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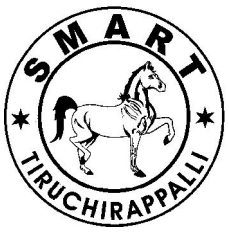

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A STUDY ON CO-MOVEMENT RELATIONSHIP BETWEEN INDIA, CHINA AND US STOCK MARKETS IN THE POST REFORM ERA

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Abstract

Indian Capital Market has undergone tremendous changes since 1991 when the Government adopted liberalization and globalization policies. With the establishment of SEBI and technological advancement, the Indian Stock Market has now reached the global standard. The major indicators of stock market development show that significant development has taken place in the Indian stock market during the post reform period. Investors are becoming increasingly interested in international diversification due to the emergence of liberalisation of stock markets in recent years. This paper endeavours to empirically investigate the co movement relationship between markets of US, China and India in the post reform era. The study found that Indian stock market was not co integrated with the China and US stock markets as yet and also found that Indian stock influenced the china stock market but China stock market did not influence the Indian stock market.

***Keywords**: Post Reform Period, Unit Root Tests, Co Integration, Granger Causality, VAR Granger Causality*

JEL CODE: C12, C19, G12, G15

I. Introduction

The last two decades have witnessed a dramatic change in the world's financial markets in general and in stock markets in particular. Indian stock market has also experienced this change due to automation and liberalization measures in early nineties. After financial sector reforms were initiated in 1991, the trading system in the BSE and NSE has achieved global standards. With the financial sector reforms initiated in 1991, not only foreign institutional investors and non resident Indians are allowed to invest in India's stock market but also Indian investors to tap the foreign market since 1993. Thus with the changes in Indian stock market since the liberalization, it is interesting to identify

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the integration of Indian stock markets with other countries stock markets. This study investigated the nature of the financial integration of Indian stock market (BSE) with the US stock market(S&P 500) and Chinese stock market (SSE).

II. Review of Literature

Most investigations that have focused on the equity markets of developed countries, reveal relationship between the stock markets of the world and the co movement between markets has been of significant interest to practioners and academics. The research conducted to examine the interdependence between stock indices across different markets, over different time periods, indicates a lack of consistency and the results are based on the sample period chosen and frequency of observations (monthly, daily or weekly) and choice of the market. A number of studies have been undertaken for emerging as well as for developed economies to explore the degree of integration of their stock markets with global markets. In this paper, we have reviewed some previous research works/papers.

Sharma and Kennedy(1977) examined the price behaviour of Indian market along with UK and US markets and concluded that the behaviour of Indian market was statistically indistinguishable from that of US and UK markets and found no evidence of systematic cyclical component or periodicity for these markets. **Rao & Naik (1990)** examined the inter-relatedness of USA, Japanese and Indian stock markets. Their study used monthly stock indices of Bombay, New York and Tokyo exchanges, for the period Jan 1971 to December 1988. I**gnatius (1992)** compared returns on the BSE Sensex with those on the NYSE, S&P 500 Index and found no evidence of integration. **Masih and Masih (1999)** studied the long-term and short-term dynamic linkages among international and Asian emerging stock markets and concluded that the U.S. stock market was the leader at the global level for short as well as long term. **R. Masih and Masih (2001)** investigated the dynamic causal linkages among nine major international stock price indices, using the vector error-correction modelling and level vector autoregressive models. The empirical results supported the significant interdependencies between the established OECD and the Asian markets and also the leadership of U.S. and U.K. markets over the short and long run. **Mishra (2002)** investigated the international integration of India's domestic financial market with the U.S. stock market. **Kumar and Mukhopadhyay (2002)** examined the short-run dynamic linkages between NSE Nifty and NASDAQ Composite during the period 1999-2001. The study supported a unidirectional Granger causality, running from the U.S. stock market to Indian stock market. **Nath and Verma (2003)** studied the transmission of market movements among the three major stock markets in the Asian region, namely, India, Singapore, and Taiwan. The results proved that there was no long-term interrelationship. **Wong, Agarwal, and Du (2005)** have found that the Indian stock market was integrated with the matured markets of the world by using the BSE-200 index. **Tripaty (2006)** examined the relationship between the world market and developed markets. He found that the world market exerted impact on developed markets and he concluded that the world stock market was efficient and co-integrated with the developed market. **Hoque (2007)** found evidence that stock prices of Bangladesh, United States, Japan, and India shared a common stochastic trend. **Phylaktis**

and Ravazzolo (2007) examined stock market linkages of a group of Pacific-Basin countries with the United States and Japan by estimating the multivariate cointegration model over the period 1980-1998. **Li and Majerowska (2008)** analyzed the linkages between the emerging stock markets in Warsaw and Budapest and the established markets in Frankfurt and the United States. They found that the emerging markets were weakly linked to the developed markets. **Menon, Subha, and Sagaran (2009)** examined whether the stock markets in the Indian subcontinent have any link with the major stock markets in China, Singapore, America, and Hong Kong. They found that the Indian markets were cointegrated to some of the markets around the world. **Bastos and Caiado (2010)** found evidence of integration and interdependence between the stock market returns of 46 developed and emerging countries for the period 1995-2009. **Park (2010)** found strong co-movement between Asian markets. Among them, the countries with more developed financial systems (i.e., Japan, Singapore, and Hong Kong in Asia) exhibited stronger linkages with the rest of the Asian markets. A**rouri and Nguyen (2010)** found no significant association between stock exchange of Gulf countries and the world stock markets during the study period of June 2, 2005 to April 2, 2008. **Subhani, Hasan, Mehar, and Osman (2011)** identified the linkage of stock prices of Karachi Stock Exchange with the stock prices of Nepal and Bombay stock exchanges except Dhaka stock exchange. **Sakthivel and Kamaiah (2012)** attempted to investigate the dynamic inter linkages among the Asian, European, and U.S. stock markets for the period January 1998 to June 2010. They found that the U.S. and some of the European and Asian stock markets influenced the Indian stock market. **Horvath and Petrovski (2012)** examined the international stock market co-movements between Western Europe and Central (the Czech Republic, Hungary, and Poland) and South Eastern Europe (Croatia, Macedonia, and Serbia) and found that the degree of co-movements was much higher for Central Europe and the correlation of South Eastern European stock markets with developed markets was essentially zero. **Malayendu Saha and Amalendu Bhunia(2012)** examined causal relationship among the leading stock exchanges of India and the US and concluded that Indian and US stock markets did cause each other. **Palamalai *et al.* (2013**) studied stock market linkages between emerging Asia –Pacific markets. The results of Granger causality/Block exogeneity Wald Test- based on VECM and variance decomposition analysis, revealed the stock market interdependencies and dynamic interactions among the selected emerging Asia-Pacific economies. As integration of stock markets across the globe is still partial, it leaves ample opportunity for switching between advanced markets like U.S. or Japan and the emerging Asian market, including India.

III. Statement of the Problem

In India since 1991, all the stock market development indicators have shown considerable increase due to reforms implemented in the capital market as a part of structural reforms and macroeconomic stabilisation process. The performance of Indian stock markets is comparable with that of developed markets like U.S. and U.K. In the background of the old adage, 'when the US gets a cold, the rest of the World sneezes', it is clear that stock markets depend upon each other. Hence the study to identify the determinants of stock prices in India in the contents of co-movement.

IV. Objectives of the Study

i. To study the relationship of China and US stock markets with the Indian stock markets.

ii. To check whether there exists long run relationship among the stock markets of selected countries.

iii. To study the lead –lag relationship between Indian stock market and other selected markets

V. Statement of Hypotheses

The following hypotheses were tested in this study.

Null Hypotheses

H_0 : There is no significant correlation between each of selected stock indices of China and US and BSE SENSEX

H_0 : There is presence of unit root for the selected variables in the time series data

H_0 : There is no co-integration between market indices of China ,US and BSE SENSEX

H_0 : There is no significant long run relationship between market indices of China, US and BSE SENSEX

H_0 : There is no Granger Causality between market indices of China and US and BSE SENSEX

Alternative Hypotheses

H_a : There is significant correlation between each of the selected indices and BSE SENSEX

H_a : There is absence of unit root for the selected variable time series data

H_a : There is co-integration between market indices variables and BSE SENSEX

H_a : There is significant long run relationship between China, US stock indices and BSE SENSEX

H_a : There is Granger Causality between market indices of China ,US and BSE SENSEX

VI. Need for the Study

The relationship between stock markets could vary from market to market and may change in different sample periods and also in different frequency of the data. Thus, more in-depth studies are needed to understand which market might influence the Indian stock market. Moreover, a country like India has to be chosen for this type of study since it is one among the fastest growing economies. Furthermore, the capital market has undergone tremendous changes after the adoption of liberalization policy and it has become more open to international investors. The reforming market and the significant economic potential have been attracting a large number of foreign institutional investors into the Indian stock market. How and at what extent the Indian stock market responds to the changes in markets, remains an open empirical question. Understanding the markets that could impact the stock market index, could be useful to investors, traders as well as the policy makers.

VII. Scope of the Study

The present study is aimed at studying the integration of Indian stock market with the stock markets of US and China in the post reform era.

VIII. Limitations of the Study

There are four limitations that need to be acknowledged regarding the present study. These limitations are as follows:

Reliability

This study was based on the analysis of secondary data only.

Accuracy

The accuracy of the result and conclusion of this study depend on the reliability of secondary data.

Time period

A time span of only 23 years was considered for examining the relation between Indian stock market, China and US Stock market only during the Post Reform Era.

Limited variables

This study mainly focused on selected stock indices which may not be completely representing India, US and China stock markets.

IX. Data and Methodology

Population: We have tried to take stock indices that are reflective of all the sectors of the economy i.e. broad based indices and those that represent the most actively traded stocks. In the case of India, BSE Sensex is the representative of Indian stock market due to the relative stability of Sensex and its popularity. To represent the US stock market, S&P500 was utilized. SSE Composite represented the stock markets of China.

Sample size: Sample size for the study was BSE SENSEX, S&P500 and SSE Composite encompassing the period January,1 1991 to December1, 2013. We have used closing stock market indices at the starting of the months of the equity markets of respective countries to study the integration of equity markets, covering a period of 276 months.

Sample elements: BSE SENSEX, S & P500 and SSE Composite

Tools Used for Data Collection: Secondary data of stock indices were collected from the official website of BSE and yahoo.finance.com.

Tools used for data analysis

- Descriptive Analysis
- Correlation between the different stock indices and returns
- Graphical analysis of price indices and their return
- Unit root tests
- Co integration technique
- Multivariate Granger Causality analysis
- Pair –wise Granger Causality analysis

To examine the stationarity of the time series data used for the study, we carried out the ADF, PP and KPSS unit root tests. These tests were conducted, with intercept and trend. Long run equilibrium relationship between and India, China and US countries was explained with the help of co-integration test. Granger causality test was used to determine whether one time series was useful in forecasting another, thereby finding out the direction of relationship between the variables of the study.

X. Empirical Results

10.1 Graphical Analysis

Co-movements of Indian stock price returns, with reference to China and US stock price returns, are shown in figure 1. The figure 1 shows that returns of Indian stock market prices (BSE_SENSEX), US (SP) and China (SSE CHINA) moved together in a long run. However, before going to study the long run relationship, we would like to study the statistical features and correlation between India stock market and China and US stock markets.

10.2 Descriptive Statistics

Table 1 summarises the time series data in terms of observations, mean, skewness,

standard deviation and kurtosis for the countries under study. During the 23 year period among the stock markets that recorded positive return, India's stock market recorded the highest mean of 8099.677, followed by China stock market at 1684.653 and followed by US stock market at 1023.460. The skewness value for all the data reveal that BSE_SENSEX and SSECHINA stock indices were positively skewed. The kurtosis values indicate that SSECHINA index was leptokurtic.

10.3 Correlation Analysis

An analysis of stock index correlation is important since correlation of stock price indices could be elevated owing to the presence of an underlying time trend and the persistence of prices in level form. The pair-wise correlations of daily stock indices (the first difference of logarithm transformed stock prices in the three markets), displayed in **Table 2**, show the correlation of the Indian markets with other countries markets. In particular, BSE SENSEX returns were positively correlated with all other indices returns**.** However, it revealed weak relationship.

10.4 Unit Root Tests.

Two or more non-stationary time series are said to be co-integrated if a linear combination of the variables is found stationary. The test of non-stationarity is regarded as the precondition for analysing co-integration. As such, the first step in the analysis is to identify the presence of unit root in each selected series and to verify whether the index series are non-stationary. The other assumption is that all the series should compulsorily be integrated in the same order.

To examine the stationarity of the time series data, the Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) Tests and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) tests were applied at log levels and their first differences level of each series were identified with constant and linear trend. Lag lengths and model were chosen according to the Schwartz Information Criterion (SIC) and Bartlett Kernel & Newly-West Bandwidth. The critical values were based on MacKinnon (1996).

10.4.1 Unit root test at log levels

The results of ADF, PP and KPSS unit root tests were applied to data at log levels and they are shown in **Table 3**. ADF and PP Unit root tests indicate that null hypothesis is accepted at level. KPSS tests reject the null hypothesis at level. Thus we conclude that data were non stationary at log levels.

10.4.2 Unit root test at first differenced log levels

The results of ADF,PP and KPSS tests at first differenced log level data are shown in **Table 4**. The calculated values were lesser than critical values at 1% level. Hence reject the null hypothesis under the ADF and PP test and accept null hypothesis under the KPSS test. Therefore, we can conclude that variables were integrated at order one I(1).

10.5 Johansen Co-integration Test

Empirical results of the co-integration rank test were derived from Johansen's multivariate VECM, involving the three stock prices chosen for the study, where linear deterministic trends (restricted) were also allowed. This test determines the rank (r) of the coefficient matrix based on Vector Auto Regression (VAR) model of the series, with the rank indicating the existence of any cointegration as well as the number of co-integrating relationships. Two likelihood ratio tests were conducted, namely, the Trace Test (TT) and the Maximum Eigen Value test (MEV), to determine the number of co-integrating vectors.

10.5.1 Cointegration of Indian Stock market with China and US markets

The results of **Table 5** reveal the max and trace statistic test. Null hypothesis vector at 0, is clearly accepted by the both max and trace test statistics at 5 % level of significance. Thus we conclude that Indian stock market did not have co integration relationship with China and US stock markets.

10.5.2 Co integration of US Stock market with China and Indian markets

According to the results shown in **Table 6** the Trace Test indicated the existence of three co-integrating equations at 1% level of significance. The maximum Eigen value test, on the other hand, confirmed this result at 1% level of significance. Thus the selected variables (US, China and Indian stock markets) of the study recorded a long-run equilibrium relationship. This means that US stock market experienced long term relationship with Indian and China Stock markets. This finding implies that US is more liberal and open economy than India.

10.5.3 Co integration of China Stock market with US and Indian markets

According to **Table 7**, stock markets of China, US and India were not co integrated because the Trace and Eigen statistic values were less than the critical value at 5% level. This means that China stock market did not have long term relationship with Indian and US stock markets.

10.6 Multivariate Granger Causality Wald Test

Results of Granger Causality Wald Test, based on Vector Error Correction Model (VECM), with the objective of revealing any causality relationship between variables in each model, are shown in **Table 8**. The test was also performed for determining the direction of causation between these three variables, using the Vector Error Correction Model. The results confirmed the rejection of the null hypothesis because no individual market of the selected three markets Granger Caused the other markets at 5% level.

10.7 Pair wise Granger Causality test

Studying the relationship with a pair of variables, there is the possibility of unidirectional causality or bidirectional causality or none. This can also be the case between two pairs of variables used in our empirical analysis. The pre-condition for applying Granger Causality test is to ascertain the stationarity of the variables in the pair. The second requirement for the Granger Causality test is to find out the appropriate lag length for each pair of variables. In our case, the optimum lag length was found to be 2 for all the variables, based on LP, FPE, ALC, SC and HQ criteria. Finally, the results of Granger causality test are reported in **Table 9**.

Pair wise granger causality test results, shown in Table 9, indicate that only BSE SENSEX exercised impact on China stock market because the probability was less than 5%. But the China stock market did not have any impact on BSE SENSEX. From the Table, it is identified that all other stock indices did not have any impact on the returns of BSE SENSEX. There was unidirectional causal influence between Indian stock indices and China but China and US did not experience any causality.

XI. Findings

Thus the statistical results show that there was neither long-term impact of the US and China markets on the Indian stock market nor long-run relationship between the Indian stock markets and China and US markets. There

is no doubt that the Indian stock market developed significantly due to various measures initiated by the Government of India after 1991. Then the question may arise: why the Indian stock market is not integrated with the world markets? At this point, it is important to distinguish between the concepts of liberalization and integration. For example, a country might pass a law that seemingly drops all barriers to foreign participation in local capital markets. This is liberalization but it might not be effective enough to result in market integration. The same thing happened in the case of India. India has liberalized the economy to a larger extent but we cannot claim that India is fully liberalized. Still a lot of restrictions are in place and they are the main hindrance to stock market integration.

XII. Conclusion

India is one of the emerging economies, which has witnessed significant development in the stock markets during the recent period due to the liberalization policy initiated by the Government. It is generally believed that due to liberalization policy and the consequent development of Indian stock markets, the latter might have integrated with the developed markets. One may argue that due to this integration, which should have taken place after liberalization, Indian stock market will mainly be governed by a common factor as in the case of the developed markets. However, our study does not support this view. Rather, it finds that Indian stock market is not at all integrated with China and US markets. Contrary to general belief, Indian stock market is not co-integrated with the developed market as yet. Of course, some short-term impact does exist although it is found to be unidirectional with China market. It is derived from the study that although some positive steps have been taken up, which are responsible for the substantial improvement of the Indian stock market, these are perhaps not sufficient enough to help Indian market integrated with the developed stock markets so far. That means, the pre-requisite, which are required for the long-run relationship, has not been achieved by India so far. The study concludes that Indian stock market should be globally integrated over the next 10 to 15 years. To move towards far greater integrated global financial world, policy makers in India need to rethink the frame work for such integration.

XIII. Scope for Further Research

This study analysed the movement of BSE SENSEX, S&P500 of US and SSE Composite of China, based on monthly data. The study may be further extended by considering other indices such as NSE, NYSE, DJIA in other countries, based on daily data, explain different kinds of relationship.

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Table 1: Comparative Descriptive Statistics of Data 1991-2013

VARIABLES/ STATISTICS	BSE SENSEX	SP	SSECHINA
Mean	8099.677	1023.460	1684.653
Median	4420.505	1111.835	1506.030
Maximum	21326.42	1808.370	5954.770
Minimum	996.4500	343.9300	113.9400
Std. Dev.	6280.898	372.5386	995.4897
Skewness	0.788516	-0.357263	1.230235
Kurtosis	1.966920	2.024399	5.441114
Jarque-Bera	40.87432	16.81697	138.1489
Probability	0.000000	0.000223	0.000000
Sum	2235511.	282474.9	464964.2
Sum Sq. Dev.	1.08E+10	3.8165885	2.73E+08
Observations	276	276	276

Source: www.bseindia.com

Table 2: Correlation of stock price returns

Variables	D_L_BSE_SENSEX	D_L_SP	D_L_SSECHINA
D_L_BSE_SENSE	1.000000		

D_L_SP	0.368494	1.000000	
	[6.549403]	-----	
	(0.00)	-----	
D_L_SSECHINA	0.114151	0.123501	1.000000
	[1.898487]	[2.056317]	-----
	(0.0587)	(0.0407)	-----

Correlation coefficient , t –Statistic [ ] , Probability( )

Source: official websites-Sensex, S&P and SSE

Table 3: Unit root test result at Log level

Variables	ADF Test	PP Test	KPSS TEST	Conclusion
	H_0: Variable is non stationary	*H_0: Variable is non stationary*	*H_0: Variable is stationary*	
L_BSE_SENSE	-2.495271	-2.817635	0.225234	Non-stationary
L_SP	-1.778590	-1.917132	0.323381	Non-stationary
L_SSECHINA	-3.527733	-3.515016	0.165024	Non-stationary
Asymptotic critical values				
1%	-3.991780	-3.991780	0.216000	
5%	-3.426251	-3.426251	0.146000	
10%	-3.136336	-3.136336	0.119000	

Source: official websites-Sensex, S&P and SSE

Table 4: Unit root test result at first differenced Log level

Variables	ADF Test	PP Test	KPSS Test	Conclusion
	H_0: Variable is non stationary	*H_0: Variable is non stationary*	*H_0:Variable is stationary*	
D_L_BSE_SENSE	-14.22069	-14.22069	0.077022	Stationary
D_L_SP	-15.58052	-15.58052	0.097669	Stationary
D_L_SSECHINA	-17.41224	-17.41224	0.054637	Stationary
Asymptotic critical values				
1%	-3.991780	-3.991780	0.216000	
5%	-3.426251	-3.426251	0.146000	
10%	-3.136336	-3.136336	0.119000	

Source: official websites-Sensex, S&P and SSE

Table 5: Cointegration of Indian Stock market with China and US markets

Eigen value	Trace statistic	5 % Critical Value	Prob.	Max-Eigen statistic	5% Critical Value	Prob.	Hypothesized No. of CE(s)
0.070717	1.386518	29.79707	0.2650	20.02221	21.13162	0.0709	None
0.007082	2.602563	15.49471	0.9820	1.940196	14.26460	0.9920	At most 1
0.002423	0.662367	3.841466	0.4157	0.662367	3.841466	0.4157	At most 2

Source: official websites-Sensex, S&P and SSE

Table 6: Co integration of US Stock market with China and Indian markets

Eigen value	Trace statistic	5 % Critical Value	Prob.	Max-Eigen statistic	5 Percent Critical Value	Prob.	Hypothesized No. of CE(s)
0.326852	237.0286	29.79707	0.0001	107.6549	21.13162	0.0001	None
0.225022	129.3737	15.49471	0.0001	69.33837	14.26460	0.0000	At most 1
0.198057	60.03531	3.841466	0.0000	60.03531	3.841466	0.0000	At most 2

Source: official websites-Sensex, S&P and SSE

Table 7: Cointegration of China Stock market with US and Indian markets

Eigen value	Trace statistic	5 % Critical Value	Prob.	Max-Eigen statistic	5 % Critical Value	Prob.	Hypothesized No. of CE(s)
0.070717	22.62477	29.79707	0.2650	20.02221	21.13162	0.0709	None
0.007082	2.602563	15.49471	0.9820	1.940196	14.26460	0.9920	At most 1
0.002423	0.662367	3.841466	0.4157	0.662367	3.841466	0.4157	At most 2

Source: official websites-Sensex, S & P and SSE

Table 8: Results of Multivariate Granger Causality Wald Test

Dependent variable: L_BSE_SENSEX		
Independent variables	Chi-sq	Prob.
L_SP	1.210823	0.5458
L_SSECHINA	2.605404	0.2718
All	3.538198	0.4721
Dependent variable: L_SP		
Independent variables	Chi-sq	Prob.
L_BSE_SENSEX	0.724841	0.6960
L_SSECHINA	0.500714	0.7785
All	0.850949	0.9315
Dependent variable: L_SSECHINA		
Independent variables	Chi-sq	Prob.
L_BSE_SENSEX	5.279088	0.0714
L_SP	2.321753	0.3132
All	9.515941	0.0494

Source: official websites-Sensex, S&P and SSE

Table 9: Pairwise Granger Causality Tests

Null Hypothesis:	F-Statistic	Prob.	Result	Relationship
L_SP does not Granger Cause L_BSE_SENSEX	0.46535	0.6284	Accept	No Relationship
L_BSE_SENSEX does not Granger Cause L_SP	0.17610	0.8386	Accept	
L_SSECHINA does not Granger Cause L_BSE_SENSEX	1.16711	0.3128	Accept	
L_BSE_SENSEX does not Granger Cause L_SSECHINA	**3.59280**	**0.0288**	**Reject**	**Unidirectional Relationship**
L_SSECHINA does not Granger Cause L_SP	0.06335	0.9386	Accept	No Relationship
L_SP does not Granger Cause L_SSECHINA	2.09291	0.1253	Accept	

Source: official websites-Sensex, S&P and SSE