Original Article

Cointegration Among The Bourse Of BRICS Countries: A Case Of COVID-19 Pandemic

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Abstract

This paper is aim to find out the relationship among stock markets of BRICS Countries during the COVID-19. International investors want different portfolio while investing in other countries and policy makers needs information about the economies of the countries so this paper help them to get the relationship among BRICS countries. To find out the Cointegration among these secondary data has been used from 31st December 2019 to 31st December 2020. ADF and PP Test used to check the stationarity in the data set and VAR Model used to find out the cointegration between these countries and Granger Causality test used to find out the Cause relationship among the stock prices of the BRICS Countries. After analysis this paper finds that a significant integration among the BRICS Countries.

Keywords: BRICS, Cointegration, Granger Causality Test, COVID-19

Introduction

Almost every country's economy has been affected by COVID-19. The reactions of developed countries' economic indices (such as the BRICS) to the COVID-19 shock are especially important Following the economic crisis of 2008, India's financial markets experienced substantial changes, which are still ongoing. The Indian stock market has grown closer to other Asian and global stock markets as a result of liberalisation and globalisation. These reforms are also important for Indian stock markets to keep up with global market dynamism.

The BRICS trading relationship consists of a group of countries which includes Brazil, Russia, India, China, and South Africa. (Mehrara & Ali, 2013) the group of these countries are called BRICS countries. This Group have reached an agreement on trade, finance, and international cooperation in order to boost development and economic growth in these developing nations Despite the fact that the economies of BRICS Countries are geographically distant, trade transparency, globalization of finance and connectivity (Shahbaz, 2018) and because of the linkage of advanced information technology this group of countries allowed their distant economies to function in a globalized area.

All things being equal because of the economic location of one country tied with common economic and as a result, economic ambiances in one country within a community of nations bound together by a trade interest and shared economic may cause some discomfort in other countries within the group (Baltagi, Egger & Pfaffermayr, 2008).

I. Literature Review

Our study focused upon analysis of co-integration among stock market of BRICS countries. All countries of the association have some agreement or understanding for the development of economy, trade and investment. It is

very important to understand the effect of one stock market to another stock market. A brief review of literature is as follow:

Mehrara & Ali (2013) said that Brazil, Russia, India, China and South Africa has common understanding for the overall wellbeing of their economy. Interconnectedness of the all these countries can help them for development of economy and they can have pace with the global market (Shahbaz, 2018). Zhou, Jiang, Liu, Lin & Liu (2019) conducted study to know the effect of oil prices on the stock market of BRICS countries and their findings revealed that low volatility in oil prices do not influence stock market while high volatility is the reason for the large impact over stock market.

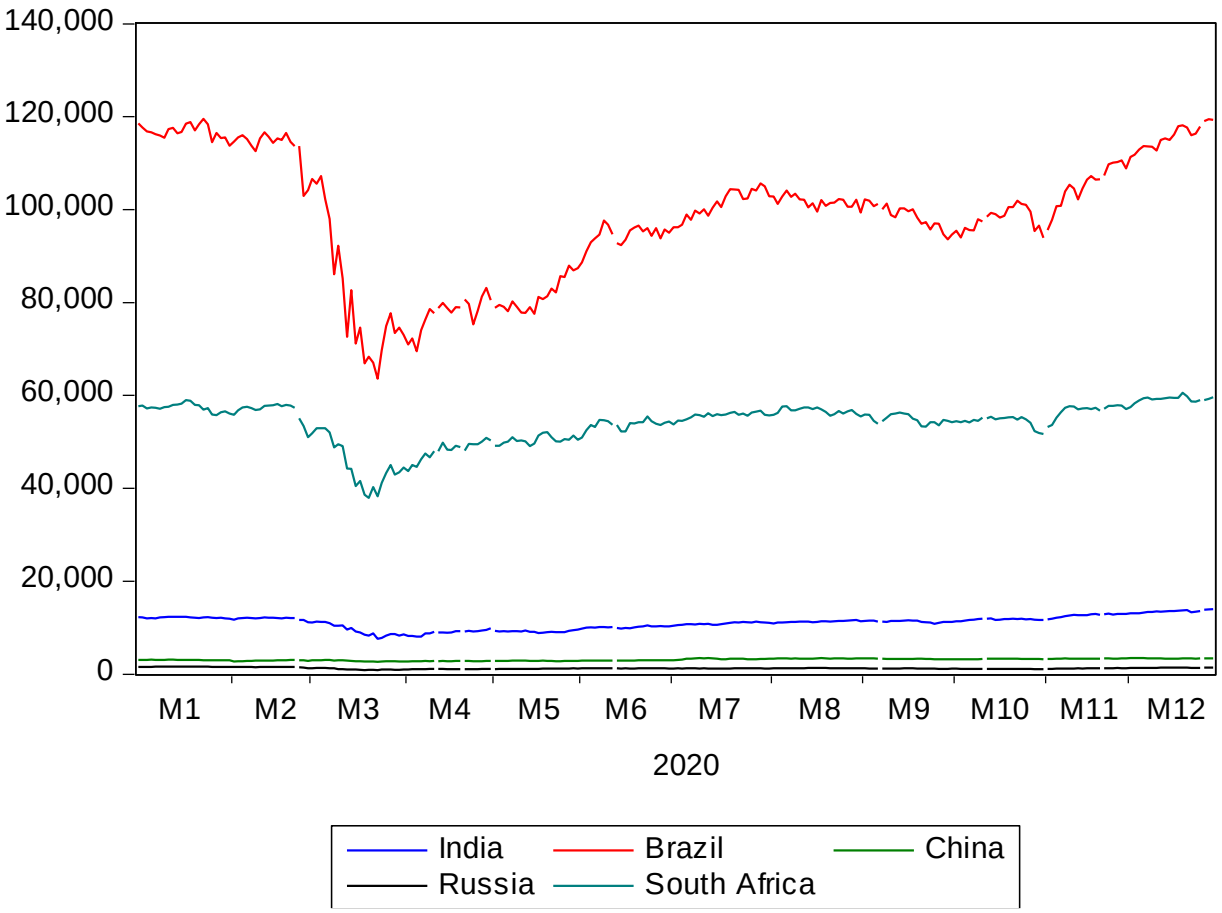
Dong, An, Liu, Li and Yuan (2020) conducted a study and concluded that stock market of BRICS countries are associated to each other but association is not permanent in nature. The researchers also identified some causes related to need of return and mode of investment. they observed various investment avenues according to geographical area depending upon scale of investment. Marinova (2019) study was based upon the kind of risk namely, common risk and specific risk. Korajczyk (1996) concluded that growth in stock market of developing countries is higher than developed countries. He also said that stock market of developing countries is not cointegrated as developed nations. Financial market integration in developing countries based upon their price equalities and depend upon the financial market's behaviour of developed nation (Mukhopadhyay 2009).

II. Research Methodology

Objective of this research paper is to find out the cointegration among the BRICS Countries Namely Brazil **(B)**, Russia **(R),** India **(I)**, China **(C)** and South Africa **(S)** during one year of COVID-19. In this paper quantitative approach applied by using the VAR (Vector Autoregressive) and Granger Causality Test. First Case of COVID-19 Found in China on 31st December 2019 (WHO Report), so to find out the objective of this paper data from 31st December 2019 to 31st December 2020 was taken from the Stock Market Websites of above mentioned countries.

III. Analysis and Discussion

Graph I. Shows the trend of BRICS Countries stock prices



(Source: Compiled by author)

Graph I represent that stock prices got down in the M3 when the cases of COVID-19 reported high and lockdown was applied during these month and trend shows that the Lowest of Brazil Stock prices value 63570, Russia Stock prices value 832, India Stock prices value 7610, China Stock prices value 2660 and South Africa Stock prices value 37963 during M3 and M4 of 2020. Trend also shows that stock market graph started recovery as the cases started recovery.

Table I. Shows the Descriptive analysis of BRICS Countries

	B	R	I	C	S
Mean	98706.55	1261.597	11096.85	3119.924	54061.4
Median	100369	1246.94	11301.93	3111.195	55257.78
Std. Dev.	13642.61	164.9985	1427.743	228.9041	4393.699
Skewness	-0.46333	0.429205	-0.280529	-0.155073	-1.434239
Kurtosis	2.439143	3.045161	2.402599	1.519729	5.009198
Jarque-Bera	12.1237	7.635388	6.940637	23.6364	126.7388
Probability	0.00233	0.00198	0.003110	0.000007	0.0000

(Source: Compiled by author)

Table I Represent the Descriptive analysis of the Stock market of BRICs Countries. Descriptive analysis shows the basic structure of the data set and found that no entry is missing. Table shows that data is normally distributed and most of the data is negatively skewed. Jarque Bera Test probability value shows significant at 10% Level which represent goodness of fit.

A. Correlation

Table II. Shows the result of Correlation Between BRICS Countries

		B	C	R	S
I	Pearson Correlation	.912	.730	.658	.867
	Sig.	**0.000**	**0.000**	**0.000**	**0.000**

(Source: Compiled by author)

Table II represent the correlation between the stock prices of BRICS countries. Indian stock market is highly correlated with Brazil Stock Prices and South Africa Stock market prices. This table shows that there is positive correlation among BRICS Countries stock market and all value are significant.

B. Unit Root Test – ADF

Table III. Shows the ADF Test results of BRICS Countries

Augmented Dickey-Fuller Test Equation	**0 Level**		**1 Level**	
	Adj. t-Sta.	**p**	**Adj. t-Sta.**	**p**
B	-1.06014	0.7317	-19.7569	**0.0000**
R	-1.8319	0.3645	-9.36368	**0.0000**
I	-0.24786	0.929	-17.2406	**0.0000**
C	-1.0713	0.7274	-15.3813	**0.0000**
S	-1.48704	0.5387	-15.5932	**0.0000**

(Source: Compiled by author)

In this paper secondary data has been used for the analysis and the basic condition of the secondary data before applying any test that data must be stationary. All the stock prices of BRICS Countries checked for unit root as it causes the unpredictable results in the time series and found that all the stock prices are stationary at one level.

C. Unit Root Test – PP

Table IV. Shows the PP Test results of BRICS Countries

Phillips-Perron Test Equation	**0 Level**		**1 Level**	
	Adj. t-Sta.	**p**	**Adj. t-Sta.**	**p**
B	-1.29641	0.6317	-19.2713	**0.0000**
R	-1.97145	0.2994	-15.9174	**0.0000**
I	-0.25887	0.9275	-17.1798	**0.0000**
C	-1.10316	0.7151	-15.3779	**0.0000**
S	-1.70551	0.4272	-15.6556	**0.0000**

(Source: Compiled by author)

Table IV shows the unit test result by using PP unit root test. This test corrects the serial correlation between data as well as correct the heteroscedasticity. Results shows that all data is stationary at one level.

By using both the test it found that all the data stationary at one level so to find out the relationship among the variables VAR Model can be applied.

D. Leg Length Criteria

Table V. Shows the Results of Leg Length Criteria for VAR

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-7943.89	NA	5.32E+22	66.51791	66.59064	66.54722
1	-7874.49	135.3156	3.67E+22	66.14636	66.58273*	66.32221*
2	-7846.96	52.51876	3.59E+22	66.12522	66.92524	66.44761
3	-7816.54	56.78208	3.44E+22	66.0798	67.24347	66.54872
4	-7796.82	35.9735	3.60E+22	66.12398	67.6513	66.73945
5	-7769.81	48.13699	3.54E+22	66.10719	67.99816	66.8692
6	-7737.41	56.4018	3.34E+22	66.04524	68.29985	66.95378
7	-7708.84	48.52286	3.26e+22*	**66.01541***	68.63367	67.0705
8	-7684.26	40.72833*	3.29E+22	66.01892	69.00082	67.22054

(Source: Compiled by author)

Table V represent the results of leg length. For the VAR Model selection of length play an important role, according to this table 7 leg length selected because minimum of AIC gives the optimum leg length.

E. VAR Model

VAR Model calculated five times with Individual series as dependent variable and others as Independent variable. So five model prepared to find out the relationship among the BRICS Countries stock market.

Table VI. Table Shows the VAR Model dependable variable as Brazil

	Coef.	**S. E.**	**t-Sta.**	**p**
C(-1)	29.47157	7.260734	4.059035	**0.0001**
B(-7)	0.332252	0.092187	3.604127	**0.0004**
B(-1)	-0.30742	0.08724	-3.52381	**0.0005**
C(-5)	23.88162	7.674131	3.111965	**0.0021**
C(-6)	21.91939	7.790699	2.813533	**0.0054**

(Source: Compiled by author)

Table VI represent only the results which is significant to the stock market prices of Brazil. This table represent that one-day lag value of China impact the stock prices and seven and one-day lag value of Brazil itself impact on the pricing as well as previous value of fifth and six day of china stock price also impact the pricing of Brazil stock market.

According to the VAR Model Analysis Russian stock market not effect by any other market of BRICS Countries.

Table VII. Table Shows the VAR Model dependable variable as China

	Coef.	S. E.	t-Sta.	p
B(-1)	0.00376	0.001062	3.538526	0.0005
C(-3)	-0.25434	0.093335	-2.72505	0.007

(Source: Compiled by author)

Table VII represent only the results which is significant to the stock market prices of China. This table represent that one-day lag value of Brazil and Three-day lag of china stock market itself impact the stock prices of China.

Table VIII. Table Shows the VAR Model dependable variable as India

	Coef.	S. E.	t-Sta.	p
B(-1)	0.033014	0.006058	5.449666	0.0000
S(-3)	0.08136	0.019381	4.197913	0.0000
B(-7)	0.023621	0.006402	3.689812	0.0003
C(-3)	-1.85977	0.532194	-3.49453	0.0006

(Source: Compiled by author)

Table VIII represent only the results which is significant to the stock market prices of India. This table represent that one day and Seventh-day previous value of Brazil impact the stock prices and Three-day lag value of China and South Africa stock price impact the pricing of Indian stock market.

Table IX. Table Shows the VAR Model dependable variable as South Africa

	Coef.	S. E.	t-Sta.	p
B(-7)	0.13993	0.032478	4.308394	**0.0000**
C(-1)	8.706384	2.55804	3.403537	**0.0008**
C(-6)	8.409613	2.744753	3.063887	**0.0025**
I(-4)	1.263627	0.422165	2.993206	**0.0031**
B(-1)	0.089567	0.030736	2.914117	**0.004**
S(-6)	-0.28439	0.101319	-2.8069	**0.0055**
S(-5)	-0.28318	0.102471	-2.76355	**0.0062**

(Source: Compiled by author)

Table IX represent only the results which is significant to the stock market prices of South Africa. This table represent that one day and Six-day previous value of China impact the stock prices and seven and one-day lag value of Brazil as well as previous value of fifth and six day of own stock market of South Africa stock price impact the pricing of South Africa stock market.

F. Granger Causality Test

Table X. Table Shows Granger Causality Test Results of BRICS Countries

H_o			F-Sta.	p
B	→	I	9.92284	**0.0000**
B	→	S	7.29804	**0.0000**
R	↔	B	6.39178	**0.0000**
B	↔	R	6.39243	**0.0000**

R ⟷	S	5.95015	**0.0000**
S →	I	4.83997	**0.0000**
I ⟷	R	4.11674	**0.0003**
R ⟷	I	3.57571	**0.0011**
S ⟷	R	2.74175	**0.0095**

(Source: Compiled by author)

Note: * Significant at the level of 5%. p-value <.05.

Table X represent the details about the Granger Causality Test which represent that weather one series can be predict by using the other one or not and this test also tell about the relationship one way or two-way relationship in the series. Table represent that Brazil stock market price Causes the Indian Stock market and South African stock market, South African market data series can be used to predict the stock price of Indian Market as the Null Hypothesis was rejected in this case and they these series are having one-way relationship. Russia and Brazil both marker data can be used to predict one another as they are having two-way relationship. Russia and South Africa Stock Market having two-way relationship and India and Russian Stock market is also having Two-way relationship and one market data can be used to predict the other countries data or vice versa during the COVID-19.

IV. Conclusion

This paper concluded that all the stock prices of BRICS countries are positively correlated to each other. All the stock prices are stationary at first level and VAR Results shows that Stock market of different countries are influenced by other countries stock prices as well as the lag value of the same stock prices. Granger test concluded that Brazil, South Africa and India having one-way relationship. Russia is having two-way relationship with Brazil, South Africa and India. It's found that during this COVID-19 duration of one-year stock prices of BRICS Countries have a significant relationship and the stock prices of one country can be used to forecast the other countries stock market prices.

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