Emerging Stock Market Integration Among Selected SAARC and Developed Countries: An Empirical Analysis of ShortTerm and Long-Term Linkages

Vanita Tripathi*
Ritika Seth**

ABSTRACT

This paper has tried to explain the presence of integration among the stock markets of selected SAARC countries within themselves as well as with selected three Developed countries of the world. The data set consists of daily closing values of benchmark stock indices of selected SAARC and developed countries for more than 27 years period starting from November 5th, 1991 till December 31st, 2018. The data is analysed using Unit Root tests, Correlation Analysis, Vector Autoregression, Granger Causality Test, Impulse Response Analysis, Johansen's Co-integration Test and Vector Error Correction Model. The results indicate the strong influencing nature of USA economy which is found to significantly affect the stock market behaviour of selected SAARC countries both in the short term as well as long term specially after the Asian and Global Financial Crisis. Not much integration has been found among the stock markets of SAARC countries. The extent of linkages among the stock markets has been found to intensify with the passage of time because of opening up of economies, capital market reforms and advancements in Technology. This study is unique because of its emphases on selected SAARC countries, for which there is dearth of literature. Moreover, the time period of study is substantial. Sub-period analysis has also been carried on to check for the impact of Asian and Global Financial Crisis. Therefore, its results can be of great help in formulating portfolio diversification strategies by potential investors. The findings also have noteworthy value for government, regulators, policy makers, academicians and researchers.

Keywords: Financial Econometrics, Integration, SAARC, Financial Crisis, Unit Root, Short Term Linkages, Long Term Co-Integration.

JEL Classification: C58, G01, F36, G15

* Professor, Department of Commerce, Delhi School of Economics, University of Delhi, New Delhi – 110007. Email: vanitatripathi1@yahoo.co.in

** PhD. Research Scholar, Department of Commerce, Delhi School of Economics, University of Delhi, New Delhi – 110007. Email: ritika.pisces@yahoo.co.in, (Corresponding Author)

1. INTRODUCTION

The economies of most of the countries have become more open and liberalized since the last two decades on account of undertaking several reforms in the capital markets, technological advancements, IT revolution, reduction in tariffs and controls, liberalized capital movements, easier international cross listing and trading of securities and so on. The economic growth of any particular economy is not isolated in today's time; rather it depends much on its integration and regional economic alliance with the other countries. There is greater opportunity for trade and economic development for a particular economy if it has close association with the economies of other countries. However, such close association does not always bring the benefits rather, it might also lead to transmission of adverse economic conditions existing in other countries. Therefore, studying the correlation and information linkages among the global markets holds significant importance while taking financial decisions in relation to investment and risk management as they have a bearing on potential benefits from international portfolio diversification and also impact the financial stability of a country.

The present study focuses on examining the existence and extent of integration among the stock markets of selected four SAARC countries. South Asian Association of Regional Cooperation (SAARC) is a regional trade bloc that was founded in 1985 in Dhaka with the collaboration of seven South Asian countries (Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka). Afghanistan also became the member of SAARC in 2005. The basic objective behind the formation of SAARC is to bring collective economic, social, technical, and cultural development of all its member states. There is extreme diversity in South Asian region in terms of the size of countries, their level of economic and social development, governance system, weather, languages and culture. The combined economy of all SAARC countries is 3rd largest in the world after the USA and China in terms of GDP (PPP) and is 8th largest in the terms of nominal GDP. While, SAARC nations comprise only 3% of the world's area, their population is close to one-fourth of the world's total population. India can be called a leader in SAARC as it covers over 70% of the total area and population among these eight countries. Moreover, India contributes approximately 80% of SAARC total GDP. Some of the significant steps that

have been initiated in order to improve the integration among the regional capital markets of SAARC countries include SAARCFINANCE (1998), South Asian Federation of Exchanges – SAFE (2000) and South Asian Securities Regulators' Forum – SASRF (2005).

Therefore, the focus of this research paper is mainly on the South Asian markets that have received relatively little research interest by the researchers. There is plethora of studies that have been carried out in the past studying the presence and extent of integration among several countries of the world, but there is hardly any study that has specifically focussed on the emerging economies of South Asia together and extensively as well as their association with the developed economies of the world. Moreover, there is no study that has concentrated on recent data with respect to these four selected SAARC countries and that too for such a long-time span of over 27 years and using the most advanced econometric techniques. Sub-period analysis has also been carried on checking for the impact of Asian and Global Financial Crisis. This makes our study unique and an important contribution to the existing literature.

- **Research Objectives and Hypotheses**

The **Main Research Objectives** of the present study are:

1) To check for the presence of any short-term causal relationship among stock markets of selected SAARC countries among themselves and with the stock markets of three developed countries of the world, namely, USA, UK and Japan.

2) To check for the presence of any long-term co-integration relationship among stock markets of selected SAARC countries among themselves and with the stock markets of three developed countries of the world, namely, USA, UK and Japan.

3) To check for the presence of sensitivity in the stock markets of selected SAARC countries to the shocks created in the stock markets of other countries (SAARC and Developed) in the short term.

All the above stated objectives have been checked for the entire sample period and pre and post Asian Financial Crisis (1997) and Global Financial Crisis (2007).

Research Hypotheses

Based on the above listed research objectives, the following **Null Hypotheses** have been tested:

H_1: There is no significant short-term causal relationship among the stock returns of selected SAARC countries among themselves and with the stock markets of three developed countries of the world, namely, USA, UK and Japan for the entire sample period.

H_2: There is no significant long-term co-integration relationship among the stock returns of selected SAARC countries among themselves and with the stock markets of three developed countries of the world, namely, USA, UK and Japan for the entire sample period.

H_3: The stock markets of selected SAARC countries are not sensitive to the shocks produced in stock markets of other countries (SAARC and selected three developed) in the short term.

H_4: There is no significant change in the extent of short-term causal relationship among the stock returns of selected SAARC countries among themselves and with the stock markets of three developed countries of the world, namely, USA, UK and Japan across sub-periods, i.e., pre and post crisis periods, i.e., Asian Financial Crisis (1997) and Global Financial Crisis (2007).

H_5: There is no significant change in the extent of long-term co-integration relationship among the stock returns of selected SAARC countries among themselves and with the stock markets of three developed countries of the world, namely, USA, UK and Japan across sub-periods, i.e., pre and post crisis periods, i.e., Asian Financial Crisis (1997) and Global Financial Crisis (2007).

H_6: There is no significant change in the extent of sensitivity of stock market of SAARC countries to the shocks created in the stock markets of other countries (SAARC and Developed) in the Short term across sub-periods, i.e., pre and post Asian Financial Crisis (1997) and Global Financial Crisis (2007).

The remaining paper is structured as follows: Section II contains an extensive review of literature on the related subject. Section III explains the

data and methodology employed in order to achieve the said research objectives in Section I. Section IV provides the empirical results and Section V concludes.

2. LITERATURE REVIEW

The study of examining the integration and inter-linkages among stock markets began as early as in 1968 with Grubel's seminal paper. The empirical study by Grubel (1968) was concerned with the range of potential gains that US investors could avail through international diversification. The process of globalisation has been identified as one of the driving forces of market integration. Agmon (1972), Hilliard (1979), Eun and Shim (1989), Becker, Finnerty and Gupta (1990), Koch and Koch (1991) and Arshanapalli and Doukas (1993) are a few names who also tried to find out the correlation among the then developed markets, namely, the USA, the UK, Germany, Australia, Singapore and Japan.

A lot of studies have been carried out in the past in order to study the inter-linkages between the stock markets of Asian countries with the stock market of USA. Arshanapalli, Doukas and Lang (1995), Elyasiani, Perera and Puri (1998), Hashmi and Xingyun (2001) and Bose and Mukherjee (2006) are a few names. It was found that the inter-linkages among the South East Asian markets increased after the Asian Financial Crisis and there was existence of information leadership from the US market to the Asian markets.

Lamba (2004) focused on investigating the markets of India, Pakistan and Sri Lanka in South Asia, and the major developed markets, and did not find Indian market to be the leader among South Asian countries. Narayan, Smyth and Nandha (2004), Sharma and Bodla (2011), Prakash and Kumar (2014) and Tripathi and Seth (2016) also tried exploring the extent of linkages between the stock markets of South Asian countries and indicated the presence of long-run relationship and the existence of short run linkages as well. Khan and Aslam (2014) investigated the co-integration of Pakistan stock exchange with the other major stock exchanges of south Asia and indicated the presence of co-integration of Pakistan's stock market with the market of India, Indonesia, Malaysia and Singapore. Latha and Kumar (2016) examined the short and long run correlating, causal and

cointegrating relationship between Indian and other major developed and developing markets. They found Indian stock market to have high correlating, short run causal and long run cointegrating relationship with Brazil, China, Russia and South Africa among the developing countries and with Australia and Canada among the developed ones. It was further established that while the correlations significantly reduced post crisis, causal and cointegrating relationships increased post crisis. Sehgal, Pandey and Deisting (2018) also empirically evaluated the dynamic co-movements between the equity market indices of the member countries of the SAARC region. The results obtained from both time invariant and time varying copula models indicated very low level of financial integration in the region due to almost zero dependencies between the equity markets of SAARC member countries.

Dhal (2009) tried to capture the impact of global financial crisis of 2008 on the market integration and found that the global crisis had a very moderating impact on the long-run coefficients pertaining to the integration among the regional and global markets. Srivastava, Bhatia and Gupta (2015) also investigated the integration of the developed market of the US and emerging Asian stock markets, namely, Japan, Singapore, Hong Kong and India, pre and post global financial crisis from the perspective of international portfolio diversification. They found the existence of strong long-term integration but the lack of short-term integration of Indian stock market with global markets. Tripathi and Sethi (2010) found Indian stock market to be integrated with the US stock market and in their other paper (Tripathi and Sethi (2012)), they found that both the short run and long run integration of the Indian stock market with Advanced emerging markets has increased over the study period. Tripathi, Seth and Kumar (2013) also conducted a study where they found contagion effect on Indian economy while examining the short run inter-linkages and long run co-integration between India and some major economies of the world namely, US, Europe, other emerging markets and World economy.

The literature can be summarized as increase in the level of integration among the international stock markets with the passage of time. A lot of studies have considerably supported this result as some of them reported above. Therefore, a comprehensive attempt has been made to ponder over such relationship between major equity markets of SAARC countries and

Developed countries, incorporating the impact of Asian and Global Financial crisis.

3. DATA AND METHODOLOGY

A. Data

The data consists of closing values of daily benchmark stock indices of four out of eight SAARC countries, namely, Bangladesh, India, Pakistan and Sri Lanka and three developed countries of the world, namely, USA, UK and Japan. The Time period of study spans over 27 years period starting from November 5th, 1991 till December 31st, 2018. Such a long period holds great significance in reaching at important conclusions. There have been significant economic developments that took place in each of the SAARC countries post 1991 affecting the performance of stock markets and ultimately the stock returns. Because of several regional agreements, the trade and commerce has also grown in SAARC countries post 1991. Most of the SAARC countries are now considered as Emerging Economies of the world.

Only four countries out of the eight (SAARC) countries could be included in the study because of non-availability of enough stock indices data for the other four markets. The stock markets of Nepal, Bhutan and Maldives are not much developed and there is very little trading activity. Nepal Stock Exchange Limited (NEPSE) is the only Stock Exchange of Nepal that operates under Securities Exchange Act, 1983. The Royal Securities Exchange of Bhutan is the only stock exchange in Bhutan founded in 1993 and it is one of the world's smallest stock exchanges, with a market capitalization of around 493.40 million Ngultrum (Nu. – Bhutanese Currency) and only 21 listed companies as of June 2018. It has only 3 trading days, Monday, Wednesday and Friday. There are lot of restrictions to deal in Bhutanese stock market, for instance, International companies are not allowed to be listed in Bhutan and they are also not permitted to work in the country. The Maldives Stock Exchange was established on April 14, 2002 and it is operated by the Maldives Stock Exchange Company Private Ltd., with effect from January 24, 2008. Currently, only 10 (8 Equity and 2 Debt) companies are listed on the Maldives Stock Exchange (MSE). The stock exchange of Afghanistan is not yet operational. (Tripathi and Seth, 2016).

The three developed countries chosen for analysis are USA, UK and Japan. The choice of developed countries is based upon the logic that USA economy is the world's largest national economy and has significant influence on the rest of the world including South Asian countries; UK's stock exchange is the largest stock exchange in Europe and can be considered as the next substantial and influencing economy of the world; and Finally, Japan's stock exchange is regarded as the Asian giant and third largest stock exchange in the world in terms of market capitalization. The stock exchanges are chosen for each of the selected country based on Volume of trading taking place at that exchange. The ones with the largest volume or Market Turnover are chosen and then the benchmark stock index of that exchange is selected for further study.

The stock market indices for Bangladesh, India, Pakistan and Sri Lanka are Dhaka Stock Exchange Broad Index (DSEX), Bombay Stock Exchange Sensitive Index (BSE Sensex), Karachi Stock Exchange 100 Index (KSE100) and Colombo Stock Exchange All Share Index (CSEALL), respectively. The benchmark indices taken up in the study of three developed countries of USA, UK and Japan are S&P 500 Index, FTSE 100 Index and Nikkei 225 Index respectively. All the data has been collected from Bloomberg Database denominated in their respective local currency units and adjusted for dividends and splits. The data has been filtered to consider only those dates where all the selected stock markets were open for trading.

It is best to use daily frequency data for meeting research objectives as stock markets are dynamic in nature where the securities are dealt on real time basis. Therefore, to capture the potential interactions, daily data fits in the best. Also, we expect the spillovers between financial markets to take place within very short time intervals due to modern information technology.

The whole analysis has been done for the entire sample period as well as for the sub-periods. The entire time-period of study is divided into three sub-periods based on the dates of Asian Financial Crisis (1997) and Global Financial Crisis (2007). The purpose is to check if there is any change in the extent of Short-term and Long-term integration among the selected countries because of the Crisis situation.

B. Methodology

The closing values of all the stock indices have been converted into Natural Logarithm form to smoothen out the fluctuations and to create a linear data series for further analysis of data. Such conversion has the advantage that it removes most first-order serial correlation and logarithm series are of greater theoretical interest. The closing stock indices values are considered for analysis for the very reason that the closing prices are after the adjustment of noise generated during the trading period.

The daily log returns are calculated using the following formula:

$$R_t = ln\left(\frac{P_t}{P_{t-1}}\right) \quad \text{..... Equation 1}$$

Where, P_t = Closing stock indices value of day (t).

P_{t-1} = Closing stock indices value of day (t-1).

The following statistical and econometrics techniques are applied to check the **Integration** of selected four stock markets of SAARC countries among themselves as well as with the selected three developed countries of the world:

1. Karl Pearson Coefficient of Correlation

Karl Pearson's Coefficient of Correlation is a very widely used mathematical tool to find out the degree and direction of the relationship between two linear variables. It is also called as the "Pearson R test".

The formula for calculation of Coefficient of Correlation (r) can be seen as:

$$r = \frac{\sum(X-\bar{X})(Y-\bar{Y})}{\sqrt{\sum(X-\bar{X})^2}\sqrt{\sum(Y-\bar{Y})^2}} \quad \text{..... Equation 2}$$

Where, $\bar{X}$ = Mean of Variable X

$\bar{Y}$ = Mean of Variable Y

2. Vector Auto Regression (VAR)

Vector Auto Regression (VAR) Model and Granger Causality test are the two econometric tools usually used for predicting the inter-linked series.

IHS (2013): "The Vector Autoregression is commonly used for forecasting

systems of interrelated time series and for analysing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modelling 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 VAR is:

$$Y_t = A_t y_{t-1} + \ldots + A_p y_{t-p} + Bx_t + \in_t \quad \text{..... Equation 3}$$

Where, y_t is a k vector of endogenous variables, x_t is a d vector of exogenous variables, A_1, ……, A_p and B are matrices of coefficients to be estimated, and $\in_t$ 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.

Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneously is not an issue and OLS yields consistent estimates. Moreover, even though the innovations $\in_t$ may be contemporaneously correlated, OLS is efficient and equivalent to GLS since all equations have regressors." (p. 553).

3. Granger Causality Test

Granger causality test is a test of prediction whose mathematical formulation is based on linear regression modelling of stochastic processes (Granger 1969). As per this test, if a signal Y is "GRANGER CAUSED" by signal X, it means that signal Y can be predicted not only from the information contained in its own past values but from the information contained in the past values of X as well.

This test can be mathematically explained with the help of following two regressions equations that show the direction of causality among stock market indicators of SAARC countries.

$$\boldsymbol{X_t = \alpha_1 + \sum_{p=1}^{m} \beta_{1p} X_{t-p} + \sum_{p=1}^{m} \gamma_{1p} Y_{t-p} + e_{1t}} \quad \text{..... Equation 4}$$

$$\boldsymbol{Y_t = \alpha_2 + \sum_{p=1}^{m} \beta_{2p} Y_{t-p} + \sum_{p=1}^{m} \gamma_{2p} X_{t-p} + e_{2t}} \quad \text{..... Equation 5}$$

Where, Y_t and X_t are the test variables, e_{1t} and e_{2t} are mutually uncorrelated white noise error terms, t signifies the time period, p is the number of lags and m is the maximum number of lagged observations included in the model. The null hypothesis is $\gamma_1 = \gamma_2 = 0$ for all p's versus $\gamma_1 \neq \gamma_2 \neq 0$ for at least some p's. If the coefficient γ_1 is significant but γ_2 is not, then Y granger causes X. However, in the reverse case, X granger causes Y. And, if both γ_1 and γ_2 are significant then causality runs in both directions. Finally, if both γ_1 and γ_2 are not statistically different from zero, then X and Y will be independent.

The optimal lag length is decided using AIC (Akaike Information Criterion) and SC (Schwarz Information Criterion). Here, the short-term causal relationship among the stock markets of selected four SAARC countries among themselves and with the stock markets of selected three Developed countries is checked with the help of VAR and Granger Causality Test.

4. Impulse Response Analysis

IHS (2013): "A shock to the *i*-th variable not only directly affects the *i*-th variable but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VAR. An impulse response function traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables." (p. 561).

Impulse Response Analysis is carried out to measure the response of stock market indicators of one country on account of the shocks emerged in the stock market of another country with the help of graphs.

5. Johansen's Co-integration Test

Johansen Co-integration test is applied on non-stationary series to check for the presence of any long run equilibrium relationship. When two variables are co-integrated, it implies that the two-time series cannot wander off in opposite directions for very long without coming back to a mean distance eventually. But it doesn't mean that on a daily basis the two series have to move in synchrony at all.

IHS (2013): "Consider a VAR of order p

$$\boldsymbol{Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots\ldots\ldots + A_p Y_{t-p} + B X_t + \varepsilon_t} \quad \ldots\ldots \text{Equation 5}$$

Where, Y_t is a k-vector of non-stationary I(1) variables, X_t is a d-vector of

deterministic variables and ε_t is a vector of innovations. We may re-write the VAR as:

$$\Delta Y_t = \pi Y_{t-1} + \sum_{i=1}^{p-1} \tau_i \Delta Y_{t-i} + BX_t + \varepsilon_t \quad \text{..... Equation 7}$$

Where,

$$\pi = \left(\sum_{i=1}^{p} Ai\right) - I \quad \text{..... Equation 8}$$

$$\tau_i = -\sum_{j=i+1}^{p} Aj \quad \text{..... Equation 9}$$

Granger's representation theorem asserts that if the coefficient matrix π has reduced rank r<k, then there exist k*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 co-integrating relations (the *co-integrating rank*) and each column of β is the co-integrating vector. 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 ." (p. 849-850).

Johansen Co-integration test is applied here to check for long run co-integrating relationship between the stock markets of SAARC countries and selected three developed countries.

6. Vector Error Correction Model (VECM)

Further, Vector Error Correction Model (VECM) has been applied on those pair of variables which have long run causal relations to see which variable sacrifices more or is the 'follower' in order to attain the long-term equilibrium position.

A Vector Error Correction Model (VECM) is a restricted VAR that has Co-integration restrictions built into the specification, so that it is designed for use with non-stationary series that are known to be co-integrated. The VEC specification restricts the long-run behaviour of the endogenous variables to converge to their co-integrating relationships while allowing a wide range of short-run dynamics. The Co-integration 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.

E-views 8.0 package program has been used for arranging the data and implementation of econometric techniques.

4. EMPIRICAL RESULTS

1. ADF and PP Unit Root Tests

The result of ADF and PP Unit Root test suggest that the stock returns series of all the selected four SAARC countries are stationary at level. The results are reported in Table 1.

Table 1: Results of ADF and PP Unit Root Test at level

Log Returns of Stock Index	Level			
	ADF		PP	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
	t – statistics			
Bangladesh	-61.76824*	-61.77336*	-62.25878*	-62.21338*
India	-59.12852*	-59.12166*	-59.20455*	-59.19745*
Pakistan	-38.65643*	-38.65128*	-56.78031*	-56.77394*
Sri Lanka	-23.38757*	-23.38462*	-54.54038*	-54.53420*
*Significant at 1%; **Significant at 5%				

Since the stock returns series are stationary at level, the further analysis of data in order to find out the short-term linkages using Correlation analysis, VAR, Granger Causality Test and Impulse Response Analysis is performed using the stock returns series of selected four SAARC countries. The log series of stock indices of selected countries is taken up for the application of Johansen's Co-integration test and VECM in order to check for Long-term inter-linkages.

2. Correlation Analysis

Table 2: Correlation Coefficients (Daily Data)

Series	Bangladesh	India	Pakistan	Sri Lanka	USA	UK	Japan
Bangladesh	1	-0.01568	0.010478	-0.00638	-0.01078	-0.00286	-0.02384
India		1	0.110903*	0.11947*	0.19778*	0.27885*	0.269198*
Pakistan			1	0.11638*	-0.01745	0.02993	0.046187*
Sri Lanka				1	-0.04059*	0.010398	0.054762*
*Significant at 1%							

As per the results of Correlation Analysis, the stock returns of Bangladesh stock market doesnot appear to be correlated with stock returns of any of the other stock markets, while, on the other hand, Indian stock returns are

positively and significantly related to stock returns of all other stock markets taken up in the study. The reason that can be attributed to this positive and significant correlation of Indian stock market returns with the stock market returns of other countries is the open nature of Indian economy. Over the last two decades, several reforms have taken place in India in order to liberalize and globalize the economy to keep pace with other developed economies of the world. Further, Rapid development in technology (especially in the last one decade) is another major driver of linking the various markets across the world. Internet has enabled the investors to virtually trade/invest in any developed market across the world. Also, stock returns of Pakistan stock market are positively and significantly related to the Indian, Sri Lankan and Japanese stock returns, while, Sri Lankan stock returns has significant correlations with USA and Japanese stock returns, besides Indian stock returns.

Since notable correlations have been found between the variables under consideration, so further econometric tools are applied on them. However, one important point to be noted here is that a high or low degree of correlation surely doesn't signify or rules out causality. It merely points towards the positive or negative linear relationship that exists between the two variables.

3. Vector Auto Regression (VAR) Test

Akaike Information Criterion (AIC) and Schwarz Information Criterion (SC) are applied to calculate the optimal lag length to be used in applying the statistical tools. It has come out to be two as per AIC and one as per SC. Therefore, VAR is applied on Lag one on Stationary series of indices because VAR is a vector extension of the univariate autoregressive (AR) process and therefore, it is applicable only with I(0) variables. The stock markets of two countries are said to be integrated with each other if the t-statistics is more than 2.58 (i.e. at 1% level of significance); 1.96 (i.e. at 5% level of significance) and 1.645 (i.e. at 10% level of significance).

Table 3: Results of VAR - 1 Lag – Daily Data (Log Differenced Series)

VAR Estimates t-statistics in []	Bangladesh	India	Pakistan	Sri Lanka	USA	UK	Japan
Bang(-1)	-0.003584	0.010860	-0.021997	0.012572	0.005714	-0.008444	0.014866
	[-0.22046]	[0.68425]	[-1.44790]	[1.10980]	[0.53391]	[-0.79013]	[1.10335]
Ind(-1)	0.019279	0.018781	0.021730	0.001277	-0.010022	0.000970	0.015484
	[1.09364]	[1.09122]	[1.31899]	[0.10392]	[-0.86361]	[0.08368	[1.05976]
Pak(-1)	0.017767	-0.025500	**0.091460***	**0.029138****	0.010635	-0.012758	0.010464
	[1.01899]	[-1.49788]	**[5.61274]**	**[2.39808]**	[0.92651]	[-1.11304]	[0.72407]
Slk(-1)	-0.029682	0.021280	**0.059919***	**0.152877***	0.014201	0.015057	**0.044401****
	[-1.27342]	[0.93506]	**[2.75062]**	**[9.41160]**	[0.92546]	[0.98256]	**[2.29821]**
USA(-1)	-0.018614	**0.199338***	**0.119635***	**0.093643***	**-0.061365***	**0.244563***	**0.326414***
	[-0.57001]	**[6.24310]**	**[3.91443]**	**[4.10907]**	**[-2.85031]**	**[11.3755]**	**[12.0425]**
UK(-1)	0.007431	-0.012519	0.008780	0.000699	**0.039474*****	**-0.167036***	**0.067129****
	[0.21957]	[-0.37888]	[0.27760]	[0.02965]	**[1.77175]**	**[-7.50763]**	**[2.39318]**
Japan(-1)	-0.006626	-0.005814	-0.009745	-0.010027	-0.012234	**-0.065149***	**-0.164341***
	[-0.31011]	[-0.27870]	[-0.48807]	[-0.67344]	[-0.86981]	**[-4.63830]**	**[-9.28047]**
C	0.000784	0.000673	0.000758	0.000402	0.000489	0.000184	-0.000290
	[2.15471]	[1.89640]	[2.23192]	[1.58636]	[2.04200]	[0.76951]	[-0.96228]

*Significant at 1%
**Significant at 5%
***Significant at 10%

The following inferences can be made from the results obtained for VAR and reported in Table 3:

- Returns in Bangladesh and India has no significant influence on the returns from any other stock exchange at lag 1.
- Returns in Pakistan has an influence on its own returns and returns of Sri Lanka at 1% and 5% level of significance respectively.
- Returns in Sri Lanka has an influence on its own returns at lag 1 at 1% level of significance. Further it has influence on returns of Pakistan and Japan at lag 1 with 1% and 5% level of significance respectively.
- Returns in USA has an influence on the stock returns of all other selected markets including its own returns except Bangladesh stock returns at lag 1 with significance level of 1%. These results again establish the strong nature of USA economy having influence on practically all other countries of the world.
- Returns in UK has an influence on its own returns and returns of USA and Japan.
- Returns in Japan are found to influence its own returns and the returns of

UK at 1% level of significance.

4. Granger Causality Test

Granger Causality test is also applied at one lag length. Also, Stock market is a dynamic market where it is generally not expected that the lag would be more than one or two as it is unlikely that effects of a shock in one market on others will extend beyond two days.

Table 4: Granger Causality Test - 1 Lag – Daily Data (Log Differenced Series)

(Lag 1)	DlogBang	DlogInd	DlogPak	DlogSlk	DlogUSA	DlogUK	DlogJapan
DlogBang	N.A.						
DlogInd		N.A.	→ *				→ *
DlogPak		→ ***	N.A.	↔ *			
DlogSlk				N.A.			
DlogUSA		→ *	→ *	→ *	N.A.	→ *	→ *
DlogUK		→ *	→ *	→ *		N.A.	↔ *
DlogJapan		→ **	→ **				N.A.

* Significant at 1%
** Significant at 5%
*** Significant at 10%

Table 4 shows the result of Granger causality test at one lag length. It is found that the stock returns of all the selected SAARC countries except Bangladesh are granger caused by the changes taking place in the stock markets of developed countries, namely, USA and UK at 1% level of significance. The impact of USA and UK markets on Asian markets can be attributed to the Asian country's trade and financial exposures to these advanced markets, their individual cyclical positions, and their internal/external imbalances. Moreover, most of the investment in Asian markets is dominated by foreign direct investment and portfolio investment held by private investors in US and European economies. This structure is susceptible to "risk-on, risk off" flows, which are often driven by developments in advanced economies, especially when global markets experience stress.

Further, there is two-way causality found between Japanese and Indian stock returns; Pakistan and Sri Lankan stock returns; and UK and Japanese stock returns. Also, Indian stock returns are granger causing Pakistan stock

returns and is granger caused by Bangladesh stock market. One important observation made from the above stated results is that USA stock returns are granger causing the stock returns of all the remaining countries except Bangladesh stock returns. This shows the strong and influencing character of USA economy. This rightly goes with the quote, "If US sneezes, the World catches cold".

5. Impulse Response Analysis

Figure 1: Results of Impulse Response Analysis (Daily Data) – Selected SAARC and Developed countries stock markets

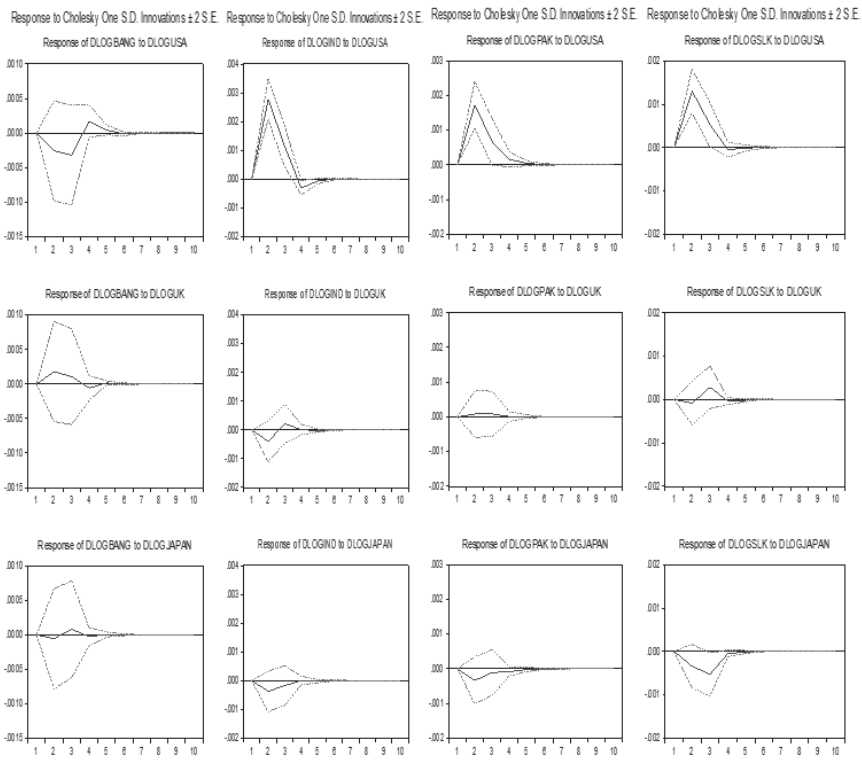

Figure 2: Results of Impulse Response Analysis (Daily Data) – SAARC countries stock markets

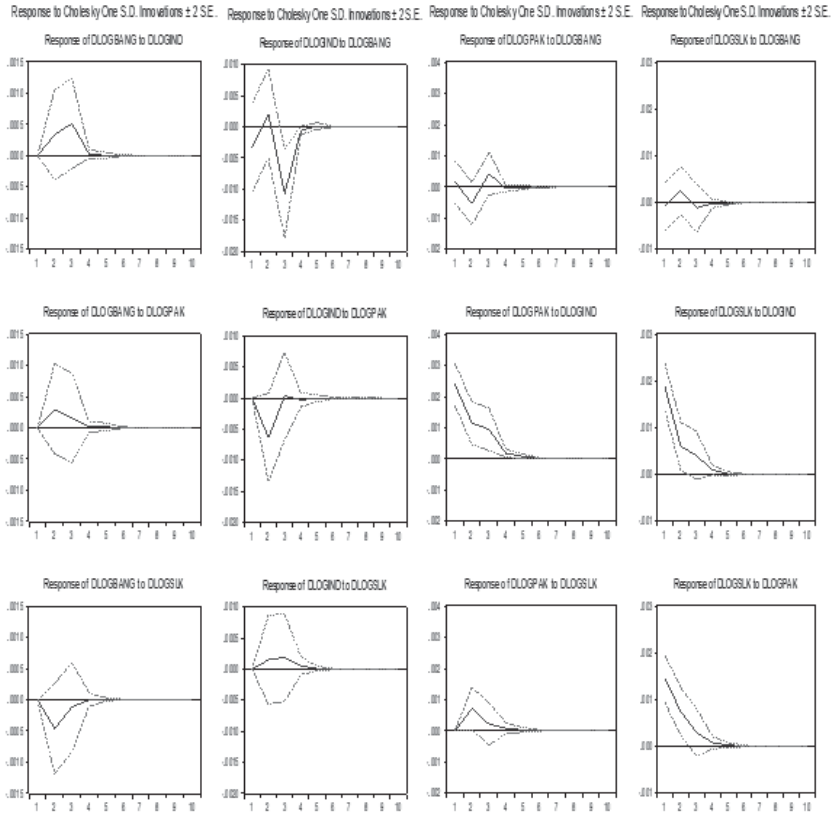

Figure 1 and 2 shows the response of stock market indicators in one market to the one standard deviation shock created in another market. For instance, while, Bangladesh stock market reacts negatively to the shocks created in developed countries, all other selected SAARC countries stock markets responds positively to the shocks that occurred in USA stock market. If there is one standard deviation shock created in the USA stock market, there is a positive response observed in the stock returns of all the selected SAARC countries except Bangladesh stock market, that lasts for upto 4-5 days. However, the response of these markets to the shocks that occurred in UK and Japanese market are not that significant. Again, it can be concluded here that USA economy is the largest economy in the world. A lot of small

and large countries mainly depend on exporting to American markets. As a result, analysts track the news related to USA very closely (for example weekly USA employment numbers, sub-prime crisis of USA, FED interest rate movement etc). Whenever we see any negative news occuring in American markets, it triggers a tsunami in global markets especially in short term.

Further, looking at the responses given by the SAARC countries for the shocks created in other SAARC countries, it is observed that Bangladesh stock market responds positively to one standard deviation shock created in Indian and Pakistan stock market that lasts for upto 3-4 days; Indian stock market responds negatively to one standard deviation shock created in Pakistan stock market that lasts for upto 2-3 days; Pakistan stock market responds positively to one standard deviation shock created in Indian and Sri Lankan stock market that lasts for upto 4-5 days and Sri Lankan stock market also responds positively to one standard deviation shock created in Indian and Pakistan stock market lasting for upto 4-5 days. The results are similar to the ones obtained under Granger Causality Test.

6. Johansen's Co-integration Test

The Johansen co-integration test to check for the long-term relationship based on both Trace and Maximum Eigenvalue statistics is applied using the following models:

1. No Intercept, No Trend;
2. Intercept, No Trend;
3. Linear Intercept, No Trend;
4. Linear Intercept with Trend; and
5. Quadratic Intercept with Trend.

Table 5: Johansen's Co-integration Test – Daily Data (Log Series)

Variables	Test Type	Number of Co-integrating Relations by Model					Presence of Co-integration
		No Intercept, No Trend	Intercept, No Trend	Linear Intercept & No Trend	Linear Intercept & Trend	Quadratic Intercept & Trend	
Bang – Ind	Trace	1	1	0	0	0	Yes
	Max-Eigen	1	1	0	0	0	
Bang – Pak	Trace	1	0	0	0	0	Yes
	Max-Eigen	0	0	0	0	0	
Bang – Slk	Trace	2	0	0	0	0	Yes
	Max-Eigen	0	0	0	0	0	
Bang – USA	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Bang – UK	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Bang – Japan	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Ind – Pak	Trace	0	1	0	0	2	Yes
	Max-Eigen	0	1	1	0	0	
Ind – Slk	Trace	0	0	0	0	1	Yes
	Max-Eigen	0	1	0	0	0	
Ind – USA	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Ind – UK	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Ind – Japan	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Pak – Slk	Trace	2	0	0	0	0	Yes
	Max-Eigen	0	0	0	0	0	
Pak – USA	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Pak – UK	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Pak – Japan	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Slk – USA	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	
Slk – UK	Trace	0	0	0	0	0	No
	Max-Eigen	0	0	0	0	0	

Slk – Japan	**Trace**	0	0	0	0	0	**No**
	Max-Eigen	0	0	0	0	0	
Bang – Ind – Pak – Slk	**Trace**	1	0	0	0	0	**Yes**
	Max-Eigen	0	0	0	0	0	
Bang – Ind – Pak – Slk – USA – UK – Japan	**Trace**	0	0	0	0	0	**No**
	Max-Eigen	0	0	0	0	0	
"0" means Absence of Co-integration							

Table 5 shows the results obtained from using different models of Johansen's Co-integration Test of finding the long term co-integrating relationship between the stock markets of selected four SAARC countries and selected three developed countries considered in the study. It has been found that the stock markets of following pairs of countries are co-integrated in the long term by atleast one of the model, Bangladesh & India; Bangladesh & Pakistan; Bangladesh & Sri Lanka; India & Pakistan; India & Sri Lanka; and Pakistan & Sri Lanka. This implies that the stock markets of all four selected SAARC countries are co-intgrated in the long term. Multi-variate Johansen's co-integration test is also applied using all these five above mentioned models on all the selected SAARC countries as well as total set of countries taken up in the study including both SAARC and developed countries. The results revealed that there is long term co-integrating relationship among the stock market indices of selected SAARC countries together at 5% level of significance. However, all seven selected countries are not co-integrated in the long term. This opens up long term benefits from portfolio diversification across these markets.

7. Vector Error Correction Model (VECM)

Now, let us discuss the results derived from the application of VECM on those pairs of variables that are co-integrated in the long term. While, long term relationship among the variables is established through co-integration test, it is the VECM that helps in capturing the short-term dynamics. Therefore, before the VECM can be performed, there first has to be an evidence of co-integration. VECM results help in knowing which variable among the two long term co-integrated variables makes more adjustment in order to reach this long term co-integrating relationship. The results are summarised in Table 6.

Table 6: Summary of VECM results (Daily Data)

Pair of Countries	Leader	Follower
Bangladesh and India	Indian stock market	Bangladesh stock market
Bangladesh and Pakistan	Pakistan stock market	Bangladesh stock market
Bangladesh and Sri Lanka	Sri Lankan stock market	Bangladesh stock market
India and Pakistan	Pakistan stock market	Indian stock market
India and Sri Lanka	Sri Lankan stock market	Indian stock market
Pakistan and Sri Lanka	Sri Lankan stock market	Pakistan stock market

- **Sub-Period Analysis**

1. ADF and PP Unit Root Test

Table 7: Results of ADF and PP Unit Root Test at level for the Sub-periods

	Level				
Log Returns of Stock Index	**Sub - Periods**	**ADF**		**PP**	
		Intercept	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
		t – statistics			
Bangladesh	**1**	-25.63700*	-25.62516*	-25.83468*	-25.82094*
	2	-36.16015*	-36.32448*	-36.25075*	-36.36870*
	3	-41.51499*	-41.53781*	-41.61457*	-41.62608*
India	**1**	-21.98654*	-21.97918*	-21.99121*	-21.98173*
	2	-37.71956*	-37.80554*	-37.72280*	-37.80714*
	3	-18.39171*	-18.38835*	-40.77290*	-40.76547*
Pakistan	**1**	-21.40880*	-21.43301*	-21.80806*	-21.82308*
	2	-24.00122*	-24.06059*	-35.78091*	-35.78663*
	3	-36.46513*	-36.46128*	-37.21912*	-37.21233*
Sri Lanka	**1**	-19.11373*	-19.09941*	-20.42706*	-20.41475*
	2	-27.23276*	-27.31960*	-33.60177*	-33.64217*
	3	-35.14347*	-35.20355*	-37.73989*	-37.69793*

*Significant at 1%;
**Significant at 5%

The results of ADF and PP Unit Root test reported in Table 7 suggest that the stock returns series of all the four selected SAARC countries are stationary at level across Sub-periods. So, there is no change in the level of stationarity due to the occurrence of Asian and Global Financial Crisis.

2. Correlation Analysis

Table 8: Correlation Coefficients (Daily Data – Sub-Period Analysis)

Series	Sub-Periods	Bangladesh	India	Pakistan	Sri Lanka	USA	UK	Japan
Bangladesh	**1**	1	-0.05242	0.03715	0.000003	-0.02516	0.04203	-0.02585
	2		0.028663	-0.00294	-0.018982	0.024101	0.000749	-0.01342
	3		-0.02154	0.001635	0.004398	-0.03529	-0.03703	-0.03309
India	**1**		1	0.19412	0.1702*	-0.122*	-0.087**	-0.05262
	2			0.15156*	0.08096*	0.14766*	0.21336*	0.27858*
	3			0.12738*	0.14767*	0.40478*	0.53767*	0.45767*
Pakistan	**1**			1	0.3226*	-0.2239*	-0.1522*	-0.1459*
	2				0.08052*	-0.00056	0.038967	0.07075*
	3				0.025600	0.05133**	0.107942*	0.128547*
Sri Lanka	**1**				1	-0.2229*	-0.1562*	-0.1075*
	2					-0.02066	0.012257	0.049126
	3					0.00991	0.089379*	0.160356*

*Significant at 1%
**Significant at 5%

By comparing the results of Correlation coefficients across sub-periods, it has been found that the Bangladesh stock returns are not correlated to the stock returns of any of the other selected countries stock returns across all the three sub-periods, while, on the other hand, Indian stock returns are positively and significantly correlated to the stock returns of Bangladesh and Japanese stock returns as well after Asian Financial Crisis besides having significant correlation with Sri Lankan, USA and UK stock returns even before the occurence of Crisis. Pakistan stock returns are also postively and significantly related to the Sri Lankan stock returns in Sub-period 1 and 2 but the correlation with Sri Lankan stock returns does not remain significant post Global Financial Crisis. Lastly, both Pakistan and Sri Lankan stock returns are negatively and significantly correlated to the stock returns of all the three developed countries stock market in Sub-period 1. However, the correlation turned insignificant in Sub-period 2 and then, positive and significant in Sub-period 3.

3. Vector Auto Regression (VAR) Test

Table 9: Results of VAR - 1 Lag – Daily Data (Log Differenced Series)

VAR Estimates t-statistics in []	Sub-Periods	Bangladesh	India	Pakistan	Sri Lanka	USA	UK	Japan
Bang(-1)	1	-0.042387	0.007889	**-0.06033****	-0.009372	0.007369	**-0.02573*****	**0.050065****
		[-1.03524]	[0.24699]	**[-2.30238]**	[-0.49983]	[0.52890]	**[-1.72794]**	**[2.21880]**
	2	0.040808	0.042843	0.045638	0.039239	-0.026308	-0.004905	-0.042161
		[1.53735]	[1.36088]	[1.28611]	[1.44279]	[-1.24140]	[-0.23261]	[-1.63264]
	3	0.008232	-0.001080	-0.031952	0.023728	0.032135	0.010001	0.019457
		[0.34436]	[-0.04435]	[-1.55673]	[1.58857]	[1.58983]	[0.050075]	[0.81231]
Ind(-1)	1	0.017439	**0.110997***	0.006217	-0.008002	-0.003292	0.023739	0.015934
		[0.32964]	**[2.68957]**	[0.18362]	[-0.33029]	[-0.18286]	[1.23406]	[0.54653]
	2	0.013429	-0.036808	**0.06668****	0.006571	-0.007145	-0.022151	-0.019884
		[0.57292]	[-1.32406]	**[2.12808]**	[0.27361]	[-0.38183]	[-1.18957]	[-0.87199]
	3	0.034643	**-0.05828****	-0.034844	-0.005713	-0.028463	-0.000241	0.032656
		[1.21569]	**[-2.00722]**	[-1.42401]	[-0.32082]	[-1.1812]	[-0.01011]	[1.14361]
Pak(-1)	1	0.080994	**-0.11418****	**0.142734***	-0.006955	-0.007825	-0.013321	-0.038171
		[1.20346]	**[-2.17490]**	**[3.31408]**	[-0.22567]	[-0.34167]	[-0.54436]	[-1.02920]
	2	0.014187	-0.002812	**0.05024*****	**0.04638****	**0.03443****	-0.002406	0.014600
		[0.70858]	[-0.11840]	**[1.87697]**	**[2.26114]**	**[2.15381]**	[-0.15127]	[0.74952]
	3	-0.018376	-0.003115	**0.134571**	-0.010826	-0.019462	-0.025715	0.027495
		[-0.66866]	[-0.11127]	**[5.70284]**	[0.63046]	[-0.8375]	[-1.11996]	[0.99845]
Slk(-1)	1	-0.062714	0.012662	0.075310	**0.273715***	**0.05886*****	0.013263	0.077673
		[-0.67230]	[0.17400]	[1.26155]	**[6.40707]**	**[1.85422]**	[0.39101]	[1.51093]
	2	-0.040793	0.013175	0.037518	**0.109365***	-0.026474	-0.007221	0.018007
		[-1.58093]	[0.43051]	[1.08764]	**[4.13673]**	[-1.28514]	[-0.35227]	[0.71731]
	3	0.003403	0.049919	**0.105336***	**0.176369***	**0.08291****	**0.06868****	**0.07549****
		[0.08918]	[1.28407]	**[3.21494]**	**[7.39703]**	**[2.56946]**	**[2.15425]**	**[1.97423]**
USA(-1)	1	-0.059076	0.090780	0.062087	**0.153597****	**0.09103*****	**0.167726***	0.100740
		[-0.37781]	[0.74425]	[0.62047]	**[2.14493]**	**[1.71090]**	**[2.95002]**	[1.16909]
	2	0.006227	**0.216079***	**0.134998****	**0.07645*****	-0.033001	**0.248613***	**0.272285***
		[0.14615]	**[4.27588]**	**[2.36999]**	**[1.75126]**	[-0.97014]	**[7.34471]**	**[6.56868]**
	3	-0.034654	**0.201245***	**0.121303***	**0.098159***	**-0.117375***	**0.269575***	**0.420558***
		[-0.89866]	**[5.09303]**	**[3.64249]**	**[4.05037]**	**[-3.57897]**	**[8.31908]**	**[10.8213]**
UK(-1)	1	0.011798	-0.161838	0.084313	-0.033126	-0.014259	-0.027301	0.054084
		[0.08386]	[-1.47459]	[0.93643]	[-0.51412]	[-0.29783]	[-0.53366]	[0.69755]
	2	0.018883	0.000757	-0.052526	0.039859	0.012347	**-0.201028***	0.032026
		[0.43633]	[0.01476]	[-0.90792]	[0.89895]	[0.35736]	**[-5.84733]**	[0.76068]
	3	0.000107	**0.08037*****	**0.07106*****	-0.017135	**0.085838****	**-0.186586***	**0.10345****
		[0.00245]	**[1.80461]**	**[1.89303]**	[-0.62730]	**[2.32215]**	**[-5.10859]**	**[2.36164]**
Japan(-1)	1	0.005315	0.007356	0.020655	0.005682	-0.039723	-0.102379	-0.088732
		(0.07888)	(0.06153)	(0.05048)	(0.03612)	(0.02684)	(0.02868)	(0.04347)
	2	0.012332	**0.05852*****	0.004544	-0.026143	**-0.04124*****	**-0.04975****	**-0.146926***
		[0.41268]	**[1.65112]**	[0.11375]	[-0.85387]	**[-1.72880]**	**[-2.09561]**	**[-5.05402]**
	3	-0.023820	-0.044897	-0.035616	-0.002506	0.016210	**-0.54620****	**-0.21377***
		[-0.88835]	[-1.64349]	[-1.54693]	[-0.14958]	[0.71495]	**[-2.43812]**	**[-7.95614]**
C	1	0.002304	0.001287	0.000457	3.65E-05	0.001190	0.000768	-0.000610
		[1.51042]	[1.08210]	[0.46813]	[0.05222]	[2.29211]	[1.38477]	[-0.72598]
	2	0.000492	0.000821	0.001269	0.000554	0.000347	0.000188	-0.000242
		[0.99052]	[1.39194]	[1.90986]	[1.08806]	[0.87323]	[0.47626]	[-0.50016]
	3	0.000526	0.000450	0.000472	0.000379	0.000297	-0.0000535	-0.000085
		[1.23491]	[1.03725]	[1.29210]	[1.42489]	[0.82351]	[-0.15044]	[-0.19911]

*Significant at 1%
**Significant at 5%
***Significant at 10%

The following inferences can be made from the results obtained for VAR and reported in Table 9:

- Returns in Bangladesh has significant influence on the returns from Pakistan, UK and Japan in Sub-period 1 but no significant influence on the stock returns of any other stock market post Asian and Global Financial Crisis.
- Returns in India has a significant influence only on Pakistan stock returns in Sub-period 2.
- Returns in Pakistan has an influence on Indian stock returns in Sub-period 1 and on the returns of Sri Lanka and USA in Sub-period 2. It does not influence the stock returns of any other country in Sub-period 3.
- Returns in Sri Lanka are found to have significant influence on returns of Pakistan and three selected developed countries post Global Financial Crisis in Sub-period 3.
- Returns in USA has an influence on the stock returns of all other selected markets except Bangladesh stock returns post the occurrence of Asian and Global Financial Crisis.
- Returns in UK also has a significant influence on the stock returns of all other selected markets except Bangladesh and Sri Lankan stock returns post the occurrence of Global Financial Crisis in 2007.
- Returns in Japan are found to be insignificant in influencing the stock returns in Japan are found to be insignificant in influencing the stock returns in selected SAARC countries in any of the three Sub-periods.

4. Granger Causality Test

Table 10: Granger Causality Test - 1 Lag (Daily Data – Sub Period Analysis)

(Lag 1)	Sub-Periods	DlogBang	DlogInd	DlogPak	DlogSlk	DlogUSA	DlogUK	DlogJapan
DlogBang	**1**	N.A.		→**			→***	→**
	2							
	3			→***				
DlogInd	**1**		N.A.					
	2			→*				
	3							→*
DlogPak	**1**		→**	N.A.				
	2				→**	→***		
	3							
DlogSlk	**1**				N.A.			
	2							
	3			→*				
DlogUSA	**1**			↔**		N.A.	→**	→***
	2		→*	→*	→*		→*	→*
	3		→*	→*	↔**		↔*	→*
DlogUK	**1**						N.A.	
	2		→*		→**			→*
	3		→*	→*	→*			→*
DlogJapan	**1**						→*	N.A.
	2		→*					
	3					→***	→**	

* Significant at 1%; ** Significant at 5%; *** Significant at 10%

Table 10 shows the result of Granger causality test at 1 lag length. There is not much causality found among the stock returns of selected SAARC countries post Asian and Global Financial Crisis except Indian stock returns causing Pakistan stock returns and Pakistan stock returns causing Sri Lankan stock returns in Sub-period 2 and Bangladesh and Sri Lankan stock returns causing Pakistan stock returns in Sub-period 3.

What is more important to be noted here is the causality running from the stock markets of developed countries to the stock markets of selected SAARC countries. The extent of integration has intensified with the passage of time. USA and UK stock returns are found to granger cause the

stock returns of all the remaining countries except Bangladesh stock returns post Global Financial Crisis. This shows the increasing dominance of USA among the world stock markets over a period of time. Japanese stock returns are not found to granger cause the stock returns of selected SAARC countries in any of the three Sub-periods.

5. Impulse Response Analysis

The comparison of results among the three Sub-periods obtained from Impulse Response Analysis gives almost the same conclusion as obtained through Granger Causality test. It is found that all selected SAARC countries stock markets except Bangladesh responds positively to one standard deviation shock occured in USA stock market that lasts for 3-4 days in Sub-period 2 and 3. There is almost negligible response observed in case of SAARC countries stock markets for the shocks taking place in UK and Japanese stock market in all the three Sub-periods except Indian and Sri Lankan stock markets responding negatively to the shocks created in UK stock market in Sub-period 1.

Now, looking at the responses given by the SAARC countries for the shocks created in other SAARC countries, it is found that the Bangladesh stock market is immune to the shocks created in other selected SAARC countries stock markets in all the sub-periods except responding positively to one standard deviation shock occured in Pakistan stock market in Sub-period 1. Indian stock market gives a negative response to one standard deviation shock occured in Bangladesh and Pakistan stock market in Sub-period 1 and a positive response to one standard deviation shock occured in Bangladesh stock market in Sub-period 2. However, in Sub-period 3, there is no response recorded for Indian stock market for changes taking place in rest of the SAARC countries. There is positive response observed in the case of Pakistan and Sri Lankan stock market for one standard deviation shock occuring in Indian stock market that lasts for upto 3-4 days in all the three Sub-periods.

6. Johansen's Co-integration Test and Vector Error Correction Model (VECM)

Table 11: Summary of Johansen Co-integration Test and VECM Results

Pair of Countries	Co-integration relationship in the Long term					
	Sub-Period 1		Sub-Period 2		Sub-Period 3	
Bangladesh and India	No		Yes		No	
			Leader	**Follower**		
			Indian Stock Market	Bangladesh Stock Market		
Bangladesh and Pakistan	No		Yes		No	
			Leader	**Follower**		
			Pakistan Stock Market	Bangladesh Stock Market		
Bangladesh and Sri Lanka	No		Yes		No	
			Leader	**Follower**		
			Sri Lankan Stock Market	Bangladesh Stock Market		
Bangladesh and USA	No		No		No	
Bangladesh and UK	No		No		No	
Bangladesh and Japan	**Yes**		No		No	
	Leader	**Follower**				
	Bangladesh Stock Market	Japanese Stock Market				
India and Pakistan	Yes		No		No	
	Leader	**Follower**				
	Pakistan Stock Market	Indian Stock Market				
India and Sri Lanka	No		Yes		No	
			Leader	**Follower**		
			Sri Lankan Stock Market	Indian Stock Market		
India and USA	Yes		No		Yes	
	Leader	**Follower**			**Leader**	**Follower**
	Indian Stock Market	USA Stock Market			Indian Stock Market	USA Stock Market
India and UK	Yes		No		No	
	Leader	**Follower**				
	Indian Stock Market	UK Stock Market				
India and Japan	Yes		Yes		Yes	
	Leader	**Follower**	**Leader**	**Follower**	**Leader**	**Follower**
	Indian Stock Market	Japanese Stock Market	Indian Stock Market	Japanese Stock Market	Indian Stock Market	Japanese Stock Market

Pakistan and Sri Lanka	No	Yes		No
		Leader	**Follower**	
		Sri Lankan Stock Market	Pakistan Stock Market	
Pakistan and USA	No	No		Yes
				Leader / **Follower**
				Pakistan Stock Market / USA Stock Market
Pakistan and UK	No	No		Yes
				Leader / **Follower**
				Pakistan Stock Market / UK Stock Market
Pakistan and Japan	No	No		Yes
				Leader / **Follower**
				Pakistan Stock Market / Japanese Stock Market
Sri Lanka and USA	No	No		No
Sri Lanka and UK	No	No		No
Sri Lanka and Japan	No	Yes		No
		Leader	**Follower**	
		Japanese Stock Market	Sri Lankan Stock Market	

The results reported in Table 11 indicates that the Bangladesh and Sri Lankan stock market had long term co-integration with rest of the selected SAARC countries only in Sub-period 2, i.e., post Asian Financial Crisis. Besides this, Bangladesh stock market had long term co-integration relationship with only Japanese stock market among the selected three developed countries in Sub-period 1. Indian stock market had long term co-integration with Pakistan stock market in Sub-period 1 and with Bangladesh and Sri Lankan stock market in Sub-period 2. Further, Indian stock market has long term co-integration with all the three developed countries in Sub-period 1; with only Japanese stock market in Sub-period 2; and USA and Japanese stock market in Sub-period 3. Pakistan stock market had long term co-integration with Bangladesh and Sri Lankan stock market in Sub-period 2 and with all three developed countries in Sub-period 3. These results also reinforce the strong nature of USA economy whose stock market is found to have long term relationship with Indian and Pakistan stock markets specially after Global Financial Crisis in Sub-period 3.

5. CONCLUSION

This paper focussed on checking for the presence of any short-term causal relationship and long-term co-integration relationship among stock markets of selected SAARC countries among themselves and with the stock markets of three developed countries of the world, namely, USA, UK and Japan. It also checked for the presence of sensitivity in the stock markets of selected SAARC countries to the shocks created in the stock markets of other countries (SAARC and Developed) in the short term. The data consisted of daily stock indices of these seven countries for more than twenty-seven years period starting from November 5th, 1991 till December 31st, 2018. The analysis is carried out using ADF and PP Unit root tests, Karl – Pearson's Correlation Matrix, Granger-Causality Test, Impulse Response Analysis, Johansen's Co-integration Test and VECM. Apart from the analysis of objectives for the entire sample period, a Sub-period analysis has also been carried on checking for the impact of Asian and Global Financial Crisis.

The result of correlation analysis points towards the fact that Indian stock returns are positively and significantly related to the stock returns of all other countries stock markets taken up in the study, except Bangladesh stock returns. The reason that can be attributed to this positive and significant correlation of Indian stock market returns with the stock market returns of other countries is the large bi-lateral trade between these countries. Also, the countries in the SAARC region have close social, political and cultural ties that makes their stock returns closely related. The degree of correlation of stock returns of SAARC countries with the stock returns of developed countries has increased post global financial crisis.

The short run causal relationships reported by VAR, Granger Causality Test and Impulse Response Analysis with respect to the stock market integration of selected four SAARC countries (not only among themselves but also their integration with the developed economies of the world) unanimously point towards the strong influencing nature of USA economy on rest of the selected countries. USA stock returns are found to significantly influence the stock returns of all other selected countries except Bangladesh stock returns for the entire sample period. Not much short-term financial integration has been found among the selected four SAARC countries. The

reasons for the same can be low regional trade intensity in the SAARC region which is in fact found to be the lowest amongst all the major regional trading blocs of the world. Janakiramanan and Lamba (1998) and Mukherjee and Bose (2008) also reported that the US market has a dominating effect on other markets. As per the results of Johansen's co-integration test, there is found long-term co-integrating relationship among the selected SAARC countries. VECM results helped in finding out the long run correction mechanism to arrive at the equilibrium situation.

The result of VAR, Granger Causality Test, Johansen's Co-integration test and VECM varies among the three sub-periods. It is found that the short-term inter-linkages among SAARC countries are not significant, but the influence coming from the developed countries is substantial. Among the developed countries, USA and UK stock returns have more influence on the stock returns of selected SAARC countries as compared to the stock returns of Japan. The result of Johansen's co-integration test also reinforces the strong nature of USA economy whose stock market is found to have long term relationship with Indian and Pakistan stock markets specially after Global Financial Crisis in Sub-period 3. It can be concluded that the extent of inter-linkages of SAARC countries (among themselves and also their integration with the developed economies of the world) has intensified with the passage of time and have been found to be at their peak after the Global Financial Crisis of 2007, i.e., Sub-period 3.

- **Policy Implications**

The findings of present study can have significant implications for policy makers, regulators, government, potential investors, academicians and researchers.

Since, there are found Inter-Linkages across the stock markets of SAARC countries (not only from their own SAARC counterparts but also from the selected three developed countries of the world), the regulators in these markets must consider the effect of any policy or regulation change taking place in counter markets so as to take preventive measures well in advance.

Among the SAARC countries, Indian stock market has been found to be the dominant one and therefore, the market regulators of Bangladesh, Pakistan and Sri Lanka should keep a close watch on the developments taking place

in Indian Stock Market as these developments might change the perception of investors across the remaining three markets. On an International front, USA stock market has been found to be the dominant one and the regulators of all the South Asian Markets are always required to formulate their policies keeping in consideration the developments taking place in USA stock market as well USA economy.

In order to further enhance the level of trade integration among the member countries, the policy-makers of SAARC countries must try to improve their macroeconomic fundamentals, reinforce the regional institutional frameworks, carry out capital market reforms and efficiently manage cross-border portfolio investments. They should also take steps to foster a stable political environment for clean and transparent governance, while ensuring the security concerns of member countries.

In order to promote the development of equity markets in SAARC countries, the member countries can come up with an Integrated Equity Markets Platform where companies of only the member countries can get their shares listed. India can take the lead by providing its financial support and technical expertise for establishing and operating equity market infrastructure in other SAARC member countries which are lagging like Bhutan, Afghanistan, Nepal and Maldives, as India has the most sophisticated equity market infrastructure with effective regulatory framework in the SAARC region.

The investors would find little opportunity to make abnormal gains through international diversification because of the significant positive correlation among the stock returns of selected stock markets. Potential investors need to work upon some schemes in order to exploit possible arbitrage opportunities as there is presence of lead-lag relationships among selected markets.

- **Limitations and Scope for Future Research**

The study is confined to only four out of eight SAARC countries because the stock markets of rest four countries are either not developed or they are in their nascent stage of existence. So, a complete analysis of SAARC as a whole could not be performed. Further, the study is exclusively based on secondary data collected from Bloomberg Database. Therefore, the quality

of the study depends purely on the accuracy, reliability and quality of the secondary data source.

In future, a greater number of developed countries can be considered and the study can be made more in line with the recent times by including the data for recently established stock markets of Nepal and Maldives among the SAARC countries.

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