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SUPREMACY OF THE US ON EQUITY MARKETS OF THE BRICS: A MYTH OR A REALITY?

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Abstract

The BRICS is considered as the most promising and emerging markets' group and pool of economies. For the last few years, the economies of the US and BRICS are sharing increasing trade, economic and financial linkages. As the emerging economies aspire to become truly developed nations, the issue of heavy interdependence on developed economies is often addressed. However, the patterns of influence of the US on the equity markets of the BRICS have undergone tremendous changes in the recent years. The present study aims to investigate the inter-linkages and causal relationships between the US and BRICS equity markets. The study exclusively depends on different econometric models and techniques such as unit root test, cointegration and causality tests to evaluate and analyse the empirical data. The overall results report changing market dynamics and time varying integration among the countries across the years of study. The study also finds the fading away of the US supremacy over the BRICS markets and a story of Chinese supremacy as a leader in world economy.

Key Words: BRICS, Causality, Integration, Stationarity, Unit Root Test.
JEL Classification: G15

1. Introduction

The developed countries are significantly influencing global economy and stock markets of major countries since long past. The concept of influence and supremacy of one nation over others has become more significant due to worldwide globalisation and liberalisation during 1980s. Umpteen number of studies deal with influence of advanced developed countries on the equity markets of developing nations. Among the various reasons, which beget the strong or semi-strong form of economic and financial relationships between the developed and emerging countries, intense financial integration among the stock markets due to price discovery mechanism and return-volatility spillover effects due to growing cross-border trade are considered the most important.

Price discovery mechanism is a process in which one market attempts to react and reach an equilibrium price level, both in the long and short-run (Booth *et al.,* 1999; Sehgal *et al.,*

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2015; Singh & Singh, 2016). The dynamic version of the price discovery process also exhibits how information produced in one stock market transmits across the other equity markets just like sea waves. Thus, the ailments arising from disturbances in economic and financial systems in one country could be transmitted to the other countries of the world. The effect magnitude and intensity become more significant when it is originating from one of the world's leading economies (Forbes & Chinn, 2004). The international financial linkages among the equity stock markets became more naked due to some economic phenomena, such as, financial crises, crash of one or more stock markets, economic tsunami, extraordinary political events having intense impact on policy decisions of many countries etc. In spite of having many positive aspects of integration among the stock markets at regional, national and international level, there are umpteen evidence of how some extraordinary incidents or scams, such as, the US stock market crash in 1987, the breakdown of the European monetary system in 1992, bond market turmoil in 1994, the Asia-Pacific crisis beginning in 1997 and subprime crisis in US in 2007 etc. primarily churned out one stock market negatively, which had severe bad contagion effects over several stock markets. Studies found that the US stock markets influence most of the European and Asian stock markets (Huyghebaert & Wang, 2010), specifically, the emerging and frontier economies and their financial markets (Bianconi, *et al.* 2013) during the time of financial crisis.

It is often stated when US sneezes, the other parts of the world gets flu. No one can deny the US influence on the world economy since long ago. However, over the passage of time, US supremacy as a global leader fades away, more specifically on economic standpoint. One burning instance is economic turmoil throughout the world due to unexpected devaluation of the Chinese Yuan on 25th August, 2015, commonly referred to as Black Monday of 2015. The Chinese incident exerted the fading away of supremacy of US control to a great extent and the level of integration among the economies of many countries have also reached such a level where traditional economic explanations have to either accept defeat or require all round modification. The US could not get rid of the tide of Chinese Tsunami, which resulted in a fall down of S&P 500 and NASDAQ Composite by 3.8% and 4.5% respectively (The Economic Times, 25th August 2015).

Several studies have also found some emerging and mature markets acting as a bloc or responding to several economic consequences quiet in the same manner. For example, during the Eurozone turmoil, five most vulnerable countries of Euroarea, popularly known as GIPSI (Greece, Ireland, Portugal, Spain and Italy) suffered a lot. Plethora of evidences can be cited in favour of integration among the member countries representing some global level economic or financial forums. Such forums may have an impact on other non-financial matters. For major emerging national economies BRIC[1] (Brazil, Russia, India and China) is such an example

[1] First coined by Jim O'Neill of Goldman Sachs in 2001

of such forum. During the passage of time such forums have grown in size to include more and more homogeneous countries which share long-term association among them such as BRICS[2] (Brazil, Russia, India, China and South Africa) and BRIICKS (Brazil, Russia, India, Indonesia, China, South Korea and South Africa) etc. Taking the advantages of growing population, cheaper labour force, the emerging countries like BRICS actively participated in the world trade and were able to build strong economic linkages with industrialised economies. All these homogeneous pool of economies make the international equity markets to witness greater degree of interdependence among themselves, thus, undermining the possibility of diversification benefits arising from the short-run price disparity among the countries or markets. However, there are contradictory views as well, such as, Harvey (1995) suggests inclusion of emerging market asset classes in an internationally diversified portfolio as they do not correlate strongly with developed markets and further have little exposure to global risk factors.

BRICS is a geopolitical, economic collection of the above mentioned five emerging countries, the most promising emerging markets' group. Owing to increasing economic ties within the bloc and with the mature markets, the lead-lag hypothesis amongst the respective economies is under scanner (Singh & Singh, 2016). Together BRICS represents 26% of the planet's land mass and is home to 46% of the world's population (2017). According to the statistics of World Trade Organisation (WTO), participation of BRICS in global exports had doubled between 2001 and 2011, from 8% to 16%. In those eleven years, their total exports have grown more than 500% as compared to global exports which grew merely 195%. Intra-BRICS trade increased 922% between 2002 and 2012, while international trade of BRICS rose 29% between 2010 and 2012. Between 2002 and 2012, intra-BRICS trade increased by 922% (from $27 billion to $276 billion) and international trade rose up by 29% (from $4.7 trillion to $6.1 trillion). China alone accounts for 66% of the GDP followed by Brazil and India each having 12% share within BRICS (IMF, 2017) (Ndzendze, 2017).

In this backdrop, the present study aims to empirically investigate the notion of the supremacy of the US on the equity stock markets of the BRICS during and after the US Global Financial Crisis (GFC).

2. Review of Empirical Literature

Kansas (1998) considered US and six largest European equity markets and found that the US market was not pair wise cointegrated with any of the European markets. Masih & Masih (2001) investigated the dynamic causal linkages amongst nine major international stock price indices and found increasing linkages of majority of selected stock markets to increase data dissemination, increased stock market efficiency. Wang *et al.* (2003) used the generalized impulse response analysis in order to examine the dynamic causal linkages and relationships

[2] Subsequently South Africa was added in 2011

among the five largest emerging African stock markets and the US market during the 1997-98 global emerging market crisis. Aktan *et al* (2009) examined the emerging market indices of BRICA and found that the US market has a significant effect on all BRICA countries in the same trading day. Haifeng & Shigeyuki (2012) investigated the dynamic linkages between the BRICS countries and the US and found that the international transmission of stock prices weakened in both the mean and variance due to 2008-09 US financial crisis. Palamalai *et al* (2013) examined the stock market integration among major stock markets of emerging Asia-Pacific economies. They argued that although long-term diversification benefits from exposures to these markets might be limited, short-run benefits might exist due to substantial transitory fluctuations. Park (2013) studied stock markets of ten emerging Asian economies and nineteen advanced economies. The results indicated that while the pace of regional integration of financial markets in Asia's emerging economies had accelerated, these markets remained more integrated with global financial markets than with other financial markets in the region. Wang (2014) examined the integration and causality among six major Asian stock exchanges and the US before, during and after the global financial crisis and revealed that East Asian markets are less responsive to the shocks in the USA after crisis. Singh & Singh (2016) investigated the long and short-run inter-linkages and causal relationships between the US and BRIC equity markets. Their results supported changing market dynamics and partial integration across the years 2004-2014.

3. Objectives of the Study

This study focuses on the following aspects:

(i) To make a brief statistical overview of the equity markets of BRICS and the US.

(ii) To analyse and evaluate the existence of long-run and short-run linkages, if any, between the selected equity markets in order to understand the extent and intensity of the US supremacy over the BRICS markets.

(iii) To study the dynamic relationship between them during and after the US financial crisis and to make necessary conclusion.

4. Data Sources and Research Methodology

4.1. Sources and Nature of Data: As the study is empirical in nature, the secondary data have been obtained from various websites of representative stock markets including Yahoo Finance and www.investing.com.

4.2. Variables Selected: Table 1 shows the proxy stock markets of the US and BRICS countries along with their equity indices which act as the primary variables. Their selection is based on the review of literature, which can appropriately reflect the state of the economic condition of the country.

Table 1: Equity Indices of BRICS and US

Country		Stock Markets	Representative Indices
United States (US)		New York Stock Exchange	S&P 500
BRICS Countries	Brazil	The Bolsa de Valores de São Paulo	Bovespa
	Russia	Moscow Exchange	RTS
	India	National Stock Exchange	CNX NIFTY 50
	China	Shanghai Stock Exchange	SSE Composite Index
	South Africa	Johannesburg Stock Exchange	FTSE Top 40

4.3. Time Frame: The study has been conducted on daily closing representative equity indices (comprising 5 days in a week) of the selected stock markets comprising the period from 2nd January, 2007 to 29th December, 2017. In order to explore the dynamic linkages among the countries during the 2007 global financial crisis, the study has considered US sub-prime crisis period spanning from 7th August, 2007 to 2nd April, 2009 following the former studies of Dooley & Hutchison, 2009; Cheung et al. 2010; Chudik & Fratzscher, 2011; Wang L. , 2014.

4.4. Data Mining: Due to different stock exchange holidays, missing observations was the relevant difficulty. To overcome this problem, this study adopts a procedure to match the daily data of the selected indices and, finally, reached at 2,862 observations. There is no significant difference in trading hours of the selected equity stock markets except those located in the American region. Therefore, such difference in trading hours of the stock exchanges of the US and Brazil has been adjusted considering one day lag, for example, yesterday's (lag = 1) indices of Brazil and the US with today's stock indices of the rest of countries. First, the daily closing indices are converted into natural logarithm forms and daily returns have been calculated taking the first difference of the logarithmic indices. Therefore, Return $(R_t) = \ln (P_t / P_{t-1}) = \ln P_t - \ln P_{t-1}$

4.5. Econometrics Models Used: Initially, Augmented Dicky-Fuller's (ADF) Test and Phillips Perron (PP) Test have been conducted to test the stationarity of the data series. Depending on the outcome and other the diagnostic tests conducted, Johansen-Juselius Model has been used. Thereafter, Granger Causality Test is conduted to identify the nature and direction of causality.

5. Empirical Analysis and Discussion

5.1. Summary Statistics:

Table 2 provides the summary statistics for the full sample period of six indices returns (%), each representing one country. All BRICS countries have positive mean value except Russia. Among BRICS markets, India has the highest mean return, which also exceeds the mean return of US. Russia poses the highest risks of volatility followed by Brazil, China. The US exhibits the lowest standard deviation, thereby posing the low risk of volatility. The skewness is negative in all the cases except India. None of the country has kurtosis value nearest of 3 which is required for a normal distribution. The Jarque-Bera tests show that the null hypothesis of normal distribution of the return series is rejected at 1 % level of significance.

Table 2: Summary Statistics (Daily Returns, %)

	Brazil	Russia	India	China	Africa (S)	US
Mean	0.018913	-0.017816	0.033770	0.007409	0.029092	0.022341
Standard Deviation	1.723522	2.174459	1.412630	1.662926	1.303771	1.244352
Skewness	-0.040822	-0.317789	0.060223	-0.618390	-0.088543	-0.353191
Kurtosis	9.499631	15.01096	15.04343	7.870711	7.020172	14.39787
Jarque-Bera	5036.775*	17245.54*	17292.21*	3010.421*	1930.357*	15546.01*

*Significant at 1% level.

Source: Author's Computation

5.2. Simple Correlations:

Table 3 exhibits pair wise return correlation coefficients between the US and each of the equity markets of BRICS countries, which are all positive and significant at 1% level (two-tailed) and demonstrate the effect of the US on the BRICS countries during and after global financial crisis (GFC). In addition to Pearson's simple correlation coefficient, the study uses non-parametric Spearman's rank correlation coefficients and Kendall's correlation coefficients. Spearman's rank correlation coefficient is used if neither variable is distributed normally or if one of the variables is discrete. Kendall's tau coefficient is a measure of association between two measured quantities. All three kinds of correlations have increased significantly during the US global financial crisis and were relatively low in the post crisis period. During the crisis period, Pearson's correlation coefficient between the US and Brazil was the highest (0.7327) and between the US and China was the lowest (0.2167). Therefore, the scope of diversification benefit has increased significantly since 2009. As shown by all kinds of correlation coefficients, the Chinese stock market gets affected by the US to the lowest extent during and post crisis periods and thus China remained less affected by the US.

Table 3: Simple Correlations between the BRICS and the US (Daily Returns)

	Pearson's Correlation	Kendall's Tau Correlation	Spearman's Rank Correlation
Full Sample Period (2nd January, 2007- 29th December, 2017)			
Country	**United States (US)**	**United States (US)**	**United States (US)**
Brazil	0.6498*	0.3953*	0.5481*
Russia	0.2728*	0.1447*	0.2111*
India	0.2228*	0.1578*	0.2293*
China	0.1721*	0.1081*	0.1586*
South Africa	0.2828*	0.1522*	0.2196*
Crisis Period: Sub-sample Period (7th August, 2007- 2nd April, 2009)			
Brazil	0.7327*	0.5002*	0.6697*
Russia	0.3394*	0.2054*	0.2913*
India	0.2216*	0.1995*	0.2902*
China	0.2167*	0.1573*	0.2370*
South Africa	0.3616*	0.2172*	0.3137*
Post Crisis Period: Sub-sample Period (3rd April, 2009- 29th December, 2017)			
Brazil	0.5711*	0.3566*	0.5018*
Russia	0.2124*	0.1265*	0.1862*
India	0.2065*	0.1394*	0.2045*
China	0.1662*	0.1084*	0.1600*
South Africa	0.2049*	0.1385*	0.2017*

*Significant at 1% level (two-tailed)

Source: Author's Computation

5.3. Unit Root Test Results:

In analysis of cointegration, test of non-stationarity of the time series data is considered as the precondition. For stationarity analysis, Augmented Dicky-Fuller (ADF) (1979, 1981) and Philip-Perron (PP) (1988) tests have been conducted.

Table 4 suggests that all the equity indices and the respective countries are found to be integrated of order one, i.e. I (1).

Table 4: Unit Root Test

Country		At Levels		At First Differences	
		ADF	PP	ADF	PP
		Intercept + Trend		Intercept + Trend	
BRICS Countries	Brazil	-2.529885 [3] (0.3135)	-2.525343 [17] (0.3157)	-33.07601* [2] (0.0000)	-55.40398* [20] (0.0000)
	Russia	-2.577813 [27] (0.2906)	-2.146046 [13] (0.5192)	-8.387828* [27] (0.0000)	-47.65303* [20] (0.0000)
	India	-2.751449 [14] (0.2158)	-2.589243 [6] (0.2853)	-13.48600* [13] (0.0000)	-51.43212* [11] (0.0000)
	China	-2.083994 [20] (0.5540)	-1.829733 [9] (0.6902)	-10.75814* [19] (0.0000)	-52.88683* [8] (0.0000)
	South Africa	-2.121078 [24] (0.5332)	-2.523826 [19] (0.3164)	-12.62411* [23] (0.0000)	-53.64146* [23] (0.0000)
United States		-2.157609 [18] (0.5126)	-2.179313 [8] (0.5005)	-13.03831* [17] (0.0000)	-60.13654* [10] (0.0000)

Figures in [ ] represent Lag Lengths based on AIC in case of ADF Test and Bandwidth based on Newey-West, * Indicates the statistical significance level of 1 %; Figures ( ) represent MacKinnon (1996) one sided *p* values.
Source: Author's Computation

❒ ***Long-run Linkages and Causal Relationships-***

5.4. Vector Auto regression (VAR) Based Multivariate Johansen's Cointegration Test:

In order to test the long-run linakges between the US and BRICS countries Johansen & Juselius (1988, 1990) cointegration test has been applied. The test can be used only if all the variables are integrated of same order (here all are integrated of order 1). Selection of proper number of lag is considered very crucial and complicated in case of Johansen test. Selection of higher number of lags than what is desired would lead to problem of loss of degree of freedom and thereby may fail to identify the proper number of cointegrating equation(s) existing among the countries. On the other hand, selection of lower number of lags than what is actually required would lead to model mis-specification problem and hence result will not be perfect.

• Long-run Linkages between the US and BRICS Countries during US Crisis Period:

Table 5: Johansen's Cointegration Test Results (Crisis Period- Lag 3)

Multivariate Cointegration among the US and BRICS Countries							
Hypothesized No. of CE (s)	***Eigen value***	***Trace Statistics***	***Critical Value***	***Prob.***	***Max-Eigen Statistic***	***Critical Value***	***Prob.***
None, r = 0	0.102899	123.3949	117.7082	**0.0207***	46.80093	44.49720	**0.0276***
At most 1, r ≤ 1	0.066842	76.59401	88.80380	0.2735	29.81676	38.33101	0.3376
At most 2, r ≤ 2	0.043165	46.77725	63.87610	0.5635	19.01752	32.11832	0.7281
At most 3, r ≤ 3	0.033031	27.75974	42.91525	0.6364	14.47680	25.82321	0.6810
At most 4, r ≤ 4	0.020784	13.28294	25.87211	0.7159	9.052120	19.38704	0.7191
At most 5, r ≤ 5	0.009768	4.230820	12.51798	0.7085	4.230820	12.51798	0.7085
Diagnostic Tests at level VAR (3)							
AIC Value	-29.26691	Autocorrelation LM Test Result- Null hypothesis of n**o Serial Correlation** is accepted **(Prob. - 0.3143)** at the selected lag.					
SC Value	-28.18141	**VAR satisfies stability condition** as AR Roots Table shows no root lies outside the unit circle					

Both Trace Test and Max-Eigen value Test indicate one cointegrating equ at the 0.05 level. *Indicates rejection of null hypothesis of no cointegration at 0.05 level; *p*-values are MacKinnon- Haug-Michelis (1999) *p*- values. The variables of the respective countries are at logarithmic levels.

Source: Author's Computation

The long-run linkages between the US and BRICS countries during US crisis period are shown in Table 5. The Johansen cointegration model indicates that there exists long-run co-movement between the countries as both the Trace Test and Max-Eigen value Test show the presence of one cointegrating equation. Therefore, during crisis period, all the countries share common shocks.

Table 6: Long-run Causality Test based on Cointegrated VECM (Crisis Period)

	← Dependent Country →					
	US	**Brazil**	**Russia**	**India**	**China**	**Africa (S)**
Coefficient of ECT (-1) (Probability)	-0.108533 (0.0000*)	-0.156822 (0.0000*)	0.003603 (0.7337)	-0.007100 (0.4989)	-0.000361 (0.2912)	0.000056 (0.9986)

Lag length based on AIC. *Rejects null hypothesis of no significant relationship at 1% level of significance.

Source: Author's Computation

The presence of cointegrating vectors supports the application of Vector Error Correction Model (VECM) to examine the long-run causal linkages among the countries. The negative and statistically significant coefficients of ECT of the US and Brazil indicate their corrective stance in the event of any disequilibrium from long-run relationships. In case of any disequilibrium, the US and Brazil would act as restoring agents towards long-run equilibrium path with the speed of adjustment of 10.85% and 15.68% respectively in one day and the rest in the

coming days.

Additionally, the contribution of individual country in restoring the long-run equilibrium

Table 7: Exclusion Test from Long-run Cointegrating Equation (Crisis Period)

Country Excluded						
US	**Brazil**	**Russia**	**India**	**China**	**Africa (S)**	**All BRICS**
28.26751 (0.00000*)	29.22108 (0.00000*)	10.70107 (0.00107*)	10.89684 (0.00096*)	0.101578 (0.74994)	20.56920 (0.00000*)	47.42404 (0.00000*)

* Rejects null hypothesis of no contribution to the long-run equilibrium relationship at 1% level. Figures are respective χ^2 statistics (probability).

Source: Author's Computation

relationship has been tested using country 'exclusion tests' (Table 7). It is seen that China is the dominant and autonomous player among the countries and acted independently during the crisis period. As a result, China is less impacted by the US crisis. Except China, all other BRICS countries and the US are not considered as independent players during crisis period. Therefore, only China acted as an isolated country not impacted by the US even during the crisis period or in other words, if China is excluded, it does not hamper the long-run relationship between the US and BRICS countries other than China.

▪Long-run Linkages between the US and BRICS Countries during Post Crisis Period:

Table 8: Johansen's Cointegration Test Results (Post Crisis Period- Lag 8)

Multivariate Cointegration among the US and the BRICS Countries							
Hypothesized No. of CE (s)	***Eigen value***	***Trace Statistics***	***Critical Value***	***Prob.***	***Max-Eigen Statistic***	***Critical Value***	***Prob.***
None, r = 0	0.022045	134.3945	117.7082	**0.0029***	50.73631	44.49720	**0.0093***
At most 1, r ≤ 1	0.013994	83.65817	88.80380	0.1110	32.07581	38.33101	0.2192
At most 2, r ≤ 2	0.009947	51.58235	63.87610	0.3462	22.75359	32.11832	0.4362
At most 3, r ≤ 3	0.008069	28.82877	42.91525	0.5723	18.43923	25.82321	0.3445
At most 4, r ≤ 4	0.002963	10.38954	25.87211	0.9073	6.754587	19.38704	0.9166
At most 5, r ≤ 5	0.001596	3.634951	12.51798	0.7941	3.634951	12.51798	0.7941
Diagnostic Tests at level VAR (8)							
AIC Value	-37.01945	Autocorrelation LM Test Result- Null hypothesis of n**o Serial Correlation** is accepted **(Prob. - 0.8781)** at the selected lag.					
SC Value	-36.27927	**VAR satisfies stability condition** as AR Roots Table shows no root lies outside the unit circle					

Both Trace Test and Max-Eigen value Test indicate one cointegrating equ at the 0.05 level. *Indicates rejection of null hypothesis of no cointegration at 0.05 level; *p*-values are MacKinnon- Haug-Michelis (1999) *p*- values. The variables of the respective countries are at logarithmic levels.

Source: Author's Computation

Table 8 shows that there exists long-run integration between the US and BRICS countries in the post crisis period. However the impact of one country on the others could be ascertained using long-run causality and exclusion tests.

Table 9: Long-run Causality Test based on Cointegrated VECM (Post Crisis Period)

	← Dependent Country →					
	US	**Brazil**	**Russia**	**India**	**China**	**Africa (S)**
Coefficient of ECT (-1) (Probability)	-0.002083 (0.0086*)	0.002200 (0.5282)	-0.013202 (0.0000*)	-0.016387 (0.0000*)	-0.000121 (0.5760)	0.000987 (0.7435)

Lag length based on AIC. *Rejects null hypothesis of no significant relationship at 1% level of significance.

Source: Author's Computation

In the post crisis period, only the US, Russia and India are observed to be affected by the other countries. The equity markets of the rest of the BRICS countries, i.e. Brazil, China and South Africa are found to have acted independently following a dominant path in the long-run during the post crisis period.

Table 10: Exclusion Test from Long-run Cointegrating Equation (Post Crisis Period)

Country Excluded						
US	**Brazil**	**Russia**	**India**	**China**	**Africa (S)**	**All BRICS**
1.131610 (0.287432)	18.85463 (0.000014*)	20.89182 (0.000005*)	13.16708 (0.000285*)	0.237339 (0.626135)	6.405704 (0.011375**)	46.93325 (0.00000*)

* and ** Reject null hypothesis of no contribution to the long-run equilibrium relationship at 1% and 5% levels respectively. Figures are respective χ^2 statistics (probability).

Source: Author's Computation

The exclusion tests (Table 10) show that the US and China do not have any impact in creating long-run integrating relationship during the post crisis period. Therefore, in the post crisis period, the US fails to impact BRICS countries as its exclusion from long-run cointegrating equation does not create any impact. Thus, not only China but also the US acted as an isolated country during the post crisis period. It signifies the loss of supremacy and control of the US over the other countries in making any significant impact.

❒ ***Short-run Causal Relationship:***

5.5. VECM Based Granger Causality/ Block Exogeneity Test:

- **Short-run Causality Relationships during the US Crisis Period:**

The presence of long run association between the US and other BRICS countries does not undermine the possibility of diversification benefits arising from slow adjustments to the equilibrium path. In existence of long-run cointegrating relationship among the countries, the

presence of short-run causal relationship has been tested using VECM based Granger Causality model, also known as Block Exogeneity test.

Table 11: VECM Based Granger Causality Test (Crisis Period)

Independent Countries ?	← Dependent Countries →					
	Δ US	Δ Brazil	Δ Russia	Δ India	Δ China	Δ Africa (S)
Δ US	-	0.7298	0.0648***	0.6641	0.8738	0.5744
Δ Brazil	0.2815	-	0.7783	0.5425	0.1838	0.5166
Δ Russia	0.5326	0.0220**	-	0.0470**	0.2400	0.6249
Δ India	0.0000*	0.0077*	0.0082*	-	0.0394**	0.6009
Δ China	0.2039	0.0002*	0.0168**	0.0011*	-	0.2550
Δ South Africa	0.0004*	0.0000*	0.0804***	0.2644	0.8832	-
All Countries	0.0000*	0.0000*	0.0080*	0.0024*	0.0502***	0.6529

*, ** and *** indicate level of significance at 1%, 5% and 10% respectively. Figures are respective *p*-values of χ^2 statistics.

Source: Author's Computation

Table 11 shows that the US has short-run influence only on Russia, among the BRICS countries, during the crisis period. On the other hand, India, South Africa individually and all the BRICS countries jointly granger cause the US. It is also evident that there exists a pair wise unidirectional causality running from all the BRICS countries to the US, as the null hypothesis of no joint granger causality has been rejected at 1% level of significance. The results of the short-run causality test show that China and South Africa remained all together not influenced by most of the countries including the US.

- **Short-run Causality Relationships during the Post Crisis Period:**

Table 12: VECM Based Granger Causality Test (Post Crisis Period)

Independent Countries ?	← Dependent Countries →					
	Δ US	Δ Brazil	Δ Russia	Δ India	Δ China	Δ Africa (S)
Δ US	-	0.8600	0.1425	0.6729	0.5984	0.2948
Δ Brazil	0.0353**	-	0.3543	0.6095	0.5195	0.2279
Δ Russia	0.1160	0.0728***	-	0.1591	0.3892	0.0284**
Δ India	0.0002*	0.0073*	0.0010*	-	0.1835	0.0113**
Δ China	0.5033	0.0127**	0.0433**	0.0014*	-	0.2796
Δ South Africa	0.0001*	0.0000*	0.2096	0.7094	0.3950	-
All Countries	0.0000*	0.0000*	0.0065*	0.0078*	0.0434**	0.0640***

*, ** and *** indicate rejection of null hypothesis of non Granger causality at 1%, 5% and 10% levels of significance respectively. Figures are respective *p*-values of χ^2 statistics.

Source: Author's Computation

Table 12 shows that the US is unable to influence any of the BRICS countries during the post crisis period. However, Brazil, India, South Africa individually and all the BRICS countries jointly granger cause the US. During this period, China is not affected at all by any of the countries in short-run. Therefore, scope of diversification benefits exists in Chinese equity market in the post crisis period.

6. Conclusion

The study shows that the US and BRICS countries share long-run integrating relationship both in the crisis and post crisis periods. During the crisis period, the US and Brazil both act as restoring agents for any deviation from long-run relationships. Only China acts as an independent and isolated player during the crisis period and is free from US contaminating effect. However, all other BRICS countries except China are influenced by the US in the crisis period. In the post crisis period, Brazil, China and South Africa are found to have acted independently, which implies that in case of any disequilibrium from the long-run integrating relationship, these three countries will not tend to converge to equilibrium relationship. Thus, US cannot create any long-run impact in these three countries of BRICS during the post crisis period.

Coming to the short-run dynamic linkages analysis, South Africa is not influenced by any of the countries during the crisis period. China follows South Africa as only India has short-run influence on China. Therefore, the scopes of diversification exist in China and South Africa, even during the crisis period. In the post crisis period, investment in Chinese equity markets is less risky as China does not share short-run linkages with any of the other BRICS countries and US.

The US is integrated in long-run with the BRICS countries during the crisis and post crisis periods. However, the supremacy of the US fades away in the post crisis period and it cannot influence the BRICS countries individually; rather its power gets enhanced when it acts together with the BRICS countries. The US has short-run dynamic influence only on Russia during the crisis period, whereas it fails to impact any other BRICS countries in the post crisis period. From investment point of view, investment in China and South Africa is prone to the lowest risk in all the periods under study and, thereby, increases the scope of diversification in those countries and these two countries are the safe harbour for the risk-averse small investors.

Looking at the policy formulation strategy of the national governments, it is advisable to create a strong coordination with the China. Chinese economy is the least impacted by any unwanted waving effect in the world stock markets. Moreover, China is going to be one of the most significant leading powers in world economy, even superseding the position of US. China bailed out the US during 2007 financial crisis by purchasing the maximum US bonds and as of April 2018, China is the biggest foreign creditor of US. Time may come in near future when

the US government will have to dance according to the whims of China and China could use $1.7 trillion US treasury bonds (CNBC, April 5, 2018) in a trade war with the US. Therefore, it can be concluded that the US has lost its supremacy during the passage of time, especially from the perspective of strong influence over equity markets of BRICS and the US has to digest the loss of control over the BRICS countries as it is the hard reality of dynamic time- a far away from the myth.

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