

INTEGRATION OF FINANCIAL MARKETS

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(Note: This paper is still in working stage. A final version of it will be uploaded in next five days. Author is really sorry for any inconvenience)

ABSTRACT

Paper analyzes the degree of integration of Indian stock market with other developing and developed nations' stock markets using various techniques of cointegration like Engle Granger two stage method, Johansen cointegration method, VAR-ECM, Principle-Component Analysis and Impulse-response analysis.

KEY WORDS

Financial markets Integration, Johansen test, VAR-ECM, Engle-Granger Two stage method, Developed nations, Developing Nations.

OBJECTIVE

This paper makes an attempt to examine the financial integration of emerging or newly industrialized countries and developed economies and test it empirically. Stock market data have been used for the purpose of the study. Paper considers three developed countries; USA, CANADA & UK and three developing nations; India, Malaysia, Singapore.

INTRODUCTION

Financial market integration can be understood as a situation where there are no quantitative and qualitative barriers like tariffs, taxes, restriction on trading in foreign assets or information costs which hampers the free flow of capital from one market to another. Financial market integration is a buzzword now a day. Financial markets can be considered integrated if there is no barrier on free capital mobility and same risk assets command the same return across the different markets. In the last decade significant improvement have been made in terms of financial reforms to achieve market integration especially in developing countries like India. The reforms helped considerably in removing the institutional bottlenecks on free flow of capital across different markets.

Liberalization of Financial Markets is a major force behind Financial Market integration. An open and well-integrated financial market helps to maximize the benefits of an increasing globalised economy. A financial market that is well integrated with the rest of the world allows country to smooth its consumption pattern and attract investment from abroad to enhance its productivity. Integration of Financial markets helps developing nations in achieving high economic growth and improve living standard by opening international pool of resources. It also adds depth and liquidity to the domestic capital markets and permits it to perform its intermediation and risk diversification roles more efficiently. Highly integrated financial markets also help individuals and investors to diversify their portfolio risk by investing in different countries worldwide.

Although this integration has some attached cost with it especially for developing nations. It makes domestic economy vulnerable to international shocks. It also increases the volatility of the markets, as large amount of freely flowing money makes it very difficult to have a balanced and planned economic development approach. If the Financial markets are integrated to a high degree then the economy of the country is influenced by foreign policies especially in case of developing nations. Another cost associated with the capital flows is misallocation of capital inflows in domestic financial system. It may be due to weak banking system and poor regulation of the financial system.

Increasing integration of world markets should have an obvious impact on the behaviour of stock market prices. Several studies done in the past show that linkage among countries has increased after 90s, but increasing linkage need not mean increasing integration also. Historical evidences also show the international capital flow has been limited to small number of large and medium income countries to reeve the benefits of high return .The small developing nations do not enjoy the benefits of the integrated world capital market. The extent of financial integration among different countries is still a debated issue, and there is evidence that some countries have made relatively slow progress along this path. In this paper an attempt is made to study the integration between different developing countries and developed countries¹.

There are mainly two different approaches to study the financial markets integration. First, testing the sensitivity of Capital flow from one market to another based on Interest rate differentials and Second, testing of real interest rate prevalent in different countries or return on capital (net of risk).

BACKDROP OF THE PAPER

Studying the integration of different markets is not a new area of research. Hordick (1972), Argy and Hodreja (1973) and Salant and Sweeny (1976) tested the degree of integration in different markets using different techniques. Fase (1976) found evidence of substantial degree of market integration in eleven European countries, base on monthly short-term interest rate data for the period of 1961-1972 and using Principle Component analysis technique. The wave of globalization accompanied by financial sector reforms in many emerging countries during 1990s (or 1980s more specifically) motivated many empirical studies in this area.

¹Countries with a high degree of industrialization, high standards of living and high per capita GDP come into the gamete of Developed Nations. Developing country is a country with low average income compared to the world average. In the United Nations system there is no established convention for the designation of "developed" and "developing" countries or areas. In common practice, Japan in Asia, Canada and the United States in northern America, Australia and New Zealand in Oceania and Europe are considered "developed" regions or areas. In international trade statistics, the Southern African Customs Union is also treated as a developed region and Israel as a developed country; and countries of Eastern Europe and the former USSR, countries in Europe are not included under either developed or developing regions.

Mishkin (1982) studied the equality of real interest rates and other parity conditions for countries UK, West Germany, Netherlands and Switzerland and found evidences that real interest rates are not equal in these countries, although he acknowledged that there is a tendency for real interest rates across these countries are equalizing over time.

Mark (1983), Cumby and Mishkin (1984) investigated the movement of real interest rates in developed countries and found a strong positive correlation between interest rate movements in US and these countries. Kasa (1992) examined number of common stochastic trends in the equity market of US, Japan, England, Germany and Canada and found a strong common trend driving stock prices of these countries

Cheun and Mark (1992) using weekly return series for the period of 1977 and 1988 Investigated the relationship between the two developed markets US and Japan and eight Asian-Pacific markets; Australia, HK, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand and found that US market leads the stock market of most of these countries with the exception of Korea, Taiwan and Thailand. While Japanese market found to have a less important influence in this region. Malliaris and Urrutia (1992) analyzed lead-lag relationship for six major stock market indexes² for before and after 1987 market crash. Although they did not find any causality for pre-crash and post-crash period but they found important feedback relationship and unidirectional causality for the month of causality.

Chung and Liu (1994) conducted a study to examine the common stochastic trend among national stock prices of the US and five East Asian countries Japan, HK, Singapore, Taiwan and Korea. Their study suggests that except Taiwan, all other countries in the sample has a strong linkage with US market and holds same speed of adjustments from short term disequilibrium.

Corhay et al (1995) conducted a study to investigate long-run relationship among five major European markets France, Germany, Italy, Netherlands and UK and found evidences of strong integration among these countries. Korajczyk (1996) and Harvey (1995) found asymmetric integration relationship; stock markets of developed nations are more integrated than those of emerging nations.

Choudhary (1994) test the stochastic structure of individual stock markets of US, UK, Japan, Italy, France, Canada and Germany. Their study supports the efficient market hypothesis. All stock indices contain a long-term permanent stochastic trend (unit root) that makes long run predictions impossible. Using Johansen method of cointegration, they found no evidence of the presence of common stochastic trend among these stock markets (for the period of 1953-1989). In a different paper, same author (Choudhary 1997) used a bivariate framework for the period of 1985-1993 for six Latin-American markets and found support for the existence of long-run relationship.

² New York S&P 500, Tokyo Nikkei, London FT-30, Hong Kong Hang Seng, Singapore Straits Times and Australia All Ordinaries.

Solnik et al (1996) examined the correlation of volatility in stock prices in different markets and found that this correlation increases during the period of high market volatility. They also found that in the last 37 years (1959-1995) correlation of individual foreign markets with the US stock market has increased slightly, but in the last 10 yrs (1985-1995) there is no significant increase in this correlation.

Ghosh et. al. (1998) checked the individual integration of nine Asia pacific markets with either the US or Japanese stock markets, but they did not find any evidence that US or Japanese stock market movements dominates these markets. Phylaktis (1999) also examined Asia Pacific Basin countries to investigate whether the Japan has play a more influencing role in this region than USA. Using Impulse-response analysis for speed of adjustments and long-run comovements of real interest rates, they found that these countries are closely linked with world financial markets. Their relationship is stronger with Japan than with USA. Haung et al (2000) explored the causality and cointegration relationship among the US, Japan and several South East Asian countries including recently established markets in China; Shenzhen and Shanghai exchanges. They found no cointegration among these markets except between Shanghai and Shenzhen.

A recent study of Robert P. Flood and Andrew K. Rose (2003) tests the assets integration within and between American stock markets. Using inter-temporal asset-pricing model, they compared the expected risk free rates across assets. According to the study expected risk-free rates vary dramatically over time, unlike short interest rates. They found that the S&P 500 market seems to be well integrated, and the NASDAQ is generally (but not always) integrated. However, the NASDAQ is poorly integrated with the S&P 500.

DATA AND METHODOLOGY

DATA

The paper uses the daily stock index data for a period of 11 years (1994 to 2005) for three developing and three developed countries; US, Canada, UK, India, Singapore and Malaysia. Most popular indexes of respective countries are selected for study like S&P/TSX Composite Index for Canada, S&P 500 Index for United States, BSE Sensex for India, Straits Times Index for Singapore, FTSE 100 Index for UK and Composite Index for Malaysia. There are total 2760 observations. The data has been collected from www.finance.yahoo.com and the validity of the data was checked from the respective stock exchange websites. Since the objective of this study is to check whether the cointegration of the movement of these indexes, so natural logarithm of the data has been used for further analysis.

METHODOLOGY (unit root, integration, EG two stage, Johansen, VAR-ECM, Principle-Component Analysis, Impulse-response analysis, Lead-Lag analysis)

There are a number of test used in the literature to test the long-run relationship of two variables. Some of the most widely used techniques are Engle-Granger two-step technique of cointegration, Johansen cointegration analysis, VAR-ECM model, Principle-Component Analysis and Impulse-Response Analysis.

Corhay *et al.* (1993) used co integration methods with relatively large samples, and both standard Dickey Fuller tests for unit roots as well as VAR analysis. This study takes a four stage approach. In the First stage integration of the series was tested using the unit root hypothesis on the logarithms of the indices. The testing procedure followed is Dickey Fuller and augmented Dickey Fuller (ADF) as well as respective tests incorporating a deterministic trend. In the second stage a multivariate VAR system is constructed, with its corresponding VECM. Then maximum likelihood tests of Johansen (1988) and Johansen and Juselius (1991) are used to determine the number of co integrating vectors. The third stage used Granger causality through the analysis of a vector error correction feedback mechanism in cointegrated models. Block Granger non-causality, which is a variation of the Granger causality restricted model that tests for mutual dependency on each of the other variables' lag structures, is applied to the non-co integrating VAR models. The last stage follows the autoregressive distributed lag (ARDL) approach to co integration, developed by Pesaran and Shin (1995) based on the results of the previous two sections.

Phylaktis (1999) did a study on Pacific Basin countries to determine the influence of the USA and Japan, using a similar approach but in addition they also used impulse response functions, in which the variables within a specially constructed VAR are subjected to external shocks. The resulting response times are compared and those with the shortest response times are considered to be the most highly integrated.

Recent studies, such as Gros Lambert and Kassibrakis (1999) and Hwang and Satchell (1999), have questioned the validity of conventional models that assume a normal returns distribution in analyzing financial markets within emerging markets. Further, Duarte and Mendes (1997) have suggested a generalized method of moments (GMM) model as an alternative to the widely used linear capital assets pricing model (CAPM), which relies on normally distributed returns.

Maysami and Koh (2000) examined possible interactions between the Singapore market and those of Japan and the USA. The initial time series are tested for stationarity using standard augmented Dickey Fuller (ADF) and Phillips Perron unit root tests. Then, the series are analyzed using Vector Auto regressions (VAR), to construct a Vector error correction model (VECM).

Any study of integration should be based on three steps. The first step is test of stationarity. The analysis is to be done on a stationary series otherwise the results cannot be generalized. The second step is test of integration and the third step is test of cointegration.

The first step in the time series analysis is to examine the stationarity properties of the variables. The Stationarity of the series (which is a precondition for using the Granger

causality tests) as well as the autocorrelation in error terms is being tested by ADF (Augmented Dicky-Fuller Test) tests. This consists of estimating the following regression:

$$Y_t - Y_{t-1} = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_1 (Y_{t-1} - Y_{t-2}) + \dots + \alpha_m (Y_{t-m} - Y_{t-m-1}) + \varepsilon_t$$

Where ε_t is pure white noise error term. The number of lagged difference terms (m) to include is determined empirically by either including enough terms so as to make the error term uncorrelated or by using the AIC / SIC criteria.

Note: ADF test is an extension of DF test, to be applied when the errors terms of DF test equation are correlated. The following term is added in the DF equation for the purpose

$$\alpha_1 (Y_{t-1} - Y_{t-2}) + \dots + \alpha_m (Y_{t-m} - Y_{t-m-1})$$

The choice of lag or the lag length for both the causality tests and the ADF test for the stationarity of the series is decided using the AIC (Akaike Information Criterion) and/or SIC (Schwarz Information Criterion).

The test which takes care of the trade-off between goodness of fit of the model and its complexity (from the number of regressors), is defined as:

$$\mathbf{AIC} = (e)^{2k/n} (\mathbf{RSS}/n)$$

Where

k is the number of regressors,

n is the number of observations

RSS is the residual sum of squares

$$\mathbf{SIC} = (n)^{2k/n} (\mathbf{RSS}/n)$$

Where

k is the number of regressors,

n is the number of observations

RSS is the residual sum of squares

Note: 1. Another criteria which is used as a choice for lag length in different equations is the likelihood ratio which is contingent on calculation of log likelihood values for same equation with different lag length.

$$\mathbf{Likelihood\ ratio} = 2(L_2^* - L_1^*)$$

Where

L_2^* is the log likelihood of the equation when lag length is L2 and

L_1^* is the log likelihood of the equation when lag length is L1.

This ratio follows a chi-square distribution with $n^2 (L2-L1)$ degrees of freedom.

H_0 : L1 is the appropriate lag

H_1 : L2 is the appropriate lag

2. Some researchers (Farrokh Nourzad, 2001) have also used the white noise property for the error/residual term as the criterion for selection of the appropriate lag length

Tests for cointegration:

1. Engle – Granger or Augmented Engle – Granger tests:

(These are based on DF and ADF tests for unit root for the residual obtained from the cointegrating equation. The DF and ADF critical significance values are not appropriate for this test therefore Engle and Granger have calculated these values separately).

2. Johansen's tests for cointegration (developed by Johansen 1991,1994).

One of the most used tests for testing the cointegration the Johansen test has become the standard with most of the s/w packages available today. This test uses the trace statistic (trace = the sum of the diagonal elements, of a diagonal matrix of generalized eigenvalues) to find out the number of co-integrating equations in the system (maximum $n-1$ where n is the number of variables). The most appropriate equation (which satisfies the economic rationale) is then added in the VAR model to obtain VECM.

The trace statistic test is based on the

$$\text{Log-likelihood ratio} = \ln[\text{Lmax}(r)/\text{Lmax}(n)] ;$$

and is calculated sequentially for $r = n-1, \dots, 1, 0$.

$\text{Lmax}(r)$ is the maximum likelihood for r cointegrating equation.

This test tests the null hypothesis that the cointegration rank (number of cointegrating equations) is equal to r against the alternative hypothesis that the cointegration rank is k . Note that a cointegrating rank of n will imply that the series is stationary.

The VECM thus obtained by including the cointegrating relations will help to analyze and study the long term (through cointegrating equation) as well as the short-term association (through coefficients of lagged terms and coefficient of error term representing the cointegrating equation) between the variables.

Examining cointegration in the context of this study has two main purposes. First, if two or more series are cointegrated they are said to share common trends in the long run. Such a result would be desirable in the case of a proposal for integrating two stock markets, because, otherwise, they will tend to persistently drift apart. Second, if the hypothesis of cointegration among series cannot be rejected, then a short-run adjustment model can be constructed according to an error correction mechanism \pm that is, taking into account deviations from the long-run relationship. Therefore, in this case, the short run responses of the two main emerging markets India and Malaysia can be estimated. Bivariate and multivariate cointegration tests are carried out using the Engle and Granger (1987) two-step estimation technique and the standard Johansen (1988) maximum likelihood methodology. In both methods, a prerequisite for cointegration is that the non-stationary series have the same order of integration (i.e. the number of times a variable has to be differenced to become stationary). Therefore, the first step is to determine the order of integration of the relevant variables, which is done by computing the Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) tests. For the series that are integrated of the same order, the next step \pm according to the Engle and Granger (1987) two step procedure \pm is to estimate a long-run relationship, which can be expressed as following regression

$$lsto_{i,t} = \beta_0 + \sum_{j=1}^3 \beta_j lsto_{j,t} + u_{i,t}$$

where $lsto$ is the logarithm of the stock market index, the subscript i stands for one of the indexes and the subscript j refers to the other stock price indexes. If the error term is stationary, then, there is cointegration among the non-stationary series. An alternative and more powerful test for cointegration has been proposed by Johansen (1988). The procedure is based on a full information maximum likelihood approach which can be expressed by an extended error correction model. In this sense, the Johansen test can be seen as a multivariate version of the ADF test, which provides a likelihood ratio (LR) statistics for the null hypothesis of at most r cointegrating vectors (where r ranges from 0 to the number of variables in the model). The final step is to construct and estimate an error correction model for the first differences of the cointegrated series, which can be expressed for the bivariate case by the following equation:

$$\begin{aligned} \Delta lsto_{i,t} = & \gamma_0 + \gamma_1 \Delta lsto_{i,t-1} + \gamma_2 \Delta lsto_{j,t} + \gamma_3 (lsto_i - lsto_j)_{t-1} \\ & + \omega_{i,t} \end{aligned} \quad (2)$$

where the term $(lsto_i - lsto_j)_{t-1}$ captures the deviation from the long-run relationship; and γ_3 is the speed of adjustment toward the long-run equilibrium and $\omega_{i,t}$ is a stochastic disturbance.

Co-integration and VECM

Regression of a non-stationary time series on another non-stationary time series may produce a spurious regression. If the linear combination of two non-stationary variables is stationary (to be calculated by checking the residual term for Stationarity) the regression becomes meaningful and it is said that the two variables are co-integrated. Interpreting this in terms of economics would imply that the co-integrated variables have a long term equilibrium relationship between them. According to Granger "A test for cointegration can be thought of as a pre-test to avoid 'spurious regression' situations".

RESULTS

The series of the index values have been tested for stationarity and it was found that the series US, UK, Canada, Malaysia, Singapore is non stationary in Level form and stationary at First difference. India is stationary both in level form and at first difference (Table 1). Graphical display of all the series in its level form and first difference has been shown in the appendix.

A two step co-integration test is done to test the co-integration between different countries. In the first step a regression equation is estimated between every two pairs of index series possible. In the second step the residuals are tested for stationarity by using

unit root test . The residuals are stationary when the absolute value of ADF test statistics is more than the critical values at 1% , 5% or 10% significance level . If the residual series is found to be stationary we can infer that the financial markets of the two countries have a long term relationship and they are cointegrated. The results of the two step co-integration process is displayed in Table 2 .

TABLE 2 : Cointegration test (E.G. two stage)

Country/India	Test Statistics	Critical Values
US	-3.114308 ^b	-3.4358 at 1% -2.8631 at 5% -2.5676 at 10%
UK	-3.086291 ^b	
Canada	-3.129796 ^b	
Malaysia	-2.919639 ^b	
Singapore	-3.069255 ^b	
Country/US	Test Statistics	Critical Values
India	-0.233109 ^d	-3.4358 at 1% -2.8631 at 5% -2.5676 at 10%
UK	-3.066344 ^b	
Canada	-2.057051 ^d	
Malaysia	-1.445910 ^d	
Singapore	-0.728549 ^d	
Country/UK	Test Statistics	Critical Values
India	-0.734139 ^d	-3.4358 at 1% -2.8631 at 5% -2.5676 at 10%
USA	-3.265412 ^b	
Canada	-0.867045 ^d	
Malaysia	-1.554998 ^d	
Singapore	-0.867045 ^d	
Country/MALAYSIA	Test Statistics	Critical Values
India	-1.200060 ^d	-3.4358 at 1% -2.8631 at 5% -2.5676 at 10%
USA	-2.184273 ^d	
Canada	-1.810108 ^d	
UK	-1.973575 ^d	
Singapore	-3.214308 ^b	
Country/CANADA	Test Statistics	Critical Values
India	-1.326677 ^d	-3.4358 at 1% -2.8631 at 5% -2.5676 at 10%
USA	-2.562379 ^d	
Malaysia	-1.639370 ^d	
UK	-2.522434 ^d	

Singapore	-1.639370 ^d	
Country/Singapore	Test Statistics	Critical Values
India	-2.188477 ^d	
USA	-2.399749 ^d	-3.4358 at 1%
Malaysia	-3.611466 ^a	-2.8631 at 5%
UK	-2.211596 ^d	-2.5676 at 10%
Canada	-2.286632 ^d	

- a residuals are stationary at 1% significance level
- b residuals are stationary at 1% significance level
- c residuals are stationary at 1% significance level
- d residuals are non stationary

The test shows that India is co-integrated with both developed economies like US , UK and Canada and other developing economies like Malaysia and Singapore . Canada being a closed economy shows no co-integration with other countries . UK and USA are co-integrated with each other . The economies Malaysia and Singapore are open to each other and shows a high level of integration with each other.

The test also shows some contradictory results like India is integrated with all the other six countries considered in the test when India is taken as the dependent variable but when the regression was run taking India as independent variable and residuals were tested for stationarity it was observed that India was not integrated with the countries.

Several literatures used different methods to test the co-integration between different series . To further strengthen our point we are also doing Johansen co-integration test . At first we decided the lag by using unrestricted VAR and observing the Akaike AIC and Schwarz SC values for all the series upto one third of the number of observations and found out that AIC and SC values are lowest at lag value of one and this is used in Johansen co-integrating equation .

Johansen co-integration test indicates 2 cointegrating equation(s) at 5% significance level . The results for Johansen test are reported below .

Sample: 1 3000

Included observations: 2760

Test assumption: Linear deterministic trend in the data

Series: INDIA CANADA US MALAYSIA UK SINGAPORE

Lags interval: 1 to 1

Likelihood Eigenvalue	5 Percent Ratio	1 Percent Critical Value	Hypothesized No. of CE(s)	
0.026797	170.1959	94.15	103.18	None **
0.017343	95.22761	68.52	76.07	At most 1 **
0.008559	46.94001	47.21	54.46	At most 2
0.004527	23.21484	29.68	35.65	At most 3
0.003784	10.69332	15.41	20.04	At most 4
8.30E-05	0.229013	3.76	6.65	At most 5

*(**) denotes rejection of the hypothesis at 5%(1%) significance level

L.R. test indicates 2 cointegrating equation(s) at 5% significance level

Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

INDIA	CANADA	US	MALAYSIA	UK	SINGAPORE	C
1.000000	2.424869	-5.066977	1.906477	4.825605	-3.957123	-18.74093
	(1.67879)	(2.51292)	(1.01448)	(2.17148)	(1.65820)	

Log likelihood 48831.45

Normalized Cointegrating Coefficients: 2 Cointegrating Equation(s)

INDIA	CANADA	US	MALAYSIA	UK	SINGAPORE	C
1.000000	0.000000	-1.740739	3.738882	3.045891	-5.284706	-7.401481
		(0.79513)	(2.43322)	(1.49581)	(2.92220)	
0.000000	1.000000	-1.371719	-0.755672	0.73394	0.547487	-4.676313
		(0.15356)	(0.46992)	(0.28888)	(0.56436)	

Log likelihood 48855.59

Causality test has been performed and the results are reported below :

COUNTRY	LAG	F STATISTICS	PROBABILITY
US → INDIA			
INDIA → US	22,38	1.38132	0.06086

CANADA → US US → CANADA			
MALAYSIA → US US → MALAYSIA			
UK → US US → UK			
SINGAPORE → US US → SINGAPORE	2,		
CANADA → INDIA INDIA → CANADA			
MALAYSIA → INDIA INDIA → MALAYSIA	1		
UK → INDIA INDIA → UK			
SINGAPORE → INDIA INDIA → SINGAPORE			
MALAYSIA → CANADA CANADA → MALAYSIA			
UK → CANADA CANADA → UK	1		
SINGAPORE → CANADA CANADA → SINGAPORE	1		
UK → MALAYSIA MALAYSIA → UK			
SINGAPORE → MALAYSIA MALAYSIA → SINGAPORE	1		
SINGAPORE → UK UK → SINGAPORE			

VAR- ECM was used to estimate the model . The models are reported below :

Model for Canada.:

$$\begin{aligned}
D(\text{CANADA}) = & - 0.00310887795*(\text{CANADA}(-1) - 1.37171857*\text{US}(-1) + 0.7339424134*\text{UK}(-1) - \\
& 0.7556717028*\text{MALAYSIA}(-1) + 0.5474868481*\text{SINGAPORE}(-1) - 4.67631283) + 0.0004658356276*(\\
& \text{INDIA}(-1) - 1.740739431*\text{US}(-1) + 3.045891219*\text{UK}(-1) + 3.738882214*\text{MALAYSIA}(-1) - \\
& 5.284706382*\text{SINGAPORE}(-1) - 7.401481436) + 0.09177687775*D(\text{CANADA}(-1)) - \\
& 0.01625638979*D(\text{INDIA}(-1)) + 0.047655655*D(\text{US}(-1)) - 0.00368025883*D(\text{UK}(-1)) + \\
& 0.001948974309*D(\text{MALAYSIA}(-1)) + 0.006812814548*D(\text{SINGAPORE}(-1)) - 0.0002529676143
\end{aligned}$$

Model for India:

$$\begin{aligned}
D(\text{INDIA}) = & 0.002573710699*(\text{CANADA}(-1) - 1.37171857*\text{US}(-1) + 0.7339424134*\text{UK}(-1) - \\
& 0.7556717028*\text{MALAYSIA}(-1) + 0.5474868481*\text{SINGAPORE}(-1) - 4.67631283) + 0.0007954815254*(\\
& \text{INDIA}(-1) - 1.740739431*\text{US}(-1) + 3.045891219*\text{UK}(-1) + 3.738882214*\text{MALAYSIA}(-1) - \\
& 5.284706382*\text{SINGAPORE}(-1) - 7.401481436) - 0.02925681622*D(\text{CANADA}(-1)) + \\
& 0.09676603592*D(\text{INDIA}(-1)) - 0.0234404977*D(\text{US}(-1)) - 0.03228217927*D(\text{UK}(-1)) + \\
& 0.03594464191*D(\text{MALAYSIA}(-1)) - 0.004456435828*D(\text{SINGAPORE}(-1)) - 0.0002530702885
\end{aligned}$$

Model for US:

$$\begin{aligned}
D(\text{US}) = & 0.007717260089*(\text{CANADA}(-1) - 1.37171857*\text{US}(-1) + 0.7339424134*\text{UK}(-1) - \\
& 0.7556717028*\text{MALAYSIA}(-1) + 0.5474868481*\text{SINGAPORE}(-1) - 4.67631283) + 0.0009679427782*(\\
& \text{INDIA}(-1) - 1.740739431*\text{US}(-1) + 3.045891219*\text{UK}(-1) + 3.738882214*\text{MALAYSIA}(-1) - \\
& 5.284706382*\text{SINGAPORE}(-1) - 7.401481436) + 0.2040545409*D(\text{CANADA}(-1)) - \\
& 0.0262545298*D(\text{INDIA}(-1)) - 0.02419417843*D(\text{US}(-1)) - 0.0209431246*D(\text{UK}(-1)) - \\
& 0.004462428357*D(\text{MALAYSIA}(-1)) + 0.02830772501*D(\text{SINGAPORE}(-1)) - 0.0003075804244
\end{aligned}$$

Model for UK:

$$\begin{aligned}
D(\text{UK}) = & - 0.0106293662*(\text{CANADA}(-1) - 1.37171857*\text{US}(-1) + 0.7339424134*\text{UK}(-1) - \\
& 0.7556717028*\text{MALAYSIA}(-1) + 0.5474868481*\text{SINGAPORE}(-1) - 4.67631283) - 0.00173003938*(\\
& \text{INDIA}(-1) - 1.740739431*\text{US}(-1) + 3.045891219*\text{UK}(-1) + 3.738882214*\text{MALAYSIA}(-1) - \\
& 5.284706382*\text{SINGAPORE}(-1) - 7.401481436) + 0.05806840472*D(\text{CANADA}(-1)) - \\
& 0.008205209471*D(\text{INDIA}(-1)) - 0.03360355305*D(\text{US}(-1)) + 0.007012377993*D(\text{UK}(-1)) + \\
& 0.004222190302*D(\text{MALAYSIA}(-1)) - 0.009050186017*D(\text{SINGAPORE}(-1)) - 0.0001646199984
\end{aligned}$$

Model for Malaysia:

$$\begin{aligned}
D(\text{MALAYSIA}) = & 0.01449846137*(\text{CANADA}(-1) - 1.37171857*\text{US}(-1) + 0.7339424134*\text{UK}(-1) - \\
& 0.7556717028*\text{MALAYSIA}(-1) + 0.5474868481*\text{SINGAPORE}(-1) - 4.67631283) + 0.002504886416*(\\
& \text{INDIA}(-1) - 1.740739431*\text{US}(-1) + 3.045891219*\text{UK}(-1) + 3.738882214*\text{MALAYSIA}(-1) - \\
& 5.284706382*\text{SINGAPORE}(-1) - 7.401481436) + 0.03389232279*D(\text{CANADA}(-1)) - \\
& 0.03577598402*D(\text{INDIA}(-1)) + 0.02419756106*D(\text{US}(-1)) - 0.001876213382*D(\text{UK}(-1)) + \\
& 0.05603228023*D(\text{MALAYSIA}(-1)) + 0.01223418046*D(\text{SINGAPORE}(-1)) + 0.0001442326803
\end{aligned}$$

Model for Singapore :

$$\begin{aligned}
D(\text{SINGAPORE}) = & - 0.004630436147*(\text{CANADA}(-1) - 1.37171857*\text{US}(-1) + 0.7339424134*\text{UK}(-1) - \\
& 0.7556717028*\text{MALAYSIA}(-1) + 0.5474868481*\text{SINGAPORE}(-1) - 4.67631283) + 0.002347034073*(\\
& \text{INDIA}(-1) - 1.740739431*\text{US}(-1) + 3.045891219*\text{UK}(-1) + 3.738882214*\text{MALAYSIA}(-1) - \\
& 5.284706382*\text{SINGAPORE}(-1) - 7.401481436) + 0.08735316341*D(\text{CANADA}(-1)) + \\
& 0.01758045872*D(\text{INDIA}(-1)) + 0.08238919898*D(\text{US}(-1)) - 0.01921319096*D(\text{UK}(-1)) + \\
& 0.01453571004*D(\text{MALAYSIA}(-1)) + 0.1336019666*D(\text{SINGAPORE}(-1)) + 4.332694742e-05
\end{aligned}$$

CONCLUSION

Financial Integration of developed and developing countries were tested and it was found that developing country like India is integrated with other developing and developed countries . Countries like US and UK are also integrated and manifests the integration between strong economies . Integration between Malaysia and Singapore also shows integration between developing countries . All this shows openness within the economies which works together for mutual progress .

APPENDIX

Table 1 Unit root test (Augmented Dicky Fuller test)

COUNTRY	ADF STATISTIC	TEST	CRITICAL VALUES
India	-2.998772 ^{a*} -22.95305 ^{b 1}		1 % critical value -3.4358 5% critical value -2.8631 10% critical value -2.5676
Malaysia	-1.227468 ^a -23.02237 ^{b 1}		1 % critical value -3.4358 5% critical value -2.8631 10% critical value -2.5676
Canada	-0.807676 ^a -23.71414 ^{b 1}		1 % critical value -3.4358 5% critical value -2.8631 10% critical value -2.5676
Singapore	-2.027627 ^a -22.93792 ^{b 1}		1 % critical value -3.4358 5% critical value -2.8631 10% critical value -2.5676
US	0.502667 ^a -25.26462 ^{b 1}		1 % critical value -3.4358 5% critical value -2.8631 10% critical value -2.5676
UK	-0.481968 ^a -25.55713 ^{b 1}		1 % critical value -3.4358 5% critical value -2.8631 10% critical value -2.5676

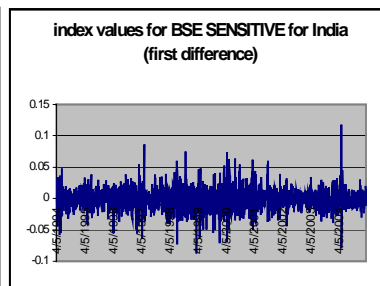
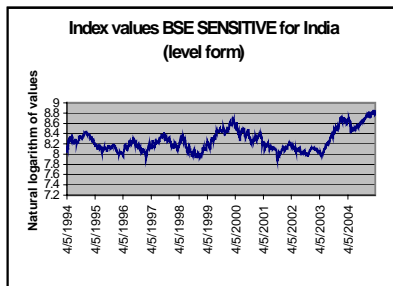
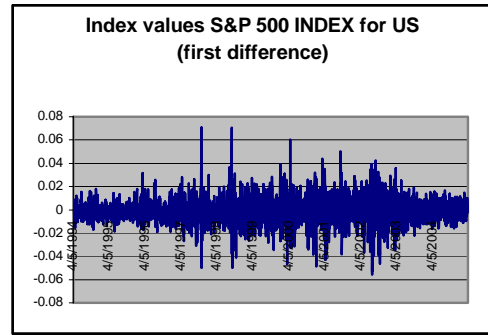
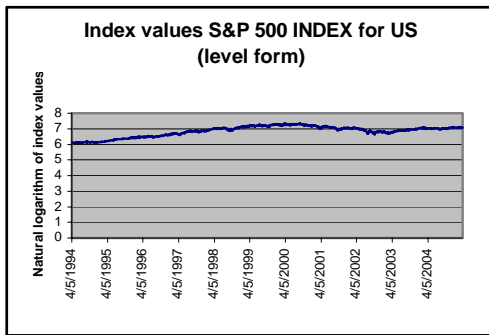
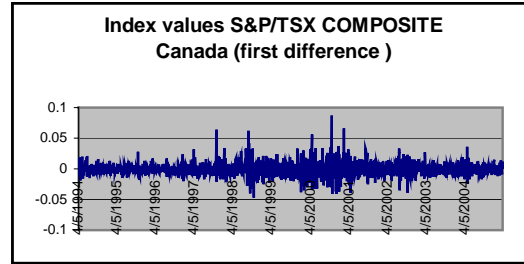
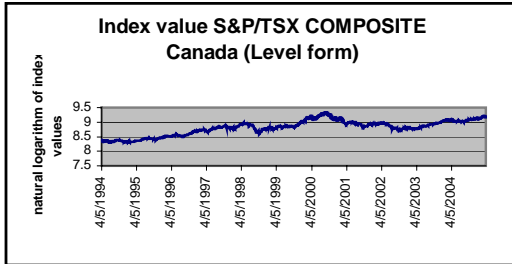
a* Stationary in Level form .

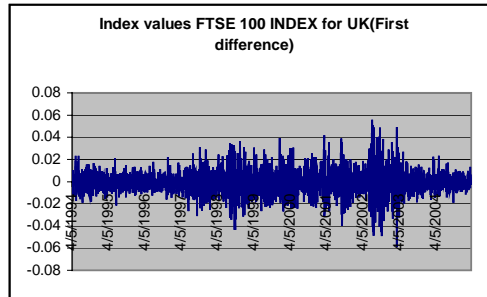
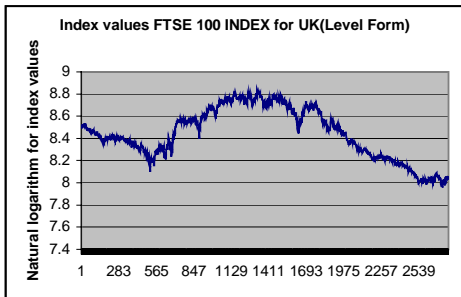
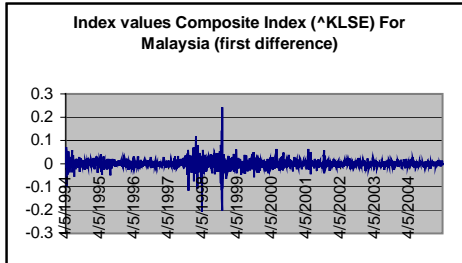
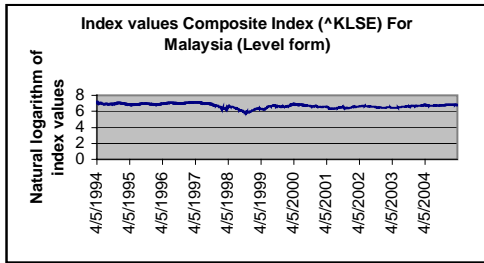
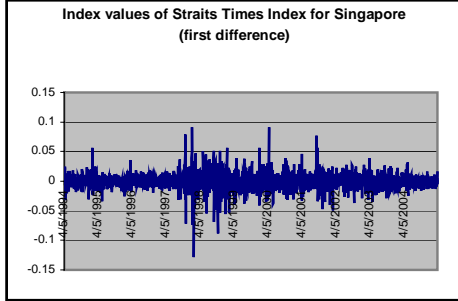
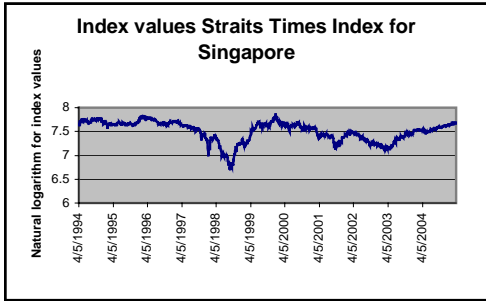
a Nonstationary in Level Form .

b Stationary in First Difference .

1 Stationary at 1 % significance Level .

GRAPHS SHOWING THE INDEX SERIES FOR DIFFERENT COUNTIES IN LEVEL FORM AND IN FIRST DIFFERENCE





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