

An Empirical Analysis of Cointegration among BRICS Economies

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Abstract:

The principal objective of this study is to find out the Cointegration between BRICS economies. This study mainly concentrates to test whether Indian stock market is interdependent with rest of BRICS stock markets. The most popular emerging stock markets viz. Brazil, Russia, India, China and South Africa are analyzed using Johansen's Cointegration test. The data is collected for the period of five years from January 2013 to December 2017. The monthly returns of BVSP, RTSI, NIFTY50, SHANGHAI and FTSE for the above mentioned period are considered for testing Cointegration. The result of the study confirmed that Cointegration exists between BRICS countries.

Keywords: BRICS, Cointegration, Economies.

I. INTRODUCTION

In present business environment, Globalisation is becoming popular where various countries in the world are integrating with one another. No country is independent to act because they depend on one another. After Globalisation in order to get markets or resources such as cheap labour, different countries are moving from their own nations and invest on other countries which has become more common now a days. Due to the technical advancement country boundaries are no longer matters.

Investing in various stock markets would not generate any long term gain to portfolio diversification while stock markets of various countries move together or when stock markets are integrated. That is why it is important to know whether stock markets are integrated or they work independently by both investors as well as academicians. Any studies or research on stock

market integration either theoretical or empirical, it carries a lot of significance.

There are several studies relating to the interdependence between developed and emerging stock markets and also between the emerging markets. India is one of the emerging stock market having securities traded in global stock exchanges. Thus, it is necessary to examine and analyse the interdependence between the Indian stock markets with the other emerging markets.

A rapid increase in information efficiency in an environment facilitates the emerging market economies to grow rapidly. Such economies become the leaders among developing countries. To be more precise Brazil, Russia, India, China and South Africa normally referred as the BRICS countries are considered to be the leading emerging market economies. Among BRICS, due

to high growth of its GDP, technology and literacy level, China is the leading one.

While capturing some of the higher rates of return offered by the emerging markets of Asia, Eastern Europe and Latin

Americageographic diversification would eventually generate superior risk-adjusted returns for long-term global investors by reducing overall portfolio risk. By doing so, these institutional investors have contributed to the financial and economic development of key emerging nations such as Brazil, India, China, and Russia.

The BRICS countries objective is to actively encourage mutual trade and investment and to create a business-friendly environment for both investors and entrepreneurs. The present study aims to find out whether BRICS countries are integrated to foster innovative economic development. BRICS main theme is Stronger Partnership for a brighter future. Among BRICS nation Russia is depending other partnership countries to raise finance.

There are numerous researches that explain the importance of stock market behaviour investigations. The main motive of this paper is to examine the stock market long term relationships in order to determine the behaviour of BRICS nations.

II. Review of Literature

Tamir (1972) investigated the share price behaviour of US, UK, Germany and Japan equity markets. The co-movement of share prices was estimated by running first and second pass regression. This implies that share price changes in the three non-US countries respond immediately to changes in the price of market index.

Taylor and Tonks(1989)used the bi-variate Cointegration technique and states that there is a Cointegration between the UK index and US index stock prices, Germany, Netherlands and Japan. Based on their empirical findings, they proposed the lack of long-term benefit from diversification for the UK investors after the abolition of exchange controls.

Choudhury, (1997) tried to examine the cointegrating relationship among stock indices from six Latin American markets and the United States using Unit Root test, Johansen Cointegration and Error correction models. The results of Cointegration result possess long-run relationship between all the indices.

Kumar (2002), examined whether the Indian Stocks are integrated with US, Japan, Singapore and Hong-Kong. His findings states that Indian stock market was not having cointegrating relationship with the developed markets. It indicates that there is no long run relationship between the selected markets.

Nath, G. C., & Verma S (2003) examined the integration of three major stock markets viz. India, Singapore and Taiwan using multivariate Cointegration test. The result shown absence of Cointegration exists between the sample market indices.

Ahmad et al (2005) explained the inter-linkages and causal relationship between the Nasdaq, Nikkei, Nifty and Sensex using Johansen Cointegration test and Granger Causality test. The result shows that there is no long-term relationship exists between Indian stock market with US and Japanese stock markets.

Tripathi and Sethi (2010) detected the integration of Indian stock market with stock markets of USA, Japan, UK and China by means

of Cointegration and Correlation. They found that positive correlation was observed and weak integration shown between India and USA.

Chittedi (2010) found Cointegration existing between India and developed countries (USA, UK, Japan, France and Australia).

Tripti Nashier (2015) examine the integration among the stock markets of BRICS and the stock markets of U.S. and U.K. The study identified the evidence for both the short-term static and long-term dynamic integration between the stock markets.

Amanjot Singh and Parneet Kaur (2016) empirically analyse co-movement between BRIC countries stock markets by utilizing Johansen's Cointegration test and found that Russian market act as a cause for several market shock.

III. Objectives

1. To study the stock market interdependencies and dynamic interactions among BRICS nation.
2. To establish the degree of association between BRICS countries.

IV. Research Methodology

The following null hypotheses are tested to study the integration between BRICS countries stock markets.

1. Data series are not normally distributed.
2. Stock index prices are not stationary.
3. There is no Cointegration between BRICS stock market indices.

4.2. Data and Sources of Data:

In this study, closing values of monthly prices of BRICS stock market indices are collected for the period of five years from 2013 to 2017 from the respective stock exchange websites. Investigation of stock market integration is performed among BRICS countries. The stock indices selected for this study are BVSP (Brazil), RTSI (Russia), Nifty50 (India), Shanghai (China) and FTSE (South Africa). The indices are chosen based on purposive sampling.

4.3. Tools used for this study:

Returns of the indices are used to identify the Cointegration between the stock markets and monthly compounded returns have been calculated by using $r = (P_t - P_{t-1}) / P_{t-1} * 100$ where P_t is current closing price. Tools used for this study are

- a. Descriptive statistics and JB Test: To test whether data are normally distributed or not.
- b. Unit root Test: To check the stationarity of data
- c. Johansen's Cointegration Test: To measure stock market interdependencies and interactions among BRICS countries. The Johansen's test results are compared using Trace value and Maximum Eigen value.
- d. Correlation Coefficient: To evaluate the degree of association between BRICS economies stock markets. The correlation coefficient of returns of indices explains how the stock of particular market moves together with other stock markets. The result values ranges from +1 to -1. If the resulted correlation analysis shows +1 that indicates perfect positive correlation and if it is -1 it indicates perfect negative correlation. If the result is 0 there is no correlation between the selected stock markets.

5. Analysis and Findings:

5.1. Descriptive Statistics:

Descriptive statistics helps to explore the distribution properties of daily returns, summarizing the data and to find out the normality of time series.

Table 1: Summary Statistics

	BVSP	FTSE	NIFTY 50	RTSI	SHANG HAI
Mean	0.5554	0.8118	1.0434	0.2127	0.872861
Std. Dev.	6.0520	3.4030	3.9169	7.2226	6.980953
Skewness	0.2230	0.2163	0.0643	0.5541	0.232248
Kurtosis	2.8042	2.4817	2.8255	3.8706	5.509715
Jarque-Bera	0.5933	1.1393	0.1175	4.9665	16.28607
Probability	0.7432	0.5657	0.9429	0.0834	0.000291
Sum	33.327	48.712	62.607	12.762	52.37168
Sum Sq. Dev.	2161.0	683.25	905.21	3077.8	2875.288

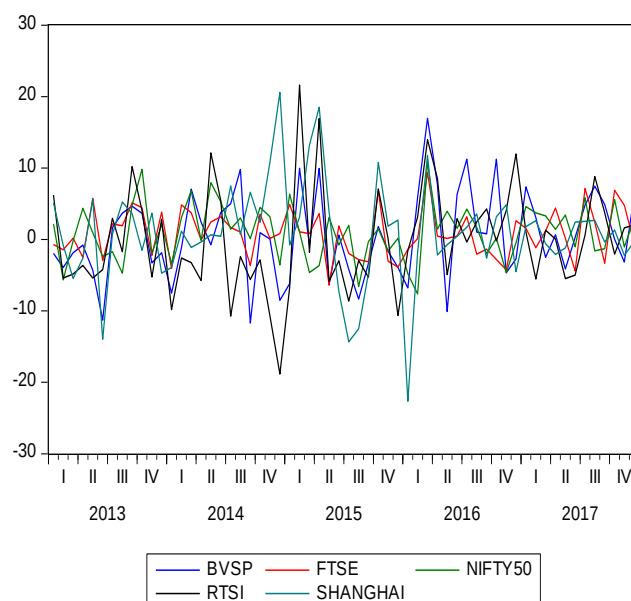
Looking at the above statistics it is clearly evidence that the index Nifty50 resulted with higher return (1.04) with lower risk (3.91) next to the index FTSE. Compared with all indices Nifty has highest return and FTSE shows lowest risk. The index RTSI shows negative mean (-0.21) with highest standard deviation (7.22).

For any data to be random, it should possess the characteristics of a normal distribution. Skewness and Kurtosis are considered as the important distribution properties of normal distribution. Both the values are equal to 0 and 3 respectively; we can conclude that the data are normally distributed. The study result reveals that the index

RTSI is normally distributed and other indices are not normally distributed.

Movements of return of BVSP, RTSI, NIFTY50, SHANGHAI and FTSE indices are depicted below.

Fig.1 – Chart showing Return movement of BVSP, RTSI, NIFTY50, SHANGHAI and FTSE



5.2. Correlation Matrix:

The correlation coefficient between the stock indices during the period January 2013 to December 2017 is studied and analysed to measure the degree of association between the selected variables. Pearson correlation coefficient is used to examine the correlation between BRICS economies. The simple correlation coefficients among 5 variables are given below.

Table 2 – Correlation Matrix

	BVSP	FTSE	NIFTY 50	RTSI	SHANG HAI
BVSP	1.0000				
FTSE	0.4130	1.0000			

NIFTY50	0.320356	0.495762	1.000000		
RTSI	0.547602	0.361301	0.154553	1.000000	
SHANGHAI	0.306855	0.247696	0.109772	0.086806	1.000000

The above result indicates that all the variables selected for this study are positively correlated but not at high level. Among the selected indices BVSP and RTSI index are correlated at the level (0.54).

5.3. Unit Root Test:

Unit Root Test helps to check the stationarity and find out shocks in time series. Data series mean and variance are consistent over time, it is said to be stationary and vice versa. The most suitable and commonly used test is Augmented Dickey-Fuller test. The below table shows the results of unit root for Level and First difference.

Table 3 – Augmented Dickey Fuller test Result

Indices	Level		1st Difference	
	t-Statistic	Probability	t-Statistic	Probability
BVSP	-0.480507	0.8872	-7.092164	0.0000
RTSI	-2.479338	0.1256	-6.511107	0.0000
NIFTY50	-0.259175	0.9241	-7.9793	0.0000
SHANGHAI	-1.968474	0.2997	-5.376196	0.0000
FTSE	-1.0194	0.7409	-8.78808	0.0000

	43		3	
		Level	1st difference	
Critical Values	1% level	-3.546099	-3.548208	
	5% level	-2.91173	-2.912631	
	10% level	-2.593551	-2.594027	

Augmented Dickey-Fuller test result at the level indicates the series are non-stationary. If we consider the first difference of all the variables there is no evidence for unit root because the probability value is less than 5%. The null hypothesis can be rejected and the variables we have used are stationary at first order difference I(1). Hence, we can employ Johansen's Cointegration test to see these variables are co-integrated or not.

5.4. Cointegration Test:

Johansen's Cointegration test is used to find out the presence of Cointegration between the variables in the long run. The Trace test result indicates that 5 cointegrating equation at 5% level. It clears that 5 linear combinations exists between the variables over the entire time period.

Table 4 – Johansen's Cointegration Trace test between BRICS nation

Date: 14/01/18 Time: 23:32
Sample (adjusted): 2013M03 2017M12
Included observations: 58 after adjustments
Trend assumption: Linear deterministic trend
Series: BVSP FTSE NIFTY50 RTSI SHANGHAI

Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.*
None *	0.695098	179.5427	69.81889	0.0000
At most 1 *	0.500058	110.6524	47.85613	0.0000
At most 2 *	0.437361	70.44307	29.79707	0.0000
At most 3 *	0.329841	37.08629	15.49471	0.0000
At most 4 *	0.212726	13.87238	3.841466	0.0002
Trace test indicates 5 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The result of Maximum Eigenvalue also analysed to verify the result of Johansen's trace test.

Table 5 – Johansen's Cointegration Maximum Eigenvalue test between BRICS nation

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.*
None *	0.695098	68.89036	33.87687	0.0000
At most 1 *	0.500058	40.20929	27.58434	0.0007
At most 2 *	0.437361	33.35678	21.13162	0.0006
At most 3 *	0.329841	23.21391	14.26460	0.0015

At most 4 *	0.212726	13.87238	3.841466	0.0002
Max-eigenvalue test indicates 5 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The result of Maximum eigenvalue test statistics also shows that there are 5 cointegrating equation exists at 5% critical value. Hence we can conclude that cointegrating relationship exists between the variables throughout the sample study period of 5 years.

VI. Conclusion

The Cointegration between BRICS stock markets have been studied using Johansen's Cointegration test. This study focused on how Indian stock market is integrated with rest of the BRICS nation stock markets. Return value of BVSP, RTSI, NIFTY50, SHANGHAI and FTSE indices are used for this study. During the study the test outcomes explains that Cointegration exists between BRICS economies.

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