ABSTRACT

The integration of global stock markets has been a topic of great interest for researchers particularly since the US stock market crash of October 1987. Initially, most of the studies have been conducted for developed countries like the US, European countries and Japan. Post the East Asian crises 1997, the researchers have started focusing on Asian countries as well. They are taking keen interest in the area of international stock markets being inter-linked and interdependent with each other. As economies have become open and dependent on each other, any negative shock to one economy might lead to economic unrest in the other. The economies have opened themselves for setting up of basic industries, up-gradation of services, investment in various financial instruments, capital inflow etc. India also opened its doors for Foreign Institutional Investors (FIIs) in the year 1991 through the introduction of New Industrial Policy. As global investors are always on a look out for new and better investment avenues to allocate their portfolios for reducing risk and increasing returns, many Asian markets proved to be a good investment destination as they exhibited exceptionally high economic growth rate during the past two decades. The sustainability of the growth rate of Asian markets is due to foreign institutional inflows, structural and institutional reforms and financial liberalization. (Aye et al., 2014; Bhar and Nikolava, 2009a; Manamperi, 2014). India proved to be a good investment destination, post the reforms from 1991 onwards. Further, the investment managers were keen on understanding the reaction of India and other Asian markets when a negative shock hit an international/ foreign stock market. Examination of dynamic risk-return properties, potential volatility spillover effects, inter-relationship between countries during and post crisis period, time to mitigate the negative impact (if any) etc. was an important task to guide the investors. Short and long-run stock market dynamics can have critical implications for diversification of portfolio, hedging and risk allocation. Thus, there was a need to understand the behaviour of markets to mitigate the risks of asset allocation and possible contagion between markets (Aloui et al., 2011; Celik, 2012; Kenourgios et al.; 2011, Syriopoulos, 2006; 2007; 2011; 2013; Syriopoulos et al., 2015).

1 Reforms in the financial sector took place like passing of SEBI Act 1992, T+ 2 rolling settlement, Depository Act 1996, stock exchanges becoming demutualised, setting up of screen based trading system etc.
To understand the impact of any negative shock to the stock market, it is important to examine the co-integration between the crisis originating country and the country on which impact is being measured. If the markets are co-integrated with each other, the next step would be to test for contagion from crisis originating country to other countries. It was suggested by Forbes and Rigobon (2002) that if there is a significant change in the correlation between the stock markets of two countries; from tranquil times to period of turmoil; it would be termed as contagion. If the level of correlation from pre-crisis period to post crisis period remains the same; then it qualifies for interdependence. Thus, testing of contagion would help traders and portfolio managers in diversification of risk.

The last two decades have witnessed an enormous flow of external capital in the form of both direct and portfolio investments, due to increased globalization. The increase in international capital mobility is due to increase in the interaction between world economies, both developing and developed (Chen et al., 2005). Due to liberalization of capital markets and the development of new varieties of financial instruments, the level of international diversification of portfolios has increased. Such linkages may be due to common macroeconomic policies or may be without any common link among the stock markets of the countries under the study. However they do have implications on portfolio diversification and macroeconomic policy formulation of a country (Srivastava, 2007). To address the issue of international diversification of portfolio and impact of one economy on another, the present study was undertaken.

Thus, the objectives of the present study are:

a) To test for co-integration between Indian stock market with other Asian stock markets and the US stock market.

b) To empirically examine contagion from US stock market to Asian stock markets during the housing bubble of 2007-08.

The responses to the above objectives will spell out whether Indian stock market and other Asian markets reacted to the global economic crisis that originated in US in 2007-08 or not. It will further address the issues of investors and traders before investing and trading in international stock markets. Thus, in the light of structural changes in the Indian economy during 1991 and various reforms in the financial
sector of India, the first objective of the present study is to study the co-integration between Indian stock market with other major Asian stock markets. The objective of the present study is to complement the existing literature by examining the integration hypothesis and analyze the linkages between the Indian Stock market with the other stock markets namely Indonesia, China, Hong Kong, Japan, Taiwan, South Korea and Malaysia.

For testing unit root, Lee and Strazicich (2003, 2004) have developed an alternative (at most two) endogenous break unit root test that uses the Lagrange Multiplier (LM) test statistics, and allows for breaks both under the null and the alternative hypothesis. Thus, any conclusion on the rejection of unit root null based on this LM test provides quite strong evidence of stationarity.

The findings of the study suggest that the Indian stock market did not function in relative isolation from other Asian countries. Stock returns of Indian stock markets are correlated with other stock markets under the study. The increasing trend in correlation and integration among markets is limiting the scope of international diversification. Further, the degree of correlation between the return of the Indian stock market with other stock market returns is low, suggesting that the stock markets will not be immediately impacted in case of a regional crisis.

Once the level of interdependence between countries (under study) is determined, the next step is to find the level of contagion between the US stock market and the Asian stock markets under study. Thus, the second objective of the present study is to examine contagion from the US stock market to Asian stock markets (under study), considering US as the crisis-originating country using DCC-GARCH and ADCC-GARCH frameworks. The DCC-GARCH and the ADCC-GARCH models are multivariate GARCH models that have been used in the present study. These models allow the researcher to measure time varying conditional correlations and also enable to address the problem of heteroskedasticity. These models further allow us to perceive active investor behavior in relation to the dynamic/significant changes in news and innovation. This information will help the global investors in understanding the cross market correlations thus, helping them in taking decisions on risk management, asset allocation, policy formulation and designing hedging strategies (Fong, 2003).
While understanding the co-movements of series, stationarity of time series has been a major concern. To examine the volatility and co-movement of non-stationary time series is of practical importance. In this study, our major concern is to examine contagion among different stock markets using DCC GARCH and extending it to the ADCC model. The ADCC model allows for the “leverage effect”, i.e. to study the behaviour of current volatility due to asymmetric impact of the positive and negative returns. Of late, few papers have looked into the asymmetries in a multivariate framework (McAleer, Hoti and Chan, 2009; McAleer, Chan, Hoti and Liebermann, 2009; Francq and Zakoian, 2010b).

Cappiello et al. (2006) brings out an important limitation of the DCC GARCH approach; is that the conditional correlation does not take into account the dynamics of asymmetric effects. This further implies that the DCC model does take into consideration the impact of past shocks on the future conditional volatility and correlation; it is still unable to distinguish between the effect of positive and negative shocks. Cappiello et al. (2006) suggested the ADCC model to capture the potential asymmetries in the conditional correlations between series.

The findings of the study suggest that all the Asian markets have been impacted by the US Sub-prime crisis. Thus, there exists contagion from the US stock markets to all the Asian stock markets; though the level of impact of crisis is different for different countries. The impact of crisis would help the policy makers to frame policies so that they can insulate the economy from such negative impacts thereby, helping the portfolio managers diversify their international portfolio risk. If the markets show contagion, then the investors will not be able to earn profits through diversification of portfolio.

The second objective is further extended to study the contagion from the US stock market to the Asian markets under study using Copula technique. This technique helps in understanding the joint behaviour of a set of random variables. Copulas allow us to decompose the multivariate distribution and to model the marginal behaviour of a series. The finding of the study is that the Indian stock market is co-integrated with the US market and other Asian markets but the level of co-integration is quite low. To further examine the contagion between the US stock market and Asian markets, we have used various methods. The results indicate that nearly all the Asian markets have
got impacted due to the US Sub-prime crisis; though the degree of impact is different for different countries. Further, India’s results indicate that the impact on Indian stock market of US crisis was not sudden. The Indian market did react to the crisis but little late. For many of the markets like Japan, Indonesia, Hong Kong, Taiwan, South Korea, the results show that the stock markets of these countries did react negatively to the US financial shock.

The study would help traders as they need to hedge their portfolios against unforeseen risks. Thus, a portfolio manager and international investors would diversify their portfolios by investing in different countries. Different countries not only means different in terms of geographical boundaries, but also different in terms of reaction to an external shock to the financial markets. Countries which are less affected by the shocks in other parts of the world would be preferred destination for the investors. The above study would also help the policy makers in framing policies.

The policy makers would prefer that the financial markets of the country should react to each negative or positive information shocks pertaining to other parts of the world. They would want to negate the impact of such shocks in the country and hence would frame such policies so that they are able to insulate themselves against such shocks. This would make the country more stable, financially and economically. It would further attract more capital inflows into the country.

For banks and financial institutions, the study is all the more important as they serve as intermediary to many international investors and agencies. Sometimes, they also act as insurance agents to international investors to reduce burden of possible risk. Thus, if the bankers are aware of the contagion effect between various pairs of countries they will be able to take informed decisions.