Financial Integration of Indian Stock Markets with US and UK Stock Markets

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ABSTRACT

Over the past 15 years, financial markets have become increasingly global. The relationship among the equity markets of the developed and the emerging countries has been examined extensively in the literature. This paper studies the interdependence among the major stock markets of the world. Using the monthly data from January 1993 to September 2003, we examine the stock market indices of India (Sensex), Hong Kong (Hang Seng), the USA (DJIA) and the UK (FTSE-100). Co-integration technique has been employed to study the long-term linkages among the markets. We found that the equity markets of India and Hong Kong are co-integrated with the other markets whereas the markets of the USA and UK are not.

Key Words: Equity markets, Emerging Economies and Co-integration.

INTRODUCTION

Stock markets across the globe are becoming increasingly integrated. Financial literature presents a strong emphasis on this interaction amongst international financial markets. The interest has increased significantly following the abolition of foreign exchange controls in both developed and emerging markets during last twenty years. The cross border movement of funds has increased with the world moving towards a free trade zone, thanks to globalization! Given the advancements in technology, communication, trading systems and introduction of innovative financial products, investors today enjoy ample opportunities to maximise their returns by diversification. Indeed international competition for funds has increased the growth in international flows of equity. The correlations among such interrelated equity markets are important in determining the benefits from diversification. Hence, the paper investigates the same in the context of extent of integration among equity markets.

There is a need to verify if the markets move together over time so that benefits from cross border diversification get exhausted. Since the lesser the correlation between equity returns, the greater is the benefit from diversification. However, if stock markets move together, then investing in various markets would not generate any long-term gains from portfolio diversification. Therefore, it is important for both investors and academicians to know whether stock markets are integrated or inter-linked. The issue is also important for policy makers for the reason that if stock markets are found to be closely linked then there is a danger that shocks in one market will spill over to the other markets.

In the backdrop of recent 2007-08 US financial crisis, the notion that US stock markets were "too big to fail" no longer held true, with the result that markets were deemed to be risky. There has not been a happy ending to this story. At best there was a long period of weak growth and high unemployment as individuals, banks and countries paid down the excessive levels of debt accumulated in the bubble years. At worst, the global economy as expected plunged back into recession next year as the US went backwards and the euro came apart at the seams. In the midst of all these episodes, the emerging markets like India, seemed somewhat insulated from such disruptions. On the contrary, they were generally experiencing current account and primary fiscal surpluses. This may be attributed to the fact that emerging economies took reforms prior to crisis that were designed to insulate them from adverse shocks from rest of the world or this may be because there is no international co-operation between developed world markets and emerging economies. This paper studies the nature of this relationship using equity markets. The analysis here is based on three countries, namely, the United States, the United Kingdom, and India.
States of America (USA), the United Kingdom (UK) and India. Majority of the studies undertaken in this field has focused on integration either in the emerging or developed world. The sample of countries was selected so as to represent both the blocs, with US and UK representing the developed markets and India the emerging markets. This paper uses time series data of daily stock indices of the three countries for the period January 2007 to December 2009

This paper is organised as follows: First, a literature review is presented. The definitions of the basic concepts like financial integration are then spelled out. Next, is a discussion on the data sources and the methodology. This is followed by the hypothesis empirical analysis of the study and the conclusion.

LITERATURE REVIEW

The intent of analysing the integration among the world’s equity markets has not been new for financial investors and academicians. In literature, financial market integration derives its importance from various postulates such as the law of one price (Cournot (1927), Marshall (1930)), portfolio diversification with risky assets (Markowitz (1952)), capital asset price models (Sharpe (1964), Lintner (1965)) and arbitrage price theory (Ross (1976)). Despite distinguishing features, these postulates share a common perspective i.e. “If risks command the same price, then the correlation of financial asset prices and the linkage among markets comes from the movement in the price of risks due to investors’ risk aversion”. Based on these theoretical postulates, financial integration at the empirical level is studied using several measures. The results of majority of these studies usually hold implications for asset diversification and the efficient market hypothesis. The theme of asset diversification was initially advocated by Markowitz (1952). The theme encourages investors to allocate their assets across borders, as long as returns in their domestic markets are less than perfectly correlated with their chosen foreign market. Ultimately, the goal of cross-border diversification is to reduce risk while keeping returns constant in one’s portfolio. If evidence of co-integration were found, it would imply that there is a common force that brings these markets together in the long run and that these markets would act as one integrated market. Hence, the possibilities of gains from asset diversification would be greatly reduced in the long-term. However, the literature review shows that there is conflicting evidence on the issue of international stock market linkages. Following the seminal works of Engle and Granger (1987), Johansen (1988) and Johansen and Juselius (1990), numerous studies beginning with Taylor and Tonks (1989), Kasa (1992) and, subsequently, Masih and Masih (2005), Chowdhry (1997) and Chowdhry et al (2007), among several others in the applied finance literature, have used the cointegration hypothesis to assess the international integration of financial markets.

Literature post 1991 Indian economic reforms suggests that the nature of integration with emerging Asian markets does not yet warrant any immediate concern for India regarding possible contagion and also shows that there is still much scope for reaping benefits of portfolio diversification by investing in Indian markets. P.Dooley Michael and M. Hutchison Michael (2009) investigate the transmission of the US Subprime crisis on emerging markets using the evidence on the decoupling-recoupling hypothesis and found that emerging markets appeared to be somewhat insulated from developments in US financial markets from early 2007 to summer 2008. Khan Masood Ahmad, Shahid Ashraf and Shahid Ahmed (2005) examine no long term relationship of Indian Equity market with that of US and the Japanese equity market. They conclude that Nikkie and Nasdaq have stronger causal relation in 1999-2001 which becomes weak or disappears in 2002-2004. Such segmentation of stock market is not an unrealistic assumption since it is caused by barriers that are difficult to overcome by the investors. The recent literature by Yoshida, Yushi (2010) investigates whether the effects of sub-prime financial crisis on 13 Asian economies are similar to those of the previous crisis, by examining stock markets for volatility spillovers and causality directions between the US and Asia as well as for the degree of regional integration. The results indicate stark differences between these two crises. Given the wide popularity of the cointegration hypothesis, it seems imperative to adopt the same technique to highlight interactions between various stock markets. What is striking about the empirical
literature is that studies on the subject have brought to the fore various useful perspectives relating to price equalisation, market equilibrium, market efficiency and portfolio diversification. Moreover, this method allows separation of any long run equilibrium relationships between the markets from the short run casual effects.

The conclusions of the above studies however are limited in scope because the authors examine different countries for varying time periods.

DEFINITION

Financial integration and segmentation

The concept of market integration is central to research in international finance, international economics, development economics and policy making across the globe. Before defining international financial integration, it is important to look at financial integration. Financial integration expresses the links between financial markets. It can be classified as total, direct and indirect integration. Direct financial integration, also referred to as capital market integration, is expressed in deviations from ‘the law of one price’ for financial securities. In other words, when there is direct integration the investor can expect the same risk-adjusted return on investments on different markets. Indirect financial integration refers to a situation in which the return on an investment in one country is indirectly linked to the return on investments in other countries. Total financial integration encompasses direct and indirect integration. Therefore, perfect total financial integration implies that expected real interest rates are the same on the markets in question. When this does not happen, then the markets are said to be segmented. Segmentation is a result of lack of integration and this can happen due to high transaction costs involved in arbitrage or market inefficiency due to incomplete information and trade barriers.

The concept of financial integration can be interpreted in many ways. One of these focuses on geographical integration. This form of financial integration includes the international integration of national financial markets which is the subject of this paper and the international integration of financial institutions/companies i.e. cross border co-operation and ownership relations between banks and between insurance companies. Thus, if equity markets are integrated, the price of risk is same everywhere. When markets are integrated, assets of identical risk command the same expected return regardless of the domicile. If stock markets move together then investing in various markets would not generate any long-term gain to portfolio diversification. In the short run, however, markets are not perfect and asset diversification is possible due to the existence of arbitrage opportunities. Financial integration in the short run is indicated by inter-linkages among the markets considered. Thus, separate tests for long run integration and short run causality are required to conclude anything on nature and aspect of integration.

The paper considers the stock market indices of the equity markets of respective countries to study the integration between the same. Any factor affecting the economy especially the industrial sector (US retail bubble in the current case), be it domestic or global has an effect on the prices of the stocks. This in turn is reflected in the changes in the stock index whether it is price-weighted or market-capitalisation weighted. Thus, a stock market index represents the equity market adequately. Co-movements in the index can be used to estimate integration.

DATA SOURCES

The paper uses the stock market indices to study integration of equity markets of India, UK and US. Stock indices undertaken are those that are reflective of all the sectors of the economy i.e. broad-based indices and those that represent the most actively traded stocks (blue chip companies). Accordingly, choice set consists of Bombay Stock Exchange (BSE) Sensex for India, Dow Jones Industrial Average (DJIA) for the US and FTSE-100 for UK. Use of time series daily closing equity price data for the two years (from January 2007 to December 2009) have been taken into consideration. The time period involved is expected to reflect the series of episodes before and during
the US subprime crash. The following is a note on the type of index undertaken for the three countries under consideration:

**Note on the type of index**

<table>
<thead>
<tr>
<th>Index</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BSE Sensex:</strong></td>
<td>BSE Sensex is a &quot;market capitalisation-weighted&quot; index of 30 stocks representing a sample of large, well-established and financially sound companies. The Sensex is calculated using a market capitalisation-weighted methodology. As per this methodology, the level of index at any point of time reflects the total market value of 30 component stocks relative to a base period. (The market capitalisation of a company is determined by multiplying the price of its stock by the number of shares issued by the company).</td>
</tr>
<tr>
<td><strong>DJIA:</strong></td>
<td>DJIA is a price-weighted index based on 30 stocks. The companies incorporated in the calculation of the index right now are major factors in their respective industries or sectors, and their stocks are widely held by individuals and institutional investors. A stock is typically added only if it has an excellent reputation, demonstrates sustained growth, is of interest to a large number of investors and accurately represents the sector(s) covered by the average.</td>
</tr>
<tr>
<td><strong>FTSE-100:</strong></td>
<td>This the most widely quoted and popular index for tracking the London stock exchange. The index comprises of the shares of the top 100 U.K. companies ranked by market capitalisation. FTSE-100 is a market capitalisation-weighted index, re-weighted every day.</td>
</tr>
</tbody>
</table>

The US and UK markets do not share a common time zone for trading with Indian stock markets. This fact has been considered before starting the analysis of data. Moreover holidays and days with no trading have been omitted from the paired series. For example: if there is a holiday in UK, then the data for that day has been removed for the rest of the two countries (India and US) and similarly for India and US. This makes number of observations equal for two paired series. Also, the currency differences across countries are taken care of by the methodology undertaken to make respective series stationary. The daily closing prices for Sensex are taken from bseindia.com. The data for DJIA is taken from djia.com and for FTSE-100 from ftse.com.

**METHODOLOGY**

The purpose of the study is to provide an analysis of the transmission mechanism of stock market movements in India, US and UK. If stock markets share a long run relationship, then they have a tendency to move together towards the same direction in the long run. Therefore such markets are integrated and have limited scope for gains from diversification. Under such a situation, investors do not benefit from international diversification. On the other hand if stock markets do not move together in long run, then their markets are segmented providing ample gains from diversification. The dynamic linkages between two stock exchanges using co-integration do not indicate their short run movements. The granger causality technique is deployed to analyse the same. In the analysis of testing the presence or absence of such integration two methods are adopted:

- **Co-integration**
- **Granger Causality**

The Co-integration technique is applied when the series is non stationary and Granger- causality test is applied when the series are stationary. Thus testing a series for stationarity is a pre-test for integration.

**Co-integration**

The first step in the co integration technique is to check whether the series considered are stationary or not at level and if it is non-stationary then to find out the order in which they are integrated. For this we need to perform a unit root test using Augmented Dickey Fuller test (ADF) and the Phillips-Perron (PP) test. (Dickey and Fuller 1979, 1981; Enders 1995; Phillips & Perron 1988).
A series is said to be stationary if the mean and auto-covariance of the series do not depend on time. While performing co-integration test we proceed by considering the three equations:

\[ \Delta Y_t = \gamma Y_{t-1} + \epsilon_t \]
\[ \Delta Y_t = a_o + \gamma Y_{t-1} + \epsilon_t \]
\[ \Delta Y_t = a_o + a_1 + \gamma Y_{t-1} + \epsilon_t \]

The first equation is a pure random walk model without intercept and drift. The second equation consists of an intercept term indicating the presence of drift. The third equation consists of drift and a linear time trend. Here \( \Delta Y_t \) represents the log differences for the dependent variable. The null hypothesis \( H_0 : \gamma = 0 \) i.e. presence of unit roots is tested for each of these equations. The test statistics against the critical values are checked and the null hypothesis is accepted or rejected if test-statistics is greater or less than the critical value respectively. Once we get the order of integration using the ADF and PP test, we proceed with the method of co-integration to test the presence of co movement between the different stock market indices.

Co-integration method is used to model the dynamic co-independence that is often found in financial market. Co-integration has emerged as a powerful technique for investigating common trends in multivariate time series and provides a sound methodology for modelling long run dynamics in the system (Alexander 2003). The fundamental aim of co-integration analysis is to detect any common stochastic trends in the price data, and to use these common trends for a dynamic analysis of the correlation in return. The present analysis uses the Engle-Granger Testing Procedure for testing the presence of co-integration among the stock prices. The presence of co-integration further forms the basis of Vector Error Correction Model (VECM) specification.

Suppose \( Y_t \) and \( Z_t \) are two \( I(1) \) variables, Engle-Granger propose a straight forward test whether the two \( I(1) \) variables are co-integrated. The test is carried out in two steps:

**Step 1: Pre-testing the variables for their order of integration.**
Co-integration necessitates that the variables be integrated of the same order. Thus the first step in the analysis is to pre-test each variable to determine its order of integration. For this we perform the Augmented Dickey Fuller (ADF) Tests and Phillips-Perron (PP) Tests using the following equation:

\[ \Delta Y_t = a_o + \gamma Y_{t-1} + a_2 + \Sigma \gamma_i \Delta Y_{t-1} + \epsilon_t \]

Where \( i \) stands for the number of lags required to make the error term white noise. The \( H_0: \gamma = 0 \) is tested for unit root or non-stationarity. Or \( H_0: I(1) \) and \( H_2: I(0) \) or stationary series. Once a series is tested non stationary, we move to second difference for the series and \( H_0: I(2) \) is tested for unit root.

**Step 2: Estimating long-run equilibrium relationship.**
If both the variables are integrated of same order, the next step is to estimate the long-run relationship of the form:

\[ Y_t = \beta_0 + \beta_1 Z_t + e_t \]

To determine if the variables are co-integrated, the residual sequence from this equation is denoted as \( \{e_t\} \). Thus \( \{e_t\} \) is a series of the estimated long-run relationship. If these deviations from long run equilibrium are found to be stationary, then \( Y_t \) and \( Z_t \) sequences are co-integrated of order \((1,1)\).

The Engel-Granger technique for co-integration is applied, where stationarity of residuals imply the presence of long run relationship between \( Y_t \) and \( Z_t \) series. To test the stationarity of residuals, we can apply 2 methods after attaining the estimated residuals from above equations -

(i) Apply ADF and PP tests
(ii) Alternatively, observing D-W Statistics from co-integrating regression

\[ DW = \frac{\Sigma (e_t - \bar{e})^2}{\Sigma (e_t)^2} \]
If \( \{ e_t \} \) is random walk, the expected value of \( (e_t - e_{t-1}) \) is zero and so DW statistics is close to zero.

Autoregression equation of residuals can be written as:

\[
\Delta e_t = a_1 e_{t-1} + \varepsilon_t
\]

Our parameter of interest is \( a_1 \). If we cannot reject the null hypothesis \( a_1 = 0 \), we conclude that the residual series has unit roots or no cointegration. In other words, if it is not possible to reject the null hypothesis \( a_1 = 0 \), we cannot reject the hypothesis that the variables are not co-integrated.

**Granger-Causality Test**

This study uses the procedure of causality detection or short run association between two time series data as developed by Granger (1969, 1988) using the regression approach. A time series \( Y_t \) granger causes another time series \( Z_t \), if \( Z_t \) can be predicted with better accuracy by using past values of \( Y_t \) rather than by not doing so. This test is conducted only for stationary time series. If the results above do not conclude cointegration in the relationships of \( Y_t \) and \( Z_t \), one may examine them by the simple Granger causality test. But one must be aware that the Granger causality test must be ran on I(0) series, in present case, its . This is done by a simple F-test where one compares restricted (R) and unrestricted model (UR).

The traditional Granger causality test uses following two equations:

**Restricted**

\[
\Delta Y_t = \alpha + \sum_{i=1}^{m} \beta_i Y_{t-i} + \varepsilon_t
\]

**Unrestricted**

\[
\Delta Y_t = \alpha + \sum_{i=1}^{m} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{m} \gamma_i \Delta Z_{t-i} + \varepsilon_t
\]

Now, F-test

Instead of using the traditional granger causal equations, a bivariate vector autoregression (VAR) model of the following kind is used.

**Graphical Analysis**

We use the graphical representation of the stock indices to reinforce our conclusion derived from the above two methods. Here we consider graphs of stock price indices of the countries examining the effect of change in index of one country on other countries-presence of any contagion effect.

**HYPOTHESES**

(a) \( H_0 \): There is no co-integration between the US and Indian stock markets or between UK and Indian stock markets.

(b) \( H_0 \): Dow Jones (DJIA) does not granger cause Sensex and FTSE-100 does not granger cause Sensex.

**EMPERICAL RESULTS**

**Results from the correlation analysis**

Correlation matrix is obtained for the price indices of the countries considered:

<table>
<thead>
<tr>
<th></th>
<th>BSE</th>
<th>DJIA</th>
<th>FTSE</th>
<th>HANG</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE</td>
<td>1.000000</td>
<td>0.412120</td>
<td>0.486365</td>
<td>0.694508</td>
</tr>
<tr>
<td>DJIA</td>
<td>0.412120</td>
<td>1.000000</td>
<td>0.915842</td>
<td>0.646019</td>
</tr>
<tr>
<td>FTSE</td>
<td>0.486365</td>
<td>0.915842</td>
<td>1.000000</td>
<td>0.699341</td>
</tr>
<tr>
<td>HANG</td>
<td>0.694508</td>
<td>0.646019</td>
<td>0.699341</td>
<td>1.000000</td>
</tr>
</tbody>
</table>

Table 1
From the table it is clear that BSE Sensex is highly correlated with Hang Seng (0.694508); whereas correlation between Sensex and DJIA and between Sensex and FTSE is low. DJIA is highly correlated with all other stock indices except Sensex, with the highest correlation with FTSE (0.915842). Same observation is made for FTSE. Hang Seng on the other hand is highly correlated with all other stock indices.

**Results from the co-integration analysis**

ADF Test and PP Test performed on the stock price indices of four countries suggest that the series are integrated of order (1).

<table>
<thead>
<tr>
<th></th>
<th>ADF Test Statistics (Critical Value -3.4466)</th>
<th>PP Test Statistics (Critical Value -3.4455)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE</td>
<td>-4.898794</td>
<td>-11.02662</td>
</tr>
<tr>
<td>DJIA</td>
<td>-5.587330</td>
<td>-12.15798</td>
</tr>
<tr>
<td>FTSE</td>
<td>-4.935510</td>
<td>-11.36321</td>
</tr>
<tr>
<td>HANG-SENG</td>
<td>-5.737997</td>
<td>-11.46347</td>
</tr>
</tbody>
</table>

Table 2

We then perform Engle-Granger co-integration test on the four series of stock price indices, taking each as a dependent variable, dependent on other variables, a constant term and a residual. The residual from each equation is further tested for stationarity. We also note down the D-W Statistics from each regression equations.

The results that we obtained are as follows:

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Test Statistics for Residual (Critical Value -1.9425)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSE</td>
<td>-2.902335</td>
</tr>
<tr>
<td>DJIA</td>
<td>0.6523</td>
</tr>
<tr>
<td>FTSE</td>
<td>-0.220722</td>
</tr>
<tr>
<td>HANG</td>
<td>-2.321824</td>
</tr>
</tbody>
</table>

Table 3

From the above table we can say the null hypothesis $H_0$: no co-integration, is rejected for BSE and HANG and is accepted for DJIA and FTSE. Thus it seems to suggest that there is integration in the stock markets of India and Hong-Kong whereas markets are not integrated in case of USA and UK.

**INFERENCES**

Over the past 15 years, financial markets have become increasingly global. In the globalised financial market, the main challenge for both investors and policy makers is to take advantage of and promote efficiency enhancing aspects of market interaction, while containing and controlling the undesirable destabilising effects. There are various factors that influence market interaction and hence integration of financial markets like institutional framework of the economy, governmental policies and technological advancement of the country. These factors are incumbent on the market efficiency and the transaction costs of diversification. Several studies conducted on integration assert that openness of capital markets is a prerequisite for market integration because it increases market efficiency and lowers the transaction costs.

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From the correlation table-1 it is observed that correlation coefficient between Hang Seng and other stock indices is quite high (Hang Seng-FTSE=0.699341, Hang Seng-DJIA= 0.646019 and Hang Seng-BSE 0.694508). The co-integration results also support the fact that the Stock Exchange of Hong Kong is integrated with the equity markets of the developed countries UK and USA. The reason for this can be attributed to the liberalised and free trade regime in the country. Local investors contributed only half of the market turnover whereas the international participants continue to take bigger share. In 1996, almost 70% of the foreign investment came form the USA and UK\(^2\). Thus, the absence of restrictions on the entry and exit of foreign investors result in the lack of arbitrage opportunities in the long run and strengthens the integration of one market with the other markets.

BSE Sensex on the other hand shows low correlation with all the other indices. However, co-integration results reveal that the Indian equity market is integrated with all the other markets of the world. India is still in the intermediate stage of development. Prior to 1993, even the domestic financial markets were fragmented. However, post 1992, government undertook financial liberalisation in the form of de-regulation, privatisation and implementation of pro-market oriented policies. The Indian government began the process of integration of its financial markets with global finance capital in two major ways. Firstly, by permitting foreign institutional investors to enter its capital markets and secondly, by allowing domestic companies to raise capital from abroad through the issuance of equity, Global Depository Receipts (GDR) and other debt instruments. All these policies have contributed towards increasing domestic as well as global financial integration of India. Studies have revealed that countries with relatively greater number of restrictive entry barriers are less responsive to global shocks than countries with fewer restrictive entry barriers. Thus gradual phasing out of restrictions can explain the movement of Indian equity market in tandem with the world markets in long run.

The high correlation coefficient between the stock indices of the two developed countries- UK and USA (0.915842) is not surprising. Both the countries are identical in terms of technological and institutional advancements and have liberal regimes and pursue common macroeconomic policies.

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2 Tiehang, Niu, 1996, Regional Stock Market Integration in China and Hong Kong.
The equity markets of USA and UK are well developed and integrated well with other domestic sectors and volume of trading is also very high. Hence, their markets are unperturbed by the disturbances in other markets. However, any disturbance occurring in the former are absorbed by the markets of the less developed and the emerging countries. Empirical studies conducted along these lines also support this fact. Paper by Botha and Apostolellis says that, “application of the impulse response functions reveals that the US is the dominant market and that all responses to shocks in the US market are absorbed by the emerging markets rapidly…this analysis however indicates that the converse does not hold.”

**Results from the graphical analysis**

Stock Price indices of all the sample countries:

<table>
<thead>
<tr>
<th></th>
<th>ADF statistics</th>
<th>99% Critical Value</th>
<th>95% Critical Value</th>
<th>90% Critical Value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>HANG</td>
<td>-1.472144</td>
<td>-2.5823</td>
<td>-1.9425</td>
<td>-1.8171</td>
<td>Not co-integrated</td>
</tr>
<tr>
<td>BSE</td>
<td>-1.158915</td>
<td>-2.5823</td>
<td>-1.9425</td>
<td>-1.8171</td>
<td>Not co-integrated</td>
</tr>
</tbody>
</table>

The graph traces the movements of all the stock price indices over the period January 1993-September 2003. We can infer the following:

1. Hang Seng seems is the most volatile index of the four whereas Sensex seems to fluctuate along a linear trend. Studies show that integration brings about an equity market, which is significantly larger, and more liquid than before and stock returns which are more volatile and more correlated world market returns than before because investors flock in to benefit from asset diversification.
2. On the other hand, DJIA and FTSE exhibit co-movement for the entire period under consideration and are less volatile. This strengthens our assertion that these markets are more affected by domestic factors.

3. The markets seem to move in tandem—especially during major world shocks. The period of East Asian Crisis is responsible for the sharp decline in Hang Seng in 1997-1999. The fact that the other indices declined at the same time supports the integration hypothesis though the trough is not so prominent. If we consider the shock arising in USA due to the terrorist attack on 9 September 2003, it is evident that the dip in the Hang Seng and DJIA was almost identical. Thus we can conclude that the biggest shocks in the equity market of USA are domestic in nature and no shocks in other markets seem to have an effect on the US. On the other hand, a shock in the US market is quickly absorbed in the market of Hong Kong. This shows the absence of one-to-one correspondence between the markets of developed and emerging countries. The former affect the latter but not vice-versa.

CONCLUSION

Though we cannot unambiguously conclude the existence of perfect total integration among the world markets given the limitations of our analysis. However, we can unambiguously assert that over time, with the opening up of economies and integration and strengthening of domestic financial markets, the benefits from asset diversification are getting exhausted. In the short run an investor might make some windfall profits due to lag in the transmission of shock from one market to the other but in the long run such opportunities are getting eroded.

REFERENCES


Footnotes

1: In general most time series data is integrated of order one or is I(1), it becomes stationary at first difference.
2: Co-integration doesn’t require two series to be stationary, just the order of integration should be the same.
3: Once hypothesis for co-integration is accepted, we may run VECM specification test. However, if series under consideration is not co-integrated, VECM has no meaning. In the present paper, series under consideration are tested as not co-integrated, thus VECM has not been deployed as a further step.
4: Y_t and Z_t both need to be stationary before we test for causality between them.
5: Vargranger model using Wald Endogeniety Test maybe used as a substitute for the same, however they tend to give the same results in the present paper.