AN EMPIRICAL STUDY OF TESTING FINANCIAL INTEGRATION BETWEEN INDIAN AND NEW YORK STOCK MARKET

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PURPOSE

THE current study is an attempt to analyze the financial integration between NSE and NYSE stock market on the basis of daily closing index of NYSE and NSE. A saying goes like, 'when America sneezes, world catches cold'. Therefore, we tried to testify that to what extent this statement is applicable in respect of Indian stock exchange market and further study inter linkages and inter relationships between them.

Design/Methodology/Approach: *For the purpose of this study, New York Stock Exchange (NYSE) has been considered as America's representative exchange and in respect to India, the National Stock Exchange (NSE) has been selected. The monthly closing stock index price has been taken starting from January, 2000 to December, 2016. The data were mainly collected from NYSE and NSE website. The Descriptive Statistic has been applied to study the normal trend and pattern. For checking data series stationarity, the line graph and the log value of indices have been used and further, to testify the data Augmented Dickey-Fuller (ADF) test under unit root hypothesis has been applied. Also, Granger Causality was applied for causation and for long-term relationship, Johansen Co-integration test was used. E-Views 9 was used for the analysis.*

Findings: *Descriptive statistics show that stock market of India provides lower returns in comparison to the New York stock market. Results inferred by Granger Causality test show that returns at NYSE does granger cause the returns at Indian stock exchange which also depicts that the returns on NSE is influenced more with NYSE index co-movements but not vice-versa because NSE does not Granger Cause return at NYSE. The result of the Johansen Co-integration test suggest the existence of co-integration between them which means that movements in NYSE index influences NSE market and both having co-movements.*

Research Limitations/Implications: *We took the sample data for the period January, 2000 to December, 2016. A larger sample data could also be taken in the future and although only one stock market index from both the countries were taken but one more major stock exchange could also be taken for the same study like Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) and New York Stock Exchange (NYSE), National Association of Securities Dealers Automated Quotations (NASDAQ).*

Practical Implications: *The study provides the basis for framing government policy keeping in mind the existence of empirically proven financial integration between NSE and NYSE. Not only this, various market participants may use the conclusion of this study in order to formulate different*

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investment strategy especially keeping in mind the fluctuations happening in Indian and American market.

Originality/Value: *The study is unique, unpublished, and original.*

Key Words: *India-New York Inter-relationship, Stock Market, Integration, Granger Causality.*

Introduction

Growth of a country is dependent upon growth of industries in the country and growth of industries are further dependent upon condition of capital market of the country because this market is going to give an element which is most important for the success and failure of every industry i.e., funds. Funds work as a life blood for an industry, more particularly for a company. The capital market helps the companies to raise funds for satisfying their fund requirement need. Basically capital market of a country works as a channel for creating demand and supply of the debt and equity capital. It's always been a key part of overall financial system of every economy. On one hand primary market helps raising the funds for long-term requirements of corporates and institution and on the other, secondary market provides buying and selling the securities already issued in primary market and hence provide liquidity to investors. This market not only boost growth of different sectors of economy but also channelize the surplus funds (savings) to the deficient fund (borrowings) units of society and thereby enables the optimum allocation of capital resource scarce in nature thus provide the long-term funds for sustainable economic growth. As we know that, a sound and efficient stock market is now need of the hour for increasing growth of economy manifold therefore, the focus has been shifted now on establishment of variables which determine the stock returns.

New York stock exchange (NYSE) is the biggest exchange of not only America but of the whole world with market capitalization of US $ 19.3 million. It enjoys the distinguished position of the most advanced and electronically mechanized exchange of the world. In line with the same standards, India has also developed a progressively advanced stock exchange which is called National Stock Exchange (NSE). NYSE in USA and NSE in India are the leading stock exchanges of the respective countries. India and USA enjoy strong economic and political connections with each other for the past many years. On one hand, USA is considered as economic giant of the world and on the other, India is having a strategic position in the Asian region. Considering all these factors, main objective of this study is to examine causal relationship and inter-linkages in between these two nations in terms of their respective stock exchange markets. Further, the study also attempts to find the scope of integration between stock exchange markets of USA and India.

About Indian and American Stock Market

National Stock Exchange

In India, there are basically two leading stock exchanges the National Stock Exchange of India Limited (NSE) and Bombay Stock Exchange (BSE) but for the present article only NSE has been taken as it is being considered as the real barometer with the market capitalization US $1.65 trillion ranked 12th in the world. NSE, established in 1992, being India's first demutualized electronic exchange, not only provide more modern and screen-based fully-automated trading system but also makes the trading facility easier to investors who are spread across India. NSE flagship index is *CNX Nifty* which incorporates 50 stock in index, which is used by the investors extensively in and around India and world for analyzing the Indian capital markets. NSE's is having state of-the-art application with record up time of 99.99% which processes messages around 450 million daily having sub millisecond response time.

New York Stock Exchange

New York stock exchange has history of 224 years, established in May, 1792. Its history can be traced to Buttonwood Agreement. Earlier securities were intermediated by auctioneers. New York

Stock Exchange (also known as Big Board) offers a platform for sellers and buyers to trade in the shares of registered companies listed on the exchange. Continuous auction format was in practice earlier which helped traders to make transactions on behalf of investors but this process was scrapped and fully automated system was introduced in 1995. Basically, the composite index of New York Stock Exchange was created in mid-1960s starting with 50 points base which was then equal to 1965's yearly close. It was an attempt to reflect all the stocks traded at exchange instead of only taking 30 stocks which were included in Industrial Average of Dow Jones. But again in 2003, NYSE index value was set to a new base level of 5,000 for raising its profile. Its flagship indices are NYSE Composite, S&P 500, and Dow Jones. Since, it is among the first top stock exchanges of world, therefore, it has more than 2,400 companies listed having more than US $ 19.3 trillion market capitalization. It is not only considered as the 'financial barometer' of United States of America but for the world at large as a crisis in USA leads to spillover effects across the globe. Although, USA has two stock exchanges NYSE and NASDAQ, but in the present study NYSE has been taken as a sample exchange for making comparison with NSE.

Review of Literature

Study by Ripley (1973, p. 360) suggest the existence of "low correlations between national stock markets, supporting the paybacks of international diversification". Chaudhuri (1997) examined the relationship among six countries of Latin America with the help of co-integration and causality. The study found a long-term connection among all the six countries. Bekaert & Harvey (1995) tried to explore the inter-linkages between Pakistan equity market and seven other prominent equity markets of the world including USA and UK. They examined market integration among these countries through Engle and Granger co-integration techniques. It was found that, there is a little evidence of inter-linkages between Pakistani market and other major markets. They concluded that, there is a scope of diversification for global investors. Campbell & Hamao (1992) found that all assets with similar risk exposure, in the perfect integrated markets, observe equal expected returns. Researchers (Karolyi, 1992 & Harvey, 2001) have also examined time-varying linkages between different international markets and they explored that when a global factor dominates domestic market, it tends to correlate with the global market. Longin & Solnik (1995); Goel & Gupta (2011) suggested that when domestic market tends to go with international market, the correlation is found to be very high. Faff & Mittoo (2003) tried to explore the origin of market integration, that is, whether it is associated with geographical proximity or industry proximity. The study was conducted for the period from 1983 to 1997 and multi-factor pricing framework was tested. It was found that U.S.A. and Canadian markets exhibit different prices than Australian stock market.

Mukhopadhyay & Sarkar (2003); Khan & Asif (2000) examined impact of macroeconomic level factors on returns of Indian stock market, specifically, in the pre and post liberalization period. The study established that "before liberalization, real economic activity, inflation, money supply growth, FDI and NASDAQ-index were found significant in explaining Indian stock return's variations but same was not prevalent after liberalization period" (Oseni & Nwosa, 2011, p. 44). Gupta & Basu (2008) observed that "the Indian stock market is integrated with mature markets and sensitive to their dynamics in the long run. In the short-run, the US and Japan markets influenced the Indian market but not vice versa" (p. 22). Mukherjee (2007) captured the trend, patterns and similarities in Indian stock market movements in relation to international markets. The study opted different stock exchanges, namely; Russian Stock Exchange (RSE), New York Stock Exchange (NYSE), Hong Kong Stock Exchange (HSE), Korean Stock Exchange (KSE), and Tokyo Stock Exchange (TSE). From India, both BSE and NSE have been taken. The study pointed out that stock markets actually impacted each other and especially during the post 2000 period. Aktar (2009) investigated the possibility of co-integration and co-movements among stock prices at stock exchange of Hungry, Russia, and Turkey during January, 2000 to October, 2008. The study highlighted the co-integration among markets under study. Chittedi (2009) explored inter-relationship between the stock markets of BRIC and developed nations (like US, UK, and Japan). The results of the study highlighted the existence of co-integration between them. Sheu & Liao (2011)

examined causal relationship and integration between USA and BRIC markets. It was found that Brazil, Russia, and China are having significant influence on Dow Jones after 2006 but Dow Jones has significant impact on all BRIC nations.

The study conducted by Vieito, Bhanumurthy & Tripathi (2013) empirically explored the weak-form efficiency amongst the nations which ranked highest on the development scale (G-20) along with assessing the impact of global financial crisis on the markets of such nations. The study point towards the existence of inefficient market index but efficient individual stocks. Venkatesh (2013) explored inter-linkages among BRICS markets and found that BRICS markets do not constitute a strong homogeneous alliance. Further, it was found that Indian market is more integrated towards other BRICS counterparts (Modi, 2000).

The long term inter-relationship between stock returns and inflation in BRICS markets was analyzed by Tripathi & Kumar (2014); Maheshwari, Krishnamoorthy, Berry, & Stone (2003). The panel data for the period from March, 2000 to September, 2013 were empirically tested using statistical measures like ADF, PP, and KPSS. They found non-stationarity in the characteristic of data. They also examined co-integrating relationship, by using Pedroni. It was found that in short run, inflation may lead to some movement in market returns but in long run, inflation is not a good option to hedge against inflation. Bhanumurthy & Singh (2014), through the analysis of IPOs performance, found a significant relationship between introduced IPO's performance and market index performance.

Gulia & Handa (2015); Singh & Gupta (2013) analysed BRICS stock exchange daily closing indices in an attempt to study causal relationship among returns of BRICS' and also to check the possibility of integration of Indian market with rest of the BRICS nation's stock exchanges during the period of study from June 1, 2009 to March 31, 2015. The result of the study revealed that neither Indian stock returns are affecting China's returns nor China's stock returns are affecting India's stock returns. Their results of co-integration test inferred that the stock exchanges of the BRICS countries are not co-integrated. Nashier (2015) examined stock market integration among BRICS, USA and UK stock markets with the application of correlation and Johansen's co-integration test. The study found the evidences for both the short-term static and the long-term dynamic integration between these stock markets. Therefore, study identified that no gain can be derived by different investors in developed stock markets from diversifying their investments across the BRICS markets or vice versa. Singh & Shrivastav (2016) tried to explore the inter linkages between Indian and Sri Lankan stock market. They found that inspite of the fact that these two countries share very long political and historical relations, still these nations did not exhibit any co-movement in their stock market over the period of time.

Objectives of Study

The study highlights the inter-linkages and relationship between Indian and USA stock exchanges. The objectives of the study are stated below:

Primary Objective

1. To examine the possibility of inter-linkages between American and Indian stock exchanges.

Secondary Objective

1. To find the correlation between the performance of National Stock Exchange and New York Stock Exchange.
2. To examine the existence of co-integration between National Stock Exchange and New York Stock Exchange.

Research Design and Methodology

Data

This study is a small attempt to identify that whether NSE and NYSE markets share any inter-linkages or not. Further, to identify the co-integration between both of them the study has used data for a period of 17 years starting from 1st January, 2000 to 31st December, 2016 in order to evaluate dynamic relationship between them. Only one stock exchange from both the nations has been selected as a sample exchange. As a representative of USA market, New York Stock Exchange (NYSE) has been chosen. Similarly from India, National Stock Exchange (NSE) is selected.

Monthly closing index price has been taken for NYSE and NSE during the study period. The data series converted into log form to reduce any distortion in the data and to have both series of data at same level for comparison purpose. Data is obtained from the respective stock market's website. The data so obtained was analysed with the help of E-Views 9.

Tools and Techniques

For checking the basic properties of the data, the first and foremost tool is descriptive statistics. Basically it has been used to summarize features of the data series with regard to skewness, kurtosis, and normality. Further, in the studies related to time series analysis, it is essential to check data series for stationarity as unit root presence in the data may yield false results which may be type I or type II errors. Therefore, it is imperative to go for checking stationarity of data series in time series. For this purpose, a more sophisticated tool, that is, Augment Dickey-Fuller test was applied to find out whether data is having unit root or not. Time series data is called as stationary if it is constant over time.

$$\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

Here in the above equation α is constant, β is coefficient of time trend, autoregressive process lag order is denoted by p. Treating constraints $\alpha = 0$ and $\beta = 0$ implies random walk hypothesis. After checking the unit root, we applied Granger's causality to identify any short run causality between them. Johansen co-integration test is applied to explore long term relationship between NSE and NYSE after exploring Granger's causality.

Data Analysis and Interpretation

Table No. 1: Descriptive Statistics

Particulars	NSE	NYSE
Mean	32.70739	33.30391
Median	29.50000	43.45000
Maximum	975.0000	971.7000
Minimum	-1035.600	-1036.450
Std. Dev.	277.9912	279.1563
Skewness	-0.344256	-0.357714
Kurtosis	5.412618	5.262856
Jarque-Bera	53.24328	47.64034
Probability	0.000000	0.000000
Sum	6639.600	6761.850
Sum Sq. Dev.	15610384	15741505
Observations	203	203

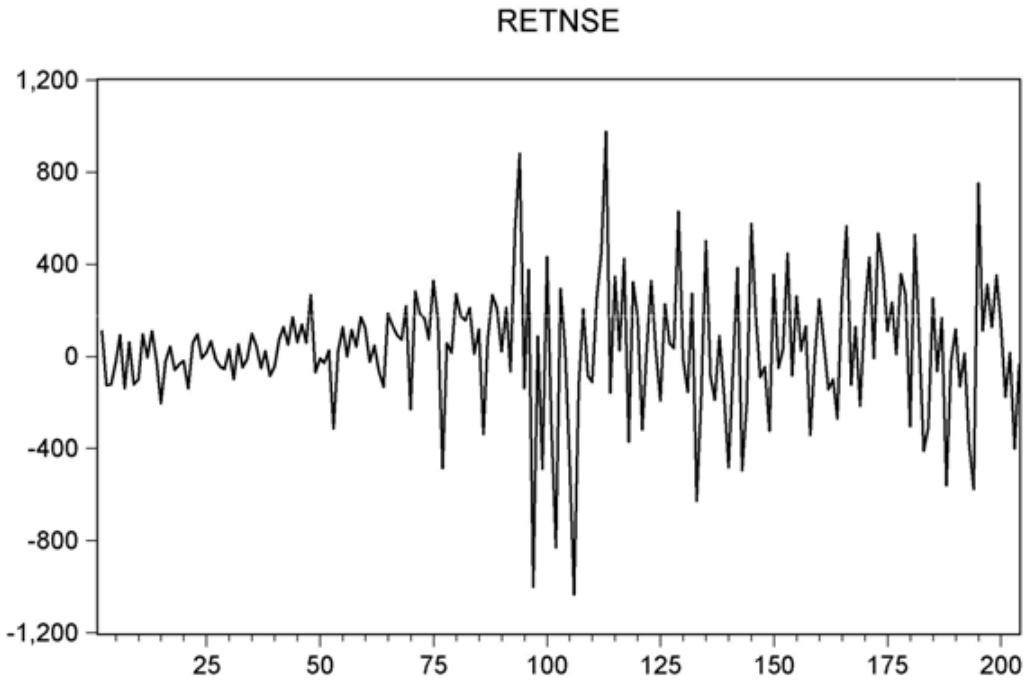

Figure No. 1: Line Graph of NSE Nifty Return

This section shows the analysis and interpretation of panel data with respect to the indices of NSE and NYSE. Starting with descriptive statistics as shown in table no. 1, results of descriptive statistics shows that NYSE and NSE index series are negatively skewed, which means tail of distribution is on

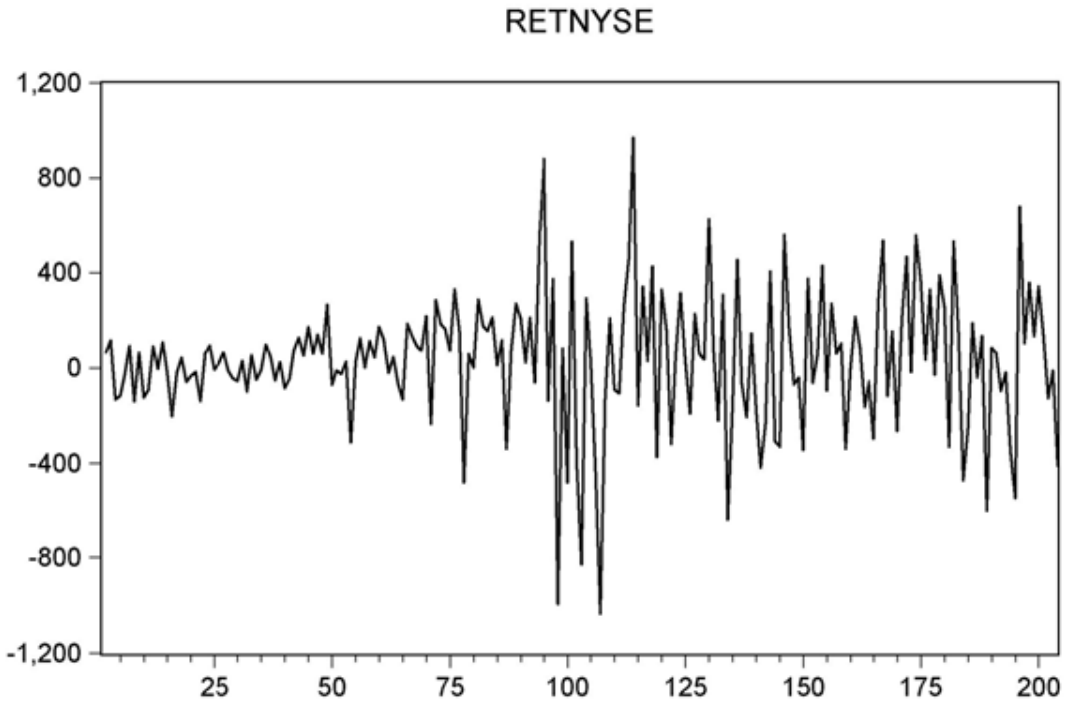

Figure No. 2: Line graph of NYSE

left and mass distribution concentration is on right. The mean return comparison shows that NYSE is giving higher returns than NSE.

Further, line graphs have been prepared for these two time series data. Figure no. 1 and 2 depict return series of NYSE and NSE respectively. Here it is very clear that, both the series are having constant mean over time but volatility is also visible in data series with spike movements in the line. For checking unit root in the data, ADF test results were obtained through E-Views 9.

Table No. 2: ADF Results for NSE Index

Augmented Dickey-Fuller test statistic			-14.47453	0.0000
Test critical values:	1% Level		-3.462737	
	5% Level		-2.875680	
	10% Level		-2.574385	
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGIND(-1) -1.023207	0.070690	-14.47453	0.0000	
C	33.09892	19.78652	1.672802	0.0959
R-squared	0.511614	Mean dependent var.	-0.729802	
Adjusted E-squared	0.509172	S.D. dependent var.	398.5930	
S.E. of regression	279.2507	Akaike info criterion	14.11195	
Sum squared residual	15595191	Schwarz criterion	14.14470	
Log likelihood	-1423.307	Hannan-Quinn criter.	14.12520	
F-statistic	209.5121	Durbin-Watson stat	1.997315	
Prob.(F-statistic)	0.000000			

Table No. 3: ADF Results for NYSE

Null Hypothesis: D(LOGNYSE) has a unit root				
Exogenous: Constant Lag				
Length: 0 (Automatic - based on SIC, maxlag=14)				
Variables		Std. Error	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-14.56304	0.0000	
Test critical values: 1% Level		-3.462737		
	5% Level	-2.875680		
	10% Level	-2.574385		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LOGIND(-1) -1.035579	0.071110	-14.56304	0.0000	
C	34.42048	19.88726	1.730780	0.0850
R-squared	0.514660	Mean dependent var.	-2.342574	
Adjusted E-squared	0.512233	S.D. dependent var.	401.4368	
S.E. of regression	280.3647	Akaike info criterion	14.11191	
Sum squared residual	15720878	Schwarz criterion	14.15267	
Log likelihood	-1424.111	Hannan-Quinn criter.	14.13316	
F-statistic	212.0820	Durbin-Watson stat	1.987938	
Prob.(F-statistic)	0.000000			

Table No. 4: Granger Causality Test Results

Null Hypothesis	Obs.	F-Statistics	Prob.	Causal Relationship
RETNSE does not Granger Cause RETNYSE	201	0.50562	0.6039	No
RETNYSE does not Granger Cause RETNSE		9938.74	1E-197	Yes

Table No. 5: Co-integration Results of NSE and NYSE

Trend assumption: Linear deterministic trend
Series: LOGNSE LOGNYSE
Lags interval (in first differences): 1 to 4
Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistics	0.05 Critical Value	Prob.**
None*	0.537130	178.7660	15.4971	0.0001
At most 1*	0.124140	26.24472	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Co integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigen value	Trace Statistics	0.05 Critical Value	Prob.**
None*	0.537130	152.5213	14.26460	0.0001
At most 1*	0.124140	26.24472	3.841466	0.0000

Trace test indicates 2 co integrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Unrestricted Co integrating Coefficients

LOGNSE	**LOGNYSE**
-0.158124	0.15747
-0.004956	0.013510

The result of unit root test has been presented in table no. 2 & 3. The null hypothesis was tested with the use of Augmented Dickey Fuller test and it was found that data series was having unit root at 5% significance level. Therefore, the test was again conducted on first difference data series. With the usage of first difference data series, t- value was higher compared to the critical values and hence, data series exhibited stationarity, that is, no presence of unit root. The results were statistically significant as p-value was found to be less than 0.05.

After checking the unit root in the data series, the short term relationship was explored through Granger's causality test. It was concluded that NYSE market movement does affect the market movement of NSE but not vice-versa. The opinion in case of NYSE affecting NSE is statistically significant as the p-value was found to be less than 0.05.

After exploring short run relationship, Johansen co-integration test was applied to explore long-term

relationship in the data series. It is clear from the result of co-integration (table no. 5) that there is possibility of having long run co-integrating relationship between NYSE and NSE market.

Conclusions

It's a known fact that NYSE is the biggest exchange of not only USA but of the whole world with market capitalization of US $ 19.3 million. It enjoys the distinguished position of the most advanced and electronically mechanized exchange of the world. NSE is also ranked world's 12th largest stock exchange with market cap of more than $ 1.65 trillion. NSE is capable of processing more than 450 million messages daily with sub millisecond response and with 99.99% of record up time.

These are the two prominent stock exchanges in India and USA. Although, India and USA do not enjoy close proximity when it comes to their geographical location but, in terms of trade, the relationship between both the nations continued to be strong over the past many years. Considering all these factors, present study tried to explore causal relationship and inter-linkages between the stock markets of these two nations. It is observed through descriptive statistics that NYSE and NSE both data series are having negative skewness and NYSE gives higher return in comparison to NSE. Further, Granger's causality showed that NYSE affects NSE market but the reverse is not true. Johansen co-integration showed presence of co-integrating relationship between both of them. Therefore, it can be concluded that, India and USA have good relations, both countries enjoy a strategic position in their own geographical cluster. Both the nations have been found to have strong historical connections as well. Such associations in different spheres between both the nations are reflected in the co-integration of their stock markets. Granger causality also speaks about causal relationship of NYSE and NSE and the results are also confirmed from Johansen's Co-integration test in order to have a broader picture of relationship between them. Thus, it can be concluded that the stock exchange market of both the nation's reflect significant financial integration.

Policy Implication of the Study

The study will be useful for the portfolio investors to take the decision with respect to portfolio diversification strategy. The study provides basis for forming government policy keeping in mind the explored financial integration between NSE and NYSE. Various market participants may also get benefitted by the use of results of the study to formulate different investment strategy especially keeping in mind fluctuations happening in Indian and American stoclk market.

Limitations of the Study

Although we tried to capture relationship between stock market of USA and India with the help of different statistical and econometric test but due to the large number of dataset we took the sample data for period January, 2000 to December, 2016. Therefore, a larger sample data comprising more than 20 years could have been taken to have more detailed analysis.

Although we have taken only one stock market index from both the nations i.e. NSE and NYSE but we know that there is more than one stock exchange in both countries. So in future one more major stock exchange could also be taken for the same study like taking Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) from India and along with New York Stock Exchange (NYSE), National Association of Securities Dealers Automated Quotations (NASDAQ) or Dow Jones from USA.

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