Global Financial Crisis and Stock Market integration
(A study on the impact of the Global Financial Crisis on the level of Financial Integration between the US and Indian Stock Market)

Dr. Srinivasa Rao Gangadharan
Faculty
Email – ganga@ifmr.ac.in
98406 86927, 044-28303484
and
C.A. Yoonus
Research Scholar
yoonus786@ifmr.ac.in
9840377561, 044 – 28303531

Institute for Financial Management and Research (IFMR)
24, Kothari Road,
Nungambakkam,
Chennai – 600 034
Tamil Nadu,
INDIA
Global Financial Crisis and Stock Market integration
(A study on the impact of the Global Financial Crisis on the level of
Financial Integration between the US and Indian Stock Market)

Abstract

This paper examines the impact of the Global Financial Crisis on the level of financial integration between the US (S & P 500) and the Indian stock market (CNX S & P Nifty) indices. Using the daily returns of the two indices from March 2005 to November 2010, this paper examined the existence of co-integration and the dynamic relationship between the two indices during the Pre-Crisis, Crisis, and Post-Crisis and in the last 5 years. The statistical tools used for this examination are Johansen Co-integration analysis, Vector Autoregression (VAR) Model and the Variance Decomposition Analysis (VDC). The above analysis has been cross examined with another equally powerful US Stock Index (DOW Jones) to clarify the skepticism that the results are not unique to a particular US Index.

The paper finds that there is no co-integration between the two indices in all the four periods. The Global Financial Crisis had an impact on the return dynamics of the Indian and US Stock Market. The VDC analysis justifies this outcome.

Key words – Global Financial Crisis, Co-integration, Stationarity, Akaike Information Criteria, Vector Auto Regression (VAR) Model, Variance Decomposition Analysis (VDC).
I. Introduction

Some positive developments on the financial sector such as the establishment of Securities and Exchange Board of India (SEBI) in 1988, the Structural Adjustment Program (SAP) in 1991 and the implementation of the recommendations of the Narasimham Committee Report on Financial Systems in 1992 made large section of the people to presume that the Indian Financial Market is well integrated with the Global Financial Market. Besides this, the removal of capital controls, the financial innovation and technological advancement in communications and trading systems added further support to this presumption.

Many studies (Rao & Naik, 1990, Ignatius, 1992, Sharma & Kennedy, 2002, Kumar, 2002 and Mishra, 2002) including a RBI research study\(^1\) showed that these developments are not sufficient enough to make the Indian Stock market a matured one to integrate with the developed stock markets. The inferences made out of these studies are obsolete. Lot of changes has taken place in the US economy since then. In the last decade, US economy has seen two bubbles (Housing & Commodity) that has created adverse economic effects\(^2\). The global housing bubble peaked the U.S. in 2006 caused the values of securities tied to real estate pricing to plummet, thereafter, damaging financial institutions globally. Questions regarding bank solvency, declines in credit availability and damaged investor confidence had an impact on global stock markets, where securities suffered huge losses\(^3\) during late 2008 and early 2009.
So, this paper in the above background examines the impact of the global financial crisis on the level of financial integration between US and the Indian Stock market.

II. Importance of the Study

- A study on the financial Integration of a well-developed and large stock market such as India is of particular importance for corporate managers as it influences the cost of capital. For investors it influences international asset allocation and diversification benefits (e.g, Sentana, 2000). Further, they contribute significantly to economic growth (Arestis, Demetriades and Lunitel, 2001, Beck, Levive and Loeysa, 2001).

- Increasing integration of the domestic financial market with the world financial market is one of the most important national policy decisions during the late twentieth century and forepart of this century (Cerny 2004).

- Financial Integration gives foreign investors an opportunity to invest in these emerging markets. They find it attractive since the returns are higher than what is available in their parent country while diversifying their risk. This has increased the gross and net capital flows between developed and emerging economies and intensified the curiosity among the academics in exploring international market linkages (Agarwal,2000)

- A study on the financial integration with the US stock market is of prime importance because, several studies show that the US Index prices are considered as “global factor” and lead almost every country index (Fischer & Palasvirta, 1990, Cheung & Mak, 1992). This is because US market is
highly influenced by its own historical innovations and by market innovations from the UK, Switzerland, Hong Kong, France and Germany (Bessler and Yang, 2003).

- Similarly a study on the financial integration of the Indian Stock Market is of importance considering India’s role in the global capital market. In recent years, the Indian Stock market has been attracting the attention of policy makers in several dimensions - the initial public offering in the Indian Stock market registered a 30.5 percent growth during the calendar year 2006. As on 30th November, 2010, the cumulative amount mobilized through equity in the primary market account for Rs.467 Bn. as against a mere 21 Bn. in 2008-09 (crisis period), the mean IPO size increased from Rs.5 Bn. to Rs.8.3 Bn. for the same period. Besides this, many performance indicators in the Post – Crisis period are more or less very close to the level of Pre-crisis period. This shows that Indian corporate sector have been able to mobilize funds for its requirement, exemplifying the strong and speedy rejuvenation efforts taken by the policy makers during the post-crisis period.

- Coming to the Secondary market the returns from both Nifty and Sensex for the year 2010-11 account for 17.9 per cent and 17 per cent respectively as against 12.3 per cent and 15.9 per cent for the year 2006-07. The Market capitalization nearly doubled and the daily volatility has come down from Rs.18 Mn. to Rs.10 Mn. The P/E ratio of Nifty (24.5 per cent) and Sensex (23.6 per cent) tops among P/E ratio achieved by select five (Korea, Thailand, Taiwan, Malaysia and Indonesia) emerging economies.
The foreign investors have shown great faith in investing in the Indian markets. This is evident from the fact that the total investment from GDR/ADR, FIIs and Off Shore funds amount to US $ 98.85 bn from 1991-92 to 2009-10. Besides this, from January 2000 to July 2008, ten foreign companies have invested Rs.324 Bn. in ten Indian Companies. Apart from this, the net foreign fund investment crossing US$ 100 billion mark on November 8, 2010, a huge increase in the number of Foreign Institutional Investors (FIIs) from 1 in 1993 to 481 in 1998 and to 1,738 on November 10, 2010, the number of registered sub-accounts reaching 5,592 with an investment worth US$ 4.11 billion in equities and US$ 6.68 billion in debt market as of 31st December 2010 add further support to this.

So the above facts justify the importance of undertaking a study that examines the level of financial integration between the US and the Indian Stock Market Indices during 2005 – 2010 that includes a financial crisis period.

III. Organisation of the Paper

The paper has been organized into four sections. Section – I deal with the Review of literature; Section - II details data and methodology employed; Section - III explains the empirical findings of the hypothesis developed, and Section – IV Summaries the paper with a conclusion.

Section – I

A. Theoretical background of Financial Integration

The theoretical background of financial integration is based on the benefits and costs such integration produce. These can be viewed from the perspective of Governments, Individuals, Corporate and Financial Institutions. Though
domestic financial integration constitute a critical pillar of a market based economy as they mobilize savings, allocate risk, absorb external financial shocks and foster good governance, it is the international financial integration that provide various benefits on which much economic literature is dedicated.

Major benefits of International financial integration are risk-sharing and efficiency in resource allocation, that depends on size, composition and quality of capital flows. If capital controls or other forces prevent free movement of capital across borders, then it is likely that different economies will demand different levels of compensation for risk. Some countries may impose severe restrictions on the capital flow and have dual classes of common equity. They may allow domestic residents to hold restricted equity and allow both domestic and foreign investors to hold unrestricted equity. The price differential between restricted and unrestricted shares that have identical payoffs is a direct measure of the effects of capital controls (Hietala 1989; Bailey and Jagtiani 1994). Similarly, differences between official and black market exchange rates, between official and offshore interest rates, or between the market price and Net Asset Value (NAV) of closed-end country mutual funds can be used to measure the effects of capital controls (Bonser–Neal and Others 1990).

The difficulty arises when attempting inter country comparisons of the severity of capital controls because different countries may have different mechanisms for restricting capital movements. For example, a country that prohibits all foreign investment does not have unrestricted shares whose prices can be compared to restricted shares. Similarly, countries without any formal restrictions against foreign investment will not have restricted share trading.
Given the difficulty of directly comparing the effects of the wide array of official capital controls across countries, a measure of deviations from capital market integration that can be consistently applied across countries is important for cross-sectional analyses of the effects of market segmentation. Theoretical models have identified a number of direct and indirect channels through which international financial integration can help enhance economic growth (Prasad et. al.[2003]). The primary theoretical channel of attaining benefits from international financial integration is improved risk sharing and the second major channel is the alleviation of capital scarcity.

The cost side of the increased international financial integration is the risk of contagion that highlights the importance of appropriately sequencing the liberalization process and balancing the risks and benefits of integration. The contagion risks works through two channels - the real and information channels. The former relates to the “domino effects” potential of real exposures on participants operating in other segments, and the latter relates to contagious withdrawals due to lack of accurate and timely information.

In the context of globalization, conceivable costs include the high degree of concentration of capital flows and their misallocation that may hamper economic growth and exacerbate domestic distortions; the loss of macroeconomic stability; the pro-cyclical nature of short-term capital flows, the risk of abrupt reversals; the high volatility of capital flows, which relates to part to herding and contagion effects and risks associated with foreign bank infiltration

Today it is widely recommended that policy makers examine the pros and cons of financial integration precisely by taking full account of the real and
financial situations as well as the economic climate including business cycles and financial crises\textsuperscript{16}. The approach taken here is to measure the level of financial integration via capital market using the returns from the Stock Market Indices of US and India.

B. Empirical Literature

The literature review focuses on the historical background of integration, the outcomes of the studies on financial integration in Western Nations and India and the effect of externals shocks on the level of financial integration.

Although the study of financial integration dates back to late 70’s, the number of studies during that time was scanty due to conservativeness of the stock markets. However, the financial markets, especially the stock markets, for developing and developed markets have now become more closely interlinked despite the uniqueness of the specific market and country profile. The earliest work that has been widely cited on the relationship among national stock markets and on clarifying the benefits from international portfolio diversification was that of Grubel (1968). He examined the rates of return from portfolio investment in common stock market from January 1959 to December 1966, in 11 major countries (US, UK, Canada, West Germany, France, Belgium, Netherlands, Japan, Australia and South Africa).

The enduring popular representation of financial market integration is the equalization of the rates of return on similar financial assets. This has considerable intuitive appeal: as markets become more open and unified differences in rates of return should reflect only fundamental factors such as differences in asset quality, associated risk, liquidity and such factors.

Studies on financial integration are dichotomized in their findings irrespective of the country classification. The Western Nations studies showed existence of substantial interdependence of both short and long run among the national stock markets. They also revealed that US market is the most influential and exerts significant impact on European markets - Eun & Shim, 1989, Hassan and Naka ,1996, Gerrits and Yuce, 1999.

Against this, the studies that established non-existence of integration showed that US market does not have pair wise co-integration (Kanas, 1998) with none of the European markets. The Nordic stocks (Mathur & Subrahmanyam, 1990), Hungary, Poland and the Czech Republic show existence of limited interaction of Regional and Global stock markets (Scheicher, 2001). Australia had no causal links with Germany and France but it had with UK with causality running from the UK to Australia but not vice-versa (Hatemi and Roca, 2004).

Coming to India, there are very few studies on financial integration between Indian and the International Stock Market. Here also the outcomes are dichotomized, many found evidence of no integration with the developed markets (Rao & Naik, 1990, Kumar, 2002). Studies that examined the integration of the US Stock Markets (S & P 500 & NASDAQ) with the Indian (BSE Sensex) signifies no long-run relationship between these two stock exchanges (Ignatius, 1992, Mishra, 2002). The price behaviour of the Indian market is statistically indistinguishable from that of US and UK markets with no evidence of systematic cyclical component or periodicity for these markets (Sharma and Kennedy, 1977). However, there are number of studies that showed integration of Indian stock market with the matured markets of the World (Hansda and Ray, 2002, Nath and Verma, 2003, Wong, Agarwal and Du, 2005).

Studies that examined financial integration in the background of external shocks reveals that stock prices provide signals before a number of recessions (Fisher and Merton, 1984). Studies that examined the effect of 1987 crash concluded that the degree of international co-movement in stock price indices has increased significantly since the 1987 crash. Equity volatility is more likely to become high during recessions and the US stock market is more volatile than others (Hamilton and Susmel, 1994, Lee and Kim, 1994, Jeon and Von-Frustenberg, 1990)

Most studies used methodologies such as Granger causality, Cross-Spectral analysis, GARCH models, VAR Approach, Impulse Response Function Analysis and variance decomposition analysis to examine the level of integration between countries.
Section – II

Data and Methodology

The approaches developed to evaluate the degree of financial integration have been classified into (a) quantity based measures (b) price based measures and (c) institutional and regulatory based measures. Here, we have used price based daily closing stock market indices of India (CNX S & P Nifty) and US (S & P 500 & Dow Jones) from April 2, 2005 to March 31, 2010 to determine the degree of financial integration. The key variable used in this paper is the returns of the above indices that are computed as follows:

\[ R_t = \ln \left( \frac{P_t}{P_{t-1}} \right) \]

Where \( R_t \) refers to the log returns at time “t” and \( P_t \) and \( P_{t-1} \) are the closing index on day t and t-1 respectively.

Since, India is 12.5 hours ahead of US, the impact of the US Stock indices returns gets reflected in the Indian Stock indices returns in the next trading session. Hence, the returns from US Stock Market are compared with subsequent day returns of the Indian Stock market.

We have classified our analysis into four periods - Pre-Crisis (2005 – 2007), Crisis Period (2007-2009), Post Crisis Period (2009-2010) and the whole period (2005 – 2010)

The CNX S & P Nifty index, the S & P 500 and Dow Jones index have been collected from Thomson Reuters. We have also collected data from the websites of Reserve Bank of India (RBI) and the Securities and Exchange Board of India (SEBI).
We have extensively used E-views statistical package for our analysis.

**Rationale for using the indices CNX S&P Nifty and S & P 500**

BSE Sensex and CNX S&P Nifty are the two prominent Indian Stock Market indices. We have preferred to use Nifty index due to the following reasons:-

1. Nifty represents a well diversified 50 stock index accounting for 22 sectors of the economy, whereas the BSE Sensex is fairly diversified with 11 sectors representing 30 stocks.

2. Nifty is considered as the “core barometer” of the Indian Stock Market as it attracts a major chunk of the foreign institutional investment.

3. Nifty has a big hold in the derivative market. Growth of derivative market foster increased integration of the national financial market with the international markets. NSE has established as the sole market leader in the country accounting for 99% of the market share in this segment for the year 2009-10 (Turn over Rs.115 tn., No.of contracts - 49.31 crore - Source - NSE Fact Book, 2009-10).

4. There exists a strong correlation between BSE Sensex and Nifty and the results worked out using both the indices showed more or less similar result. So it does not matter much whether we use BSE Sensex or Nifty to represent the market index for Indian Stock Market.

5. The rationale for using NYSE S&P 500 index for US stock market is that the index has been widely used by the researchers in the studies involving US Stock market.

6. The rationale for using the daily rather than the monthly or week index is to capture potential interactions, since a month and week may be long.
enough to obscure interactions that may be lost only for a few days (Cotter, 2004).

**Methodology**

In the literature, one of the most extensively used method to examine the long-run relationship between two variables, is the co-integration approach. This approach was first addressed by Engle and Granger (1987). But the most popular test that examines the multiple long-run relationships was developed by Johansen and Juselius (1990). Here, we use Johansen Co-integration Test to make different combination of our time – series from non-stationary to stationary. There are two types of Johansen test, Trace and Eigenvalue (Max). The null for trace test is the number of co-integration vector \( r \leq x \), for Eigenvalue test \( r = x \). Trace test indicates \( x \) number of co-integrating equations.

In empirical macro economic analysis, a theory- free model that estimates the dynamic relationship between the two variables will bring more insight on the level of integration. The apt model that fulfills the above criteria is Christopher Sims (1980), Vector Autoregression (VAR) Model. In VAR, all variables are endogenous and each endogenous variable is explained by its own lagged and lagged values of all other endogenous variables. This simple frame work provides a systematic way to capture rich dynamics in multiple time-series. In this paper we employed VAR model to explain the dynamic relationship between the returns from the Indian and US Stock market at various time period.

Finally, we use the Variance Decomposition Analysis (VDC) to bring further robustness in the paper. VDC analysis gives the proportion of the movements
in the dependent variables that are due to their own shocks, versus shocks to other variables. VDC determine how much of the s-step-ahead of forecast error variance of a given variable is explained by innovations to each explanatory variable for \( s = 1,2,\ldots,n \).

Two important conditionality to be satisfied before the implementation of VAR model is (1) the selected variables should be stationary\(^{20}\) (2) selection of optimal number of lags in the system.

(1) **Stationarity of the Variables**

Empirical analysis of large time series data assumes that the underlying time series is stationary. Besides this, regressing one time series variable on another time series variable, one often obtains a very high \( R^2 \) although there is no meaningful relationship between the two.

This type of situation displays the problem of spurious regression. This problem arises because if both the time series exhibit strong trends (sustained upward or downward movements), the high \( R^2 \) observed is due to the presence of the trend, and not to a true relationship between the two.

We apply the Augmented Dickey – Fuller (ADF) unit root test to check for the stationarity of the series.

(2) **Selection of optimal number of lags in the system**

The accuracy and complexity of a VAR model is determined by the selection of optimal lag length for the model. We have used Akaike's information criteria (AIC), a statistical tool developed by Hirotsgu Akaike for estimating the optimal lag. The lowest value of AIC is the decision criteria for selecting the optimal lag length.


Section – III

Empirical findings

We begin our analysis with some important descriptive statistics on the returns from the Indian and US Stock market Indices as reported in Table – I. The annualized average returns from the two stock indices shows that the returns from the Indian Stock market was more than the US stock market in the short run (Pre-Crisis, Crisis and Post – Crisis), whereas in the long run (the whole period), the returns from the US stock market was more than the Indian Stock Market. Another interesting outcome of the average return analysis is the magnitude of increase in the stock market returns. The returns from the US stock market outsmart the Indian Stock Market return. For instance the average returns from Nifty (33.10%) during the Pre – Crisis period was nearly three times that of SP 500 (12.6%), whereas the average returns from SP 500 (19%) in the whole period was nearly 18 times that of Nifty (0.87%).

The same trend continued in the Volatility between the two indices. The Indian Stock market returns are more volatile than the US Stock market return during the Crisis and Post – Crisis period, whereas S & P 500 was more volatile than Nifty in the last 5years.

The Sharpe ratio that compute the risk adjusted returns shows that the returns in the post crisis period are better risk adjusted than the pre-crisis period for both the indices as the ratios for all the three indices are more less equal to 2. A Sharpe ratio more than 2 indicates that the risks adjusted returns are very good. The uncertainty prevailed in the crisis period made the returns more risky in this period. After adjusting for volatility Nifty returns are better than
SP 500. Huge withdrawal of FIIs investment during the crisis period may be the contributing factor for this. The whole period return from US was higher because of high risk.

Skewness and Kurtosis that determines the shape of the distribution shows that, the returns from Nifty are right skewed in all the periods, whereas US stock market returns are left skewed with lepto kurtic, (fat tails). Kurtosis is very high. Return distribution dynamic coincide with stylized facts of asset price.

Before proceeding further, it is customary to check the stationarity of the time series. The results of ADF test given in Table – II shows presence of no unit root in the difference (return series) in all the four periods and the series is stationary.

We computed the Johansen Co-integration test with the following hypothesis to find out the existence of co-integration between the two indices, in all the four periods.

<table>
<thead>
<tr>
<th>Hypothesis developed- None</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Null Hypothesis (H₀)</strong> ( \rho \leq 0 )</td>
</tr>
<tr>
<td><strong>Alternative Hypothesis (H₁)</strong> ( \rho &gt; 0 )</td>
</tr>
</tbody>
</table>

In the first case (none) we are testing for the null hypothesis \( \rho \leq 0 \) against the alternative hypothesis \( \rho > 0 \). We reject the null hypothesis if “t” is more than the Critical Value. The results (Table – II) shows no co-integration between the US and Indian Stock Market Indices as the “t” statistics of the Johansen
co-integration test for the Pre – Crisis (4.80), Crisis (6.60), and Post-Crisis (10.11) and also in the whole period (4.69) was less than the Critical Value (15.50) at 5% level of significance. The same test conducted with respect to Nifty and DOW Jones also displayed no co-integration (“t” < CV in all the four periods).

This is further confirmed by looking at the results of the unrestricted Co-integration Rank Test (Max. Eigen value) that also displays the test statistics less than the critical value (14.27) in all the four periods. Since the results of mere existence of co-integration between showed no co-integration, there is no point in looking for atmost one co-integration.

To examine the dynamic relationship between the returns of the Indian and the US Stock Market we estimated the VAR model. Before that we need to decide on the optimal lag length, that is, k. Too many lagged terms consume more degrees of freedom. So decision on selecting the optimal lag length rests on criterion like the Akaike (AIC) or Schwarz Information Criteria (SIC) that gives the lowest values. We relied on the AIC criteria and selected one lag (k = 1) as that pertains to be the minimum value of AIC computed (Table – IV) between the Nifty and S & P 500. We got the same one lag as the minimum optimal lag length of AIC with respect to Nifty and Dow Jones.

In the VAR analysis we compare the “t” statistics of the returns from the Indian Stock market with its previous days return and the previous day’s return of the US Stock Market. Similarly the US stock market returns are compared with the previous day’s returns of the US stock market as well as the previous day’s return of the Indian Stock Market. Return dynamics of the Indian Stock market as reported in Table – V reveals that, the previous day’s
returns in terms of the reactions from the Indian Stock Market is insignificant throughout, whereas the overnight performance of the US stock market is very significant. The “t” statistic of the relationship between the returns from the Indian Stock Market with reference to the previous day’s return of US stock shows lot of feedback effect from US to India. This could potentially explain why any crisis that the US market face could spill over to the Indian Market.

In terms of the returns from the US stock market there is no significant reaction in the overall period as well as in two of the sub period. However, in terms of its own past (previous day) there is a strong negative reaction. This suggests that there is over reaction or mean reversions in the US Stock Market.

In the post crisis period, the “t” statistic of the relationship between the returns of the US stock market with previous day’s return from the Indian Stock market, do show significant at 2.18, but one out of 16 going other way is not a big deal. Simply by chance you should expect one out 20 “t” statistic go the wrong way.

Cross examination of the return dynamics of Nifty with Dow Jones (Table – VI) also draws same inference.

We use Variance Decomposition analysis to compare the forecast error variance of the dependent variable (Returns from Nifty) with the explanatory variable (Returns from S & P 500) to support the result of the VAR dynamics.

The results of the VDC analysis (for one day) reported in Table – VII (detailed table available on request) shows that the influence of Nifty on S&P 500 increased from 4.22% in the Pre-Crisis period to 16.43% in the Crisis period. At the same time, the influence of S&P 500 in the Nifty returns was 10.41% in
the Pre-Crisis period has come down drastically around 4% in the subsequent sub sets. This shows Nifty has an upper hand in influencing the returns from Nifty as well as S & P 500.

Finally, we conclude, that Investors and Regulators will pay attention to whatever crisis that is brewing in the US market as a consequence it is possible that whatever crisis that occur in the US has an impact over Indian Stock Market. Besides this, on the basis of the outcome of the co-integration analysis we also conclude that the developments that has been taking place in the Indian Capital Market, is still not strong enough to integrate Indian Financial Market with other developed markets in the World.
End Notes

1. Sadhan Kumar Chattopadhyay and Samir Ranjan Behra (2006), Department of Economic Analysis and Policy, Reserve Bank of India, Mumbai

2. The Real Gross Domestic Product (RGDP) decreased at an annual rate of approximately 6% in the fourth quarter of 2008 and first quarter of 2009, unemployment rate increased to 10.2% by October 2009, the highest rate since 1983 and roughly twice the pre-crisis rate. The average hours per work week declined to 33, the lowest level since the government began collecting the data in 1964.

3. $14.5 trn. or 33% of the value of the World’s companies have been wiped out by the crisis (Bloomberg)

4. The Indian Stock Market is the oldest in the world; its origin goes back to 18th Century when long-term negotiable securities were first introduced. The real beginning occurred in the middle of 19th century after the enactment of companies act in 1850.

5. Economic Survey, GOI, 2006-07

6. consisting of IPOs, Follow on Public Offers (FPO) and rights issue

7. Economic Survey, 2010-11

8. Rajya Sabha Starred Question No.60 dated 21/10/2008

9. With regard to the sequencing in the financial integration, Sundararajan et al. (2003) argue that domestic financial market integration comes first in the hierarchy, followed by global and regional integration.

10. In principle, countries can use equity or derivatives markets to trade the risks of income fluctuations with foreigners. This risk-sharing process, in principle, could reduce the level of consumption relative to output volatility.

11. This effect may work by lowering the cost of capital and perhaps transitonally, adding to the rate of growth.

12. Problems in one market segment can readily be transmitted to other markets and potentially causes systemic instability.

13. a country thought likely to be affected by political events in another country
14. Since 1990s, we have seen that capital flows to emerging countries have been pro-cyclical: capital inflows in growth periods, have boosted growth, and capital outflows in periods of problems and crisis, have made them worse.

15. Volatility of capital flows translates into exchange rate instability (under flexible exchange rate) or large fluctuations in official reserves (under a pegged exchange rate regime) and sometimes currency crises as was observed in the East Asian crisis. For instance, nominal exchange rate volatility may hamper expansion of exports if appropriate hedging techniques are not available to exporters. Large capital inflows could also lead to rapid monetary expansion (due to difficulty and cost of pursuing aggressive sterilization policies), inflationary pressures (resulting from the effect of capital inflows on domestic savings), real exchange rate appreciation and widening of current account deficits.

16. Stiglitz (2010) argues that we need to determine the optimal degree and form of financial integration considering benefits and costs, and that full integration is not in general optimal. Focusing on risks, he has just touched the surface of the complexities of optimal financial architectures. Even ignoring issues raised by learning, information asymmetric and institutional coordination, he has shown that full integration may be less desirable than previously thought.

17. When referring to current events Western Nation often includes developed countries in Asia, such as Japan, Singapore, Taiwan, and South Korea.

18. We consider Recession, Stock market crash, financial crisis etc as external shock.

19. Owned and managed by India Index Services and Products Ltd. (IISL), a joint venture between NSE and CRISIL. Has Marketing and licensing agreement with S&P. Nifty stocks represent about 62% of the Free Float Market Capitalization as on Mar 31, 2010.

20. A time series $x(t); t=1,...$ is called to be stationary if its statistical properties do not depend on time $t$. The mean may be stationary as the mean does not depend on time $t$, but variance is not stationary as it depends on time $t$.

References


Movement in Stock Price Indexes”, Quarterly Review of Economics and

Further evidence from Cointegration Tests”, Applied Financial 
Economics, 8:607-614

Investigation of US , Japan stock return comovements, Journal of 
Finance, 51:951 – 986mmon Stochastic trends in International Stock Prices 


co-movement in Stock Price Indexes”, Quality Review of Economics and 


smaller European stock markets”, International Advances in Economic 
Research, 3(2):142-153

(4):587-597

Markets: A Study of India”. The ICFAI Journal of Applied Finance, 8 (2):5- 
15

Integration and its economic determinants: a study of Indian and World equity 
market” Vikalpa, 32(4):29-4


### Table - I
**Descriptive Statistics**

<table>
<thead>
<tr>
<th>Period</th>
<th>Average Return (Annualised)</th>
<th>Volatility = Std.Dev.</th>
<th>Sharpe Ratio(Mean/ Std)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nifty</td>
<td>SP 500</td>
<td>Dow Jones</td>
</tr>
<tr>
<td>Pre-Crisis</td>
<td>33.10%</td>
<td>12.6%</td>
<td>11.40%</td>
</tr>
<tr>
<td>Crisis</td>
<td>7.31%</td>
<td>-9.10%</td>
<td>-8.20%</td>
</tr>
<tr>
<td>Post - Crisis</td>
<td>55.90%</td>
<td>36.00%</td>
<td>34.80%</td>
</tr>
<tr>
<td>Last 5 years</td>
<td>0.87%</td>
<td>18.98%</td>
<td>9.70%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Period</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nifty</td>
<td>SP 500</td>
</tr>
<tr>
<td>Pre-Crisis</td>
<td>-0.67</td>
<td>-0.34</td>
</tr>
<tr>
<td>Crisis</td>
<td>0.12</td>
<td>-0.04</td>
</tr>
<tr>
<td>Post - Crisis</td>
<td>2.45</td>
<td>-0.30</td>
</tr>
<tr>
<td>Last 5 years</td>
<td>0.04</td>
<td>-0.04</td>
</tr>
</tbody>
</table>

### Table - II
**Augumented Dicky – Fuller (ADF) test Statistics**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Return S &amp; P CNX Nifty</td>
<td>22.59</td>
<td>19.43</td>
<td>15.19</td>
<td>33.16</td>
</tr>
<tr>
<td>Return S &amp; P 500</td>
<td>24.25</td>
<td>17.19</td>
<td>9.29</td>
<td>27.91</td>
</tr>
<tr>
<td>Return Dow Jones</td>
<td>24.24</td>
<td>18.10</td>
<td>17.17</td>
<td>29.41</td>
</tr>
<tr>
<td>Critical Value (1% level)</td>
<td></td>
<td></td>
<td></td>
<td>3.43</td>
</tr>
</tbody>
</table>
## Table – III

**Johansen Co Integration Test**

<table>
<thead>
<tr>
<th>No.of.Lags</th>
<th>Pre-Crisis</th>
<th>Crisis</th>
<th>Post - Crisis</th>
<th>Last 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>-12.908</td>
<td>-9.904</td>
<td>-11.279</td>
<td>-10.708</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.of.Lags</th>
<th>Pre-Crisis</th>
<th>Crisis</th>
<th>Post - Crisis</th>
<th>Last 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>-12.991</td>
<td>-10.114</td>
<td>-11.532</td>
<td>-10.915</td>
</tr>
<tr>
<td>Two</td>
<td>-13.004</td>
<td>-10.149</td>
<td>-11.561</td>
<td>-10.952</td>
</tr>
</tbody>
</table>

## Table – IV

**Akaike information criterion - Nifty Vs S & P 500**

<table>
<thead>
<tr>
<th>No.of.Lags</th>
<th>Pre-Crisis</th>
<th>Crisis</th>
<th>Post - Crisis</th>
<th>Last 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>-12.908</td>
<td>-9.904</td>
<td>-11.279</td>
<td>-10.708</td>
</tr>
</tbody>
</table>

**Akaike information criterion - Nifty Vs Dow Jones**

<table>
<thead>
<tr>
<th>No.of.Lags</th>
<th>Pre-Crisis</th>
<th>Crisis</th>
<th>Post - Crisis</th>
<th>Last 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>-12.991</td>
<td>-10.114</td>
<td>-11.532</td>
<td>-10.915</td>
</tr>
<tr>
<td>Two</td>
<td>-13.004</td>
<td>-10.149</td>
<td>-11.561</td>
<td>-10.952</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Return from NIFTY(-1)) - one lag</td>
<td>0.000464</td>
<td>-0.033271</td>
<td>-0.018455</td>
<td>0.027075</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.04247</td>
<td>-0.02091</td>
<td>-0.04236</td>
<td>-0.03803</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[0.01092]</td>
<td>[-1.59128]</td>
<td>[-0.43564]</td>
<td>[0.71189]</td>
</tr>
<tr>
<td>Return from SP500(-1) - one lag</td>
<td>0.707143</td>
<td>-0.055536</td>
<td>0.239499</td>
<td>-0.15698</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.09019</td>
<td>-0.04439</td>
<td>-0.04737</td>
<td>-0.04253</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[7.84089]</td>
<td>[-1.25096]</td>
<td>[5.05614]</td>
<td>[-3.69140]</td>
</tr>
<tr>
<td>C - Intercept</td>
<td>0.001013</td>
<td>0.000578</td>
<td>0.00054</td>
<td>-0.000431</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.00061</td>
<td>-0.0003</td>
<td>-0.00091</td>
<td>-0.00081</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[1.64977]</td>
<td>[1.91128]</td>
<td>[0.59666]</td>
<td>[-0.52971]</td>
</tr>
</tbody>
</table>

Table V
Vector Autoregression (VAR)Estimates
S & P CNX Nifty Vs S & P 500
Post -Crisis Period
last 5 years (whole - Period)
### Table - VI

Vector Autoregression (VAR) Estimates

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre - Crisis Period</th>
<th>Crisis Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return from NIFTY(-1) - one lag</td>
<td>0.006934</td>
<td>-0.02017</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.04039</td>
<td>-0.01953</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[0.17166]</td>
<td>[-1.03283]</td>
</tr>
<tr>
<td>Return from DJIA(-1) - one lag</td>
<td>0.701038</td>
<td>-0.018118</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.08813</td>
<td>-0.04261</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[7.95417]</td>
<td>[-0.42521]</td>
</tr>
<tr>
<td>C - Intersect</td>
<td>0.000991</td>
<td>0.000485</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.00058</td>
<td>-0.00028</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[1.72086]</td>
<td>[1.74064]</td>
</tr>
</tbody>
</table>

#### Post - Crisis Period
last 5 years (whole - Period)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Post - Crisis Period</th>
<th>last 5 years (whole - Period)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>June 2009-March 2010</td>
<td>April 2001 -March 2010</td>
</tr>
<tr>
<td>Return from NIFTY(-1) - one lag</td>
<td>-0.015198</td>
<td>0.120009</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.06569</td>
<td>-0.03655</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[-0.23135]</td>
<td>[3.28336]</td>
</tr>
<tr>
<td>Return from DJIA(-1) - one lag</td>
<td>0.296188</td>
<td>-0.17486</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.11635</td>
<td>-0.06474</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[2.54585]</td>
<td>[-2.70108]</td>
</tr>
<tr>
<td>C - Intersect</td>
<td>0.001648</td>
<td>0.00125</td>
</tr>
<tr>
<td>Standard Error</td>
<td>-0.0012</td>
<td>-0.00067</td>
</tr>
<tr>
<td>t-Statistic</td>
<td>[1.37134]</td>
<td>[1.86910]</td>
</tr>
</tbody>
</table>
### Table - VII

<table>
<thead>
<tr>
<th>Period</th>
<th>Variance Decomposition of returns from NIFTY Vs S &amp; P 500</th>
<th>Variance Decomposition of returns from S &amp; P 500</th>
<th>Variance Decomposition of returns from NIFTY Vs DJIA</th>
<th>Variance Decomposition of returns from S &amp; P 500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Variance Decomposition of returns from NIFTY</td>
<td>Variance Decomposition of returns from S &amp; P 500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre - Crisis</td>
<td>89.59</td>
<td>10.41</td>
<td>95.38</td>
<td>4.22</td>
</tr>
<tr>
<td>Crisis</td>
<td>96.31</td>
<td>3.69</td>
<td>83.57</td>
<td>16.43</td>
</tr>
<tr>
<td>Post - Crisis</td>
<td>97.67</td>
<td>2.33</td>
<td>86.82</td>
<td>13.18</td>
</tr>
<tr>
<td>Last 5 years</td>
<td>95.61</td>
<td>4.23</td>
<td>86.54</td>
<td>13.46</td>
</tr>
</tbody>
</table>

#### Period Variance Decomposition of returns from NIFTY

<table>
<thead>
<tr>
<th>Period</th>
<th>Variance Decomposition of returns from NIFTY</th>
<th>Variance Decomposition of returns from S &amp; P 500</th>
<th>Variance Decomposition of returns from NIFTY Vs DJIA</th>
<th>Variance Decomposition of returns from S &amp; P 500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Variance Decomposition of returns from NIFTY</td>
<td>Variance Decomposition of returns from S &amp; P 500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre - Crisis</td>
<td>88.1</td>
<td>11.9</td>
<td>99.83</td>
<td>0.17</td>
</tr>
<tr>
<td>Crisis</td>
<td>96.52</td>
<td>3.48</td>
<td>84.89</td>
<td>15.11</td>
</tr>
<tr>
<td>Post - Crisis</td>
<td>88.75</td>
<td>11.25</td>
<td>95.98</td>
<td>4.02</td>
</tr>
<tr>
<td>Last 5 years</td>
<td>83.81</td>
<td>16.19</td>
<td>99.97</td>
<td>0.03</td>
</tr>
</tbody>
</table>