Long Run Financial Market Cointegration And Its Effect On International Portfolio Diversification

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SECTION I

INTRODUCTION

The advent of globalization and growing surge of international trades have developed an interest among the corporate managers and academicians on the interaction amongst international financial markets. The interest has increased considerably following the abolition of foreign exchange controls in both mature and emerging markets during last twenty years. In the 1980's, many emerging countries opened their stock markets to foreign investors. In the 1990's, severe financial crises affected many of these countries. These events have helped fire a strong debate on the benefits of stock market liberalization and more generally on globalization (Stiglitz, 2002; Soros, 2002). Economists are now seeking further guidance on policy-making that looks beyond the standard argument that stock market liberalization leads to better risk-sharing and hence improves welfare. There is more interest in the effects of stock market liberalization on stock market volatility, correlation among markets, and the prospect of international portfolio diversification (Bailey and Stulz (1990)). As is well known from standard portfolio diversification theory, if the returns on assets in a portfolio have a correlation of less than unity, then diversification can reduce risk. In the extreme case, where the returns are perfectly negatively correlated, then diversification can in theory eliminate risk entirely. Grubel (1968) gave one of the earliest expositions of how these benefits could be extended by diversifying a portfolio internationally, and in recent years, international portfolio diversification has become fashionable because of the belief that the returns on financial assets from different countries had relatively low correlations; indeed, *"The main driving force in global equity markets has been the fact that international portfolio diversification lowers risks without sacrificing expected returns"* (Aburachis, 1993). Coming to India's context, since the financial sector reforms in 1991, Indian stock market has joined the integration process. The inflow of foreign funds with entry of foreign institutional investors (FII) has transformed the style of functioning of the Indian stock market. During this phase, investment norms for non-resident Indians (NRIs), persons of Indian origin (PIOs) and overseas corporate bodies (OCBs) have been largely liberalized, *inter alia*, with permission to purchase of shares without any prior approval from the RBI. Further, the Indian corporates have been allowed to tap the global market with global depository receipt (GDR), American depository receipt (ADR) and foreign currency convertible bond (FCCB) since 1993. On the other hand, the world-class facilities provided by the newly constituted National Stock Exchange (NSE) have unleashed competitive forces, prompting other exchanges to go for automation and screen based trading. All these have ushered in an era of integration and globalization of the hitherto insulated and segmented Indian stock market. This cross border movement of funds has posed an opportunity for the investors to maximize their returns by international diversification. Hence, the suitability of hedging one's portfolio by international diversification has been investigated in the context of equity markets: Do the markets move together over time so that benefits from cross border diversification get exhausted? How much of the movement in one market can be attributed to innovations in another? If stock markets move together, then investing in various markets would not generate any long-term gains from portfolio diversification. Therefore, it is essential for both active investors and academicians to probe into the fact whether stock markets are inter-linked. The issue is also important to the policy makers because of 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. Under this backdrop, this paper makes an attempt to analyze the causality and long run cointegration relationship between Indian stock market (BSE-SENSEX-30) and two leading developed economy stock markets

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(S&P-100, FTSE-100).

The specific objectives of this paper are as follows:

(i) To test the stationarity of the stock market indices;

(ii) To test the pair-wise causality relationship among the respective share indices movements.

(iii) To test the long run cointegration relationship among the markets.

(iv) To test the effectiveness of international diversification among these three markets.

This paper is organized as follows. After the introductory note in Section-I, a brief review of literatures is done in Section-II. The data and the methodological aspects have been discussed in Section-III. Section-IV contains the results and discussion of the study. Lastly, the conclusion and summary appears in Section-V.

SECTION II

REVIEW OF LITERATURE

Large bodies of studies have attempted to examine the integration of capital markets. Several literatures exist on the equity market integration both at national and global levels. Since the seminal work of **Grubel (1968)**, which enumerated the benefits of international portfolio diversification, the relationship among national stock markets has been analyzed in a series of studies such as **Granger and Morgenstern (1970), Engle and Granger (1987), Johansen (1988), Johansen and Juselius (1990), Kasa (1992), Bailey and Stulz (1990), Bakaert and Harvey (1995), Redel (1997) , Ayuso and Blanco (1999), Park (1999), L.Cappiello, R.F. Engle and K. Sheppard (2003), Bekaert G. and Harvey C.R. (1995)** among several others. **Bailey and Stulz (1990)** used the daily return of the pacific basin stock markets indices of Malaysia, Korea, Singapore, Hong Kong, Japan, Philippines, Taiwan and Thailand and that of the US market during the period January 1977 to December 1985 and have shown that there is a strong correlation between the US and Asian countries and this degree of correlation between US and Asian equity returns depended upon the period specification, whether daily, weekly or monthly. **Ghosh, Saidi, and Johnson (1999)**, however, suggest that while some markets are co-integrated with the US, some are co-integrated with Japan, and others are not co-integrated with either. **Kasa (1992)** using multivariate cointegration method for five well-established financial markets of USA, Japan, England, Germany, and Canada concluded that in the presence of cointegration between stock market indices, it is possible that gains from diversification occur in the short term but not in the long term. **Redel (1997)** argued that capital market integration in Asian developing countries in the 1990's was a consequence of broad-based economic reforms, especially in the trade and financial sectors, which is the critical reason for economic crises which followed the increased capital market integration in the 1970s in many countries will not be repeated in the 1990s. He concluded that deepening and strengthening the process of economic liberalization in the Asian developing countries is essential for minimizing the risks and maximizing the benefits from increased international capital market integration. **Ayuso and Blanco (1999) and Park (1999)** have also found that the degree of international financial integration has been increasing modestly in recent decades both for the developed and developing countries. **Park (1999)** observed that among the developed countries the variance of international financial integration is relatively large vis-à-vis developing countries. Coming to the Indian context the stock markets integration has been analyzed by **Amanulla and Kamaiah (1995), Nath and Verma (2003), Tripaty (2006),Chowdhry (1994), Chittedi (2007), R.N Agarwal (2000), and Chowdhry et al (2007)** among several others. According to **Amanulla and Kamaiah (1995),** there is a long-run equilibrium relation between the price indices of five stock exchanges and error correction models indicated short run deviation between the five regional stock exchanges. The study found that there is no evidence in favour of market efficiency of Bombay, Madras, and Calcutta stock exchanges while contrary evidence is found in case of Delhi and Ahmedabad. **Agarwal (2000)** also holds the opinion that there is a lot of scope for the Indian stock market to integrate with the world market. By using Granger causality relationship and the pair wise, multiple and fractional cointegration, **Wong, Agarwal and Du (2005)** have found that the Indian stock market is integrated with the matured markets of the World. This was also supported by **Chittedi (2007) and Tripaty (2006)**, also found that the world stock market is efficient and co-integrated with developed market, indicating long-run equilibrium relationship. **Nath and Verma (2003)** examined the interdependence of the three major stock markets in south Asia stock market indices namely India (NSE-Nifty), Taiwan (TAIEX) and Singapore (STI) by employing bi-variate and multivariate co-integration analysis to model the linkages among the stock markets. However, they have not found any co -

integration in the long run equilibrium. Thus, most of studies relating to investigation of integration of stock markets within India and also their convergence with the world markets point out the existence of co-integration among different countries. Further, it has been observed from empirical studies that the financial sector reforms have been successful in bringing significant improvements in various market segments.

SECTION III

DATA AND METHODOLOGY

For the purpose of the analysis, monthly index values of BSE-SENSEX-30, S&P-100 and FTSE-100 spanning from March-2000 to December-2009 were collected from *http://in.finance.yahoo.com/q/hp*. The monthly data as opposed to daily data is used to avoid representation bias from some thinly traded stocks, i.e., the problems of non-trading and non-synchronous trading and to avoid the serious bid/ask spreads in daily data. These stock market indices are used to study whether the stock markets returns of one market is influenced by the innovations in the other market. Our choice of stock markets is guided by the consideration that India has significant trade and financial relations with these countries. Illustratively, global markets such as the United States continue to be India's single largest trade and investment partner. India has had long-standing trade and financial relations with the United Kingdom since the era of British colonial rule. The reason for choosing the above three particular indices rather than other stock indexes is that they are fairly representative measure of the corresponding stock markets.Since the objective of this study is to check the co-integration of the movements of these indexes, so natural logarithm of the returns of these indices are used instead of the absolute indices value. The returns of the respective stock indices are calculated using the formula:

$$Ln\left(\frac{I_t}{I_{t-1}}\right)$$

Where $I_t = Index\ Value\ at\ time\ t$

$I_{t-1} = Index\ value\ at\ time\ t-1$

The purpose of using Natural Logarithm is that it is widely used for depicting share price returns and also because of the fact that it is symmetrical across the upward and downward movements of returns.Almost every empirical study using time series data starts with the testing of the stationarity of the time series data. For this purpose, Correlogram analysis, Augmented Dickey Fuller Test for unit root were used. A series is said to be stationary if the mean and covariance are constant over time and the auto-covariance of the series depends only on the lag between two time periods - not the actual time at which the covariance is computed. First, the stationarity of the series is tested on the basis of autocorrelation function (ACF) and correlogram. The ACF at lag k is defined as:

$$\rho_k = \frac{covariance\ at\ lag\ k}{variance} = \frac{\sum(Y_t-\bar{Y})(Y_{t+k}-\bar{Y})/n}{\sum(Y_t-\bar{Y})^2/n} = \frac{\gamma_k}{\gamma_0} \quad ....(1)$$

ρ_k is pure number and it lies between -1 and +1. If we plot ρ_k against k, the graph we get is known as correlogram. The autocorrelations at various lags for a purely white noise process hovers around zero. Now, if the correlogram of a time series resembles the correlogram of a white noise time series, then the time series is stationary. However, generally for a non-stationary time series, the autocorrelation coefficient starts at a very high value and declines very slowly towards zero as the lag lengthens. One practical question that arises is the choice of the lag length. The rule of thumb is to compute ACF up to one-third to one-quarter the length of the time series. Generally, we start with sufficient large lags and then reduce the lag length by using the statistical criterion Akaike or Schwarz information criterion. The statistical significance of the all the ρ_k can be tested by using the Q statistic developed by Box and Pierce.

$$Q = n\sum_{k=1}^{m}\bar{\rho}_k^2 \quad where\ n = sample\,size\ and\ m = lag\ length...............(2)$$

While performing ADF test we proceed by considering the following equation:

$$\Delta Y_t = b_0 + a_0 t + a_1 Y_{t-1} + \sum_{i=1}^{p}(b_i\,\Delta Y_{t-1}) + \varepsilon_t \quad ....(3)$$

Where ΔY_t = *Change in the value of Y (* Y_t*-*Y_{t-1}*),*
ε_t= *white noise error term,*

The above regression equation (equation 3) includes a drift term (b_0) and a deterministic trend ($a_0 t$). Integer p is chosen in equation (1) to achieve white noise residuals for the ADF test and when p=0, the test is known as the Dickey-Fuller (DF) test. Testing the null hypothesis of the presence of a unit root in Y_t is equivalent to testing the hypothesis that H_0: $a_1 = 0$. If a_1 is significantly less than zero, the null hypothesis of a unit root is rejected. In addition, we test the hypothesis that Y_t is a random walk with drift, i.e. a_0 and a_1 are equal to zero, and Y_t is random walk without drift i.e. b_0,a_0, a_1 are individually equal to zero. For these three purposes, the Tau (τ) test statistics are checked against the critical values and the null hypothesis is accepted or rejected if the Tau (τ) -statistics is greater or less than the critical value respectively.Once we get the order of integration using the ADF test, we proceed with testing of statistical causality between different stock index return using the direct *"Granger-causality"*. Granger Causality test is carried out to ascertain the presence of unidirectional or bidirectional relationship among these stock markets. But before starting with the Granger Causality test, the appropriate lag length for each pair of variables are required to be found out. For this purpose, we used the vector auto regression (VAR) lag order selection method. The length of the lags to be included in each system is determined in a trial and error method using the usual information criteria like Akaike Information Criterion (AIC), Schwartz Criterion (SC) and Likelihood Ratio (LR). The particular lag for which all or most of the above criterions are minimum will be selected as optimum lag for the corresponding variables. Granger causality may have more to do with precedence, or prediction, than with causation in the usual sense. It suggests that while the past can cause/predict the future, the future cannot cause/predict the past. According to Granger, X causes Y if the past values of X can be used to predict Y more accurately than simply using the past values of Y. In other words, if past values of X statistically improves the prediction of Y, then we can conclude that X *"Granger-causes"* Y. It should be pointed out that given the controversy surrounding the Granger causality method, our empirical results and conclusions drawn from them should be considered as suggestive rather than absolute. To test causality between two time series variable (say X and Y) and its direction, the following two equations are specified:

$$Y_t = a_0 + \sum_{i=1}^{k} (a_i) Y_{t-i} + \sum_{i=1}^{k} (b_i) X_{t-i} \quad \text{------------ (4)}$$

$$X_t = c_0 + \sum_{i=1}^{k} (c_i) Y_{t-i} + \sum_{i=1}^{k} (d_i) X_{t-i} \quad \text{------------ (5)}$$

The steps in testing whether X *"Granger cause"* Y are as follows. First, we regress Y on past values of Y, but do not include the lagged X terms. This is the restricted regression. After we run the regression, we obtain the restricted residual sum of squares, RSS_R. Second, we run the regression and include the lagged X terms. This is the unrestricted regression. After we run this regression, we obtain the unrestricted residual sum of squares, RSS_{UR}.
The null hypothesis is $b_i = 0$ for all values of i. In other words, the lagged X terms do not belong in the regression. To test this hypothesis, the F-test is applied, as shown below:

$$F = \frac{RSS_R - (RSS_{UR}) / k}{(RSS_{UR}) / (n - 2k - 1)} \quad \text{... ... ... (6)}$$

If the F-value exceeds the critical F-value at the chosen level of significance, the null hypothesis is rejected, in which case, the lagged X variable belongs in the regression. This would imply that X *"Granger causes"* or improves the prediction of the Y variable. We then use the same steps for equation 2 to test whether the Y variable *"Granger-causes"* X.
Based on the results from equations 1 and 2, four possibilities representing possible causal relationships between Y_t and X_t may be formulated, which are defined below:

(1) X *"Granger-causes"* Y if X improves the prediction of Y, and Y does not improve the prediction of X (bi≠ 0 and di=0).

(2) Y *"Granger causes"* X if Y improves the prediction of X, and X does not improve the prediction of the Y (bi=0 and di≠0).

(3) A feedback relationship exists between X and Y when X *"Granger causes"* Y, and then, Y *"Granger causes"* X (bi≠0 and di≠0).

(4) Independence is indicated when no causal relationships are found between X and Y (bi=0 and di=0).
After the causality relationship between the stocks markets are established, cointegration test is performed 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 modeling both long run and short run dynamics in the system. The fundamental aim of co-integration analysis is to detect any common stochastic trends in the time series data, and to use these common trends for a dynamic analysis of the correlation in return. In our analysis, we use the Engle-Granger Testing procedure for testing the presence of co-integration among the stock prices. Suppose Y_t and Z_t are two I(1) variables, Engle-Granger proposed 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.

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:

$$Y_t = \beta_0 + \beta_1 Z_t + e_t \quad \text{.........................(7)}$$

To determine if the variables are co-integrated, the residual sequence from this equation is denoted as $\{\varepsilon_t\}$. Thus $\{\varepsilon_t\}$ 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).
To test the stationarity of residuals, we can apply 2 methods -
(i) ADF Test
(ii) Alternatively, observing DW Statistics from co-integrating regression

$$DW = \frac{\Sigma(e_t - e_{t-1})^2}{\Sigma(e_t^2)} \quad \text{... ... ... (8)}$$

If $\{e_t\}$ is random walk, the expected value of $(e_t - e_{t-1})$ is zero and the DW statistics is close to zero. Auto regression equation of residuals can be written as:

$$\Delta e_t = a_1 e_{t-1} + \varepsilon_t \quad \text{..............................(9)}$$

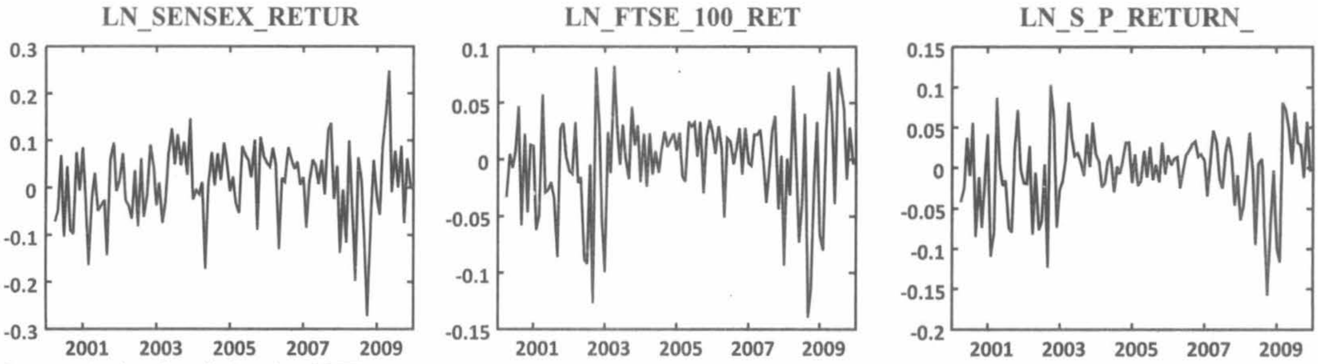
Our parameter of interest is a_1. If we cannot reject the null hypothesis $a_1=0$, we conclude that the residual series has unit roots. In other words, if it is not possible to reject the null hypothesis $a_1=0$, the variables are not co-integrated.

SECTION IV

EMPIRICAL FINDINGS

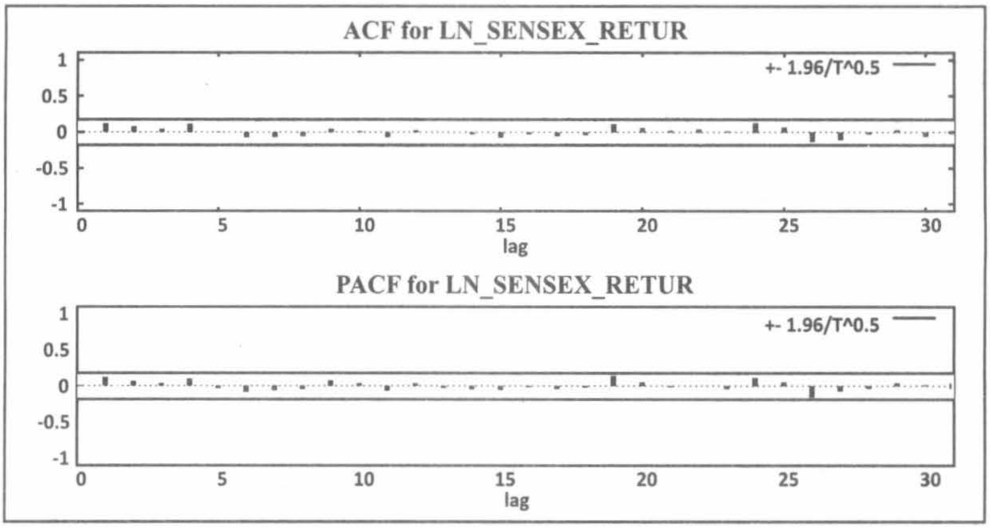
Graphical Representation of the respective Stock index returns against time are shown in Figure-1. Visual inspection of the figures hints towards the stationarity of the return data. For rigorous analysis, the researchers start with the Correlogram analysis using 36 lags for each of the respective index return. The plot of the ACF and the PACF against 36 lags of the respective indices are shown in Figure-2, 3 and 4. The results indicates that the returns are stationary i.e. the return data are integrated to the order zero -I (0).
The stationarity or non-stationary of the returns of SENSEX 30, S&P 100, and FTSE 100 can be further confirmed by the Augmented Dickey Fuller Test. The hypothesis of the stationarity analysis can be set as follows:
H0 : The selected indices returns have unit roots against
H1 : The selected indices returns are stationary
The result of the Augmented Dickey Fuller test is shown in the Table 1. From the Table 1, it can be seen that the test-statistics of all the three index returns (SENSEX 30, S&P 100 and FTSE 100) are exceeding the 1% critical values. Hence, the null hypothesis (i.e., H_0= the returns have unit roots) is rejected.

Figure 1: Plot Of Natural Logarithm Of The Indices Return Against Time



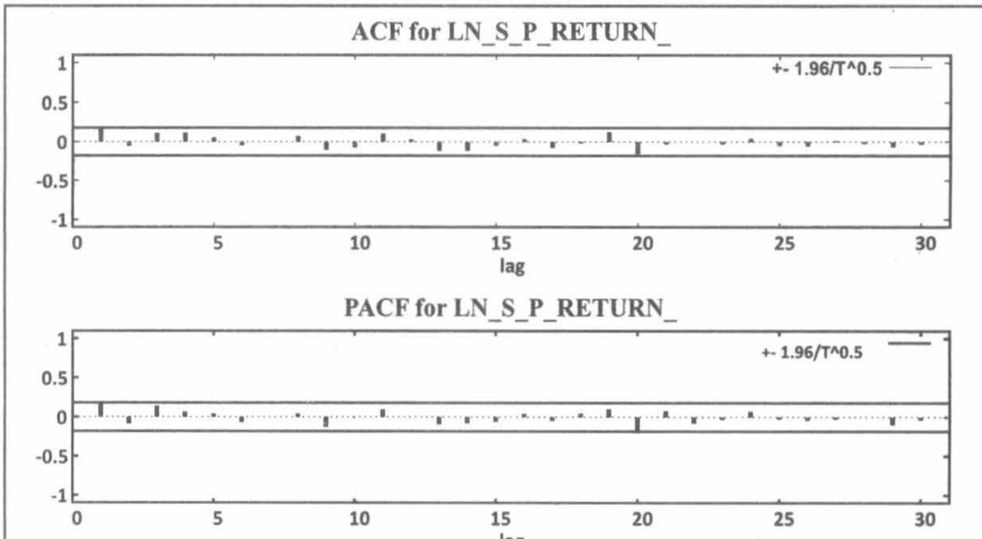
Source : Authors' analysis using GRETL

Figure 2: Correlogram Analysis of SENSEX- 30 Return



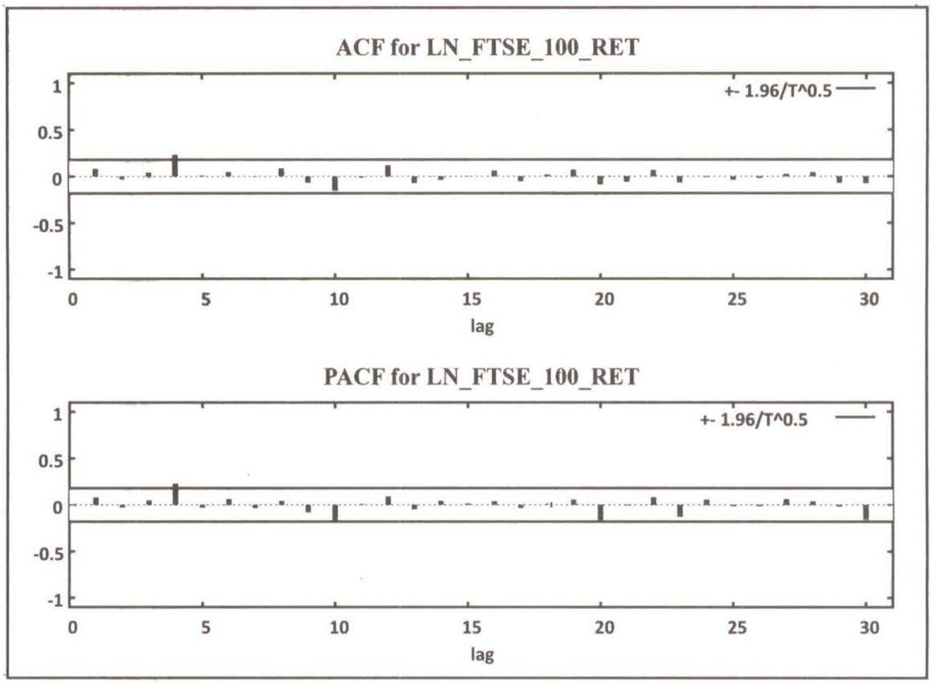
Source : Authors' analysis using GRETL

Figure 3: Correlogram Analysis of S&P-100 Return



Source : Authors' analysis using GRETL

Figure 4: Correlogram Analysis of FTSE-100 Return



Source : Authors' analysis using GRETL

Table 1: Augmented Dickey Fuller Unit Root Test

Variables	Tau-statistics			Critical Values		
	Without Intercept	With Intercept	With Intercept and Trends	Test critical value at 1% level	Test critical value at 5% level	Test critical value at 10% level
SENSEX-30 Return	-6.49232	-6.63517	-6.65083	-4.039075	-3.449020	-3.149720
S&P -100 Return	-7.41674	-7.43693	-7.44342	-4.039075	-3.449020	-3.149720
FTSE-100 Return	-7.37588	-7.36081	-7.38837	-4.039075	-3.449020	-3.149720

Source: Authors' calculation.

Therefore, it can be concluded that at 99% confidence level, all the three stock indices return data are stationary. After confirming that all the stock indices returns are stationary, we try to delve into the cause-effect relationships among the variables. Between any pair of variables, there can be unidirectional causality, bidirectional causality or none. One of the preconditions of this causality test is the stationarity of the variables, which we have ascertained in the previous analysis. The second requirement for the Granger Causality test is to find out the appropriate lag length for each pair of variables. For this purpose, we used the vector auto regression (VAR) lag order selection method available in *'Gretl'* econometric package. The length of the lags to be included in each system is determined in a trial and error method using the usual information criteria like Akaike Information Criterion (AIC), Schwartz Criterion (SC), Hannan-Quinn Criterion (HQC) and Likelihood Ratio (LR). For the purpose of the analysis, Sensex-30 return is taken as the endogenous variable and the S&P-100 return and the FTSE-100 return are taken separately as the exogenous variable. Hence, the following two pairs are tested:

1. SENSEX -30 and S&P-100 returns;

2. SENSEX - 30 and FTSE-100 returns.

For each of these pairs, 24 numbers of lags of the variables are used for the analysis, which is approximately $1/4^{th}$ of the total number of observations. The optimum lag order is one at which all or most of the information criteria (AIC, SC and HQC) are minimum. Our analysis on both the pair individually returned the optimum lag order of one. The information criteria for the lag orders of the variables for both the pairs are displayed in Table 2 and Table 3. respectively.

Table 2: VAR lag selection

Endogenous Variable : SENSEX 30 Return Exogenous Variable: S&P 100 Return				
Lags	Log likelihood	AIC	BIC	HQC
1	125.73629	-2.617985	-2.509056	-2.574002
2	125.74664	-2.596702	-2.460541	-2.541724
3	126.61065	-2.593777	-2.430384	-2.527804
4	126.61342	-2.572332	-2.381706	-2.495362
5	127.86623	-2.577768	-2.359910	-2.489804
6	128.41623	-2.568091	-2.323001	-2.469131
7	128.44254	-2.547151	-2.274829	-2.437195
8	130.08870	-2.561047	-2.261492	-2.440096
9	130.86723	-2.556284	-2.229497	-2.424337
10	131.00438	-2.537729	-2.183709	-2.394786
11	133.63981	-2.572899	-2.191648	-2.418961
12	133.77775	-2.554360	-2.145876	-2.389426
13	134.19989	-2.541933	-2.106217	-2.366004
14	134.20526	-2.520543	-2.057595	-2.333618
15	134.21258	-2.499195	-2.009015	-2.301274
16	134.27574	-2.479048	-1.961635	-2.270132
17	134.76173	-2.467994	-1.923349	-2.248082
18	135.33111	-2.458733	-1.886856	-2.227826
19	138.65847	-2.508784	-1.909675	-2.266881
20	139.74442	-2.510633	-1.884291	-2.257734
21	140.85006	-2.512904	-1.859330	-2.249010
22	141.67423	-2.509123	-1.828317	-2.234233
23	142.49462	-2.505261	-1.797222	-2.219375
24	146.73878	-2.575028	-1.839757	-2.278146

Source : Authors' analysis using GRETL

The logic behind lag order one being optimum is as follows. For the purpose of the analysis, monthly return data of the market indices are taken, and in the present era of electronic communication, when it takes negligible time for information to transmit from one country to another, more than one month old innovations in the S&P market and FTSE market have negligible effect on the current price movement in the Sensex market.

After the Lag length selection and the test of stationarity of the respective test variables are over, we proceed to the test of Causality between the Stock Market returns. The primary objective of the researchers is to examine whether innovations in the developed economy stock market returns helps in predicting the returns in the Indian stock market. With this objective in mind, the researchers start with the following four equations-

$$SENSEX = c + a_0(SENSEX)_{-1} + b_0(S\,\&\,P) + b_1(S\,\&\,P)_{-1} \quad \text{......................}\mathbf{(9)}$$

$$S\,\&\,P = d + e_0(S\,\&\,P)_{-1} + t_0(SENSEX) + t_1(SENSEX)_{-1} \quad \text{......................}\mathbf{(10)}$$

$$FTSE = h + m_0(FTSE)_{-1} + n_1(SENSEX) + n_2(SENSEX)_{-1} \quad \text{....................}\mathbf{(11)}$$

$$SENSEX = y + x_0(SENSEX)_{-1} + z_0(FTSE) + z_1(FTSE)_{-1} \quad \text{......................}\mathbf{(12)}$$

The Results of the Granger Causality Test are displayed in Table-4, from where we can see that at 1% level of significance, FTSE-100 RETURN and S&P-100 RETURN granger cause SENSEX-30 RETURN individually. Hence, there is a unidirectional causality between the following two pair of market returns - {SENSEX-30 RETURN

Table 3: VAR Lag Selection

Endogenous Variable : SENSEX 30 Return Exogenous Variable: FTSE 100 Return				
Lags	Log likelihood	AIC	BIC	HQC
1	127.57419	-2.657509	-2.548580	-2.613527
2	127.67515	-2.638175	-2.502014	-2.583197
3	128.54771	-2.635435	-2.472041	-2.569461
4	128.80278	-2.619415	-2.428789	-2.542445
5	129.53284	-2.613609	-2.395751	-2.525645
6	131.31023	-2.630328	-2.385237	-2.531367
7	131.44211	-2.611658	-2.339336	-2.501702
8	133.23813	-2.628777	-2.329222	-2.507825
9	134.05364	-2.624809	-2.298022	-2.492862
10	134.38791	-2.610493	-2.256473	-2.467550
11	136.43789	-2.633073	-2.251821	-2.479134
12	136.67473	-2.616661	-2.208177	-2.451727
13	136.83306	-2.598560	-2.162844	-2.422631
14	136.88947	-2.578268	-2.115320	-2.391343
15	137.24116	-2.564326	-2.074146	-2.366405
16	137.43327	-2.546952	-2.029539	-2.338035
17	138.35111	-2.545185	-2.000540	-2.325273
18	138.64077	-2.529909	-1.958032	-2.299001
19	142.85621	-2.599058	-1.999949	-2.357155
20	143.10651	-2.582936	-1.956594	-2.330037
21	144.77783	-2.597373	-1.943799	-2.333478
22	145.03082	-2.581308	-1.900502	-2.306418
23	145.22408	-2.563959	-1.855920	-2.278073
24	148.98801	-2.623398	-1.888127	-1.888127

Source : Author's analysis using GRETL

Table 4: Pair Wise Granger Causality Test

Sample 118 Lag 1			
Null Hypothesis	**Number of Observation**	**F-Statistics**	**Probability**
LN_S_P_RETURN_ does not Granger Cause LN_SENSEX_RETURN_	116	12.0602	0.00073
LN_SENSEX_RETURN_ does not Granger Cause LN_S_P_RETURN_	116	0.84691	0.35939
LN_FTSE_100_RETURN_ does not Granger Cause LN_SENSEX_RETURN_	116	7.02792	0.00918
LN_SENSEX_RETURN_ does not Granger Cause LN_FTSE_100_RETURN	116	1.11362	0.29355
LN_FTSE_100_RETURN_ does not Granger Cause LN_S_P_RETURN_	116	0.02500	0.87465
LN_S_P_RETURN_ does not Granger Cause LN_FTSE_100_RETURN_	116	2.96440	0.08785

Source: Authors' calculation.

& S&P-100 RETURNS}and {SENSEX-30 RETURN & FTSE-100 RETURN}. Therefore, we can conclude that at 95% confidence level, innovations in the S&P-100 returns and FTSE-100 returns helps in predicting the SENSEX- 30 return. After determination of causality relationship between various markets, we proceed for cointegration test in order to detect whether any common stochastic trends are present between two pair of variables of interest-{SENSEX-30 RETURN & S&P-100 RETURNS}and {SENSEX-30 RETURN & FTSE-100 RETURN}. For this purpose, we proceeded with the Engle Granger Cointegration test. Equation-13 represents the OLS equation (Sensex-30 return is taken as the dependent variable). The results of the test are displayed in Table-6.

$$Sensex\_30 Return = 0.0146046 + 1.03617 \times S\&P\_100 Return \qquad ....(13)$$

$$S.E. ...(0.00595167) \quad (0.126606)$$

$$R^2 = 0.36, D.W. = 2.09$$

Table 5: Cointegration Regression between SENSEX-30 Return and S&P-100 Return

Section 5A: Cointegrating Regression OLS, using observations 2000:04-2009:12 (T = 117) Dependent variable: LN_SENSEX_RETURN				
Variable	Coefficient	Std. error	t-ratio	p-value
const	0.0146046	0.00595167	2.454	0.0156
LN_S_P_RETURN_	1.03617	0.126606	8.184	4.17e-013

Section 5B :Information criteria and other indicators			
Mean dependent var	0.010430	S.D. dependent var	0.080337
Sum squared resid	0.473107	S.E. of regression	0.064140
R-squared	0.368070	Adjusted R-squared	0.362575
Log-likelihood	156.3547	Akaike criterion	-308.7094
Schwarz criterion	-303.1850	Hannan-Quinn	-306.4666
rho	-0.048698	Durbin-Watson	2.093441

Source : Authors' analysis using GRETL

The Augmented Dickey-Fuller test of the error term (U hat) returned a Tau value of -5.64176.The Engle Granger 1% Critical Tau Value is -3.51. Since the calculated Tau (-5.64176) is more than the critical value, the unit root hypothesis is rejected for the residuals (U hat). Therefore, we can conclude that there is a long run equilibrium relationship between SENSEX 30 RETURNS and S&P 100 RETURNS.Next, we analyzed the long run relationship between the SENSEX-30 Return and the FTSE-100 return. The Cointegration Regression relationship is depicted by equation-14. Table-6 presents the Engle-Granger Cointegration test results. Once again the tau value from the regression (-6.07422) exceeds the critical tau value (-3.51 at 1% level of significance). Hence statistically, at 99% confidence level, we can conclude that there is a long run equilibrium relationship between the Sensex-30 return and the FTSE-100 return.

$$Sensex\_30 Return = 0.0126649 + 1.11235 \times FTSE\_100 Return \qquad ....(14)$$

$$S.E.. \ (0.00598383) \quad (0.138936)$$

$$R^2 = 0.357895, D.W. = 1.964062$$

Table 6: Cointegration Regression Between SENSEX-30 Return And FTSE-100 Return

Section 6A: Cointegrating Regression OLS, using observations 2000:04-2009:12 (T = 117) Dependent variable: LN_SENSEX_RETURN				
Variable	Coefficient	Std. error	t-ratio	p-value
const	0.0126649	0.00598383	2.117	0.0365
LN_FTSE 100_RETURN_	1.11235	0.138936	8.006	1.06e-012

Section 6B :Information criteria and other indicators			
Mean dependent var	0.010430	S.D. dependent var	0.080337
Sum squared resid	0.480725	S.E. of regression	0.064655
R-squared	0.357895	Adjusted R-squared	0.352312
Log-likelihood	155.4203	Akaike criterion	-306.8406
Schwarz criterion	-301.3163	Hannan-Quinn	-304.5978
rho	0.015613	Durbin-Watson	1.964062

Source : Authors' analysis using GRETL

SECTION V

CONCLUSION AND POLICY IMPLICATIONS

This paper empirically investigates the causality and long run equilibrium relationship between the Indian stock market and the stock market indices of two developed countries namely USA and UK using Engle Granger causality and Engle Granger cointegration regression tests. The study depicts that USA and UK market factors influence Indian stock market in the long run. This statement is supported by the presence of unidirectional causality relationship and long term equilibrium cointegration relationship between SENSEX-30 return and S&P-100 return and between SENSEX-30 return and FTSE-100 return. It might be because of maximum international trade and commercial activities, efficient flow of market information, availability, and trading of cross-country financial instruments between these countries.Financial integration is the key to delivering competitiveness, efficiency and growth. But will integration also bring about financial stability? Not necessarily. Increasing level of regulatory relaxations, closer co-operation and in particular, a readiness to share information and co-ordinate action across borders are necessary complements, but it also diminishes the incentive of cross border flow of funds. One of the main motivations behind these cross border investment is portfolio hedging, which is unfortunately not effective in an environment of high cross border financial cointegration. It is evident from the present study that investment in US and UK markets by an Indian investor with an intention of reducing risk bears no significant benefit in the long run. Cointegration among the major market economies enhances market efficiencies, reduces the chance of arbitraging, buttresses price stability, but at the same time, also diminishes the advantages of cross country hedging. International investment products are welcomed by potential investors because of one of the obvious advantages of risk reduction through international diversification. With the growing level of integration among the major financial markets, this obvious benefit is no longer perceivable. This in the long run can decrease the demand of the foreign investment products among the investors- thereby making it tough for the corporates to raise foreign funds to finance growth and hedge risk of their international ventures.While the increasing surge of international trade and cross border investment in an era of globalization and MNCs is buttressing financial integration across countries, the financial stability is still a far cry.

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