

Assessing stock market interdependence: An analysis of the interrelation of the Indian stock market with the global capital market

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Abstract:

Many global issues exert influence on the market movement of different equity markets. A knowledge of the interrelationship between the equity market of India and the global stock markets will potentially assist the investors in analyzing the trend of the Indian stock market and how much the events in other stock markets are expected to affect the Indian stock market. Such information is also essential for the portfolio and risk managers to formulate efficient stock portfolios. The primary purpose of this study was to analyse the extent of co-movement between the national stock exchange index with other select global stock market indices. Secondary data were extracted for this study in the form of daily market indices' closing prices from April 2007 to March 2017. The indices whose daily return data had been extracted for this study were NIKKEI, FTSE, DJI, SHCOMP, CAC 40, DAX, KOSPI and NSE. The results established that all the stock markets are associated with the Indian stock market in some manner, but the Tokyo stock market is not associated at all. The U.S. and the Shanghai market also recorded a weak positive correlation.

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I INTRODUCTION

The Indian stock market and its indexes have a significant impact on Asia and the other continents as well. The Bombay Stock Exchange (BSE) stands amongst the most developed indices globally, while the National Stock Exchange (NSE) is one of the best as far as the progression and refinement of innovation are concerned. The scenario of Indian stock exchanges truly experienced a spur after the liberalization of the Indian economy in the mid-nineties. In the present situation, stock market coordination is an exciting phenomenon. The unidirectional movement of share prices over the securities exchanges in the world is an as often as possible experienced

occurrence. Particularly, amid the season of emergency it is often seen that all the stock exchanges crash all the while. Stock market integration is also thought to have critical ramifications for the macroeconomic strategies, capital consumption choices of a nation and market efficiency of the economies. The contemporary portfolio theory, instituted by Markowitz (1952), states that the benefits of enhanced management of portfolio can be harvested when the yield on resources in which the assets are invested have low correlation. In the event that two stock markets have a low correlation, putting resources into them can prompt a decrease in the efficient returns from the

portfolio. In the 1960s and 1970s, there were external obstructions to exchange of merchandise and capital. During these two decades, Hilliard (1979), and Grubel and Fadner (1971) found that the stock markets had a low correlation. With liberalization and globalization, the coordination and co-movements of global economies have become unavoidable to a certain extent (Bekaert, Harvey, and Lumsdaine, 2002). The inevitability in this respect directs toward the need of studying the degree of transformation in the association of the Indian stock market with its global counterparts as if evidence of integration is discovered, the strategic theories concerning the diversification of one's portfolio might not be applicable any longer (Tripathi and Sethi, 2010).

In light of the backdrop of globalization and in the wake of the successive consolidation of the

markets worldwide, this paper encapsulates the overall trends, correspondence and patterns in the movements and activities of the Stock exchange of India as against its global equivalents. The inclusion of all of the stock exchanges and economies in one study is neither feasible nor executable, hence, the present study has taken 7 economies into consideration for discovering the magnitude of their stock market integration with the Indian economy. The economies whose indices have been analyzed in relation to the Indian economy's index in this study are: Tokyo, South Korea, Shanghai, France, Germany, UK and the US. For better insights into this study, the table presented underneath showcases the countries and the exchanges along with the names of their indices:

Table 1
Tabular view of the economies considered and their indices

Country	Stock Exchange	Index
India	National Stock Exchange	NIFTY 50
South Korea	Korean Stock Exchange	KOSPI
Tokyo	Tokyo Stock Exchange	NIKKEI 225
UK	London Stock Exchange	FTSE 100
United States	New York Stock Exchange	DJI
Shanghai	Shanghai Stock Exchange	SHCOMP
France	France Stock Exchange	CAC 40
Germany	Frankfurt Stock Exchange	DAX

The stock exchange of India stands third amongst the world's greatest stock marketplaces based on its investor base and possesses a collaborative pool of around 20 million investors. The stock exchange of the nation has around 9000 listed companies. The Bombay Stock

Exchange(BSE), which had been founded in 1875, is the oldest stock marketplace of Asia. National Stock Exchange is a comparatively recent establishment which came into being in 1992 and yet, is the most significant and most advanced stock marketplace in India. It is also the third

biggest stock exchange in Asia in terms of transactions. It's in the league of the five largest stock exchanges across the globe considering the transaction volume that take place daily on it (Mukherjee, 2007). Hence, it appears that the Indian Stock Exchange has two major stock exchanges, i.e. BSE and NSE, but this study would involve the daily return data extracted from NSE as despite BSE being the oldest stock exchange in India, NSE is the largest. Further, prior academic researches on stock market cointegration are abundant (see, for example, Benelli and Ganguly (2007), Forbes and Rigobon (2002), Horvath and Poldauf (2012), Johnson and Soenen (2003), Longin and Solnik (1995), Shoham and Pelzman (2011), among many others). This study is novel in its approach in the sense that it uses a relatively longer and a recent time period whereas most of the studies done in this context pertain to a relatively older time period. Further, the present study uses daily returns of the stock market indices whereas most of the researches done previously considered weekly return for the ease of calculation. The use of daily returns would enable representation of higher accuracy and comprehension. Also, most of the studies done in this regard have been checking the integration of the global stock markets with the US stock market only. However, this study checks for the integration of the Indian stock market with the other stock markets over an extended timeline. The indices chosen to analyze interdependence with the Indian stock market are also different from the indices selected in the previous researches. Hence, the present study is built upon various gaps identified in the existing literature in the context of stock market interdependence. The major idea behind this study is to be in the position of recognizing the extent to which the stock market indices of different markets across the globe move in a unidirectional manner and whether or not such behavior exists when taking a long period into consideration for

the same.

The motive behind this section is to introduce the readers with the dynamics of the stock markets and the Indian stock market and to familiarize them with the intention behind the execution of this research. The remainder of this paper is assembled as follows. In section 2, the objectives of the present study have been presented to outline the direction of this research. In section 3, the conceptual model and a set of hypotheses formulated to assess the degree of co-movement between the rates of return for stocks traded in the Stock market of India with different stock markets have been presented. Section 4 presents the methodology adopted by the researcher to study the stock market integration between India and the rest of the economies chosen. Section 5 hands out the results of the correlation and regression analysis with the seven sets of economies to depict the various co-movements and interdependence of the economies across the globe with the Indian stock market. The final portion, i.e. the section 6 concludes the study, accentuates the usability of this study and the scope of further research in this context.

Correlation between different stock markets

Various investigations exhibit that coexisting correlation between worldwide financial markets' returns become volatile as the time progresses (see Knif and Pynnonen (1999) and Koch and Koch (1991)). In such manner, it is expected that the correlations among global markets, in general, will rise when the stock returns fall sharply (see, Ang and Bekaert (2002), Baele (2005), Chesnay and Jondeau (2001), Dennis, Mayhew, and Stivers (2005), Silvennoinen and Teräsvirta (2005), and others). There have been myriads of studies conducted to analyze the extent of correlation between different stock markets and various authors have instituted distinct views in this respect.

The interconnections between Japan, the US

and other Asian-Pacific investment markets have been extensively acknowledged. Prior examinations demonstrate that the US stock exchange during the 1980s was seen to impact the majority of the Asian-Pacific stock exchanges and that the Japanese market appeared to have less noteworthy effects. Similar experimental confirmations can be seen in Cheung and Mak (1992) and Liu and Pan (1997). While during the 1990s, the trend shifted considerably. Masih and Masih (1999) discovered that the Asian markets are influenced more from one another, as opposed to the influence exercised by the developed markets. Ghosh, Saidi and Johnson (1999) established in their study that Indonesia, Singapore and Philippines are firmly connected with Japan; while India, Hong Kong, Korea, and Malaysia are increasingly connected with the US. Ng (2000) established evidence of huge territorial shocks from Japan to Asian-Pacific stock exchanges, other than worldwide shocks from the US; Johnsen and Soenen (2002) discovered that the Asian Markets were exceedingly connected with Japan during the 1990s. Miyakoshi (2003) discovered that the non-anticipatory nature of the Asian markets is impacted more by the Japanese market. In the meantime, there exist critical antagonistic consequences from the Asian markets on Japan. In contrast to Japan, Huang, Yang and Hu (2000) demonstrated that the US has a more grounded effect on Shanghai, Shenzhen and Hong Kong securities exchanges.

The correlations and spillovers between developing markets have also been the focus of empirical studies. Worthington and Higgs (2004) undertook a study to analyse the associations in daily yields of developing Asian markets and the developed markets. They employed a constant conditional correlation (CCC) MGARCH specification for the same. Next, a study by Allen et al. (2010) attempted to analyse the fluctuations and associations in the stock market indices of the developing European markets. The research

established that the MSE has the weakest volatility, and is marked by self-directed, autonomous behaviour as against the eleven European stock market indices of the Central and Eastern Europe. Bekaert et al. (2005) inspected the impact of visibly coordinated worldwide stock exchanges on the returns, cross-market associations and volatilities of stock exchanges of the developing markets. Their outcomes, alongside the investigation by SokGee et al. (2010), demonstrate a high degree of relationship and unstable spillovers. Ellul (2015) examined the time-varying association between the Malta Stock Exchange (MSE) index, and five noteworthy worldwide stock exchanges. The outcomes show that the nearby stock exchanges were not driven by similar factors that drive the external stock exchanges, inferring that neighbourhood elements shape returns on the Exchange, as opposed to the international events.

From the reviewed literature on this subsection, it can be seen that most of the studies revolve around the correlation and volatility found in the U.S. stock market as against the other stock markets. Considering this, the literature recommends that there have been different research enquiries with regards to various nations in the selected study area, i.e. the relation between the stock markets of different economies, but, the same in the context of India has been studied to a significantly lesser extent. Notably, there are only a few studies that have attempted to gain insights into the comovements of various stock markets as against the Indian stock market. Hence, this study intends to assess the same, i.e. the integration of the Indian stock market with the other stock markets over a long time-period. Further, it was also seen that the existing literature takes into consideration mostly the emerging economies and the studies conducted in this respect also belong to a relatively earlier time-period. Hence, drawing from this gap, the present study has taken both developed and developing economies into

consideration, and the time-span chosen for this study is quite recent (2007-2017).

II FACTORS CONTRIBUTING TO INTEGRATION OF STOCK MARKETS

Regarding the development of the aspects related to the integration of securities' markets, numerous authors affirm that mergers, acquisitions and other such alliances and endeavors of stock and derivatives market co-movement point towards another method so as to increase the value of stock exchange markets (Domowitz, 1995; Lee, 1998; Domowitz and Steil, 1999; Cybo-Ottone et al., 2000; Hasan and Schmiedel, 2004). Numerous researchers have presented that deregulation, globalisation and technological advancements are among the primary reasons for the development of the stock market integration case that have transformed the business strategies of stock markets across the globe. The customary role of stock exchanges as controlled and administered by its participants or government is being challenged owing to the remarkable ongoing advances, which thus pressurises the stock exchanges more to change their administrative structure to be more cost-effective, straightforward and responsible. Besides, the prior researches confirm a rise in the unidirectional nature of global stock exchanges lately (Karolyi and Stulz, 2001; Mishkin, 2007; Lee, 2015).

There is an agreement in the previous researches that intraregional integration will, in general, be higher than interregional integration for the most part as the intraregional time zones are bound to overlap more, prompting more considerable overlaps in the trading hours within a region as compared to between locales (Nagel and Singleton, 2011). Investigations of associations alternating with time and covariance discovered that macroeconomic factors, for example, instability and inflation, considerably impact bilateral lead-slack associations between the

equity exchanges (Guvener, 2009). A few investigations show that administrative perspectives, levels of trade, and economic signals can likewise impact stock exchange comovements over time. For instance, Jawadi et al. (2010) reason that money related deregulation strategies and privatization can prompt more grounded integration of zonal stock exchanges. Karim et al. (2011) discovered in their study that direct business contacts with larger economies are a standout amongst the essential aspects that clarify market comovements.

As far as researcher's belief is concerned, Carrieri et al. (2007) had been the first to endeavour in taking up the issue of the prime impetus for market integration employing an asset pricing approach. They assessed a pooled regression with four illustrative factors to consider the share markets of eight rising nations: Argentina, Chile, India, Brazil, Mexico, Korea, Thailand and Taiwan. They discovered that improvement related to finance and liberalised trade positively impact market integration, while openness to trade and worldwide market volatility doesn't have a positive impact on market integration. The price measures that profoundly affect the stock market integration process are interest rates and inflation (Aghion et al., 2009). These two factors influence investment and consumption costs, and in a literal sense, these affect an organization's anticipated cash inflows (Ehrmann et al., 2011). The levels of inflation raise the friction of the financial market and have a negative influence on the productivity of the economic system (Boyd et al., 2001). Therefore, interest rates influence stock market integration by altering capital flows between the stocks and the additional asset markets like the bonds (Faust et al., 2007).

III IMPACT OF STOCK MARKET CO-MOVEMENTS ON ASSET ALLOCATION AND RISK MANAGEMENT

A comprehension of volatility and co-movements in financial markets is imperative for portfolio distribution and risk management practices. There are numerous studies (Geotzman & Massa, 2002; Chordia, Sarkar and Subrahmanyam, 2005; Angew and Balduzzi, 2005; Longstaff, 2004) that are based on exploring whether the stocks and securities market has an inverse relationship in the developed market, and it will be advantageous to test whether there is a co-movement between these two markets. Long run volatility is varying in stocks and securities; in this manner, the yields are also not comparable (Clifford S. Asness, 2000). It is imperative to have an idea about the co-movements of the stock and security market to make an ideal portfolio for investment purpose, a portfolio including both bonds and stocks is superior to an arrangement consisting of only stock. Sharpe (1987) clarifies both strategic and tactical asset allocation choices, and the tactical decision includes reaping benefits of the momentary opportunities within long run changes.

Investigation of financial market co-movement and correlation is an imperative issue for both strategy makers and market members, for example, portfolio managers. Concerning portfolio managers, the higher degree of correlations and co-movement between global stock exchanges would infer decrease in the advantages associated with portfolio diversification, to such an extent that portfolio managers would need to effectively adjust their portfolios in an attempt to locate assets with lower correlations (Evans and McMillan 2008). The correlation between markets is a critical component relevant to investor asset allocation since it is instrumental in deciding the associated risk. Evaluating the correlation structure and

utilizing this information to choose efficient portfolios is a fundamental essential point for portfolio and risk managers. Moreover, monetary strategy experts use data contained in asset prices with the motive of developing expectations concerning inflation and business cycle conditions (Sclip et al., 2016).

This suggests that the information pertaining to stock market co-movements is essential for asset allocation and risk management practices. Thus, the present study is likely to provide meaningful insights to the professionals in this domain of research thereby also contributing to the academic literature in this respect.

IV STUDY AIM AND OBJECTIVES

The primary aim of this study is to analyze the extent to which the stock market of different economies are integrated with the stock market of India, i.e. whether the stock market of India varies on the basis of movements taking place in other stock markets. Also, whether such movements are unidirectional or bilateral and the nature of movements when considering a long term period would be assessed through this study.

The specific objectives that this study seeks to address are as follows:

- To study whether the stock market movements in the Indian Market are affected by another market's movements
- To assess whether the stock price co-movements in the global capital market are direct or indirect
- To study the frequency with which the price movements in foreign markets are transferred to the Indian Stock market
- To analyze the extent to which movements in the Indian market can be caused by significant changes in another stock market

- To assess that the transformations in economic, technological and political conditions in which stock market affects the Indian stock market the most

V CONCEPTUAL FRAMEWORK AND HYPOTHESES

The following flowchart represents the proposed conceptual framework developed based on the current study:

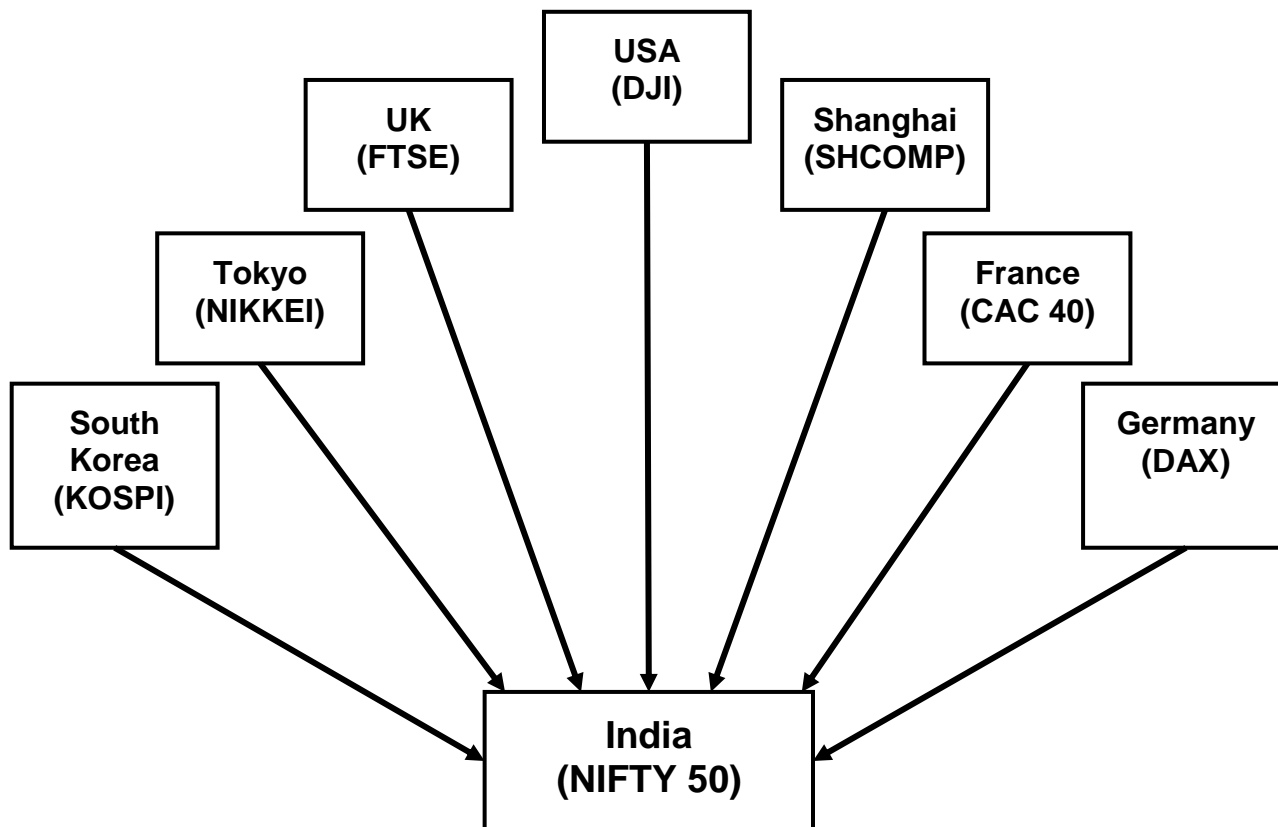


Fig. 1. Proposed conceptual framework

For the present study, the daily data of various indices have been taken for ten years (2007-2017) and an analysis of this period has been made to assess whether the interrelationship amongst the equity market indices during a long time period leads to the emergence of certain differences in their dependence over time. The daily returns of the major stock exchanges have been taken for the study (as shown in the figure above), i.e. each of the leading stock exchange of USA, Tokyo, France, Germany, Shanghai, South Korea and the UK has been considered in this study. The interrelationship of each of these with that of the Indian Stock exchange (NSE) has been established thereafter. The major stock exchanges of all the mentioned countries have been

correlated with that of the stock exchange of India. The securities exchange of India has two major stock exchanges, i.e. BSE and NSE, but this study has employed the daily return data extracted from NSE as despite BSE being the oldest stock exchange in India, NSE is the largest.

Further, correlation analysis and regression analysis has been performed between all the stock exchanges and the Indian stock exchange to establish whether there is a movement in the same direction or whether some stock exchanges have a negative directional relationship as well. The present study attempts to analyze the extent to which the securities markets of different economies are correlated with the stock market of India. The study is on the same line as various

existing researches (See, for example, Mukherjee (2007); Horvath and Poldauf (2012); Tripathi and Sethi (2010); Chougala and Srivatsa (2016), amongst others), but, the present study uses a relatively recent time period and a more extended time period for analysis. Moreover, the current study relies on testing the integration in the context of India, and unlike most of the studies done in this regard, the present study has considered the stock market indices of both the developed as well as developing economies to assess for co-integration.

As portrayed in the sections presented above, the literature accentuated that the integration between the stock markets of the Indian economy and other economies is uncertain, particularly, when taking a long period into consideration. Some claim that the alliance between the stock market returns of different economies is higher during the long period as compared to the momentary returns while there also exist specific researches that exhibited the presence of a lower integration when a long time period is being considered. Hence, arising from the paucity of coherence in this aspect, the paper hypothesized the following to evaluate the integration of markets during a long-term period in the context of India:

Hypothesis

H_{a1}: The KOSPI and NIFTY composite indices are correlated with one another positively.

H_{a0}: KOSPI and NIFTY composite indices are not correlated with one another positively.

H_{b1}: NIKKEI and NIFTY composite indices are correlated with one another positively.

H_{b0}: NIKKEI and NIFTY composite indices are not correlated with one another positively.

H_{c1}: FTSE and NIFTY composite indices are correlated with one another positively.

H_{c0}: FTSE and NIFTY composite indices are not correlated with one another positively.

H_{d1}: DJI and NIFTY composite indices are correlated with one another positively.

H_{d0}: DJI and NIFTY composite indices are not correlated with one another positively.

H_{e1}: SHCOMP and NIFTY composite indices are correlated with one another positively.

H_{e0}: SHCOMP and NIFTY composite indices are not correlated with one another positively.

H_{f1}: CAC and NIFTY composite indices are correlated with one another positively.

H_{f0}: CAC and NIFTY composite indices are not correlated with one another positively.

H_{g1}: DAX and NIFTY composite indices are correlated with one another positively.

H_{g0}: DAX and NIFTY composite indices are not correlated with one another positively.

VI METHODOLOGY

Research Methodology section features the techniques utilized in performing the research operations. Here, the strategies utilized while attempting to assess the research problems would be emphasized upon.

● *Research approach*

The reasoning approach chosen for this research was the **deductive approach**. The study was built upon the need for establishing results which outline the extent of unidirectional nature of different global stock exchanges as compared to the Indian stock exchange deploying a quantitative assessment using the secondary data which was drawn from the daily returns of various stock exchanges and correlating these with the daily returns of the Indian stock exchange. The base of this study is outcome oriented. The data was gathered from the financial information related to the daily returns of different stock exchanges; hence, the approach used was deductive as the variables used in this research were predefined, i.e. the Indian financial market and its integration with select global stock exchanges. Also, there had been a pre-stated set of

assumptions (refer to the previous section) which were tested in the study, and a top-down approach was used. Therefore, this research met all the requirements of a deductive study.

- *Research design*

The purpose of this study is to recognize and to delineate the extent of co-movement amongst various global stock exchanges and the Indian stock exchange. The focus of the research is towards the description of the state of events as they were in the past and how they have progressed in the context of market co-movement, i.e. to probe the extent to which the global stock markets are co-integrated with the Indian stock market during an extended time period. Hence, an **exploratory research design** was chosen for this study. Further, the research was built upon a set of hypotheses which were tested and dealt with the “how” aspect of the investigation, i.e., how much the different global stock markets are integrated with the Indian stock market when considering an extended time period. Hence, this study had been suggestive and aimed at the exploration of the state of international stock market co-movements as against India and the extent of unidirectionality between them; thus, the chosen research design was the exploratory research design. Further, in general terms, the research design used for this study was the **Quantitative research design** as the study relied on the assessment of the data involving the daily returns of various stock exchanges and, numbers and statistics were used to present the findings of this study. Within the ambit of quantitative research design, the specific research design chosen for this study had been the **correlational design research** as the study attempts to establish the association between various stock market indices.

- *Sample*

The sample used in the present study was neither too extensive nor too small, i.e. it is a decent sample to adequately study the co-

movements between different stock markets for an extended period of time. The present study used daily returns of various stock market indices, to draw a sample for this research work. The time period under investigation had been taken as 2007-2017. The indices whose daily return data has been extracted are NIKKEI, FTSE, DJI, SHCOMP, CAC 40, DAX, KOSPI and NSE.

- *Data Analysis*

In this study, the co-movement of the indices of the stock markets of various economies with respect to the stock market index of the economy of India was empirically tested. To examine the stock market integration amongst the stock market indices, first the stock returns of different indices was computed as given below:

$$R_t = \text{Log} \left(\frac{P_t}{P_{t-1}} \right)$$

Where, the return for the period t has been represented by R_t , the daily closing prices of various indices at time t and t-1 have been referred to as P_t and P_{t-1} respectively. The daily returns were computed from the closing price values. Further, the daily returns of the indices were correlated with the daily returns of NIFTY to check for the association between the study variables. Further, regression analysis was also undertaken with a view of studying the strength of relationship within the global stock market indices and the stock market index of India. Ms Excel and SPSS were used as the analytical softwares for making these calculations. The computations of daily returns were performed on Ms Excel. The extent and strength of associations were identified through SPSS by running correlation analysis using the Pearson's correlation coefficient and regression using the simple regression method. Further, the model computations to estimate the daily returns from closing prices were carried out using Ms Excel.

All results obtained herefrom have been presented comprehensively in the Appendix section and these results have been discussed in the next section.

VII RESULTS AND DISCUSSION

The computed values for correlation coefficients for the respective 7 stock market indices selected and the index of the stock market of India are summarised in the Table 2 given below:

Table 2
Table showing correlations between Indian stock exchange and other stock exchanges

Indices	Correlation	Level of correlation	Hypothesis
KOSPI and NIFTY	0.867	Strong positive	H _{a1} : Accepted
NIKKEI and NIFTY	-0.339	Weak negative	H _{b1} : Rejected
FTSE and NIFTY	0.824	Strong positive	H _{c1} : Accepted
DJI and NIFTY	0.183	Weak positive	H _{d1} : Rejected
SHCOMP and NIFTY	0.316	Weak positive	H _{e1} : Rejected
CAC and NIFTY	0.848	Strong positive	H _{f1} : Accepted
DAX and NIFTY	0.882	Strong positive	H _{g1} : Accepted

The correlation between NIFTY and KOSPI is 0.867, which indicates a high degree of positive correlation. This supports the presence of a unidirectional movement between the NSE Index and KOSPI Index which implies that an increase in the value of NIFTY on an average would simultaneously result in the increase in the value of KOSPI and vice-versa. The value of R-square is 0.751 which reflects the presence of a strong association. Also, the value of f - test was 27.182 and p-value = 0.001 < 0.05 hence, a significant relationship was established. So, the alternate hypothesis (H_{a1}) with respect to the first hypothesis was accepted.

Further, the correlation between NIFTY and NIKKEI is -0.339, which indicates a moderately weak negative correlation. This supports the presence of a bilateral movement between the NSE Index and NIKKEI Index which implies that an increase in the value of NIFTY on an average

would simultaneously result in a decrease in the value of NIKKEI and vice-versa. The value of R-square is 0.115 which reflects the presence of a weak association. Also, the value of f - test was 1.166 and p-value = 0.308 < 0.05 hence, an insignificant relationship was established between the study variables. So, the null hypothesis (H_{b0}) with respect to the second hypothesis was accepted.

Next, considering the third hypothesis, the correlation between NIFTY and FTSE is 0.824, which indicates a high degree of positive correlation. This supports the presence of a unidirectional movement between the NSE Index and FTSE Index which implies that an increase in the value of NIFTY on an average would simultaneously result in the increase in the value of FTSE and vice-versa. The value of R-square is 0.679 which reflects the presence of a strong association. Also, the value of f - test is 19.022

and $p\text{-value} = 0.002 < 0.05$ hence, a notable relationship was established. So, the alternate hypothesis (H_{c1}) with respect to the third hypothesis was accepted.

Further, concerning the extent of correlation between the Indian and the U.S. stock markets, the correlation between NIFTY and DJI was found to be 0.183, which indicates a strongly weak positive correlation. This supports the presence of a unilateral movement between the NSE Index and DJI Index but to a significantly lesser extent which implies that an increase in the value of NIFTY on an average would simultaneously result in a negligible increase in the value of DJI and vice-versa. The value of R-square is 0.033 which reflects the presence of a weak association. Also, the value of f - test was 0.310 and $p\text{-value} = 0.591 > 0.05$ hence, an insignificant relationship was established between the study variables. So, the null hypothesis (H_{d0}) with respect to the fourth hypothesis was accepted.

The correlation between NIFTY and SHCOMP was found to be 0.316, which indicates a strongly weak positive correlation. This supports the presence of a unilateral movement between the NSE Index and SHCOMP Index but to a significantly lesser extent which implies that an increase in the value of NIFTY on an average would simultaneously result in a negligible increase in the value of SHCOMP and vice-versa. The value of R-square is 0.1 which reflects the presence of a weak association. Also, the value of f - test was 0.997 and $p\text{-value} = 0.344 > 0.05$ hence, an insignificant relationship was established between the study variables. So, the null hypothesis (H_{e0}) with respect to the fifth hypothesis was accepted.

Considering the extent of correlation between the Indian and the French stock markets, the correlation between NIFTY and CAC was found to be 0.848, which indicates a strong positive correlation. This supports the presence of a unilateral movement between the NSE Index and

CAC Index which implies that an increase in the value of NIFTY on an average would simultaneously result in an increase in the value of CAC and vice-versa. The value of R-square is 0.719 which reflects the presence of a strong association. Also, the value of f - test is 23.011 and $p\text{-value} = 0.001 < 0.05$ hence, a significant relationship was established. So, the alternate hypothesis (H_{f1}) with respect to the sixth hypothesis was accepted.

Next, considering the last hypothesis, the correlation between NIFTY and DAX is 0.882, which indicates a high degree of positive correlation. This implies that the NSE Index moves in the same direction as the DAX Index which implies that an increase in the value of NIFTY on an average would simultaneously result in the increase in the value of DAX and vice-versa. The value of R-square is 0.779 which reflects the presence of a strong association. Also, the value of f - test was 31.65 and $p\text{-value} = 0.000 < 0.05$ hence, a significant relationship was established. So, the alternate hypothesis (H_{g1}) with respect to the seventh hypothesis was accepted.

Summing up the results of the study, it was found that the stock markets of Germany, France, South Korea and the UK move unidirectionally with the Indian stock market. The study established significant positive correlation of these indices with the NSE index. Moreover, it was found that the stock markets of the U.S. and shanghai were weakly correlated with the Indian stock markets reflecting unidirectional nature but to a very lesser extent. Only the stock markets of Tokyo were observed to be negatively correlated reflecting a bilateral (opposite directional) movement between these stock markets. This implies that where all other markets are linked with the Indian stock market in some or the other manner, the Tokyo stock market is not associated at all.

VIII CONCLUSION AND RECOMMENDATION

Evaluation of the correlation and comovements between global stock markets and using this knowledge to make decisions with respect to efficient portfolios is a major key aspect for portfolio and risk management. Moreover, the market professionals are likely to use the data contained in asset prices with the motive of developing expectations concerning inflation and business cycle conditions. Considering its heightening importance, the current research examined the stock market integration of various global stock exchanges with the Indian stock exchange for a longer time period (2007-2017). The objective of the study had been to analyze the extent to which the stock market of different economies are integrated with the stock market of India, i.e. whether the stock market of India varies on the basis of movements taking place in other stock markets. Also, whether such movements are unidirectional or bilateral and the nature of movements when considering a long term period was assessed through this study. The indices whose daily return data had been extracted for this study were NIKKEI, FTSE, DJI, SHCOMP, CAC 40, DAX, KOSPI and NSE.

The observations of this research recorded that the stock markets of France, Germany, South Korea and the UK move unidirectionally with the stock market of India. It was also identified that the stock markets of the U.S. and Shanghai were weakly correlated with the Indian stock markets reflecting unidirectional nature but to a negligible extent. Only the stock markets of Tokyo were observed to be negatively correlated reflecting a bilateral (opposite directional) movement between these stock markets. This implies that where all other markets are linked with the Indian stock market in some or the other manner, the Tokyo stock market is not associated at all. Hence, the results of this study provide meaningful insights for the professionals who indulge in stock trading

and also for the official authorities of these economies. The portfolio and risk managers are also very likely to benefit from these results. Furthermore, concerning the scope of future research, stock market integration being a pressing issue, its linkage with other variables such as economic performance, firms' profitability, interdependence, audit committee, risk management and so on can be assessed in future researches where the inputs as per the needs of the future researchers can be extracted from this study.

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