ANALYSIS OF STOCK MARKET VOLATILITY:
A COMPARATIVE STUDY OF INDIA AND CHINA

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Indian capital market has witnessed liberalisation for more than two decades on account of ongoing economic and financial sector reforms initiated by the Government of India since 1991. The information technology revolution, substantial deregulation and harmonization has led to increasing free flow of capital across and within markets that has fostered integration. This market integration has resulted in transmission of volatility from one market to other as well as within markets. The general concern which is emerging with such developments is the increased volatility of equity returns. The present paper is an attempt to understand the nature of volatility in Indian and Chinese stock markets and examine the interlinkage between them. The study uses monthly returns from Bombay Stock Exchange (BSE Sensex) for Indian stock market and Shanghai Stock Exchange (SSE COMPOSITE) for Chinese stock market respectively from April 01, 2004 to March 31, 2012. The transmission of volatility between India and China is examined by applying Granger causality test. The results show that the volatility was at its highest level in the year 2008 in both the countries. However, the Indian stock market is found to be more volatile than Chinese stock market but returns in Indian stock market were comparatively more than in China.

Keywords: Volatility, Integration, Volatility Transmission, India, China.

INTRODUCTION
Volatility refers to the amount of uncertainty or risk about the magnitude of changes in security’s value. Volatility measures variability of dispersion about a central tendency. Glen (1994) defined volatility as the frequency and magnitude of price movements. According to Batra (2004), it is a measure of how far current price of an asset deviates from its average past prices. A higher volatility means that a security’s value can potentially be spread out over a larger range of values. This implies that the price of the security can change dramatically over a short time period in either direction. Investors perceive high volatility as a sign of investor nervousness and low volatility as a sign of confidence (Jain and Dash, 2012).

With the advent of globalization, world financial markets and economies are increasingly integrated due to free flow capital and international trade. Globalization has also increased co-movement in stock prices across international markets. This co-movement stimulates vulnerability to market shocks. Therefore, shocks originating in one market not only affect its own market but are also transmitted to other equity markets. Consequently, any information regarding the economic fundamentals of one country gets transmitted to other markets and thus affects other’s stock markets. Before investing in an asset, investors incorporate information about price movements and volatility in the same asset and related assets listed in different countries. This issue is an important concern for portfolio investors because greater integration among world markets implies stronger co-movements between markets, thereby nullifying much of the gain out of diversification across borders.

With the rapid growth in the economies of India and China, many investors would certainly consider investing in these two markets rather than in developed or other developing markets. However, the question of whether both markets are integrated
with each other, so that investing in either India or China will provide a benefit of diversification, is a major concern for investors. There are several reasons to analyze the cross-border volatility spillovers. In addition to various domestic factors, volatility of major foreign trading partners is one of the important determinants of stock return volatility in a domestic market.

**REVIEW OF LITERATURE**

**Studies on Trends and Reasons Leading to Volatility**

The researchers have been working around the globe on measuring the reasons of volatility in stock market. Majority of the studies have focused on one or more factors leading to volatility in stock market.

Aggarwal et al. (1999) examined the events associated with the sudden shift in volatility of stock market returns. He found that mostly country specific events caused large shift in volatility rather than global events or change in exchange rate regimes. The only global event that affected most of the emerging markets was October 1987 crash.

Pal (2005) studied the impact of change in trading behaviour of Foreign Institutional Investors (FIIs) on Indian stock market (BSE Sensex) for the period (March-June) 2004. He identified herd instinct of investors due to FIIs movement responsible for increasing volatility in stock market.

Raju and Ghosh (2004) made an international comparison of 18 countries by dividing them into developing and developed economies and found that the returns of markets in India and China were as high as that of United States (US) and United Kingdom (UK) but the volatility of both the markets was higher.

Joshi and Panday (2007) examined the nature of the volatility in the Indian stock markets using closing prices of S&P CNX Nifty and BSE Sensex stock prices and concluded that both the stock markets exhibited volatility clustering and volatility persistence. In a similar study, Kumar (2007) tried to measure the quantum and spread of volatility of daily and monthly return with respect to economic growth and concluded that volatility was higher when economic growth declined as compared to the growth periods. Sarkar et al. (2009) analysed transmission of volatility across countries leading to volatility while Kang and Yoon (2012) identified global events responsible for increasing volatility in most of the Asian markets.

**Studies on Stock Market Integration**

The studies on interdependence among equity markets are numerous. Majority of the studies have focused on the interdependence among developed and emerging markets, US being the most influential.

Cha and Cheung (1998) examined the impact of US and Japanese market on Asia’s market and found strong evidence of co-movements among world equity markets with the US market playing the leading role. Macdonald (2001) studied the interlinkages among Central and Eastern Europe (CE) stock market indices as a group and three developed markets (US, UK and Germany) and found significant long run co-movements among them. Chen et al. (2005) tried to examine the long term linkage between the three pairs of stock markets namely India – US, China – US and India – China. The results revealed that all three pairs of stock markets were fractionally integrated. It was found that the linkage between Indian and Chinese stock market was strong during the period of study.

Bhar and Nikolova (2007) analysed the degree of integration of the BRIC countries on a regional and global basis and found that high degree of integration exists between the BRIC countries and their respective regions and lesser with rest of the world. Kim (2010) investigated the impact of shock on US stock market to East Asian Economies namely Hong Kong, Singapore, Korea and Taiwan. The author found that there is a unidirectional causal relationship between US stock market and East Asian economies running from US to East Asian economies.

Singh (2010) analysed the linkage between China and India with four major developed markets and concluded that both Indian and Chinese stock market are cointegrated with all the four developed markets and also there exists a bilateral causality between India and China.

Fahami (2011) examined the impact of global financial crisis on the integration of selected
developed markets returns namely US, UK, Japan and emerging stock markets of Brazil, Russia, India, China and evidenced that causality increased during crisis period. Mukherjee (2011) examined whether the volatility of stock returns in India is significantly influenced by the stock market volatility of developed and emerging markets. The results revealed that Republic of Korea and United States positively influence the Indian stock market returns while Hong Kong and China negatively influence the Indian stock market returns.

Tripathi and Sethi (2012) examined the interlinkage between India and the advanced emerging economies i.e Brazil, Hungary, Taiwan, Mexico, Poland and South Africa. The Granger Causality results revealed that short term linkage of Indian stock market with the advanced emerging economies has increased over the period of study. Gahlot (2014) studied the nature of volatility and volatility spillover among South Asian countries. He found the existence of bilateral causal relationship between India and US, both in short and long term. Moreover, the recession has been found to have a higher shock impact on the permanent component of volatility.

The information technology revolution had a tremendous impact on the structure of financial markets with the quick diffusion of information and the substantial deregulation and harmonization which led to increasing flow of capital across and within markets that has fostered integration (Gallo and Otrando, 2007). This market integration provides an opportunity to the investors to diversify their portfolio. It also leads to transmission of volatility from one market to other markets as well as within markets and causes the linkages between stock markets around the world to be stronger.

OBJECTIVES OF THE STUDY
A lot of research has been done to determine the linkage between developed and emerging markets. However, not much attention has been given on the detection of the volatility transmission between emerging markets. Hence, this paper is an attempt to examine the trend in volatility over different months in the study period of both the emerging economies and to identify the linkage or relationship between Indian and Chinese stock market. The objectives of the current study are:

1. To determine the trend in volatility in BSE Sensex vis a vis SSE Composite.
2. To identify the reasons for volatility in Indian stock market.
3. To determine the causal relation between BSE Sensex and SSE Composite.

DATABASE AND METHODOLOGY
The present study is based on the volatility in BSE Sensex and SSE Composite. BSE Sensex, the free-float market capitalization based index, estimated on the basis of 30 stocks is considered to be the representative of the Indian equity market. The SSE Composite Index is stock market indexes of all stocks (A shares and B shares) that are traded at the Shanghai Stock Exchange, calculated using a Paasche weighted composite price index formula.

The time period chosen for study is April 2004 to March 2012. This period has been selected because it represents the period during which the global and the Indian economy has passed through many ups and downs, thus, affecting the volatility of the Indian and Chinese stock exchanges. The monthly closing prices have been taken from the BSE website and yahoo finance. From the closing prices, returns have been calculated for each month.

Return is calculated using logarithmic method as follows:

$$r_t = \left( \log p_t - \log p_{t-1} \right) * 100$$

where

- $r_t$ = Market return at the period t
- $p_t$ = Price index at day t
- $p_{t-1}$ = Price index at day t–1 and
- $\log$ = Natural log

Volatility has been calculated as the standard deviation of the natural log of returns in indices for the respective period. Graphs have been used to evaluate the trends in volatility over to facilitate comparison. Separate graphs have been drawn for each individual year of the study and reasons for the volatility have been identified from them.

Granger causality test has also been applied in order to examine the dynamic linkage between Sensex and its Sectoral Indices. Granger causality test is applied on a stationary series. This test
analyses the two given factors to identify the cause and affect variable. The test is based on following two regression equations:

\[ Y_t = \sum_{i=1}^{n} \alpha_i X_{t-i} + \sum_{j=1}^{n} \beta_j Y_{t-j} + u_{1t} \quad \text{(I)} \]

\[ X_t = \sum_{i=1}^{n} \lambda_i X_{t-i} + \sum_{j=1}^{n} \delta_j Y_{t-j} + u_{2t} \quad \text{(II)} \]

In the two equations given above it has been assumed that disturbances \( u_{1t} \) and \( u_{2t} \) are not correlated with each other. Equation (II) postulates that \( Y \) for the current year is related to its own past values as that of \( X \) and next equation (III) postulates a similar behavior of \( X \).

**RESULTS AND ANALYSIS**

**Trend in Volatility in BSE Sensex Vis-a-Vis SSE Composite**

The trend in volatility at BSE Sensex and BSE Sectoral Indices on monthly basis for the years 2004-05 and 2012-13 has been analysed in Graphs 1-8.

The monthly volatility as shown in Graph 1 indicates that Indian stock market was highly volatile in May 2004. The trend declined after May 2004 till December 2004 and in January, the volatility again shot up. The overall performance of Indian stock market was quite well during the year 2014 except for the month of May. However, the Chinese stock market followed an increasing trend towards the beginning of year till September 2004, after which it started declining. The volatility was highest in the month of September. Strikingly, Sensex exhibited more volatility than SSE during the year. Volatility of Sensex was high in May 2004 mainly due to political uncertainty. The prospect of a non-BJP government in the center made the big players in the stock market nervous about the continuation of the ongoing reforms in India. In January, volatility shot up due to general weakness in global markets. The volatility of SSE Composite was high in the beginning, incidental to the announcement of new policies to restrain out-of-control fixed asset investment through restrictions on credit and land use. Volatility was high in September on account of Government macro-economic tightening measures and questions about Chinese accounting standards. The major reason for continued slump in the markets was the unresolved question of State shares.

As shown in Graph 2, the volatility of BSE Sensex declined significantly in 2005-06 in comparison to previous year. The trend in volatility was inconsistent during the year. The volatility was highest in October 2005. After October 2005, the volatility followed a declining trend. SSE Composite witnessed declining trend in the beginning of the year. The volatility shot up in the month of June. Except for June, the volatility remained stable throughout the year. Volatility of BSE Sensex increased in April on account of the aftermath effects of Union Budget 2005-06. The persistent hike in Fed rate, increase in domestic inflation, uncertainty regarding international crude oil prices, three bomb blasts in Delhi were the factors responsible for increased volatility. The
The volatility of SSE was quite stable because of the number of reforms initiated by the Chinese Government in order to protect the interest of investor such as elimination of non-tradable shares held by the State or by the politically connected institutional investors, issuing of new guidelines to encourage listed companies to be more transparent, inform investors of their growth strategies, business plans and about major events in order to improve governance and strengthen shareholder rights.

As graph 3 shows that BSE Sensex exhibited more volatility than that of SSE Composite in the beginning of the year but since October the volatility of SSE Composite was more than that of BSE Sensex. The trend in volatility of BSE Sensex was quite inconsistent with constant ups and downs.

Volatility was found to be highest in the month of June 2006 due to uncertainty in global interest rates, fall in metal prices, inflationary pressures, announcement of international sports event (FIFA World cup) and declining trend in the Asian market. The volatility of SSE Composite was quite stable till December owing to stock market reforms initiated by China Securities Regulatory Commission (CSRC). The volatility shot up towards the end of financial year in January 2007 and it was highest in the month of February. The volatility was highest in February on account of fear that Government would raise interest rates in order to curb inflation and put check on speculative trading with borrowed money.

As shown in Graph 4, the year 2007-08 followed an upward trend in equity returns of Sensex on one hand and increased level of volatility on the other hand. The month-wise volatility in the benchmark index BSE Sensex was highest in January 2008 and March 2008 and was lowest during May 2007 and June 2007. On the other hand, SSE Composite was quite volatile throughout the year.
the year. The volatility was highest in the month of February. There was increase in returns of Sensex for a major part of the year 2007-08 on account of liquidity support from Foreign Institutional Investors (FIIs), controlled inflation rate and an upward trend in global markets. Volatility shot up in January 2008 due to sub-prime losses, slowdown in world economy led by recession in USA. In March 2008, sixth pay commission recommended a major revision in salaries of all government employees. SSE Composite was quite volatile because of rippling effect of the financial meltdown in the United States, excess liquidity, real estate booms and increase in speculative and gambling activities, overvaluation and low efficiency of listed companies. China’s stock market developed into a speculative bubble, which lead to the greater uncertainty and greater provoking losses in the market.

Graph 5 reveals that both BSE Sensex and SSE Composite witnessed volatile trend during 2008-09. The markets were characterised by severe bouts of volatility during the year. Volatility of Sensex was highest in October 2008. Infact, it was highest for the total study period while for SSE Composite, volatility was highest in the month of April. SSE plunged a staggering 65% during the year. As far as Sensex is concerned, the volatility was high during the year on account of uncertainties in international financial markets, concerns of deepening recession in developed economies, high inflation rates, tightening RBI policies and weak industrial production data. Global events have been largely responsible for the rising volatility in the month of October. In January 2009, a massive corporate scandal was witnessed where Satyam’s chairman Ramalinga Raju confessed that the company’s accounts had been falsified causing huge loss to the investors. During the same time, SSE Composite witnessed a volatile trend on account of tightening monetary policy, global economic slowdown, pressure of huge freed up non-tradable shares coming into the market and US subprime mortgage crisis.
The volatility of both the indices as shown in Graph 6, reduced significantly during the year as compared to the previous year. The market environment improved in 2009-10. Volatility of Sensex was highest during May but declined during the later part of the year. SSE exhibited highest volatility in the month of August as CSRC approved a variety of investment products and strategies, margin accounts for trading, stock index futures, short selling and also devised some stock market changes to limit speculation. SSE Composite gained 80% during the year. However, the volatility of Indian stock market was quite stable throughout the year except for the month of May on account of political uncertainty. May 2009 was the most volatile month for BSE Sensex. A positive view of the Government on promissory notes, optimistic manufacturing data from China and election results were the factors responsible for sudden fluctuations among indices.

As shown in Graph 7, both the indices exhibited a similar pattern of volatility throughout the year. The trend was declining in the beginning and observed inconsistent movements throughout the year but the volatility was lesser as compared to the previous year. The volatility of BSE Sensex was highest in May 2010 and February 2011 and was lowest during July 2010. SSE showed highest volatility in the month of May which came down afterwards and shot up in the month of November. Volatility of Indian stock market was quite high in May due to sovereign debt crisis in Greece. Volatility somehow reduced till October 2010 but again shot up in February 2011 due to high inflation, excessive selling by FIIs, and poor growth in industrial activities. SSE witnessed high volatility during May on growing concerns about Europe debt crisis, real estate speculation and expectations.
that Beijing is going to take swing action to slow the nation’s booming economy by raising interest rates and prevent it from overheating. Volatility shot up in November as Petro China’s restricted shares, valued at 1.89 trillion Yuan and China National Petroleum Corporation were made freely tradable.

Graph 8. Volatility at BSE and SSE Composite during 2011-12

Graph 8 reveals that Indian stock market in 2011-12 witnessed a bearish trend for major part of the year. The volatility declined marginally in 2011-12 as compared to the previous year. Sensex had highest volatility in the month of September but declined afterwards. SSE Composite has inconsistent up and down movements throughout the year. It did not do quite well during the year and fell by 22% during the year. SSE had highest volatility towards the end of the financial year in January 2012. The Indian stock market had a bearish trend due to weakening global trend. Adding to the woes, RBI raised the repo rate 13 times since March 2010 in order to control inflation. Also, uncertainties in the financial markets, slowdown in exports due to low growth in US and Euro area, intensified the risks in Indian stock markets. SSE did not do well during the year on account of cooling of economic growth, tight monetary policy, liquidity crunch that prevented SMEs from obtaining credit, falling property prices and fall in large amount of hidden local Government debt, decline in exports and global policy risks.

**Causal Relation between BSE Sensex and SSE Composite**

The Granger-causality test was conducted to study the causal relationship between BSE Sensex and SSE Composite. Table 1 reflects that there is unidirectional causality between the SSE Composite and BSE Sensex running from SSE Composite to BSE Sensex. The reported p value at 5% level of significance suggests that any variation in Chinese stock market significantly influences the Indian stock market.

**Table 1. Granger Causality Results**

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<th>obs</th>
<th>F-Statistic</th>
<th>Probability</th>
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<tbody>
<tr>
<td>SSE Composite does not Granger Cause BSE Sensex</td>
<td>94</td>
<td>7.07</td>
<td>0.0014</td>
</tr>
<tr>
<td>BSE Sensex does not Granger Cause SSE Composite</td>
<td>0.83</td>
<td>0.0638</td>
<td></td>
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</tbody>
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Source: Author’s calculations based on secondary data.

and human resources as well as cheap products demanded by the whole world. They work on the strategy of mass production and mass consumption. This economy is the second largest exporter in the world after Germany. Chinese goods are relatively cheaper, widely available and give huge profit to the dealers. However, the price of these goods is 10-70% lower than that of Indian goods owing to low prices, bulk availability and variety. These products are dumped into the Indian markets in huge quantities which adversely affects the Indian units. These goods are not only affecting the
domestic business and Indian market but also the export market of our country. If China’s economy slows, it would not just hurt demand and world prices for raw materials, it would also reduce demand and prices for a range of industrial materials, like steel. For every dollar’s worth of exports to China, India imports three times from China. The largest imports from China are in the industry sub-group of radio, television and communication equipment, followed by machinery and equipment, office accounting and computing machinery, other transport equipment, electrical machinery and apparatus, basic metals, fabricated metal products, except machinery, chemical and chemical products, motor vehicles, trailers and semi-trailers, and rubber and plastic products.

The two economies have several similarities as well: they compete in several markets, and they complement each other in other markets. In several important sectors, notably textiles, wearing apparel, leather, and manufacturing, when China grows, India experiences the largest welfare losses. It may be because of more competition in these sectors. Growth in other Chinese industries, such as machinery, transportation and electronic equipment, which are imported from China, has a beneficial effect on India’s welfare. Due to India’s huge dependence on China with regard to certain goods such as electronic goods, iron and steel, transport equipment, electrical machinery, etc any cooling in demand from China would exert a downward pressure on commodity prices. The slowdown in China badly affects certain specific sectors of Indian economy such as manufacturing sector, capital goods sector and metal sector. Consequently, slump in Chinese market will spill volatility in Indian market, China being the India’s top import source.

**CONCLUSION**

The present research highlights that there have been multiple reasons, local and domestic, leading to volatility in the both Indian and Chinese stock markets. The volatility was highest in year 2008 in both the markets for which the global events have been largely responsible. However, BSE Sensex was found to be more volatile than SSE Composite. In addition to various domestic factors, volatility of major foreign trading partners was one of the important determinants of stock return volatility in a domestic market. Although China’s stock market did not perform well in early 2000, due to large proportion of non tradable shares, the various reforms initiated by the Chinese government revived the market. SSE Composite was volatile mainly because of the release of non-tradable shares by the Government, rippling effect of the financial meltdown in the United States, excess liquidity, real estate booms and increase in speculative and gambling activities, overvaluation and low efficiency of listed companies. In India as well, there are a number of domestic and global factors that led to volatility. The prominent ones being political reasons, economic policies, regulations of the government, privatization and globalization, the net effect of FIIs, civil disturbances in the country as well as outside the country, psychological factors etc. With increasing integration any shock that occurs in one market is quickly transmitted to the other markets. The Granger Causality test reveals that there is unidirectional causality running from Chinese stock market to Indian stock market.

**REFERENCES**


