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DYNAMIC LINKAGES AMONG THE INDIAN AND THE EMERGING ASIAN STOCK MARKETS

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Abstract

The Indian stock market resisted the global financial crisis in the short run but became susceptible in the long run. In this paper an attempt has been made to examine whether and to what extent, Indian stock market is integrated with stock markets in the emerging Asian stock markets (China, Indonesia, Kolalumpur, Korea and Taiwan before and after the financial crisis. The main findings are: No evidence of long run relationships was found between the stock prices of India and the emerging Asian Markets before and after the financial crisis except Taiwan. Second, in terms of short – run movements of international stock market returns, bidirectional Granger causality exist between the stock returns of India and Korea. In the post crisis period there is a unidirectional Granger causality running from India to Taiwan, Kolalumpur, Korea and China. Bidirectional Granger causality exists between India and Indonesia. In the whole sample period there is a unidirectional Granger causality running from India to China, Kolalumpur and Taiwan. Indian markets offer diversification benefits to international investors looking for investment in India.

Introduction

The Indian stock market resisted the global financial crisis in the short run but became susceptible in the long run. The Indian stock exchanges hold a place of prominence not only in Asia but also at the global stage. Asia is becoming the growth centre of the world economy is in circulation for some time. The dynamics of the world economy are changing. The equity markets in emerging economies are on a high since 2005. The Asian economies are advancing technology wise and are acting as an attraction for foreign capital. Knowledge on stock markets integration is very important for both practitioners and policymakers. Exchanges are now expanding national boundaries to extend their service areas and this has led to market integration. To provide overseas investment options for investors, exchanges have begun to offer cross-border trading. This improved the image of the exchange for investors and attracts more volume. This encourages the global investors to look for investment opportunities internationally to diversify their portfolios and to reduce their portfolio's risk.. Foreign capital can be easily generated through market integration but these markets can be vulnerable for the financial crises that are happening in other regions. The global financial crisis had affected the stock market adversely. It is very interesting to examine whether the financial crisis has affected the long term and short term relationship between Indian and other emerging Asian stock markets.

Review of Literature

As stock markets world-wide have become more open there has been increasing interest in international linkages. Voluminous literature is available on stock market integration. Siew-yen at el (2008) explored the co-movements between the stock indices of Singapore and five Asian Pacific economies and evidenced that the interdependence between these markets had intensified after the financial crisis. Before the crisis, only Malaysian stock market was found to be co integrated with Singapore but after the crisis Hong-Kong, Malaysia, Japan and US were found to be co integrated with the Singapore stock market. The stock market of Singapore was Granger – caused by that of Malaysia, but the causal relationship had weakened after the crisis.

Harju and Hussain (2008) explored the dynamic first and second moment linkages among international equity markets using 5-minute index returns from the equity markets of the UK, Germany and the US, for the period from September, 2001 to August, 2003. The two European markets exhibited significant reciprocal return and volatility spillovers. This relationship appeared virtually unchanged by the presence or absence of the US market.

Bhar and Nikolova (2009), examined the level of integration and the dynamic relationship between the BRIC countries, and found that India showed the highest level of regional and global integration among the BRIC countries, followed by Brazil and Russia and lastly by China. There was a negative relationship between the location conditional volatility of India with that of the Asia-Pacific region and of China with the world, which indicated a presence of diversification opportunities for portfolio investors and concluded that portfolio investors can continue to receive sound returns from taking positions in the index of these countries, however for an outstanding investment performance, they should consider investing in specific areas of growth within the economy rather than the country index.

Janak Raj and Sarat Dhall investigated the nature of the financial integration of India's stock market with global and major regional markets. Empirical evidence supported the international integration of India's stock market in terms of stock

prices measured in US dollars but not in local currency, a finding attributable to investment decisions of foreign investors. However, in the short run, markets would continue to be influenced by the portfolio diversification objective of foreign investors. The lack of evidence of integration of stock markets in terms of local currency gives rise to a concern that India's stock market integration may not be complete, a finding attributable to the inadequate role of domestic investors.

Saleem (2009) examined the impact of Russia's 1998 financial crisis on the international linkage of the Russian market and suggested that after the crisis, the Russian market showed a bidirectional connection with the U.S. and Asian markets and a unidirectional relationship with emerging European markets.

Huyghebaert and Wang (2010) examined the degree of stock markets integration among the seven major stock exchanges from developed and emerging countries such as; Hong Kong, Japan, Shanghai, Shenzhen, Singapore, South Korea and Taiwan. Their study also included the USA in the analysis to see the linkages with East Asian stock exchanges. Analysis conducted on pre-crisis, during-crisis and post-crisis (Asian financial crisis) by using daily data from July 1992 to June 2003. The Hong Kong and Singapore stock markets considerably respond to the shocks originating from other East Asian markets, particularly during financial crisis. During the post crisis period, shocks in Hong Kong and Singapore mainly influences other East Asian markets (except mainland China). It is also observed that the associations between East Asian stock markets are time varying. The evidence shows that USA has significant influence on stock returns of East Asian markets (excluding mainland China) during all periods of study.

Komlavi Elubueni Assidenou (2011) investigates the cointegration properties of major capital markets indices during the September, 2008 / August, 2009 episode of the financial and banking crises originated in U.S markets. Based on daily closing prices of international stock markets indices, the analysis shows that three set of indices of economies (OECD group, Pacific group and Asia group) have at least one cointegrating vector. Contrary to former studies that concluded on the independencies of Asian markets, this paper reveals that during the deeper financial crisis period, Asian major markets indices were cointegrated. This finding suggests that local investors in Asian capital markets cannot avoid any influence from outside capital markets even if some local markets are still entirely not opened to international investors.

Claus and Lucey (2012) investigated the stock market integration between ten economies of Asia Pacific region. Results of this study indicated that the observed stock markets exhibit some degree of integration but the degree of segmentation varies among the ten economies. Further, it indicates that membership in a formal economic organization does not appear to influence the degree of integration.

To the best of our knowledge, no in-depth analysis of co-dependent relationship of Indian markets with other emerging Asian markets is available in the literature for the past 2007

Data and Methodology

The empirical work is based on daily closing prices of the stock indices. Only secondary data were used. The data consisted of daily series of the S&P CNX Nifty (India), TW11 (Taiwan) Shanghai Composite (China) Jakarta Composite (Indonesia) KLSE Composite (Malaysia) Seoul Composite (South Korea) The data on daily stock markets indices were downloaded from the Yahoo Finance website (http://finance.yahoo.com). The period is from April 2000 to March 2012. The analysis was done for the pre crisis (April 2000 – June 2007), and the post crisis period (July 2007 – March 2012). The daily stock index returns are computed as the first difference of the natural logarithm of the daily stock index value. The return is calculated by the following formula.

$$rt = (\log pt - \log pt\text{-}1)*100$$

Augmented Dickey–Fuller Test

In order to test whether the two market indices are co integrated, it is necessary to first determine that each index series is stationary. If they are non stationary, the index series are then examined to determine whether they are co integrated.
To perform the ADF test, for each market index series, the following regression is estimated.

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \mu_t$$

Where μ_t is a white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$. $Y_t = \text{Ln}(Y_t)$. ADF still test whether $\delta = 0$

The null and alternative hypotheses are

$H_0 : \delta = 0$

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$H_1 : \delta \neq 0$

The acceptance of the null hypothesis implies non stationarity. The critical value of ADF test at five per cent level of significance is –3.41.

Engle Granger Augmented Dickey–Fuller

In the first step the cointegrating coefficient δ is estimated by ordinary least squares with the following formula:

$$X_t = \beta_1 + \delta Y_t + \mu_t \quad (1)$$

This regression is called co integrating regression. Then the Engle-Granger ADF test is conducted on 'cointegrating residuals', obtained from the co integrating regression by using the following equation.

The Engle Granger Augmented Dickey–Fuller test is applied on the 'co integrating residuals' μ_t received from the equation 1. The formula for EG–ADF test is as follows

$$\Delta\mu_t = -\delta\mu_{t-1} + a_i \sum_{i=1}^{m} \Delta\mu_{t-1} + \mu_t$$

Where $\Delta\ \mu_t$ represents the first difference of the error term.

This two step procedure is called the Engle–Granger DF test for cointegration or EG–DF (Engle–Granger 1987)
The specific hypotheses are:

H_0: $\delta = 0$

H_1: $\delta \neq 0$

Null hypothesis is that there is no cointegration among the market indices. The calculated absolute tau (τ) value is greater than the tabulated critical tau (τ) value, the null hypothesis of no cointegration is rejected. Engle and Granger have provided the critical values of DF statistics.

Null hypothesis is that there is no co integration among the stock indices. The value of a calculated absolute tau (τ) value is greater than the tabulated critical (τ) value; the null hypothesis of no cointegration is rejected. Engle and Granger have provided the critical values of ADF statistics.

Granger Causality Test

The study uses Granger – causality test (1969, 1988) to examine the hypotheses. Formally, a time series x_t Granger – causes another time series y_t if series y_t can be predicted with better accuracy by using past values of x_t rather than by not doing so, other information being identical. In other words, variable x_t fails Granger –cause y_t if

$$\Pr(y_{t+m} | \Omega_t) = \Pr(y_{t+m} | \Psi_t), \quad (1)$$

Where $\Pr(y_{t+m} | \Omega_t)$ denotes conditional probability of y_t, Ω_t is the set of all information available at time t, and $\Pr(y_{t+m} | \Psi_t)$ denotes conditional probability of y_t obtained by excluding all information on x_t from y_t this set of information is depicted as Ψ_t.

The hypotheses are tested in the context of VAR of the following form:

$$x_t = \alpha_0 + \sum_{j=1}^{k} \gamma_j + x_{t-j} + \sum_{j=1}^{k} \beta_j y_{t-j} + \mu_{xy} \quad (2)$$

$$y_t = \alpha_0 + \sum_{j=1}^{k} \gamma_j + x_{t-j} + \sum_{j=1}^{k} \beta_j y_{t-j} + \mu_{xy} \quad (3)$$

Where k is a suitably chosen positive integer, γ_j and β_j, j = 0,1 .....k are parameters and α ' are constants; and μ_t's are disturbance terms with zero means and finite variances. The null hypothesis that y_t does not Granger – cause x_t is not accepted if the β_j's, j>0 in equation (2) are jointly significantly different from zero using a standard joint test (e.g., and F test). Similarly, x_t Granger – causes y_t, if the γ_j's j >0 coefficients in equation (3) are jointly different from zero.

To test the hypotheses, the restricted F-test is applied, which is given by:

$$F = [(RSSR - RSSUR)/m] / [RSSUR/(n-k)] \ldots \ldots \ldots (4)$$

Where, m is number of lagged terms and k is the number of parameters and RSS_R and RSS_{UR} are residual sum of squares of restricted and unrestricted models respectively. Granger causality test captures lead lag relationship within the sample period.

Empirical Results

Table 1 displays the results of ADF test for all the series in their log level. As can be seen in table 1, the ADF test fails to reject the null hypothesis of the existence of a unit root in log levels and hence all the market indices are nonstationary. In contrast, unit root tests reject the same null hypothesis in the log first-differenced form of the series, which indicate that in first-differenced form, all the series are stationary. Therefore, each stock market index is integrated in order one, or I(1).

TABLE – 1,Unit Root Tests on Returns

	Augmented Dickey Fuller			Philip Peron		
Countries	(2000-2007)	2007-2012	2000-2012	(2000-2007)	2007-2012	2000-2012
China	-41.608*	-34.030*	-53.845*	-41.617*	-34.030*	-53.845*
Indonesia	-37.345*	-30.436*	-42.556*	-37.348*	-30.297*	-42.489*
KolaLumpur	-34.379*	-45.657*	-60.685*	-34.294*	-45.814*	-60.514*
Korea	-41.775*	-33.502*	-51.278*	-41.668*	-33.514*	-51.323*
India	-38.128*	-32.330*	-50.445*	-37.981*	32.293*	-50.445*
Taiwan	-40.668*	-35.312*	-53.942*	-40.690*	-32.329*	-53.907*

The critical value for ADF test at 5% level of significance is -3.41.
* Significant at 1% level

The calculated tau (τ) values of δ and Philip Peron values for all the stock market indices are more than the tabulated value. These values are significant at 1 per cent level. The ADF test and Philip Peron results prove that all the stock market indices are stationary at market index returns. All the series are stationary for the entire sample period and the sub – sample periods.

Cointegration analysis is used to investigate long term relationship between NSE and the emergin Asian markets. The analysis recognizes the non – stationarity of the time series. Economically speaking, two variables will be cointegrated if they have long-term, or equilibrium relationship between them (Engle and Granger 1987). Because all the stock price indices are non – stationary, the Engle Granger cointegration test is conducted. The results shown in Table 2 depicts that there is no long term relationship between the stock markets for the pre and post period except Taiwan. But for the full period 2000 – 2012 there was a long term relationship between Taiwan and Korea. The results of EG–ADF test are given in Tables 2, 3, and 4.

Table 2, Engle-Granger ADF Test of Cointegration (2000 – 2007) ((Lag 5)

Name of the Indices	*δ*	*probability*
India on China	-0.124	0.983
China on India	0.369	0.995
India on Indonesia	-3.017	0.106
Indonesia on India	-2.976	0.116
India on Kolalumpur	-2.701	0.199
Kolalumpur on India	-2.606	0.235
India on Korea	-2.364	0.342
Korea on India	-2.418	0.316
India on Taiwan	-2.836	0.155
Taiwan on India	-4.046	0.006**

The critical value for EG -ADF tests at 5% level of significance is –3.17.

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Table 3,Engle-Granger ADF Test of Cointegration (2007 – 2012) ((Lag 5).

Name of the Indices	*δ*	*probability*
India on China	-1.604	0.720
China on India	-1.391	0.802
India on Indonesia	-1.988	0.534
Indonesia on India	-1.381	0.805
India on Kolalumpur	-2.858	0.148
Kolalumpur on India	-2.501	0.279
India on Korea	3.210	0.082
Korea on India	3.174	0.090
India on Taiwan	-3.371	0.046*
Taiwan on India	-3.441	0.038*

The critical value for EG -ADF tests at 5% level of significance is –3.17.

Table 4, Engle-Granger ADF Test of Cointegration (2000 – 2012) ((Lag 5)

Name of the Indices	*δ*	*probability*
India on China	-1.044	0.936
China on India	-1.492	0.832
India on Indonesia	-3.159	0.092
Indonesia on India	-3.060	0.116
India on Kolalumpur	-3.471	0.042*
Kolalumpur on India	-3.332	0.061
India on Korea	-3.687	0.023*
Korea on India	-3.716	0.021*
India on Taiwan	-3.670	0.024*
Taiwan on India	-4.321	0.002**

The critical value for EG -ADF tests at 5% level of significance is –3.17.

Granger causality test is used to examine the pair – wise short – run interactions between different stock markets. According to the results presented in the Table 5 in the pre financial crisis period there is a unidirectional Granger causality running from India to Indonesia, Kolalumpur and Taiwan. Bidirectional Granger causality exists between India and Korea. In the post crisis period there is a unidirectional Granger causality running from India to Taiwan, Kolalumpur, Korea and China. Bidirectional Granger causality exists between India and Indonesia. In the whole sample period there is a unidirectional Granger causality running from India to China, Kolalumpur and Taiwan.

Table 5,Granger Causality Test Results

Pre- Crisis Period (April 2000 - June 2007)		
		F-Statistic
INDIA→CHINA	4.43	0.001
CHINA→INDIA	1.17	0.318
INDIA→INDONESIA	2.91	0.020*
INDONESIA→INDIA	1.58	0.176
INDIA → KOLALUMPUR	6.12	0.000**
KOLALUMPUR→INDIA	0.06	0.991
INDIA → KOREA	4.21	0.002**
KOREA → INDIA	4.85	0.000**
INDIA→TAIWAN	11.32	0.000**
TAIWAN→INDIA	1.34	0.251

The critical value at 5% and 1 % level of significance * **

Table 6,Granger Causality Test Results

Post Crisis Period (July 2007 - April 2012)	F-statistic	
	F-Statistic	Causality Inference
INDIA→CHINA	3.52	0.007**
CHINA→INDIA	1.50	0.198
INDIA→INDONESIA	5.05	0.000**
INDONESIA→INDIA	15.67	0.000**
INDIA → KOLALUMPUR	26.67	0.000**
KOLALUMPUR→INDIA	0.89	0.466
INDIA → KOREA	15.42	0.000**
KOREA → INDIA	2.04	0.085
INDIA→TAIWAN	15.65	0.000**
TAIWAN→INDIA	1.56	0.180

The critical value at 5% and 1 % level of significance * **

Table – 7, Granger Causality Test Results

Full Sample Period April 2000 - December 2012	F-statistic	
	F-Statistic	Causality-Inference
INDIA→CHINA	4.09	0.002**
CHINA→INDIA	0.727	0.573
INDIA→INDONESIA	7.64	0.000**
INDONESIA→INDIA	9.74	0.000**
INDIA → KOLALUMPUR	24.19	0.000**
KOLALUMPUR→INDIA	0.33	0.854
INDIA → KOREA	16.23	0.000**
KOREA → INDIA	5.19	0.000**
INDIA→TAIWAN	25.25	0.000**
TAIWAN→INDIA	0.702	0.589

The critical value at 5% and 1 % level of significance * **

Conclusion

In this paper, cointegration of long term and short term stock returns of India with China, Indonesia, Kolalumpur, Korea and Taiwan are analyzed. There exists a very weak correlation among the Indian markets and Taiwan markets. There was a strong influence from India. Hence it can be said that the Indian markets offer diversification benefits to international investors looking for investment in India. The empirical results presented in this paper support the view that international investors have long – run opportunities for portfolio diversification by acquiring stocks from these countries. Indian stock market was not affected by the global financial crisis because of its strict monitoring of RBI.

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