

Stock Return Volatility Effect: Study of BRICS

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Abstract: The present study examines the stock return volatility relationship of emerging economies from 2007 to 2013 which also includes the financial crisis of 2008 and its impact on emerging economies of the world. For the methodology, GARCH model is used to examine the impact of news coming from US which is affecting the returns of global index S&P 500 as well as the returns generated by the indices of the BRICS countries. The study found that BRICS stock market except Brazil and Chinese stock market has been significantly affected by the news of in US stock market. There exists a significant difference in the stock return volatility in all the countries stock markets. These findings have important implication for the investors seeking portfolio diversification. This study is important for the Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs). Since the study is confined to BRICS stock market only, effect of FIIs investment and influence of developed stock markets returns cannot be ruled out.

Keywords: Volatility, stock market return, Inter linkages, global crisis, portfolio diversification, conditional variance

1. Introduction

Growing inter linkages among the global economies in the modern era invites a major menace of spread of financial distress from one market, asset class and nation to the other markets. Financial crisis have become a part and parcel of the modern financial system. Search for higher return and associated risk has become a common base for these crises. The crises that originated from the developed economies not only affect their own countries but also have spillover effect on the emerging economies and other developing countries. During these crises, stock market may witness which may lead to stock price fall and volatility in both the developed and developing economies. The global financial crisis which started with the onset of US subprime crisis in August 2007 saw a fall of major banks and stock market worldwide. The Indian stock markets were badly affected by US financial crisis; there was a decline of 60 percent in the index and US\$ 1.3 tn was wiped out in terms of market capitalization. This financial spillover has evolved due to rising correlation between global equity prices and sudden reversal of capital flow leading to disastrous effect on the economy. There have been many crises earlier but majority of these crises were not as serious as the crisis of US subprime crisis in 2008. The degree and intensity of this crisis vary from country to country based on their financial system and markets. This crisis had a negative effect on the volatility pattern of stock price returns. The volatility of returns has become a key issue for researchers and analyst in financial markets. The stock price and other assets depend on the expected volatility of

returns; therefore, banks and other financial institutions make volatility assessments as a part of monitoring their investment risk exposure.

Several studies have been carried out to analyze the relationship between stock returns and volatility but only a few studies focus on the behavior of stock indices returns during the financial crisis. A majority of studies have been carried out in the context of the developed countries. Therefore, it is very significant to measure the impact of US sub-prime crisis of 2008 on the stock return indices of emerging economies like BRICS during the crisis and recovery period. Table 1 shows the various countries and their respective indices included in the study.

Table1. Sample countries and their Indices

S.no	Country	Region	Stock Exchange	Index Selected	Abbreviation Used
1.	Brazil	America	BM & FBOVESPA	BOVESPA Index	BOVESPA
2.	Russia	Europe	Moscow Interbank Currency Exchange	MICEX Index	MICEX
3.	India	Asia	National Stock Exchange	CNX NIFTY 50	NIFTY
4.	China	Asia	Shanghai Stock Exchange	SSE Composite	SSECOMPOSITE
5.	South Africa	Africa	Johannesburg Stock Exchange	FTSE/JSE Top 40 Index	JSETOP40

2. Review of literature

Looking at the time varying behavior of volatility, ARCH model was conceived by Engle (1982), which was further developed into GARCH model by Bollerslev (1986). Since then a number of elongation of the basic GARCH model customized for estimating the conditional volatility of financial time series have been formulated.

Malkiel (1979) and Pindyck (1984) concluded that the upward trend in U.S volatility has been major reason behind the decline in U.S stock prices during 1970s and 1980s. Hilliard (1979) examined the relationship between the 10 major equity market indices during worldwide financial crisis and found closed relationship among the indices. According to Poterba and Summer (1986) a considerable impact of volatility on the stock price can take place if the shocks to volatility persist over long time. French et al. (1987) examined the relationship between stock returns and stock market volatility of NYSE for 1928 to 1984 and found a positive unexpected change in volatility that had increased future expected risk premium and lowered the current stock prices. Baillie and DeGennaro examined the expected return on stock portfolio and risk using the GARCH model and found a weak relationship between mean returns and volatility of stock prices. Schwert (1990); Engle and Mustafa (1992) concluded that stock volatility increased extensively after the crash of 1987. Cheung and Ng (1992) found that the firm's stock return and changes in volatility had a negative relationship.

Arshanapalli, Doukas and Lang (1995) examined the co integration among stock markets of US, Japan & five other Asian countries and the change in their relationship over a period of time. They also studied the

impact of US and Japanese stock markets on five Asian markets for the pre and post 1987. It was found that the extent of co integration among all these markets have increased after the 1987 crash signifying arbitrage activities between US and other Asian markets . Asian markets were more integrated with the US market. Choudhry (1996) studied the volatility in six emerging economies before and after the 1987 stock market crash and found changes in the ARCH parameter risk premia and persistence of volatility before and after the 1987 crash.

Kearney (2002) has suggested the transmission of conditional volatility from U.S/Japan to other European markets. Kumar and Mukhopadhyay (2002) have found significant return and volatility spillover from U.S to India. Nath and Verma (2003) found no co-integration between the Indian stocks market with those of Taiwan and Singapore. Wang and Gunasekarage (2005) examined the return and volatility spillover from U.S and Japan to three South-East Asian capital market viz. India, Pakistan and Sri Lanka. They found a return spillover from U.S and Japan to all the three markets. Mukherjee and Mishra (2005) using daily data also reported that the Indian stock market was not integrated with the above mentioned developed nations. Similarly, other researches on the integration of the Indian stock market with that of the emerging markets also provided mixed results. Mukherjee and Mishra (2005) discovered that the Indian stock market was integrated with the emerging Asian markets of Indonesia, Malaysia, Philippines, Korea and Thailand. Ahmad, Ashraf and Ahmed (2005) examined the interlinkages and causal relationship between the NASDAQ composite index in the US, the Nikkei in Japan with that of NSE Nifty and BSE SENSEX in India using daily closing data from January 1999 to August 2004. The study used Granger Causality and Johansen Co-integration method to examine short run and long term relationship among the stock market respectively. The results of Co-integration test revealed that there was no long term relationship of the Indian equity market with that of the US and Japanese equity markets. Granger causality test suggested that there was a unidirectional relationship from NASDAQ and Nikkei to Indian stock markets. Li et al. (2005) analyzed the relationship between the expected stock returns and volatility of 12 largest stock markets for the period 1980 to 2001 using EGARCH-M model and found a negative relationship between stock returns and volatility.

Sulin et al. (2007) examined the volatility of Shenzhen stock market by using the weekly closing price and concluded that AR (1) model exhibits the best predicting result. Chuang et al. (2007) have investigated the volatility interdependence in six East Asian markets and have found strong interdependence among the conditional variance of different markets specially the Japanese market which was found to be most influential in transmitting volatility to the other East Asian markets. Kenourgios et al. (2007) studied the nonlinear relationship between four emerging stock markets BRIC and two developed markets (the U.S and the UK) during the five recent financial crisis and found that there is an asymmetric increase in dependence among the stock markets during these entire five crisis. Yu and Hassan (2008) discovered conditional volatility between MENA and world stock market using the EGARCH- M models and found volatility spillover within the MENA region to be higher than the cross- volatility spillovers all over the world. Bhar and Nikolova (2009) studied the level of integration and the dynamic relationship between the BRIC countries and the world and found that India showed the highest level of regional and global integration among the BRIC countries followed by Brazil and Russia and lastly by China.

Sheikh (2010) concluded that Indian economy was hurt by the global financial recession; the Indian banks were in better position to recover quickly and grow as they did not have significant exposure to sub-prime loans like other bank. Mishra (2010) studied the stock market integration and volatility spillover between

India and its major Asian counterpart and found a positive and significant flow of information flowing to and from these markets to India and vice versa. Diamandis et al.(2011) examined the three groups of stock market indices and found skewed ARCH model outperform all other specification modeling VaR for either long or short position.

Babikir et al.(2012)examined the stock return volatility using both in-sample and out of sample tests applied to daily return of the Johannesburg Stock Exchange (JSE) Index and found a high level of persistence and variability in the parameter estimates of the GARCH(1,1) model across the sub-sample. Zhou et al. (2012) analyzed the directional volatility between the Chinese and world equity markets and found that Chinese market had a significant positive impact on other markets since 2005.Tripathy and Rahman (2013) studied the conditional volatility of both Bombay Stock Exchange (BSE) and Shanghai Stock Exchange (SSE) based on the daily closing value of 23 years data and found that there is significant ARCH effect in both the stock markets. Makkar and Singh (2013) analyzed the stock return behavior of two Indian commercial banks SBI and ICICI bank during the period of financial crisis and found that the stock prices of ICICI bank was more affected by the U.S subprime crisis compared to SBI. Singh and Kishor, (2014) examined the effect of macro-economic variables on stock market indices and found no inter linkages between gold price and Nifty indices. Singh and Makkar (2014) examined the relationship between the crisis and stock returns volatility in the Indian banking sector and applied GARCH model to capture the impact of the crisis on the volatility of banks and found that crisis had a significant impact on the stock volatility of the Indian banking sector and stock return volatility has significantly changed during the pre and post crisis period.

The above literature reviews reveal that not much work has been carried out on BRICS stock market Indices return volatility during the financial crisis and therefore, the present study makes an attempt to measure the stock market Indices volatility during the U.S financial crisis of 2008.

3. Objectives and methodology

The main objectives are to fit an appropriate GARCH model to estimate the conditional market volatility based on the market Indices return of BRICS stock market. The objectives of the present study are: To find out the trends in Stock market Indices volatility of BRICS countries and to analyze the significant impact of news from US stock market on the volatility of Stock Exchanges of BRICS countries. The hypotheses of the study are: **H01:** BRICS Indices returns are not stationary or got unit root. **H02:** There is no significant impact of news from US markets on stock returns volatility of BRICS indices during the period.

3.1. Data source and time period

This study is mainly based on secondary data that have been collected from the database maintained by BRICS Stock Exchanges websites and from websites like www.investing.com and www.yahooofinance.com. The study analyses the daily data on Stock indices return of Brazil, Russia, India, China and South Africa for the aforesaid period. Wherever data were missing, the averages of the data of the previous date and next date have been taken. The paper examined the BRICS countries Stock Indices over the period of four years starting from 1stJanuary 2007 to 31st December 2013. Daily adjusted closing

value on the day has been used. The daily stock market returns (R_t) based on individual BRICS indices have been calculated by the logarithmic difference change in the BRICS stock indices i.e.,

$R_t = \text{Log} (P_t / P_{t-1})$ where P_t and P_{t-1} are the closing value of daily BRICS stock indices at time 't' and "t-1" respectively. Where P_t is the present indices value and P_{t-1} is the previous day's indices value.

3.2. Tools and techniques

The following tools and techniques have been used to test the hypotheses:

Unit Root Test: In order to check whether or not the series are stationary, Augmented Dickey-Fuller unit root test has been applied to examine the stationarity of the time series of the study and to find the order of integration between them. The ADF unit root test has been performed by estimating the regression: $\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum \gamma_j \Delta Y_{t-j} + \varepsilon_t$

The ADF unit root test is based on the null hypothesis $H_0: Y_t$ is not $I(0)$. If the calculated ADF statistics is less than the critical value, then the null hypothesis is rejected; otherwise accepted.

GARCH model: The volatility of stock price is estimated through Generalized Auto Regressive Conditional Heteroscedasticity (GARCH) model. The model is applied mainly to analyze the financial data and has proven its worth in estimating the volatility in developed and developing markets. Statistically, volatility denotes strong autocorrelation in squared returns, which can be detected through Heteroscedasticity tests.

GARCH is a generalized form of ARCH, which helps in judging the volatility (Bollerslev, 1986). GARCH captures the tendency for estimating time series data for volatility clustering. The model helps to know the behavior of returns, where the behavior of the dependent variables is postulated to be function of the past values of the dependent and independent variables (Engle, 2002). It enables the understanding of the relationship between information and volatility. GARCH (1, 1) model for daily stock return is:

$$Y_t = a + bY_{t-1} + \varepsilon_t$$

Variance equation is given as:

$$h_t = \omega + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1}$$

Where $\omega > 0$, $\alpha \geq 0$, $\beta_1 h_{t-1} \geq 0$. h_t is the conditional variance and h_{t-1} is the conditional variance calculated based on past information. Using GARCH, it is possible to interpret the current fitted variance (h_t) as a weighted function of a long term average value (dependent on ω), information about the volatility during the previous period ($\alpha_1 \varepsilon_{t-1}^2$) and the fitted variance from the model during the previous period ($\beta_1 h_{t-1}$). The stationarity condition for GARCH (1, 1) is $\alpha_1 + \beta_1 < 1$. In order to avoid spurious regression, stationarity of the data is checked through Augmented Dickey Fuller (ADF) test. Minimum Akaike Information Criteria is used to determine the number of lags.

4. Discussion and analysis

The study measures the impact of news of US stock markets on the stock returns of the BRICS stock markets through GARCH model. . Before analyzing the data, stationarity of time series is checked through

ADF test. Since we have taken the returns of the indices using log natural returns of each index, so the issue of stationarity is taken care off at the level only. For performing the econometrics analysis, it is essential to make sure that the series under reference are stationary. The log of the five series has been taken. In this way five new variables are created which denote the return on Brazil Stock Exchange, Russian Stock Exchange, National Stock Exchange, Shanghai Stock Exchange and Johannesburg Stock Exchange respectively.

Table 2. Unit Root Test for stock indices of BRICS countries

S.no	Country	At level	Critical values				
		ADF test Statistics	1%	5%	10%	p-value	DW Statistics
1	Brazil	-23.53371	-3.43764	-2.86466	-2.56847	0.00001	2.005531
2	Russia	-39.53752	-3.43476	-2.86465	-2.56846	0.00001	2.051722
3	India	-29.17971	-3.43763	-2.86464	-2.56847	0.00001	1.996095
4	China	-28.67311	-3.43763	-2.86464	-2.56847	0.00001	1.996368
5	South Africa	-28.96633	-3.43764	-2.86464	-2.56847	0.00001	1.995867

Source: Authors calculation.

The results in Table 2 indicate that the unit-root is not present in the levels of all indices. In all the cases of BRICS indices the P value of individual index is less than 5 per cent. Therefore, the null hypothesis of existence of unit root is rejected at level indicating stationarity in data which means equity stock indices of BRICS are integrated at level only as we have taken Log natural returns of each index. The null hypothesis for ADF test is; the data has a unit root. The calculated ADF statistics for Brazil stock return (-23.53371), Russian stock return (-39.53752), Indian stock return (-29.17971), Chinese stock return (-28.67311) and South African stock return (-28.96633) which all are less than the critical value (-3.4376, -2.8646 and -2.5684 at 1%, 5% and 10 %, respectively) therefore, the null hypotheses H0 is rejected.

The results of estimated GARCH model are presented in Table 3. First, the model is applied on the whole length of data using dummy variables (taking the value 0 for the crisis period and 1 for the post crisis period). Then the GARCH model is applied on the BRICS stock indices returns for crisis and recovery periods.

Variance equation for dependent variables, BRICS stock returns:

$$\text{GARCH} = C(3) + C(4) * \text{RESID}(-1)^2 + C(5) * \text{GARCH}(-1) + C(6) * \text{SQRUSNEWS}(-1)$$

In the mean equation, the US news has been taken through a residual series after taking the impact of S&P 500 own returns at previous day on today return and the impact of its own news which was further captured through making a residual series and taking the square of the residual series, its impact have been tested on the individual BRICS indices indicating that the impact of news emanating from US stock markets on BRICS indices and it was found it had an mixed impact on the stock returns of the BRICS stock markets i.e. all the BRICS stock market's volatility were affected by this.

The coefficient of Bovespa stock returns is very low in periods as presented in table 3 is 9.67E-06 (i.e., 0.0000967). The coefficient of ARCH and GARCH (α and β) are significant, which reveals the persistence of information effect on the stock returns volatility. The ARCH coefficient (α_1) is high in the period (0.0885). The high value of GARCH coefficient (β_1) in the period (0.8678) indicates that the volatility of stock returns is high during this period. It also describes the increasing effect of old news in the stock price volatility. The sum of ARCH and GARCH coefficient ($\alpha_1 + \beta_1$) is close to one for all the sub periods as it is 0.95644 for the whole period, indicating high persistence of stock return volatility. The high value of α and β implies long memory in the stock market. The information effect on the conditional variance is lasting and will take a long time to die away. The impact of US news is not significant on the Bovespa Index return.

Table 3. GARCH (1, 1) Estimate of stock returns for Brazil stock index

Brazil	Variables	Coefficient	Std. Error	Z-Stat.	Prob.
Total period	C	9.67E-06	2.53E-06	3.815909	0.0001
	RESID(-1)^2	0.088570	0.013659	6.484506	0.0000
	GARCH(-1)	0.867876	0.018338	47.32549	0.0000
	SQRUSNEW(-1)	0.027616	0.01629	1.695234	0.0900

Source: Authors calculation.

In table 4 coefficient of Micex stock returns is very low in the whole period i.e. 0.00000674. This indicates that there was volatility in the Micex stock return throughout irrespective of the US subprime crisis. Volatility in Russian stock market is always high but it was not because of global financial crisis. Russian stock markets are volatile in nature and global financial crisis has little bearing on the volatility of the stock returns. There is eminent impact of the US news on the returns of Russian stock market returns. News from the US has a major impact on the Micex index returns and volatility.

Table 4. GARCH (1, 1) Estimate of stock returns for Russian stock index

Russia	Variables	Coefficient	Std. Error	Z-Stat.	Prob.
Total period	C	6.74E-05	7.20E-06	9.365789	0.0000
	RESID(-1)^2	1.200028	0.065327	18.36957	0.0000
	GARCH(-1)	0.314903	0.016212	19.42447	0.0000
	SQRUSNEWS(-1)	0.456244	0.099682	4.577001	0.0000

Source: Authors calculation.

In table 5 the coefficient of Nifty stock returns is very low in the periods. The coefficient of the crisis period stock return is 1.86E-06 (i.e., 0.0000186). The difference in the Nifty stock returns in the whole periods is mainly due to US financial crisis as it has affected the stock market drastically. Hence the null hypothesis is rejected. The coefficient of ARCH and GARCH (α and β) are significant, which reveals the persistence of information effect on the stock returns volatility. The ARCH coefficient (α_1) is low (0.057004) indicates less impact of previous news or events in India. The high value of GARCH coefficient (β_1) in the period (0.9259) indicates that the volatility of stock returns is high due to its own previous returns. It also describes the increasing effect of old news in the stock price volatility. The sum of

ARCH and GARCH coefficient ($\alpha_1 + \beta_1$) is close to one for the period is 0.9829, indicating high persistence of stock return volatility. The high value of α and β implies long memory in the stock market. The information effect on the conditional variance is lasting and will take a long time to die away. US stock market news plays a significant impact on the stock market returns in India.

Table 5. GARCH (1, 1) Estimate of stock returns for Indian stock index

India	Variables	Coefficient	Std. Error	Z-Stat.	Prob.
Total period	C	1.86E-06	6.15E-07	3.023813	0.0025
	RESID(-1)^2	0.057004	0.009022	6.31838	0.0000
	GARCH(-1)	0.925987	0.008930	103.6914	0.0000
	SQRUSNEWS(-1)	0.017951	0.005319	3.375041	0.0007

Source: Authors calculation.

Similarly table 6 and table 7 show the SSE composite stock returns and JSE top40 stock return indices. Coefficient of stock returns is very low in the whole periods. The coefficient is 1.10E-06 i.e. (0.0000011) in case of SSE composite and 3.95E-06 i.e. (0.00000395) in case of JSE top 40 index indicates that there is a significant difference in the stock return volatility in the whole periods. The difference in the stock returns in period is mainly due to US financial crisis as it has affected the stock market drastically. Hence the null hypothesis H02 is not rejected in case of Chinese stock exchange and null hypothesis H02 is rejected in case of South African stock exchange. The sum of ARCH and GARCH coefficient ($\alpha_1 + \beta_1$) for SSE composite is close to one for the period which is for 0.9947, indicating high persistence of volatility in SSE composite stock returns and in case of JSE top 40 index the sum of ARCH and GARCH coefficient ($\alpha_1 + \beta_1$) is close to one is 0.946115 for the period which indicates long memory in the stock market.

Table 6: GARCH (1, 1) estimate of stock returns for Chinese stock index

China	Variables	Coefficient	Std. Error	Z-Stat.	Prob.
Total period	C	1.10E-06	3.88E-07	2.841028	0.0045
	RESID(-1)^2	0.024507	0.00417	5.876623	0.0000
	GARCH(-1)	0.970198	0.004477	216.7096	0.0000
	SQRUSNEWS(-1)	0.000588	0.001691	0.347828	0.728

Source: Authors calculation.

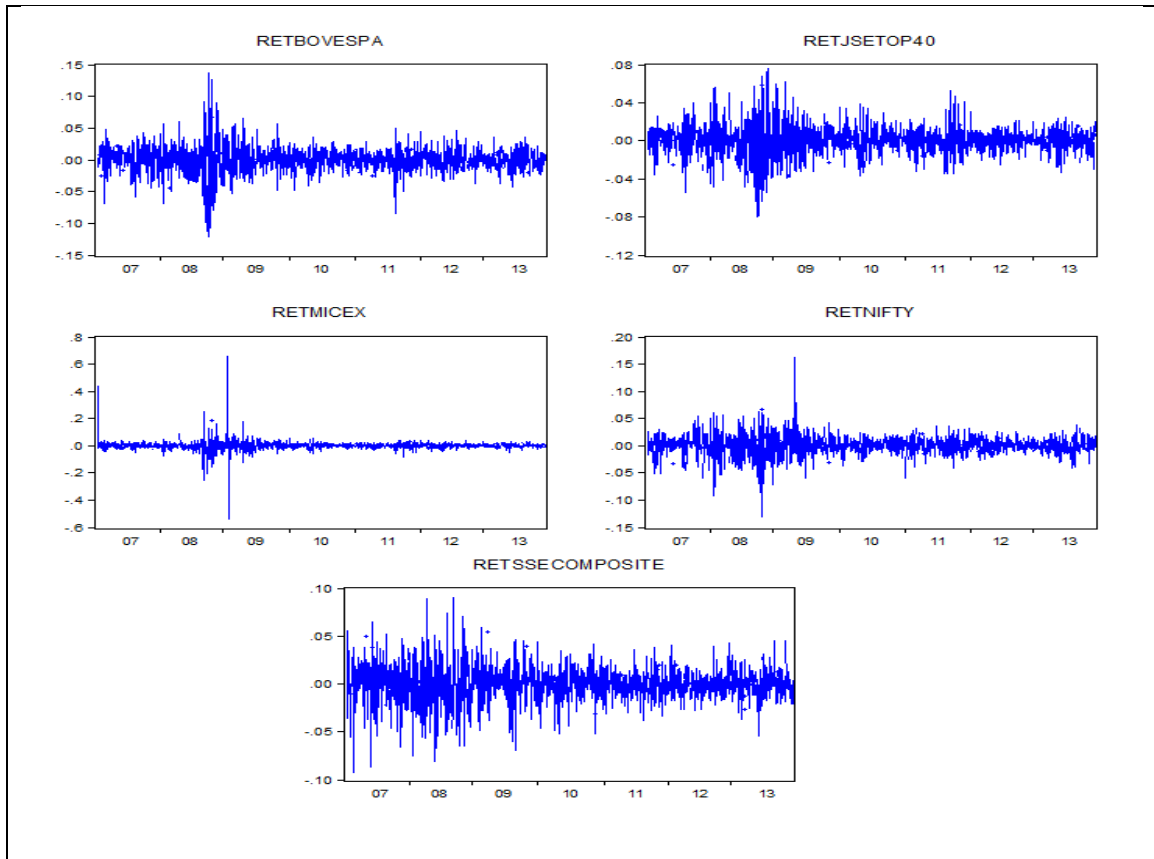
Table 7. GARCH (1, 1) Estimate of stock returns for South African Stock Index

South Africa	Variables	Coefficient	Std. Error	Z-Stat.	Prob.
Total period	C	3.95E-06	1.13E-06	3.488414	0.0005
	RESID(-1)^2	0.076486	0.014289	5.352931	0.0000
	GARCH(-1)	0.869629	0.018421	47.20804	0.0000
	SQRUSNEWS(-1)	0.044116	0.012422	3.551370	0.0004

Source: Authors calculation.

Figure 1 presents the conditional variance estimate which shows noticeable time varying trends and register high values during the end of crisis period. It clearly indicates the impact of crisis on stock market return of Bovespa whereas some volatility was witnessed at the end of 2008 but it withered out after the crisis period was over. There has been only marginal effect on the volatility in the Russian stock market that too only during the peak point of crisis but Russian markets are greatly influenced by the news of US stock markets

Figure 1. Stock market return volatility estimate for BRICS Stock Indices



Source: Authors calculation.

Figure 1 further presents the conditional estimate for Nifty stock returns. The increase in volatility during the financial crisis is obvious but during the meltdown, the volatility of Nifty stock return has increased drastically. The figure clearly indicates the effect of crisis on stock market returns of Nifty indices, the market were volatile during the crisis period and also moderate after the crisis period. The information effect on the conditional variance is lasting and will take a long time to die away. US stock market news plays a significant impact on the stock market returns in India.

Similarly other figure shows the significant negative impact of crisis on the stock market returns of Chinese and South African indices. The Chinese market was extremely volatile during the crisis period and this volatile nature continued during the whole period also. Only the intensity of volatility slenderizes after the crisis period. South African market witnessed very high volatility as compared to Russian markets during the crisis period and it continued to be moderately volatile during the recovery period also.

It is observed from the above analysis that Indices of all the BRICS stock markets were stationary at level and there was a significant difference in the volatility between the crisis period and recovery period of all the BRICS stock markets during the 2008 global crisis. However, the impact was in varying proportion depending on the internal strength of the economy of the individual BRICS countries. The crisis spread to the BRICS through all four channels- trade, finance, commodity and confidence channels. In Brazil the local currency and stock market has seen huge fluctuation as foreign investment has gone down, demand for commodity export dried up and external credit decreased, the financial markets in Russian froze due to a rise in risk aversion and sudden change in exchange rate expectation which was triggered by the collapse of oil prices in September 2008 led the Russian banks and firms to seek to hedge their foreign currency exposure which led to pressure on the rouble. Volatility of the Russian stock market is highly impacted by the US stock market news and out of all the BRICS stock markets Russian stock market, Indian and South African stock markets are influenced by the news emanating from the US whereas Brazil and Chinese stock markets are not influenced by the news from US stock markets. The Indian economy remained insulated but there was fall in GDP growth rate and external demand shock had a larger impact on output and employment. Impact of the financial crisis on China took the form of decrease in external demand which led to economic slowdown and rising unemployment. In case of South Africa, portfolio inflows had accounted for the bulk of financing of South Africa's large CAD (Current Account Deficit) which led to large net outflows, both export and import volumes felled which affected South African's main export commodities weakened. The global financial crisis inflicted significant loss in output in all the BRICS economies. Information spillover from US to these emerging economies is quite evident and it has been observed that bad news affects the volatility more as compare to good news emanating from the US market. The US crisis of 2008 impacted the BRICS economy in a big way and global index like S&P 500, Nikkie225 and FTSE100 have informational spillover affect over emerging economies stock markets.

5. Conclusion

The present study examined the relationship between the BRICS stock returns volatility and the news generated from US market including the recent financial crisis of US. GARCH model was applied to analyze the time varying volatility and stock price reaction to the crisis. The study found that BRICS stock market except Brazil and Chinese stock market have been significantly affected by the news of US stock market. There was a significant difference in the stock return volatility in all the countries stock markets in the whole period. The ARCH and GARCH coefficient explain significantly the persistence of information on BRICS stock return volatility. The findings point out the increasing effect of old news in the market and long lasting memory. This clearly indicates the impact of the global financial crisis on the BRICS stock returns except moderate affect on the Brazilian and Chinese stock market where stock market volatility got affected very little by the global crisis. In case of global crisis, Indian stock market took some time to react which shows that the Indian economy seems to be immune from this crisis which may be due to stringent banking sectors. This study has driven some important policy implication. Our findings suggested that stock market return volatility of BRICS countries has been significantly affected in the whole period.

There has been information spillover from the US markets to these BRICS stock market returns. All the news whether good and bad has a significant impact on BRICS stock market returns. These findings have important implications for the investors seeking portfolio diversification. This study may be significant for the Foreign Institutional Investors (FIIs) and Domestic Institutional Investors (DIIs). It is a well-known

fact that FIIs come for short term returns. They are attracted towards a market which has high degree of volatility or FIIs are interested in causing volatility because without volatility or speculations the FIIs may not gain such high return. The result will help the DIIs and the MFs to analyze the movement of FIIs and their impact on BRICS Indices and plan their strategies accordingly. It has been seen when FIIs sell their stocks, DIIs and Mutual Funds start buying. This means that DIIs have been investing in a falling market, trying to take advantage of the volatility in the prices of stocks. Therefore, volatility may be contained to tone down the negative impact of the withdrawal of FIIs.

References

- Ahmad, K. M., Ashraf, S. and Ahmed, S. (2005). Foreign Institution Investment Flows and Equity Returns in India, *The ICAFI Journal of Applied Finance*, 11:16-30. <http://ssrn.com/abstract=1701154>
- Arshanapalli, B., Doukas, J. and Lang, L. H. (1995). Pre and Post October 1987 Stock Market Linkages between US and Asian Markets, *Pacific Basin Finance Journal*, 3:57-73. doi:10.1016/0927-538X(94)00025-3
- Babikir, A., Gupta, R., Mwabutwa, C. and Owusu-Sekyere, E. (2012). Structural Breaks and GARCH Models of Stock Return Volatility: The Case of South Africa, *Economic Modelling*, 29(6):2435-2443. doi:10.1016/j.econmod.2012.06.038
- Baillie, R. T. and DeGennaro, R. P. (1990). Stock Returns and Volatility, *Journal of Financial and Quantitative Analysis*, 25(2):203-214. <http://dx.doi.org/10.2307/2330824>
- Bhar, R., & Nikolova, B. (2009). Oil Prices and Equity Returns in the BRIC Countries, *The World Economy*, 32(7):1036-1054. DOI: 10.1111/j.1467-9701.2009.01194.x
- Bollerslev, T. (1986). Generalised Autoregressive Conditional Heteroscedasticity, *Journal of Econometrics*, 31:307-327. DOI:10.1016/0304-4076(86)90063-1
- Cheung, Y. W. and Ng, L. (1992). Stock Price Dynamics and Firm Size: An Empirical Investigation, *Journal of Finance*, XLVII(5):1985-1997. DOI: 10.1111/j.1540-6261.1992.tb04693.x
- Choudhry, T. (1996). Stock Market Volatility and the Crash of 1987: Evidence from Six Emerging Markets, *Journal of International Money and Finance*, 15(6):969-981. DOI:10.1016/S0261-5606(96)00036-8
- Chuang, I. Y., Lu, J. R. and Lee, P. H. (2007). Forecasting Volatility in the Financial Markets: A Comparison of Alternative Distributional Assumptions, *Applied Financial Economics*, 17(13): 1051-1060. DOI:10.1080/09603100600771000
- Diamandis, P. F., Drakos, A. A., Kouretas, G. P. and Zarangas, L. (2011). Value-at-Risk for Long and Short Trading Position: Evidence from Developed and Emerging Equity Markets, *International Review of Financial Analysis*, 20(3):165-176. DOI:10.1016/j.irfa.2011.02.009
- Engle, R. (2002). Dynamic Conditional Correlation: A Simple Class of Multivariate Generalized Autoregressive Conditional Heteroscedasticity Models, *Journal of Business & Economic Statistics*, 20(3):339-350. DOI:10.1198/073500102288618487
- Engle, R. F. and Mustafa, C. (1992). Implied ARCH Models from Options Prices, *Journal of Econometrics*, 52(1):289-311. DOI:10.1016/0304-4076(92)90074-2
- French, K. R., Schwert, G. W. and Stambaugh, R. F. (1987). Expected Stock Returns and Volatility, *Journal of Financial Economics*, 19:3-29. DOI:10.1016/0304-405X(87)90026-2
- Hilliard, J. (1979). The Relationship between Equity Indices on World Exchange, *The Journal of Finance*, 34:103-114. DOI: 10.1111/j.1540-6261.1979.tb02074.x

- Kearney, C. (2001). The Determination and International Transmission of Stock Market Volatility, *Global Finance Journal*, 11(1):31-52. DOI:10.1016/S1044-0283(00)00015-6
- Kenourgios, D. and Samitas, A. (2007). Financial Development and Economic Growth in a Transition Economy: Evidence for Poland, *Journal of Financial Decision Making*, 3:35-48.
<http://ssrn.com/abstract=1327774>
- Kumar, K. K. and Mukhopadhyay, C. (2002). *Equity Market Interlinkages: Transmission of Volatility-a Case of US and India*, NSE, India Research Paper, <http://www.nseindia.com>.
- Li, Q., Yang, J., Hsiao, C. and Chang, Y. C. (2005). The Relationship between Stock Returns and Volatility in International Stock Markets, *Journal of Empirical Finance*, 12(5):650-665. DOI:10.1016/j.jempfin.2005.03.001
- Makkar, A. and Singh, S. (2013). *Banking Stock Price Volatility & Global Financial Crisis*, Rohtak: Luxmi Publishing House.
- Malkiel, B. (1979). The Capital Formation Problem in the United States, *Journal of Finance*, 34: 291-306. DOI: 10.1111/j.1540-6261.1979.tb02092.x
- Mishra, R. K. (2010). Stock Market Integration and Volatility Spillover: India and its Major Asian Counterparts, *Research in International Business and Finance*, 24(2):235-251. DOI:10.1016/j.ribaf.2009.12.004
- Mukherjee, D. and Mishra, R. (2005). Stock Market Interlinkages: A Study of Indian and World Equity Markets, *Indian Journal of Commerce*, 58(1). <http://ssrn.com/abstract=746324>
- Nath, G. and Verma, S. (2003). Study of Common Stochastic Trend and Co-integration in the Emerging Markets: A Case Study of India, Singapore and Taiwan, *Research paper. NSE-India*.
- Pindyck, R. (1984). Risk, Inflation and the Stock Market, *American Economic Review*, 74:335-351. (DOI): 10.3386/w1186
- Poterba, J. M. and Summers, L. H. (1987). *The Persistence of Volatility and Stock Market Fluctuations*, NBER working paper series, working paper no 1462.
- Schwert, G. W. (1990). Stock Volatility and the Crash of '87, *Review of Financial Studies*, 3:77-102. DOI: 10.1093/rfs/3.1.77
- Shaikh, R. K. (2010). Global Economic Recession and its Impact on Indian Economy, *International Research Journal*, 1(2):61-62.
- Singh, R. P. and Kishor, N. (2014). Co-Integration of Gold Price Movement with Nifty Indices: A study in Indian Context, *Transnational Corporation Review*, 6(1):42-57.
<http://tnc-online.net/journal/html/?483.html>
- Singh, S. and Makkar, A. (2014). Relationship between Crisis and Stock Volatility: Evidence from Indian Banking Sector, *IUP Journal of Applied Finance*, 20(2):75-83.
<http://ssrn.com/abstract=2508586>
- Sulin, P., Feiqi, D. and Yanming, W. (2007). A Comparison of Forecasting Models of the Volatility in Shenzhen Stock Market, *Acta Mathematica Scientia*, 27B(1):125-136. DOI:10.1016/S0252-9602(07)60011-3
- Tripathy, S. and Abdul, R. S. (2013). Forecasting Daily Stock Volatility using GARCH Model: A Comparison between BSE and SSE, *The IUP Journal of Applied Finance*, 19(4):71-83. <http://ssrn.com/abstract=2445825>
- Wang, Y., Gunasekarage, A. and Power, D. M. (2005). Return and Volatility Spillovers from Developed to Emerging Capital Markets: The Case of South Asia, *Economic Finance Analysis*, 86:139-166.
- Yu, J. S. and Hassan, M. K. (2008). Global and Regional Integration of the Middle East and North African (MENA) Stock Markets, *Economic Finance*, 48(3):482-504. DOI:10.1016/j.qref.2006.06.003
- Zhou, X., Zhang, W. and Zhang, J. (2012). Volatility Spillovers between the Chinese and World Equity Markets, *Pacific-Basin Finance Journal*, 20(2):247-270.
DOI:10.1016/j.pacfin.2011.08.002

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