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Stock Market Interlinkages among Major Developed Equity Markets: Critical Literature Review

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Abstract
This paper examines the short run linkages and long run linkages among the major developed equity markets. Stock market linkage or integration means a situation in which returns of different market affected by each other either in long run or short run. Stock market linkage is important from both perspectives whether there are strong stock market linkages or weak stock market linkages. If there is strong market linkage it protects the domestic economy from external shock. On another point of view if there are weak linkages, it offers potential gains to the investor by international portfolio diversification.

Keywords: Cointegration, Correlation, Stock market Integration, stock market.

JEL classification: G15, G11, F36

1. Introduction
Stock market integration can be defined as a condition in which stock markets in different countries trend together and depict similar expected risk adjusted returns. Two markets are perfectly integrated, if investors can pass from one market to another without paying any extra costs and if there are possibilities of arbitration which ensures the equivalence of stock prices in both markets.

Stock markets across the world have become more integrated specifically during the post globalization period. If stock markets are integrated, movements of stock prices are expected to be correlated with one another. There are many reasons why the prices of different stock markets might be correlated. For example, two markets belonging to two different economies might be related through trade and investment. Further, one country's shares are listed on and traded in other international stock exchanges. Therefore, any information regarding the economic fundamentals of one country is transmitted to the other and thus affects the other's stock markets.

International linkage of markets has major implications for international diversification & for domestic economies. Weak market linkage offers potential gains from international diversifications whereas strong linkage reduces the insulation of domestic market from any global shock. Analyzing short and long run interdependence in returns and volatility across different markets increases our ability to apply diversification and hedging strategies. As markets become more integrated, the cost of capital decreases because the removal of investment barriers allows for risk sharing between domestic and foreign agents. All assets with identical risk exposure also command identical expected returns in perfectly integrated markets (Campbell and Hamao, 1992). Barriers to investment like exchange rate risk, legal and tax differences, information availability, foreign ownership restrictions, can prevent markets from integrating. (Stulz, 1981; Errunza and Losq, 1985). The complete elimination of barriers to financial integration allows firms to choose the most efficient sources and greater financial integration allows and a reallocation of funds to the most productive investment opportunities takes place.

Today, the stock markets around the world experience related price and volume movements due to globalisation, financial sector reforms, higher bilateral trade, transparency and technological advancements in stock trading. Growing inter-linkages have manifested mainly through foreign portfolio investments and foreign listing of MNCs. Also Increasingly

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regional economic activity and financial market liberalization since 1980s resulted in integration of regional economies all over the world. Globalization also allowed an enterprise in one country to sell its stock in another country as new source for raising its capital needs for its expansion. This spreading out was further helped by fast paced developments in communication and information technology. This has made it possible for local stock markets to achieve an international scale. Integration of financial markets, especially in capital markets, resulted in a correlation between return and volatility of every capital market. Due to the increasing interdependence of major financial markets all over the world, the stock market co-movements among the major markets has become an issue of keen interest for academicians and researchers.

Objectives
- To examine the interlinkages among stock markets of India and major developed countries
- To find short run equilibrium among stock market of India and major developed countries.
- To find short run equilibrium among stock market of India and major developed countries.
- To synthesizes the literatures on stock market integration among major developed markets.

Literature Review
Grubel (1968) [8] depicted the benefits of international diversification. His study was based on empirical data sketching ex post rates of returns from investment in 11 major stock markets. The interdependency between financial markets has been at the focus of interest since then. The majority of studies in that early period reach the conclusion that the degree of interdependency between markets is quite low, since the prime factors in the development of financial markets are of domestic nature.

Sharma & Kennedy (1977) [15] examined the price behaviour of Indian market with US and London markets. The objective of their study was to test the random-walk hypothesis by runs analysis and spectral densities, for the Bombay Variable Dividend Industrial Share Index (BVDISI),the New York Standard and Poor's 425 Common Stock Index (S &P 425), and the London Financial Times-Actuaries 500 Stock Index (London F.T.-A). The test period covered 132 monthly observations for the 11-year period 1963-1973. They found that the behaviour of the BVDISI is statistically indistinguishable from that of London F.T.-A. and S&P 425. In the runs analysis of and expected distribution of runs length turns out to be very similar, with probability equal to 0.5 for rise or fall. Further, the spectral densities, estimated for the first difference series (raw and log transformed) of each index, confirmed the randomness of the series, with no evidence of systematic cyclical component or periodicity was present. Based on these tests, they concluded that stocks on the Bombay Stock Exchange obey a random walk and are equivalent in this sense to the behaviour of stock prices in the markets of advanced industrialized countries, like UK and US.

Taylor and Tonks (1989) [17] studied the market integration concerning markets of U.S. Germany, Netherlands and Japan using monthly data on stock price indices for the sub periods, April1973 – September 1979 and October 1979 – June 1986

and employed is a bivariate cointegration technique (Engle and Granger, 1987). They found stock price index of the U.K. was cointegrated with the stock price index of the U.S. Germany, Netherlands and that of Japan for the later period but not for the former period. Based on these results they suggested that there is no long-term gain from diversification for the U.K investors after the abolition of exchange control.

Rao and Naik (1990) [12] examined the interrelationships between the US, Japanese and Indian stock markets with monthly data for the period 1971-88. They concluded that the relationship between Indian markets and international markets was poor, reflecting the institutional fact that the Indian economy was characterized by heavy control throughout the entire 1970s, with liberalization initiated only in the late 1990s.

Lin *et al.* (1994) examined the short-run interdependence of prices and price volatility across three major international stock markets namely, the Tokyo, London and New York with daytime and overnight returns data. Their analysis utilizes a Two-stage GARCH model, where in the first stage they extract the unexpected shocks from the daytime returns of one market and use it as a proxy for volatility surprise while modeling the other market's overnight returns in the second stage GARCH model. They found that cross-market interdependence in returns and volatilities is generally bi-directional between the New York and Tokyo markets particularly after 1987 crash.

Kwan *et al.* (1995) studied the stock markets of Australia, Japan, Hong Kong, Singapore, South Korea, Taiwan, the UK, the US and Germany employing monthly data from January 1982 to February 1991. Their evidence suggested that these markets were not weak-form efficient, as they found significant lead-lag relationships among equity markets.

Mohammad (1996) examined the direction of the causal relationship among the Asian stock markets, viz. Hong Kong, Singapore and Japan, using state space modeling. He concluded that Japan's stock market played an important role among the Asian stock markets during and after the crash of October 1987 and the interactions among the Asian stock markets increased substantially after the crash.

Chan *et al.* (1997) [4] analyzed the international stock market efficiency and integration of 18countries, viz. Australia, Belgium, Canada, Denmark, Finland, France, Germany, India, Italy,
Japan, Netherlands, Norway, Pakistan, Spain, Sweden, Switzerland, UK and US, covering a 32-year period from January 1961 to December 1992, with 384 monthly observations of each of the stock indices. Data was divided into four sub-samples—the 1960s, the 1970s, the pre- and the post-October 1987 crash. The empirical results evidenced that there was no significant cointegration for the full sample, 1960s, 1970s, and after 1988. However, in the 1980s, i.e. before the stock market crash in 1987, there was significant cointegration, and therefore, their study concluded that international diversification among the stock markets might be effective, because the stock markets did not have long-run co-movements.

Liu and Pan (1997) [10] studied the mean and volatility spillovers from U.S. and Japanese stock markets to four other Asian stock markets and found that the U.S. market is more influential than the Japanese market in transmitting returns and volatilities to the other four Asian markets.

Janakiramanan and Lamba (1998) [9] examined the linkages between the stock markets in the Pacific-Basin region during 1988–96 using a vector autoregression model. The study finds that during 1988–96 the US market influences all other Australasian markets, except Indonesia, and none of these markets exert a significant influence on the US market. An analysis excluding the US market revealed persistent linkages between the markets that can be traced to the indirect influences of the US market. The study indicates that the markets that are geographically and economically close and/or with large numbers of cross border listings exert significant influence over each other, with markets closing earlier in the day exerting greater influence over markets closing later in the day.

Roca (1999) [13] investigated the price linkages between the equity market of Australia and that of the US, UK, Japan, Hong Kong, Singapore, Taiwan, and Korea using weekly MSCI stock market data covering the period 1974-1995.The study conducted Cointegration test using the Johansen(Journal of Economic Dynamics and Control, 12, 1988) and Johansen and Juselius (Oxford Bulletin of Economics and Statistics, 52, 1990) procedure and Granger-causality tests based on error-correction models and standard vector autoregression models. He found no correlation between Australia and the other markets. However, the Granger causality and forecast variance decomposition analyses reveal that Australia is significantly linked with the US and the UK. The impulse response analyses further show that Australia responds to shocks from the US and the UK immediately during the first week and this response is completed with a period of four week.

Agarwal (2000) [1] concluded that there is a lot of scope for the Indian stock market to integrate with the world market after having found a correlation coefficient of 0.01 between India and developed markets Using Granger causality relationship and the pair-wise, multiple and fractional cointegration.

Cheung and Westermann (2001) [6] concluded that the spillover did not change between U.S and European market before and after the introduction of the EURO. While analyzing volatility spillover between U.S. UK and Japanese market using high frequency data.

Veiga and McAleer (2003) [19] found that volatility spillover took place from UK to the U.S. and Japan and from the U.S. to UK. Savva, Osborn, and Gill (2004) examined the spillover among U.S. German, UK and French markets using dynamic correlation framework and found that European markets (only UK and German) are affected by the U.S. market.

Bose and Mukherjee (2005) [3] investigated the co-movement of the Indian stock market with developed markets like the US, Japan and other Asian markets like Hong Kong, Malaysia, South Korea, Taiwan and Thailand during the period 1999 to 2004. They applied correlation analysis, interdependence of stock markets under sample drawn. Their findings revealed that structural reforms of the Indian stock markets have helped in integrating it with the rest of the world markets. They also found evidence that India played a unique role in the integration of Asian markets within the sample period when FII activity in the domestic market had been growing.

Bose (2005) [3] investigated the interlinkages between the Indian stock market and the stock markets in Asia and the US. The study found that post-Asian crisis and up to mid-2004, 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 major Asian markets and was led by returns in the US, Japan, as well as other Asian markets.

Wongswan (2006) [20] studied the information transmission from the U.S. and Japan to the Korean and Thai equity markets and concluded that there is a large and significant association between developed market and emerging market volatility at short time horizons. In European countries' context, many authors examined the effect of the introduction of the EURO (1st Jan 1999) on European markets linkage and linkage between European and U.S. markets. Most of the studies found that linkages between European markets increased after the introduction of the EURO (Melle, 2003). However, the evidence for linkage between European and U.S. markets is not conclusive.

Tirkkonen (2008) [18] argued that the Russian stock markets are relatively isolated from the global markets such as the US, China, Japan, UK, Germany, as well as nearby Poland and the Czech Republic.

Sarkar et al. (2009) [14] have identified strong correlation between the global stock market and the Indian stock market, with the impact of the US stock market on India being the most prominent.

Siddiqui (2009) [16] empirically examined the associations between S&P CNX Nifty and selected Asian markets like China, Hong Kong, Indonesia, Malaysia and so on, and the US stock markets. Their data period consisted of daily closing indices from June 1999 to June 2009. They applied various tests like Jarque-Bera, Pearson correlation technique, ADF and PP tests, Johansen cointegration technique and Granger test of causality over the daily return series found out by taking their natural logarithm. They found that no very clear direction of relationship in the short-run as depicted by Granger causality test indicating the eroding influence of US stock market. For the long-run integration, co-integration tests have revealed that world stock markets move together by and large.

Queensly (2009) [11] investigated the interlinkages and volatility spillovers under market reforms, and examined to what extend Indian stock markets are integrated with stock markets of the US,UK and Japan and also found the relationship between the stock prices of India. According to findings long run relationships was found between the stock prices of India and its major trading partners before and after the structural changes.

Chittedi (2010) [5] examined the stock market integration between India and developed countries such as the US, the UK, Japan, France and Australia during 1997 to 2007 by applying the Unit-root tests, Granger causality test, cointegration and Error Correction Mechanism. They found that the US, Japan and France market factors did influence Indian stock market in the short-run, except markets like the UK and Australia. They concluded that India and developed countries' markets like the US, the UK, Japan, France and Australia are highly cointegrated in the long-run during the study period.

Sinha et al. (2010) reported increasing integration of the Indian stock markets with the world market during the post-recession period. They ascribe the recent growth and integration of the Indian stock market with the world market to the revival of foreign institutional investors' (FIIs) interest in emerging market economies including India.

Cheung et al. (2010) [7] provided some evidence relating to the impact of the financial crisis on the relationships between the US and other countries; their analysis was confined to the informational role of TED spread. However, in addition to the spillover effects, since price fluctuations are easily identifiable in the emerging markets, it is also important to understand and compare the risks and efficiency of information transmission within the BRICV markets.

Aloui et al. (2011) applied the copulas to examine the extreme financial interdependences of the BRIC emerging markets with the U.S. markets and provide strong evidence of time-varying dependence between them. This dependency is stronger for the commodity-price dependent markets than for the finished product export-oriented markets of the BRIC countries. Moreover, those authors observe high levels of dependence persistence for all market pairs during both bullish and bearish markets.

Xu and Hamori (2012) [21] suggested that on account of the 2008–09 US financial crisis, international transmission of stock prices weakened in both the mean and variance.

Zhang et al. (2013) [22] provided strong evidence that the recent global financial crisis changes the conditional correlations between the developed (U.S. and Europe) markets and the BRICS stock markets. They also find that 70% of the BRICS stock markets' conditional correlation series demonstrate an upward long-run trend with the developed stock markets since the global crisis.

Birau (2014) [2] provided additional empirical evidence regarding dynamic causal linkages between international developed stock markets such as Spain and Canada. The results of Granger causality tests among developed stock markets of Spain and Canada highlights significant investment opportunities based on international portfolio diversification and risk management. Granger causality runs simultaneously in both directions for Spain and Canada (feedback relationship). Empirical analysis included the calculation for both lags=1 and lags=2, so the results are quite different considering the behaviour of causal relationships. The impulse response under the sample period of time is very relevant in the context of globalization.

Summary and Conclusion
We studied the literature on major developed equity markets and found that most of the developed countries like US, UK, Japan, France, and Germany etc. have significant correlation coefficient with each other. So, we can say that there is linkages in short run among these major developed equity markets. However when we talk about long term integration, there is contradictions among the results of the various studies. There is no robust result which supports to the long term integration.

Now if we talk about the implication of the stock market interlinkages, it has very significant importance for the investors while making their portfolio. Suppose if there are weak market linkages, it provides opportunities of portfolio diversification which offers them potential gain both in terms of return and minimum risk. On the other hand if there are strong market linkages, it reduces insulation of domestic market from any global shock. Further research can be done by analyzing the interlinkages among developed and emerging markets using more robust tests.

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