INTERLINKAGES BETWEEN STOCK RETURNS OF EMERGING ECONOMIES: AN EMPIRICAL STUDY

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ABSTRACT

This paper investigates dynamic linkages and interactions of selected stock markets of twelve countries including ten emerging and two developed countries. The daily closing prices of the stock exchanges are taken for the study. The study applies Granger's causality, Johansen's Co-integration and multivariate co-integration tools on the reference series. Then give one-line results from each model. Finally, give the implications. The Granger-causality test is used to check the causal relationship between the twelve return series and the Johansen co-integration test is applied to measure the long term relationship between twelve indices. Results of Granger causality test in few cases shows that the return series in one stock market had causal influence on return in other stock markets. However, the results of the co-integration test rejects the presence of a long-run relationship, this rejection does not imply that these markets are totally independent of one another as co-integration test does not consider an integration process among returns of these stock markets. This study is useful for the international investors and fund managers who are interested in international diversification and want to achieve long term gains by investing in the international stock markets.

***Key words**: portfolio diversification, stock market integration, Granger cause*

1. Introduction

Financial literature has presented a strong emphasis on the interaction amongst international financial markets. Since the October 1987 stock market crash, a large empirical literature has emerged testing interdependence among national equity markets. Portfolio diversification models (Markowitz, 1952; Sharpe, 1964; Lintner, 1965) have been developed on the premise of strong interdependence of various markets. If stock markets move together then investing in various markets would not generate any long-term gain to portfolio diversification. Therefore, it is important to know whether stock markets are interlinked. The issue is also important because if stock markets are found to be closely linked then there is a danger that shocks in one market may spill over to other markets.

The interest in study of inter-linkages of various markets has increased considerably following the abolition of foreign exchange controls in both mature and emerging markets during last 20 years, the technological developments in communications and trading systems and attaining such technology at cheaper costs, and the introduction of innovative financial products in markets giving their participants opportunity to hedge their risk. Further, the increasing cross-border movement of funds and issuers raising funds through American Depository Receipts and Global Depository Receipts have created more opportunities for global international investments. In particular, the new attractive emerging equity markets have attracted the attention of international fund managers as an opportunity for portfolio diversification and have also intensified the curiosity of academics in exploring international market linkage [Golaka C Nath & Sunil Verma (2003)].

2. Review of Literature

In recent years, research on linkages between national stock markets of emerging economies has increased. For instance: Classens(1995); Michelfelder (2005); Choudhry (1997); Cheung and Ho (1991); Christofi and pericli (1999); Darbar and Deb (1997); Erb et al. (1996); Rogers (1994); Divecha et al. (1992) and Hamao et. al. (1990) have examined the interrelationship issues among the emerging economies. Econometric techniques such as Granger causality analysis, cointegration test, factor analysis and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models have been widely employed in empirical studies of stock market integration.

Chan, Gup and Pan (1997) examine the long-run relationships among 18 stock market indices, including developed and emerging stock markets and reject the evidence of long-run relationship. They use monthly stock market indices in these markets and the sample period covered was from January 1961 to December 1992. Johansen's cointegration tests indicate that only a small number of stock markets show evidence of long-run co-movement with others. However, the number of significant cointegrating vectors increased before the October 1987 stock market crash. The results also imply that international diversification among stock markets might be effective, because the stock markets do not have long-run relationships

Masih and Masih (1999) examine the long and short-run relationships among international and Asian emerging stock markets using multivariate cointegration analysis and causality test. The results confirmed the leading role of the United States, and the existence of a significant long- and short-run relationship between the established OECD and emerging Asian stock markets. Their results supported the view that stock market fluctuations in all these Asian stock markets were generally linked to other regional stock markets.

The study conducted by Leong and Felmingham (2003) analyses the interdependence of five East Asian stock price indices – Singapore Strait Times (SST), Korea Composite (KC), Japanese Nikkei (JN), Taiwan weighted (TW) and Hang Sang (HS) – on daily data from 1990 to 2000. The study reveals that the degree of integration among these five Indices had increased and the opportunities for risk diversification had lessened in the 1990s. Jeon et al. (2006) observe the increase in the degree of financial integration in East Asia in recent times. They further find that the increase is due to the integration with the global market rather than regional counter parts.

Syriopoulos (2004) investigates the long-run relationship among stock market indices of major emerging Central European countries, namely Poland, Czech Republic, Hungary and Slovakia and developed stock markets, specifically Germany and the United States. The multivariate cointegration test results found a stationary long-run relationship among these countries, and the individual Central European stock markets were likely to display stronger linkages with their mature international counterparts rather than their neighbours.

Sarmas Paul (2004) investigates the linkage between the Hong Kong stock market, Singapore stock market and the U. S. stock market during the pre-and post-East Asia Financial Crisis in 1997 and 1998 using multivariate regression models. The result of the study indicated that the exchange rate is not a significant determinant of linkage between the U. S. and the two Asian stock markets, but the evidence of the study suggests that stronger post-crisis relationships between the U. S. and the two Asian stock markets. The evidence also supported a stronger short-run relationship between the U. S. and Hong Kong stock markets relative to that between the U. S. and Singapore stock markets.

A study by Phylaktis and Ravazzolo (2005) examine the linkages between Pacific-Basin markets. Their results were robust and consistent in that no evidence was found to indicate a long-run relationship among the stock markets under study. The results were also consistent with those obtained in previous studies such as Chang (2001) and Ng (2002). Lack of cointegration among ASEAN emerging economies documented by Ibrahim (2005) also.

Singh Priyanka, Kumar Brajesh and Pandey Ajay (2010) examine price and volatility spillovers across North American, European and Asian stock markets. The effect of same day return in explaining the return spillover is analyzed using VAR and AR-GARCH with exogenous variables incorporating the same day effect. In both return and volatility spillover, they found that there is a greater regional influence among Asian and European stock markets.

However, studies in context to India are not in large number. The few studies in this subject are: Nath and Verma (2003); Hansda Sanjay K. and Ray Partha (2003); Narayan, Smyth and Nandha (2004); Lamba (2005); Bose (2005), Bodla and Turan (2006) and Bhar Ramaprasad and Nikolova Biljana (2009).

Nath and Verma (2003) find no co-integration between the stock markets of India, Taiwan and Singapore by employing bivariate and multivariate co-integration analysis for the period of January 1994 to November 2002.

Hansda Sanjay K. and Ray Partha (2003) look into the price interdependence of 10 Indian companies, which have floated American Depository Receipts (ADRs). The, National Stock Exchange (NSE) found to share the bidirectional relation scrip wise with the NASDAQ/New York Stock Exchange. Furthermore, study found the impulse responses pattern indicates a positive shock in the domestic (international) price of scrip gets transmitted in terms of a strong positive movement in the international (Domestic) price the very next day. It was stated that the quotes of both the markets share not only stock wise bidirectional causality, but markets also are efficient in processing and incorporating the pricing information.

Narayan, Smyth and Nandha (2004) examine the linkages between stock markets of Bangladesh, India, Pakistan and Sri Lanka using a temporal Granger causality approach and impulse response functions among the stock price indices. The study shows that in the long run, stock prices in Bangladesh, India and Sri Lanka Granger cause stock prices in Pakistan. In the short run there is unidirectional Granger causality running from stock prices in Pakistan to India, stock prices in Sri Lanka to India and from stock prices in Pakistan to Sri Lanka. The study describes Bangladesh is the most exogenous among the four markets, reflecting its small size and modest market capitalization.

Lamba (2005) study the long-term relationships among South Asian equity markets and the developed equity markets for the period 1997-2003. Findings of the study shows that Indian stock markets are influenced by developed equity market of US; UK and Japan while Pakistani and Sri Lankan equity markets were relatively independent from the influence of equity markets of developed markets.

Bose (2005) investigate the interlinkages of the Indian stock market and the stock markets in Asia and the US from post Asian crisis to mid-2004 and find the Indian stock market did not function in relative isolation from the rest of Asia. The study shows stock returns in India were highly correlated with returns in major Asian markets and was led by returns in the US, Japan, as well as other Asian markets. On the other hand, the Indian BSE Sensex return was also seen to exert some influence on stock returns in some major Asian markets. The degree of integration found between the Indian and other markets in the Asian region is, however, not of a very high order, consequently opportunity for portfolio diversification and not posing any immediate threat for capital outflows in case of regional crisis. Similar are the findings of the study of five Asian countries being conducted by Bodla and Turan(2004).

Bhar and Biljana (2009) examine the level of integration between the BRIC countries, their respective regions and the world. They describe that India shows the highest level of regional and global integration among the BRIC countries, followed by Brazil and Russia and lastly by China. The paper shows negative relationship between the location conditional volatility of India with that of the Asia-Pacific region and of China with the world, which indicates a presence of diversification opportunities for portfolio investors. They suggest portfolio investors to continue receive sound returns for taking positions in the index of these countries.

Majid M. Shabri Abd. (2009) explore market integration among five selected Association of Southeast Asian Nations (ASEAN) emerging markets (Malaysia, Thailand, Indonesia, Philippines and Singapore) during the pre-and post-1997 financial crisis periods by employing two-step estimation, co-integration and generalized method of moments (GMM). Data used for pre-crises period spans from 1st January 1988 to 31st December 1996 and for post crises period spans from 1st January 1998 to 31st December 2006. The study finds that the stock markets in the Asian region are co-integrated both during the pre-and post-1997 financial crisis. They also added that markets are moving towards a greater integration, particularly during the post-1997 financial crises. Evidence of cointegration is also supported by Azman - saini et al (2002); Leong and Felmingham (2003); Sarmas Paul (2004); Jeon et al. (2006); and Singh Priyanka et al. (2010).

The review of previous studies indicate mixed results about the subject whether international investors still have opportunities for portfolio diversification by investing in stock markets of emerging economies as well as advanced countries. The objective of this paper is to conduct a fresh study to investigate the interlinkages among the stock market returns of emerging economies and to know whether diversification opportunities are there or not for international investors.

This paper aims to explicitly characterize the dynamic interactions among selected emerging markets and to study their level of integration. The study is an attempt to understand the dynamic inter-linkages between 10 emerging stock markets: Taiwan, Brazil, South Korea, China, India, Malaysia, Mexico, Philippines, Indonesia, Russia and 2 developed economies- Japan and USA. If these markets are independent then investors can invest in different markets of the region to diversify their portfolio and the authorities in the region need not worry about any contagious effects if one market experiences any turmoil.

3. Research Methodology

To investigate the issue of stock market integration, this study used MSCI (Morgan Stanley Capital International, Inc.) indexes of 12 countries (2 developed and 10 emerging markets). Daily stock price indices in domestic currency for these countries exhibit are extracted from MSCI database.

Exhibit-1

Country	Stock index	Exchange	Source
Brazil	BVSP INDEX	BOVESPA SAO PAULO Stock Exchange	World Federation Exchanges
Russia	RTSI	RTS exchange	www.allstocks.com
India	S&P CNX Nifty	National Stock Exchange	www.nseindia.com
Mexico	IPC	Bolsa Mexican Valores,(BMV)	www.allstocks.com
China	SSE	Shanghai Stock Exchange	www.yahoo.com
Indonesia	JKSD	Jakarta Stock Exchange	www.allstocks.com
South Korea	KOSPI	Korea Stock Exchange	World Federation Exchanges
Taiwan	TWSE	Taiwan stock Exchange	www.yahoo.com
Philippines	PSI	Philippines Stock Exchange	World Federation Exchanges
Malaysia	KLSI	Kaula Lumpur Stock Exchange	www.allstocks.com
U.S.	S&P 500	New York Stock Exchange	www.allstocks.com
Japan	NIKKEI-225	Tokyo Stock Exchange	www.allstocks.com

The sample period covers 1st June, 1997 to 30th June 2012. To make the series stationary the study uses the daily returns of daily close prices by logarithm method of the stock index and then apply further analysis.

Data have been analyzed using econometric tools. The analysis of econometrics can be performed on a series of stationary nature. Therefore, to begin with study checks the stationary nature of the series by preparing line graphs. In order to make the series stationary, we determine the log of the twelve series and arrive at the daily return of the twelve series. Further, we perform the Augmented Dickey-Fuller test under the unit root test to finally confirm whether or not the series are stationary. For the basic understanding of Unit root testing, we may look at the following equation:

$$y_t = \rho y_{t-1} + x_t'\delta + \varepsilon_t, \quad (1)$$

where x_t are optional exogenous regressors which may consist of constant, or a constant and trend, ρ and δ are parameters to be estimated, and the ε_t are assumed to be white noise. If $|\rho| \geq 1$, y is a nonstationary series and the variance of y increases with time and approaches infinity. If $|\rho| < 1$, y is a (trend) stationary series. Thus, we evaluate the hypothesis of (trend) stationarity by testing whether the absolute value of $|\rho|$ is strictly less than one.

The Standard Dickey-Fuller test is carried out by estimating equation (2) after subtracting y_{t-1} from both sides of the equation.

$$\Delta y_t = \alpha y_{t-1} + x_t'\delta + \varepsilon_t \quad (2)$$

where $\alpha = \rho - 1$. The null and alternative hypotheses may be written as,

$$H_0: \alpha = 0 \quad (3)$$

$$H1: \alpha < 0 \quad (4)$$

All the remaining analysis is performed at the daily return (log of the series) of the twelve exchanges.

In order to observe whether the return at each stock exchange Granger causes the return at the remaining eleven stock exchanges we perform the Granger's causality model at stationary log series of the twelve stock exchanges. The Granger (1969) approach to the question of whether x causes y is to see how much of the current y can be explained by past values of y and then to see whether adding lagged values of x can improve the explanation. y is said to be Granger-caused by x if x helps in the prediction of y, or equivalently if the coefficients on the lagged x's are statistically significant. It is pertinent to note that two-way causation is frequently the case; x Granger causes y and y Granger causes x. It is important to note that the statement "x Granger causes y" does not imply that y is the effect or the result of x. Granger causality measures precedence and information content but does not by itself indicate causality in the more common use of the term. In Granger's Causality, there are bivariate regressions of the under-mentioned form–

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \ldots\ldots + \alpha_l y_{t-l} + {}_1x_{t-1} + \ldots\ldots + \beta_l x_{t-l} + \varepsilon_t \quad (5)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \ldots\ldots + \alpha_l x_{t-l} + {}_1y_{t-1} + \ldots\ldots + \beta_l y_{t-l} + \mu_t \quad (6)$$

for all possible pairs of (x, y) series in the group. In equation (6), one can take lags ranging from 1 to *l*. In Granger's model, one can pick a lag length, l that corresponds to reasonable beliefs about the longest time over which one of the variables could help predict the other. We take lag length of 2 in our study. The reported F-statistics are the Wald statistics for the joint hypothesis:

$$\beta_1 = \beta_2 = \ldots\ldots = \beta_l = 0 \quad (7)$$

for each equation. The null hypothesis is that x does not Granger-cause y in the first regression and that y does not Granger-cause x in the second regression.

After Granger Causality we apply the Vector Autoregression (VAR) Model on the twelve series of the selected stock exchanges. The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system. The mathematical representation of a VAR is:

$$y_t = A_1 y_{t-1} + \ldots\ldots + A_p y_{t-p} + Bx_t + \varepsilon_t \qquad (8)$$

where y_t is a k vector of endogenous variables, x_t is a d vector of exogenous variables, $A_1, \ldots\ldots, A_p$ and B are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

We also apply the Variance Decomposition Analysis in order to quantify the extent upto which the twelve indices are influenced by each other. While impulse response functions trace the effects of a shock to one endogenous variable on to the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component shocks to the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR.

Impulse response function is applied to trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variables. So, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted. Thus, if there are g variables in a system, a total of g2 impulse responses could be generated. The way that this is achieved in practice is by expressing the VAR model as a VMA — that is, the vector autoregressive model is written as a vector moving average. Provided that the system is stable, the shock should gradually die away.

To illustrate how impulse responses operate, consider the following bivariate VAR (1)

$$y_t = A_1 y_{t-1} + u_t \qquad (9)$$

We have further, applied cointegrating rank of the system Johansen (1991, 1995) maximum eigenvalue and trace tests using a Group object or an estimated Var object. Johansen's methodology takes its starting point in the vector autoregression (VAR) of order p given by

$$y_t = A_1 y_{t-1} + \ldots\ldots + A_p y_{t-p} + Bx_t + \epsilon_t \qquad (10)$$

where y_t is a k-vector of non-stationary I(1) variables, x_t is a d-vector of deterministic variables, and $_t$ is a vector of innovations. We may rewrite this VAR as,

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + \epsilon_t \qquad (11)$$

where:

$$\Pi = \sum_{i=1}^{p} A_i - I \qquad \Gamma_i = -\sum_{j=i+1}^{p} A_j \qquad (12)$$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exist $k \times r$ matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). r is the number of cointegrating relations (the *cointegrating rank*) (0.1) and each column of β is the cointegrating vector. As explained below, the elements of α are known as the adjustment parameters in the VEC model. Johansen's method is to estimate the matrix from an unrestricted VAR and to test whether we can reject the restrictions implied by the reduced rank of Π.

The trend assumption in the case of our series applied for cointegration is that the level data and the cointegrating equations have linear trends:

$$H^*(r): \prod y_{t-1} + Bx_t = \alpha(\beta' y_{t-1} + \rho_0 + \rho_1 t) + \alpha \perp \lambda_0 \quad (13)$$

Johansen (1995) identifies the part that belongs inside the error correction term by orthogonally projecting the exogenous terms onto the space so that is the null space of. We identify the part inside the error correction term by regressing the cointegrating relations on a constant (and linear trend). To determine the number of cointegrating relations conditional on the assumptions made about the trend, we can proceed sequentially from to until we fail to reject.

The trace statistic for the null hypothesis of cointegrating relations is computed as:

$$LR_{tr}(r / k) = -T \sum_{i=r+1}^{k} \log(1 - \lambda_i) \; k \qquad (14)$$

Where is the -th largest eigenvalue of the Π matrix in (1.11).

The maximum eigenvalue statistic is computed as –

$$LR_{max}(r / r+1) = -T \log(1 - \lambda_{r+1}) = LR_{tr}(r / k) - LR_{tr}(r+1 / k) \quad (15)$$

for $r = 0, 1, \ldots, k-1$

A vector error correction (VEC) model is a restricted VAR designed for use with non-stationary series that are known to be cointegrated. The VEC has cointegration relations built into the specification so that it restricts the long run behavior of the endogenous variables to converge to their cointegrating relationships while allowing for short-run adjustment dynamics. The cointegration term is known as the *error correction* term since the deviation from long-run equilibrium is corrected gradually through a series of partial short-run adjustments.

4. Analysis and Interpretation Data

The descriptive statistics related to daily returns offered by the twelve stock exchanges under study are presented in table 1. The table also presents Jarque- Bera statistic and p value for the selected period. It is clear from the table that the highest mean daily return during the study period is found in stock market of Russia (0.094%) followed by that of Brazil (0.087%), Mexico (0.077%), Indonesia (0.063%), India (0.060%), China(0.036%), South Korea (0.046%), Philippines (0.025%), USA (0.025%), Malaysia (0.017%) and Japan (-0.006%). The lowest mean daily return in the reference period is found in Japan. Besides others, Tsunami is the main reason for this sad performance. The daily average return of Tokyo Stock Exchange from 6th January 1997 to 31st December 2010 is (0.0338%) even better than China. The daily mean return of the developed markets has been in general lower than the mean returns in emerging economies. Volatility of returns as presented by standard deviation and coefficient of variation in emerging economies was relatively higher than that of the developed economies. The coefficient of variation (CV) of mean returns in the developed countries stock markets were relatively lower 53.49 percent (USA) than that of emerging economies and it ranges from 20.61 percent (Mexico) to 186.80 (Taiwan). This table further illustrates that Malaysia, Brazil, Philippines, Mexico and Indonesia have significant positive Skewness, whereas South Korea, Taiwan, Russia and Japan have Negative Skewness. Stock returns of China, India and USA have near to zero Skewness. The excess Kurtosis in all markets both emerged and emerging exceeds three, and was significant indicating a leptokurtic distribution in the market returns. Excess kurtosis in returns has been well documented by a number of studies including Bekaert and Harvey (1997) and Ananth Rao (2008).

To test the normal hypothesis that the distribution of daily return is normal Jarque – Bera Statistic and corresponding p value are derived. With all p values equal to zero we reject the null hypothesis that returns for the economies are well approximated by the normal distribution. Table 1 indicates that returns of emerging markets are significantly deviated from the normal distribution based on the results of the Jarque – Bera's test for normality. The same has also been stated by Nguyen and Bellelah (2008).

Table 1: Descriptive Statistics Based on Series of Daily Stock Market Returns of Selected Countries

	Brazil	Russia	India	Mexico	China	Philip-pines	South Korea	Taiwan	Indonesia	Malaysia	USA	Japan
Mean (%)	0.09	0.09	0.06	0.08	0.03	0.02	0.05	0.01	0.06	0.02	0.02	-0.01
Median (%)	0.14	0.18	0.12	0.11	0.00	0.00	0.11	0.01	0.09	0.02	0.07	0.00
Std. Dev. (%)	1.6	1.7	1.8	1.6	1.7	1.6	1.6	2.7	2.1	1.6	1.3	2.3
C.V. (%)	26.19	28.93	28.53	20.61	51.55	63.68	44.28	186.8	28.25	95.67	53.49	-257
Maximum (%)	9.9	17.7	14.0	14.2	23.1	12.9	17.6	22.4	11.9	8.9	11.6	33.4
Minimum (%)	-8.8	-12.2	-12.0	-11.4	-21.5	-13.3	-12.3	-19.1	-12.0	-9.5	-9.0	-15.8
Skewness	0.0	0.0	0.1	-0.1	1.7	0.2	0.7	-0.1	0.0	-0.1	0.0	0.9
Kurtosis	7.5	9.9	9.6	8.6	57.0	9.7	17.0	10.2	6.7	5.4	10.4	20.9
Jarque-Bera	2565.8	7293.6	6296.7	4660.7	442350.7	6902.2	29473.7	7810.2	2036.3	831.0	8314.2	48323.8
Probability	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum (%)	94.9	220.1	218.8	-22.2	62.9	282.3	88.9	344.1	162.5	29.9	90.4	311.3
Sum Sq. Dev.	7974.6	10805.7	11053.9	9209.0	9962.8	9270.9	8950.4	27168.0	14775.7	8932.5	6404.8	18536.1
Observations	3584	3648	3648	3648	2999	3576	3504	3488	3455	3632	3648	3556

Notes: C.V. stands for Coefficient of Variation

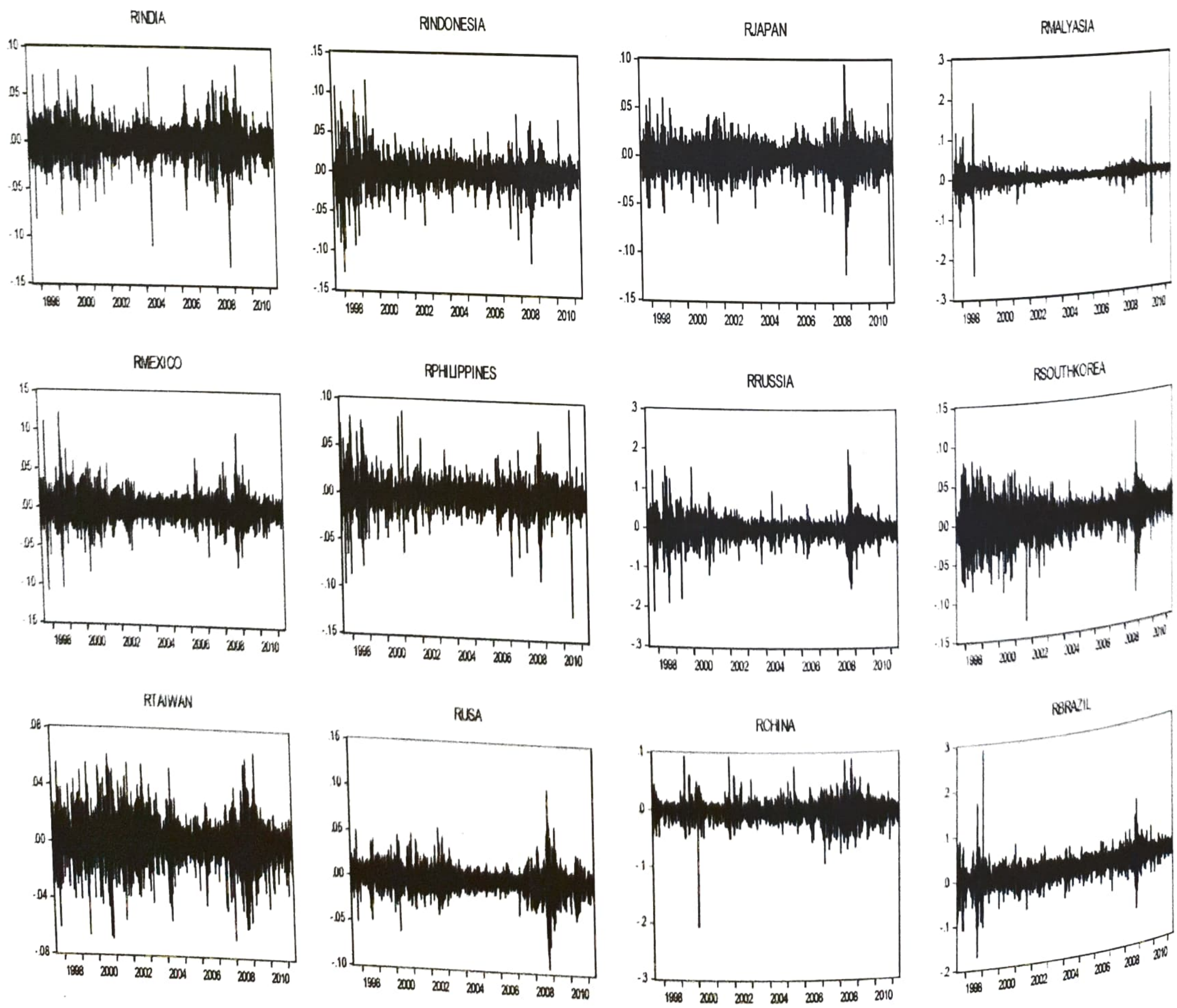
To begin with stochastic properties of the time series of stock returns are investigated for each of the twelve equity markets by applying Line graph and ADF unit root test. The most empirical work based on time series data assumes that the underlying time series is stationary. In order to make the series stationary, we take the log of the price series and arrive at the daily return of the twelve series. All the remaining analysis is performed at the daily return (log of the series) of the twelve exchanges. We name the variable indicating return series of sample countries as Rbrazil, Rrussia, Rindia, Rmexico, Rchina, Rphilippines, Rsouthkorea, Rtaiwan, Rindonesia, Rmaleysia, Rusa, and Rjapan.

The result of ADF-unit root test and line graph on return series of underlying stock markets are available in table 2 and figure 1. The ADF test result values of all stock return series are significant at 0.001 levels. It means return series does not have a unit root. Further, the statistic values are less than the critical values at the 1%, 5%, and 10% levels of significance. So we can reject the null hypothesis. The above confirms in case of each of the stock market return series and hence, the return series don't have a unit root and are stationary. The above is also confirmed by figure I.

Table 2: ADF Test Results for Return Series

Null Hypothesis: individual return series has a unit root			R Brazil	R Russia	R India	R Mexico	R China pines	R Philip- Korea	R South	R Taiwan	R Indo-nesia	R Malay-sia	R USA	R Japan
Prob.*	ADF Test Statistic		-38.42	-30.56	-36.24	-36.88	-35.68	-34.91	-36.87	-35.50	-35.28	-25.84	-38.89	-38.95
	Prob.*		0	0	0	0	0	0	0	0	0	0	0	0
	Test critical values:	1% Level	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43	-3.43
		5% Level	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86	-2.86
		10% Level	-2.57	-2.57	-2.57	-2.57	-2.57	-2.57	-2.57	-2.57	-2.57	-2.57	-2.57	-2.56

Figure-1



5. Granger Causality Estimates

In order to investigate the causal relations in between the returns of selected stock markets we employ the Granger causality test. For conducting the test, we use 2 lag length in each market pair. A summary of the Granger causality test of the significant directions of Granger causality between each pair is shown in Table 3.

Table 3: Summary of the Granger Causality Tests for the Stock Market Return Series

	RBRA-ZIL	RRUS-SIA	RINDIA	RMEX-ICO	RCHINA	RPHILI-PPINES	RSOUTH KOREA	RTAI-WAN	RINDO-NESIA	RMAL-AYSIA	RUSA	RJA-PAN
RBRAZIL	—	—	→	—	—	→	—	↔		→	—	
RRUSSIA		—	←	—	—	—	←	↔	→	→	←	—
RINDIA			—	↔	—	↔	←	—	←	↔	—	→
RMEXICO				—	—	—	→	↔	←	←	—	—
RCHINA					—	—	—	←	—	—	↔	—
RPHILIPI-NES						—	↔	←	→	—	→	→
RSOUTH-KOREA							—	—	→	→	→	←
RTAIWAN								—	←	←	→	↔
RINDO-NESIA									—	—	—	—
RMALAY-SIA										—	—	←
RUSA											—	—
RJAPAN												

Notes: The arrows point out significant directions of causality as the p-value < 0.05 (or at least at the 5% level) under the Granger sense. The symbol "—" means no directional effect, while →, •←, and ↔ denote forward, backward and bi-directions of causality, respectively.

Table 3 reveals the presence of short-run association of each stock market with four of more emerging stock markets, except one i.e. China. US stock returns show two-way casuality in case of Chinese's stock market. Chinese market is also influenced by Taiwan market. The table 3 shows the interdependence of markets, especially Taiwan, Indonesia and Malaysia have Granger causality with 10 out of 12 selected stock market indexes. Table exerts evidences of the short-run associations from all the market from one to another.

After application of Granger- causality, Vector Auto – regression (VAR) model has been applied on the twelve return series under study to determine integration among them. By the application of VAR Model, we analyse that the integration of a stock exchange with the other can be established if the t-statistic is more than 1.96. The integration of stock exchange with the other stock exchange is tested at lag 1 and 2. The columns of the table 4 represent the return at lag 0 while returns at the respected stock return series at lag 1 and 2 are shown in its rows. For understanding the analysis produced by the Vector Auto-Regression, table has been analysed column-wise and that column explains the cause of all the stock markets return on the return of particular stock return at lag 0. Taking the first column i.e. returns in India, we find that the series is influenced by the returns of India itself and by the returns of Malaysia, Mexico, Russia and Taiwan at lag 2. Return in India has been significantly influenced by US at both lag 1 and 2. Some results of this series are similar with results of Granger causality test. Return of Indonesia is integrated with the return series of Mexico, South Korea and Indonesia itself at lag 2. Return series of Japan is integrated with Mexico, Russia and USA both at lag 1 and 2. Stock Return of Malaysia is integrated with Philippines and Taiwan at both lags 1 and 2. It is also significantly influenced by South korea at lag 1 and Malaysia at lag 2. Mexico's return is also integrated with India and South korea at both lag 1 and 2. Return series of Philippines is influenced by Socks return series of Indonesia, Japan, Taiwan, USA, Brazil, India at lag 1and Japan Mexico, Russia at lag 2. Rrussia is influenced by Japan and Mexico at both Lags 1 and 2 as well as influenced by return series of Indonesia, Philippines and USA at lag 1. Rsouthkorea is significantly influenced by Rindonesia at lag 1 and Rjapan, Rmexico, Rtaiwan at lag 2. Rtaiwan is Integrated with the return series of Malaysia, Mexico, South korea, Taiwan, USA at Lag 2 and Russia, South Korea at lag 1. Return at US market is significantly affected by Rjapan, Rrussia at both Lags 1 and 2. It is also influenced by Rsouth Korea at lag 1 and Taiwan at lag 2. VAR Results regarding China is similar to Granger causality test. Rchina is influenced by Rtaiwan at lag 1 and China itself at lag 2. Rbrazil is influenced by Rphilippines, Rrussia, Rtaiwan at lag 1 while Rusa at lag 2 and from Rjapan at both lags 1 and 2.

Table 4: Vector Auto-Regression Estimates

	RINDIA	RINDO-NESIA	RJAPAN	RMALY-ASIA	RMEX-ICO	RPHILI-PPINES	RRUS-SIA	RSOUTH-KOREA	RTAI-WAN	RUSA	RCHINA	RBRA-ZIL
RINDIA(-1)	-0.102	-0.010	0.009	0.0262	0.029	0.026	0.035	0.001	-0.0198	0.015	0.004	0.03
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RINDIA(-2)	0.029	-0.001	0.018	0.0141	0.028	0.004	-0.002	0.0003	0.006	-0.006	0.001	-0.002
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RINDO-NESIA(-1)	0.026	0.023	0.010	-0.017	0.012	0.027	0.052	0.070	0.005	-0.006	0.012	0.011
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
RINDO-NESIA(-2)	-0.012	0.030	-0.007	0.022	0.021	0.012	0.017	0.018	0.020	0.006	0.019	0.026
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RJAPAN(-1)	-0.012	0.008	-0.171	-0.021	0.018	0.141	0.131	0.007	0.007	0.055	0.006	0.045
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RJAPAN(-2)	-0.004	0.017	0.007	0.027	-0.004	0.110	0.136	0.043	0.021	0.042	-0.005	0.086
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
RMALYA-SIA(-1)	0.001	0.011	-0.000	-0.156	-1.480	0.015	-0.011	-0.007	0.013	0.002	-0.024	-0.054
	(0.015)	(0.015)	(0.014)	(0.014)	(0.014)	(0.013)	(0.024)	(0.017)	(0.013)	(0.011)	(0.014)	(0.020)
RMALYA-SIA(-2)	0.036	-0.023	-0.031	0.062	-0.041	0.026	-0.017	0.031	0.040	0.014	0.004	0.004
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RMEXICO(-1)	0.009	0.043	0.098	-0.007	-0.036	0.015	0.092	0.012	0.004	0.010	0.001	0.006
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RMEXICO(-2)	0.038	0.004	0.155	-0.003	-0.005	0.064	0.146	0.039	0.033	-0.006	0.013	0.005
	(0.015)	(0.015)	(0.013)	(0.014)	(0.014)	(0.013)	(0.024)	(0.018)	(0.013)	(0.011)	(0.014)	(0.020)
RPHILI-PPINES(-1)	0.015	-0.020	0.023	0.0421	-0.009	-0.033	0.095	0.011	-0.009	0.012	0.002	0.070
	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RPHILI-PPINES(-2)	0.025	-0.003	-0.002	0.055	0.018	0.022	0.030	0.032	-0.008	0.010	-0.010	0.030
	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)	(0.019)	(0.01)	(0.01)	(0.01)	(0.02)
RRUSSIA(-1)	0.019	-0.002	0.030	0.010	-0.009	0.001	-0.035	0.006	0.021	0.029	0.016	0.031
	(0.01)	(0.01)	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
RRUSSIA(-2)	0.016	-0.015	0.026	0.007	0.006	0.022	0.015	0.001	0.009	0.021	-0.002	0.019
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
RSOUTH-KOREA(-1)	0.004	-0.008	-0.019	0.026	0.027	0.019	0.029	-0.063	0.108	0.028	0.009	0.022
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
RSOUTH-KOREA(-2)	0.011	0.035	0.007	-0.002	0.043	0.012	0.010	0.018	0.076	0.010	0.010	-0.015
	(0.012)	(0.013)	(0.010)	(0.011)	(0.011)	(0.011)	(0.020)	(0.014)	(0.010)	(0.010)	(0.012)	(0.016)
RTAIWAN(-1)	0.074	0.002	-0.003	0.036	0.018	0.029	-0.017	-0.003	-0.098	0.014	0.030	0.054
	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RTAIWAN(-2)	0.029	-0.017	0.026	0.086	0.027	-0.003	0.046	0.086	0.062	0.035	-0.017	0.034
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)

RUSA(-1)	0.046	0.034	0.065	0.023	-0.006	0.036	0.067	-0.013	0.030	-0.187	-0.045	0.119
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
RUSA(-2)	0.047	0.008	0.083	0.012	-0.022	0.014	0.0509	0.022	0.045	-0.026	-0.036	0.117
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
RCHINA(-1)	0.010	0.021	-0.015	-0.008	0.023	-0.008	0.011	-0.003	0.017	-0.032	-0.110	-0.006
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
RCHINA(-2)	0.026	9.71	0.014	-0.005	0.015	0.011	0.043	0.006	0.019	-0.023	0.038	-0.008
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.013)	(0.02)	(0.02	(0.01)	(0.01)	(0.01)	(0.02)
RBRAZIL(-1)	0.018	-0.023	-0.008	0.001	0.004	0.022	-0.001	-0.000	0.011	-0.008	-0.001	-0.136
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
RBRAZIL(-2)	-0.001	0.019	-0.005	-0.031	-0.003	0.005	-0.037	-0.004	0.019	0.006	0.011	-0.032
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
C	0.000	0.000	-0.000 300	6.050	0.000	4.11E -05	0.000	0.000	-8.90E -05	8.43E -05	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Note: Standard errors in ( ).

In order to quantify the extent to which the twelve indices are influenced by each other Variance Decomposition Analysis has been carried out. The results of the variance decomposition analysis of daily returns of the 12 countries are reported in table 5. Overall, each market explains a larger proportion of its own variation than foreign markets.

Variance decomposition analysis of stock return at India shows at first day stock return of India is composed 100 percent by itself. The own market contribution to variance decomposition for India lies from 100 per cent to 98.27 per cent. It was shown from the table that Indian Stock Exchange has the influence of Taiwan, USA, Russia, Mexico and Malaysia. Jakrata stock exchange of Indonesia also explains a larger proportion of its own variations and has marginal deviation influence from outside countries i.e., Mexico and South Korea. The linkages results of Nikkie 225 (Tokyo Stock Exchange –Japan) are somewhat similar to VAR. More than 99% return at Japan is composed by itself at day 1 and it goes down day by day and on 10th day its composition is 95%. India leaves a visible impact at day 1 but after that Mexico have a significant influence on variance composition of Japanese stock market. Malaysia, Mexico and South Korea explain a larger proportion of its own variation. Decomposition of Variance at Philippines decreased from 99.74% at day one to 94.89% at 10th day. Japan has a significant effect on the variance composition of Philippines. Indonesia, Mexico, Japan, India. USA, Brazil, Taiwan and South Korea also explain variance composition of Philippine's stock market. Result shows decomposition of variance at Russia by its own decreased from 98.13% at first day to 94.86% at tenth day. Mexico and Japan have exerted significant influence on returns of Russia stock market. Indonesia, Philippines and USA also leave some effect on the stock returns of Russia. A glance of this table offers that day one 98.62% of return is decomposed by Taiwan itself, but it decreased significantly by day 10. South Korea has a significant influence on the Taiwan's stock return. Malaysia, Mexico, Russia and USA also influence the stock return of Taiwan. Large proportion of variation at USA has been expressed by itself. Japan, Russia, Mexico, Indonesia and India have shown effect on stock returns in case of USA. More than 99% of China's stock market is influenced by itself from day 1 to day 10. It shows that stock market of China is independent of the International influence. The result is also supported by Granger casualty test and Vector Auto Regression. Results of this table shows stock market of Brazil is highly influenced by international markets. At 1st day composition of variance at this market is only 86.13 percent by itself to 84.67 percent on 10th day. This table indicates that return at Brazil stock market is highly influenced by USA.

Table 5: Decomposition of Variance

PERIOD	S.E.	RINDIA	RINDONESIA	RJAPAN	RMALYASIA	RMEXICO	RPHILIPPINES	RRUSSIA	RSOUTH KOREA	RTAI	RUSA WAN	RCHINA	RBRAZIL
Decomposition of Variance for Rindia													
1	0.01	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	98.28	0.12	0.04	0.12	0.20	0.11	0.18	0.11	0.46	0.27	0.07	0.05
10	0.01	98.27	0.12	0.04	0.12	0.20	0.11	0.18	0.11	0.46	0.27	0.07	0.05
Decomposition of Variance for Rindonesia													
1	0.01	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	0.01	99.31	0.02	0.04	0.14	0.03	0.06	0.17	0.02	0.03	0.04	0.13
10	0.01	0.01	99.31	0.02	0.04	0.14	0.03	0.06	0.17	0.02	0.03	0.04	0.13
Decomposition of Variance for Rjapan													
1	0.01	0.07	0.01	99.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	0.14	0.04	95.15	0.11	3.24	0.08	0.39	0.15	0.08	0.54	0.06	0.01
10	0.01	0.14	0.04	95.15	0.11	3.24	0.08	0.39	0.15	0.08	0.54	0.06	0.01
Decomposition of Variance for Rmalaysia													
1	0.01	0.10	0.00	0.00	99.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	0.17	0.13	0.20	97.98	0.03	0.38	0.05	0.16	0.68	0.05	0.01	0.15
10	0.01	0.18	0.13	0.20	97.98	0.04	0.38	0.05	0.16	0.68	0.05	0.01	0.15
Decomposition of Variance for Rmexico													
1	0.01	0.00	0.22	0.00	0.09	99.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	0.14	0.32	0.04	0.25	98.55	0.04	0.04	0.41	0.09	0.04	0.07	0.01
10	0.01	0.14	0.32	0.04	0.25	98.55	0.04	0.04	0.41	0.09	0.04	0.07	0.01
Decomposition of Variance for Rphilippines													
1	0.01	0.02	0.13	0.05	0.01	0.06	99.74	0.00	0.00	0.00	0.00	0.00	0.00
5	0.01	0.16	0.32	2.72	0.09	0.99	94.90	0.26	0.13	0.11	0.23	0.02	0.08
10	0.01	0.16	0.32	2.72	0.09	0.99	94.89	0.26	0.14	0.11	0.23	0.02	0.08
Decomposition of Variance for Rrussia													
1	0.02	0.04	0.01	0.33	0.00	1.07	0.42	98.13	0.00	0.00	0.00	0.00	0.00
5	0.02	0.10	0.22	1.38	0.02	2.27	0.70	94.87	0.08	0.10	0.12	0.06	0.08
10	0.02	0.10	0.22	1.38	0.02	2.27	0.70	94.86	0.08	0.11	0.12	0.06	0.08
Decomposition of Variance for Rsouth Korea													
1	0.02	0.00	0.14	0.08	0.01	0.13	0.03	0.01	99.59	0.00	0.00	0.00	0.00
5	0.02	0.01	0.54	0.21	0.09	0.28	0.10	0.02	98.26	0.44	0.04	0.01	0.00
10	0.02	0.01	0.54	0.21	0.09	0.28	0.10	0.02	98.26	0.44	0.04	0.01	0.00
Decomposition of Variance for Rtaiwan													
1	0.01	0.09	0.04	0.00	0.08	0.06	0.03	0.03	1.05	98.63	0.00	0.00	0.00
5	0.01	0.17	0.21	0.11	0.26	0.28	0.04	0.17	3.36	95.03	0.25	0.06	0.07
10	0.01	0.17	0.21	0.11	0.26	0.28	0.04	0.17	3.36	95.02	0.25	0.06	0.07
Decomposition of Variance for Rusa													
1	0.01	0.11	0.09	0.08	0.03	0.00	0.23	0.02	0.03	0.01	99.39	0.00	0.00
5	0.01	0.15	0.13	0.60	0.07	0.13	0.26	0.44	0.21	0.17	97.61	0.18	0.04
10	0.01	0.15	0.13	0.60	0.07	0.13	0.26	0.44	0.21	0.17	97.61	0.18	0.04
Decomposition of Variance for Rchina													
1	0.01	0.03	0.00	0.01	0.03	0.15	0.01	0.00	0.00	0.00	0.01	99.74	0.00
5	0.01	0.04	0.07	0.02	0.09	0.17	0.03	0.08	0.02	0.14	0.17	99.16	0.02
10	0.01	0.04	0.07	0.02	0.09	0.17	0.03	0.08	0.02	0.14	0.17	99.16	0.02
Decomposition of Variance for Rbrazil													
1	0.02	0.09	0.21	0.01	0.30	0.00	0.66	0.00	0.02	0.00	12.57	0.01	86.13
5	0.02	0.14	0.28	0.57	0.50	0.11	0.85	0.21	0.10	0.15	12.40	0.02	84.67
10	0.02	0.14	0.28	0.57	0.50	0.11	0.85	0.21	0.10	0.16	12.40	0.02	84.67

6. Findings of Cointegration Analysis

Table 6 shows the results of Johansen' cointegration test on the stock markets price index series of twelve countries namely Taiwan, Brazil, South Korea, China, India, Malaysia, Mexico, Philippines, Indonesia, Russia, Japan and USA. Although there are two categories of the cointegration test, vis., Engle-Granger test and Johansen's test; the first one is applicable on a case with maximum of two variables while the latter can be applied on a case with more than two variables. Hence, we apply the Johansen's cointegration test on our series. Out of the five specifications of Johansen cointegration test, the result of this test assumes that series under reference have intercept, no trend in CE and test VAR. In table 6 the first column is the number of cointegration relations under the null hypothesis, the second column is the ordered eigenvalue , the third column is the trace statistics, the fourth and fifth columns are critical values at 5 and 1 percent, the sixth column is the number of cointegration relations under the null hypothesis for maximum Eigenvalue, the eighth column is the test statistics for the eigenvalue, the ninth and tenth columns are 5 and 1 percent critical values for the eigenvalue. To determine the number of cointigration relations r conditional on the assumptions made about the trend, we can proceed sequentially from r=0 to r=k-1(in this k=12 market series).

Table 6: Cointegration Test Results

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
1	2	3	4	5
None *	0.034	575.121	374.908	0.000
At most 1 *	0.024	400.169	322.069	0.000
At most 2 *	0.013	275.791	273.189	0.039
At most 3	0.010	211.774	228.298	0.223
At most 4	0.008	159.405	187.470	0.523
At most 5	0.007	120.153	150.559	0.674
At most 6	0.006	84.399	117.708	0.851
At most 7	0.004	53.965	88.804	0.961
At most 8	0.002	34.313	63.876	0.969
At most 9	0.002	22.565	42.915	0.894
At most 10	0.001	11.408	25.872	0.851
At most 11	0.001	5.344	12.518	0.548

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
6	7	8	9	10
None *	0.034	174.952	80.870	0.000
At most 1 *	0.024	124.378	74.837	0.000
At most 2	0.013	64.017	68.812	0.131
At most 3	0.010	52.368	62.752	0.344
At most 4	0.008	39.252	56.705	0.772
At most 5	0.007	35.754	50.600	0.666
At most 6	0.006	30.434	44.497	0.664
At most 7	0.004	19.652	38.331	0.950
At most 8	0.002	11.748	32.118	0.996
At most 9	0.002	11.157	25.823	0.919
At most 10	0.001	6.064	19.387	0.953
At most 11	0.001	5.344	12.518	0.548

Notes: Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

The result indicates that out of twelve stock index series only three in trace statistics reject the null hypothesis at 0.05%. Hence the series do not have linear deterministic trend and they are significantly integrated. But the Maximum Eigenvalue statistics presented in columns sixth to tenth depicts only in two series statistics where we can reject the null hypothesis at 0.05% significant level. It implies that the series does not have a linear deterministic trend and that are significantly integrated. So, it is better to choose two series that are common in both for further analysis that have a linear deterministic trend and that are significantly integrated.

7. Conclusion

This paper analysed the level of stock markets integration in 10 emerging economies and two developed economies by examining the transmission of market movements. While the literature suggests the existence of significant interactions between the various stock markets, but the empirical results of this study shows lack of uniformity between the results provided by various models. Results of Johansen's cointegration test shows only two cointegrating equation while Vector Error correction model confirms only one cointegrating equation out of twelve.

The results of study depicts that returns in these stock markets are not inter-related and there is no long term equilibrium, though in few cases the return series in one stock markets had causal influence on return in other stock market. Further, there is largely uniformity in the results of various models. Results of different-2 models found return series of China is independent. Our results suggest that international investors can achieve long term gains by investing in the stock markets as the market under study have been generally independent, which means that the opportunities for diversification do exist in these countries.

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