STUDY ON STOCK MARKET INTEGRATION AND CONTAGION EFFECT

(with special reference to Sectoral Indices of India and China)

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Submitted by:

HEENA SHARMA

Reg No. 11511919

Supervised by:

Dr. BABLI DHIMAN

Dr. LALIT BHALLA

Associate Professor

MITTAL SCHOOL OF BUSINESS

LOVELY PROFESSIONAL UNIVERSITY, PUNJAB

[2015-2016]

Dedicated to

the strength of my life

Ms. Alka Sharma and

Mr. Rakesh Sharma

Declaration

I, Ms. Heena Sharma do hereby declare that the Dissertation entitled **"**Study on Stock Market Integration and Contagion Effect (with special reference to sectoral indices of India and China)" submitted to Lovely Professional University for the award of the Degree of Master of Philosophy under the faculty of Commerce, is the record of original and independent research work done by me. Under the supervision and guidance of Dr. Babli Dhiman, Associate Professor, Mittal School of Business and with the co-guidance of Dr. Lalit Bhalla, Associate Professor, Mittal School of Business. I further declare that this Dissertation has not previously formed the basis for the award of any Degree or Diploma or Fellowship or other similar titles of recognition.

Heena Sharma

Reg. No. 11511919

M.Phil (Commerce)

Mittal School of Business

Lovely Professional University

Phagwara, Punjab

Date:

Certificate

I certify that the Dissertation entitled “Study on Stock Market Integration and Contagion Effect (with special reference to sectoral indices of India and China)” is a bonafide record of research work done by Ms. Heena Sharma under my supervision and guidance. It is further certified that the Dissertation is not previously used for the award of any Degree, Diploma and Fellowship or for awarding other similar titles of recognition. She is permitted to submit the Dissertation to the university.

Dr. Babli Dhiman
Associate Professor
Mittal School of Business
Lovely Professional University
Phagwara, Punjab

Dr. Lalit Bhalla
Associate Professor
Mittal School of Business
Lovely Professional University
Phagwara, Punjab

Date:

Abstract

In the worldwide financial framework, the monetary markets are going through diverse shocks and situation get worsened when confidence in global financial institutions badly shake due to different integration levels. Due to such spread of common linkages the stock markets are found to be integrated. The study is exploring about three broad hypotheses such as Stock Market Integration, Market Efficiency and Contagion Effect. It was found that behavioral pattern of stock markets in terms of integration (inter-linkage, interdependence and co-integration) brings the situation of contagion effect as markets turns out to be vulnerable towards shock and thus volatility transmit across the nations. The contagion effect is being studied for in-depth analysis which is termed as intra-regional contagion effect in which fluctuations of indexes are held due to market's own shock or when minute cross-country effect is being held. In such situation of stock market linkages, the predictability power of one stock' current prices could be notably raised due to the information set available on leading stock market's prices. Before analyzing the integration levels it must state the outlining for the same such as similarity in behavior of indices prevail or not, do such indices have any influencing power over each other or not, the causality move in any direction or not and the responsiveness of such indices stated to be strong or not. Thus the dis-integrated markets are immune from contagion effect.

The main objectives around which the study roams reflect the performances of India and China to state the contemporary status of integration levels or degrees prevailing for these indexes as these two markets are in most competitive position. Out of the stock markets of both nations the benchmark and sectoral indexes are considered for analyzing the same. As benchmark index being the representative of whole stock market is able to comment over the efficiency, integration status and Contagion risk for whole stock exchange whereas the sectoral indexes are generalizing the statements or facts over sectoral markets of both nations such as India and China. The stock market integration led the market to function effectively with the possession of efficiency. Due to the common driver such as arbitrage the markets are found to be integrated in long run. The worth of market efficiency was put into another words as in such scenario the asset prices would reflect

optimal return/reward ratio towards risk. There would not be any situation of under and over-valued assets and expected returns will have its due consideration.

The results are revealed through the tests over stock indexes for Common-movements, Dependence levels or Causality and Robust Analysis approach. In nutshell the analysis for associations across the indexes found that for such stated period all of the sectoral indices are showing very strong correlation. The range of the correlation coefficients for sectoral indices resides in between 0.783 to 0.985. On the other side benchmark index of BSE and SSE are encountering the moderate sort of correlation or linkage. In crux it is being stated that correlation coefficient for sectoral indices is close to 1 or is higher which means those sectoral indices are linearly associated or influenced by the another markets. Such implication is being tested or analyzed in further study for examining the long or short run linkage across the indexes and the extent of influence such indexes are posing onto each other. For exploring the long run co-movements in between the benchmark and sectoral indexes of BSE & SSE the findings are stating that the benchmark index is immune from having the effect of long run co-movements. Out of the sectoral indexes, the Utilities index is having nullified co-integration for long run. Whereas all the other indexes such as Healthcare, Energy, Information Technology, Industrials, Consumer Discretionary, Materials and Telecom sectoral indexes are facing or exposed to be indulged into co-movements that are of long run in nature.

The co-movement analysis goes in depth by testing for the short run movements too as the Benchmark index is safe or rescued from the short run common movements in the whole study period meaning thereby that the stock market representative index of both nations are rescued from the existence of causality approach either long or short run. As there is nil short run cause-effect status found for the stock markets of both nations as a whole. On the other extreme side all the sectoral indices such as Consumer Discretionary, Materials, Telecom, Information Technology, Industrials, Utilities and Healthcare does possess the causality direction moving from SSE to BSE. That means the China stock market is having lead status when compared with lagged values of BSE and is largely dominating the BSE at sectoral level. For stating the robust transmission mechanism across the indexes it is crystal clear that given in 10-days lag it is the stock exchanges

own fluctuations/innovation shocks that are impacting the variance held in their indexes. Except the Utilities sectoral index which is showing the exact opposite picture for the same. As the benchmark index of Sensex and SHCOMP of both stock exchanges are having majority share of their own fluctuations or innovational shocks for explaining the variance held across both the indexes. That means very minor share for the inter-fluctuations is held for both the indexes. For sectoral indexes the variance held in BSE is at increasing rate being explained or placed due to SSE-fluctuations as well but with minor share only. Out of which BSE (Utilities) sectoral index is highly or at extreme level being affected by SSE with 99.916% at 10-days horizon. Although on the basis of the percentage share of their variances the Materials, Energy, Consumer Discretionary, Telecom, Industrials, Information Technology and Healthcare sectoral indexes respectively are securing their due position being the variance of BSE explained via SSE-fluctuations/innovation shocks.

The concluding remark about benchmark index that is SENSEX and SHCOMP state that there is nil long run and short run integration or co-movement prevailing across both the nations. That means benchmark indexes being the representative indices of both the stock exchanges are showing that markets at large or in general are immune from integration and thus inefficient in nature. But if sectoral indexes of both stock exchanges are considered, the scenario gets different turn reflecting that all the sectoral indexes are showing the long run co-movement excluding the Utilities sectoral index. The co-integration presents in such indexes shows that markets are efficient in nature and does possess the arbitrage situations. If short run co-movement is considered the SSE-sectoral indexes are operating independently and BSE is found to be the lagging variable for all the sectoral indices. So, in terms of portfolio diversification the Utilities sectoral index is the best venture to have a deal from the investors. The transmission mechanism via VDC is being shown with the transmission of informational shock across the indexes but there exist the decision point as the shock resulting in the indexes is due to their own innovations/fluctuations or it’s happening due to cross-country shock. The cross-country effect is their but such effect is minor in nature but accelerating as well whereas for Utilities index the cross-country effect is highest and fluctuations are heading due to innovational shock that is inter-regional by nature. Out of the sectoral indexes the

Utilities and Healthcare are showing the transmission by following the highest to lowest transmission rate respectively. Moving on order - wise Materials, Energy, Consumer Discretionary, Telecom, Industrials and Information Technology consist its due rank on the basis of percentage rates for transmission in 10-days lag. If transmission is considered the contagion is intra-regional in nature for all the indexes except the Utilities index.

Thus all the sectoral indexes are exposed to different levels of integration and eventually market efficiency. That means the Stock Market are integrated at sectoral level and contagion effect or spread of shock does prevail across such sectoral indexes. The limitations for the above study done should also not be ignored that data required for the analysis was partially available. For having broader view over the study the data period could be extended. The contagion effect could also be studied by having a crisis perspective as the study done above is showing another perspective of having non-crisis situation. The study or analysis done over integration levels could be further elaborated with having an attribute for Interdependence signifying the Joint efficiency across the stock exchanges of both the nations. Such analysis involves the multivariate dataset with panel data for stating the properties of interdependence happening across the nations. Therefore, the contagion test analysis could further be elaborated with vast mechanism involved.

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Heena Sharma

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Acronyms

1	BSE	Bombay Stock Exchange
2	SSE	Shanghai Stock Exchange
3	SENSEX	Sensitivity Index
4	S&P BSE	Standard & Poors Bombay Stock Exchange
5	GFSR	Global Financial Stability Report
6	FDI	Foreign Direct Investment
7	NSE	National Stock Exchange
8	SZSE	Shenzen Stock Exchange
9	CE	Co-efficient Equation
10	GDP	Gross Domestic Product
11	VDC	Variance Decomposition
12	CV	Co-efficient of Variation

Chapter 1

Introduction

With the relaxation of major capital controls the interest-quotient for investors has increased and presence of investors across overseas markets existed long back. But existence of such liberalized environment across different markets results into integration via financial or real linkages. The stock market integration is the condition in which stock exchanges of any nation depict the same trend due to the prevalence of common channel such as arbitrage. Such arbitrage guarantees the existence of equivalence on both the markets via stock prices and its indices. Through trade and investment itself major economies are stated to be inter-linked or interdependent. As a result co-movements prevail that negatively affects the investors' risk-return trade off. Therefore, fundamental news relative to one economy has proposition for the equity prices of another economy. An investor behave aggressively upon the information available at his/her disposal but informational trading is said to be although risky. That's why behavior of different stock prices or their indices need to reflect on real time basis.

Stock exchanges operate via Efficient Market Hypothesis (EMH) or Random walk theory as efficient market prices fully reflects available information. The efficiency of stock markets for any nation depict that it is informationally-efficient, there would be unpredictable price changes and situation of excessive return is negligible. Due to such scenario the capital or financial market participants are more interested in performance of individual stock and market indices. Even in tracking the portfolios (actively managed) investors locate the performance of sectoral indices as well. Thus in-depth analysis over stock exchanges is required to be done firsthand for stating the same.

1.1 Stock Market Integration

The terminology such as 'International stock market integration' encompassed the inter-linkages across market of equity. The markets are stated to be integrated if investors can move freely from one market onto another and there is the possibility for the existence of arbitration which guarantees the commonality or uniformity across the markets. The

status of co-movements shows the presence of co-integration which led to adjustments towards the new information or innovation held side by side across the nations. In return the abnormal profits attached or diversifying risk in concern to lagged index (being the representative of lagged information processing) got eliminated. The evidence or existence of integration is held when markets are at risk for having shocks and thus volatility gets the spillover (Nashier, 2015). Moreover the long run common movements implied the fact that such scenario bound the market due to stochastic trend that contained common information flows and predictability was enhanced by exploiting the information referring to the stock prices. The existence of such movement also implied that arbitrage being the common channel brought the stock markets to be connected in long run and thus integrated. If the common movements with lead-lag status are stated, it indicates the strong integration. The investigations over integration are found to be relevant due to recognition of prospective gains available and constraints posed relative to diversification of portfolios across the globe. The behavioral pattern associated with stock markets in terms of integration (inter-linkage, interdependence and co-integration) implies the situation of contagion effect as markets turns to be vulnerable towards shock and thus volatility transmit across the nations (Azad, 2007). Before analyzing the integration levels it must state the outlining for the same such as similarity in behavior of indices prevail or not, do such indices have any influencing power over each other or not, the causality move in any direction or not and the responsiveness of such indices stated to be strong or not. Thus, the dis-integrated markets are immune from contagion effect. The drivers of integration are placed where the money related liberalization is held by a large portion of the nations around the globe via technological advancement in communication for trading systems. Such drivers create more opportunities for portfolio investments. Therefore, world Stock Markets turns out to be all the more nearly interlinked in spite of the uniqueness of particular business sector and nation profile.

Although the studies over integration dates back to 1970s, but the number of studies proved to be obsolete when conservativeness of stock markets was removed. With the uniqueness of financial markets and dispersed country-profiles, the markets are stated to be integrated due to adoption of money related liberalization by the vast majority of the nations around the world. The Globalization for securities of business sector is bringing

strong consideration towards securities exchanges throughout the world. The International speculators are more disposed in finding the benefits of worldwide wealth enhancement with conviction that connection between the profits of created markets and having so as to develop markets will balance their portfolio due to high and low correlations respectively in between the markets. The normal integration prompts regular co-movements in worldwide securities exchanges which in return prompted deliberate country hazard of having 'Non-Diversification Situation'. The common movements in stock markets depict the deteriorating Wealth exposures on side of international investors. Monetary synthesis wins because of openness and Bilateral relationship that builds the interdependency between the securities exchanges. Those countries with trade-ties do have financial markets which move together. Markets which are economically and geographically close and whose cross-border listings are large; those markets do have significant influence over each other. Such emerging Markets platform provides for portfolio risk management measures for global investors as due to being relatively un-correlated with each other. Such circumstance is straightforwardly an introduction to worldwide speculators for scattering their portfolios when contrasted with developed markets which are much linked due to integration itself. The common integration signifies that stock markets are functioning effectively.

1.2 Contagion Effect

According to World Bank,
Broad Definition: “Contagion is the cross-country transmission of shocks or the general cross-country spillover effects. Contagion can take place both during "good" times and "bad" times. Then, contagion does not need to be related to crises. However, contagion has been emphasized during crisis times.”

Following the broad definition of World Bank which clarifies the fact that common movements in respect to long and short run are more contagious when integration is proven at first place. However contagion effect needs not to be related with the bad or good time. The spread of common movements can held at any time as acclaimed by such definition.

The co-integration, market efficiency and Contagion effect are found to be all interlinked in the system. It is stated that behavioral pattern of stock markets in terms of inter-linkage, interdependence and co-integration implies the situation of contagion effect as markets turned out to be vulnerable towards shock and thus volatility transmit across the nations. The contagion effect is being studied for in-depth analysis as well termed as intra-regional contagion effect in which fluctuations of indexes are held due to market's own shock or when minute cross-country effect is being held. In such situation of stock market linkages the predictability power of one stock's current prices could be notably raised due to the information set available on leading stock market's prices.

1.3 Indian and Chinese Stock Markets: Related Facts

China's growth model was built from manufacturing, investments and infrastructure whereas Indian economy was found to be driven from service sector. That's the reason the titles associated with them are "the world's back office" and "the world's workshop" for India and China respectively. In both the nations the wide developed stock markets operate with continuously increasing market worth of its own. On the basis of global market values (value of public companies listed on stock markets) China's stock market adds up to 7% of the total global value with $3697 bn. share while Indian stock market-share is $1263 bn. There are certain properties associated with such nations which are common as well as diverse by nature. But the most important question to put into front is why investors in such markets should go for overseas investments? The answer is stating the fact that America and UK markets had outperformed both the markets of India and China from the period of 1990s. But after the period of 2007 both these nations are showing the impressive growth that's why investors should consider putting at-least 15-20% of their assets into such markets (Ghosh, A. 2011).

The current profile of both the stock exchanges relative to their origination and current market capitalization is being stated in table 1.1. The country-wise stock exchanges of India and China are being stated in terms of their current performance. In India two national stock exchanges operates such as Bombay Stock Exchange (BSE) and National Stock Exchange (NSE). The Sensex is the benchmark index for BSE whereas Nifty is the

benchmark index of NSE. The pricing of such indexes is being shown in table with total market capitalization of both the stock exchanges in USD.

Table 1.1 Stock Exchange Details of India and China

Country Name	Stock Exchanges (SE)	Indexes	Market Capitalization *($)*
India	BSE (1957)	SENSEX	1700 Billion
	NSE (1992)	Nifty	1650 Billion
China	Shanghai SE (1990)	SSE Composite (SHCOMP)	3900 Billion
	Hong Kong Stock Exchange (1891)	Hang Sang Index	3200 Billion
	Shenzen SE (1991)	SZSE Component	2200 Billion

Source: *Official Websites of respective Stock Exchanges*

Whereas in China three national stock exchange which operate cross world are Shanghai Stock Exchange (SSE), Hong Kong Stock Exchange (HKEX) and Shenzen Stock Exchange (SZSE) with diverse set of market capitalization.

Table 1.2 The Details of Sectoral Indexes of BSE and SSE

BSE	SSE
1. S&P BSE Energy	1. SSE Energy sector Index
2. S&P BSE Consumer Discretionary Goods	2. SSE Consumer discretionary sector
3. S&P Materials	3. SSE Materials sector Index
4. S&P BSE Information Technology	4. SSE Information technology sector
5. S&P BSE Healthcare	5. SSE Healthcare sector Index
6. S&P BSE Industrials	6. SSE Industrials sector Index
7. S&P BSE Telecom	7. SSE Telecommunication Services
8. S&P BSE Utilities	8. SSE Utilities sector Index
9. S&P BSE Capital Goods	9. SSE Consumer Staples sector Index
10. S&P BSE Consumer Durables	10. SSE Financials sector Index
11. S&P BSE Metal	
12. S&P BSE AUTO	
13. S&P BSE BANKEX	
14. S&P BSE Oil & Gas	
15. S&P BSE Power	
16. S&P BSE Fast Moving Consumer	

Goods	
17. S&P BSE Realty	
18. S&P BSE Teck.	
19. S&P BSE Finance	

Source: *Official Websites of Stock Exchanges*

In table 1.2 the details of Sectoral indices of BSE (India) and SSE (China) are being shown. In BSE-India, overall nineteen sectoral indexes are operating whereas in SSE-China, total ten sectoral indexes are working. Having a look upon the table it is clear that numbers of sectoral indices are un-common.

From the above discussion it can be concluded that due to spread of common linkages such as trade and financial linkages the stock markets are found to be integrated. The stock market integration led the market to function effectively with the possession of efficiency. Due to the common driver such as arbitrage the markets are found to be integrated in long run. The worth of market efficiency was put into another words as in such scenario the asset prices would reflect optimal return/reward ratio towards risk. There would not be any situation of under and over-valued assets and expected returns will have its due consideration. The benchmark index being the representative of whole stock market is able to comment over the efficiency, integration status and Contagion risk for whole stock exchange whereas the sectoral indexes are generalizing the statements or facts over sectoral markets only. For assessing the integration with in depth perspective the dominating stock markets of both the nations in terms of market capitalization are being selected. Of these stock markets, the benchmark and sectoral indexes are considered for analyzing the same.

Chapter 2

Literature Review

2.1 Stock Market Integration

The inter-linkages across market of equity constitute the terminology of 'International integration of stock markets'. If the common movements with lead-lag status was stated that was the indication of strong integration (Bracker et.al, 1999). The literature relative to the pre-liberalization turned out to be obsolete and nowadays their occurred the need to study the same due to dearth of such literature. Stock markets are openly available to laymen around that is why robust mechanism is important to put into front for analyzing the linkages. Due to such reason the co-movement status of Indian market with world got diverse results as well (Chattopadhyay, 2014 and Chan et.al, 1997). The most relevant policy decisions that nations put into front across the globe confronted the fact that integration had increased with diverse nations at diverse levels. Due to such situation the investors turned out to be motivated to move out of the domestic boundaries to improve their risk-return status and look out for the investment opportunities existing around. As the domestic and global factors may not be in congruence that led towards dis-similar risks-returns and exposure level of investors differ at vast degree as well (Masih and Masih, 1999; Liu et.al, 1998; Rajwani and Mukherjee, 2013; Sharma and Seth, 2011; Chattopadhyay, 2014; Batareddy et.al, 2010). Moreover investors move their investments across the world due to two issues involved that is: To enlarge the growth phenomena in portfolios and to minimize the risks associated with portfolios for attaining the efficient diversification of portfolios (Modi et.al, 2010).

The investigations over integration were found to be relevant due to recognition of prospective gains available and constraint relative to diversification of portfolios across the globe. One more important fact was the worth of regional and overseas markets in reference to floating arbitrarily across the globe (Ahmed, 2012). Before analyzing the integration levels it must state the outlining for the same such as similarity in behavior of indices prevail or not, do such indices have any influencing power over each other or not, the causality move in any direction or not and the responsiveness of such indices stated to be high or not. The Modern Portfolio theory outline the fact that portfolio or investment

diversification give an advantage to investors only when correlations associated with them are low. Most importantly investors in such integrated status of markets should be able to diversify their funds with lowest cost possible (Nashier, 2015; Rajwani and Mukherjee, 2013; Masih and Masih, 1999; Liu et.al, 1998; Constantinou et.al, 2005; Chan et.al, 1997 and Chattopadhyay, 2014; Arbelaez et.al, 2001; Brocato, 1994; Pyeman and Ahmad, 2009). Expanding the earlier facts in the study of Click and Plummer (2003) the benefits associated with portfolio diversifications are discussed as the value of regional stock market is based upon the liquidity and transaction costs. On the other side companies involved in stock exchanges could expand their base of shareholder and cost of capital could improve on their side (Sharma and Seth, 2011). Besides the earlier discussion the Markowitz Theory found to be relevant for the same as well. It was stated that low or weak correlation coefficient constitute the diversification of risk-return status across markets (Metin and Muradoglu, 2001; Markowitz, 1976).

Before testing the integration levels the most used statistics is descriptive which had its due role to play such as if upward movement was stated it was found that the index traced the consistent or uniform pattern/trend acclaiming that the information relative to particular market/sector had an influencing power in identical fashion (Vardhan et.al, 2015). For proving the integration across the markets the correlation techniques were given due weight age to state the sign or probability of common movements. The high/positive correlation matrix showed strong/contemporaneous interactions or linkages across the markets of respective indices. It was an implied fact that high correlation across the indexes meant that markets were reacting towards market forces/information in a similar way. The correlation technique had its own implications such as the correlation coefficient being close to 1 or strong in nature stated to be linearly association or found to be under influence of other markets (Nashier, 2015; Fayoumi et.al, 2009; Modi et.al, 2010). Moving on argument against correlation was put into front by stating that correlation was short terminal analyses which change the results as per the variations in time. It require further advanced analysis to put the accurate measures of linkages (Batareddy et.al, 2010). Under the modern portfolio theory the low correlation led the portfolio risk to get diversified (Rajwani and Mukherjee, 2013). But as time passed and

markets become real / robust, the analysis was shifted to long with short run linkages across the markets (Liu et.al, 1998 and Masih & Masih, 1999).

The linkages or relationships across markets differ largely due to certain ways adopted such as different markets selected, diverse sampling tenure, observations under consideration and the research methodology adopted (Metin and Muradoglu, 2001). While forecasting the markets via common movements the degrees of integration differ. The dynamicity of linkages were studied throughout in different markets for stating the long and short run co-movements taking diverse level of tools and different markets involved (Nashier, 2015; Hamori, 2003; Floros, 2005; Click and Plummer, 2003; Metin and Muradoglu, 2001; Ghosh et.al, 1999; Granger, 1986). Expanding the status of long run co-movements it is being stated that presence of co-integration led to adjustments towards the new information or innovation held side by side across the nations. In return the abnormal profits attached or diversifying risk in concern to lagged index (being the representative of lagged information processing) got eliminated (Nashier, 2015). Moreover the long run common movements implied the fact that such scenario bound the market due to stochastic trend that contained common information flows and predictability was enhanced by exploiting the information referring to the stock prices. The existence of such movement also implied that arbitrage being the common channel brought the stock markets to be connected in long run. As when arbitrage prevailed the possibility of abnormal profits was assumed to exist but following the theory such favorable situation had very limited occurrence as such arbitraged situation will eventually write off in long run. In certain examination of co-movements there were different perspectives such as econometric and asset pricing which were termed as an integral part of such analysis. (Masih & Masih, 1999; Liu et.al, 1998; Syriopoulos, 2004; Nashier, 2015; Richards, 1995; Rajwani & Mukherjee, 2013; Floros, 2005; Vardhan et.al, 2015; Ahmed, 2012; Fayoumi et.al, 2009; Kanas, 1997). Moreover, stock markets were found to be functioning or operating effectively in a co-integrating sort of relationship. The co-integration proof implied the verity that the stock prices in diverse or selected markets were bound to move together or could not move far away from each other. Consecutively, the technical analysis of stock prices turned out to be useful tool as per

indicated by the information function operated for long term in global scenario (Floros, 2005).

The short run co-movements stated that the lead-lag status in between variables helped to predict for the lagging variable with the help of leading variable due to superior set of information in the later variable. As the existence of granger causality in either direction showed the ability to predict for the prices. Moreover granger causality was stated to help for exploring inter-sectoral causal linkage with explanation of directional transmission for informational content (Liu et.al, 1998; Nashier, 2015; Sharma and Seth, 2011; Floros, 2005; Ahmed, 2012; Alkulaib and Najand, 2009; Huang et.al, 2000; Patra and Poshakwale, 2008; Pyeman and Ahmad, 2009; Chen et.al, 2006). Relating the short run causality with the contagion effect it was stated by the analysis that non-causality or nil short run co-movement indicated the situation of negligible contagion effect (Azad, 2007). Extending the above facts it was clarified further that before causality test to run, the integration status need to be specified. The long run integration must also be supported by the short run causality direction in at least one direction (Hamori, 2003; Vardhan, 2015). The granger causality analysis was found to be the measure for stating the joint or collective efficiency of markets (Liu et.al, 1997). On the contrary the granger-causality analysis it was stated that there was found to be the lag or time gap in between when the innovation or informational content being absorbed in the market and when decision rule was being applied. That was found to be the sole reason for non-existence of the term such as ‘instantaneous causality’ (Granger, 1988).

For stating the drivers of integration in majority of literature it was found to be relative to market efficiency itself but there were certain other factors that were the reason behind stock market integration. In contrast to ASEAN markets trade and stock market volatility played their due role for having integration status across such markets as degree of common movements turned out to be higher in a significant span of time (Karim and Ning, 2013). Another side of stock markets was shown when these were stated to be inefficient by nature. It showed the fact that in such situation the allotted speculators or market players availed the opportunity to mould the prices (Azad, 2007). Moreover, the capital market liberalization, availability of information and technological advancements

were the other drivers stated behind stock market integration (Rajwani and Mukherjee, 2013). Besides such drivers for integration the transactions across the nations (in reference to goods/services/financial flows etc.), elimination of restrictions and easing the control measures were found to be the other driving forces behind integration as well (Ahmad et.al, 2005; Huang et.al, 2000). Besides with earlier benefits of integration the same analysis was found to be useful in terms of evaluating the portfolios, pension funds (investing the reserves fund in trading of stocks), insurance companies and mutual funds etc. The investors circulating the finance in such categories could be private, institutional and financial institutions etc (Constantinou et.al, 2005). The literature in context to stock market integration specifically mentioned the pros and cons for the same. The limitations relative to analysis for integration was associated with the issues in context of exposure to overseas asset prices fluctuations and drainage in regional finance (Bhaduri & Samuel, 2009).

2.2 Contagion Effect

The terminology ‘contagion’ was arrived from epidemiology field which helped to study the spread of diseases. The co-integration, market efficiency and Contagion effect were found to be all interlinked in nature. The study reflected three hypotheses in sync relative to: the efficiency, the contagion and the co-integration hypothesis. It was found that behavioral pattern of stock markets in terms of integration (inter-linkage, interdependence and co-integration) implied the situation of contagion effect as markets turned out to be vulnerable towards shock and thus volatility transmit across the nations (Azad, 2007). The categorization of contagion in context to market shocks was done into two parts via co-movements. It was stated that such common movements moved in exchange rates, capital flows, sovereign broadened and stock prices. The first category of contagion was stated to be related with financial crisis due to global shocks via trade or financial linkages across the markets. The second category belonged with common movements placed across the stock prices which happened due to interdependence and efficiency within markets via financial/real associations. Most of the literature explained about the levels of co-movements with its suitable transmission mechanism (Karolyi, 2003). The hypothesis in evidence to contagion effect implied that the fluctuations

recorded in Asian markets were found to be explained by their regional markets itself. The same was being tested or proved via short and long term linkages and when such linkages were quantified it was stated to be contagion effect that is intra-regional in nature. Due to such spread of fluctuations across the markets they were found to be integrated which had an important implication that similar level of risk attracted the similar degree of returns across the asset prices (Masih and Masih, 1999; Gebka and Serwa, 2006). Due to enhancing integration levels across the stock markets, the transmission of informational content was found to be the most advent area to research (Mukhopadhyay, 2009). The mechanism of transmission was also belonged to volatility and innovation shocks across the indices. On basis of mean & variance the markets followed each other and reacted to information that generated overseas linkage; however such innovations/news to travel or move from one another there was stated to be certain ways. One is the financial information transmission due to real/instant linkages. Another one was stated to be the liquidity shock due to which investors/participants were found to be forced to liquidate the portfolios (Ahmed, 2012; Gebka and Serwa, 2006).

There was found to be another linkage across nations such as variance-linkage that helped to forecast, regional assets-valuation and hedging function. The variance decomposition analysis was stated to be the transmission tests which attribute the proportions of each variable in context to specific shocks relative to it. In other words variance decomposition should cross check the lead-lag status earlier explored as it is the lagged values which explained the variance in terms of its own disturbances or fluctuations (Arbelaez et.al, 2001; Gebka and Serwa, 2006; Fayoumi et.al, 2009; Gjerde and Saettem, 1995; Patra and Poshakwale, 2008; Eun and Shim, 1989; Masih and Masih, 1997; Wang et.al, 2005; Syriopoulos, 2004; Canova, 2005; Ewing, 2002). The literature relative to contagion effect and stock market integration could differ due to following ways adopted such as: Econometric tools or methodology adopted, Yearly segregation, Country-wise differing integration levels and based upon number of years considered (Sharma and Seth, 2011). While studying the contagion most important considerations to put into front were: how the policies relative to fiscal/monetary regulations should be entered into regional financial system, how the central agencies or qualified authorities

could supervise the markets well and maintenance for the standards in context to management of risk relative with financial system (Karolyi, 2003).

2.3 Market Efficiency

The stock market integration led the market to function effectively with the possession of efficiency. In long run markets were found to be integrated due to the common driver such as arbitrage. The market efficiency led to violation of the Informational efficiency, absence of predictability and when integration was held the arbitrage lacked by its very nature (Masih and Masih, 1999; Huang et.al, 2000; Gjerde and Saettem, 1995; Brocato, 1994; Patra and Poshakwale, 2008). Besides such facts relative to market efficiency it was stated co-integration must be interpreted relative to market efficiency which in return showed the absence of predictability but at the same time it violated the informational efficiency and arbitrage lacked as well. The most important fact was implied that if even one co-integrating vector prevailed, that happened due to arbitrage process itself (Vardhan et.al, 2015). Supporting the earlier fact it was stated that in an efficient market the stock prices or its changes always showed the randomness and un-predictability property engraved into it. But at the same time informational trading due to such reason always reflect as risky venture. As stated that in efficient market there was found to be deprived arbitrage that's why situation of super or excessive returns not possible to occur as risks analysis was accurately reflected in such sort of efficient market (Azad, 2007). Further theories that supported or constitute integral part for market efficiency were stated to be returning rates equalization, global completeness for market relative to capital, common movements across or within the asset prices, volatility transmission across nations and responsiveness to information advent etc. (Bhaduri and Samuel, 2009). The worth of market efficiency was put into another words as in such scenario the asset prices would reflect optimal return/reward ratio towards risk. There would not be any situation of under and over-valued assets and expected returns will have its due consideration (Gupta and Basu, 2007).

2.4 India and China: Associated Facts

Over the decade the extinct feature associated with the economies of India and China was stated as per “the world’s back office” and “the world’s workshop” respectively. China’s growth model was built from manufacturing, investments and infrastructure whereas Indian economy was found to be driven from service sector (Das, 2006; Batareddy et.al, 2010; Krishna and Bhardwaj, 2016). One more property associated with both nations indicated the fact that India in terms of contribution to world GDP possessed smaller but faster share whereas vice-versa situation was stated for China. The World Bank report reflected that economy size of China was worth $ 17 trillion whereas India is heading with the worth of only $ 2 trillion (Krishna and Bhardwaj, 2016). As per the study done over efficiency level of Shanghai stock exchange such market was found to possess unit root and was ascertained to have random walk or un-predictability power (Seddighi and Nian, 2004). Extending the literature over efficiency of Chinese market stock exchanges, they were found to be individually efficient with a randomness process engraved into it (Liu et.al, 1997). The Asian markets due to familiar cultural levels and nearby location (geographically) led to spread of investment/information prospects. Moreover the analysis over market (benchmark) and sectoral level helped to extract the reason behind co-movements that it happened due to international linkage across the sectors or it occurred due to the particular group of sectors. The sectoral indices of China exhibited different integration status across the world markets. As per the investigations done it was found that Healthcare, Telecommunications and Utilities sector showed low correlations. The study also segregated the investor’s perspectives into two groups: the first group belonged to Chinese investors who assume that domestic stock in their kitty was helping them to accumulate wealth. The second group belonged to global investors who can diversify their portfolios via investing in Chinese markets to have higher profits in hand (Chiang et.al, 2015). Another analysis for sectoral indices of Chinese market showed that Industrials sector was found to be the most influential set in both exchanges of China. Being in such position the Industrial sector was found to be a better and faster informational source (Wang et.al, 2005). For sectoral indices of India’s stock market showed differing results as the sectoral index of Information technology was termed to be vital for the accelerated movements of other sectoral indices of India (Vardhan et.al, 2015). In other study over sectoral indices of India in relation to developed stock markets

across the globe it was found out that Healthcare sector was the least responsive for any sort of change held in Indian market whereas Information Technology showed negative risk adjusted returns. But it was interesting to observe that these particular sectors had highest foreign investments at that time (Garg and Chauhan, 2012).

As a whole literature claims that integration levels were tested via common movements through long run, short run and robust analysis. Moving on further it was identified that dis-integrated economies couldn’t have any sort of contagion. Due to the fact that India and China possess certain identical infrastructural base, there are going to be held diverse level of integration for different indices.

Chapter 3

Research Methodology

3.1 Theoretical Framework

As the literature signified, the study is covering two concepts broadly: Stock Market Integration and Contagion Effect.

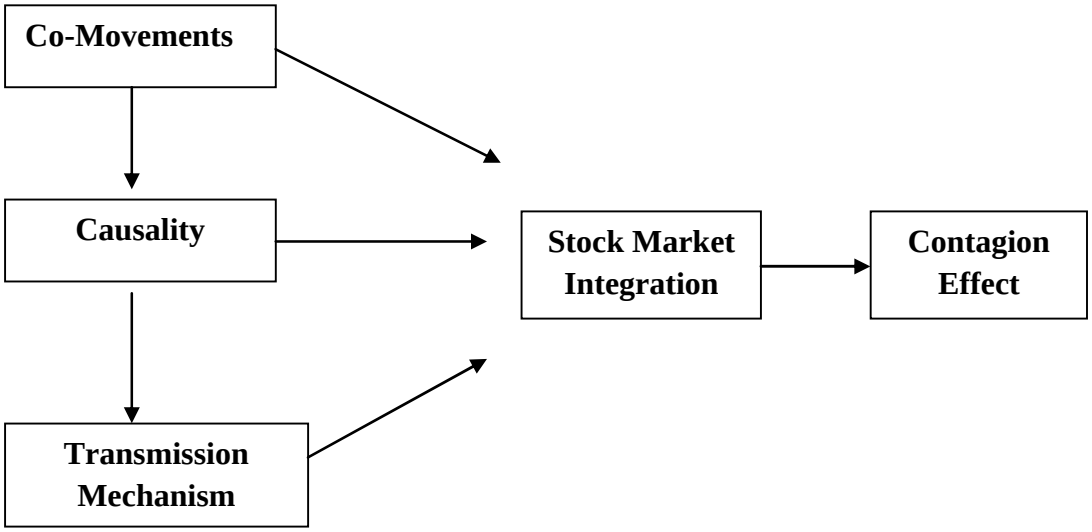


Fig.1. Theoretical Framework for the Study

The Integration levels were being studied through co-movements (Chiang et.al, 2015; Floros, 2005; Garg, 2012; Hamori, 2003; Masih & Masih, 1999; Nashier, 2015) through dependence levels or causality (Floros, 2005; Hamori, 2003; Vardhan, 2015) and via shock transmission mechanism (Click and Plummer, 2003; Gjerde and Saettem, 1995; Eun & Shim, 1989; Wang et.al, 2005; Liu et.al, 1998).

3.2 Rationale of Study

The Regional collaboration is an initial step for financial and economic integration among the nations. The ultimate policy decision which originated at national levels across the globe is of liberalizing financial market (Equity) which developed the world finance manifold. Over the globe the mix force on cross-country securities exchanges gave the worldwide financial specialists enough chances to differentiate their portfolios well crosswise over nations. Such sort of coordination begins as a center explanation behind

money related turmoil that can appear both in good or bad times. If two markets say an extensive increment in co-developments it came up as central explanation for finance chaos. As per the standpoint of regulators if co-integration prevails those stock markets are termed to be effective. On the other path around from the viewpoint of worldwide financial specialists such co-mix ends up being a definitive issue as they fail to diversify their portfolios in such kind of coordinated sectors and their respective securities exchanges. The ideal situation for speculators is to have less coordinated markets. Therefore, this study is an attempt to distinguish the scope of integration in distinctive securities exchanges. Moreover the study involves the in-depth analysis for degrees of integration moving from long run, short run and robust analysis for benchmark and sectoral indexes of India and China.

3.3 Objectives of the Study

i. To know the cross-country associations across the benchmark and sectoral indices of India and China stock exchanges.
ii. To examine the existence of long run common movements among the sectoral and benchmark Indices of Indian and Chinese stock markets.
iii. To check the cause and effect status between the India and China stock market' sectoral and benchmark indices.
iv. To state the transmission mechanism over indexes of India and China's stock exchanges.

3.4 Methodology

The study covers quantitative objectives of proving stock market integration through taking Benchmark index itself and Sectoral Indices of stock exchanges belonging to India and China. It was based on empirical testing using the secondary data (daily closing prices of every index) across different time periods.

Coverage: On the basis of market capitalization Bombay Stock Exchange from India and Shanghai Stock Exchange from China were considered for testing the integration levels. Afterwards the common sectors prevailing in these stock markets such as Healthcare,

Industrials, Energy, Information Technology, Consumer Discretionary, Utilities, Materials and Telecommunications sectoral index were chosen. The study was being targeted for the time period of 24th August, 2010 to 23rd August 2016 to state the degrees of co-movements.

Data Collection: For the quantitative objectives to attain; the data was collected from Wall Street Journal Quote.com that is an asset management company of Dow Jones Industrials, Market Watch.com and the official websites of Bombay stock Exchange were used to extract the time series data.

Data Analysis: In the securities exchanges of these nations the pretty much reconciliation was demonstrated through the tests over stock indexes for Common-movements, Dependence levels or causality and Transmission Mechanism. The daily closing price data of every index was used but stock exchanges' indexes being exposed to dis-similar currency and different magnitude. Daily closing price leads to uncommon base to compare. For removing such anomaly the daily closing prices were converted into natural logs. The correlation technique was on first hand being applied to state the initial prospects of association across the indexes. For applying the models over time series data, pre-condition was to prove the stationarity among the data for which Augmented Dickey fuller- Unit Root analysis was done over every index involved. The pre-condition to apply Johansen is that data should be non-stationary at level and stationary at differences. Afterwards the Johansen Co-integration was being used to state the long run common movements. Whereas for Granger Causality model stationarity should be proven over 1st or 2nd difference only then such model was appropriate to apply for showing the dependence levels among stock markets for short run. The Variance Decomposition is being used to emphasize upon robust responsiveness or shock transmission mechanism of Indexes. Then the robust response or impacts in different time lag was stated for every index.

Chapter 4

Data Analysis and Interpretation

The data analysis constitutes the investigation of benchmark indexes and sectoral Indexes of Indian & Chinese stock exchanges.

Table 4.1.1 Descriptive Statistics of Bombay Stock Exchange (BSE)

Particulars	Mean	Maximum	Minimum	CV (%)
SENSEX	21786.8	29681.77	15175.08	18.83
Healthcare	10479.7	18581.01	5536.4	39.68
Information Technology	8109.48	12144.86	4710.18	28.48
Energy	2421.65	3102.02	1920.7	10.35
Industrials	2337.49	3460.61	1405.85	23.07
Consumer Discretionary	1919.52	3161.03	1202.54	28.33
Materials	1771.75	2393.8	1155.9	15.16
Utilities	1609.38	2407.22	1163.21	14.54
Telecom	1259.93	1668.88	839.4	12.95

In table 4.1.1 shows the descriptive statistics of Indian stock market and its indexes for the period 2010-2016. The benchmark index with average of 21786.78 is showing the highest value. Whereas in sectoral indexes the healthcare index being the most developed sector of the lot is showing the highest worth with Information Technology, Energy etc. following. The range (max-min) is also shown for the indexes. When the CV (Co-efficient of variation) is considered, the Healthcare sectoral index is showing the highest prospects of having large dispersion out of the lot selected.

In table 4.1.2 the Descriptive Statistics of benchmark and sectoral indexes of SSE are being shown. Indicating the performance of these indexes from 2010-2016. The mean value of Healthcare sectoral index is highest showing the utmost worth of such index. For SSE the Telecom sectoral index is also showing the lowest worth or value. The range is being settled with the CV for all the indexes. The Energy sectoral index is taking the lead with standard deviation of 42.87%. That means prospects of having highest dispersion are most in Energy and least in Utilities sectoral index which will be checked in further analysis.

Table 4.1.2 Descriptive Statistics of Shanghai Stock Exchange (SSE)

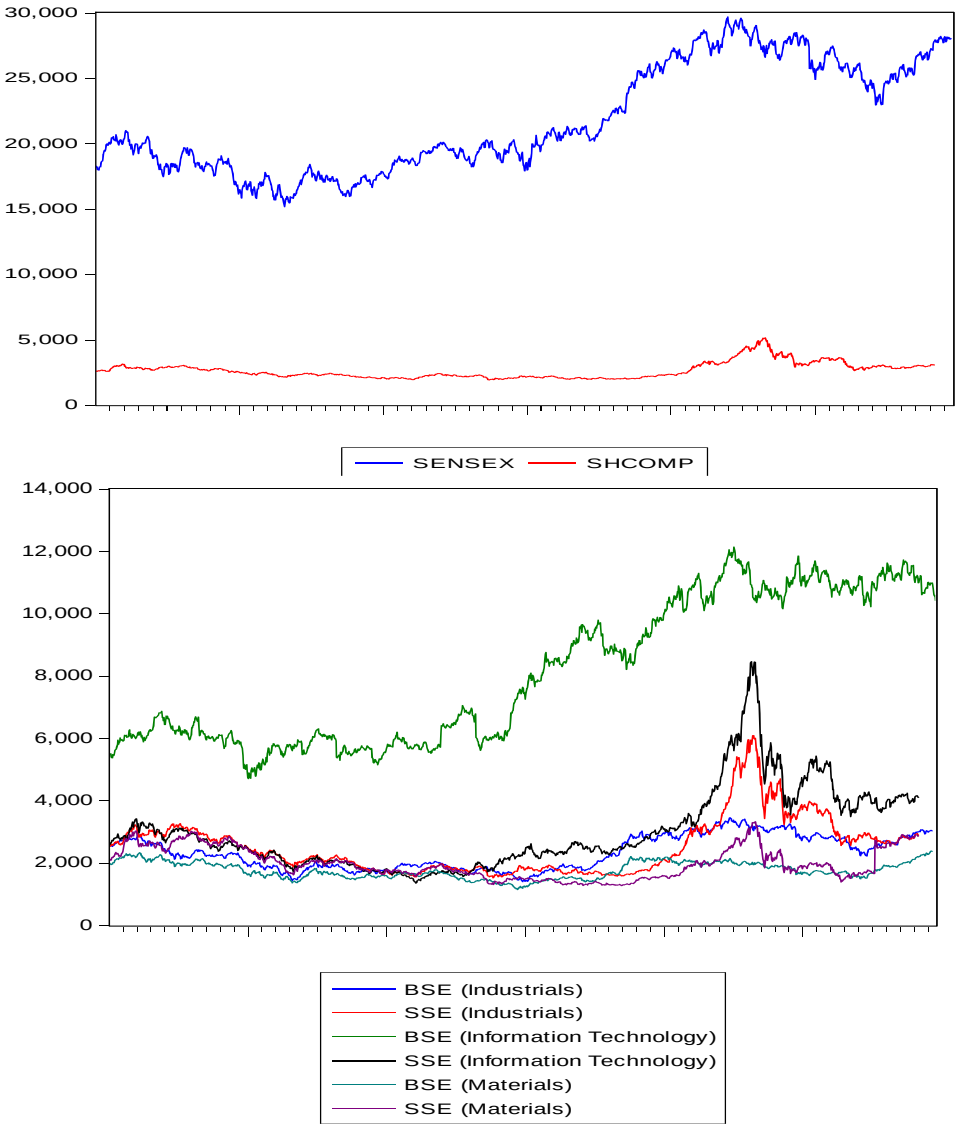
Particulars/Sectors	Mean	Maximum	Minimum	CV (%)
SHCOMP	2659.14	5166.35	1950.01	23.05
Healthcare	5918.89	12496.93	3574.17	28.34
Energy	3303.03	5273.48	2025.98	26.09
Information Technology	3002.21	8470.33	1360.05	42.87
Industrials	2527.72	6095.38	1527.07	35.20
Consumer Discretionary	2532.09	5645.89	1462.66	30.52
Utilities	2152.08	5216.23	1405.97	32.43
Materials	1990.26	3332.1	1274.58	24.98
Telecom	1898.45	4733.68	983.19	36.09

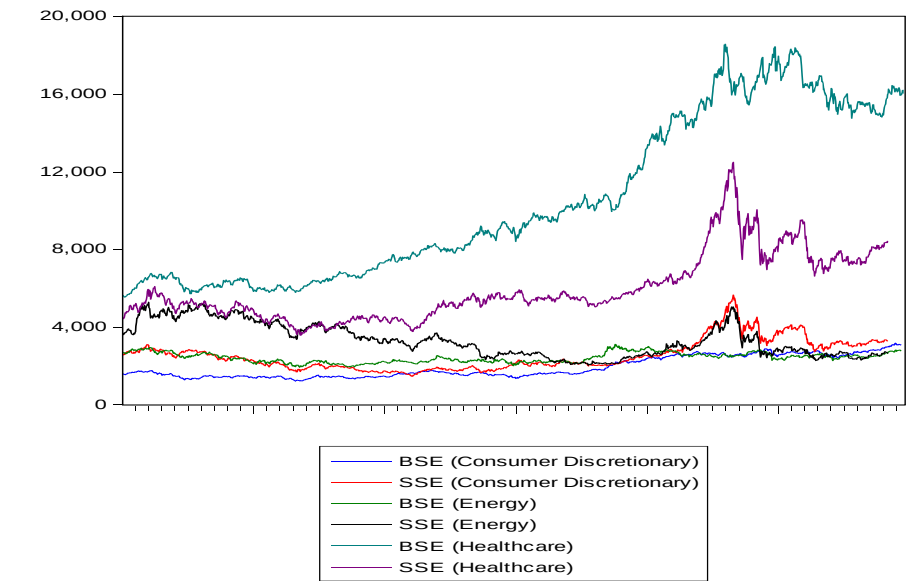
The trends are stated for benchmark and sectoral indexes for which the daily closing prices are considered to show the movements for such indexes starting from the period 2010 to 2016 in Figure 2. Total 1250 observations are there which are scattered in their different time periods with diverse closing price value.

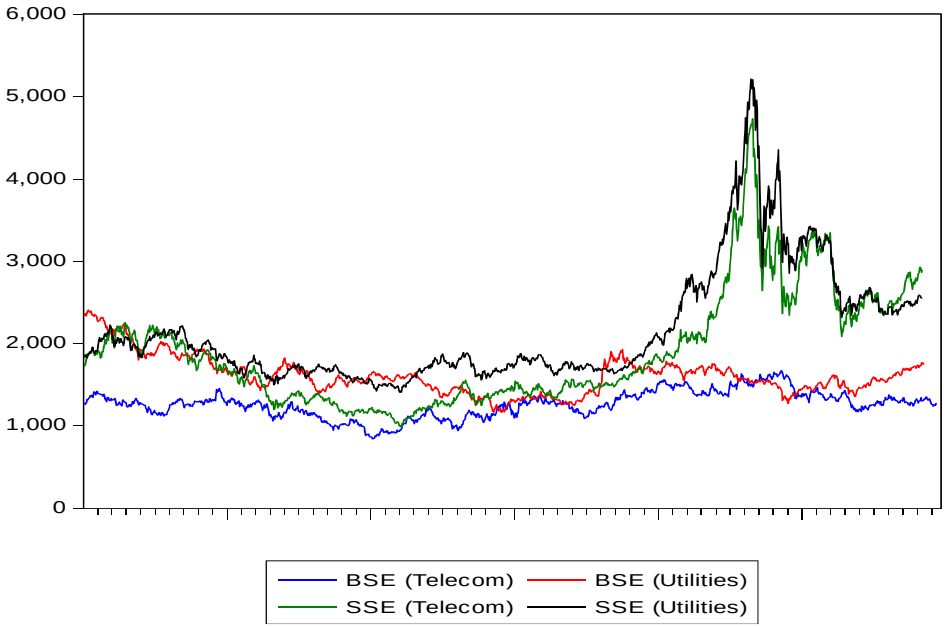
For all of the figures for benchmark and sectoral indexes the trends are showing the status that it ends up being upward and stagnant in nature after certain downfalls in earlier years. Overall all of the indexes considering the reference periods are showing the upward or stagnant movements across different time periods.

The descriptive trends for all of the indexes are signifying that movements or trends heading are identical if sectoral market indexes are considered. But taking the indexes such as benchmark analysis (representative of whole stock exchange) shows that there is huge diversity in terms of value of closing price. As for SHCOMP the value is residing around 4000-5000 but the value of Sensex is around 25000. So there is actually large diversity of data in terms of value for daily closing prices.

Fig.2.The trends or movements in Benchmark and Sectoral indexes


30,000
25,000
20,000
15,000
10,000
5,000
0
SENSEX
SHCOMP
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
BSE (Industrials)
SSE (Industrials)
BSE (Information Technology)
SSE (Information Technology)
BSE (Materials)
SSE (Materials)





Objective 1: The cross-country associations across the benchmark and sectoral indices of India and China stock exchanges.

In table 4.2.1 for the period of 2010-2016 the correlation across the benchmark and sectoral indexes are being shown. For benchmark indexes such as Sensex and SHCOMP the Pearson value of 0.281 is stating that correlation is positive and is moderate in nature. The index of Healthcare sector shows the Pearson value of 0.784 signifies the fact that such association is positively of very strong status. The index of energy sector states the

Pearson value of 0.831 recommends that there is positively very strong correlation across such sector. For the index of information technology the Pearson value of 0.783 signifies the fact of very strong positive association prevalence.

Table 4.2.1 Correlation status

Particulars	Pearson value
Sensex*SHCOMP	0.281
BSE (Healthcare)*SSE (Healthcare)	0.784
BSE (Energy)*SSE (Energy)	0.831
BSE (Information Technology)* SSE (Information Technology)	0.783
BSE (Industrials)*SSE (Industrials)	0.832
BSE (Consumer Discretionary)*SSE (Consumer Discretionary)	0.836
BSE (Utilities)* SSE (Utilities)	0.985
BSE (Materials)*SSE (Materials)	0.833
BSE (Telecom)*SSE (Telecom)	0.834

*Correlation

**P value < 0.05

The index of industrials sector shows the Pearson value of 0.832 shows such correlation or association to be very strongly positive. Moving on the index of consumer discretionary reflects the Pearson value of 0.836 shows the positive and very strong level of association. On the other side the index of utilities sector signifies the Pearson value of 0.985 that proves correlation is of positive but of having very strong association. The pearson value of 0.833 for Materials sectoral index signifies the fact that correlation is of positively very strong in nature. During such tenure for telecom sectoral index the Pearson value of 0.834 indicates that association is of positive and very strong in nature.

In nutshell the analysis of 1st objective found that for such stated period all of the sectoral indices are showing the highest association. The range of the correlation coefficients for sectoral indices resides in between 0.783 to 0.985. On the other side the benchmark index of BSE and SSE encountering the moderate sort of correlation or linkage. In crux it is being stated that correlation coefficient for sectoral indices is close to 1 or is higher which means such sectoral indices are linearly associated or influenced by the another markets. Such implication is being tested or analyzed in further study for stating the long or short run linkage across the indexes and the extent of influence needs to be examined as well.

Stationarity Test Results: Before applying the time series models upon the selected data the Pre-condition is to look for Stationarity that is as follows:

In table 4.3.1 the stationarity is being assessed through ADF-Unit Root analysis for benchmark indexes of BSE and SSE.

Table 4.3.1 Augmented Dickey Fuller Unit Root Test on Benchmark Indexes

Null Hypothesis: The Dataset has a Unit Root				
Indexes	**Level (ADF Test)**		**1st Difference (ADF Test)**	
	t-statistics	**P value**	**t-statistics**	**P value**
SENSEX	-2.317614	0.4235	-35.61505	0.0000
SHCOMP	-0.904014	0.9539	-38.22648	0.0000

At level the P value for benchmark indexes such as Sensex and SHCOMP are leading to acceptance of null hypothesis that means data does possess unit root and is non-stationary at level. On the other side at 1st difference the P value is leading to rejection of hypothesis that evidenced the fact of data being stationary at such point. Overall the index is appropriate to apply the Johansen co-integration and Granger Causality models for further analysis.

In table 4.3.2 the sectoral indices of BSE are being shown over which ADF-Unit Root is tested. At level the hypothesis is being accepted that means data does possess unit root and is non-stationary. On the other side at 1st difference the P value leads to acceptance of hypothesis which means data is stationary. Thus BSE-Sectoral indices are eligible to have further analysis of Johansen co-integration and Granger Causality analysis.

Table 4.3.2 Augmented Dickey Fuller Unit Root Test on Sectoral Indexes of BSE

Null Hypothesis: The Dataset has a Unit Root				
Indexes	**Level (ADF Test)**		**1st Difference (ADF Test)**	
	t-statistics	**P value**	**t-statistics**	**P value**
Healthcare	-0.897647	0.9546	-38.61584	0.0000
Energy	-0.848465	0.9597	-38.63327	0.0000

Information Technology	-0.938447	0.9500	-38.67340	0.0000
Industrials	-0.850376	0.9595	-38.55144	0.0000
Consumer Discretionary	-0.840356	0.9605	-38.56730	0.0000
Utilities	-0.829696	0.9615	-38.27370	0.0000
Materials	-0.765644	0.9671	-38.57270	0.0000
Telecom	-0.959186	0.9475	-38.43617	0.0000

Putting into other words for such data set the mean and variance are constant over a time period and for this particular reason the dataset relative to BSE is able to generalize and predict for future events as well.

From the table 4.3.3 the ADF-Unit Root is being analyzed for sectoral indices of SSE. At Level the P value leads to acceptance of null hypothesis that means data does possess unit root.

Table 4.3.3 Augmented Dickey Fuller Unit Root Test on Sectoral Indexes of SSE

Null Hypothesis: The Dataset has a Unit Root				
Indexes	**Level (ADF Test)**		**1st Difference (ADF Test)**	
	t-statistics	**P value**	**t-statistics**	**P value**
Healthcare	-0.877468	0.9568	-38.21548	0.0000
Energy	-0.907417	0.9535	-38.28949	0.0000
Information Technology	-0.928715	0.9511	-38.19681	0.0000
Industrials	-0.906503	0.9536	-38.17529	0.0000
Consumer Discretionary	-0.911529	0.9531	-38.21144	0.0000
Utilities	-0.940597	0.9497	-38.23082	0.0000
Materials	-0.882531	0.9562	-38.26385	0.0000
Telecom	-0.851352	0.9594	-38.21131	0.0000

On the other side at 1st difference the P value leads to rejection of null hypothesis which left data to be stationary. Thus SSE-Sectoral Indices are fit to have further analysis.

Objective 2: The existence of long run common movements among the sectoral and benchmark indices of Indian and Chinese stock markets.

In table 4.4.1 for the period of 2010-2016 the co-integration for the benchmark indexes are being tested for stating the long run co-movements.

Table 4.4.1 Johansen Co-Integration Test Results for Benchmark Indexes

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	2.789192	15.49471	0.9756	2.665711	14.2646	0.966
At most 1	0.123481	3.841466	0.7253	0.123481	3.841466	0.725

For the benchmark indexes the trace statistics of 2.789192 at P value of 0.9756 and max eigen value of 2.665711 with P value of 0.9665 adjudges that there is nil co-integration across such index. This leads to acceptance of null hypothesis being zero co-integrating vectors. Afterwards the max-eigen value and trace statistics are less than critical values at 5% significance level that clarifies the same implication of having no co-integration for the time phase selected.

The table 4.4.2 depicts the test results for Johansen co-integration with the help of trace and max-eigen value statistics. The trace statistics states 53.90904 at the P value of 0.0000 which means there is an existence of co-integration for the Healthcare index during the time period of 2010-2016. Which leads to rejection of null hypothesis of $r = 0$ as co-integrating vector being zero. The max-eigen values and trace statistics are more than critical values depicting the same results for having the co-integration for long run in Healthcare index of both markets.

Table 4.4.2 Johansen Co-Integration Test Results for Healthcare sector

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	53.90904	15.49471	0.0000	53.90886	14.2646	0.0000
At most 1	0.000178	3.841466	0.9911	0.000178	3.841466	0.9911

In table 4.4.3 the test results for co-integration are being depicted for sectoral index of Energy.

Table 4.4.3 Johansen Co-Integration Test Results for Energy sector

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	72.09185	15.49471	0.0000	72.08812	14.2646	0.0000
At most 1	0.003734	3.841466	0.9501	0.003734	3.841466	0.9501

The trace statistics of 72.09185 at P value of 0.0000 leads to rejection of null hypothesis being Zero co-integration vector. Meaning thereby that there is the co-integration found in such sector of Energy. Whereas the trace statistics and eigen values are more than critical values stating the same fact of having the co-integration across the time frame selected.

In table 4.4.4 the co-integration for the Information technology sectoral indexes is being stated for the period of 2010-2016.

Table 4.4.4 Johansen Co-Integration Test Results for Information Technology

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	54.59944	15.4947	0.0000	54.58952	14.2646	0.0000
At most 1	0.009921	3.84146	0.9204	0.009921	3.841466	0.9204

The Trace statistics shows the P value of 0.0000 at trace value of 54.59944 which imply that the null hypothesis of r = 0 is being rejected. That means there is an existence of co-integration for the sectoral index stated. The max-eigen value and trace statistics both are more than critical values signifying the same fact of co-integration in long run.

In table 4.4.5 during the whole period the co-integration tests are being done over Industrials sectoral index.

Table 4.4.5 Johansen Co-Integration Test Results for Industrials sector

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	72.56232	15.49471	0.0000	72.55533	14.2646	0.0000
At most 1	0.006988	3.841466	0.9328	0.006988	3.841466	0.9328

For which Null hypothesis is being made as r = 0 that means there is nil-prevalence of co-integrating equation as being co-integrating vector to be zero. Against the alternative hypothesis of r greater than 1 the Null hypothesis is being rejected on basis of P value stated to be 0.9328. Moreover the trace statistics and eigen values are more than critical values depicting the existence of co-integration. So, there is one co-integrating equation prevailing across the index.

For table 4.4.6 the Johansen tests are being applied over Consumer discretionary sectoral index.

Table 4.4.6 Johansen Co-Integration Test Results for Consumer discretionary

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	73.06275	15.49471	0.0000	73.05919	14.2646	0.0000
At most 1	0.003566	3.841466	0.9513	0.003566	3.841466	0.9513

The Null hypothesis is stated as per r = 0 means zero co-integrating vectors. The trace statistics of 73.06275 at P value of 0.0000 and eigen value of 73.05919 at P value of 0.0000. The P values of both statistics lead to rejection of Null hypothesis. That means there is an existence of co-integration for Consumer discretionary sectoral index of both markets of India and China.

In table 4.4.7 the status of co-integration or long run linkage among Utilities sector of both stock markets is being shown. The trace statistics of 6.784922 at P value of 0.6028 and max eigen value of 6.483017 with P value of 0.5520 held the null hypothesis to be accepted. As such hypothesis states the co-integrating vector to be zero. That means such index is dis-integrated as also supported by the fact that critical values are higher than trace and max eigen values. So, nil co-integrating equation has been held for such index

Table 4.4.7 Johansen Co-Integration Test Results for Utilities sector

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	6.784922	15.49471	0.6028	6.483017	14.2646	0.552
At most 1	0.301905	3.841466	0.5827	0.301905	3.841466	0.582

In table 4.4.8 the Materials sectoral indexes are being represented for Johansen co-integration test during the period selected.

Table 4.4.8 Johansen Co-Integration Test Results for Materials sector

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	73.00693	15.49471	0.0000	72.99790	14.2646	0.0000
At most 1	0.009028	3.841466	0.9239	0.009028	3.841466	0.9239

The trace statistics of 73.00693 at P values of 0.0000 and eigen value of 72.99790 with P value of 0.0000 leads to rejectiom of Null hypothesis. Such null hypothesis states that co-integrating vector being zero shows the nil co-integration. That means such index possess the co-integration across both the markets. Moreover both the statistics are higher than critical values stating the fact for tracing of co-integration across such sector.

In table 4.4.9 the co-integrating status for the selected period is being shown for Telecom sector of both the stock markets. The trace statistics and eigen value both are more than

critical value at first place. Afterwards P values of 0.0000 leads to rejection of null hypothesis. Such hypothesis is stating that there is the co-integrating vector prevailing for such sectoral index. Meaning thereby there is actually the co-integration for the telecom sector showing that long run co-movements do exist for such index with the scenario of market that is operating efficiently.

Table 4.4.9 Johansen Co-Integration Test Results for Telecom sector

No. of Hypothesized CE (s)	Trace Statistics	Critical Value (0.05)	Prob. Value	Max-Eigen Value Statistics	Critical Value (0.05)	Prob. Value
None	72.96395	15.49471	0.0000	72.9627	14.2646	0.0000
At most 1	0.00125	3.841466	0.9711	0.00125	3.841466	0.9711

From the above analysis of Johansen co-integration test for stating the long run co-movements or integration in between the benchmark and sectoral indexes of BSE & SSE the finding are put into front. As analyzed it is found that the benchmark index is immune from having the effect of long run co-movements. Out of the sectoral indexes, the Utilities index is having nullified co-integration for long run. Whereas all the other indexes such as Healthcare, Energy, Information Technology, Industrials, Consumer Discretionary, Materials and Telecom sectoral indexes are facing or exposed to be indulged into co-movements that are long run in nature.

The co-integration for long run is favorable scenario for the investors if it is negligible. As operationally all such indexes are working independently without any long run causality model prevailing. This is the most preferred situation for investors to park their funds into. As risk-return trade off due to arbitrage (that exists due to nil co-movements) is favorable to investors and prospects of financial turmoil are minimal for the sector such as Utilities index. But there is another school of thought which state that in such dis-integrated markets the information flows are not being observed or are untapped on timely manner which turn market to be inefficient. Thus from the view point of policy makers, such dis-integrated markets are non-favorable being inefficient by nature. On the other extreme side, long run co-integration is found to prevail in Healthcare, Energy,

Information Technology, Industrials, Consumer Discretionary, Materials and Telecom sectoral indexes that means in such scenario the information flows are being observed well on time which constitute increase in trade, Capital movements, Foreign Investments, Technological advances and removal of Statutory control. But the same scenario is not favorable for investors to park their funds into such integrated market as risk-return trade off turns out to be negligible.

Objective 3: The cause and effect status between the India and China stock market' sectoral and benchmark indices.

In table 4.5.1 the causality test results for benchmark indexes of BSE and SSE during the timeframe are being stated to check for the short run causality direction across the indexes.

Table 4.5.1 Pair-Wise Granger Causality Test for Benchmark Indexes

Null Hypothesis	Observation	F-Statistic	Prob.
SENSEX does not Granger Cause SHCOMP	1457	0.51542	0.5974
SHCOMP does not Granger Cause SENSEX		1.25032	0.2867

The null hypothesis of SENSEX doesn't granger causes SHCOMP is being accepted due to P value of 0.5974 which means there is nil causality direction prevailing from SENSEX to SHCOMP. Whereas for another hypothesis of SHCOMP doesn't granger cause SENSEX the P value stated is 0.2867 which leads to acceptance of hypothesis meaning thereby there is nil causality direction for such. So, there is negligible causality direction for the benchmark indexes of both nations of India and China.

Table 4.5.2 Pair-Wise Granger Causality Test for Healthcare and Energy sectors

Null Hypothesis	Observation	F-Statistic	Prob.
BSE (Healthcare) does not Granger Cause SSE (Healthcare)	1457	0.01796	0.9822
SSE (Healthcare) does not Granger Cause BSE (Healthcare)		24.3729	0.0000
BSE (Energy) does not Granger Cause SSE (Energy)	1457	0.02258	0.9777

SSE (Energy) does not Granger Cause BSE (Energy)		32.3069	0.0000

In table 4.5.2 the granger causality test results for Healthcare and Energy sectoral indexes are being shown for the stated period. The null hypothesis of BSE (Healthcare) doesn't granger cause SSE (Healthcare) is being accepted due to P value of 0.9822 with F statistics of 0.01796 which means there is nil causality direction for Healthcare sector moving from BSE to SSE.

The another hypothesis of SSE (Healthcare) doesn't granger cause BSE (Healthcare) is being rejected due to P value of 0.0000 which means there is an existence of directional causality. Largely for the Healthcare sectoral index the directional causality move from SSE to BSE but the reverse causation has not happened. So, uni-directional causality prevails for Healthcare sector across the time period selected. Whereas the null hypothesis for Energy sectoral index has also been created which states BSE (Energy) doesn't granger causes SSE (Energy) which is accepted due to P value of 0.9777 which means there is no causality direction for the same. Whereas the hypothesis of SSE (Energy) doesn't granger cause BSE (Energy) is being rejected which means there is the causality direction for such due to P value of 0.0000. Overall there is the existence of causality direction existing for the Energy sectoral index as a whole moving from SSE to BSE.

In table 4.5.3 the granger causality test results of Information Technology and Industrials sectoral index are being represented. The null hypothesis as for Information Technology is stating that the BSE doesn't granger cause SSE. The F statistics are being stated as per 0.00434 at P value of 0.9957 which leads to acceptance of such hypothesis. That means there is nil causality direction for Information technology sectoral index moving from BSE to SSE. Whereas the another hypothesis which states that SSE (Information Technology) doesn't granger cause BSE (Information Technology) is held to be rejected due to P value of 0.0000. Largely there is a causality direction for Information technology sectoral index moving from SSE to BSE which shows uni-directional causality status for such sectoral index. Whereas for the Industrials sectoral index the Null hypothesis is

being developed which states that there is nil granger causality residing for BSE (Industrials) to SSE (Industrials) which is being accepted due to P value of 0.9963.

Table 4.5.3 Pair-Wise Granger Causality Test for Information Technology and Industrials sectors

Null Hypothesis	Observation	F-Statistic	Prob.
BSE (Information Technology) does not Granger Cause SSE (Information Technology)	1457	0.00434	0.9957
SSE (Information Technology) does not Granger Cause BSE (Information Technology)		24.6811	0.0000
BSE (Industrials) does not Granger Cause SSE (Industrials)	1457	0.00367	0.9963
SSE (Industrials) does not Granger Cause BSE (Industrials)		32.4305	0.0000

That means there is nil causality direction moving from BSE (Industrials) to SSE (Industrials). But after having a look over the another hypothesis of SSE (Industrials) doesn't granger cause BSE (Industrials) the P value of 0.0000 leads to rejecting the hypothesis which means there is an existence of causality direction. Overall Industrials sectoral index does possess the uni-directional causality moving from SSE to BSE but the reverse causation has not happened for the same.

In table 4.5.4 the Causality test results for Consumer Discretionary and Utilities sectoral index are demonstrated as per: the null hypotheses being developed states that BSE (Consumer Discretionary) doesn't granger cause SSE (Consumer Discretionary) which is being accepted as per P value of 0.9945 with F statistics of 0.00551. That means causality direction for such sectoral index doesn't move from BSE towards SSE. The other hypothesis states that SSE (Consumer Discretionary) doesn't granger cause BSE (Consumer Discretionary) which is being rejected due to P value of 0.0000 meaning thereby an existence of granger causality over such point. On the whole the sectoral index of Consumer Discretionary possesses uni-directional causality prevailing from SSE to BSE but the reverse has not happened. Whereas the null hypothesis for Utilities sectors

states that BSE (Utilities) doesn't granger cause SSE (Utilities) which is being accepted with the help of P value of 0.9554 with F statistics of 0.04560. That means nil short run causality direction reside across such sectoral index. Whereas the other hypothesis states that SSE (Utilities) doesn't granger cause BSE (Utilities) which is being accepted due to P value of 0.0000 with F statistics of 4292.50. Overall the Utilities sectoral index does possess the causality direction moving from SSE to BSE.

Table 4.5.4 Pair-Wise Granger Causality Test for Consumer Discretionary and Utilities Sectors

Null Hypothesis	Observation	F-Statistic	Prob.
BSE (Consumer Discretionary) does not Granger Cause SSE (Consumer Discretionary)	1437	0.00551	0.9945
SSE (Consumer Discretionary) does not Granger Cause BSE (Consumer Discretionary)		32.6446	0.0000
BSE (Utilities) does not Granger Cause SSE (Utilities)	1457	0.04560	0.9554
SSE (Utilities) does not Granger Cause BSE (Utilities)		4292.50	0.0000

In table 4.5.5 the causality results for Materials and Telecom sectoral index are being shown for the stated period.

Table 4.5.5 Pair-Wise Granger Causality Test for Materials and Telecom sectors

Null Hypothesis	Observation	F-Statistic	Prob.
BSE (Materials) does not Granger Cause SSE (Materials)	1457	0.00504	0.9950
SSE (Materials) does not Granger Cause BSE (Materials)		32.8027	0.0000
BSE (Telecom) does not Granger Cause SSE (Telecom)	1457	0.00123	0.9988

SSE (Telecom) does not Granger Cause BSE (Telecom)		32.6382	0.0000

The null hypothesis states that BSE (Materials) doesn't granger cause SSE (Materials) which is being accepted by P value of 0.9950 with F statistics of 0.00504 which means there is no causality direction for Materials sector moving from BSE to SSE. Whereas the other hypothesis of SSE (Materials) doesn't granger cause BSE (Materials) is being rejected as stated by 0.0000 with F statistics of 32.8027. Largely for Materials sectoral index the uni-directional causality reside which move from China stock market towards India stock market. On the other side the null hypothesis is being developed as per BSE (Telecom) doesn't granger cause SSE (Telecom) that is being accepted due to P value of 0.9988 with F statistics of 0.00123. That means there is nil causality direction for the same. Whereas for the null hypothesis of SSE (Telecom) doesn't granger cause BSE (Telecom) the P value is 0.0000 with F statistics of 32.6382 that means null hypothesis is being rejected. Basically the Telecom sectoral index has shown uni-directional causality which moves from Chinese market to Indian market but the reverse has not happened for the stated index.

From the whole analysis of pair-wise Granger causality direction analysis the crux is being stated as per:-

The Benchmark index is safe or rescued from the short run common movements in the whole study period meaning thereby that the stock market representative index of both nations are rescued from the existence of short run co-movements. On the other extreme side all the sectoral indices such as Consumer Discretionary, Materials, Telecom, Information Technology, Industrials, Utilities and Healthcare does possess the causality direction moving from SSE to BSE. That means the China stock market is having leading status when compared with lagged status of BSE and is largely dominating the BSE at sectoral level.

Objective 4: To state the transmission mechanism over indexes of India and China's stock exchanges.

The Variance Decomposition for benchmark and sectoral indexes of both the stock exchanges of India and China is being done. In such table the extent of variance or fluctuations in different time horizons are being depicted for showing the shock transmission across indexes over a robust or real time phase. On the basis of literature done, the 10-days variance period is selected for stating the nature or extent of fluctuations. The analysis will be able to answer the fact that whether fluctuations or innovational shocks heading across indexes are cross-country or internal in nature.

In table 4.6.1 for the benchmark indexes such as Sensex and SHCOMP of BSE and SSE respectively the variance in different time horizons say 10-days are stated.

Table 4.6.1 Variance Decomposition for Benchmark Indexes (%)

Variance Period	**Variance Decomposition of Sensex**		**Variance Decomposition of SHCOMP**	
	Sensex	*SHCOMP*	*Sensex*	*SHCOMP*
1	100	0	0.000207	99.99979
2	99.96417	0.035834	0.006111	99.99389
3	99.94268	0.057316	0.009998	99.9999
4	99.92578	0.074224	0.013055	99.98695
5	99.9102	0.089802	0.015835	99.98417
6	99.89481	0.105186	0.018548	99.98145
7	99.87914	0.120856	0.021285	99.97872
8	99.86295	0.137046	0.024092	99.97591
9	99.84612	0.153882	0.026995	99.97301
10	99.82856	0.171438	0.030007	99.96999

It is found out that for Sensex say at 5-days, 99.91% variance is being explained by its own shocks and very minute effects are of SHCOMP over Sensex. That means Sensex is independent of any of the SHCOMP's fluctuations over it in such robust analysis of 10 days. On the other side for SHCOMP at 10-days lag the 99.96% variance is explained by its own regional shocks and such variance is not happening due to cross country fluctuations or informational shocks.

In table 4.6.2 the variance decomposition analysis of Consumer Discretionary sectoral index is being done across both the stock exchanges. The robust analysis is showing that for BSE (Consumer Discretionary) being the dependent variable is effected by SSE (Consumer Discretionary) at 10-days lag for having the cross-country effect of 5.526% which is at increasing rate. But most of the variance is being explained due to its own shock that is BSE-fluctuations.

While for SSE (Consumer Discretionary) being the dependent variable is having very minor share of BSE (Consumer Discretionary) for elaborating the variance status. At 10-days time horizon the 99.99% variance of SSE (Consumer Discretionary) is being explained by its own internal shocks.

Table 4.6.2 Variance Decomposition for Consumer Discretionary Indexes (%)

Variance Period	**Variance Decomposition of BSE (Consumer Discretionary)**		**Variance Decomposition of SSE (Consumer Discretionary)**	
	BSE (Consumer Discretionary)	*SSE (Consumer Discretionary)*	*BSE (Consumer Discretionary)*	*SSE (Consumer Discretionary)*
1	100	0	0.0000478	99.99995
2	99.903	0.097	0.00011	99.99989
3	99.67527	0.324735	0.000196	99.9998
4	99.31542	0.684584	0.000302	99.9997
5	98.82342	1.176583	0.000426	99.99957
6	98.20059	1.799411	0.000567	99.99943
7	97.4496	2.5504	0.000724	99.99928
8	96.57441	3.42559	0.000893	99.99911
9	95.5802	4.419802	0.001074	99.99893
10	94.47324	5.526758	0.001266	99.99873

In table 4.6.3 the variance decomposition analysis for Energy sectoral index of both the stock exchanges has been done.

Table 4.6.3 Variance Decomposition for Energy Indexes (%)

Variance Period	Variance Decomposition of BSE (Energy)		Variance Decomposition of SSE (Energy)	
	BSE (Energy)	*SSE (Energy)*	*BSE (Energy)*	*SSE (Energy)*
1	100	0	0.0000424	99.99996
2	99.90177	0.098231	0.000229	99.99977
3	99.67139	0.328615	0.000532	99.99947
4	99.30774	0.692256	0.00094	99.99906
5	98.81112	1.188885	0.001443	99.99856
6	98.18315	1.816851	0.002031	99.99797
7	97.42685	2.573147	0.002697	99.9973
8	96.54653	3.45347	0.003431	99.99657
9	95.54769	4.452315	0.004227	99.99577
10	94.43691	5.563093	0.005078	99.99492

The SSE (Energy) is having the occurrence of the fluctuations due to BSE (Energy) at 10-days horizon. The variance being explained by SSE (Energy) for BSE (Energy) is 5.563% with an increasing rate. On the other side SSE (Energy) being the dependent variable is having the variance status across 10 days horizon in which most of the variance of SSE (Energy) is explained by its own fluctuations rather than by the BSE (Energy). For the Energy sectoral index beginning from the 5-days variance horizon the considerable effect of SSE (Energy) over BSE (Energy) is started to begin up.

In table 4.6.4 the VDC analysis for Healthcare indexes has been done across both the stock exchanges. In such analysis the point to consider is that variance of BSE (Healthcare) is being explained by SSE (Healthcare) itself at 10-days horizon which is 3.2322% that is at increasing rate. But the same has not been happened for SSE (Healthcare) as most of the variance of such index is being explained by its own fluctuations. At 10-days long horizon the variance of SSE (Healthcare) is being explained by its own fluctuations rather than being effected by alternative country's index. At 10^{th} day the variance of SSE (Healthcare) is 99.95% having such status due to its own fluctuations only.

Table 4.6.4 Variance Decomposition for Healthcare Indexes (%)

Variance Period	Variance Decomposition of BSE (Healthcare)		Variance Decomposition of SSE (Healthcare)	
	BSE (Healthcare)	*SSE (Healthcare)*	*BSE (Healthcare)*	*SSE (Healthcare)*
1	100	0	0.000326	99.99967
2	99.94393	0.05607	0.000589	99.99941
3	99.81241	0.187587	0.000926	99.99907
4	99.60463	0.39537	0.001331	99.99867
5	99.32021	0.67979	0.001799	99.9982
6	98.95924	1.040758	0.002324	99.99768
7	98.52228	1.477723	0.002903	99.9971
8	98.01033	1.989673	0.003531	99.99647
9	97.42485	2.575152	0.004203	99.9958
10	96.76773	3.232269	0.004917	99.99508

Overall the Healthcare sectoral index of SSE has recorded minute share of BSE for explaining the fluctuations that means the SSE itself possesses the major share for its variance held across both of the nations. Whereas for the same index BSE is having the variance being explained by SSE at increasing rates itself. But majority of its variance happened because of its own informational shocks.

In table 4.6.5 the Variance Decomposition analysis for Industrials sectoral index has been done across both of the stock exchanges belonging to India and China. The Industrials sectoral index of BSE has recorded the variance being explained by the SSE with a share that is at accelerating rate. At 10-days horizon the variance of BSE (Industrials) is being explained by SSE (Industrials) with 5.4366% with an increasing rate.

On the other side the variance of SSE (Industrials) is explained by BSE (Industrials) with very minute share of 0.000683% at 10-days horizon. The variance in SSE (Industrials) is largely held by its own fluctuations having the share of 99.993% at 10-days variance period.

Table 4.6.5 Variance Decomposition for Industrials Indexes (%)

Variance Period	Variance Decomposition of BSE (Industrials)		Variance Decomposition of SSE (Industrials)	
	BSE (Industrials)	*SSE (Industrials)*	*BSE (Industrials)*	*SSE (Industrials)*
1	100	0	0.0000147	99.99999
2	99.90469	0.095312	0.0000449	99.99996
3	99.6809	0.319101	0.0000889	99.99991
4	99.32725	0.672753	0.000145	99.99985
5	98.84364	1.15636	0.000213	99.99979
6	98.2313	1.768702	0.00029	99.99971
7	97.49274	2.507259	0.000377	99.99962
8	96.63175	3.368253	0.000472	99.99953
9	95.65327	4.346726	0.000575	99.99943
10	94.56335	5.436645	0.000683	99.99932

In table 4.6.6 the variance decomposition analysis for Information Technology has been done across both the nations.

Table 4.6.6 Variance Decomposition for Information Technology Indexes (%)

Variance Period	Variance Decomposition of BSE (Information Technology)		Variance Decomposition of SSE (Information Technology)	
	BSE (Information Technology)	*SSE (Information Technology)*	*BSE (Information Technology)*	*SSE (Information Technology)*
1	100	0	0.0000375	99.99996
2	99.94346	0.056539	0.0000802	99.99992
3	99.81079	0.189214	0.000138	99.99986
4	99.60108	0.398915	0.000209	99.99979
5	99.31392	0.686082	0.000292	99.99971
6	98.94932	1.050682	0.000387	99.99961
7	98.50778	1.492215	0.000493	99.99951
8	97.99029	2.009708	0.000608	99.99939
9	97.39827	2.601731	0.000733	99.99927
10	96.73359	3.266408	0.000866	99.99913

The sectoral index of Information Technology is recording the variance that is at accelerated rate affected from SSE towards BSE. At 10-days lag the variance of BSE is being explained by SSE with 3.266% share. The BSE is capable to have variance due to its own fluctuations as well with 96.733% share.

On the other side SSE (Information Technology) possesses the variance being elaborated or effected by its own fluctuations with a major share of 99.999% at 10-days period. The minor effect of BSE-fluctuations over SSE variance for such sectoral index is recorded. But comparatively such share of BSE-fluctuations impacting over SSE variance is less if compared with another case scenario of SSE-fluctuations/innovational shocks impacting BSE variance.

In table 4.6.7 for Materials sectoral index the representation of Variance Decomposition has been done for 10-days variance horizon across both the stock exchanges of India and China.

As per the analysis for the Materials sectoral index the variance of BSE is exaggerated due to the fluctuations heading in SSE and BSE-own fluctuations as well. As at 10-days variance period the fluctuations of SSE effecting BSE variance are 5.602% whereas the share of BSE - own fluctuations are 94.397%.

Table 4.6.7 Variance Decomposition for Material Indexes (%)

Variance Period	**Variance Decomposition of BSE (Materials)**		**Variance Decomposition of SSE (Materials)**	
	BSE (Materials)	*SSE (Materials)*	*BSE (Materials)*	*SSE (Materials)*
1	100	0	0.000318	99.99968
2	99.90147	0.098534	0.00046	99.99954
3	99.67019	0.329807	0.000626	99.99937
4	99.30487	0.695127	0.000813	99.99919
5	98.80557	1.194426	0.00102	99.99898
6	98.17376	1.826238	0.001245	99.99876
7	97.41228	2.587721	0.001484	99.99852
8	96.52529	3.474707	0.001738	99.99826

9	95.5182	4.481798	0.002003	99.998
10	94.39753	5.602475	0.002279	99.99772

But the fact to consider is that SSE impacting BSE at an increasing pace and such effect is having a considerable share across. On the other extreme side SSE (Materials) is having variance which is explained via its own fluctuations with 99.99% share with having very minor impact of BSE (Materials) over the variance of SSE for such index.

The table 4.6.8 for Telecom sectoral index is depicting the variance decomposition analysis at 10-days variance horizon. The variance for Telecom index of BSE is at accelerated rate being explained by SSE-fluctuations itself. On the other side BSE-own fluctuations are decelerated due to SSE-impact. But majorly BSE is affected by its own internal informational shocks.

On the other side the variance of SSE (Telecom) is explained via its own fluctuations with 99.99% share at 10-days lag. But very minor share of BSE (Telecom) fluctuations are affecting the SSE (Telecom) with 0.0000421%. That's why such transmission is majorly supported by inner shocks only.

Table 4.6.8 Variance Decomposition for Telecom Indexes (%)

Variance Period	**Variance Decomposition of BSE (Telecom)**		**Variance Decomposition of SSE (Telecom)**	
	BSE (Telecom)	*SSE (Telecom)*	*BSE (Telecom)*	*SSE (Telecom)*
1	100	0	0.000044	99.99996
2	99.90496	0.095044	0.0000311	99.99997
3	99.68159	0.318408	0.000022	99.99998
4	99.32827	0.67173	0.0000165	99.99998
5	98.84466	1.155338	0.0000143	99.99999
6	98.23178	1.768225	0.000015	99.99999
7	97.49195	2.508053	0.0000184	99.99998
8	96.6288	3.371196	0.0000241	99.99998
9	95.64719	4.352806	0.0000321	99.99997
10	94.55308	5.446921	0.0000421	99.99996

Overall the Telecom sectoral index is affected majorly by the own fluctuations happening in stock exchanges. But considering the BSE-variance, it is further elaborated by SSE fluctuations at increasing rate. So, it is SSE which is having a considerable share across such index for explaining the behavior of BSE variance with robust analysis for 10 days itself.

The table 4.6.9 for Utilities sectoral index is depicting the variance decomposition analysis at 10-days variance horizon. The Utilities index for BSE is having the variance explained by SSE and BSE-own fluctuations as well. But interesting observation to put into front is that at 2-days variance lag the BSE variance is elaborated by BSE at its own with 99.99% that is completely written off after the 2-days lag. As heading from 2-days onwards the variance of BSE is being majorly explained by SSE fluctuations. That means at robust/real time phase the Utilities index is highly affected by SSE considering the BSE as dependent variable.

But the same case situation has not been held for SSE (Utilities) as most of its variance is explained by its own fluctuations only rather than BSE itself. As at 10-days variance horizon the BSE is affecting SSE' variances with 0.0197% share.

Table 4.6.9 Variance Decomposition for Utilities Indexes (%)

Variance Period	**Variance Decomposition of BSE (Utilities)**		**Variance Decomposition of SSE (Utilities)**	
	BSE (Utilities)	*SSE (Utilities)*	*BSE (Utilities)*	*SSE (Utilities)*
1	100	0	0.017512	99.98249
2	99.9974	0.002598	0.014252	99.98575
3	0.317086	99.68291	0.012397	99.9876
4	0.188871	99.81113	0.012328	99.98767
5	0.148705	99.8513	0.013141	99.98686
6	0.126377	99.87362	0.014384	99.98562
7	0.111037	99.88896	0.015927	99.98407
8	0.099642	99.90036	0.017726	99.98227
9	0.090606	99.90939	0.019745	99.98026
10	0.083031	99.91697	0.021959	99.97804

As a whole analysis of the 4th objective it is crystal clear that majorly given in 10-days lag it is the stock exchanges own fluctuations/informational innovations that are impacting the variance held in their indexes except for Utilities sectoral index. As the benchmark index of Sensex and SHCOMP of both stock exchanges are having majority share of their own fluctuations for explaining the variance held across both the indexes. That means very minor share of the fluctuations & variance impact is held for benchmark indexes that is cross-country by nature.

For sectoral indexes the variance held in BSE is at increasing rate being explained or placed due to SSE-fluctuations. Out of which BSE (Utilities) sectoral index is highly affected by SSE with 99.916% at 10-days horizon. On the other side on the basis of the percentage share of their variances the Materials, Energy, Consumer Discretionary, Telecom, Industrials, Information Technology and Healthcare sectoral indexes respectively are securing their due position being the variance of BSE explained via SSE-fluctuations/informational shocks. Due to such minor cross-country transmission of shock the contagion is held to be intra-regional by nature.

Chapter 5

Findings, Conclusion and Suggestions

5.1 Findings

From the data analysis and interpretation done earlier the findings are to be stated in this chapter for integration levels of benchmark and sectoral index relative to both stock exchanges of India and China.

- In terms of how the stock exchanges of India and China performed the descriptive analysis has some figures to explain about the fact. The descriptive analysis involves the representative value that shows on an average performance of closing prices of indexes. The maximum and minimum point describes the range settled for indexes beyond which they don't record any value. Most importantly CV depicts the variance that closing prices of index do have from its average value which shows the potential of having high dispersion if deviation goes high.
    - As per such analysis the highest representative values (mean); the highest touch points (max. value); the lowest touch point (min. value) and as per the highest CV the healthcare sectoral index performed superbly well. In both stock exchanges that is BSE and SSE the Healthcare sectoral index unanimously recorded as the well performed sectoral index.
    - On the other side telecom sectoral index unanimously in both stock exchanges performed lowest as per the descriptive statistics stated. Rest of the sectoral indexes secured their respective position on the basis of the mean and CV values. In respect to CV being the measure of dispersion is depicting that Healthcare (BSE) and Energy (SSE) possess the highest prospects of dispersion.

- The Integration levels must be looked for the study period to state the existence of Contagion effect across the indexes beginning from long to short run measures & ending up at robust transmission mechanism involved.

- The benchmark index that is SENSEX and SHCOMP relative to India & China being the representative of the stock exchanges respectively shows the correlation status to be moderate in nature. This depicts that these two stock markets are linearly associated or influenced by each other but such influence is of moderate in nature. Whereas Johansen test acclaims that there is nil long run co-integration for such index and granger test specifies that Short run causality is also negligible for such index. That's why such index is immune from the long run and short run co-movements and is operating inefficiently. The transmission analysis via VDC is elaborating the fact further that there is very minor share for cross-country effect in terms of explaining the variance for the index. The reason behind their variance is found to be their own fluctuations/innovation shocks.
- The Healthcare sectoral index in such time phase shows the correlation to be very strong in nature. It depicts the fact that correlation coefficient between both the markets for Healthcare index is higher as the value is close to 1. The Johansen test shows the existence of long run common movements. Due to which risk-return trade off is non-favorable to investors and prospects of having financial turmoil is maximum in such case. While the short run causality moving from SSE to BSE at 2-days lag specifies the fact that SSE (Healthcare) index is in any case leading such index. The VDC analysis is depicting the fact that for explaining the variance for BSE the fluctuations of SSE are responsible with having minor share at increasing rate. The healthcare index in comparison with other sectoral indexes possesses the lowest impact for such variance in BSE held due to SSE fluctuations. But majority of the variance for BSE in such index is explained by its own fluctuations
- For Energy sectoral index in both stock exchanges the correlation is found to be very strong in nature. That portrays the extent of influence or association for both the markets of such sectoral index. Further analysis assures that long run integration is in existence for such index which implies that market is efficient due to having absence of predictability, arbitrage opportunities and violates the informational efficiency. The causality effect for short run states

that SSE is dominating the cause-impact status and is leading the common movements in BSE for short run. Considering the transmission of fluctuations across the exchanges the BSE (Energy) is recording the variance due to SSE at increasing rate and majorly effected by its own innovational shocks.

- For the Information Technology sectoral index of India and China's stock exchanges the integration level are specified as per: the index shows the correlation to be very strong in nature depicting the prospects of having large influence of these markets on one another. The long run co-integration is found to prevail for such index that means the integrated market violates the informational efficiency to prevail effectively by not soaking the information flows on timely manner. On the other side the short run causality for such index shows the bidirectional relationship moving from SSE to BSE. Again the China stock market is dominating the fluctuations happening all around in BSE. The VDC analysis is depicting the fact that the placement of variance is being held for BSE (Information Technology) due to the fluctuations held by SSE itself with a considerable share that is at growing rate but majorly such index is affected by its own internal shocks.
- The industrials sectoral index of both stock exchanges of India and China shows the potentials of integration. Across such index the correlation is found to be very strongly positive due to which there are prospects for large volatility in coming time. For stating the long run co-movements there is an existence of long run integration. That means for such index the market is operating efficiently due to existence of arbitrage. But for such sectoral index the causality effect for short run is having lead-lag status being SSE in dominating role for leading the fluctuations happening in BSE. The Variance Decomposition analysis is being done which finds that variance has been held across the indexes due to their own fluctuations but SSE is explaining the variance of BSE with a considerable growing share. It indicates the fact that SSE at accelerated pace is the reason behind BSE-fluctuations held.
- For the consumer discretionary sectoral index across both stock exchanges the association is stated to be very strongly positive, it indicates the fact that such

index is going to have large volatility for the coming time. The long run co-integration is found to prevail for such index. That reflects the verity that such market is efficient in nature as information flows are not observed or untapped on timely manner and investors with long holding period are not at all benefitted due to such situation held. The pair-wise causality status replicates the fact that such index possesses the lead-lag status, in which it is the SSE which is leading the BSE index. The transmission mechanism for such index is placing the fact that inter and intra regional fluctuations has been held for such index as well. Considering intra regional nature the SSE is explaining the variance placed in BSE whereas it is find out that the variance held across indexes is majorly affected via own fluctuations considering the variance horizon for 10-days.

- The utilities sectoral index of both stock exchanges of India and China shows the integration status somewhat to be different in nature. The correlation among the sectoral index is found to be very strong in such period. It shows that prospective volatility for such index is large in nature due to the correlation co-efficient being close to 1 and recorded to be the highest. But the long run co-integration is negligible for such index that means such sectoral market is in-efficient in nature. Thus it possesses the arbitrage and predictability power in such situation market players/speculators can easily manipulate the prices which need to be regulated. But having such scenario investors can favorable diversifies their portfolios across such index of both the nations. While there is an existence of short run causality for such index stating that there is lead-lag status for the index taking SSE as leading variable. Thus on the basis of SSE values the BSE-prices could be predicted. The transmission mechanism via VDC is indicating the fact that such index is highly and at most affected by SSE fluctuations if BSE-variance is considered. As even at 10-days horizon the SSE with 99.91% is explaining the variations held in BSE index. And very minor share stated in the analysis is advocating the fact that BSE-own fluctuations are playing very limited role.

- For the materials sectoral index of both stock exchanges the correlation status is found to be very strong in nature that means volatility is large for the coming time. Moving on the long run co-integration is in existence for such index which reflects that due to having common movements (long run) investors with long holding period cannot diversify their portfolios and financial turmoil gets worsened. The short run causality is moving bidirectional from SSE to BSE. That means SSE is the leading variable for predicting about BSE' prices. The VDC analysis for extent of transmission held across such index is stating the same fact that it is SSE' fluctuations that are heading or leading the variances taking place in BSE' sectoral index prices. The Materials index after Utilities index is securing the highest rank for such transmission taking place across these sectoral indexes.
- The telecom sectoral index of BSE and SSE of India and China respectively shows the correlation to be very strong. The correlation coefficient being close to 1 is showing the influence of one market onto another that is somewhat strong by facet. The long run co-integration is also in existence for such index it reflects the fact that market is efficient in nature as there is absence of predictability; arbitrage and it violates informational efficiency. The short run linkage is being held for such index moving from SSE to BSE for 2-days lag. That means SSE is the dominating index which leads the common movements in BSE within 2 days. The transmission mechanism for Telecom index is explaining the fact that such index is having a major share for own fluctuations with the reason behind the explanation of variances heading across the index of both exchanges. But if BSE-variance is considered the SSE fluctuations are having an extensive set of effect over BSE.

Discussion: As per the above findings stated the benchmark and sectoral indexes do have different degrees of integration. The correlation is found to be moderate by nature for benchmark index whereas it has been very strong for all the sectoral indexes such as Healthcare, Energy, Utilities, Consumer Discretionary, Materials, Information Technology, Telecom and Industrials. That means for such indexes there is linear association or indexes are highly influenced across countries as the correlation co-

efficient is close to 1. The correlation coefficients are studied to examine the extent of co-movements that such stock markets could display (Nashier, 2015 and Fayoumi et.al, 2009). On the other side the co-movements are being segregated in long and short run by its very nature as advocated by literature. The long run relationship states that markets are integrated and not completely segmented by national borders (Click and Plummer, 2003). The co-integration for long run has two schools of thought, one perspective for dis-integrated market states that such situation is beneficial for investors with long holding period as they can diversify their portfolios and can generate suitable risk-return trade off (Chattopadhyay, 2014; Vardhan, 2015; Hamori, 2010; Floros, 2005). The another perspective states that if stock markets are functioning effectively, only then co-integrating relationship between them is expected to prevail (Floros, 2005). It is elaborated that if markets are find to be integrated then it is efficient in nature that is relative to absence of predictability (Vardhan, 2015) it was further clarified that co-integration must have causality status in one direction at least, it indicates that knowledge of current prices of leading variable improves the ability to forecast stock prices of lagged variable (Floros, 2005).

For explaining the facts about transmission mechanism the intra-regional contagion effect is the term behind the analysis done above. As the hypothesis relative to contagion effect states that the stock market fluctuations in markets should be explained by their regional markets only (Masih and Masih, 1999; Azad, 2007).

5.2 Conclusion

The study explored or discussed about the different integration levels present in the stock exchanges of India and China during selected time phase. The general remark is that there is integration and eventually contagion effect is found to be present in every sort of sectoral index excluding the Utilities sectoral index. But the demarcated line indicates that integration is found to be of long run; short run and impulsive in nature for different indexes. Due to such demarcation the importance or potentials of each index in terms of investment differs as well. The integration levels are being tested in depth moving from benchmark indexes to selected sectoral indexes of both stock exchanges. The concluding remark about benchmark index that is SENSEX and SHCOMP state that there is nil long

run and short run integration or co-movement is prevailing across both the nations. That means benchmark indexes being the representative indices of both the stock exchanges shows that markets at large or in general are immune from integration and thus inefficient in nature. But if sectoral indexes of both stock exchanges are considered, the scenario gets different turn reflecting that all the sectoral indexes are showing the long run co-movement excluding the Utilities sectoral index. The co-integration presents in such indexes shows that markets are efficient in nature and does possess the arbitrage situations. If short run co-movement is considered the SSE-sectoral indexes are operating independently and BSE is found to be the lagging variable for all the sectoral indices. The transmission mechanism via VDC is being shown that state the analysis for transmission of informational shock across the indexes. But there exist the decision point as the shock resulting in the indexes is due to their own innovations/fluctuations or it's happening due to cross-country shock. The cross-country effect is their but such effect is minor in nature and accelerating as well whereas for Utilities index the cross-country effect is highest and fluctuations are heading due to innovation shock generated across nations. Out of the sectoral indexes the Utilities and Healthcare are showing the transmission by following the highest to lowest transmission rate respectively. Moving on order - wise Materials, Energy, Consumer Discretionary, Telecom, Industrials and Information Technology consist its due rank on the basis of percentage rates for transmission in 10-days lag. If transmission is considered the contagion is intra-regional in nature for all the indexes except the Utilities index.

Thus all the sectoral indexes are exposed to different levels of integration & eventually market efficiency. That means the Stock Market are integrated at sectoral level and contagion effect or spread of shock does prevail across such sectoral indexes.

5.3 Suggestions

The comprehensive analyses over diverse degree of stock market integration are useful for the practitioners, future researchers, academicians and policy makers. So, in terms of portfolio diversification the Utilities sectoral index is the best venture to have a deal from the investors. It is observed that the existence of the common factor such as arbitrage is co-moving the sectoral indexes for long run that is stated to be the indicator of market

efficiency to prevail and informational spillover to happen. Moreover China's sectoral indices are dominating the movement for stock prices of India due to the fundamental and financial linkages in existence. As China also possess the dominance in higher GDP, Exports and slower growth rate but with higher magnitude impact over world growth rate as well. Besides such dominating factors China is also showing the way for stock market integration with the leading status at its side. On the other side India is termed to be 'the world's back office' whereas China is stated to be 'the world's workshop' that's why in terms of dependency China is taking the lead in general as well. The strong price linkages or co-movements are the resultant outcome due to sturdy economic ties across nations, co-ordination prevailing across policies, identical investment patterns and identical technological growth.

Although market inefficiency lay down the platform for speculators to control the prices and weak players of the market expect the un-realistic return-risk trade off. So, the regulators/controllers of market need to operate for realistic price movements to save the weak players belonging to such market. Moreover investors should be well versed with the actual information flows and noise generated in the market.

5.4 Limitations of the Study

The above analysis explored about the integration levels/degrees for the stock markets of India and China. But it is recorded to be the limitation of such study that data required for the analysis was partially available. For having broader view over the study the data period could be extended. The contagion effect could also be studied by having a crisis perspective as the study done above is showing another perspective of having non-crisis situation.

5.5 Future Scope of the Study

The integration levels with contagion effect could be elaborated further with having an attribute for Interdependence signifying the Joint efficiency across the stock exchanges of both the nations. Such analysis involves the multivariate dataset with panel data analysis for stating the properties of interdependence happening across the nations. Thus, the contagion analysis could further be elaborated with vast mechanism involved.

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