STOCK MARKET INTEGRATION BETWEEN INDIA AND USA AND THE IMPACT OF CURRENT FINANCIAL CRISIS

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[The paper investigates the progress of financial market integration between the Stock Exchanges of India and USA especially after the 2008 global financial crisis. The study estimates the stock returns of two markets and assesses the effect of financial crisis on such integration. The study has been conducted over a period of 10 years (April, 2003 to March 2013), dividing the period into three sub-phases: Pre-crisis, Crisis and Post-Crisis time. Adopting Johansen co-integration test on the stock markets returns (S & P 500 and BSE Sensex), the study finds no co-integrating relationship between the two markets. The study finds unidirectional Granger causality passes through US market to Indian market. Even the long run equilibrium relationship between S & P 500 and BSE Sensex is absent; their short run dynamics,however, cannot be ignored. Through impulse response analysis under Vector Error Correction framework, the study finds significant short run response of the markets for one unit shock in two markets.

Keywords: *Financial market, Financial co-integration, Cause-effect relationship, Financial crisis, VECM]*

JEL Classification: G15, C22, G15, G01, C52

Introduction

The degree of integration across national equity markets has increased dramatically since the mid-1990s. The Indian stock market is one of the earliest in Asia being in operation since 1875, but remained largely outside the global integration process until the late 1980s. A number of developing countries in concert with the International Finance Corporation and the World Bank took steps in 1980s to establish and revitalize their stock markets as an effective way of mobilizing and allocation of finance. In line with the global trend, reform of the Indian stock market began with the establishment of Securities and Exchange Board of India (SEBI) in 1988. Through a continuous process Indian financial market is gradually co-integrating with the global financial markets.

Financial integration is the process through which a country's financial markets become more closely integrated with those in other countries or with those in the rest of the world. It implies the elimination of barriers for foreign financial institutions of some foreign countries to operate or offer cross-border financial services to other countries.

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In this backdrop this paper empirically investigates the financial integration of the stock markets of ancient one (Indian SENSEX) and the stock market of the leading one (US S & P 500). This paper also investigates the impact of the current financial crisis (2008) on the financial integration of the stock markets of two nations.The current financial crisis actually comprises three separate but related phases. The first phase hit the national housing market in the United States in late 2006 through early 2007, resulting in an increase in delinquencies on residential mortgages. The second phase was a global liquidity crisis in which overnight interbank markets froze. The third phase has proved to be the most serious and difficult to remedy and was initiated by the failure of Lehman Brothers in September 2008. Thus there may have a significant impact on the financial integration of the above two stock markets effecting from the financial crisis. The paper examines the cause and effect relationships as well as the long run interdependency between the two stock markets through Granger Causality Model and also investigates the long run equilibrium relationship and short run dynamics between the two selected stock markets.

Survey of Literature

Click and Plummer (2005) examined the degree of financial co-integration among five South Asian (ASEAN-5) countries; Indonesia, Malaysia, the Philippines, Singapore, and Thailand in the aftermath of the Asian financial crisis. The empirical results of the paper found that the stock markets of ASEAN-5 in the period after the Asian financial crisis (July 1, 1998 through December 31, 2002) were co-integrated, whether analyzed using daily data or weekly data, and whether analyzed in local currencies, the US dollar, or the Japanese yen. However, the study identified only one co-integrating vector among the five stock markets, leaving four common trends among the five variables. Thus the authors opined that ASEAN-5 stocks might have integrated in economic sense and that integration was far from complete. From the perspective of the international portfolio investors, the authors suggested that the efficient flows of capital across borders within the region would have the capacity to mitigate the effects of any asymmetric macroeconomic shocks. The authors finally concluded that Stock market integration had an important component of overall economic integration of the region and might be a useful precondition for monetary unification.

Hunter (2006) investigated the financial integration of the equity markets of Argentina, Chile, and Mexico in the post-liberalization period by using American Depository Receipts (ADR). He also examined the direct and/or indirect barriers that caused segmentation among markets. The test was based on the null hypothesis that if the markets were integrated, then the prices of systematic risks of portfolios of the region's ADRs would be the same as the risk prices of the U.S. market portfolio. The researcher found that liberalization had not successfully led to a high and sustained level of integration of Latin American markets into the international capital market. The results also indicated that there had been no tendency towards the increase in the level of integration over the period and that the level of integration in

all three markets was negatively affected by currency crises. Mexico had become less integrated following the peso crash of December 1994. That raised the issue of whether or not the increased inflow of capital resulting from liberalization was worth the potential devastation of currency crises. Additionally, the outcome of the study suggested that the countries with emerging and transitional economies opening their markets to foreign investors through liberalization might not result full integration and enjoy its potential benefits.

Huyghebaert and Wang (2009) in their paper made an effort to examine the long term and short term causal relationships among the seven major stock exchanges in East Asia. They also considered the magnitude of interactions of such stock exchanges with the U S Stock market, a market leader. The researchers applied multivariate Vector auto-regression (VAR) model to examine the degree of co-integration among those stock markets. The study had been made over a period of 12 years (July, 1992 to June, 2003), giving a special attention to the East Asian financial crisis (1997-98). Johansen's co-integration tests, Granger causality test and generalized impulse analysis had been applied to find the relationships among the markets.

The study found that, in pre-crisis period the stock markets in East Asia, except Shanghai and Shenzhen, responded to world-wide shocks. Regional innovations had little effect on those stock prices. The study found that Asian financial crisis had strengthened the linkages among the stock markets in East Asia, except for those in Mainland China, and thus had strengthened their interdependencies. They found that Hong Kong and Singapore stock markets played crucial roles in spreading the crisis in East Asia and in the world. The study found that in the post-crisis period the financial integration had been improved in comparison to pre-crisis period but it was not as strong as was observed in crisis period.

Bley (2009**)** made a study to examine the dynamics and concurrent interactions of Euro stock markets at the country level and economic sector level. Overall outcome of the study revealed that the financial market integration process was time-varying. The study found that formulation of currency union had integrated the countries more between the years 1998-2003. The researchers opined that monetary policy convergence might have facilitated the divergence of economic variables. It was revealed that return behavior of the markets were changing and stock markets within the Euro zone were starting to drift apart. The results of the study suggested that the diversification had benefited the investors in the Euro zone with the introduction of the single currency. Finally the author suggested for more intensive research before making any definite conclusion.

Valentyn and Eliza (2009) examined the extent to which emerging stock market integration influenced the joint behavior of stock and bond returns over time. The researchers used a non-parametric realized concordance-based measure to examine stock–bond market co-movements for 18 emerging markets in a post-liberalization period from 1995 to 2005. The study estimated a conditional random effects logistic panel regression model for the

market co-movements along with time-varying market integration and other relevant control variables. The study found evidence of a robust inverse relationship suggesting that stock market openings lead to an increase in demand for equities as the segmentation risk premium was reduced and also an either unchanged or reduced demand for bonds. The results suggested that in the process of opening up relatively small and undeveloped stock markets in emerging economies, foreign equity investments worked to increase diversification opportunities across emerging security markets.

Mukherjee and Mishra (2010) studied the stock market integration and volatility spillover between India and twelve other Asian countries. The study had been made on daily price observations from November 1997 to April 2008. The authors decomposed the market returns into three parts: day return, intraday return and overnight return to test the transmission of market information not only when the market had been open, but also in the absence of any trading, i.e. over the night. The GARCH (1, 1) model was applied with different specifications to serve the objectives of the study. The study likely found different degrees of correlations among Indian stock market with that of other Asian countries and the contemporaneous intraday return spillover among India and almost all the sample countries were found to be positively significant and bi-directional, whereas the same in terms of volatility were basically unidirectional, i.e. either from other Asian markets to India or vice versa. In case of lagged spillover of information, though most of the information transmitted between the markets without much delay, some amount of information, both in terms of return and volatility, remained blocked and had been found to be successfully spilled over as soon as the domestic market opened in the next day.

Buttner and Hayo (2011) examined the determinants of stock market integration among the EU member states and also examined their dynamic conditional relationship, using DCC-MGARCH Models. The authors divided the EU member countries into three parts: euro area members, old EU members not participating in EMU and new member states, for their analysis. The authors found that in almost all groups of countries there was a significant trend towards more integration. The authors then explained the relationship by interest rate risk, exchange rate risk, market capitalization and business cycle synchronization applying pooled OLS model. They found that foreign exchange risk and interest rate spread depressed integration among the old EU member states and for the new participants of the euro area. Thus if non-euro area countries adopted euro the integration would be improved. The authors found that when euro area and new EU member states were in recession, their mutual financial market correlation decreased, but it increased when the new member states were jointly in recession. The authors found that the size of absolute and relative market capitalization promoted the equity market integration.

Frijns, Tourani-Rad and Indriawan (2012) in their study investigated the role of political crises in explaining the degree of stock market integration in emerging

markets over the period 1991–2006.Using the International Crisis Behavior database which contained detailed information on political crises around the world, the researchers examined whether political crises affected stock market integration in 19 emerging markets in South and East Asia, Latin America, and Central and Eastern Europe. In investigation of the role of political crises in explaining stock market integration for the full sample of emerging markets and for the different regions individually, the authors observed that those political crises and their specific characteristics had significant negative impacts on their financial integration. Robustness tests made by the researchers using panel regression largely confirmed these results.

Objective of the Study

The objective of the study is of two fold.

- To examine the nature and extent of financial integration between the stock markets of two nations- India and USA, and
- To assess the impact of current financial crisis (2008) on the financial integration between the stock markets of the two countries.

Data Base and Methodology

The study has been conducted on one promising developing country, India and one developed and the most powerful market leader, USA. The study is based over a period of 10 years (April 2003 to March, 2013) by decomposing the period into three phases viz. Pre-crisis period (1st April, 2003 to 30th September, 2008), Crisis period (1st October, 2008 to 30th September, 2009) and Post-crisis period (1st October, 2009 to 31st March, 2013), as it is seen that the global financial crisis mostly affected the financial market in late 2008 and early 2009. The study is based on the secondary capital market data. Relevant data of US Stock Market Indices S & P 500 and Indian Stock Market Indices BSE SENSEX have been downloaded from Capitaline Database Package and from the websites.

In order to examine the cause and effect relationship between the stock market indices of India and USA, Granger-Casuality model has been applied. Granger-Casualty model will help us to know the long run interdependency between the two markets.

Since the study deals with the time series data, over a time horizon of 10 years, the problem of unit-root is highly expected, i.e., the data may be mostly non-stationary. Augmented Dickey Fuller unit root test and Phillips-Perron test have been applied to test whether the time series stock market data, S & P 500 and BSE SENSEX are stationary.

In order to find the presence of any long run equilibrium relationship between the markets Johansen co-integration test is applied.

Finally, the short run dynamic relationship between the markets for different sub- periods and their changes resulting from the financial crisis are tested applying Impulse Response analysis under Vector Error Correction framework.

Empirical Findings

Outcome of Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root test:

Null Hypothesis (H_0)**:** The stock price data has a unit-root

Augmented Dickey-Fuller (ADF) test:				
Market index	**Price**	**p-value**	**Δ Price**	**p-value**
BSE 30	-1.590858	0.4871	-45.02813***	0.0001
S & P 500	-1.870101	0.3468	-53.57043***	0.0001
Phillips-Perron test:				
Market index	**Price**	**p-value**	**Δ Price**	**p-value**
BSE 30	-1.599254	0.4828	-46.14853***	0.0001
S & P 500	-1.779909	0.3909	-57.07959***	0.0001

Note: Price = Market index; Δ Price = First difference of log prices;
*MacKinnon (1996) one-sided p-values; *** indicates significant at 1% level

Both the Augmented Dickey-Fuller and Phillips-Perron unit-root test show the existence of high unit-root problem in both BSE Sensex and S & P 500 time series data. The time series data are non-stationary and are found to be integrated of order I(1). The data becomes stationary at I(0), i.e., at its first order difference. Hence all the analysis in the following parts are made on the basis of returns series of the markets.

Outcomes of the Granger Causality test
Pair-wise Granger Causality Tests:

Pre-Crisis Period	**F -Statistic**	**Prob.**
S & P 500 does not Granger Cause BSE 30	57.2279	0.0000***
BSE 30 does not Granger Cause S & P 500	0.99057	0.3716
Crisis Period:		
S & P 500 does not Granger Cause BSE 30	8.53238	0.0003***
BSE 30 does not Granger Cause S & P 500	0.72523	0.4853
Post-crisis Period:		
S & P 500 does not Granger Cause BSE 30	34.8056	0.0000***
BSE 30 does not Granger Cause S & P 500	0.45933	0.6319

Granger Causality tests shows that, Indian Stock Market index BSE 30 is Granger caused by the US Stock Market S & P 500 for all the pre-crisis, crisis and post-crisis periods separately but not vice versa. Thus, the change in market return in India is concerned by any change in the market return of U S. But the change in return in Sensex does not concern the return of S & P 500 or in other words, in long run the Sensex return is dependent on U S Market return and not the vice versa.

Johansen co-integration test:

For the purpose of estimating the long run equilibrium relationship between BSE Sensex and S & P 500 on stock market time series data Johansen's co-integration tests has been applied.

Outcomes of Johansen co-integration test

Unrestricted Co-integration Rank Test (Trace)
Series: Return of BSE 30 and Return of S & P 500

No of CE(s)	Pre-Crisis Period				Crisis Period				Post-Crisis Period			
	Eigen value	Trace Statistic	0.05 Critical Value	Prob.	Eigen value	Trace Statistic	0.05 Critical Value	Prob.	Eigen value	Trace Statistic	0.05 Critical Value	Prob.
r = 0*	0.208422	563.4416	15.49471	0.0001	0.230090	110.8803	15.49471	0.0001	0.230427	376.2899	15.49471	0.0001
r = 1*	0.172970	252.5853	3.841466	0.0000	0.196293	50.47810	3.841466	0.0000	0.167560	154.9682	3.841466	0.0000

Unrestricted Co-integration Rank Test (Max Eigen Value)
Series: Return of BSE 30 and Return of S & P 500

No of CE(s)	Pre-Crisis Period				Crisis Period				Post-Crisis Period			
	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.	Max-Eigen Statistic	Trace Statistic	0.05 Critical Value	Prob.	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.
r = 0*	0.208422	310.8563	14.26460	0.0001	0.230090	60.40222	14.26460	0.0000	0.230427	221.3217	14.26460	0.0001
r = 1*	0.172970	252.5853	3.841466	0.0000	0.196293	50.47810	3.841466	0.0000	0.167560	154.9682	3.841466	0.0000

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon – Haug - Michelis (1999) p-values

The outcome of Johansen's co-integration test indicates that in the period of our study there is no long run equilibrium relationship between the two selected stock markets both in terms of Trace statistic and Max Eigen value statistic. Even when Johansen's co-integration test has been applied on full series (not shown in the paper), i.e., without decomposing the series into pre- and post- crisis period, we are unable to find any co-integrating relationship between the two series up to lag length 15. Thus, it can be said that the stock markets of India and USA are segmented and there is no co-movement between the two stock markets. The stochastic shocks, as exhibited in two markets, follow different patterns.

Short run relationship: Impulse Response Analysis

We have investigated the short-term causal relationships between the Indian and U S stock markets, with a special attention to the influence of the 2008 financial crisis. For this purpose, we have implemented generalized impulse response analyses in the three sub-periods. Impulse response functions trace the effects of a shock to one endogenous variable on the other variables in the VAR. We have explored the effects of a one unit shock rather than a one standard deviation shock, to account for the changing volatility of stock returns over time.

Impulse Response for one unit innovation in each market

Response of BSE 30			Response of S & P 500		
Pre-crisis period:					
Period:	**BSE 30**	**S & P 500**	**Period:**	**BSE 30**	**S & P 500**
1	0.102618	0.765312	1	0.084046	-0.02638
2	0.185571	0.514912	2	0.138225	0.128924
3	0.334026	0.608925	3	0.158804	0.220831
4	0.288166	0.459251	4	0.077180	0.217233
5	0.280898	0.513334	5	0.111408	0.203673
Crisis period:					
1	0.055875	0.448072	1	0.205055	0.043284
2	-0.035368	0.500917	2	0.104019	0.208297
3	0.323067	0.307178	3	0.263886	0.321749
4	0.245157	0.286910	4	0.134307	0.256800
5	0.168779	0.380922	5	0.122342	0.286866
Post crisis period:					
1	0.098439	0.412009	1	0.213617	0.033005
2	0.278720	0.235406	2	0.233224	0.228071
3	0.342100	0.326462	3	0.333428	0.153950
4	0.307232	0.250526	4	0.196467	0.244160
5	0.308742	0.279767	5	0.250560	0.202465

From the above table of impulse response analysis, it has been observed that one unit shock in US market has high reflection in Indian stock market in pre-crisis period, whereas the shock of its own market has shown comparatively little effect on the US market in the same period. But as regards the US market the shock of Indian market has not revealed high impact in US market. In crisis or even in post crisis period the picture has somewhat changed. Unlike in the pre-crisis period, in the crisis as well as in the post- crisis period the US market has also shown significant reflection towards the shock of Indian market. The response of US market has increased from 0.084046 in pre-crisis period to 0.205055 and 0.213617 respectively in the crisis and the post- crisis period for one day lag. On the contrary, the response of Indian market has significantly decreased in the crisis and the post- crisis period towards one unit shock of the US market. Thus the strength of market leadership of US towards India has decreased due to financial crisis and the US market is still unable to recover its strength.

As a whole, we may say that even there is no long run equilibrium relationship between the Indian and US stock markets, but the short run dynamics cannot be ignored. Though the recent financial crisis has somewhat weakened the strength of the relationship, there are enough reflections in the stock return towards the shocks of two markets.

Summary and Conclusion

In this study we have investigated the long run equilibrium relationship and short run dynamic inter- linkages between the Indian stock market (BSE Sensex) and the developed stock market of US (S & P 500). Our main findings are as follows: First, there exits unidirectional Granger causality, running from the US stock markets to the Indian stock market. Second, the Johansen ML estimation method suggests absence of any co-integrating vector for the two-variable system in the pre-crisis, crisis or post crisis period. Thus, though the Indian economy has opened up and has been passing through the financial and economic liberalization processes since 1991, the Indian stock market is still not co-integrated with the US market. At the policy level, co-integration suggests less long-run diversification benefit from investment across countries. When the markets are integrated , the regional stock exchanges attract investors to invest their money in the regional market to tap the benefits of higher liquidity and lesser transaction costs. But as the Indian market is not co-integrated, it loses such benefits and the market is largely dependent on substantial amount of foreign capital inflows. As a result, withdrawal of foreign capital by foreign institutional investors (FIIs), especially of US, from the Indian market leads to sudden market crash. Thirdly, even in absence of long term equilibrium, short term dynamics have been detected in this study, which confirms Indian financial liberalization since 1991 has successfully opened up Indian stock market towards the outside world and hence its stock market is influenced by other markets. Finally, we can say that the financial crisis (2008) resulted some impact towards the dimensionality of the short term relationship of US and Indian stock markets.

Note that, the co-integration and causality tests employed in the paper will work more efficiently if we can include more time period for finding the relationships. However, the co-integration and causality findings in the paper enable Indian as well as foreign investors in their investment decisions in Indian stock market. Investors could further enhance their investment decision by incorporating our results into the traditional approaches, like technical analysis and fundamental analysis or by incorporating the stochastic dominance approach into a study of changes of the economic situation in a country.

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