

Stock Market Integration in South Asia

Damber Singh Kharka¹, Prof. M.S.Turan², Prof. K.P.Kaushik³

¹Director, Druk Holding & Investment, Thimphu: Bhutan, PhD student Haryana School of Business.

²Former Dean & Chairman, Haryana School of Business, GJUST, Hisar, Haryana.

³Professor of Finance, NIFM, Faridabad, Haryana ,India

ABSTRACT

While the topic of stock market integration has been one of the highly researched area in the literature but focus had mostly been on the stock markets of developed economies. Few have focused on analyzing market integration in South Asian region and no inclusion of Bhutanese stock has been found in the literature in any of the earlier studies. The objective of this paper is to analyze market integration between Bhutanese, Indian and other indices in the region. We also analyzed whether other indices in the region are co-integrated with Indian stock market, as Indian market is more proficient in the region and can be believed to have influences on others. We analyzed all indices in the region on one to one basis (using pairwise co-integration test). We used weekly data from January 2006 to December 2011 period from the stock exchanges of (Bhutan, India, Nepal, Bangladesh, and Pakistan). Applying, Dickey-Fuller method, we tested unit root for each stock indices and used Johansen co-integration approach pairwise to test the long-term relationship between stock indices and multivariate approach to test market integration as a whole. We found that all indices are stationary at I(1) and confirmed no long-term relationship between Bhutanese stock with Indian and other regional stock markets. In fact we find no market integration either on one to one basis or for the south Asian market as a whole. Information on market integration should help market players in managing their investments in capital markets in a sustainable manner.

Keywords Stock market, integration, Bhutan, South Asia.

1. INTRODUCTION

Financial market integration in general implies that if there is absence of barriers for information flow then risk-adjusted returns on assets of the similar tenor in each market segment should be similar. If financial markets are integrated, we will find long-term relationship between market instruments; very popularly used instrument in analyzing market integration is stock indices.

In an effort to maximize benefits and minimize risk, the investors in the capital market do follow investment portfolio diversification. Portfolio diversification models (Markowitz, 1952; Sharpe, 1964, Lintner, 1965) have shown that if the co-movement of stock markets is similar across stock markets then the gain from the portfolio diversification is not achievable. Co-movement of stock market returns can be analyzed through study of relationship or co-integration. Co-integration theory is unarguably is most popular approach that has created interest among researchers in analyzing long-term relationship between stock markets. Engle and Granger (1987), Johansen (1988), Johansen and Juselius (1990) are some of the eye openers in the literature in areas of stock market co-integration analysis. Masih and Masih (1996), Kasa (1992), Chowdhury (1994) and others have applied co-integration approach in assessing long-term relationships and levels of financial market integration

between Asian and global markets and within Asian markets.

While the topic of stock market integration has been one of the highly researched area in the literature but focus had mostly been on the stock markets of developed economies. Few have focused on analyzing market integration in South Asian region. Among those who investigated co-movements of stock markets in South Asia in the recent times are: Gunasinghe (2005), Lamba (2005), Mohsim and Qayyum (2005), Hassan, Saleem and Abdullah (2008), Raj and Dhal (2008), Subhani, Hasan, Mehar and Osman (2011), Sharma and Bodla (2011), Saha and Bhunia (2012) Khan and Huq (2012) and others. In any of the past studies Bhutanese stock was never included probably due to unavailability of stock index data or because the Bhutanese market is too insignificant in the region due to its smallness in size and lack of frequency in trading.

2.OBJECTIVES AND SIGNIFICANCE

The objective of this paper is to investigate long-term relationship between Bhutanese and Indian stock markets and extend the investigation between Bhutanese and other markets in the region. We also look at the pairwise co-integration for all indices (one to one basis) and investigate market integration in South Asia as a whole with multivariate model. This is the first study that looks into the Bhutanese stock market vis-a-vis other markets in the region.

Mukherjee (2004) states, “stock market integration or interdependence means that the investors can buy and sell shares in those markets without restriction and that identical securities can be issued and traded at the same price across the markets after foreign exchange adjustment”. It is in this context, understanding trend of various stock markets is essential for investors and academia. If markets are integrated, any uncertainty in one market can spread to another market. Therefore, to be knowledgeable about the

relationship between stock markets is essential for the policy makers and macroeconomic regulators also. Since this is the first study of this kind that includes Bhutanese stock market, it provides more inclusive information than the earlier studies.

3. LITERATURE REVIEW

We find several studies in the finance literature that concentrated their research on stock market integration. When we looked at South Asian markets, we find very limited studies. Some of the studies that have focused on South Asian markets that are relevant for our study given our research objectives and are presented here.

Sharma and Bodla (2010) studied India, Pakistan and Sri Lanka covering daily data from 1st January 2003 to 30th June 2010 as these three countries are the most dominant ones in terms of trade and polity in the region. They firstly confirmed that all the three stock market data are stationary through unit-root test and conducted Granger causality test for each pair. They found that the Indian stock market Granger cause Pakistani and Sri Lankan stock markets and no other indices is found to Granger cause any other indices. The study also conducted variance decomposition analysis and reported that the stock markets in South Asia (represented by three indices) are not much influenced by each other. They concluded that there exist opportunities for investors to diversify their investment among South Asian countries.

Gunasinghe (2005) covered stock market of three countries Sri Lanka, India and Pakistan for 1997 – 2002 period. He conducted correlation analysis and co-integration test for 1992 – 1997 (full sample and after splitting the data) to see if there was any difference in integration behavior after economic liberalization initiated in early 1990s by these countries. He found out that the correlations between Indian stock and Sri Lankan stock and the Indian stock and Pakistani stock have marginally improved for

the full sample against the results of split sample (1992-1997). However, his multivariate co-integration test did not indicate long-term relationship or integration between the stock markets in the region.

Mohsin and Qayyum (2005) studied inward and outward capital mobility between five South Asian countries (Pakistan, India, Bangladesh, Sri Lanka and Nepal). He analyzed market integration from saving and investment prospective. His findings did not support the hypothesis that there exists a perfect mobility of capital across the five countries, which indicates lack of economic integration. However, he observed that the capital mobility has improved after economic liberalization at least in Bangladesh and Nepal. He concluded that in general the financial markets in South Asia is not perfectly integrated among each other and with the rest of the world.

Lamba (2005) conducted a study to investigate short-term and long-term relationship of south Asian stock markets (India, Pakistan and Sri Lanka) with developed markets (US, UK and Japan). He looked at the correlations among different markets and elaborated the analysis using multivariate co-integration approach covering July 1997 – December 2003 data. He reported that the South Asian markets are relatively isolated from the developed stock markets but they are becoming more integrated with each other within the region at a very slow pace.

Hasan, Salem and Abdullah (2008) have studied long term relationship between Karachi Stock exchange and equity markets of developed countries (US, UK, Germany, Canada, Italy and Australia) covering 2000 – 2006 period. They used multivariate co-integration approach advocated by Johansen and Juselius (1990). They reported that Karachi stock exchange data was not integrated with other developed countries' except with France and Japan.

Raj and Dhal (2008) looked at the integration of Indian stock market with global and regional markets. They studied correlations

for different time intervals and looked at co-integration with full and split samples for Indian Stock (Bombay stock Exchange), Hong Kong, Singapore, Japan, UK and USA for 1993 to 2008 period. Their findings suggest that Indian stock market is globally integrated in terms of stock prices measured in US dollars but not in local currency. It was also reported that the Indian stock market provides better returns than that of global and regional markets. Within the Asian region, Singapore and Hong Kong market are reported to have more influence on Indian market whereas Japanese market has a weak influence.

Subhani, Hassan, Mehar and Osman (2011) analyzed co-integration for Asian stock markets that includes stock indices from four countries (India, Pakistan, Bangladesh and Nepal). They tested for each indices the presence of unit root applying Dickey and Fuller model and reported that for both (with and without differencing (first lag) there was presence of data non-stationary. Since the data was non-stationary, Johansen co-integration has been applied to see if markets were integrated. They analyzed multivariate co-integration between Pakistani stock and the rest and they failed to accept the hypothesis of no co-integration in the equity market in South Asian region. However, when co-integration was analyzed on one to one basis between Pakistani stock and the rest, the finding suggested that Pakistani and Bangladeshi markets are co-integrated but with Indian and Nepalese markets there was no co-integration.

Saha and Bhunia (2012) studied relationship between Indian stock and leading South Asian markets between August 2002 and August 2011. They initially looked at the correlation matrix among the stock markets in the region and since Indian stock was observed having relationship with others, it was thought that Indian stock as a more proficient market in the region has some influence on the others. He also tested each variable for unit root and applied bivariate and multivariate co-integration (Johansen co-

integration approach) and Granger causality test to see if South Asian stock market is integrated. He concluded that there is ample opportunity for the investors to broaden the horizon of their investment in the capital market in the region to take advantage of the poor integration.

Khan and Huq (2012) focused their studies on the risk and return behavior of different stock indices of Bangladesh. They used three stock indices of Bangladesh stock exchange covering (2002 – 2010) period to analyze risk-return pattern. They used daily, weekly and monthly data to analyze descriptive statistics and variances for each index and found inconsistency between risk and returns indicating that an investor can achieve better returns without any additional risk. This suggests that even in the same country, the different stock indices are not integrated or closely related.

4. METHODOLOGY IN CO-INTEGRATION PROCESS

If two stock markets are integrated, we find close relationship between their returns. However, relationships measured through ordinary regression for one random variable against another random variable, leads to spurious results more often than not. The conventional significance tests will tend to indicate a relationship between the two variables even if it does not exist. This is one reason why it is important to test for random walks of variables especially while dealing with time series data as they seem to follow random walk. Detrending the variables before running regression does not help since the detrended series will still be non-stationary. Therefore, in order to create a stationary data series, we need to first-difference the series. Pindyck and Rubinfeld (1991) in their book titled "Econometric Models and Economic Forecasts", (third edition) provide a simple explanation of Dickey-Fuller unit root test procedure (1976 and 1979) and the same is reviewed and presented, which will be applied in analyzing

the unit root for stock indices of south Asian market, the focus of our study.

Suppose we believe that a variable y_t , which has been growing over time, it can be described by the following equation

$$y_t = \alpha + \beta t + \rho y_{t-1} + \varepsilon_t \quad (1)$$

One possibility is that y_t has been growing because it has a positive trend ($\beta > 0$), but would be stationary after detrending (i.e. $\rho < 1$). In this case, y_t could be used in a regression, and all the results and tests as per ordinary least square method would apply. However, there is another possibility, that is, y_t has been growing because it follows random walks with positive drift (i.e. $\alpha > 0$, $\beta = 0$ and $\rho = 1$). In such case, we should work with Δy_t . Detrending will not make the series stationary and inclusion of y_t in a regression (even if detrended) could lead to spurious results.

We use the equation of the form:

$$y_t = \alpha + \beta t + \rho y_{t-1} + \lambda \Delta y_{t-1} + \varepsilon_t \quad (2)$$

where $\Delta y_{t-1} = y_{t-1} - \Delta y_{t-2}$. Additional lags of Δy_t can be used on the right hand side. Using ordinary least square, we run the unrestricted regression of the following form.

$$y_t - y_{t-1} = \alpha + \beta t + (\rho - 1)y_{t-1} + \lambda \Delta y_{t-1} \quad (3)$$

and then the restricted regression of the form

$$y_t - y_{t-1} = \alpha + \lambda \Delta y_{t-1} \quad (4)$$

With the parameter estimates from unrestricted and restricted regression we calculate the standard F ratio and compare with the critical value of F statistics to test whether ($\beta = 0$, $\rho = 1$) holds at different significant levels (usually at 1% and 5%). We reject the null hypothesis of a unit root if calculated value of F-statistic is greater than the critical values of F given for different significant levels. Alternatively, coefficients produced by the Dickey-Fuller test can be judged against t-stats and p-values analyze the presence of unit roots.

After we determine that stock indices for different markets (x , y , z ...) that follow random walks where Δx_t , Δy_t and Δz_t are stationary, it will be easy to test if x_t and y_t are co-integrated or similarly if x_t and z_t or any other pairs are co-integrated.

Upon confirming that individual data series are stationary we can test market co-integration using the following regression equation.

$$y_t = \beta_0 + \beta_1 x_t + \varepsilon_t \quad (5)$$

From the results obtained in equation (5), we test whether ε_t are stationary. If y_t and x_t are not co-integrated, any linear combination of two variables will be non-stationary and hence residual ε_t will be non-stationary or exists no co-integration. To see if ε_t is non-stationary, we can either perform Dickey-Fuller test on residuals or simply look at the Durbin-Watson statistics from the co-integration regression. However, most popularly used approach has been Johansen co-integration test.

Johansen testing approach (1988) as reflected in Tong (2001) is a vector from of the error-correction model of the following form.

$$\Delta X_t = \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} - \Pi X_{t-k} + \varepsilon_t \quad (6)$$

where $\Gamma_i = -I + \Pi + 1 + \dots + \Pi_i$, ($i = 1, \dots, k-1$) and $\Pi = I - \Pi_1 - \dots - \Pi_k$.

X_t is an $n \times 1$ vector of $I(1)$ variables and is an $n \times n$ matrix that has rank $r < n$ if X_t are co-integrated. To determine r , Johansen uses two statistics. One is the maximal eigenvalue statistic (the Lambda-Max test), which tests the null hypothesis of rank equal $r - 1$ against the alternative of rank equal to r . The other test is the Trace statistic, which tests the null hypothesis of rank of r against the alternative of full rank. Johansen (1988) and Johansen and Juselius (1990) may provide details on Johansen approach. This study follows

Johansen approach in conducting co-integration test.

In investigation our research objectives weekly data has been pooled for January 2006 to December 2011 period from the stock exchanges of (Bhutan, India, Nepal, Bangladesh, and Pakistan). Applying, Dickey-Fuller method, we tested unit root for each stock indices and used Johansen co-integration approach pairwise to test the long-term relationship between stock indices.

5.RESULTS & DISCUSSION

This section presents the results and discussion thereof. To start with the results on unit root test following Dickey and Fuller is presented followed by the results on co-integration test.

5.1 Results for Unit Root

In table 1, we have presented the results for unit root using Augmented Dickey and Fuller (ADF) test equation firstly with same order with just the intercept and with intercept and trend for all the stock indices. When analysis is conducted for same order without trend we find presence of unit root for all stock indices or we could not reject that here is no random walk. When the model is repeated for same order with intercept and trend, except for Bhutanese stock that has (T-stat of -3.466446 and P-value of 0.0006 confirming significant at 5%) rest of the indices still show that the series are non-stationary or could not reject the hypothesis that there exist no random walk.

Table 1. Augmented Dickey-Fuller (ADF) Unit Root Test at same Order

Variables - stock indices	ADF with intercept and no trend at same level			ADF with intercept and trend at same order		
	Coeff	T-stat	P-value	Coeff	T-sata	P-value
Bhutan	-0.022452 (2)	-0.924696	0.3559	-0.115627 (2)	-3.46446	0.0006
India	-0.019126 (0)	-1.99646	0.0468	-0.021452 (0)	-1.78446	0.0753
Nepal	-0.01013 (0)	-1.266638	0.2062	-0.013238 (0)	-1.63086	0.1039
Bangladesh	-0.003913 (1)	-0.927007	0.3546	-0.012694 (1)	-1.40572	0.1608
Sri Lanka	-0.000706 (0)	-0.202902	0.8393	-0.006012 (0)	-1.0521	0.2936

Pakistan	-0.014117	-1.496677	0.1355	-0.014544 (0)	-1.52543	0.1282
Mackinnon Critical values						
1% -16.2187						
5% -3.4512						
10% -2.5717						
Figures in parenthesis are the lag order in ADF equation that was selected based on the Schwartz criterion.						

In table 2 presents the results for unit root using ADF with first order differencing. We found that both with intercept and intercept with trend the calculated T-stats are much higher than the critical values even at 1% significance level. As indicated by the p-values of (0.0000) in all cases, we reject the hypothesis that there is presence of unit root at first order differencing. Hence we can say that the series are stationary at first order differencing. We conclude that all the stock

indices that are considered in our study (six stock exchanges in South Asian region) are integrated of order one that is, they are I(1). As reported by Subhani, Hasan, Mehar and Osman (2011), we also found that all the South Asian stock markets have series non-stationary at the same order but stationary at first order difference. The only difference between them and our work is that we included six countries whereas they had only four.

Table 2. Augmented Dickey-Fuller (ADF) Unit Root Test at 1st Difference

Variables - stock indices	ADF with intercept and no trend with 1 st difference			ADF with intercept and Trend with 1 st difference		
	Coeff	T-stat	P-value	Coeff	T-sata	P-value
Bhutan	-1.422101 (1)	-18.6353	0.0000	-1.42245 (1)	-18.61050	0.0000
India	-0.859533 (1)	-10.68172	0.0000	-0.86481 (1)	-10.71123	0.0000
Nepal	-0.962632 (0)	-16.93334	0.0000	-0.97142 (0)	-17.05497	0.0000
Bangladesh	-0.852586 (0)	-15.14315	0.0000	-0.85299 (0)	-15.12393	0.0000
Sri Lanka	-0.937423 (0)	-16.52035	0.0000	-0.93826 (0)	-16.50539	0.0000
Pakistan	-0.918256 (0)	-16.21872	0.0000	-0.91826 (0)	-16.19214	0.0000
Mackinnon Critical values						
1% -3.9878						
5% -3.4234						
10% -3.1352						
Figures in parenthesis are the lag order in ADF equation that was selected based on the Schwartz criterion						

5.2 Results for Co-integration Analysis

As we found no evidence of unit root in each stock market at the first differencing, we proceeded with the test of co-integration using Johansen approach. Firstly, we applied bivariatepairwise co-integration to see whether Bhutanese stock is integrated with Indian stock and also with others in the

region. We also analyzed co-integration between each pairs; there are 15 pairs as we have six indices for which any two are taken at a time. Data for each series is converted into log form for this purpose. Johansen co-integration test for pairwise stock indices has been conducted using two models (with deterministic trend and with linear deterministic trend) at first differences. Table 3 presents the finding from the first

model. As we compare Trace statistics and Lambda-Max statistics against respective critical values at 5%, we do not reject the null hypothesis of “no co-integration” between Bhutan and India and Bhutan and any other market in the region. In fact, we find no co-integration between any pair in the region. This shows that none of the stock indices in South Asian markets is co-integrated with any other stock indices in the region. To further confirm this, we have also conducted a pairwise co-integration using second model (with linear trend at first difference). Results are presented in table 4. We observe that the second model also provides similar results for all the pairs except that between (Bhutanese and Indian stock), (Bhutanese and Pakistani stock) and (Indian and Pakistani stock) some co-integration either at

5% or 10% with Trace statistics or Lambda-Max are observed. However, in all these three pairs results are confusing since two tests (Trace and Lambda-Max) provide different conclusions. What may be derived in general from table 3 and 4 is that the Bhutanese stock market is not co-integrated with Indian stock market nor it is co-integrated with any other market in the region. Similarly, no stock market in the region is co-integrated with any other market in the region. Our finding confirms the findings of Saha and Bhunia (2012) that reported, none of the South Asian markets has any control over each other. Further they stated that none of the South Asian market leads the Indian stock market nor they are being influenced by Indian stock market.

Table 3. Johansen Co-integration (no deterministic trend)

No Deterministic Trend (first order differences)								
Variable Pairs	Hypothesized No. of CE(s)	Trace - Rank Test			Maximum Eigenvalue-Rank Test			Hypothesis of "No Co-integration"
		Trace Stat	Critical value at 5%	Prob.	Max-Eigen Stat	Critical value at 5%	Prob	
LBHU & LBSE	None	10.2459	12.3209	0.1087	8.0791	11.2248	0.1694	Not rejected
	At most 1	2.1668	4.1299	0.1663	2.1668	4.1299	0.1663	
LBHU & LNPL	None	4.1113	12.3209	0.6948	3.4190	11.2248	0.7216	Not rejected
	At most 1	0.6923	4.1299	0.4647	0.6923	4.1299	0.4647	
LBHU & LBGD	None	6.9725	12.3209	0.3278	5.8507	11.2248	0.3670	Not rejected
	At most 1	1.1218	4.1299	0.3371	1.1218	4.1299	0.3371	
LBHU & LSLK	None	5.4832	12.3209	0.5017	4.3524	11.2248	0.5731	Not rejected
	At most 1	1.1308	4.1299	0.3349	1.1308	4.1299	0.3349	
LBHU & LPAK	None	7.6378	12.3209	0.2661	6.4023	11.2248	0.3062	Not rejected
	At most 1	1.2355	4.1230	0.3108	1.2355	4.1299	0.3108	
LNPL & LBSE	None	1.2755	12.3209	0.9892	1.0365	11.2248	0.9912	Not rejected
	At most 1	0.2390	4.1299	0.6835	0.2390	4.1299	0.6835	
LNPL &	None	3.8546	12.3209	0.7318	3.6394	11.2248	0.6862	Not

LBGD	At most 1	0.2152	4.1299	0.6996	0.2152	4.1299	0.6996	rejected
LNPL & LSLK	None	1.5216	12.3209	0.9797	1.4310	11.2248	0.9724	Not rejected
	At most 1	0.0906	4.1299	0.8047	0.0906	4.1299	0.8047	
LNPL & LPAK	None	2.9966	12.3209	0.8481	2.9966	11.2248	0.7883	Not rejected
	At most 1	0.0042	4.1299	0.9984	0.0042	4.1299	0.9984	
LBGD & LBSE	None	4.1115	12.3209	0.6947	4.0997	11.2248	0.6126	Not rejected
	At most 1	0.0118	4.1299	0.9293	0.0118	4.1299	0.9293	
LBGD & LPAK	None	3.5957	12.3209	0.7683	3.0858	11.2248	0.7744	Not rejected
	At most 1	0.5099	4.1299	0.5381	0.5099	4.1299	0.5381	
LBGD & LSLK	None	5.8159	12.3209	0.4588	3.2428	11.2248	0.7498	Not rejected
	At most 1	2.5731	4.1299	0.1284	2.5731	4.1299	0.1284	
LSLK & LBSE	None	1.8137	12.3209	0.9636	1.7592	11.2248	0.9470	Not rejected
	At most 1	0.0545	4.1299	0.8482	0.0545	4.1299	0.8482	
LSLK & LPAK	None	3.4823	12.3209	0.7840	2.0505	11.2248	0.9173	Not rejected
	At most 1	1.4318	4.1299	0.2711	1.4318	4.1299	0.2711	
LPAK & LBSE	None	9.5918	12.3209	0.1374	9.3633	11.2248	0.1044	Not rejected
	At most 1	0.2286	4.1299	0.6904	0.2286	4.1299	0.6904	

Table 4. Johansen Co-integration (Linear deterministic trend)

Linear deterministic Trend (first order differences)								
Variable Pairs	Hypothesized No. of CE(s)	Trace - Rank Test			Maximum Eigenvalue- Rank Test			Hypothesis of "No Co-integration"
		Trace Stat	Critical value at 5%	Prob.	Max-Eigen Stat	Critical value at 5%	Prob.	
LBHU & LBSE	None	10.2860	15.4947	0.2594	7.1286	14.2646	0.4741	not rejected **
	At most 1	3.1574	3.8415	0.0756	3.1574	3.8415	0.0756	
LBHU & LNPL	None	22.5612	25.8721	0.1223	16.1807	19.3870	0.1377	not rejected
	At most 1	6.3805	12.5180	0.4136	6.3805	12.5180	0.4136	
LBHU & LBGD	None	17.7093	25.8721	0.3638	15.0454	19.3870	0.1912	not rejected
	At most 1	2.6639	12.5180	0.9139	2.6639	12.5180	0.9139	
LBHU & LSLK	None	18.5980	25.8721	0.3051	15.7586	19.3870	0.1559	not rejected
	At most 1	2.8394	12.5180	0.8950	2.8394	12.5180	0.8950	
LBHU &	None	28.6574	25.8721	0.0219	23.8896	19.3870	0.0105	not

LPAK	At most 1	4.7678	12.5180	0.6300	4.7678	12.5180	0.6300	conclusive *
LNPL & LBSE	None	14.2627	25.8721	0.6359	8.1317	19.3870	0.8096	not rejected
	At most 1	6.1310	12.5180	0.4438	6.1310	12.5180	0.4438	
LNPL & LBGD	None	10.9527	25.8721	0.8779	7.7237	19.3870	0.8455	not rejected
	At most 1	3.2291	12.5180	0.8482	3.2291	12.5180	0.8482	
LNPL & LSLK	None	12.9371	25.8721	0.7431	7.3977	19.3870	0.8718	not rejected
	At most 1	5.5395	12.5180	0.5209	5.5395	12.5180	0.5209	
LNPL & LPAK	None	13.3231	25.8721	0.7127	8.4155	19.3870	0.7828	not rejected
	At most 1	4.9076	12.5180	0.6097	4.9076	12.5180	0.6097	
LBGD & LBSE	None	15.4185	25.8721	0.5399	12.6132	19.3870	0.3602	not rejected
	At most 1	2.8053	12.5180	0.8988	2.8053	12.5180	0.8988	
LBGD & LPAK	None	9.2844	25.8721	0.9518	6.5345	19.3870	0.9296	not rejected
	At most 1	2.7500	12.5180	0.9048	2.7500	12.5180	0.9048	
LBGD & LSLK	None	5.4040	25.8721	0.9994	3.1859	19.3870	0.9997	not rejected
	At most 1	2.2181	12.5180	0.9537	2.2181	12.5180	0.9537	
LSLK & LBSE	None	11.8806	25.8721	0.8202	9.3636	19.3870	0.6866	not rejected
	At most 1	2.5170	12.5180	0.9283	2.5170	12.5180	0.9283	
LSLK & LPAK	None	14.7478	25.8721	0.5955	12.0729	19.3870	0.4084	not rejected
	At most 1	2.6749	12.5180	0.9127	2.6749	12.5180	0.9127	
LPAK & LBSE	None	23.2226	25.8721	0.1032	17.4792	19.3870	0.0926	not rejected **
	At most 1	5.7434	12.5180	0.4935	5.7434	12.5180	0.4935	

While we found out that none of the south Asian stock market is integrated with any other market in the region as seen through the bivariate (pairwise) co-integration results, it is important to conform through the multivariate co-integration model. Multivariate model is useful in testing whether there exists market integration as a whole in South Asian stock market. We ran all possible equations (no deterministic trend, no deterministic trend with restricted constant, linear deterministic trend, linear deterministic trend with restricted constant) for multivariate model. Lag structures are chosen according to Schwarz criterion and it has picked up first order differences for all the models. Results are presented in a

sequential fashion for each model in tables 5 – 8 below. The hypothesis of no co-integrating vectors at $r \leq 0$ against the alternative of one or more co-integrating vectors is rejected. The hypothesis of “no co-integration” in the regional stock markets (as a whole) for ($r > 0$) is not rejected both by Johansen Trace and Lambda-Max tests in all the models (tables 5 – 8). Johansen (1988) attaches more importance to the first vector as he states that it corresponds to the highest eigen value among all ranks and it is the one that is believed to capture long-term relationship between variables. From the results obtained from the multivariate models we do not see even one stock market series

co-integrated in the six-variable (six stock indices)system

Table 5. Model with no deterministic trend

No deterministic Trend (first order differences)								
Variables		Trace - Rank Test			Lambda-Max Test			
LBHU, LBSE, LNPL, LBGD, LSLK, LPAK	Hypothesized No. of CE(s)	Trace Stat	Critical value at 5%	Prob.	Lambda -Max	Critical value at 5%	Prob.	Hypothesis of "No Co-integration"
	None	87.1832	83.9371	0.0285	44.6964	36.6302	0.0046	Reject at $r \leq 0$ and not rejected for all ranks of $r > 0$
	At most 1	42.4867	60.0614	0.5920	19.6843	30.4396	0.5619	
	At most 2	22.8024	40.1749	0.7721	10.3248	24.1592	0.8983	
	At most 3	12.4776	24.2759	0.6658	7.1906	17.7973	0.7918	
	At most 4	5.2870	12.3209	0.5280	4.3876	11.2248	0.5676	
At most 5	0.8997	4.1299	0.3967	0.8997	4.1299	0.3967		

Table 6. Model with no deterministic trend with constant restriction

No deterministic Trend (restricted constant - in first differences)								
Variable Pairs		Trace - Rank Test			Lambda-Max Test			
LBHU, LBSE, LNPL, LBGD, LSLK, LPAK	Hypothesized No. of CE(s)	Trace Stat	Critical value at 5%	Prob.	Lambda -Max	Critical value at 5%	Prob.	Hypothesis of "No Co-integration"
	None	106.7524	103.8473	0.0317	44.8444	40.9568	0.0174	Rejected at $r \leq 0$ and not rejected for all ranks of $r > 0$
	At most 1	61.9080	76.9728	0.3989	22.9190	34.8059	0.6044	
	At most 2	38.9891	54.0790	0.5217	18.9054	28.5881	0.4996	
	At most 3	20.0836	35.1928	0.7215	9.4226	22.2996	0.8772	
	At most 4	10.6610	20.2618	0.5750	6.3924	15.8921	0.7427	
At most 5	4.2686	9.1645	0.3736	4.2686	9.1646	0.3736		

Table 7. Model with Linear deterministic trend

Linear deterministic Trend (in first differences)								
Variables		Trace - Rank Test			Lambda-Max Test			
LBHU, LBSE, LNPL, LBGD, LSLK, LPAK	Hypothesized No. of CE(s)	Trace Stat	Critical value at 5%	Prob.	Lambda -Max	Critical value at 5%	Prob.	Hypothesis of "No Co-integration"
	None	100.3510	95.7537	0.0232	42.9423	40.0776	0.0231	Rejected at $r \leq 0$ and not rejected for all
	At most 1	57.4088	69.8189	0.3235	22.5321	33.8769	0.5664	
	At most 2	34.8766	47.8561	0.4545	18.6217	27.5843	0.4443	

	At most 3	16.2550	29.7971	0.6942	9.1790	21.1316	0.8177	ranks of $r>0$
	At most 4	7.0760	15.4947	0.5688	6.1751	14.2646	0.5908	
	At most 5	0.9009	3.8415	0.3425	0.9009	3.8415	0.3425	

Table 8. Model with Linear deterministic trend with constant restriction

Linear deterministic Trend (restricted - in first differences)								
Variables		Trace - Rank Test			Lambda-Max Test			
	Hypothesized No. of CE(s)	Trace Stat	Critical value at 5%	Prob.	Lambda-Max	Critical value at 5%	Prob.	Hypothesis of "No Co-integration"
LBHU, LBSE, LNPL, LBGD, LSLK, LPAK	None	123.3879	117.7082	0.0207	47.0428	44.4972	0.0258	Rejected at $r \leq 0$ and not rejected for all ranks of $r > 0$
	At most 1	76.3450	88.8038	0.2810	34.2436	38.3310	0.1370	
	At most 2	42.1014	63.8761	0.7729	18.8185	32.1183	0.7428	
	At most 3	23.2830	42.9153	0.8670	11.5544	25.8232	0.8987	
	At most 4	11.7286	25.8721	0.8304	7.8625	19.3870	0.8336	
	At most 5	3.8661	12.5180	0.7614	3.8661	12.5180	0.7614	

6. CONCLUSION

This paper concludes that all the stock indices in South Asian region (six countries included in this study) have unit root presence or data non-stationary at the same order level while they are all stationary at first level differencing. There is no evidence of long-term market relationship between any of the stock market on one to one basis except for very weak association between Bhutan and India. Subhani, Hasan, Mehar and Osman (2011) also found that on a one to one basis there is no evidence of co-movements between Pakistani and Indian market and between Pakistani and Nepalese market. However, this paper does not support their findings, "the South Asian stock markets as a whole are co-integrated with each other". We have run all the equations with (no deterministic trend, no deterministic trend with restricted constant, linear deterministic trend, linear deterministic trend with restricted constant) with log data but failed to reject the null hypothesis of "no co-integration" at less than 5% significance level for $r > 0$. Difference in findings may be due to

difference in data coverage. They studied four countries data (Pakistan, Bangladesh, Nepal and India) for May 1995 – May 2011 period; we covered six countries for 2006 – 2011 period. As far as our study goes, we can conveniently conclude that the long-term relationship between South Asian stock market is very weak. Implication of such a findings is that investors in the region have opportunity to minimize risk at the similar levels of returns or maximize return at a given level of risk, if the markets were open for capital mobility.

REFERENCES

1. Chowdhury, A.R. (1994), "Stock market interdependencies: Evidence from the Asian NIEs", *Journal of Macroeconomics*, Vol. 4, pp. 629 – 651.
2. Dickey, D.A. Fuller, W.A. (1976), "Likelihood Ratio Statistics for Autoregressive Time Series with Unit Root", *Econometrica*, Vol. 49, pp. 1057 - 1072
3. Dickey, D.A. Fuller, W.A. (1979), "Distribution of the Estimators for

- Autoregressive Time-series with Unit Root', Journal of the American Statistical Association, Vo. 74. Pp. 427 – 431.
4. Dubey, M (2007), 'SAARC and South Asian Economic Integration', Economic and Political weekly (April 7), pp. 1230 -1240.
 5. Engle, R.F, Granger, C.W.J. (1987), "Co-integration and error-correction: Representation, estimation and testing, *Econometrica*, Vol.55, pp. 251 – 276.
 6. Gunasinghe, W.I.C.S. (2005), "Behaviour of Stock Markets in South Asia: An econometric Investigation", *Accounting and Finance*, Vol. 44 (3), pp. 419 – 439.
 7. Johansen, S. (1988a), "The mathematical structure of error correction models", *Contemporary Mathematics*, Vol. 12, pp. 359 – 386.
 8. Johansen, S. (1988b), "Statistical analysis of co-integration vectors", *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231 – 254.
 9. Johansen, S. Juselius, K. (1990), "Maximum likelihood estimation and inference on co-integration – with application to the demand for money", *Oxford Bulletin of Economics and Statistics*, Vol. 52, pp. 169 – 210.
 10. Kasa, K. (1992), "Common stochastic trends in international stock markets", *Journal of Monetary Economics*, Vol. 29, pp. 95 – 124.
 11. Khan, M.M.H. Huq, U.R. (2012), "Distribution of Risk and Return: A Statistical Test of Normality on Dhaka Stock Exchange", *Research Journal of Finance and Accounting*, Vol. 3, No. 3 (retrieved from www.iiste.org)
 12. Lamba, A.S. (2005), "An Analysis of the Short and Long-Run Relationships between South Asian and Developed Equity Markets", *International Journal of Business*, Vol. 10 (4).
 13. Linter, J. (1991), "Security price, risk and maximum gains from diversification" *Journal of Finance*, Vol. 20, pp. 587 – 616.
 14. Markowitz, H. (1952), "Portfolio Selection", *Journal of Finance*, Vol. 7, pp. 77 -91.
 15. Masih, A.M.M. and Masih, R. (1996), "Common stochastic trends, multivariate market efficiency and the temporal causal dynamics in a system of daily spot exchange rates", *Applied Financial Economics*, 6, 495-504.
 16. Mohsin, H.M. Qayyum, A. (2005), "The Integration of Financial Markets: Empirical Evidence from South Asian Countries", MPRA Paper No. 2364. (Available at www.pide.org.pk)
 17. Mukherjee, K.N. (2004), "Review of Stock Market Integration: An International Perspective", *ICFAI Journal of Applied Economics* (Available at [http://papers.ssrn.com/sol3/papers.cfm?](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1000000))
 18. Pindyck, R.S. Rubinfeld, D.L. (1991), "Econometric Models & Economic Forecasts", (third edition), McGraw-Hill, Inc.
 19. Raj, J. Dhal, S. (2008), "Integration of India's stock market with global and major regional markets", *BIS Papers* No. 42.
 20. Saha M. Bhunia, A. (2012), "Financial Market Integration of South Asian Countries", *Developing Countries Studies*, Vo. 2, No. 1, pp. 45 – 52. (Available at www.iiste.org).
 21. Sharma, G.D. Bodla, B.S. (2011), "Inter-linkages among stock markets of South Asia", *Asia-Pacific Journal of Business Administration*, Vol. 3 No. 2, pp. 132 – 148.

22. Sharpe, W. (1964), “ Capital asset prices: A theory of market equilibrium under conditions of risk”, Journal of Finance, Vol. 19, pp. 425 – 442.
23. Subhani, M.I. Hasan, S. A. Mehar, A. Osman, A. (2011), “Are the Major South Asian Equity Markets Co-integrated?”, International Journal of Humanities and Social Science, Vol.1, No.12, pp. 117 – 121.
24. Tong, W.H.S. (2001), “Co-integration, Efficiency and Forecasting in the Currency Market”, Journal of Business Finance and Accounting, Vol. 28, pp. 127 – 150.

