

“The Shanghai Stock Exchange Composite Index is a capitalization-weighted index which tracks the performance of all A-shares and B-shares listed on the Shanghai Stock Exchange in China. The index was developed on December 19, 1990 with a base value of CNY100 China. Shanghai New Composite Index has a base value of 1000 as of December 30, 2005. The index constituents are those which have carried out the program of the Chinese Government to reduce state-owned shares in local listed companies”. (Source: <https://www.bloomberg.com/quote/SHCOMP>)

### III. Review of Literature

Review of literature is key to any research. It establishes the theoretical background of research, while also guiding the methodological framework. This chapter presents extant literature that has been reviewed in order to form the background of the present study. A substantial amount of literature is available on stock market integration across the stock markets of different countries. Stock market integration naturally constitutes a special field for financial econometrics research. Markets are said to be cointegrated if they share a common trend, i.e., if they move together in the long run.

Dasgupta (2014) has studied the causality and cointegration of BRIC Countries. Daily closing values of benchmark indices of Brazil, Russia, India and China were taken into consideration for analysis. The result of the Engle and Granger Test shows that the Indian and Brazilian markets are cointegrated. Strong positive correlation has been found in BRIC countries whereas no causal relationship exists between India and China.

Sharma, Mahendru and Singh (2013) have studied the linkages among BRICS countries for a period of 1st April 2005 to 31st March 2010. They have applied the techniques of Granger's causality, Variance Decomposition Analysis, Vector Auto Regression, Impulse Response Analysis and found Brazilian stock markets affect the Indian, South African, Chinese and Russian markets. Further, the Indian stock market was found to affect the Brazilian, South African, Chinese and Russian markets in the study.

### IV. Research Methodology

The process of research methodology involves the establishment of a scientific and systematic solution to the research problem under investigation. This chapter deals with the processes and assumptions underlying present study.

The present study is quantitative in nature, and deals with a series of secondary daily data collected for the period April 1, 2000- March 31, 2018. Data has been collected from the Bloomberg Database using Bloomberg Terminal. Augmented Dickey Fuller (ADF) Test, Johansen Juselius Cointegration Test (JCT) and preliminary analyses that include descriptive statistics and correlation analysis have been used as analytical tools.

#### 4.1 Research Design

##### 4.1.1 Nature of Research

The study is exploratory in nature. An attempt is made to gauge the integration status of Indian stock markets with BRICS Countries.

##### 4.1.2 Scope of Research

The study covers an assessment of long-run cointegration relationship and short-run causal relationship of Nifty 50 with BRICS Economies. In domestic financial market variables; Nifty 50 has been taken as a barometer of Indian stock markets. Nifty 50 index is a well-diversified index of 50 Blue Chip Stocks accounting for 13 sectors of the economy. Augmented Dickey Fuller (ADF) Test, Johansen Cointegration Test (JCT) are used for analysis. No other cointegration method is used to judge the integration. The Indian stock market benchmark index Nifty 50 is considered for analysis, to represent Indian markets as a whole.

##### 4.1.3 Research Objectives

A well devised research objective could facilitate appropriate adoption of methodology for research and reaching out the conclusion. Herein, the objective of the study is as follows:

- i. To examine whether long run equilibrium relationships or cointegration exist between Nifty 50 and Brazil, Russia, China and South Africa.
- ii. To investigate whether correlation exist between Nifty 50 and Brazil, Russia, China and South Africa.

**Table 2: Countries Identified for Study**

S. No.	Country	Literature Support
1.	Brazil (IBOVESPA)	Dasgupta (2014); Sharma, Mahendru and Singh (2013) and Seabra (2001)
2.	China (SHCOMP)	Seth and Sharma (2015); Singh and Kaur (2015); Dasgupta (2014); Palamalai, M and Devakumar (2013); Rajwani and Mukherjee (2013);
3.	JALSH (South Africa)	Mohansundram and Kartikeyan (2015) and Sharma, Mahendru and Singh (2013)
4.	MICEX (Russia)	Sharma, Mahendru and Singh (2013)

**Table 3: Statistical Hypotheses for Cointegration Test**

SN	Null Hypotheses	SN	Alternate Hypotheses
<b>I. Long run Cointegration between Nifty 50 –BRICS Countries</b>			
H <sub>01</sub>	Nifty 50 & IBOVESPA are not cointegrated.	H <sub>11</sub>	Nifty 50 & IBOVESPA are cointegrated.
H <sub>02</sub>	Nifty 50 & MICEX are not cointegrated.	H <sub>12</sub>	Nifty 50 & MICEX are cointegrated.
H <sub>03</sub>	Nifty 50 & SHCOMP are not cointegrated.	H <sub>13</sub>	Nifty 50 & SHCOMP are cointegrated.
H <sub>04</sub>	Nifty 50 & JALSH are not cointegrated.	H <sub>14</sub>	Nifty 50 & JALSH are cointegrated.

**4.1.4 Sample Period**

This study is quantitative in nature, dealing with multiple series of secondary data. Daily data pertaining to the benchmark indices of all countries under study has been taken from Bloomberg Terminal for the period April 01, 2000 – March 31, 2018. With a perspective to the portfolio diversification and the arbitrage activities of dominant market participants like foreign portfolio investors, stock prices should be measured in common reference currency, typically, the US dollar, which globally serves as the major invoicing currency for trade and investment activities

Studies using stock prices in domestic currency units point out that indices, when measured in terms of national currencies, tend to restrict their changes solely to movements in security prices They therefore avoid distorting empirical results caused by sharp fluctuations in exchange rates.

**4.1.5 Research tools for data analysis**

Selection of appropriate research tools and techniques plays a vital role in data analysis. It is required to achieve the desired research objectives and to arrive at logical, scientific and reliable conclusions in the study. Augmented Dickey Fuller Test (ADF) and Johansen Juselius Cointegration Test (JCT) have been applied to address the research objectives and to test the hypotheses. The stationarity of the data has been checked by employing Unit Root Test consisting of Augmented Dickey-Fuller (ADF) Test. Preliminary analysis such as descriptive and correlation analysis have been under taken to find out relationship of the two series.

Continuously compounded daily returns of stock index are calculated as

$$R_t = \text{Log} (P_t / P_{t-1})$$

Where,

P<sub>t</sub> = Stock Market Index at time t

P<sub>t-1</sub> = Stock Market Index at time t-1

**Stationarity**

A stationary process is a stochastic or random process. It deals with the joint probability distribution which does not change with shift in time. There are constant behaviours of parameters such as mean and variance. These do not follow any trend; nor do they change over time.

**Johansen Cointegration Test**

Cointegration relationship might exist if the variables are integrated of order one, I(1). It is important to check if any cointegration exists. A set of variables are said to be cointegrated if they are individually integrated of the same order, and if there is at least one linear combination of these variables which is stationary.

**V. Analysis And Findings**

Further, this chapter addresses the objective of determining the short run and long run economic integration among stock markets of developed and emerging economies. Correlation Analysis and Johansen and Juselius Cointegration Test (JCT) has been applied for analysing the interlinkages and interdependencies between these markets.

Daily data has been collected from Bloomberg database using Bloomberg Terminal for the period April 1, 2000 to March 31, 2018. The first section of the Chapter deals with the descriptive statistics including mean, median, mode, skewness and kurtosis of data from all the stock markets, and thereby assesses the general characteristics of stock market data. This is followed by graphs of log returns of the stock market benchmark indices of all the stock markets under study.

**Table 4: Descriptive Statistics**

	LR IBOVESPA	LR JALSH	LR MICEX	LR SHCOMP	LR NIFTY50
<b>Mean</b>	0.0056	0.0082	0.0106	0.0051	0.0090
<b>Median</b>	0.0095	0.0109	0.0244	0.0031	0.0068
<b>Maximum</b>	0.1703	0.1240	0.2136	0.1892	0.1774
<b>Minimum</b>	-0.2452	-0.1334	-0.2861	-0.1627	-0.1358

<b>Std. Dev.</b>	0.0903	0.0518	0.0930	0.0659	0.0599
<b>Skewness</b>	-0.6940	-0.3349	-0.7705	0.0712	-0.0170
<b>Kurtosis</b>	3.4239	3.0563	4.2621	3.6908	3.0461

Russian market has the highest mean return and risk. It proves the theory of high risk and high return. Below are the graphs of return of Nifty50, IBOVESPA, JALSH, MICEX and SHCOMP.

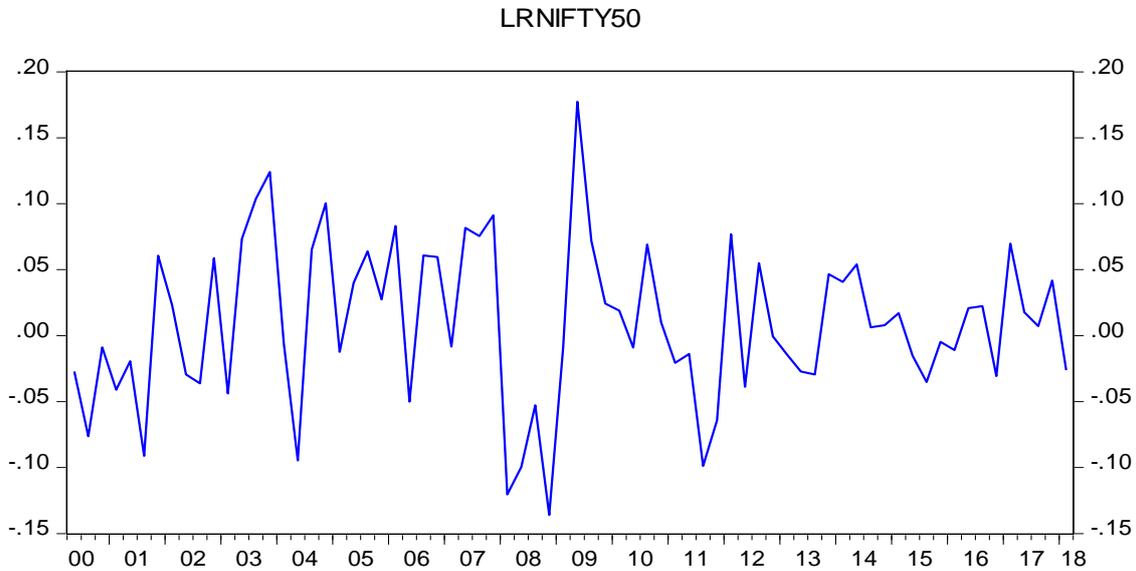


Figure 1 : Movement of Log Return of Nifty 50 (2000-2018)

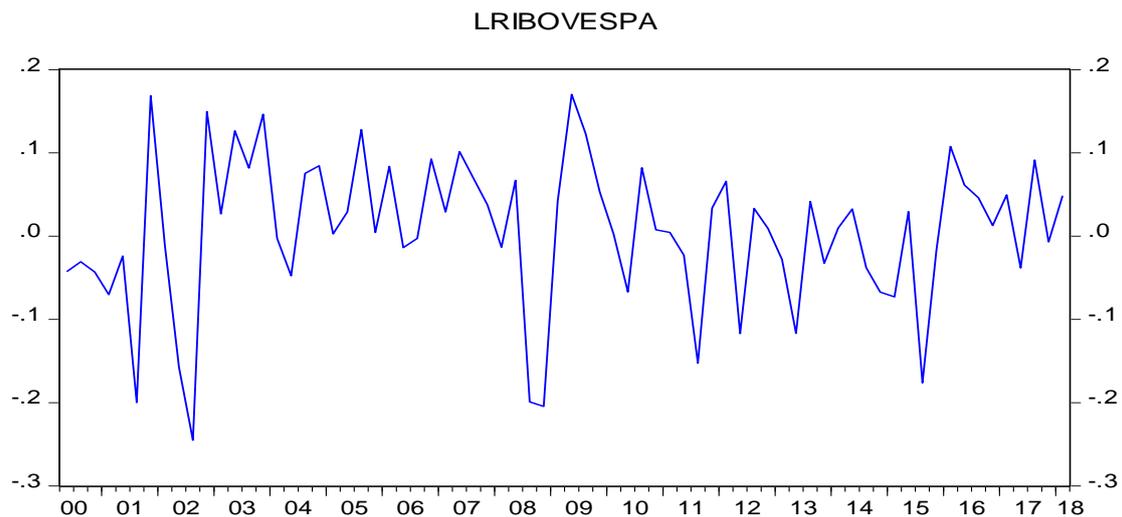


Figure 2: Movement of Log Return of IBOVESPA

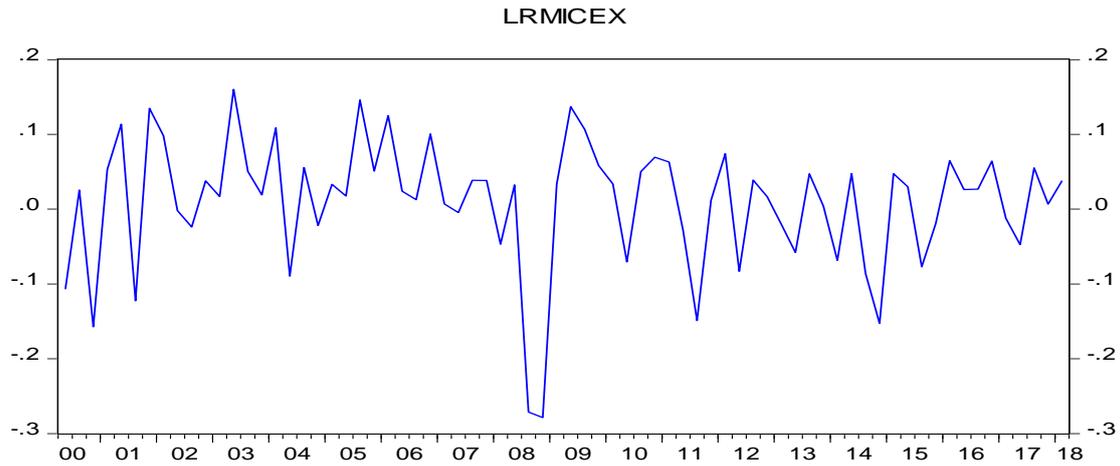


Figure 3: Movement of Log Return of MICEX (2000-2018)

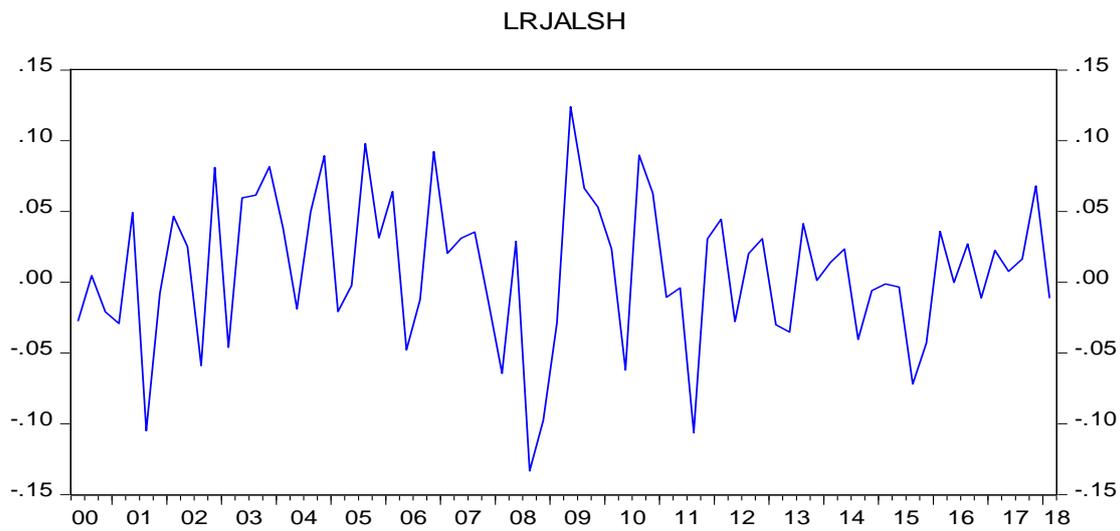


Figure 4: Movement of Log Return of JALSH (2000-2018)

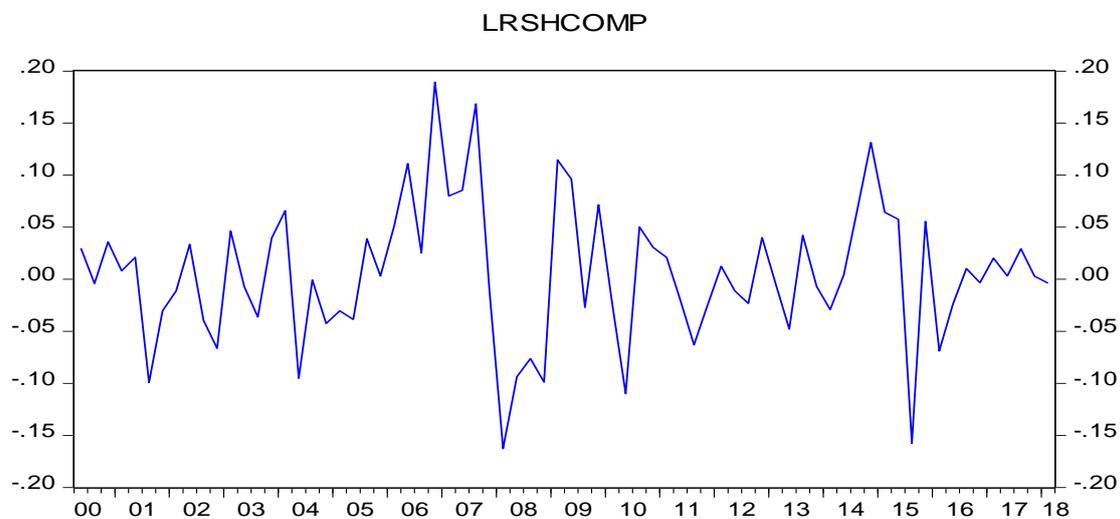


Figure 5: Movement of Log Return of SHCOMP (2000-2018)

**Table 5: Correlation of Nifty 50 with Stock Markets of Emerging Economies**

	Nifty 50	IBOVESPA	JALSH	SHCOMP	MICEX
Nifty 50 (India)	1.000				
IBOVESPA(Brazil)	0.776	1.000			
JALSH (South Africa)	0.941	0.791	1.000		
SHCOMP (China)	0.792	0.576	0.702	1.000	
MICEX (Russia)	0.745	0.850	0.810	0.548	1.000

Table 4.3 shows a high degree of positive correlation between Nifty 50 and all pairs of emerging markets as compared to developed markets. Thereby, these stock markets are driven by the same domestic factors. Nifty and JALSH are found to be highly correlated, with correlation coefficient of .941, followed by SHCOMP (.792), IBOVESPA (.776) and MICEX (.746) exhibiting that the Indian stock markets are moving in the same direction along with eight other emerging stock markets.

**Augmented Dickey Fuller Test (ADF)**

Before we apply Johansen Cointegration tests, the stationarity aspect of data must be checked to avoid spurious regression. ADF test (with intercept and trend) has been used to check the stationarity characteristics of data with a null hypothesis of non-stationarity (i.e., data has unit root), against the alternative hypothesis of stationarity.

**Table 6: Augmented Dickey Fuller Test: Developed and Emerging Economies**

Stock Market Indices of Developed and Emerging Countries						
S. No.	Indices	At Level (t-Statistic)		First Difference (t-Statistic)		Decision
		With Intercept	With Intercept and Trend	With Intercept	With Intercept and Trend	
1.	Nifty 50 (India)	-0.998752	-2.724946	-61.6829*	-61.67705*	I(1)
2.	IBOVESPA (Brazil)	-1.533487	-1.668005	-65.03238	-65.02587*	I(1)
3.	MICEX (Russia)	-1.777585	-1.657813	-65.97116	-65.96996*	I(1)
4.	SHCOMP (China)	-1.665300	-2.363812	-29.65756	-29.65435*	I(1)
5.	JALSH (South Africa)	-1.469271	-2.545984	-64.94139	-64.93440*	I(1)

Note: \*p<.05 shows rejection of null hypothesis of non-stationarity

**Cointegration Analysis:** The Johansen and Juselius Cointegration Test is used for analyzing the existence of the long-run relationship among the indices.

**Table 7: Johansen Cointegration test of Nifty 50 with Brazil, China, Russia and South Africa**

S. N.	Pairs of stock Prices Indices	No. of CE(s)	Trace Statistic	CV (0.05)	P Value	Whether Co integration Present or Not Present
1.	Nifty 50-IBOVESPA (Brazil)	None	8.368117	15.49471	0.4269	Not Present
		At most 1	1.246839	3.841466	0.2642	
2.	Nifty 50-MICEX (Russia)	None	7.681714	15.49471	0.5000	Not Present
		At most 1	1.977217	3.841466	0.1597	
3.	Nifty 50-JALSH (South Africa)	None*	23.40809	15.49471	0.0026	Present
		At most 1	0.663344	3.841466	0.4154	
4.	Nifty 50-SHCOMP(China)	None	15.494712	21.47740	0.0562	Not Present
		At most 1	1.692906	3.841466	0.1932	

We observe long run cointegration relationship to be present between Nifty 50- JALSH (South Africa). This results reveal that only South Africa stock markets are strongly cointegrated with Indian market as compared to other markets.

**VI. Conclusion**

In this study, the linkages between Nifty 50 (India) with Brazil, Russia, China and South Africa were considered together by utilizing the technique of Unit Root Test followed by Johansen Juselius Cointegration test.

High degree of Correlations of daily indices of Nifty 50 are observed with all the stock markets. This suggests a strengthening of the integration of India’s stock market with BRICS Countries. The ADF test shows that all the stock market indices are non-stationary at level and stationary at first difference, i.e., I(1).

Hence, the econometric analysis of Nifty 50 with the stock markets of developed and emerging economies shows that there exists a long run association relationship between the pairs of Nifty 50 - JALSH (South Africa). Cointegration results infer that there will be no benefit of portfolio diversification for international investors, for investments made among the cointegrating countries.

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