Co-Movements of and Linkages Between National Stock Exchange (NSE) and New York Stock Exchange (NYSE)

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ABSTRACT

The financial markets have now become more closely interlinked in the world over than ever before despite the differences in risk perceptions of the markets or the country profiles. The dynamics of cross-country trade and payments have evolved to such an extent that the economic slowdown of a country is bound to affect its trading partners as is clearly discernable from the leading movement in the global stock prices. In the current context of globalization and the subsequent integration of the global markets, this study captures the trends, similarities and patterns in the activities and movements of the National Stock Exchange of India (NSE) in comparison to the New York Stock Exchange (NYSE). The prime objective of the study is to check the long term association and cause & effect relationship between the indices of Indian stock market and New York Stock Exchange. Johansen's co-integration test and Granger Wald Causality test are used for examining the long term relationship between both the stock markets, and to know the cause and effect relationship between the variables selected. The GARCH (1,1) model has been used to capture the main characteristics of financial time series such as stationarity, fat-tails, and volatility clustering. The paper tests the correlation between the two exchanges to prove that the Indian markets have become more integrated with their global counterparts and their reactions are in tandem with what are seen globally.

Keywords: *Correlation, GARCH, Granger Wald Causality, Johansen's co-integration, NSE, NYSE, Risk, Return, Stock Market.*

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INTRODUCTION

As the world is undergoing the rapid process of globalization, international trade in both goods and financial assets, has expanded tremendously. Fast developments in information technology and means of communication have greatly facilitated the international transmission of information, dissemination of knowledge and diffusion of technology. The financial markets are characterized by dramatic evolution, with liberalization of financial transactions, removal of restrictions on cross-border capital flows, development of new financial products, as well as harmonization of practices, policies, regulations and corporate governance rules. Most importantly, the stock markets get the major impact of such happenings.

The movement towards a synchronized stock market landscape has gained momentum, especially during the past two decades, where tighter economical and financial linkages among developed economies have grown stronger. However, the rise of many important emerging markets, which had been a major driver of global growth in the past decades, had opened up additional channels for cross-border relations. Other causes behind the rapid increase in world trade, capital movements and foreign investments between world economies are market deregulation, technological advances and removal of statutory controls. Many of these factors have contributed to more interlinked economies, which in turn, are said to have given rise to a higher degree of stock market synchronization, especially in volatile time periods, like eruption of a financial crisis, war or political instability. The aftermath of historical financial crises, have opened up a tremendous interest for determining the underlying factors that might explain how stock markets are correlated with one another for better understanding the causes of the sudden and simultaneous deterioration of wealth that occur during period of crisis. The extent of financial and economic integration between a country-pair may indeed be reflected by the degree of stock markets co-movements that they exhibit. In fact, the dynamic structures of international economies have clearly intensified the complexity behind stock market performances. As our countries become more economically interlinked, explaining the formation of price co-movement between stock markets on an international level is significant for better understanding this higher interdependency and integration.

Stock markets have been the area of interest for the researchers for many years. The Indian stock exchanges hold a place of prominence not only in Asia but also at the global stage. The Bombay Stock Exchange (BSE) is one of the oldest exchanges across the world, while the National Stock Exchange (NSE) is among the best in terms of sophistication and advancement of technology. The Indian stock market scene really picked up after the opening up of the economy in the early nineties. This opening up of the system led to increased integration with heightened cross border flow of capital, with India emerging as an investment 'hotspot' resulting in our stock exchanges being impacted by global cues like never before.

Numbers of researches have been carried out in the field of integration of stock markets across the world. But the impact and degree of integration is changing and expanding continuously with the emerging reforms, integration of countries through various agreements such as BRICS, NAFTA, SAFTA etc. and the introduction of new and more effective and efficient technologies in this field. Since, the stock markets across the world show some kind of correlated movements and it has been observed that developed nations' disturbances have a significant impact on the stock exchanges of the developing nations' stock exchanges and vice-versa so it seems to be important to calculate the impact of the developed country's stock exchange on the stock exchanges of developing nation's stock exchanges and vice-versa. It would be interesting to see whether the stock markets of the developing nations impact the stock markets of developed nations or not, and if they have an impact then the degree would play a crucial role in judging the movement.

It has always been observed that even our Indian stock market is deeply influenced by the major developed markets across the world and especially by the US markets. The present study attempts to investigate these linkages between NYSE and NSE.

ITERATURE REVIEW

Emerging stock markets' integration has naturally constituted a privileged field for international financial research. Markets are said to be integrated if they share a common trend, that is to say, if they move together. There have been numerous studies on market integration and interdependence. However, the literature review shows that there is conflicting evidence on the issue of international stock market linkages.

Chan, Benton and Min (1997) conducted a study on integration of stock markets by including 18 nations covering a 32 year period. These markets were analyzed both separately and collectively in regions to test for the weak form market efficiency. The cross country market efficiency is tested by using Johansen's co-integration test. The results proved that only small number of stock markets shown evidence of co-integration with others.

Bala and Mukund (2001) in their study examined the nature and extent of linkage between the US and the Indian stock markets. They used the theory of co-integration to study the interdependence between the Bombay stock exchange (BSE), the NYSE and NASDAQ. The data consisted of daily closing prices for the three indices from January 1991 through December 1999. The results investigated that the Indian stock market was not affected by the movements in US markets for the entire sample period.

Aqil Mohd. Hadi Hassan (2003) used multivariate co-integration techniques developed by Johansen (1988, 1991, 1992b) and Johansen and Juselius (1990) to test for the existence of long-term relationships between share prices in the Gulf region. Using a vector-error correction model, they investigated the short-term dynamics of prices by testing for

the existence and direction of inter-temporal Granger-causality. Result shows that share prices in Kuwait and Bahrain are co-integrated with one co-integrating vector, which means the existence of a stable, meaningful long-term relationship between share prices in these two countries. They also investigated the inter-temporal interactions among share prices in three Gulf Co-operation (GCC) countries' stock markets, namely Kuwait, Bahrain and Oman.

Lim et al. (2003) examined the linkages between stock markets in the Asian region over the period 1988-2002 using non-parametric co-integration techniques and they found that there is a common force which brings these markets together in the long run.

Wing Keun Wonget al (2004)investigated the relationship between the major developed markets of United States, United Kingdom and Japan with the emerging markets of Malaysia, Thailand, Korea, Taiwan, Singapore and Hong Kong, and found that Singapore and Taiwan are co-integrating with Japan while Hong Kong is co-integrating with the United States and the United Kingdom. There are no long run equilibrium relationship between Malaysia, Thailand and Korea and the developed markets of the United States, the United Kingdom and Japan. The relationship between the developed and emerging markets also change over time

Wing-Keung Wong, Aman Agarwal, Jun Du (2005) investigated the long run equilibrium relationship and short run dynamic inter linkages between the Indian stock market and world major developed stock market by using the weekly data of BSE 200 (India), S&P 500 (US), FTSE 100 (UK) and Nikkei 225 (Japan) from January 1991 to December 2003.Results show that Indian stock market is integrated with mature markets and sensitive to the dynamics in these markets in the long run. In short run, both US and Japan, Granger causes the Indian stock market but not vice versa. In addition, they found that the Indian stock index and the mature stock indices form fractionally co-integrated relationship in the long run with a common fractional, non stationary component and find that the Johansen method is the best to reveal their co-integration relationship

Debjiban Mukherjee, (2007) in his study has covered New York Stock exchange (NYSE), Hong Kong Stock exchange (HSE), Tokyo Stock exchange (TSE), Russian Stock exchange (RSE), Korean Stock exchange (KSE) from various socio-politico-economic backgrounds. Both the Bombay Stock exchange (BSE) and the National Stock Exchange of Indian Limited (NSE) have been used in the study as a part of Indian stock Market. The time period has been divided into various eras to test the correlation between the various exchanges to prove that the Indian markets have become more integrated with their global counterparts.

Mazharul H. Kazi (2008) examined whether the Australian stock market is integrated to the equity markets of its major trading partners under the influence of globalization. They used the co-integration technique of Johansen (1996, 2000) to ascertain whether the Australian stock market is interrelated with the UK, USA, Canada, German, French and the Japanese stock markets. Essentially, the long-run relationship among selected markets is investigated using annual data for the period1945 to 2002. The result indicates that although selected markets are integrated yet not all are significant enough. The significant overseas markets for Australia are the UK, Canada and German of which the UK is dominating.

Arshad Hasan et al (2008) examined the long term relationship between Karachi stock exchange and equity markets of developed world for the period 2000 to 2006 by using multivariate Co-integration analysis. Johansen and Juselius multivariate Co-integration analysis indicates that markets are integrated and there exists a long term relationship between these markets. However, pair wise Co-integration analysis shows that Karachi stock market is not co-integrated with equity market of US, UK, Germany, Canada, Italy and Australia. However, Karachi stock exchange is found to be integrated with France and Japan.

Janak Raj and Sarat Dhal (2009) investigated the nature of the financial integration of India's stock market with global and major regional markets. Co-integration relation suggests that the Indian market's dependence on global markets, such as the United States and the United Kingdom, is substantially higher than on regional markets such as Singapore and Hong Kong. VECM result shows that international market developments at regional and global levels together could account for the bulk of the total variation in the Indian stock market. Within Asia, the Singapore and Hong Kong markets have significant influence, while the Japanese market has weak influence on the Indian market. The two influential global markets, the United States and the United Kingdom, could have a differential impact on the Indian market in the opposite direction, amid a structural shift in India's integration with these global markets.

Fredj Jawadiet al. (2009) studied the financial integration between the six main Latin American markets and the US market in a nonlinear framework process Co-integration techniques suggested partial time-varying financial integration of Mexico and Chile into the US market. For Brazil, the integration process seems to follow a linear pattern, while they found no long-term relationships between the other Latin markets and the US market. The dynamics of these markets depend simultaneously on local and global risk factors.

Mohamed El Hedi Arouri & Fredj Jawadi (2010) investigated the stock market integration hypothesis of two emerging countries (the Philippines and Mexico) into the world capital market over three decades. To check this hypothesis in the short and long run, they used the nonlinear co-integration techniques. The result shows that both stock markets are nonlinearly integrated into the world market, although the degree of integration is higher for Mexico. Furthermore, they showed that the stock market integration process is nonlinear, asymmetric and time-varying.

Ilhan Meric, Joe H Kim (2012) extensively examined the co-

movements of and the linkages between the U.S. stock market and Asian stock markets. They used principal components analysis (PCA) and Granger-Causality (G-C) statistical techniques. They found that the contemporaneous co-movements of Asian stock markets have become closer and portfolio diversification benefits with Asian stock markets have diminished over time during the January 1, 2001-January 1, 2011 period. They examined that the Singapore, Indian and Japanese stock markets are the most influential stock markets and the Philippine and South Korean stock markets are the least influential stock markets in Asia. The Japanese, Singapore and New Zealand stock markets are least affected stock markets while the movements in the other Asian stock markets and the Shanghai, Australian, and South Korean stock markets are the most affected stock markets.

Aman Srivastava et al (2012) studied the short and long-term relationships in three Asian markets, namely Hongkong, Singapore and Japan along with four other global markets of the USA, UK, Germany and France, perceived to be driving Indian Stock prices. By using co-integration techniques they found that Indian stock markets are very much integrated with other global markets in short run but less integrated in long run.

BJECTIVES OF THE STUDY

The specific objectives of this present study are as follows:

o To investigate the long term relationship between NSE and NYSE.

o To examine the cause and effect relationship between NSE and NYSE.

o To measure the magnitude of volatility between NSE and NYSE.

Hypotheses

The following hypotheses have been formulated:

H0: There is no long term relationship between NSE and NYSE.

H0: There is no significant cause and effect relationship between NSE and NYSE.

H0: NSE and NYSE are not volatile.

Variable and data

The study analyses the relationship between Indian stock market and US stock market. The stock indices used for the study are the most important national benchmark indices for the respective country; the NYSE as an indicator for US and NSE as an indicator for the Indian stock prices. A description of the indices analysed here is presented in table 1. The daily data series from 1st April 2004 to 31st March 2013 is taken for study. Data is collected from official websites of National Stock Exchange and New York Stock Exchange. The data has

Table 1: Description of the Indices Analyzed

Country	Stock Market	Index	Code used in Study
India	NSE	CNX Nifty	NSE_Return
USA	NYSE	NYSE Composite	NYSE_Return

Choice of market is guided by the consideration that India has significant trade and financial relations with US.

ETHODOLOGY

This paper employed the Johansen Co-integration test to determine whether selected US stock markets is co-integrated with share prices in the Indian stock exchange or not. The Augmented Dickey- Fuller (ADF) approach is used to pre-test the order of integration for all time series variables. A visual inspection of the time series plots of the variables investigated suggests that there are no significant break points during the sample period.

Then Co-integration testis used to check whether India and US countries co-integrate in the long run and whether they converge to each other in the short run. Since, the objective of this study is to check the co-integration of the movements of these indices, so natural logarithm of the empirical tests for co-integration can only proceed if the time series are non-stationary. In this analysis, series of indices have been tested for unit root properties using Augmented Dickey Fuller (ADF) Test. For this, the null hypothesis of a single root is tested against the alternative of stationary using the model stated in equation 1.

$$\Delta Y\_t = \propto\_^{\circ} + Y\_(t-1) + \beta\_iY\_(t-1) + e\_t \quad (1)$$

The co-integration analysis technique is still evolving and has many forms, as is evident from the literature. Often the terms, casuality and co-integration are synonymous. To examine the co-movements between the Indian stock market and US stock market, first of all relationship is studied with the simple regression equation.

$$X\_t\text{^}I = a + bX\_t\text{^}k + e\_t \quad (2)$$

Where the endogenous variable X_t^I represents the Indian stock index, the exogenous variable X_t^kis the US stock index and e_t error term. This is very useful when to test and incorporate both the economic theory relating to the long-run relationship between variables and short run disequilibrium behaviours.

$$\Delta y\_t = \propto\_1 + \beta\_i \ 〚\Delta y〛\_(t-1) + \gamma\_iX\_(t-1) + \theta(y\_t - \lambda x\_1)\_(t-1) + e\_t \quad (3)$$

The short-run relationship is captured by the lagged terms of the Äx variable, the current impact of x to y is captured by the β_o coefficient, while the long-run disequilibrium deviations are captured by the one period lagged error-term of the co integrating equation, with θ being the adjustment factor to equilibrium. θ, of course takes values between 0 to 1, while it is obvious that closest to one, the largest is the adjustment to

equilibrium and vice versa.

Maximum Eigen Value Test

The Eigen values are the squared canonical correlation between a linear combination of stationary and linear combination between non-stationary. This interpretation is intuitively appealing because this correlation will be high only if the linear combination of , is itself stationary. Otherwise, a non-stationary variable cannot have a high correlation with a stationary variable. Therefore, higher the Eigen value, higher will be the stationarity of the particular linear combination of the non-stationary variable. Only those Eigen values indicate the co-integrating relationship among the variables which are significantly different from zero. The corresponding (normalized to a variable) Eigen vector of an Eigen value is the potential co-integrating vector. However, this vector represents a co-integrating relationship only if its Eigen value is different from zero. Once the co-integrating vector (in the form of eigenvector) is known, the error-correction vector can easily be estimated using its OLS estimator.

Trace Test

Maximum likelihood estimator gives us k number of Eigen-values, but all of them will not be significantly different from zero. Let us assume only r Eigen values are different from zero. Now there are following possibilities:

r = 0, it means there is no co-integrating relationship among the variables. Therefore, the VAR should be estimated without error correction term.

r = k, this can happen only when is stationary rather than non-stationary.

r < k, then there are only r co-integrating relationship among the variables. This is the most obvious situation and in this case only r Eigen values are different from zero and remaining (k-r) Eigen values are non-distinguishable from zero.

Johansen suggests trace test (ML based test) to determine the number of non-zero Eigen values.

Trace test examines the null hypothesis that the co-integration rank is equal to against the alternative hypothesis that co-integration rank is. The test is conducted in inverse sequence, x i.e.,. The test statistic is computed as follows:

(4)

Although both of these statistics are based on likelihood ratio approach, these do not follow the standard-distribution. Rather they have non-standard distribution.

Before implementing Johansen's test, we have to take two important decisions: (i) what should be the order of the VAR i.e. 'p', and (ii) should we include deterministic parameters with or without imposing co- integration restrictions.

Granger Causality Test

A statistical approach proposed by Clive W Granger (1969) to assess whether there is any potential predictability power of one indicator for the other (Foresti, 2007). A time series is said to Granger Cause other if the past values of the former improve the forecast of the latter (Enders, 2008). A Granger causality test is used for testing the causal relationship between two stationary series Xt and Yt in the following two equations: +

Where α, β, δ, φ, γ, 's are constants and m is the optimal lag length and are assumed to be white noise i.e., disturbance terms with zero mean and finite variance.

Granger causality test seeks to answer whether changes in cause changes in ? If causes Xt, lags of the former should be significant in the equation for the latter i.e., 0. If this is the case and not vice-versa (i.e., = 0) it would be said that Yt Granger causes Xt or that there exists uni-directional causality from Yt to Xt. On the other hand, if Xt causes Yt, lags of Xt should be significant in the equation for Yt. If both sets of lags are significant, it would be said that there exists 'bi-directional causality' or 'bi-directional feedback'. Also, if there exists uni-directional Granger causality from Yt to Xt , then Yt is said to strongly exogenous in the equation of Xt. If neither set of lags are statistically significant in the equation for the other variable, then it is said to be independent of each other. Granger causality really means only a correlation between the current value of one variable and the past values of other. It does not mean that movements of one variable cause movements of another.

GARCH Model

The GARCH (1, 1) model is also used to capture the main characteristics of financial time series such as stationarity, fat-tails, and volatility clustering. As per GARCH (1, 1) model, the presence of persistence in volatility clustering implies inefficiency of the capital market in India.

The basic GARCH (1, 1) model can be expressed as:

Mean Equation: $R_t = \mu + e_t$

Variance Equation: $\sigma_t^2 = \omega + \alpha e_{(t-1)}^2 + \beta \sigma_{(t-1)}^2$

Where $e_{(t-1)}^2$ is the news about volatility from the previous period and 〖σ〗 $_{(t-1)}^2$ is the last period forecast variance.

being close to one shows high persistence in volatility clustering and implies inefficiency of the market.

MPIRICAL ANALYSIS

Table 2 shows statistical moments of daily stock returns. For the sample period (April 2004-March 2013), the study found that Indian stock market provided highest stock returns. In terms of risk adjusted return (average stock adjusted to standard deviation), the Indian stock market provided highest returns with higher standard deviation. Skewness and kurtosis measures provide insights about the underlying statistical distribution of stock returns. It is evident that skewness is negative and kurtosis is positive for both the markets during the sample period. Skewness and kurtosis exhibit more or less a similar pattern of statistical distribution. The Jarque-Bera statistic, defined over skewness and kurtosis measures, is very high for both the markets, implying that stock returns differ significantly from the normal distribution. This implies that in each stock market there are opportunities for investors to benefit from abnormal returns.

Table 2: Descriptive Statistics of Stock Return (April 2004- March 2013)

	NSE_Return	NYSE_Return
Mean	0.000526	0.000146
Median	0.001093	0.000757
Maximum	0.163343	0.115258
Minimum	–0.152303	–0.102321
Std. Dev.	0.017153	0.014443
Skewness	–0.483249	–0.366921
Kurtosis	14.12960	13.66803
Jarque-Bera	11247.79	10305.38

Table 3: Correlation of Stock Markets

	NSE_Return	NYSE_Return
NSE_Return	1.000000	0.330630
NYSE_Return	0.330630	1.000000

It is evident from the table 3 that Indian stock market showed lesser but positive co-movement with the global stock markets of the United States

Figure1: Stock Prices of NSE and NYSE

Both the indices are moving in tandem i.e. correlation is existing between the two indices(as quoted by table 3).Figure 1 shows the co-movement of India's stock prices with US stock market. The X-axis depicts the time frame in years and the Y-axis depicts closing prices of stock markets. Graph shows similar trend for both the markets because of their interdependence on each other, and this can be attributed to various reasons like the high dependence of the American economy on the Indian economy as far as human resources, both skilled and unskilled are concerned. There is high degree of inflow of capital to India in the form of FIIs, FDIs and jobs as well.

The sharp dip seen in the year 2009 is due to the deepening of the crisis, when many well established financial institutions (like Lehman brothers) could not sustain the crisis and collapsed leaving the finances of the world devastated. The market sentiments were highly negative during this time frame and investors' confidence in the markets had received a direct blow.

Again, both indices are moving in absolute harmony with each other. The primary trend is almost a parallel one. The shocker that came with the subprime crisis is seen to take a back seat, giving way to opening up of the trade channels between the US and India. This is the reason why the indices are seen to improve in values, though stagnant graphs highlight the slow recovery after the depression caused by the subprime crisis..

Thus, it can be deduced that there is a positive correlation among the two indices (and hence between the respective exchanges that they are representing) and they move together irrespective of the market condition. This is proved further with the analysis of the kind of relationship between these two indices considered for the study.

ADF Test Results

While testing for the stationarity of series using ADF test, the hypothesis is:

H0: Presence of unit root i.e., non-stationary series.

H1: No unit roots i.e., stationary series.

The critical values of the ADF at 1%, 5% and 10% levels are tabulated in Table 4.

Table 4: Critical Values

	1%	5%	10%
Critical Values	–3.433072	–2.862628	–2.567395

The logarithm returns of all the selected index series are tested for stationarity at various levels. The results for the same are reported in table 5.

Table 5: Results of Stationarity at First Difference (Intercept)

	Values
D(NSE_Return)	–44.73250
D(NYSE_Return)	–51.41097

Comparing table 4 and 5 shows that the calculated ADF test statistics is less than the critical value, so the null hypothesis of presence of one unit root is rejected. This implies that the series becomes stationary at first difference. Or, it can be said that the ADF test confirms the stationarity of returns of stock exchanges.

Now, since the index returns of both the stock markets are stationary, they can be used to carry out further analysis.

Johansen's Co-integration Test Results

Before testing for co-integration, it is necessary to determine the optimal lag length. The available literature suggests that optimal lag length for studies trying to prove co-integration between stock markets can be considered as one. Accordingly, the study has taken the lag length as one in the model for analysis.

Co-integration Test

The test requires maximization of Eigen value and trace test which will determine the number of co-integrating equations. The hypothesis used for the test is:

H0: There is no long run relationship between returns of Nifty

and returns of NYSE.

The analysis is done for the defined period and results are reported in table 6.

Table 6: Unrestricted Co-integration Rank Test

PERIODS	NUMBER OF HYPOTHESISED EQUATIONS	MAXIMUM EIGEN STATISTICS	TRACE STATISTICS	P-VALUE
1-04-2004 to 31-03-2013	None	499.8993	908.5862	0.0001
	At most 1	408.6870	408.6870	0.0000

As can be seen in the table 6, for the sample period both maximum Eigen statistics and trace statistics have p-value less than 0.05, so the null hypothesis that there is no long run relationship between Nifty index return series and NYSE Composite stock indices return series in logarithm is rejected, i.e., there exists a long-run relationship between the two return series. For the null hypothesis that there exits at most one co-integration equation between the two return series, both the maximum Eigen statistics and trace statistics have p-value less than 0.05. Hence, null hypothesis is rejected. So, finally we conclude that there exists a long-run relationship between NSE and NYSE returns.

Granger Causality Test Results

The pre-requisite for Granger Causality test is that the analysis is done on the stationary series. The hypothesis formulated is as under:

H0: Movement in returns of Nifty does not Granger cause movement in returns of NYSE Composite.

Table 7: Granger Causality Results

Null Hypothesis	F-Statistic	Prob.
NYSE_RETURN does not Granger Cause NSE_RETURN	68.8991	1.E-29
NSE_RETURN does not Granger Cause NYSE_RETURN	1.25609	0.2850

To examine the short-run dynamics of the series, a Granger Causality test was performed. The results, which are summarized in Table 7, suggest that the both countries are significantly related in the short-run. NSE stock market is affected by US stock market i.e NYSE. Results indicate a unidirectional Granger Causality from NYSE to NSE.

GARCH (1,1) MODEL

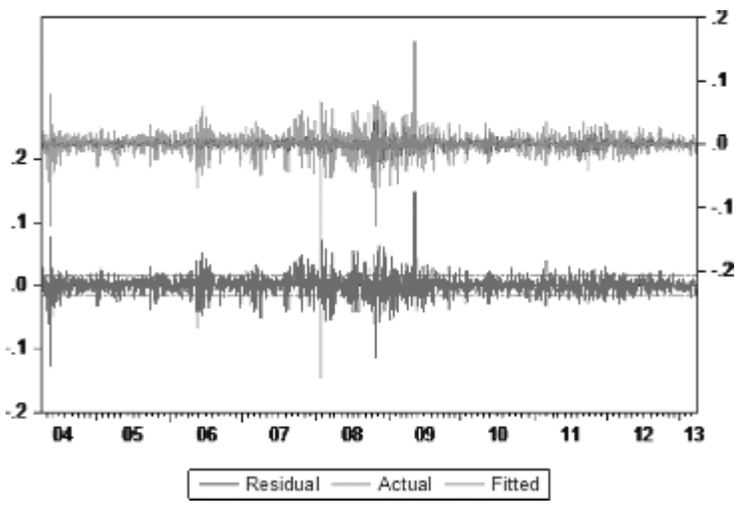

Fig. 2 plots the daily return residual and it is very apparent from this that the amplitude of the daily stock returns is changing. The magnitude of the changes is sometimes large and sometimes small. It can be seen that periods of low volatility tend to be followed by periods of low volatility for a prolonged period and periods of high volatility is followed by periods of high volatility for a prolonged period. This is the effect that GARCH is designed to measure and is known as volatility clustering.

Table 8: Garch (1, 1) Estimates of Data

Variables	Coefficient	Z-Statistics	P-value
ω	**4.77E-06**	**5.375939**	**0.0000**
α	**0.141195**	**9.63944**	**0.0000**
β	**0.849440**	**96.97795**	**0.0000**

The reported results in the table 8 show that the value of (α+β) is very close to 1 for all capital markets, suggesting thereby a high persistence of volatility clusters over the sample period in the markets. Such high persistence of volatility clusters during the sample period in emerging as well as developed capital markets may be due to the most recent global financial recession, and underlying credit and confident crises.

ONCLUSION

The present study examined the impact of global integration on Indian stock markets. The empirical analysis provides various perspectives on co-integration among global stock markets, examining daily time series for a period April 2004 – March 2013 when global markets have gone through financial sufferings by using Johansen co-integration, Granger Casuality and GARCH(1,1) model. Both markets have been exhibiting tighter co-movements with one another, and that they are more integrated due to closer financial and economical linkages. Correlation result suggests that Indian stock market showed positive co-movement with the global stock markets of the United States. The Jarque-Bera statistic, defined over skewness and kurtosis measures, is very high for both the markets, implying that stock returns follow random walk over the period of study. ADF test confirms the stationarity of returns of stock exchanges. Granger Causality test results indicate a unidirectional Granger Causality from NYSE to NSE. This proves short run relationship between NSE and NYSE. Johansen's Co-integration Test proved long-run relationship between NSE and NYSE returns. GARCH model indicates high persistence of volatility clusters among both the markets. Results provide supportive evidence of increased stock market integration both short term and long term linkages. In spite of some disturbances, the result shows that both the markets have relatively similar movements during the period of study. The present paper has made it clear that the two exchanges under study move more or less in tandem with each other. Important global happenings are seen to affect both the exchanges in a similar fashion. NYSE is a mature and the most stable stock exchange of US. NSE seems to have followed or moved in tandem with the NYSE. It actually matches the level of a well established benchmark, NYSE. Now, the volatility of NSE is almost at par with the NYSE. A greater degree of co-movements in stock prices is seen as a reflection of greater stock market integration.

The findings of this research are very important for policy makers, investors and fund managers. Policy makers, investors and fund managers should closely watch any sharp movement in the global markets which are influential for Indian stock markets. From the policy perspective, if markets are co-integrated then this implies financial stability and prices cannot deviate too far from the long-run equilibrium path. Investors cannot benefit from arbitrage activities in the long run. But in short run, markets would continue to be influenced by the portfolio diversification objective of foreign investors.

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