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Does Indian Stock Market Rely on other Asian Stock Markets?

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Abstract: The present study investigates the relationship between selected Asian eight countries stock market index and Indian stock market BSE-Sensex. In other words, the main objective of the study is whether Indian stock market index is influenced by selected Asian countries stock market or not. The progressive deletion of constraints, reduction of controls over capital movements, quick development of worldwide trade in commodities, services and financial assets, emergence of new capital markets and the upshots of financial and economic crises enhanced the significant dependability among the emerging stock markets as well. This study is based on secondary time series data obtained from index mundi database and yahoo.com database for the period from 1991 to 2013. In the course of analysis, ADF unit root test, co-integration test and causality test have been designed. Johansen multivariate co-integration test shows that Indian stock market index is related with selected eight countries stock market index in the long-run. Granger causality test illustrates that bi-directional causality exists between the selected variables between the selected stock market indices.

Keywords: Stock market, India, other Asian countries, unit root test, co-integration test, Granger causal test.

I. INTRODUCTION

Over the decade of 1990s, a series of measures in the stock markets were taken. With the automation and liberalization of the Indian stock markets, there has been a distinguishable change in the Indian Stock market towards the later part of the 1990s. Trading system in Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) has reached an international paradigm (Chattopadhyay and Behera, 2006, p. 2). This has formed on a national scale trading method to facilitate gives the same way in to every investors despite environmental position (Joshi, 2011). In that logic, technology has brought about equality among the investors across the country. The stock markets established the best probable schemes practised in advanced stock markets, viz., electronic trading method, dematerialisation of shares, replacement of the Indian carry forward trading system by the index-based and scrip-based futures and options; adoption of risk management system etc (Madhusoodhan, 2010). With the introduction of these advanced practices transparency has also increased in the stock market. As of now, India is allowed to invest in all categories of securities traded in the primary and secondary segments and in the derivative segment (Chattopadhyay and Behera, 2006, p. 6). In economic literature the issues related to stock market integration and co-movements of stock prices across countries have received considerable attention. The financial market's integration in general implies that in absence of administrative and informational barriers, risk adjusted returns on assets of the same tenor in each segment of the market should be comparable to one another. Recent globalization and free movements of capital across boundaries of nation have integrated financial market worldwide. Technological innovations have improved market assimilation. Vigilant assessment of global stock market movements in recent years suggests that there exists a substantial degree of interdependence among national stock markets (Joshi, 2011). It is quarrelled that unanticipated expansion in international stock markets seem to have become important "news" that influences domestic stock markets (Eun & Shim, 1989). This research work has been categories in the following four segments; first segment is about the review of related literature, the second segment deals with the materials and methods carried out for this study. The third segment is the analysis of empirical results and the final segment followed by the conclusion of the research work.

II. REVIEW OF LITERATURE

The interest in studying the dynamic relationships among the world's equity markets gathered considerable momentum following the October 1987 global stock market crash, and even more so, following the Asian financial

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crisis in 1997. Several researchers have examined the relationships among the major developed equity markets and markets in the Asian region. Bailey and Stulz (1990) investigated the prospects for international portfolio diversification among pacific basin stock markets using the daily returns for the Malaysia, Korea, Singapore Hong Kong, Japan, Philippines, Taiwan and Thailand market indices from January 1977 to December 1985. They used simple correlation analysis to detect interrelations among the markets. Their results showed that the degree of correlation between US and Asian equity returns depended upon the time period design. Bhattacharya and Samantha (2001) and Joshi (2011) investigated the extent to which news on NASDAQ helped price formation at the beginning and at the end of a trading day at the Indian bourses using daily data of stock price indices from 2000 (January 3) to 2000 (October 31). They examined the impact of NASDAQ on SENSEX through Ordinary Least Square (OLS) equations under co-integration and error correction outline. The study showed that the news on NASDAQ had played an important role in price formation at the beginning of the new trading day at the Indian bourses. Consequently, this study recommended the assimilation of the Indian capital market with the US market. Wong et al (2004) and Harper et al (2013) investigated the long-run equilibrium relationship and short-run dynamic linkage between the Indian stock market and the stock markets in major developed countries (United States, United Kingdom and Japan) after 1990 using the Granger causality and co-integration method. Using weekly closing prices data from January 1, 1991 to December 31, 2003, they found that Indian stock market was integrated with mature markets. Ahmad, Ashraf and Ahmed (2005) examined the inter-linkages and causal relationship between the NASDAQ composite index in the US, the Nikkei in Japan with that of NSE Nifty and BSE SENSEX in India using daily closing data from January 1999 to August 2004. The study used Granger Causality and Johansen co-integration methods to examine short run and long term relationship among the stock markets respectively. The results of Co-integration test revealed that there was no long-term relationship of the Indian equity market with that of the US and Japanese equity markets. Granger causality test suggested that there was a unidirectional relationship from NASDAQ and Nikkei to Indian stock markets, as supported in Joshi (2011). Bose (2005) identified that the Indian stock market did not function in relative isolation from the rest of Asia and the US as stock returns in India were highly correlated with returns in the US, Japan, as well as other Asian markets during the post-Asian crisis and up to mid-2004. Lamba (2005) performs a comprehensive large sample analysis to investigate the presence of long run relationships among South Asian equity markets and the developed equity markets. The results reveal that Indian markets are influenced by developed equity market of US, UK and Japan. Chen, Lobo and Wong (2006) examined the relation between India-US, US-China and India-China using Fractionally Integrated VECM to study co-integration between them. By complementing the model with a multivariate GARCH model, it was observed that all these pairs are fractionally co-integrated. The US market played a leading position at the same time as there remained an interactive relationship between US and Chinese stock markets, as supported in Saha and Bhunia (2012). Hoque (2007) explored the dynamics of stock price movements of an emerging market such as Bangladesh with that of USA, Japan and India using daily closing price data starting from January 1, 1990 to December 31, 2000. The index utilized for Bangladesh, India, Japan and USA were Dhaka Stock Exchange (DSE) All Share Price Index, BSE30, Nikkei 225 and S&P500 in that order. They examined the long-run associations among the markets using the Johansen multivariate co-integration approach and short-term dynamics were captured through vector error correction models. Vector Auto Regression was employed to investigate the impact of shocks of these markets on own markets and other markets. The testing demonstrated that there was support of long term co-integration among the markets suggesting that stock prices in the countries share a common stochastic trend. Impulse response analysis shows that shocks to US market do have an impact on Bangladesh stock market. The response of Bangladesh stock market to shocks Indian stock market is weak. Shocks to Japanese stock market do not generate a response in the Bangladesh stock market, as supported in Joshi (2011). Raj and Dhal (2008) observe that the Indian market's dependence on global markets, such as the US and the UK, is substantially higher than on regional markets such as Singapore and Hong Kong. Majid et al. (2008) find long-run relationships for five ASEAN countries with the US and Japan only in the post-crisis period, while Awokuse et al. (2009) evidenced that the number of co integrating vectors increases in the post-crisis period among 11 Asian economies. Ismail and Rah man (2009) investigated the relationship between the US and four leading Asian emerging stock markets namely Hong Kong, India, South Korea and Malaysia and found that there were possibilities of relationship between all the stock markets. Long staff's (2010) empirical investigation into the pricing of subprime asset-backed collateralized debt obligations (CDOs) and their contagion effects on other markets find strong evidence of contagion in the financial markets. Kim et al. (2010) studied the turmoil of 2007–2009 and found how the troubles in a small segment of the US mortgage market became escalated into a crisis of global proportions. Yilmaz (2010) examines the extent of contagion and interdependence across the East Asian equity markets since early 1990s and compares the ongoing crisis with earlier episodes. They show that there is substantial difference between the behaviour of the East Asian return and volatility spillover indices over time. While the return spill over index reveals increased integration among the East Asian equity markets, the volatility spill over index experiences significant bursts during major market crises, including the East Asian crisis. Fidrmuc and Korhonen (2010) analyze the transmission of global financial crisis to business cycles in China and India. They find wide differences for different frequencies of cyclical development. More specifically, at business cycle frequencies, dynamic correlations are typically low or negative, but they are influenced most by the global financial crisis. Finally, they locate a noteworthy connection between trade ties and dynamic correlations of GDP growth rates in emerging Asian countries and OECD countries. The continuation of selected variables about stock market in India is survived or not especially subsequent to international financial crises, Indian political condition and the impact of the rupee depreciation. On these arguments this research paper investigates the impact of selected eight countries stock market index on BSE-Sensex in India.

III. METHODOLOGY

The present research work is based on secondary data source consisting of daily data collected from Yahoo.Com database and index mundi database designed for 1991 to 2013. This research work considers nine countries stock price indices, that is to say, HKSE, JKSE, KLSE, KOSPI, KSE, NIKKEI, SSE, TSEC and SENSEX of Bombay stock exchange (the closing price) have been taken for the preferred periods. The entire empirical test has been prepared by using econometric (Eviews 7) software. Primarily all the preferred variables are converted into natural logarithm due to its non-uniformity status. To investigate, descriptive statistics, correlation statistics, test of stationary through ADF unit root test, Johansen co-integration test and pair wise Granger causal test method have been employed in the present research work.

Descriptive statistics contain the portrait of mean, median, standard deviation; kurtosis, skewness and J-B statistics with probability for the selected stock market indices that are exposed in Table 1. It is viewed that mean and standard deviation of the particular series have highest mean. Skewness, kurtosis and Jarque-Bera statistic with probability designates that none of the series are normally distributed.

Table1. *Descriptive Statistics*

	BSE	HKSE	JKSE	KLSE	KOSPI	KSE	NIKKEI	SSE	TSEC
Mean	9.42	9.81	7.62	7.08	7.27	9.23	9.36	7.68	8.86
Median	9.64	9.90	7.76	7.14	7.39	9.27	9.32	7.70	8.90
Maximum	10.12	10.36	8.56	7.54	7.71	10.30	9.81	8.71	9.19
Minimum	7.98	9.04	5.99	6.44	6.29	7.90	8.86	6.92	8.32
Std. Dev.	0.51	0.26	0.67	0.28	0.34	0.49	0.23	0.39	0.18
Skewness	-0.98	-0.68	-0.46	-0.17	-0.86	-0.25	0.23	0.19	-0.75
Kurtosis	2.81	2.66	2.11	1.81	2.57	2.99	1.88	2.58	3.06
Jarque-Bera	445.85	227.9	189.77	174.7	361.49	28.40	170.04	37.12	256.92
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Correlation statistics in table2 reveal that BSE-Sensex and all the selected stock market indices are positively correlated under the study nonetheless it does not talk about the justification and shock in terms of causality (Bhunia, 2013). With the intention of imply an undeniable explanation of the shock; it is requisite to perform Johansen co-integration and Granger causality test between the selected variables.

Table2. *Correlation Statistics*

	BSE	HKSE	JKSE	KLSE	KOSPI	KSE	NIKKEI	SSE	TSEC
BSE	1.00								
HKSE	0.94	1.00							
JKSE	0.95	0.87	1.00						
KLSE	0.92	0.87	0.97	1.00					
KOSPI	0.98	0.93	0.96	0.93	1.00				
KSE	0.88	0.84	0.88	0.90	0.88	1.00			
NIKKEI	0.15	0.28	0.03	0.10	0.16	0.40	1.00		
SSE	0.68	0.76	0.60	0.60	0.66	0.46	-0.01	1.00	
TSEC	0.82	0.88	0.78	0.83	0.84	0.78	0.39	0.64	1.00

IV. Empirical Results And Analysis

4.1. Results of Unit root test

Johansen co-integration and Granger causal test is crucial wherever there is any underlying shock of selected variables on BSE-sensex. This test is accessible if the series are stationary. With the purpose of stationary investigation, unit root tests of Augmented Dickey-Fuller (ADF) by way of intercept as well as intercept and trend are performed with the levels and first differences of each variables on the stipulation that the null hypothesis is nonstationary, afterward refusal of the unit root hypothesis support stationary.

Table3 & 4 shows the results of unit root test. It reveals that time series are not stationary at levels in both the test equations of intercept and intercept & trend. However, table shows that the various countries' stock market indices and BSE-sensex are stationary at 1st difference in both the test equations of intercept and intercept & trend [1(1)]. Augmented Dickey Fuller unit root analysis test divulges that errors have constant variance and are statistically independent. Consequently, Johansen cp-integration and Granger causal test can be applied on these variables, as supported in (Shahzadi and Chohan, 2012) and Kaliyamoorthy and Parithi (2012).

Table3. *ADF Unit Root Test Results at levels and Intercept*

	BSE	HKSE	JKSE	KLSE	KOSPI	KSE	NIKKEI	SSE	TSEC
t-stat.	-2.34 (0.16)	-2.70 (0.07)	-2.28 (0.18)	-1.59 (0.49)	-2.81 (0.06)	-1.54 (0.51)	-1.90 (0.33)	-1.29 (0.64)	-2.62 (0.09)
5%	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86
Rem.	NS	NS	NS	NS	NS	NS	NS	NS	NS

- MacKinnon (1996) one-sided p-values.
- NS stands for non-stationary and S stands for stationary

	BSE	HKSE	JKSE	KLSE	KOSPI	KSE	NIKKEI	SSE	TSEC
t-stat.	-49.28 (0.00)	-54.59 (0.00)	-46.9 (0.00)	-57.9 (0.00)	-51.70 (0.00)	-46.1 (0.00)	-54.68 (0.00)	-53.2 (0.00)	-49.8 (0.00)
5%	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86
Rem.	S	S	S	S	S	S	S	S	S

Table4.*ADF Unit Root Test Results at 1st differences and intercept*

- MacKinnon (1996) one-sided p-values.

4.2. Results of Multivariate Co-integration Test

Since eight countries stock market index and BSE-Sensex are stationary, therefore, multivariate co-integration method in Johansen approach can be applied to detect the co-integration affiliation between the variables in the long period. At the same time, this method can be determined the co-integration vectors. As we know, two likelihood ratios, to be precise, the Trace Test and the Maximum Eigen Value test can resolve the co-integration vectors. At the same time, this research work presupposes linear deterministic trend unrestricted with intercepts without trends on account of using a lag of 1 to 4 at 1st differences derived from AIC for the selected commodity and stock market indicators under the study.

Table-5 exhibits the multivariate co-integration test results through Johansen approach that gives surety about affiliation between eight countries stock market index and stock market index of Bombay stock exchange in the long period because trace statistics is more than critical value in case of both the likelihood ratio test, that is, the trace test and the maximum eigenvalue test. Consequently, the multivariate co-integration test results do not accept the null hypothesis (mentioned in hypothesis-2 above). This test also confirmed the number (four) of co-integration vectors. It is furthermore indicating that four common stochastic trends or a degree of market integration are pres

Table5. *Results of Multivariate Co-integration Test*

Unrestricted Co-integration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.052457	374.1467	197.3709	0.0000
At most 1 *	0.026625	225.4312	159.5297	0.0000

At most 2 *	0.019769	150.9511	125.6154	0.0006
At most 3 *	0.014110	95.84188	95.75366	0.0493
At most 4	0.008782	56.61992	69.81889	0.3535
At most 5	0.006634	32.27542	47.85613	0.5970
At most 6	0.002520	13.90526	29.79707	0.8459
At most 7	0.001501	6.941150	15.49471	0.5845
At most 8	0.001012	2.795911	3.841466	0.0945
Trace test indicates 4 co-integrating equation(s) at 5% level				
* denotes rejection of the hypothesis at 5% level				
**MacKinnon-Haug-Michel is (1999) p-values				
Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.052457	148.7156	58.43354	0.0000
At most 1 *	0.026625	74.48010	52.36261	0.0001
At most 2 *	0.019769	55.10921	46.23142	0.0044
At most 3	0.014110	39.22195	40.07757	0.0622
At most 4	0.008782	24.34450	33.87687	0.4307
At most 5	0.006634	18.37016	27.58434	0.4646
At most 6	0.002520	6.964108	21.13162	0.9553
At most 7	0.001501	4.145239	14.26460	0.8437
At most 8	0.001012	2.795911	3.841466	0.0945
Max- Eigen value test indicates 3 co-integrating equation(s) at 5% level				
* denotes rejection of the hypothesis at 5% level				
**MacKinnon-Haug-Michel is (1999) p-values				

4.3. Results of Granger causality Tests

The Granger causality test (Awe, 2012) is a statistical proposal test designed for influential whether one time series is supportive for prediction any more. This test has been prepared in the present study in pursue for the movement of causation between selected countries stock market index and sensex.

Table-6 delineations to facilitate no causality and bi-directional causality survive between selected eight countries stock market index and BSE-sensex under the study. Bi-directional causality exists between the selected variables in 30 cases because the probability is less than 0.05 and obviously the null hypothesis is rejected. No causality exists between the selected variables in 42 cases because the probability is more than 0.05 and the null hypothesis is not rejected. It is important that the effect of causality between the particular indicators does not mean that movement in one indicator basically causes movements in another indicator. To a huge exposure, causality fundamentally guides to the associations of the time series (Awe, 2012).

Table6. *Results of Granger Causality Tests*

Null Hypothesis:	Obs	F-Stat	Prob.	
HKSE ↑ BSE	2806	0.74	0.4774	
BSE ↑ HKSE		11.19	1.E-05	Bi-directional causality
JKSE ↑ BSE	2763	9.98	5.E-05	Bi-directional causality
BSE ↑ JKSE		0.12	0.8887	
KLSE ↑ BSE	2801	4.08	0.0170	Bi-directional causality
BSE ↑ KLSE		1.99	0.1373	
KOSPI ↑ BSE	2806	16.05	1.E-07	Bi-directional causality
BSE ↑ KOSPI		10.38	3.E-05	Bi-directional causality
KSE ↑ BSE	2801	1.56	0.2099	
BSE ↑ KSE		5.13	0.0059	Bi-directional causality
NIKKEI ↑ BSE	2789	1.75	0.1736	
BSE ↑ NIKKEI		1.30	0.2740	
SSE ↑ BSE	2806	0.40	0.6715	

BSE ↑ SSE		4.12	0.0163	Bi-directional causality
TSEC ↑ BSE	2805	3.90	0.0203	Bi-directional causality
BSE ↑ TSEC		5.23	0.0054	Bi-directional causality
JKSE ↑ HKSE	2763	5.38	0.0046	Bi-directional causality
HKSE ↑ JKSE		6.85	0.0011	Bi-directional causality
KLSE ↑ HKSE	2801	5.87	0.0028	Bi-directional causality
HKSE ↑ KLSE		2.54	0.0787	
KOSPI ↑ HKSE	2815	15.23	3.E-07	Bi-directional causality
HKSE ↑ KOSPI		0.04	0.9633	
KSE ↑ HKSE	2801	2.30	0.1003	
HKSE ↑ KSE		0.32	0.7295	
NIKKEI ↑ HKSE	2789	2.53	0.0802	
HKSE ↑ NIKKEI		1.52	0.2192	
SSE ↑ HKSE	2840	1.90	0.1495	
HKSE ↑ SSE		3.08	0.0459	Bi-directional causality
TSEC ↑ HKSE	2805	17.47	3.E-08	Bi-directional causality
HKSE ↑ TSEC		0.47	0.6257	
KLSE ↑ JKSE	2763	0.18	0.8330	
JKSE ↑ KLSE		9.39	9.E-05	Bi-directional causality
KOSPI ↑ JKSE	2763	2.14	0.1184	
JKSE ↑ KOSPI		12.77	3.E-06	Bi-directional causality
KSE ↑ JKSE	2763	0.07	0.9334	
JKSE ↑ KSE		1.77	0.1703	
NIKKEI ↑ JKSE	2763	4.34	0.0131	Bi-directional causality
JKSE ↑ NIKKEI		0.06	0.9438	
SSE ↑ JKSE	2763	0.23	0.7983	
JKSE ↑ SSE		0.51	0.6000	
TSEC ↑ JKSE	2763	4.63	0.0098	Bi-directional causality
JKSE ↑ TSEC		3.69	0.0251	Bi-directional causality
KOSPI ↑ KLSE	2801	2.17	0.1148	
KLSE ↑ KOSPI		13.17	2.E-06	Bi-directional causality
KSE ↑ KLSE	2801	0.07	0.9289	
KLSE ↑ KSE		4.77	0.0086	Bi-directional causality
NIKKEI ↑ KLSE	2789	0.31	0.7364	
KLSE ↑ NIKKEI		0.16	0.8492	
SSE ↑ KLSE	2801	0.62	0.5372	
KLSE ↑ SSE		0.56	0.5740	
TSEC ↑ KLSE	2801	18.33	1.E-08	Bi-directional causality
KLSE ↑ TSEC		4.02	0.0180	Bi-directional causality
KSE ↑ KOSPI	2801	1.16	0.3128	
KOSPI ↑ KSE		0.83	0.4346	
NIKKEI ↑ KOSPI	2789	0.57	0.5675	
KOSPI ↑ NIKKEI		0.88	0.4155	
SSE ↑ KOSPI	2815	1.06	0.3456	
KOSPI ↑ SSE		2.20	0.1106	
TSEC ↑ KOSPI	2805	7.19	0.0008	Bi-directional causality
KOSPI ↑ TSEC		30.40	9.E-14	Bi-directional causality
NIKKEI ↑ KSE	2789	0.71	0.4941	
KSE ↑ NIKKEI		0.99	0.3705	
SSE ↑ KSE	2801	1.09	0.3356	
KSE ↑ SSE		0.62	0.5381	
TSEC ↑ KSE	2801	3.57	0.0283	Bi-directional causality
KSE ↑ TSEC		1.96	0.1410	

SSE ↑ NIKKEI	2789	3.91	0.0201	Bi-directional causality
NIKKEI ↑ SSE		5.67	0.0035	Bi-directional causality
TSEC ↑ NIKKEI	2789	0.29	0.7468	
NIKKEI ↑ TSEC		1.99	0.1370	
TSEC ↑ SSE	2805	4.80	0.0083	Bi-directional causality
SSE ↑ TSEC		0.39	0.6744	

Note: Decision rule: reject H0 if P-value < 0.05, DNR = Do not reject; ↑ = does not Granger cause.

V. CONCLUSION

The present study investigates the relationship between selected Asian eight countries stock market index and Indian stock market BSE-Sensex. The primary findings of the study is that the time series data is non-stationary at levels but stationary at I(1) that is an indication of Johansen co-integration test and Granger pair wise causality test. Johansen multivariate co-integration test shows that Indian stock market index is associated with selected other emerging stock market index over a twenty year periods, which indicates Indian stock markets, is influenced by selected stock market index during the study period or vice-versa. Again, Granger causality test illustrates that bi-directional causality exists between the selected variables in 30 cases out of 72 cases between the selected stock market indices. These results are identical with the policy decisions of the Indian economy because Indian stock market is directly or indirectly influenced by the selected Asian countries stock market or their economic policy decisions.

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