INTERNATIONAL PORTFOLIO DIVERSIFICATION IN DEVELOPING EQUITY MARKETS OF SOUTH ASIA

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Abstract:

This study aims at exploring the relationship between South Asian Equity Markets. Four major South Asian Equity Markets (Karachi Stock Exchange, Bombay Stock Exchange, Colombo Stock Exchange and Dhaka Stock Exchange) were taken to explore this relationship. Data was taken from the year 1999 to 2009 on monthly basis. Data Analysis was conducted using co-integration Analysis for the long run relationship and VECM (Vector Error Correction Model) for the short run relationship. For the purpose of stationary of data, Unit root test was used and all series were found integrated at first difference. Co-integration Analysis indicated that there exists no long run relationship among the equity markets of South Asia. VECM shows the similar results and no relationship found among these markets in short run.

Keywords: international portofolio, equity markets, South Asia

1. Introduction

The concept of portfolio diversification has been discussed in the early work of Harry Markowitz (1952, 59) It was the first study of this nature in which concept of portfolio diversification was quantified. This concept gained very much attention in later studies and most of the studies acknowledged it as a major contribution in the field of investment analysis. This concept is known as Modern Portfolio theory. According to Modern Portfolio theory return of a portfolio is weighted average of returns of individual securities and risk of a portfolio is weighted average of individual securities risks plus their covariance with the other securities in the portfolio.

This concept was further discussed in the outstanding work by William Sharp (1964). William Sharpe extended the modern portfolio theory adding lending and borrowing opportunities in the basic idea given in modern portfolio theory. This work is known as Capital Asset Pricing Model. William Sharpe in his paper showed that how lending and borrowing opportunities will change the shape of efficient frontier and portfolio risk and portfolio returns would reduce in case of lending opportunities and would increase in case of borrowing opportunities.

This concept known as CAPM (Capital Asset Pricing Model) also gained very much popularity and was tested and supported in many later studies. In CAPM it was assumed that in market portfolio only systematic risk of portfolio exists and unsystematic risk would be diversified away because all available assets are included in market portfolio. According to CAPM the relevant risk of any portfolio is its systematic risk because unsystematic risk can easily be diversified away.

These studies contributed a lot in the field of investment management. After 1975, international markets started liberalization. After Liberalization of international stock markets, investors paid attention towards international investing. It eliminated the barriers on flow of capital from one country to another country. These relaxations encouraged many portfolio or fund managers to invest across the globe.

The risk of any individual asset could be diversified in a portfolio through selecting those assets which has low correlations or negative correlations. Furthermore, investing in different sectors reduces the company specific and industry specific risks but still risk of an economy or systematic risk was not possible to diversify. An investor could diversify company specific risk by investing in different companies having negative correlations and low correlation. Similarly industry specific risks could be diversified by investing in different sectors in the economy. However, if overall economy performs poorly it would still effect negatively to the portfolio return.

The liberalization of international stock markets and the trade among different countries attracted the capital flows of one country to the other countries and investor now has the opportunities to invest in different economies and it raises many questions on the idea that whether it is possible to reduce the risks specific to any particular economy by investing in other countries in world.

If an investor could diversify more optimally by investing in different countries stock markets then it would not be wrong to conclude that the investors do have opportunities to reduce economy specific risk as well. However, it might not be the solution because many studies focusing this idea found that in times of financial distress investor's behavior towards markets is almost similar. These studies found contagion effects and reported that in bad times many world markets perform similarly.

Now with all these points I conclude two important points. First, I found the studies reporting that systematic risk is the only relevant risk because if overall economy performs bad than it would affect the performance of the overall portfolio. So, due to liberalization of stock markets, international trade and flow of capital among countries, an investor would be facilitated to invest among different economies and to reduce portfolio risk. Secondly a contrary opinion is also important that if investor

behavior is similar towards markets in times of financial distress than it might be possible that when one world market performs poorly investors starts considering other markets to performs bad as well.

If the different world markets have similar patterns and behaviors and these markets are interdependent then it would not be the helpful for any investor to reduce his portfolio risks only by investing in different world markets. It would be more appropriate if we look for those markets which has no co-integration among them or has inverse price patterns. The idea given in modern portfolio theory was to locate the assets having negative correlation or low correlations. Similarly if an investor locates the markets having no integration or inverse price patterns might help to diversify across the globe.

These studies and the points discussed in above paragraphs strongly recommend us to adopt top to bottom approach of investing. According to this approach an investor should locate economies having inverse price patterns and then should go for sector selection and company selection.

This study focuses on this idea and therefore, examined the interdependence among different world markets that would help to fund manager to diversify their investments across the globe.

2. Literature Review

These are some of the important studies which addressed this topic and identified different world equity markets which are either integrated or not.

Eun and Shim (1989) investigated that there exists a significant interdependence among the National stock markets. In this study nine major national stock markets were included which are Australia, Canada, France, Germany, Hong Kong, Japan, Switzerland, the United Kingdom and the United States. The data was taken from December 1979 to December 1985. Vector auto-regression model was used for the analysis and results of the study indicated that US market was the major market which brings changes or variances in other markets, so it was the most influential among all the markets.

Kasa (1992) investigated the integration among the equity markets of USA, Japan, England, Germany and Canada using the stock market indices from 1974 till 1990 and found that there exist long run relationship among these equity markets using co integration technique. Results of this study indicated that there is a single common trend driving the stock markets of these countries.

Choudhury (1997) examines the interdependence among six Latin American Countries. In his study he used stock market data from the period 1985 to 1993. Long run relationship was explored by using co-integration technique and found the existence of such relationship, furthermore, causal relationship was also found by using Granger Causality Approach.

Masih and Masih. (1997) investigated the short and long term dynamic linkages among eight national daily stock price indices, which includes four major established markets (US, UK, Germany, Japan) and four Asian emerging markets (Malaysia, Thailand, Singapore, Hong Kong) using end of day national stock price indexes from 14-February-1992 to 19-June-1997 (inclusive) by using time-series econometric techniques vector error- correction model and level VAR model containing integrated and cointegrated processes of arbitrary orders, Variance Decomposition, Augmented Dicky Fuller Unit root test and Multivariate Co-integration Analysis. Results from this study found the evidence for co-integration among these eight markets. In this research study this increased interdependence is discussed in various perspectives and some of the reasons are assumed for increased interrelationship like globalization and flow of information from one market to another market.

Cha and Oh (2000) examined the interdependence among the equity markets of US, Japan with the emerging markets of Asia (Hong Kong, Korea, Singapore and Taiwan). This study found the contagion effect between these countries and indicated that after the stock market crash of 1987 co movements among these markets increased.

Narayan, Symth and Nandha (2003) examined four south Asian markets All Share (Bangladesh), Bombay SE National 200 (India), Karachi SE 100 (Pakistan) and Colombo SE All Share (Sri Lanka) by using daily data (excluding weekends and holidays) for the period 2 January 1995 to 23 November 2001. For data analysis different techniques like Descriptive Statistics, Granger Causality, Unit Root Test (For Data Stationary), Variance Decomposition Analysis were used and It was found that in long run, stock prices in Bangladesh, Sri Lanka and India granger cause the stock prices in Pakistan. In short run Stock prices in Pakistan granger cause stock prices in Sri Lanka and India, Stock prices form Sri Lanka to Stock Prices in India. Bangladesh was exogenous having less correlation due to its small size and market capitalization

Lamba (2005) concluded that there exists a long run relationship among South Asian emerging stock markets and the developed equity markets for the period of July 1997 to December 2003 by applying multivariate co-integration test. Empirical results indicate that developed equity markets of US, UK and Japan has impact on Indian stock market. Further he found that the stock markets of Pakistan and Sri Lanka are relatively independent and are not influenced by the stock markets of developed countries during the whole period. Moreover it was noticed that the three South Asian Stock Markets were integrating with each other but relatively in a slow manner.

Kazi (2008) investigated the long run relationship among equity markets of UK, USA, the Canadian, German, French and Japan. Annual data was taken from the period 1945 to 2002. Unit root test was used and both ADF and PP were used for this purpose. To find the long run relationship among these markets, co-integration technique was used. It was found that there exist integration among these equity markets and long run relationship was found by the results.. However, results for UK, Canadian and German markets were significant and investor should have more interest in the other markets for diversification purpose.

Hasan, Saleem & Abdullah (2008) investigated the dynamic linkage of Pakistan equity market with the 9 developed equity markets of USA, UK, France, Germany, Japan, Canada , Italy and Australia by using weekly prices for the period of 2000-2006. In this study they used Johansen and Juselius multivariate co integration analysis. It was found that Pakistan Equity market is not integrated with the equity markets of the USA, UK, Germany, Canada, Italy and Australia. But the UK and USA stock markets have little impact on Pakistan equity market. However, there exists integration of Pakistani equity market with France and Japan.

Bastos and Caiado (2010), this study found the integration among the global equity market using stock market indices from 46 countries. This study was conducted to examine the interdependence in terms of equity markets returns. The data was taken from the period 1995 and 2009. The study investigated the interdependence between the stock returns of developed and emerging countries. The data was taken for three different periods to examine whether interdependence increased over time or not and results indicated that interdependence among emerging and developed countries markets is increasing over time.

Sam Agyei-Ampomah (2011), investigated the stock market integration in African countries. Data was taken from 1998 to 2007. Results of this study showed that African stock markets are segmented from world stock markets and portfolio risk can be diversified by cross country diversification.

3. Data description and methodology

This study includes monthly stock prices indexes for the period of January 1999 to 2009 December for All Share Bangladesh, KSE 100 Index, Bombay National 200, and Colombo All Share. The continuous compounded returns are calculated.

$$\textbf{Return} = R_t = \ln(P_t / P_{t-1})$$

R_t = Return for Given Period 't';
P_t = Price at closing time
P_{t-1} = Price at the opening time
ln = Natural Log

HYPOTHESIS

Following hypothesis of the study are confirmed by applying the above explained methodologies.

HYPOTHESIS: 1

H_1 South Asian equity markets are interdependent in the long run.
H_0 South Asian equity markets are not interdependent in the long run.

HYPOTHESIS: 2

H_1 South Asian equity markets are interdependent in the short run.

H_0 South Asian equity markets are not interdependent in the short run.

Descriptive Statistics

Descriptive statistics explains the behavior of stock returns that which market have high return and which markets have low returns. It also explains the volatility in returns.

Correlation Matrix

Correlation matrix tells about the degree of relationship among different series. It tells about the strength of relationship, further it investigates the direction of the relationship. Correlation is considered a weak technique because it only considers the strength and direction of a relationship and does not explains the lead lag relationship. It only identifies that variables have no correlation, negative correlation or positive correlation.

Vector Auto Regression (VAR Technique)

To check the stationary and to apply the Johnson and Julius Approach, First of all proper lag length must be selected. For this purpose Akaike information criterion (AIC) and Schwarz information criterion (SIC) is used from 1 to 12 months. The appropriate lag length is considered where SIC is found minimum. Johansen, S., (1988), Toda, H.Y. and P.C.B. Phillips, (1993)

Unit Root Test

Co-integration requires that times series should be stationary. It requires that time series should be integrated of same order. Stationary in the data can be confirmed by using different unit root test. For this purpose ADF Test (Augmented Dickey Fuller Test) is used. Augmented Dickey Fuller Test assumes that all the error terms are independently distributed and have a constant variance. Augmented Dickey Fuller Test is assumed a strict test due to strict assumptions.

First difference of the time series is taken to make the time series stationary. Another test called Phillip Peron test will be used to support the Augmented Dickey Fuller Test because ADF consider strict assumptions. Phillip Peron test considers weak form of dependence.

If a time series non stationary at level and becomes stationary after differencing. It will be said co-integrated. Johnson and Julius's Approach of Co-integration is used if a series is integrated in same order. Dickey, D. A., and Fuller, W. A., (1981)

Johansen and Juselius Co-integration Test

Co-integration requires that all the time series should be integrated in same order; Co-integration assumes that even if two time series are individually non-stationary, a linear combination of two might be stationary. Co-integration analyzes the long rum

relationship between two or more variables. Co-integration analyses is used to explore the co-movement among two series, it does not study the cause and effect relationship. It is based on empirical evidence. There might be some economical reasoning of this relationship and there might not be any economic reasoning of this relationship. The method itself does not address any cause and effect relationship.
Co-integration can be applied using two different approaches.
J.J Approach (Johnson and Julius Approach)
ARDL (Auto Regressive Distribution Lag Approach)
If all the series are integrated of same order than J.J Approach of Co-integrtion is appropriate but if the series are not integrated of the same order than ARDL approach is used.

Engle, R.F., and C.W.J. Granger., (1987), Gregory, Johansen, S., (1988), Johansen, S., and K. Juselius., (1990), A. W., and B. E. Hansen., (1996)

Granger Causality Test

Granger Representation Theorem states that if two variables are co-integrated then casualty must exist in at least one direction. Co-integration only investigates the long run relationship between two variables. Co-integration examines the co-movement among the time series. It does not identify the lead lag relationship. Granger Causality is used to determine the lead lag relationship. If the lead series is known than lag series can be predicted. Granger Causality reports that which series lead the other series or which variable is exerting its pressure on other variable. If causality is found in one direction then it will be called as uni-directional causality. Uni-directional causality means that information is flowing from one market to the other market.
If the lead lag relation is found from both direction then it means that information is flowing from both sides and both the markets are exerting their pressure on each other. This case will be called bi-directional causality. Granger, C. W. J., (1969), Engle, R.F., and C.W.J. Granger., (1987)

Error Correction Model

After analyzing the long run relationship among the variables, Error correction model is used to investigate the short term relationship.

Engle, R.F., and C.W.J. Granger., (1987)

Impulse Response Function

Impulse response function explains that to what extent one Standard Deviation Change in a series will bring Standard Deviation change in other series. Impulse response function is used to observe the random shocks on the markets. It examines the response of a market to shocks in its own market and other market innovations.

Impulse response function graphically displays the response of each market to the shocks in its own returns and the shock in other markets. It also observes the speed of adjustment.

Variance Decomposition Test

Variance decomposition analysis is used for the out of sample causality tests for Lead Lag relationship. In simple words variance decomposition can be defined as decomposition of variance due to changes in same series or other series in previous periods.

Table 1: Descriptive Statistics

	DSE	KSE	BSE	CSE
Mean	0.011927	0.010166	0.008865	0.010304
Median	0.006009	0.012865	0.014628	0.010577
Maximum	0.264057	0.241114	0.248851	0.225223
Minimum	-0.221321	-0.448796	-0.272992	-0.184168
Std. Dev.	0.071584	0.101854	0.079924	0.075906
Skewness	0.279588	-1.075146	-0.404912	0.067535
Kurtosis	4.213829	6.659657	3.539045	3.412991
Jarque-Bera	11.46055	115.6081	6.072645	1.211501
Probability	0.003246	0.000000	0.048011	0.545665
Observations	154	154	154	154

Descriptive statistics are applied on the returns of four south Asian markets. Results indicated that Dhaka stock exchange has average returns of 1.1927 % with standard deviation of 7.1584 %. Karachi Stock Exchange has average returns of 1.1016% with volatility of 10.18 % during 1999 to 2009. Bombay Stock Exchange has average returns of .88 % with standard deviation of 7.99 % and Colombo stock Exchange has average returns of 1.030 % with volatility of 7.590 %.

Karachi Stock Exchange and Dhaka Stock Exchange are found as the markets with comparatively high returns and high risk. Karachi Stock Exchange returns are more volatile among these four markets with standard deviation of 10.18 %. All other markets have low standard deviation as compared to Karachi Stock Market. So, it could be deduced that Karachi Stock Market is most volatile markets in South Asian Equity Markets. Descriptive Statistics showed that Dhaka Stock Exchange is giving comparatively high returns among all these markets with the lower level of risk. So, Dhaka Stock Market is the high return market with lower levels of risk.

Bombay Stock Exchange is giving lower returns among these four markets with high risk level after Karachi Stock Exchange. Skewness and Kurtosis measures provide insight about the underlying statistical distribution of stock returns. Karachi Stock Exchange and Bombay Stock Exchange are negatively skewed. The Jarque-Bera

Statistic is high for Karachi Stock Market, implying that stock returns of Karachi Stock Market follow pattern So, it differ significantly from normal distribution.

Result of descriptive statistic shows very low returns. This study covers the time period that witnessed market crash of 2005 and 2008. This may be the reason of very low average returns.

Table 2: Correlation Matrix

	DSE	KSE	BSE	CSE
DSE	1.000000	-0.064363	0.133462	0.014367
KSE	-0.064363	1.000000	0.286309	0.195500
BSE	0.133462	0.286309	1.000000	0.289088
CSE	0.014367	0.195500	0.289088	1.000000

(5 percent level of significance)

Table 2 presents the correlation results for the four south Asian Markets. It was found that there exists no significant correlation among these markets. Karachi Stock Exchange has very weak negative correlation with the Dhaka Stock Exchange. All other correlation results depicts that there exist very weak positive correlation among these markets. Correlations among Karachi Stock Exchange and Bombay Stock Exchange and between CSE and KSE were more as compared to other results but still it is not significant and .28 is very weak to assume any significant positive relationship between these two markets.

From the results of Correlation it is clear that there exist no positive correlation among the returns of stock markets of these four countries. These results are attractive for the investors who want to get diversification benefits through investing their funds in these four south Asian markets. Correlation Analysis is considered a weak technique to explore the integration among the markets because it only discusses the relationship and does not considers the lead lag relationship. So, Co-integration and Granger Causality are used to further investigate this issue.

Table 3 Vector Auto Regression (VAR Technique)

Lag	1	2	3	4	5	6	7	8	9	10	11	12
AIC	-8.8849	-8.8786	-8.8811	-8.8146	-8.7030	-8.5557	-8.4798	-8.4728	-8.3306	-8.2532	-8.2986	-8.2800
SC	-8.4905	-8.1655	-7.8466	-7.4559	-7.0170	-6.5396	-6.1307	-5.7875	-5.306	-4.886	-4.5863	-4.2191

Akaike information criterion (AIC)
Schwarz criterion (SC)

The estimation of Johansen and Julius (1991) Co-integration approach requires that there should be appropriate lag selected for all estimations. For this purpose unrestricted VAR is estimated. Akaike information criterion and Schwarz criterion are used for this purpose. VAR is estimated from 12 months to 1 months and

SC and AIC are found minimum at 1 month lag. So, 1 month lag is used for the estimation.

Table 4: Unit Root Test

Stock Markets	Augmented Dicky-Fulller Test at Level	Augmented Dicky-Fulller Test at 1st Difference	Phillip - Perron Test at Level	Phillip-Perron Test at 1st Difference
DSE	1.426192	-8.0455	1.544272	-11.8358
KSE	-0.61484	-8.14567	-0.51802	-11.8004
BSE	-0.32028	-7.56533	-0.18642	-11.4821
CSE	0.321444	-7.95293	0.464261	-11.048
1%	-3.4741	-3.4743	-3.4738	-3.4741
5%	-2.8804	-2.8805	-2.8802	-2.8804
10%	-2.5767	-2.5768	-2.5766	-2.5767

Augmented Dickey Fuller Tests is based on the assumption that data is independently and identically distributed. Dickey Fuller Test assumes that error terms have constant variance. Results of this test show that data was non-stationary at level and when unit root was taken at first difference, it becomes stationary. Further it was found that all the data is stationary at level 1. So, Co-integration assumption that all the variables should be integrated of same order is fulfilled.

Augmented Dickey Fuller Test is assumed a strict test so; Phillip Peron Test is also used to verify the results. Phillip Peron Test also considers the weak form of dependence. Results of the Phillip Peron Test showed that data was non-stationary at level and becomes stationary at first difference.

Table 5: Multivariate Co-Integration Test-Trace Statistics

Equity Markets	Hypothesis	Eigenvalue	Trace Statistics	Critical Value at 5%	Remarks
DSE	None*	0.129701	34.56857	47.85613	Trace test indicates no co integrating eqn(s)
KSE	At most 1*	0.055164	13.31397	29.79707	
BSE	At most 2*	0.026952	4.632176	15.49471	
CSE	At most 3*	0.002949	0.451888	3.841466	

(*) indicates 5 percent level of significance

Table 6: Multivariate Co-Integration Maximum Eigenvalue Statistics

Equity Markets	Hypothesis	Eigenvalue	Maximum Eigenvalue Statistics	Critical Value at 5%	Remarks
DSE	None*	0.129701	21.2546	27.58434	Maximum eigenvalue Statistics provides results that there exists no co-integrating equations
KSE	At most 1*	0.055164	8.681799	21.13162	
BSE	At most 2*	0.026952	4.180287	14.2646	
CSE	At most 3*	0.002949	0.451888	3.841466	

(*) indicates 5 percent level of significance

If all the series are integrated in same order than co-integration can be used to investigate the long run relationship between the series. Co-integration can be applied by two different methods. One is Jhonson and Julius Approach and other is ARDL (Auto Regressive Distribution Lag Approach). Jhonson and Julius Approach is used if data is integrated of same order and ARDL approach is used if it is not integrated of same order. Unit Root test indicates that all the series becomes stationary at first difference. So, Johnson and Julius Approach of Co-integration are used.

Table 5 and 6 represents the results of Multivariate Co-integration Approach using Johnson and Julius Approach. Results of Johnson and Julius Approach are verified through two different tests, one is Trace statistics and other is Maximum Eigen Value Test. Trace Statistics indicates that there exist no co-integration vectors and Maximum Eigen Value Test also confirms the results that no co-integration vectors exist. If different series are co-integrated in a group, it might be a case that they are not integrated in bivariate analysis. Similarly if different series are showing co-integration in Multivariate Analysis then it must also be studied that which of these markets are showing integration by using Bivariate Analysis. In the above analysis it was found that there exists no integration among these markets in Multivariate Analysis. So, Bi-variate Analysis is used to further investigate the integration among these markets.

Table 7: Bivariate Co-Integration Test-Trace Statistics

	Hypothesis	Eigenvalue	Trace Statistics	Critical Values at 0.05 level	Remarks
DSE-KSE	None At most 1	0.026699 2.95E-05	4.144971 0.004521	15.49471 3.841466	No Co-integration
DSE-BSE	None At most 1	0.034432 0.004761	6.091096 0.730243	15.49471 3.841466	No Co-integration
DSE-CSE	None At most 1	0.029515 0.01217	6.457145 1.873356	15.49471 3.841466	No Co-integration
KSE-BSE	None At most 1	0.027876 0.003618	4.880167 0.554577	15.49471 3.841466	No Co-integration
KSE-CSE	None At most 1	0.056241 0.000316	8.904648 0.048338	15.49471 3.841466	No Co-integration
BSE-CSE	None * At most 1 *	0.051665 3.53E-05	8.12166 0.005404	15.49471 3.841466	No Co-integration

(*) indicates 5 percent level of significance

Table 8 :Bivariate Co-Integration Maximum Eigenvalue Statistics

	Hypothesis	Eigenvalue	Max-Eigen Statistics	Critical Values at 0.05 level	Remarks
DSE-KSE	None At most 1	0.026699 2.95E-05	4.14045 0.004521	14.2646 3.841466	No Co-integration
DSE-BSE	None At most 1	0.034432 0.004761	5.360853 0.730243	14.2646 3.841466	No Co-integration
DSE-CSE	None At most 1	0.029515 0.01217	4.58379 1.873356	14.2646 3.841466	No Co-integration
KSE-BSE	None At most 1	0.027876 0.003618	4.32559 0.554577	14.2646 3.841466	No Co-integration
KSE-CSE	None At most 1	0.056241 0.000316	8.856309 0.048338	14.2646 3.841466	No Co-integration
BSE-CSE	None * At most 1 *	0.051665 3.53E-05	8.116256 0.005404	14.2646 3.841466	No Co-integration

(*) indicates 5 percent level of significance

The results of bi-variate Co-integration analysis shows that there exist no co-integration among the stocks markets of South Asia. Trace Statistics and Max-Eigen Value Statistics both represent the same results that there exists no long run integration among these two markets.

Table 9: Vector Error Correction Model

R-Squared and R-Bar-Squared measures refer to the dependent variable dX1 and in cases where the error correction model is highly restricted, these measures could become negative. Result of the VECM suggests that there exists no short term relationship between the Karachi Stock market and other South Asian Stock Markets.

Dependent variable is KSE			
153 observations used for estimation from 2 to 154			
Regressor	Coefficient	Standard Error	T-Ratio[Prob]
DSE	-.14844	.11118	-1.3351[.184]
BSE	.33593	.10373	3.2384[.001]
CSE	.16773	.10762	1.5586[.121]
ecm(-1)	-1.0000	0.00	*NONE*
List of additional temporary variables created:			
(KSE) dX1 = X1-X1(-1)			
(DSE) dX2 = X2-X2(-1)			
(BSE) dX3 = X3-X3(-1)			
(CSE) dX4 = X4-X4(-1)			
ecm = X1 + .14844*X2 -.33593*X3 -.16773*X4			
R-Squared	.52945	R-Bar-Squared	.52317
S.E. of Regression	.097203	F-stat. F(3, 149)	56.2582[.000]
Mean of Dependent Variable	.1979E-3	S.D. of Dependent Variable	.14077
Residual Sum of Squares	1.4173	Equation Log-likelihood	141.0538
Akaike Info. Criterion	138.0538	Schwarz Bayesian Criterion	133.5081
DW-statistic	1.9370		

Table 10: Pair wise Granger Causality Test of KSE-100

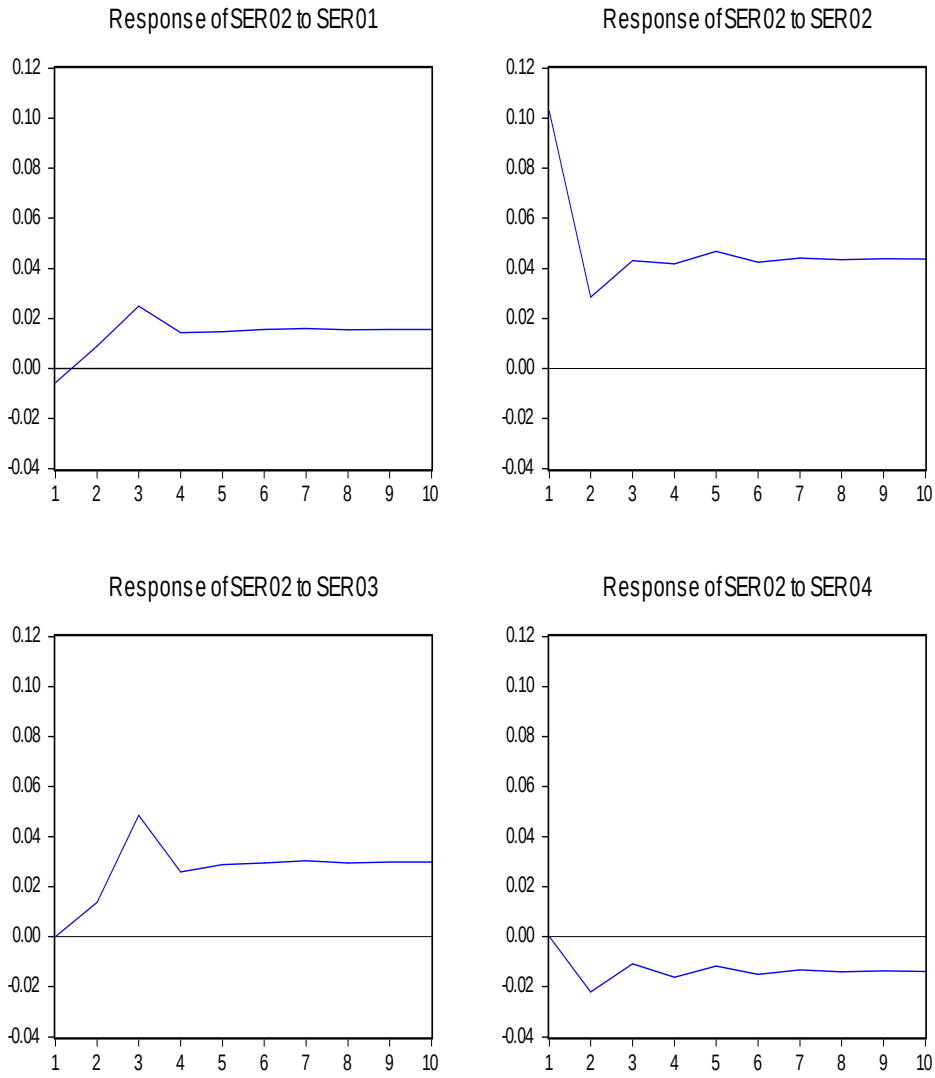
Null Hypothesis:	Obs	F-Statistic	Probability
ΔKSE does not Granger Cause DSE	153	0.56018	0.45536
ΔDSE does not Granger Cause KSE		0.91119	0.34134
ΔBSE does not Granger Cause DSE	153	1.10237	0.29544
ΔDSE does not Granger Cause BSE		0.09515	0.75815
ΔCSE does not Granger Cause DSE	153	5.379	0.02173
ΔDSE does not Granger Cause CSE		3.24223	0.07377
ΔBSE does not Granger Cause KSE	153	0.0011	0.97359
ΔKSE does not Granger Cause BSE		3.92137	0.04951
ΔCSE does not Granger Cause KSE	153	0.05099	0.82166
ΔKSE does not Granger Cause CSE		0.04562	0.83115
ΔCSE does not Granger Cause BSE	153	1.01675	0.31492
ΔBSE does not Granger Cause CSE		5.29434	0.02277

Granger representation Theorem says that if co-integration is found between two time series then granger causality must exist from at least one direction. Test

results indicated that Colombo Stock Market Granger Causes stock prices in Dhaka Stock Market and Karachi Stock Market granger causes stock prices in BSE and unidirectional causality is found from Bombay Stock Exchange to Colombo Stock Exchange. It means that information flows from Karachi Stock market to Bombay Stock market.

Impulse Response Function

Response to One S.D. Innovations



(SER01=DSE, SER02= KSE, SER03= BSE, Ser04= CSE)

Results of the impulse response function shows that most of the market shocks in KSE are explained by its own innovations and other markets do not have much influence on Karachi Stock Market. However, result of impulse response function shows that BSE is exerting some pressure on Karachi Stock Exchange in the end periods.

Table 11: Impulse Response

Period	DSE	KSE	BSE	CSE
1	-0.00565	0.102569	0	0
2	0.008946	0.028585	0.013769	-0.02202
3	0.024832	0.04317	0.048442	-0.01081
4	0.014182	0.041783	0.025779	-0.01617
5	0.014613	0.046746	0.028887	-0.01178
6	0.015623	0.042375	0.029499	-0.01499
7	0.015914	0.044079	0.030472	-0.01325
8	0.015436	0.043567	0.029465	-0.0141
9	0.015568	0.043922	0.029759	-0.01363
10	0.015568	0.043647	0.029742	-0.01391
Ordering: DSE KSE BSE CSE				

Table 12: Variance Decomposition Analysis of DSE

Variance Decomposition of DSE:					
Period	**S.E.**	**DSE**	**KSE**	**BSE**	**CSE**
1	0.080171	100	0	0	0
2	0.08984	97.56953	1.523381	0.268916	0.638171
3	0.105026	95.01521	2.100852	2.340443	0.543493
4	0.115527	94.62018	2.388995	2.335151	0.655669
5	0.126461	94.45486	2.437932	2.487899	0.619308
6	0.135903	94.13839	2.614913	2.587723	0.658978
7	0.144946	93.95166	2.690263	2.70422	0.653855
8	0.153383	93.80277	2.769548	2.761774	0.665911
9	0.161412	93.69128	2.821322	2.820256	0.66714
10	0.169045	93.59008	2.872039	2.865192	0.672686

Table 12 represents that Dhaka Stock Exchange is the most exogenous market and all of its shocks are explained by its own market innovations and other markets have very low effects on it. Most of the variable in DSE is explained by its own market changes. However, Karachi Stock market is exerting some pressure in its total variance.

Table 13: Variance Decomposition Analysis of KSE

Variance Decomposition of KSE:					
Period	**S.E.**	**DSE**	**KSE**	**BSE**	**CSE**
1	0.102724	0.302275	99.69773	0	0
2	0.110109	0.923255	93.5136	1.56365	3.999496
3	0.130643	4.268589	77.34651	14.8597	3.525201
4	0.14121	4.662216	74.95831	16.05166	4.327817
5	0.152684	4.903906	73.48969	17.30949	4.296915
6	0.162625	5.245517	71.5689	18.54826	4.637329
7	0.172474	5.514843	70.15998	19.61178	4.713398
8	0.181523	5.701836	69.09966	20.34005	4.858457
9	0.190246	5.860626	68.23845	20.96446	4.936468
10	0.198542	5.995887	67.48773	21.4931	5.023286

Table 14: Variance Decomposition Analysis of BSE

Variance Decomposition of BSE:					
Period	**S.E.**	**DSE**	**KSE**	**BSE**	**CSE**
1	0.084677	0.087684	14.43356	85.47876	0
2	0.093204	1.242511	25.18178	73.54421	0.0315
3	0.107426	2.461768	33.0996	64.30472	0.133915
4	0.116499	2.51959	35.60161	61.73207	0.14673
5	0.126754	2.65866	38.06898	59.13365	0.138712
6	0.135264	2.809696	39.96618	57.10144	0.122681
7	0.143704	2.916327	41.46092	55.51156	0.111194
8	0.151466	2.993717	42.57417	54.33202	0.100092
9	0.158959	3.058028	43.52449	53.32589	0.09159
10	0.166057	3.114419	44.30526	52.49623	0.084093

Table 15: Variance Decomposition Analysis of CSE

Variance Decomposition of CSE:					
Period	**S.E.**	**DSE**	**KSE**	**BSE**	**CSE**
1	0.088301	2.069338	1.097231	3.307147	93.52628
2	0.101495	1.876777	0.839743	5.40159	91.88189
3	0.122697	2.304539	1.458529	4.089666	92.14727
4	0.136154	2.532584	1.319923	3.918922	92.22857
5	0.150159	2.522284	1.308412	3.807306	92.362
6	0.162209	2.595652	1.26422	3.721208	92.41892
7	0.173774	2.626112	1.258009	3.6308	92.48508
8	0.184449	2.661628	1.238736	3.574197	92.52544
9	0.194613	2.681152	1.228449	3.528066	92.56233
10	0.20424	2.701799	1.218129	3.489951	92.59012

Table 13 represents the variance decomposition of Karachi Stock Market with the changes in its own market and with Bombay Stock Exchange, Dhaka Stock Exchange and Colombo Stock Exchange. In the initial periods it is clear that most of the changes in the Karachi Stock Market are due to its own market innovations. So, Karachi Stock market is exogenous market initially but table 13 shows that at the end of the table Bombay stock exchange is becoming a reason for changes in the Karachi Stock Market. Results showed that Colombo Stock Exchange is also influencing Karachi Stock Market. So, it could be deduced that Colombo Stock Exchange and Bombay Stock Exchange are exerting significant pressure on the changes in Karachi Stock Market but still most of the changes in the Karachi Stock Market index are due to innovations in its own market.

Table 14 represents the results of variance decomposition of Bombay Stock Exchange. It was found that Karachi Stock Exchange is exerting some impact on the Bombay Stock Exchange. Most of the changes in Bombay stock market are due to its own market changes or impact is found from Karachi Stock Market to Bombay Stock Market.

Table 15 represents that Colombo stock market is not influenced from changes in other markets. Dhaka Stock Market and Bombay Stock Market are exerting some impact on Colombo Stock Market. However, most of the Variance in Colombo Stock Market is explained by Bombay Stock Market or changes in its own market.

4. Conclusion

South Asian countries belong to same economic region and have similar economic environment for the investors in many aspects. Therefore, South Asian Equity markets are selected which were expected to have similarities due to same economic, geographic and social conditions. Political conditions are also not so different in these countries.

Due to these expected geographic, economic, social and political similarities, this study was conducted to explore the integration among these equity markets.

This study was aimed at exploring the relationship among the equity markets of south Asia. Four major markets from South Asian countries were selected Pakistan. (Karachi Stock Market), India (Bombay Stock Market), Sri-Lanka (Colombo Stock Market) and Bangladesh (Dhaka Stock Market). Monthly stock market index was used to explore this relationship. It was found that among these four markets KSE is the high risk and high return market. Dhaka stock market was also found with high returns but low level of risk as compared to others. (This shows that stock returns in KSE are more volatile) However, these high returns are an attraction for the investors who want to get benefit from emerging markets through directly investing or through indirectly investing like investing in emerging markets mutual funds.

Results of correlation analysis show that there exists no significant correlation among these four markets. Correlation results were showing positive correlation but it was very weak to establish any significant relationship. Dhaka and Karachi stock

markets were only showing negative correlation but it was also very weak to establish any significant inverse relationship.

This study was conducted to explore the relationship of different international markets which could benefit international investors who are interested to reduce their systematic risk through diversifying their portfolio in international equity markets.

Both Multivariate and Bi-variate Co-integration results indicated that there do not exist any long run relationship among South Asian Equity Markets and VECM also has given similar results that there exists no short run relationship among these countries.

The reason for non-integration might be absence of trade among these countries because trade between countries increases the flow of capital across the borders.

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