Evaluating the Impact of the Global Financial Crisis on the Stock Markets of BRICS Countries

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Abstract

The global financial crisis of 2007 - 2008 left every economy in a state of shock and also increased the volatility in the markets across the world since internationalization of capital markets not only gives an opportunity to investors to invest their money in their own country, but also the country of their choice too. Therefore, during the period of crisis, international investors tried to diversify their investments in more promising countries. BRICS countries, being a global market hub, have been growing faster than the world growth rate and saw more investment movements during and after this period. The present study attempted to evaluate the impact of the financial crisis on BRICS countries' stock markets. The impact was examined by analyzing the growth rate of BRICS countries' stock markets index prices in the pre and post crisis period (from 2002-2015) with the application of a dummy based model considering time as a dummy. Our results revealed that the BRICS were subject to a spillover effect during and following the financial crisis. Brazilian, Russian, and Chinese markets had a negative growth in index prices and captured more volatility and thereby, increased the risk of investors ; whereas, the Indian and South African markets captured some degree of shock in the beginning of the crisis, but showed a positive momentum. We further found that in the long run, these nations recovered successfully from the crisis as they invited more foreign investments in their markets to recover.

Key words : BRICS inter-relationship, stock market, global financial crisis, index return, risk

JEL Classification : C12, C18, F39

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The global financial crisis of 2007 - 2008 left every economy in a state of shock and also increased the volatility of the markets in the world too as internationalization of capital markets not only gives an opportunity to investors to invest their money in their own country, but also the country of their choice too. The relationship between international stock markets has become increasingly important in recent times. The investors' interest in international diversification has increased with relaxation of capital control among the economies. One of the fastest emerging countries group among the others is 'BRICS.' The original term 'BRIC' was coined in 2001 by the then chairman of Goldman Sachs Asset Management, Jim O'Neill, in his publication, *Building Better Global Economic BRICs* from the initial letters of the four major emerging national economies: Brazil, Russia, India, and China (O'Neil, 2001). This group was later extended and became 'BRICS' in 2010 by including South Africa. These countries possess quite different economies in the context of their resources, history, and global economic strategies. However, all of them have one thing in common, that is, relatively high growth potential in international comparison and high global economic growth rates. BRICS countries

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accommodate over 3 billion people. With 1.4 billion inhabitants, China is the biggest country, followed by India with 1.2 billion. On the whole, 42% of the world population lived in BRICS in 2017. Against this population backdrop, these countries are not only important resource suppliers for industrialized states, but also significant sales markets and important economic actors.

Moreover, their share in global GDP grew from 8.8% in 2002 to 19.9% in 2011 and around 25% in 2017. Their share of global trade grew from 12.6% in 2007 to 15.8% in 2010 to more than 20% in 2017. The BRICS's combined economic value is U.S. $16 trillion. A new development bank- BRICS Bank will soon be operational, which will have a U.S. $100 billion currency exchange reserve. BRICS housed foreign exchange reserves amounting to more than U.S. $ 4 trillion in 2017. The combined GDP growth rate of BRICS countries in 2017 was more than 10%, which was more than the growth rate of rest of the world which is hovering around 4% - 5%.The combined GDP value of these five nations in 2017 was slightly higher than U.S. $ 17 trillion. In March 2011, when one of the BRICS countries - China became the first country to have foreign exchange reserves of more than $3 trillion after overtaking Japan, which was the holder of world's largest foreign exchange reserves, at that time, BRICS's share of global foreign exchange reserves was more than 43%. It is estimated that by the year 2050, they will outperform most of the current richest countries of the world, including USA.

The global financial crisis of 2007-2008 increased the volatility of the markets in the world. Sharma, Mahendru, and Singh (2013) ; Gulia and Handa (2015) ; and Nashier (2015) established the financial interlinkages among BRICS's stock markets and Banerjee and Vashisht (2010) observed the impact of financial crisis on BRICs, but the results were not promising, so therefore, we tried to make an attempt to evaluate the impact of the financial crisis on the stock markets of BRICS countries. Since BRICS is not only a consortium of countries, but the BRICS countries have now become a global market hub too, therefore, the world is eyeing BRICS. Furthermore, the study examined the impact of financial crisis on the index returns of BRICS and thereby analyzed whether the crisis left a big dent on these markets or these markets got through the crisis.

Review of Literature

A study by Ripley (1973) found low correlations between national stock markets, supporting the payback of international diversification. As per the study conducted by Campbell and Hamao (1992), in perfectly integrated markets, all assets with like risk exposure also commanded equal expected returns. Chaudhuri (1997) investigated the relation among six Latin American countries for the period of 1985 -1993 and found a long-run relationship among all the six Latin American countries. Husain and Saidi (2000) tried to explore the interdependence of the equity market in Pakistan with seven major equity markets of UK, USA, France, Japan, Germany, Singapore, and Hong Kong. They examined the integration through weekly stock indices. Their analysis revealed a little support for the integration of the Pakistani equity market with the other international nations' markets. They opined the existence of opportunity for diversification for international investors in Pakistan. Mukhopadhyay and Sarkar (2003) conducted an analysis for the purpose of understanding the influence of the different macroeconomic factors on the returns of the Indian stock market before and after the liberalization of the market, and they found that before the liberalization period (1989-1995), money supply growth, inflation, real economic activity, NASDAQ-index, and FDI were found to be significant in explaining the variations in the Indian stock returns, but these phenomena were found not to be significant after the liberalization period (since 1995).

Mukherjee (2007) captured the similarities, patterns, and trends in the activities and the movements of the Indian stock market in comparison to its international counterparts. The study covered Hong Kong stock exchange, New York stock exchange, Tokyo stock exchange, Korean stock exchange, and Russian stock exchange from various socio - politico - economic backgrounds. The study used both the Bombay Stock Exchange and the National Stock Exchange of India Limited as a part of the Indian stock market. The findings of the study

showed that the stock markets impacted each other, more so in the recent times, that is, post-2000. Aktar (2009) examined the co-movement of stock prices among Russia, Turkey, and Hungry's markets with the help of using daily index value using JJ cointegration, vector error correction model, and Granger causality test. The findings of the study pointed out the existence of co-integration among the stock indices of Russia, Turkey, and Hungary. Banerjee and Vashisht (2010) looked at the transmission channels by which the financial crisis affected the four emerging economies - Brazil, Russia, India, and China, the degree and extent of the impact of the crisis, and the subsequent policy interventions which enabled recovery in these nations. It was found that in the long term, these nations recovered successfully from the crisis. The authors also opined that the hub of global consumption has to shift from the West to the global South, particularly to BRICs. The study conducted by Sheu and Liao (2011) analyzed the evolving pattern of integration and causal relationships among the BRIC stock markets and the U.S. market. Their empirical results showed that Russia, China, and Brazil's markets started exerting significant influences on the U.S. Dow Jones exchange, to some extent, after the period of 2006 and the Dow Jones index also continued to play a vital and dominant role in causing shifts in the emerging markets of India, China, and Russia.

Vieito, Bhanumurthy, and Tripathi (2013) tried to investigate the weak-form efficiency in the most developed (G-20) countries in the world along with measuring the impact of the 2007 financial crisis on the stock markets of these countries in the context of their efficiency. Their entire study period was divided into two different segments, that is, a pre-crisis period (from January 1, 2005 to August 8, 2007) and a during the crisis period (from August 9, 2007 to December 31, 2011). They found that strong contemporaneous effects emerged across all international markets (except Saudi Arabia) as a consequence of the 2007 crisis, which may be due to increased international intra-day activity across the world markets. They found that the market index was inefficient while the individual stocks were efficient. Venkatesh (2013) explored the dimension of patterns, similarities, and trends in the movements and the activities of the BRICS markets to its other counterparts. It was observed that BRICS did not constitute a homogeneous alliance. Sharma et al. (2013) studied the interlinkages among BRICS's stock markets with the help of benchmark indices of these stock exchanges. The analysis revealed that the stock markets under study were influenced by each other, but not to a great extent, which gave rise to the thought of existence of diversification opportunities for the investors.

Tyagi and Naseem (2014) evaluated the impact of the global financial meltdown of 2007- 09 on the BRIC countries on the basis of the four selected individual parameters, that is, GDP growth rate, foreign trade, FDI (inflows and outflows), and unemployment. It was found that China performed better among the BRICs throughout the crisis period ; whereas, Russia's performance was worst during crisis and showed late recovery. However, India and Brazil remained the mediator performers during the crisis period. Tripathi and Kumar (2014) studied the long term relationship between inflation and stock returns in BRICS markets. They also examined the long term co-integrating relationship between stock index values and inflation rates and found no long term co-integrating relationships. Their correlation results revealed a significant negative relationship between the stock index and inflation rate for Russia and also showed a significant positive relationship for India and China. Gulia and Handa (2015) analyzed the daily closing indices values of BRICS's stock exchanges and examined the causal relationship among the returns of BRICS's countries stock exchanges and also looked at the possibility of integration of the Indian stock market with rest of the BRICS nations. It was found that the returns at the Indian stock exchange caused the returns at Russia, Brazil, and South Africa's stock exchanges.

Nashier (2015) examined the integration among different stock markets of BRICS countries and the stock markets of U.S. and U.K. with the help of daily closing prices of the major stock indices. The study found evidence for both the short-term static and the long-term dynamic integration between these stock markets. Singh and Shrivastav (2016) attempted to investigate the interlinkages and interrelationships between Sri Lanka and India's stock markets. Testing results of Granger causality explained that returns at Colombo exchange did not Granger cause returns at the Indian stock exchange and vice versa. Johansen co-integration test told nothing about co-

integration between them. Moreover, no causal relationship and interlinkages were found between both the nations' stock markets. Jain and Bothra (2016) examined the financial performance of the luxury market pre and post the financial crisis of 2007-08. The results revealed that the tough time of recession proved to be difficult for the luxury market as a whole. The liquidity of the market in all the segments did not change significantly.

Grima and Caruana (2017) analyzed whether the BRIC's stock market returns were affected by the U.S. financial stress during the 2008 financial crisis. The results obtained revealed that the BRICs were subject to a spillover effect during and following the financial crisis. Gupta and Shrivastav (2017) made an attempt to investigate financial integration between India (NSE) and Australian (ASX) stock markets by taking daily closing index price. The study found an evidence of financial integration between the markets of India and Japan. Patel (2017) explored the co-movement among 14 stock markets, namely BSE, BVSP, FTSE -100, Hang Seng, JKSE, KSE, KSE (Korea), MXX, NASDAQ, NIKKI, RTS, SSE, SSMI, and TSEC. The correlation analysis showed that BSE remained somewhat positively correlated with Hang Seng (0.45), FTSE-100 (0.32), MXX (0.27), NASDAQ (0.24), and BVSP (0.23). Results of the Granger causality test indicated that the returns of BSE were dependent on BVSP, FTSE - 100, and MXX only. Outcome of Johansen cointegration test indicated that there was a long run relationship among the selected stock markets. Aggarwal and Khurana (2018) investigated the market integration among BRIC economies from January 2008 to August 2015. The results showed that there existed one long run cointegrating relationship between the four stock markets under study. Although there was no long run causality among the four stock markets, but there existed short term causality running from Russian, Chinese, and Brazilan stock markets to the Indian stock market.

Objectives of the Study

ↆ To study the impact of global financial crisis on the BRICS countries' stock markets.

ↆ To analyze the behaviour of BRICS countries' stock markets pre and post the financial crisis.

Hypotheses

ↆ H_{01} : There is no significant difference between returns of the Brazil index during pre and post global financial crisis.

ↆ H_{A1} : There is a significant difference between returns of the Brazil index during pre and post global financial crisis.

ↆ H_{02} : There is no significant difference between returns of the Russian index during pre and post global financial crisis.

ↆ H_{A2} : There is a significant difference between returns of the Russian index during pre and post global financial crisis.

ↆ H_{03} : There is no significant difference between returns of the Indian index during pre and post global financial crisis.

ↆ H_{A3} : There is a significant difference between returns of the Indian index during pre and post global financial crisis.

ↆ H_{04} : There is no significant difference between returns of index of China during pre and post global financial crisis.

✥ **H$_{A4}$:** There is a significant difference between returns of index of China during pre and post global financial crisis.

✥ **H$_{05}$:** There is no significant difference between returns of index of South Africa during pre and post global financial crisis.

✥ **H$_{A5}$:** There is a significant difference between returns of index of South Africa during pre and post global financial crisis.

Research Design and Methodology

The proposed research is a study of the trend analysis of stock markets of BRICS countries and the analysis of change in the behvaiour of it in the pre and post crisis periods. For the purpose of the present study, exploratory research design has been followed. This is a type of research conducted for a problem that has not been clearly defined. It helps in drawing definitive conclusions only with extreme caution. Given its fundamental nature, exploratory research often concludes that a perceived problem does not actually exist.

The study has been conducted considering the global financial crisis that occurred in 2007-2008. We tried to analyze the post stock market behavior of BRICS, keeping in mind the global financial crisis. Therefore, we selected the period of study from 2002 to 2015 in order to analyze the behavior of BRICS countries' stock markets. It is a dummy variable exercise taking time as a dummy, and we have included dummies across the two time periods, taking world recovery to be the base period. The number of sample units included in this study is five, that is, only one stock exchange is taken from every country as a representative of the respective country. The monthly closing index price of BRICS nations' stock exchanges has been used in this study. Thus, in total, 168 months were considered for the study. India has two major stock exchanges, that is, BSE and NSE, but for the purpose of this study, NSE (Nifty 50) has been considered. Similarly, China has two major stock exchanges, that is, Shanghai Stock Exchange and Shenzhen Stock Exchange, but under this study, Shanghai Stock Exchange is used. The monthly stock index price of BRICS countries was collected from the respective stock exchange websites of BRICS countries (Table 1).

Table 1. Representative Stock Exchanges of BRICS

Country	Stock Exchange	Stock Index
Brazil	São Paulo Stock Exchange	Índice BOVESPA (IBOVESPA)
Russia	Moscow Stock Exchange	RTSI INDEX
India	National Stock Exchange	S&P CNX NIFTY
China	Shanghai Stock Exchange	Shanghai SE Composite
South Africa	Johannesburg Stock Exchange	FTSE/JSE Top40

Analysis and Results

(1) Descriptive Statistics Analysis

(i) Brazil : At the outset, we conducted the descriptive statistics for the index price of BOVESPA of Brazil for the period under study. Taking into account 168 months as a period of study, the data so collected for index price was analyzed. The mean value for index price is 10.591655 (Table 2), with a standard error of 0.0028750796 and the standard deviation of the distribution is found to be 0.037209772. The coefficient of variation is found to be

Table 2. Descriptive Statistics of Brazil Índice BOVESPA Index Price	
Mean	10.5916155
Standard Error	0.002870796
Median	10.59233794
Standard Deviation	0.037209772
Sample Variance	0.001384567
Kurtosis	-1.197161211
Skewness	-0.045060797
Range	0.127772222
Minimum	10.52640002
Maximum	10.65417224
Count	168

Table 3. Descriptive Statistics of Russia RTSI Index Price	
Mean	7.361052133
Standard Error	0.037276105
Median	7.507532501
Standard Deviation	0.483153545
Sample Variance	0.233437348
Kurtosis	-0.563723684
Skewness	-0.602039231
Range	1.98206922
Minimum	6.217144878
Maximum	8.199214098
Count	168

0.0035131347. The skewness is -0.045060797. When the skewness is between -0.5 and 0.5, the distribution is considered approximately symmetric, therefore, the index price distribution is approximately symmetric and kurtosis is -1.197161211. The kurtosis, for normal distribution series, has a value of 3. Since the kurtosis value of index price is less than 3 (negative in this case), it infers that this index distribution is mesokurtic.

(ii) Russia : We calculated the descriptive statistics for the RTSI index price of Russia for the period under study. Taking into account 168 months as a period of study, the data so collected for index price was analyzed. The mean value for index price is 7.361052133 (Table 3), with the standard error of 0.037276105 and the standard deviation of the distribution is found to be 0.483153545. The coefficient of variation is found to be 0.0656364. The skewness is -0.602039231 (distribution is skewed to the left) and kurtosis is -0.563723684. Since the kurtosis value of index price is less than 3 (negative in this case), it infers that this index distribution is mesokurtic.

(iii) India : We analyzed the descriptive statistics for the Nifty index price of India for the period under study. Taking into account 168 months as a period of study, the data so collected for index price was analyzed. The mean

Table 4. Descriptive Statistics of India Nifty Index Price	
Mean	8.20420368
Standard Error	0.049360408
Median	8.452512663
Standard Deviation	0.639784005
Sample Variance	0.409323573
Kurtosis	-0.604103394
Skewness	-0.743649485
Range	2.254484429
Minimum	6.83952997
Maximum	9.094014399
Count	168

Table 5. Descriptive Statistics of China SSE Composite Index Price	
Mean	7.690030341
Standard Error	0.030145163
Median	7.700461335
Standard Deviation	0.390725967
Sample Variance	0.152666781
Kurtosis	-0.531963627
Skewness	0.212381055
Range	1.725226847
Minimum	6.966720171
Maximum	8.691947018
Count	168

Table 6. Descriptive Statistics of South Africa FTSE/JSE Top 40 Index Price

Mean	7.700030341
Standard Error	0.030156163
Median	7.800361335
Standard Deviation	0.390525967
Sample Variance	0.153776781
Kurtosis	-0.532843627
Skewness	0.214571055
Range	1.726286847
Minimum	6.974420171
Maximum	8.691957018
Count	168

value for index price is 8.20420368 (Table 4), with the standard error of 0.049360408 and the standard deviation of the distribution is found to be 0.483153545. The coefficient of variation is found to be 0.07798246. The skewness is -0.743649485 (distribution is skewed to the left) and kurtosis is -0.604103394. The kurtosis for normal distribution series has a value of 3. Since the kurtosis value of index price is less than 3 (negative in this case), it infers that this index distribution is mesokurtic.

(iv) China : We analyzed the descriptive statistics for the Shanghai SE Composite index price of China for the period under study. Taking into account 168 months as a period of study, the data so collected for index price was analyzed. The mean value for index price is 7.690030341 (Table 5), with the standard error of 0.030145163 and the standard deviation of the distribution is found to be 0.390725967. The coefficient of variation is found to be 0.050809418. The skewness is 0.212381055. When the skewness is between -0.5 and 0.5, the distribution is considered approximately symmetric, therefore, this index price distribution is approximately symmetric and kurtosis is -0.531963627. The kurtosis for normal distribution series has a value of 3. Since the kurtosis value of index price is less than 3 (negative in this case), it infers that this index distribution is mesokurtic.

(v) South Africa : We calculated the descriptive statistics for the FTSE/JSE Top 40 index price of South Africa for the period under study. Taking into account 168 months as a period of study, the data so collected for index price was analyzed. The mean value for index price is 7.700030341 (Table 6), with the standard error of 0.030156163 and the standard deviation of the distribution is found to be 0.390525967. The coefficient of variation is found to be 0.050717458. The skewness is 0.214571055. When the skewness is between -0.5 and 0.5, the distribution is considered to be approximately symmetric, therefore, this index price distribution is approximately symmetric and kurtosis is -0.532843627. The kurtosis for normal distribution series has a value of 3. Since the kurtosis value of index price is less than 3 (negative in this case), it infers that this index distribution is mesokurtic.

(2) Trend Analysis of BRICS Countries' Index Price : First of all, we did the simple trend analysis of BRICS countries' index price for the purpose of capturing the impact of the crisis on the index prices of BRICS countries.

(i) Brazil : Index Trend Equation : $\text{Ln Brazil Index}_t = \alpha + \beta \text{ Time} + u_t$

The initial trend analysis shows that for Brazil's index price, the *R* Square value is 0.6096 for 168 observations

and intercept coefficient is 9.8128 (Table 7). Here, time is the explanatory factor and its coefficient is 0.0090 since both the coefficients are not statistically significant and trend line is not fitting with the actual line (Figure 1) too. Therefore, we introduced the dummy variable for the purpose of analyzing the effect of the crisis on the index prices of Brazil. We took the crisis as a dummy and then reframed our whole model to the tune of measuring the impact of the crisis.

Index Trend Equation: Ln Brazil Index$_t = \alpha + D2 + \beta_1 t + \beta_2 D2.t + u_t$

Index Trend Equation: Ln Brazil Index$_t = 10.5258 - 0.003763 D2 + 2.9594t + 0.007913 D2.t + u_t$

After the introduction of the dummy variable, the model shows some improved results as the trend line is fitting with the actual line (Figure 2). The intercept here shows growth in the index prices before the crisis. The coefficient of intercept is 10.5258, and it is statistically significant. Therefore, we can say that before the crisis period, the index price was showing growth. During the crisis period, the dummy variable $D2$ is negative, having a value of -0.00376, which shows a fall in the overall index prices during the crisis period (it was expected that

Table 7. Summary Output of Regression Analysis (Without Dummy) for Brazil

Regression Statistics			
Multiple R	0.768107785		
R Square	0.79124898		
Adjusted R Square	0.414420832		
Standard Error	0.228233018		
Observations	168		
ANOVA			
	Df	*SS*	*MS*
Regression	1	32.07518695	32.07518695
Residual	166	20.54023309	0.123736344
Total	167	52.61542004	
	Coefficients	**Standard Error**	*t* - Stat
Intercept	9.812816569	0.054521238	179.9815423
T	0.00900988	0.000559607	16.10037377

Figure 1. Trend and Actual Index Price – Brazil
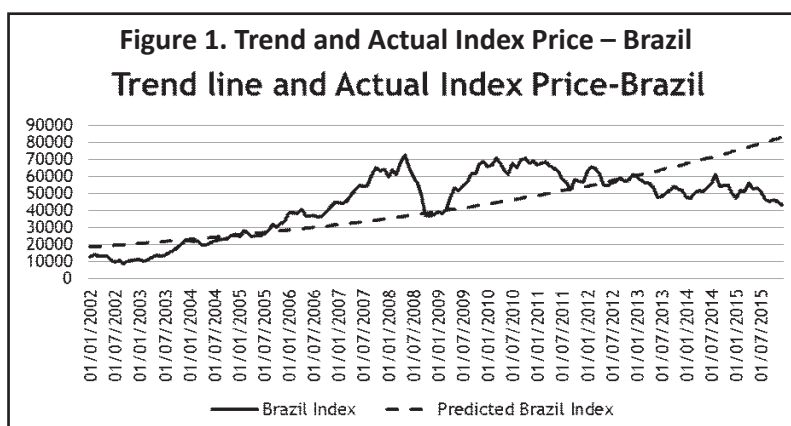
Table 8. Summary Output of Regression Analysis (with Dummy) for Brazil

Regression Statistics

Multiple *R*	0.999989945
R Square	0.99997989
Adjusted *R* Square	0.999979522
Standard Error	0.000168384
Observations	168

ANOVA

	Df	SS	MS	F	Significance F
Regression	3	0.231218059	0.077072686	171.009	0
Residual	164	4.64991E-06	2.84E-08		
Total	167	0.231222709			

	Coefficients	Standard Error	*t* - Stat	*p* - value
Intercept	10.52583092	2.010550505	263.5864564	0
*D*2	-0.003763952	1.653544748	3.49611323	0.787731414
*D*2*t*	2.959451452	0.138577489	-3.55861131	0.659514125
T	0.007913476	3.548481144	8.9966729	0.875852587
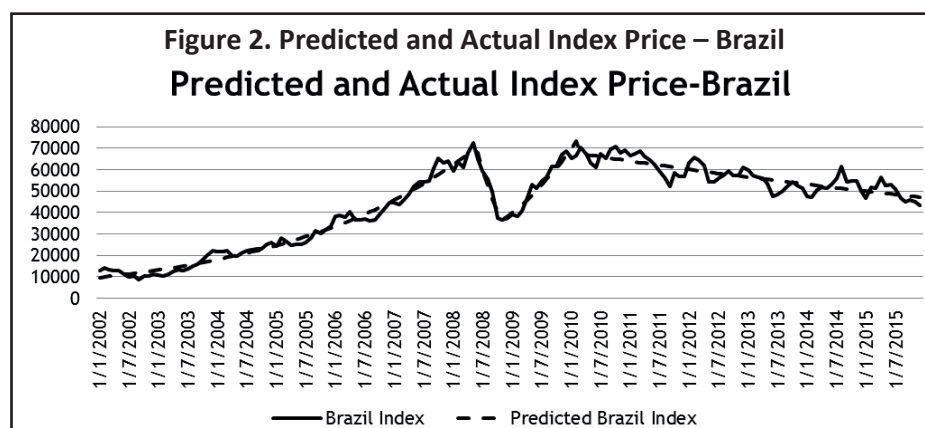
Figure 2. Predicted and Actual Index Price – Brazil

Predicted and Actual Index Price-Brazil

during the period of the global crisis, the index prices would fall). Here, the change in slope, that is, *D*2.*t* coefficient value is 2.95945 (Table 8), which indicates that every time there is a correction in the index prices, it leads to a positive slope of index prices. The overall growth in the index prices with respect to time is 0.0079. Although the value is positive, but it is very small in number. Even though in the period of crisis the index prices fell, but still, the values showed a little amount of growth over a period of time, but these results are not statistically significant as the *p* - value is more than 0.05 (Table 8). Hence, it leads to acceptance of null hypothesis H_{01} that there is no significant difference between returns of Brazil's index during pre and post global financial crisis in the long run.

(ii) Russia : Index Trend Equation : Ln Russia Index $_t = \alpha + \beta \text{Time} + u_t$

The initial trend analysis shows that for Russia's index price, the *R* Square value is 0.7912 for 168 observations, and the intercept coefficient is 6.9681 (Table 9). Here, time is the explanatory factor and its coefficient is

0.004649. Since both the coefficients are not statistically significant and trend line is not fitting with the actual line (Figure 3), therefore, we introduced the dummy variable for the purpose of analyzing the effect of the crisis on the index prices of Russia. We took the crisis as a dummy and then reframed our whole model to the tune of measuring the impact of the crisis.

Index Trend Equation: Ln Russia Index$_t$ = $\alpha + D2 + \beta_1 t + \beta_2 D2.t + u_t$

Index Trend Equation: Ln Russia Index$_t$ = $6.16918 - 1.89424 + 0.026593t + 0.0310D2.t + u_t$

After the introduction of the dummy variable, the model shows some improved results as the trend line is fitting with the actual line (Figure 4). The intercept here shows growth in the index prices before the crisis. The coefficient of intercept is 6.169098185 and it is statistically significant. Therefore, we can say that before the crisis period, the index price was showing growth. During the crisis period, the dummy variable $D2$ is negative, having a value of -1.894239654, which shows a fall in the overall index prices during the crisis period (it was expected that during the period of the global crisis, the index prices would fall). Here, the change in slope, that is, $D2.t$

Table 9. Summary Output of Regression Analysis (Without Dummy) for Russia

Regression Statistics					
Multiple R	0.768107785				
R Square	0.79124898				
Adjusted R Square	0.414420832				
Standard Error	0.228233018				
Observations	168				
ANOVA					
	Df	SS	MS	F	Significance F
Regression	1	8.542373171	8.542373171	46.58201	1.57175E-10
Residual	166	30.44166393	0.183383518		
Total	167	38.9840371			
	Coefficients	Standard Error	t - Stat	p-value	Lower 95%
Intercept	6.968153631	0.066373882	14.9833667	0.524874	6.837107841
T	0.004649686	0.000681263	6.825101591	0.878577	0.00330463

Figure 3. Trend and Actual Index Price – Russia

Table 10. Summary Output of Regression Analysis (with Dummy) for Russia

Regression Statistics	
Multiple *R*	0.87171415
R Square	0.859885559
Adjusted *R* Square	0.855493221
Standard Error	0.238907961
Observations	168

ANOVA				
	Df	*SS*	*MS*	*F*
Regression	3	29.62340681	9.874468937	173.0025495
Residual	164	9.360630292	0.057077014	
Total	167	38.9840371		
	Coefficients	Standard Error	*t* - Stat	*p* - value
Intercept	6.169098185	0.056902874	108.4145281	0.000454145
*D*2	-1.894239654	0.12277889	15.42805657	0.426221241
*D*2*t*	0.031044682	0.001615436	-19.2175293	0.535717854T
T	0.002693839	0.001354766	19.62983467	0.615871478

Figure 4. Predicted and Actual Index Price – Russia

coefficient value is 0.031044682 (Table 10), which indicates that every time there is a correction in the index prices, it leads to a positive slope of index prices. The overall growth in the index prices with respect to time is 0.02693839. Although it is positive, but the value is very small in number. It depicts that even though in the period of crisis the index prices had fallen, but still, the prices showed a little amount of growth over a period of time, but these results are not statistically significant as the *p* - value is more than 0.05 (Table 10). Hence, it leads to acceptance of null hypothesis H_{02} that there is no significant difference between returns of the Russian index during pre and post global financial crisis in the long run.

(iii) India : Index Trend Equation : Ln India Index$_t$ = α + β Time + u_t

The initial trend analysis shows that for India Nifty index price, the *R* Square value is 0.8559 for 168 observations and intercept coefficient is 7.7159 (Table 11). Here, time is the explanatory factor, and its coefficient is 0.0121.

Table 11. Summary Output of Regression Analysis (Without Dummy) for India

Regression Statistics

Multiple R	0.925186244
R Square	0.855969586
Adjusted R Square	0.855101933
Standard Error	0.243536844
Observations	168

ANOVA

	Df	SS	MS	F	Significance F
Regression	1	58.51154443	58.51154443	986.5343561	9.47E-72
Residual	166	9.845492268	0.059310194		
Total	167	68.3570367			

	Coefficients	Standard Error	t - Stat	p - value
Intercept	7.175922508	0.03774694	190.1060747	0.8253E-196
T	0.012169008	0.000387435	31.40914447	0.76822E-72

Table 12. Summary Output of Regression Analysis (with Dummy) for India

Regression Statistics

Multiple R	0.978212621
R Square	0.956899931
Adjusted R Square	0.956111516
Standard Error	0.134032053
Observations	168

ANOVA

	Df	SS	MS	F	Significance F
Regression	3	65.41084373	21.80361458	1213.699451	1.0693E-111
Residual	164	2.94619297	0.017964591		
Total	167	68.3570367			

	Coefficients	Standard Error	t - Stat	p-value
Intercept	6.704675338	0.031923628	210.0223463	0.02268011
D2	0.951955145	0.068881366	1.82021299	0.659981415
D2t	-0.017538793	0.000906291	-1.35227291	0.895141245
T	0.025600297	0.00076005	3.6823642	0.373121425

Since both the coefficients are not statistically significant and trend line is not fitting with the actual line (Figure 5) too, therefore, we introduced the dummy variable for the purpose of analyzing the effect of the crisis on the index prices of India. We took the crisis as a dummy and then reframed our whole model to the tune of measuring the impact of the crisis.

Index Trend Equation : $\text{Ln India Index}_t = \alpha + D2 + \beta_1 t + \beta_2 D2.t + u_t$

Index Trend Equation : $\text{Ln India Index}_t = 6.7046 + 0.95195 + 0.02560t + (-0.017538)D2.t + u_t$
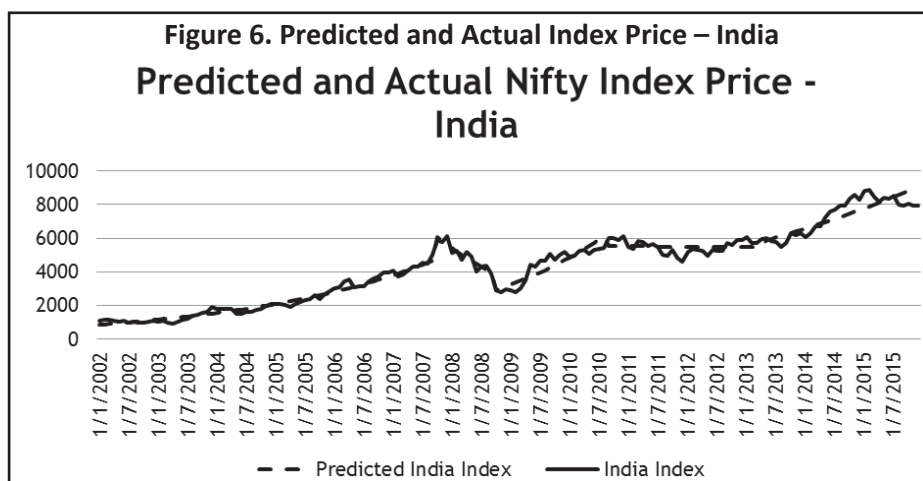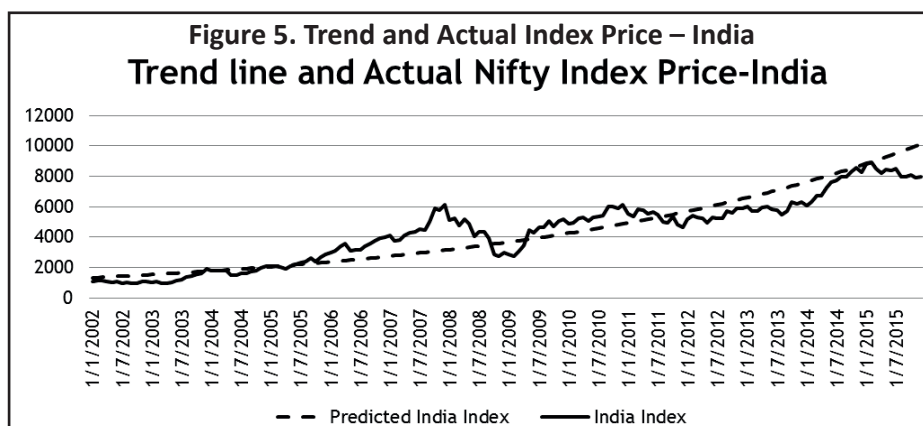
Figure 5. Trend and Actual Index Price – India

Trend line and Actual Nifty Index Price-India

Figure 6. Predicted and Actual Index Price – India

Predicted and Actual Nifty Index Price - India

After the introduction of the dummy variable, the model shows some improved results as the trend line is fitting with the actual line (Figure 6). The intercept here shows growth in the index prices before the crisis. The coefficient of intercept is 6.7046, and it is statistically significant. Therefore, we can say that before the crisis period, the index price was showing growth. During the crisis period, the dummy variable $D2$ is positive, having a value of 0.951955145, which shows a rise in the overall index prices during the crisis period. It was although expected that during the period of the global crisis, the index prices would fall, but here, in case of India, the prices rose with corrections. The reason for the same could be that during this period of global crisis, the Indian economy was growing ,therefore, the negative shocks of crisis had been absorbed by the economy to some extent. Although the Indian market also responded to the crisis later on, but overall, the index prices showed growth. Here, the change in slope, that is, $D2.t$ is -0.0175 (Table 12), which indicates that every time there is a correction in the index prices, it leads to a negative slope of index prices. The overall growth in the index prices with respect to time is 0.0256. Although the value is positive, but it is very small in number. It depicts that even though in the period of crisis, the index prices of India showed positive responses towards growth in the Indian index, but these results are not statistically significant as the p - value is more than 0.05 (Table 12). Hence, it leads to acceptance of the null hypothesis H_{03} that there is no significant difference between returns of the Indian index during pre and post global financial crisis in the long run.

(iv) China : Index Trend Equation: Ln China Index $_t$ = α + βTime + u_t

Table 13. Summary Output of Regression Analysis (Without Dummy) for China

Regression Statistics

Multiple *R*	0.567045747
R Square	0.521540879
Adjusted *R* Square	0.317453776
Standard Error	0.322803555
Observations	168

ANOVA

	Df	SS	MS	F	Significance F
Regression	1	8.197798043	8.197798043	78.67207377	1.12E-15
Residual	166	17.29755439	0.104202135		
Total	167	25.49535243			

	Coefficients	Standard Error	*t* - Stat	*p* - value	Lower 95%
Intercept	7.305137609	0.050032866	146.0067793	0.9748177	7.206355
T	0.004554944	0.000513538	8.869727942	0.7888815	0.003541

Figure 7. Trend and Actual Index Price – China
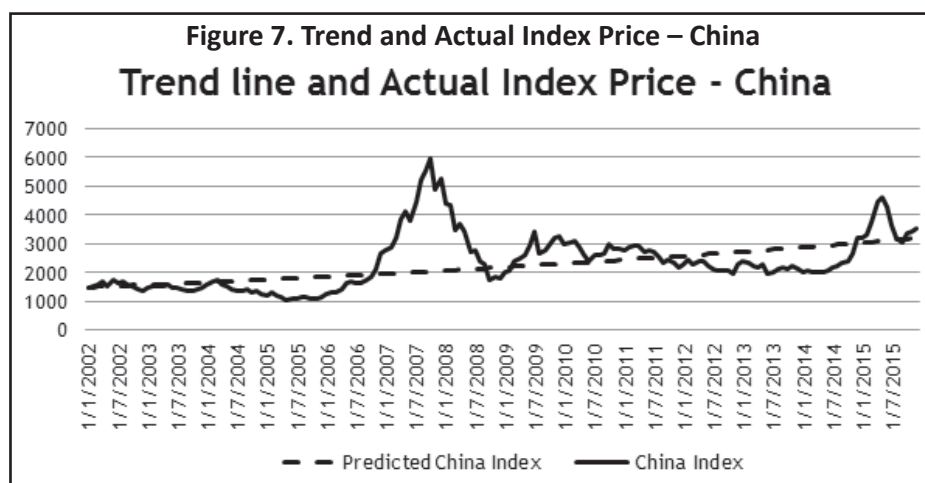
The initial trend analysis shows that for China's index price, the *R* Square value is 0.521540 for 168 observations and the intercept coefficient is 7.305137 (Table 13). Here, time is the explanatory factor and its coefficient is 0.004554944. Since both the coefficients are not statistically significant and the trend line is not fitting with the actual line (Figure 7) too, therefore, we introduced the dummy variable for the purpose of analyzing the effect of the crisis on the index prices of China. We took the crisis as a dummy variable and then reframed our whole model to the tune of measuring the impact of the crisis.

Index Trend Equation: $\text{Ln China Index}_t = \alpha + D2 + \beta_1 t + \beta_2 D2.t + u_t$

Index Trend Equation: $\text{Ln China Index}_t = 7.0127 - 0.8646 + 0.01207t + 0.0121608.t + u_t$

After the introduction of the dummy variable, the model shows some improved results as the trend line is fitting with the actual line (Figure 8). The intercept here shows growth in the index prices before the crisis. The coefficient of intercept is 7.0127, and it is statistically significant. Therefore, we can say that before the crisis

Table 14. Summary Output of Regression Analysis (with Dummy) for China

Regression Statistics

Multiple *R*	0.874060736
R Square	0.874357876
Adjusted *R* Square	0.444376617
Standard Error	0.291247718
Observations	168

ANOVA

	Df	SS	MS	F	Significance F
Regression	3	11.58401	3.861338058	45.52110153	0.860351452
Residual	164	13.91134	0.084825233		
Total	167	25.49535			

	Coefficients	Standard Error	*t* - Stat	*p* - value
Intercept	7.012723409	0.069369	101.0928877	0.014748574
*D*2	-0.864830226	0.149677	0.077983149	0.707921458
*D*2*t*	0.012160848	0.001969	-0.175075552	0.019011245
T	0.012076666	0.001652	0.312245455	0.100127412
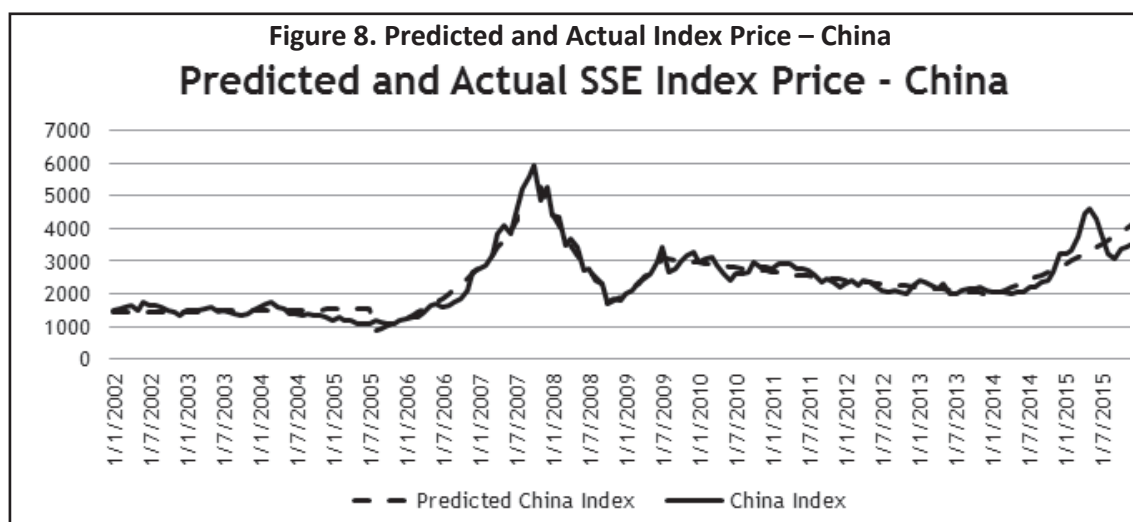
Figure 8. Predicted and Actual Index Price – China

period, the index price was showing growth. During the crisis period, the dummy variable $D2$ is negative, having a value of -0.8648, which shows a fall in the overall index prices during the crisis period (it was expected that during the period of the global crisis, the index prices would fall). Here, the change in slope, that is, $D2.t$ is 0.01216 (Table 14), which is statistically significant, indicating that every time there is a correction in the index prices, it leads to a positive slope of index prices. The overall growth in the index prices with respect to time is 0.01207. Although the value is positive, but it is very small in number. It depicts that even though in the period of crisis the index prices fell, but still, the values showed a little amount of growth over a period of time, but these results are not statistically significant as the p - value is more than 0.05 (Table 14). Hence, it leads to acceptance of null hypothesis H_{04} that there is no significant difference between returns of China index during pre and post global financial crisis in the long run.
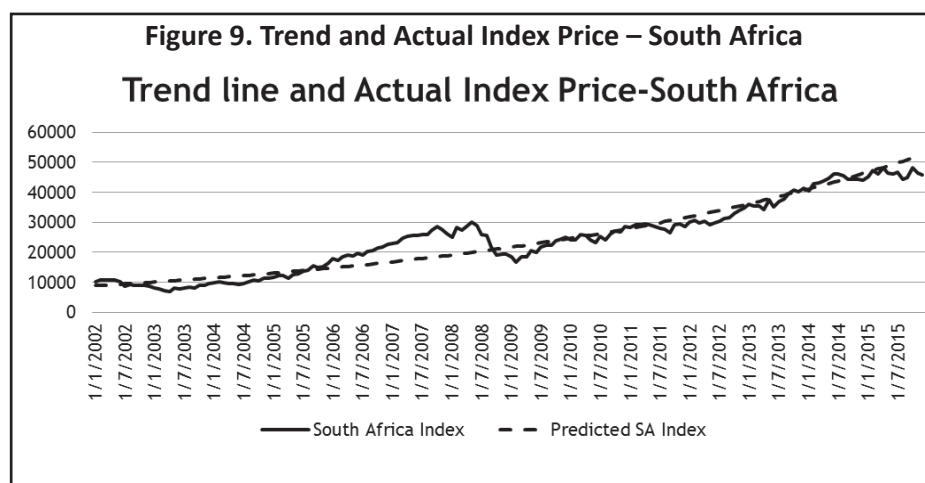
Figure 9. Trend and Actual Index Price – South Africa

Table 15. Summary Output of Regression Analysis (Without Dummy) for South Africa

Regression Statistics

Multiple R	0.945619042
R Square	0.894195373
Adjusted R Square	0.893557996
Standard Error	0.179024907
Observations	168

ANOVA

	Df	SS	MS	F	Significance F
Regression	1	44.96377448	44.96377448	1402.93	7.06E-83
Residual	166	5.320286273	0.032049917		
Total	167	50.28406075			

	Coefficients	Standard Error	t - Stat	p - value
Intercept	9.077760719	0.027747926	327.1509626	0.33215235
T	0.010667577	0.000284805	37.45570051	.060124474

(v) South Africa : Index Trend Equation : $\text{Ln South Africa Index}_t = \alpha + \beta \text{Time} + u_t$

The initial trend analysis shows that for the South African index price, the value of R Square is 0.8941 for 168 observations and the intercept coefficient is 9.0777 (Table 15). Here, time is the explanatory factor and its coefficient is 0.01066. Since both the coefficients are not statistically significant and trend line is not fitting with actual line (Figure 9) too, therefore, we introduced the dummy variable for the purpose of analyzing the effect of the crisis on the index prices of South Africa. We took the crisis as a dummy and then reframed our whole model to the tune of measuring the impact of the crisis.

Index Trend Equation : $\text{Ln South Africa Index}_t = \alpha + D2 + \beta_1 t + \beta_2 D2.t + u_t$

Index Trend Equation : $\text{Ln South Africa Index}_t = 8.81652 + 0.4119872 + 0.0184561t + (-0.00913)D2.t + u_t$

After the introduction of the dummy variable, the model shows some improved results as the trend line is fitting

Table 16. Summary Output of Regression Analysis (with Dummy) for South Africa

Regression Statistics	
Multiple R	0.967415994
R Square	0.935893705
Adjusted R Square	0.934721029
Standard Error	0.140198571
Observations	168

ANOVA

	Df	SS	MS	F	Significance F
Regression	3	47.0605359	15.6868453	798.0836969	1.45542E-97
Residual	164	3.22352485	0.019655639		
Total	167	50.28406075			

	Coefficients	Standard Error	t - Stat	p - value
Intercept	8.816527911	0.033392364	264.0282658	0.04578217
$D2$	0.411987121	0.072050445	5.718037171	0.979831245
$D2.t$	-0.009183091	0.000947988	-9.68693261	0.867111478
T	0.018456133	0.000795019	3.21471523	0.060781453

Figure 10. Predicted and Actual Index Price – South Africa
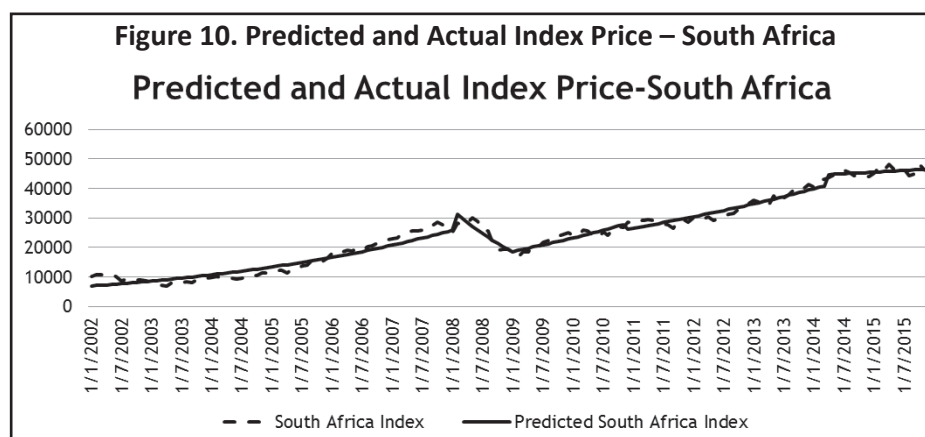
with the actual line (Figure 10). The intercept here shows growth in the index prices before the crisis. The coefficient of intercept is 8.816527, and it is statistically significant. Therefore, we can say that before the crisis period, the index price was showing growth. During the crisis period, the dummy variable $D2$ is positive, having a value of 0.411987, which shows a rise in the overall index prices during the crisis period. It was although expected that during the period of global crisis, the index prices would fall, but here, in case of South Africa, it rose with corrections. The reason for the same could be that during this period of global crisis, the South African economy was growing, therefore, the negative shocks of the crisis were absorbed by the economy to some extent. Although the South African market also responded to the crisis later on, but the overall index price showed growth. Here, the change in slope, that is, $D2.t$ is -0.0091830 (Table 16), which indicates that every time there is a correction in the index prices, it leads to a negative slope of index prices. The overall growth in the index prices with respect to time is 0.018456. Although the value is positive, but it is very small in number. It depicts that even tough in the period of

crisis, the index prices of South Africa showed a positive response towards growth in the South African index, but these results are not statistically significant as the p - value is more than 0.05 (Table 16). Hence, it leads to acceptance of null hypothesis H_{05} that there is no significant difference between returns of the South African index during pre and post global financial crisis in the long run.

Discussion and Conclusion

The global financial crisis of 2007-2008 left every economy in a state of shock and also increased the volatility of the markets in the world too as internationalization of capital markets not only gives an opportunity to investors to invest their money in their own country but also the country of their choice too, and diversification opportunities exist in BRICS markets with interlinkages. These findings are supported by the results of Sharma et al. (2013). Grima and Caruana (2017) observed that BRIC's stock market returns were affected by the U.S. financial stress during the 2008 financial crisis. So, we tried to analyze the impact of the global financial crisis on BRICS's stock markets. Our results also reveal that the BRICS were subject to spillover effect during and following the financial crisis.

We observe from the results that Brazil, Russia, and China had a high degree of volatility in their stock markets, and hence, there was a negative growth in the market index value. But in our study, we also observe that India and South Africa are the two countries, who although showed some downfall in their respective index prices at the beginning of the crisis, but after a while, both market index prices picked up the upward trend with corrections from time to time, although the p - values for our results are not statistically significant, which led us to accept the null hypotheses that no major difference was observed before and after the crisis in the growth rates. We tried to investigate the possible causes of the same, and we observe that both India and South Africa were in the phase of growth during the study period. Therefore, even if the crisis was there, but still, India and South Africa managed to absorb the impact, and therefore, showed a positive momentum in the stock index prices, which is in conformity with the results obtained by Tyagi and Naseem (2014). Not only this, being high growth emerging nations, the BRICS, in fact, saw more foreign investment flows (Tyagi & Naseem, 2014), which make our results similar to Banerjee and Vashisht's (2010) study that just because of the long term horizon, these nations recovered successfully from the crisis as they invited more foreign investments in the markets to recover, and hence, no significant difference was observed before and after the crisis in the long run in the stock index prices.

Research Implications

The study highlights the behavior of the BRICS countries' stock markets in the financial crisis. This information can be utilized in order to formulate policies with respect to governance and to target more capital inflows in the economy. Therefore, this study can act as a guiding force in order to form different policies for inviting more foreign capital in BRICS nations, especially in India. It could be used by the FIIs in order to take investment decisions keeping in mind the international diversification opportunities which exist in BRICS markets.

Limitations of the Study and Scope for Further Research

The present study focused on evaluating the impact of the financial crisis on the growth of BRICS' countries stock index prices in the pre and post crisis period. The study period was from 2002-2015. If the study period was extended, it could have provided more meaningful information. Only one stock exchange was picked as to represent a nation's stock market, however, more than one leading stock exchange is present in case of India and

China, respectively. Time as a dummy was used, taking only index price as the explanatory variable.

More than one leading stock exchange can be taken in the case of China and India while conducting research in the future on the present subject matter. The time period could also be extended in order to have a broader view of the scenario. More variables could be used in future instead of only index price as the explanatory variable. Not only BRICS, but other major emerging nations can also be taken to have a broader perspective with respect to the global financial crisis. A future study can also be done to study the impact of the financial crisis on the efficiency of these markets in line with the study of Vieito et al. (2013).

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