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Co-integration between KSE and other developed & emerging stock markets

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ABSTRACT

The purpose of the study is to examine the relationship among developed and emerging stock markets of different countries. In developed countries there are four stock markets (Australia stock exchange, London Stock exchange, U.S Stock exchange and Tokyo Stock Exchange) where in developing countries (Bombay Stock Exchange, Colombo Stock Exchange and Chinghai Stock Exchange). Ten year data has been taken for the period from 2003 to 2012. Monthly data was taken and total numbers of observation are 120. Using the co-integration analysis we find out the long run relationship among these stock exchanges. Further for stationarity of data we use unit root test and then used Descriptive analysis, correlation analysis, vector error correction model, granger causality test, variance decomposition test and impulse response test is used to examine the existence of long run relationships. Data was stationary at first difference then we used co-integration technique. Analysis shows that KSE has long run association with developing as well as developed countries. There is a unidirectional causality between KSE, Colombo and BSE30 among the developing countries. This means that movement in KSE leads toward movement in Colombo and BSE30. On the other hand, variance decomposition of KSE shows that mostly variation in the return of KSE is due to its internal factors.

Introduction

Harry Markowitz gave the concept of portfolio diversification in 1952. In early time it was new concept with respect to portfolio diversification and attained so many attention recognized it as so many involvements in field of investment analysis and this portfolio diversification concept is called Modern Portfolio Theory. The theory explains that return of 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.

In 1964 William Sharp extended the idea of modern portfolio theory and adds two concepts of lending and borrowing opportunities which was given by Markowitz in modern portfolio theory. The concept is called Capital Asset Pricing Model (CAPM). William Sharp suggested in his paper that how lending and borrowing opportunities would change the outline of efficient frontier and portfolio risk and portfolio returns would reduce in case of lending opportunities and would enhance in case of borrowing opportunities.

The model of Capital Asset pricing Model (CAPM) was also very famous and after that many economist tested in their studies. There are two types of risks exists in market. One is systematic and other is unsystematic. Systematic risk is that risk which is uncontrollable and incurred due to macroeconomic variables and unsystematic risk is risk that is controllable. In Capital Asset Pricing Model only systematic risk exist in market and unsystematic risk can be diversified because all existing assets are incorporated in market portfolio. According to Capital Asset Pricing Model the appropriate risk of any portfolio is its systematic risk because unsystematic risk can be easily diversified.

In this paper our aim is to check the relationship between the behaviour of stock prices of the developed(developed economies are those countries that are consider to be the most developed and therefore less risky.) and developing countries(emerging markets are nations with social or business activity in the process of brisk growth and industrialization.) and their exchanges with KSE market to examine whether there is potential for diversifying risk by investing in stock markets of these countries. In developed countries there are USA, UK, and Japan and in developing countries there are India, Sri Linka and Bangladesh. The aim of this paper is to examine whether the developed and developing countries still offer international investors a important diversification benefit even though their rapidly growing economic integration and emerging role in the world economy.

The Significance of the study is many researchers have found relationships of different stock markets of different countries. But most of them found short run relationship between Asian countries and Karachi stock exchange. Long run relationship between equity stock market of china and Pakistan. Co integration between KSE and emerging stock markets of different countries but in this paper I found the relationship of KSE with developed countries stock markets and then found the relationship of KSE with developing countries Stock markets.

The paper is ordered as follows: Section II briefly glances at the previous studies on market integration. In section III the data and the methodology are presented. The empirical results are discussed in Section IV. Section V concludes the paper.

Literature Review

The study is conducting to identify the behaviour of different stock markets whether these are co integrated or not. For this purpose we addressed some previous studies which explain the past results. Hussain et. Al (2012) examined the long run relation between East Asian equity market and Karachi stock exchange. Data used in this study was monthly from January 2000 to December 2010. Result of this study indicated

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that there exists no relationship among East Asian equity markets.

Hamid and Hasan (2011) conducted study to explore the causal and dynamic linkages of KSE-100 with emerging stock markets of India, China, Hong Kong, Malaysia, Indonesia, Thailand, Turkey, and Brazil, as well as with the developed stock markets of Japan, USA, UK and France, monthly data for the period of January, 1998 to December, 2008. Results conclude that KSE-100 is a volatile market and have suitable level of returns. Moreover, JCI and BCI have long run relationships with KSE, and SCI have short run relationships to KSE.

Yang, W. Kolari and Min (2002) examined long-run relationships and short-run dynamic causal linkages among the U.S., Japanese, and ten Asian emerging stock markets, particularly 1997-1998 Asian financial crises. Comparative analyses of pre-crisis, crisis, and post-crisis periods were conducted comprehensively to evaluate how stock market integration is affected by financial crises. In general, the results for the case of Asia showed that both long-run co-integration relationships and short-run causal linkages among these markets were strengthened during the crisis and these markets have generally been more integrated after the crisis than before the crisis. Reboredo (2010) Using Markov-switching models, they investigate whether oil price shock cut nonlinear effects on stock returns. Empirical evidence from a set of international stock indexes suggests that an increase in oil prices has a negative and significant impact on stock prices in one state of the economy, whereas this effect was significantly diminished in another state of the economy. Furthermore, it shown that in considering a Markov-switching model with time-varying transition probabilities, empirical results suggest that oil price changes and oil price volatility play no role in explaining the dynamics of switching between two states of the economy. Ravichandran, A. Alkhathlan (2010) investigated the impact of oil Prices on Gulf Cooperation Council (GCC) stock markets'. Since GCC countries were major suppliers of oil, their stock markets were likely to be subject to change in oil prices. The results confirm that there is an influence of oil price change on GCC stock markets returns in the long-term.

Nath Mukherjee and K. Mishra studied Return and volatility spill over among Indian stock market with that of 12 other developed and emerging Asian countries over a period from November 1997 to April 2008. Daily opening and closing prices of all major equity indices from the sample countries were examined by applying the GARCH model to explore the possibility of stock market integration and volatility spill over. In terms of return and return series, among Indian stock market with that of other Asian countries, the simultaneous intraday return spill over among India and almost all the sample countries were found to be positively significant and bi-directional. More specifically, Hong Kong, Korea, Singapore and Thailand were found to be the four Asian markets from where there is a significant flow of information in India. Similarly, among others, stock markets in Pakistan and Sri Lanka were found to be strongly influenced by movements in Indian market.

Hasan and Ratti (2012) examine the effect of oil shocks on return and volatility in the sectors of Australian stock market and finds significant effects for most sectors. For the overall market index, an increase in oil price return significantly reduces return, and an increase in oil price return volatility significantly reduced volatility. The energy, material and the financial sectors were taken. It was found that for the overall market index, an increase in oil price return significantly reduces return, and an increase in oil price return volatility significantly reduces volatility. The latter result follows since increased oil price volatility is associated with oil price changes that tend to move most stocks in a particular direction. For eight out of ten sectors (significantly so for six sectors) oil price return and stock price return move in opposite directions, but for the energy and materials sectors increased oil price return increases sector returns. In the energy and material sectors higher oil prices increase positive cash flows with resultant increases in sector returns.

Tambi study the financial integration between emerging countries and developed countries. Stock market data for six countries USA, Canada, UK, India, Malaysia and Singapore have been used for the purpose of the study. Co-integration was tested on the basis of various alternative techniques. Results showed that although developments at international level significantly influence national stock markets, but they are driven mainly by the developments at domestic level. Study also indicates that world equity market is segmented; where developed nations and emerging markets have made separate grouping. In case of India he found that it is positively correlated with all the markets, but this relationship was not highly positive.

Hussian and Sadi (2000) investigated the relationship of the Pakistani stock market with international markets. Results obtained from weekly data ranging from 1983 to 1993 show poor evidence of integration, their study about Pakistani equity market attractive for reduction in portfolio risk. Hassan and Abdullah (2008) examined the co-integration between KSE and equity markets of USA, UK, Germany, Canada, Italy and Australia. Results showed that KSE has no relationship with equity markets of developed countries and it can be an option to equity diversification.

Nabeel, Hussain and Altaf (2012) examined the relationship among the major developed equity market and KSC this research covered stock return prices from 1999 to 2012. The correlation result shows that the Karachi stock exchange weakly correlated with developed stock market. Granger Clive W.J,Huang, Bwo-Nung,Yang Chinw in April (1998) this study based on monthly data have found little relationship can be established between two market or exchange rate leads stock market ,they applied advance statistical techniques coupled with daily data to analyse the problem in Asian economic. This paper was developed by unit root, co-integration model determine the granger causality relationship between stock prices and exchange rate. Data from Japan and Thailand were agreed with this approach that exchange rate leads stock price with positive correlation. The data of Taiwan using by portfolio approach show negative correlation, data from Indonesia, Korea, Malaysia and Philippines show strong feedback relation. The Asia flu certainly had put the stock and the exchange rate market in a spotlight that suggests financial market in the Asia economics need an overhaul.

A.Iqbal, N.Khalid and Strafe this study is an attempt to find the dynamic linkages among the equity market USA and emerging market of Pakistan ,India using daily data covering the period of 2003 to 2009 co-integration procedure for long run relationship and Granger-causality test based on Toda and yahamamto methodology. The result show no integration was found stock market of USA, Pakistan, and India. Investigated through the Johansson co-integration this suggests that these

three equity market are not co-integrated in the long run. The result of this application showed that unidirectional causality exists from New York stock exchange to Bombay and KSE. Bombay and KSE did not cause New York stock. This was result of the trade relation of India, Pakistan and USA.

Jer-Shiou Chiou and Yen-Hsien Lee (2008) study investigated a long-run relationship exist between the stock and threshold co-integration testing. In this paper using Granger-causality test based on the corresponding threshold error-correlation model to assess whether causality between stock and oil market. The empirical result is differ between traditional and threshold co-integration tests .Find that an asymmetric adjustment exist between S&P 500 and oil price. The Granger causality tests based on TECM are further employed to explore S&P 500 and oil price in term of the long-run situation a unidirectional relationship exist from oil price to S&P 500 in the event of negative shocks on error correct term.

This paper is to explore co- integration between the leading Saudi house market indexes with leading indexes from china, India, UK, Malaysia, Japan Singapore, USA and Hong Kong. The theory of co-integration techniques were used to study the dependency between these indices that show a significant relationship between S&P and no dependence with other stock index. The result of the test showed absence of co-integration between Saudi stock market and emerging market. The S&P index is mirroring it by howling negative return when test is show a significant relationship with S&P and no dependence with other staticindeices. The Saudi stock market and investor sentiments move with the America economics trends rather than better performing market.

Data Description and Research Methodology

This empirical study is based on monthly closing prices of the stock market indices of equity markets Pakistan & other developed & emerging stock markets. The index prices of equity markets have been taken from Yahoo Finance and MSCI for the period of 10 years from July 2003 to June 2012. The continuously compounded rate of return is calculated by using the following formula:

$R_t = \ln (P_t/P_{t-1})$……..…… (1)

Where:

R_t = Return on day 't'

P_t = Index closing value on month't'

P_{t-1} =Index closing value on month '$t-_1$'

ln= Natural log.

There are various methods to check the integration of stock markets across the world. In this study the emphasis is given to check the inter-linkages among the equity market of Pakistan and its major trading partners via:

i. Descriptive Statistics
ii. Correlation Matrix
iii. Unit Root
iv. Vector Auto Regressive test
v. Multivariate co integration test
vi. Granger Causality Test
vii. Impulse Response
viii. Variance Decomposition

Descriptive statistics for each series' daily returns include mean, median, maximum, minimum, standard deviation, skewness, kurtosis, Jarque-Bera tests (test of normality).

Co-integration exists for variables means variables are individually non-stationary and a linear combination of two or more time series can be stationary and there is a long-run equilibrium relationship between these variables. Co-integration analysis requires that time series should be integrated of same order. To test for the stationarity of stock returns, the Dickey-Fuller test (DF), the augmented Dickey-Fuller test (ADF) and Phillip-Perron test are used. The Augumented Dickey Fuller test examines the presence of unit root in an autoregressive model. A simple AR (1) model is:

$y_t = \rho y_{t-1} + u_t$,……..……(2)

Where y_t is the variable of interest, t is the time index, ρ is a coefficient, and *ut* is the disturbance term. The regression model can be written as:

$\Delta y_t = (\rho - 1)\, y_{t-1} + u_t = \delta y_{t-1} + u_t$ ……(3)

Where Δ is the first difference operator. This model can be estimated and testing for a unit root is equivalent to testing. δ = 0.

The Dickey-Fuller tests assume that the error terms are statistically independent and have a stable variance but the Phillip-Perron test, is also used to test the stationarity of data. Phillip-Perron test assume that a weak form of dependency exists in error term.

$y_t = \alpha_o + \alpha_1\, y_{t-1} + \alpha_t \{t - T/2\} + u_t$ ……..(4)

Co-integration analysis can be conducted by using residual based Engle-Granger (1987) test or Johansen and Johansen (1988) test. The Johansen and Johansen procedure tests the presence of long run relationship between the variables, if J&J approach confirms the relationship that shows that variables are co-integrated then Granger causality must exist in at least one direction. Variance decomposition analysis provides a breakdown of the changes in the value of the variable in a given period arising from changes in the same variable in addition to other variables in previous periods.

Results

Descriptive statistics is used on the 8 stock markets for the period of 2003 to 2012. According to the statistical analysis, Table 1 indicates the descriptive statistics of return series regarding to the emerging and developed equity markets. Mean of the returns of developing and developed countries stock markets, maximum and minimum values of the returns, standard deviation, skewness and Kurtosis.

Table 1 shows the descriptive statistics. Means show the average return of stock exchange of different countries. We can see that Return of AORD is 0.3% per month which would be 3.6% per year. Maximum return for AORD is 7% per month and maximum loss can be 15% per month. This return can deviate from the mean up to 4% per month. Table also shows that stock exchanges of Pakistan, India and Sri Lanka provide the higher return than the developed counties. Stock exchange of China provides negative return during the period of study. Skewness shows that data of return of mostly stock exchanges is negatively spread.

Table 3 shows the existing correlation of KSE with other developed and emerging stock markets. We see that KSE have strong relationship with developed and emerging stock markets. KSE & Nikkei .33 and KSE and Colombo have .79 correlations which means the Colombo have more than doubled correlation with KSE comparison to Nikkie. BSE and Colombo have .87 correlations. FTSE and BSE have .76 and SP have .91 correlations with FTSE. AORD and SP show .78 correlations whereas SSE has .18 correlations with SORD. In the above table most of the stock exchanges have positive strong relationships with each other whereas some of them have negative, SSE have positive correlation with Nikkie, FTSE, SP and AORD but have significant negative relationship with KSE, Colombo and BSE. KSE have strongest positive significant relationship with BSE,

FTSE and AORD but have negative significant relationship with SSE.

Table 2 describe the results of Augmented Dickey Fuller and Philips Perron test. These tests are used to check the Stationarity of data. It is the requirement of Co-integration that data of all variables should be Stationarity at the 1st difference. We use ADF to check the Stationarity. Results indicate that data is non-stationarity at the level as T-statistics of variables are less than the critical values at 5% level. Then we check the presence of unit root at the first difference by using ADF test which shows that data is Stationarity at the 1st difference as critical values are less than T-statistics. Then we apply the Philips Perron test to confirm the result because ADF test assume that error term is statistically independent but that may not be the case in actual. PP test relax this assumption and check the presence of unit root in the data. Results of PP test also confirm the results of ADF test. So we can apply Co-integration on this data to find out the relationship between these variables.

Lag Length Criteria

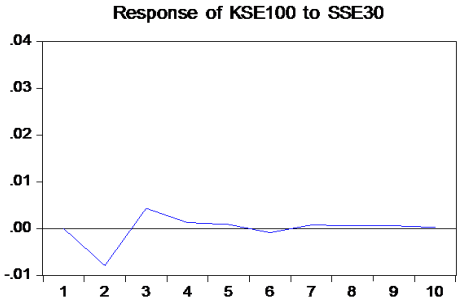
Table 3 shows the results of Vector Auto Regressive test for KSE100 and developing countries. This test is used to specify the lag length for the Co-integration. AIC test is used for selection of Lag length. This test shows the lag length of 1.

As we discussed earlier that all the variables are Stationary at the first difference. So we apply maximum likelihood-based Johansen (1988, 1991) test and Johansen-Juselius (1990) for checking the co-integration equations in the data. Firstly this test is performed at KSE100 and other developing countries. Results of Co-integration indicate 1 equation in the data. So we can say that long run relationship exist between these stock exchanges.

Co-integration test only tells us about the existence of long run relationship between the variables but don't tell us about the lead lag relationship between the variables. To know the lead and lag relationship between developing stock exchange, granger causality test is performed. Results shows that BSE30 granger causes to KSE100 because probability is less than 0.5 and when can reject the Null Hypothesis. This indicates BSE30 is leading and KSE100 is following to it. Other causality exists between KSE100 & Colombo Stock exchange and BSE30 & Colombo.

Impulse Response test tell about the response of shock. Graph shows that shock in SSE30 causes to decrease in the return first and then it recover which of KSE100 to Colombo and BSE30 is in the increase in the return of KSE100.

Variance Decomposition test tells us that how much variance is due to internal and external factors? Results show that mostly variance in the KSE100 index is due to internal factor of KSE and only one percent variance is due to other developing stock exchange. So investor should be aware of this behavior of KSE.



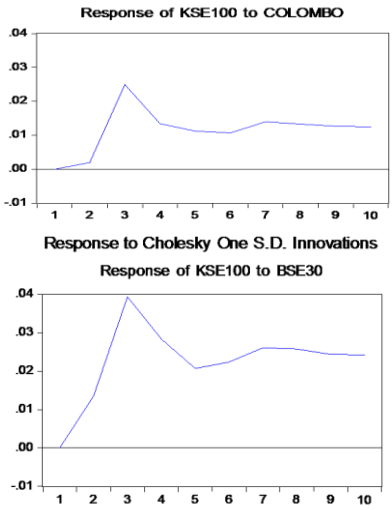


Table 3 shows the results of Vector Auto Regressive test for KSE100 and developed countries. This test is used to specify the lag length for the Co-integration. AIC test is used for selection of Lag length. This test shows the lag length of 1.

The results of Co-integrations between the KSE100 and developed countries also show one co-integration equation in the data. This means that long run relationship also exist between the KSE and developed stock exchanges. As long run relationship is present so we can further move for granger causality test to check the lead and lag relationship between these stock exchanges.

Granger causality test between the KSE and developed countries shows that KSE100 granger cause to AORD, FTSE100, Nikkie225 and S&P500. This mean change in KSE100 return also effect to the return in the other developed countries. This causality is only one way and change in the return of developed countries does not granger cause to the KSE100 return.

Impulse response of KSE100 to other developed stock exchanges shows that shock in the FTSE100, Nikkie225 and S&P500 cause to increase in the return of KSE100 while response of KSE100 to AORD is in form of decrease of return.

Result of variance decomposition shows that almost 96 percent variance in KSE100 return is due to internal factor of KSE and only 4 percent variance is due to the developed stock exchanges of the study. The note able variance of external stock exchange is above than 3% in case of FTSE100.

Conclusion

The emerging stock market of South Asian countries belong to same economic region and have similar economic environment for the investors in many aspects. On the other hand UK, USA, Japan, and Australia are leading stock markets in the developed countries. 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 to exploring the relationship among the equity markets of emerging countries and developed stock market. Monthly stock market index was used to explore this relationship. It was found that among these eight markets KSE is the high risk and high stock return as comparatively to other stocks. COLOMBO stock market was also found with high returns then to KSE.

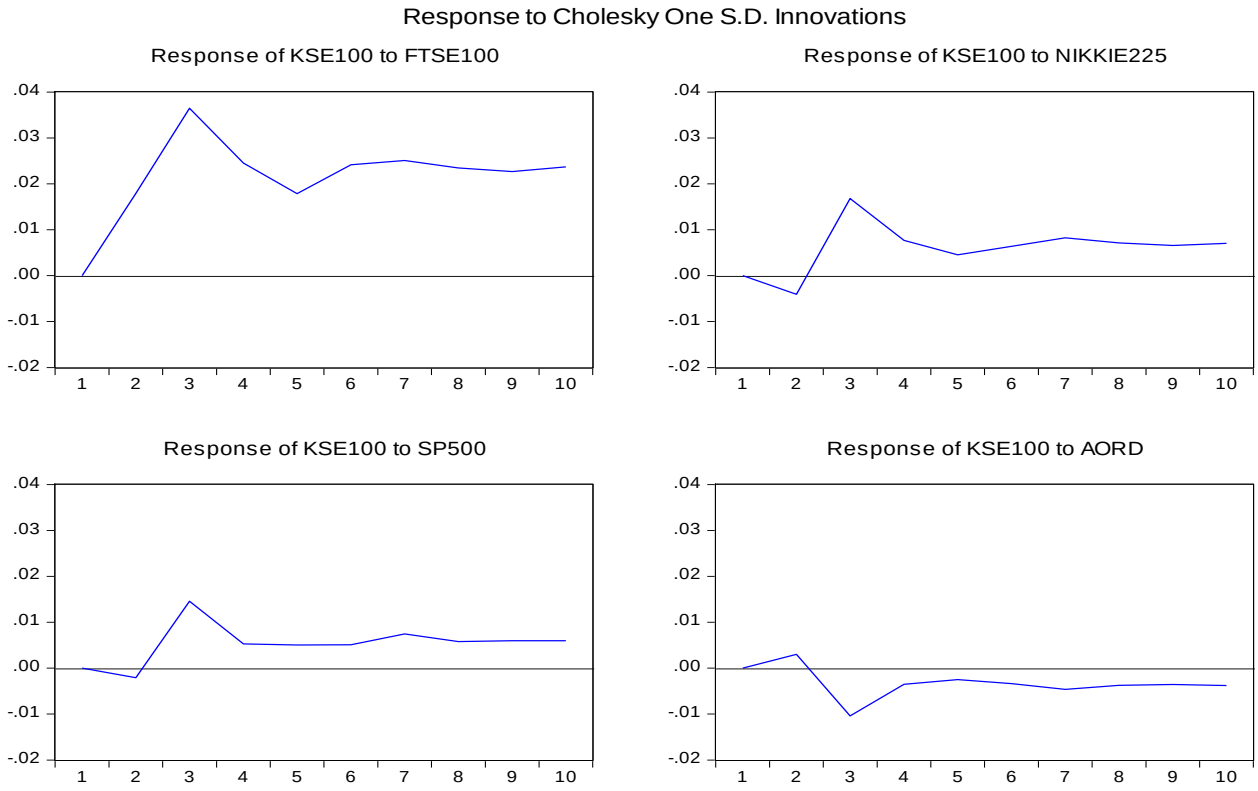


Table 1. **Descriptive Statistics**

	RAORD	BSE30	SSE30	RCOLMBO	RKSE	RFTSE	RNIKKIE	RS&P
Mean	0.0038	0.0150	-0.0033	0.0164	0.0159	0.0042	0.0018	0.0042
Median	0.0129	0.0144	-0.0079	0.0129	0.0202	0.0097	0.0034	0.0110
Maximum	0.0736	0.2488	0.2827	0.2124	0.2022	0.0830	0.1208	0.1023
Minimum	-0.1509	-0.2730	-0.2425	-0.1762	-0.4488	-0.1395	-0.2722	-0.1856
Std. Dev.	0.0404	0.0758	0.0874	0.0766	0.0804	0.0395	0.0585	0.0434
Skewness	-1.2000	-0.5968	0.5485	0.0956	-1.8838	-0.7960	-1.0339	-1.0198
Kurtosis	4.7519	4.6763	4.1900	3.1691	11.5607	4.2746	6.0577	5.7074

Table 2. Correlation matrix of emerging and developed markets

	Nikkie225	KSE100	Colombo	BSE30	FTSE100	SP500	AORD	SSE30
Nikkie225	1							
KSE100	.336**	1						
Colombo	-.124	.796**	1					
BSE30	.126	.910**	.873**	1				
FTSE100	.611**	.889**	.662**	.767**	1			
SP500	.624**	.759**	.503**	.546**	.914**	1		
AORD	.703**	.835**	.508**	.751**	.928**	.789**	1	
SSE30	.654**	-.167	-.434**	-.394**	.171	.378**	.187*	1

Table 3. Unit root test

Variable	Augmented Dickey Fuller		Philips Perron Test	
	Level	1st Diff.	Level	1st Diff.
AORD	-2.114275	-8.560181	-1.880696	-8.725908
BSE30	-1.865932	-9.557956	-2.069715	-9.657197
Colombo	-1.724123	-9.347551	-2.097922	-9.534007
FTSE100	-2.227747	-10.06100	-2.384129	-10.10056
KSE100	-2.387443	-8.992539	-2.460769	-9.025296
Nikkie225	-2.075169	-8.930792	-2.203373	-8.982786
S&P500	-2.419272	-8.504890	-2.306535	-8.606383
SSE30	-2.112326	-5.653051	-1.480240	-10.57421
Critical Values				
1% Level	-4.037668	-4.038365	-3.486064	-4.037668
5% Level	-3.448348	-3.448681	-2.885863	-3.448348
10% Level	-3.149326	-3.149521	-2.579818	-3.149326

Table 4. Vector Auto Regressive test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-101.2328	NA	7.45e-05	1.846189	1.942196	1.885153
1	531.5908	1210.136	1.49e-09*	-8.975277*	-8.495243*	-8.780458*
2	540.9361	17.21502	1.67e-09	-8.858528	-7.994465	-8.507854
3	562.2115	37.69851*	1.53e-09	-8.951079	-7.702988	-8.444549
4	571.7856	16.29280	1.72e-09	-8.838344	-7.206226	-8.175959
5	582.6411	17.71158	1.90e-09	-8.748090	-6.731943	-7.929849
6	589.9530	11.41688	2.24e-09	-8.595667	-6.195493	-7.621571
* *indicates lag order selected by the criterion*						

Table 5. Multivariate Co-integration analysis based on Trace Statistics

Hypothesized		Trace	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.223341	43.62792	40.17493	0.0216
At most 1	0.063088	13.80288	24.27596	0.5536
At most 2	0.050087	6.113308	12.32090	0.4223
At most 3	0.000423	0.049928	4.129906	0.8547
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				

Table 6. Granger causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
BSE30 does not Granger Cause KSE100	117	2.91377	0.0491
KSE100 does not Granger Cause BSE30		2.20115	0.1407
COLOMBO does not Granger Cause KSE100	117	0.09454	0.7590
KSE100 does not Granger Cause COLOMBO		2.72294	0.0470
SSE30 does not Granger Cause KSE100	117	0.00385	0.9506
KSE100 does not Granger Cause SSE30		0.01631	0.8986
COLOMBO does not Granger Cause BSE30	117	0.50486	0.4788
BSE30 does not Granger Cause COLOMBO		5.06481	0.0263
SSE30 does not Granger Cause BSE30	117	0.73041	0.3945
BSE30 does not Granger Cause SSE30		0.26038	0.6108
SSE30 does not Granger Cause COLOMBO	117	1.51494	0.2209
COLOMBO does not Granger Cause SSE30		1.48773	0.2251

Table 7. Variance Decomposition test

Period	S.E.	KSE100	BSE30	COLOMBO	SSE30
1	0.080398	100.0000	0.000000	0.000000	0.000000
2	0.082119	99.25241	0.740628	0.004418	0.002539
3	0.082231	99.18904	0.794373	0.009381	0.007209
4	0.082239	99.18205	0.799675	0.010343	0.007932
5	0.082240	99.18133	0.800193	0.010459	0.008023
6	0.082240	99.18125	0.800242	0.010472	0.008033
7	0.082240	99.18125	0.800246	0.010473	0.008034
8	0.082240	99.18125	0.800247	0.010473	0.008034
9	0.082240	99.18125	0.800247	0.010473	0.008034
10	0.082240	99.18125	0.800247	0.010473	0.008034

Table 8. Vector Auto Regressive test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	479.1484	NA	1.68e-10	-8.318393	-8.198384	-8.269688
1	1143.427	1258.633	2.26e-15*	-19.53380*	-18.81375*	-19.24157*
2	1165.951	40.70256	2.37e-15	-19.49037	-18.17028	-18.95462
3	1183.049	29.39586	2.74e-15	-19.35174	-17.43160	-18.57246
4	1197.008	22.77497	3.36e-15	-19.15803	-16.63785	-18.13523
5	1215.931	29.21474	3.81e-15	-19.05142	-15.93119	-17.78510
6	1244.488	41.58238*	3.69e-15	-19.11382	-15.39355	-17.60397
* *indicates lag order selected by the criterion*						

Table 9. Multivariate Co-integration analysis based on Trace Statistics

Hypothesized		Trace	0.05	
No. of CE(s)	Eigen value	Statistic	Critical Value	Prob.**
None *	0.329022	99.58041	88.80380	0.0067
At most 1	0.212509	52.49619	63.87610	0.3099
At most 2	0.091497	24.30557	42.91525	0.8231
At most 3	0.068869	12.98265	25.87211	0.7396
At most 4	0.037929	4.562766	12.51798	0.6599

Table 10. Granger causality test

Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
AORD does not Granger Cause KSE100	117	3.06096	0.0829
KSE100 does not Granger Cause AORD		5.39159	0.0220
FTSE100 does not Granger Cause KSE100	117	0.42579	0.5154
KSE100 does not Granger Cause FTSE100		10.3373	0.0017
SP500 does not Granger Cause KSE100	117	0.94287	0.3336
KSE100 does not Granger Cause SP500		10.5906	0.0015
NIKKIE225 does not Granger Cause KSE100	117	0.10180	0.7503
KSE100 does not Granger Cause NIKKIE225		9.62962	0.0024
FTSE100 does not Granger Cause AORD	117	0.00205	0.9639
AORD does not Granger Cause FTSE100		2.46507	0.1192
SP500 does not Granger Cause AORD	117	0.54590	0.4615
AORD does not Granger Cause SP500		0.67954	0.4115
NIKKIE225 does not Granger Cause AORD	117	1.38219	0.2422
AORD does not Granger Cause NIKKIE225		0.92592	0.3380
SP500 does not Granger Cause FTSE100	117	3.07408	0.0822
FTSE100 does not Granger Cause SP500		0.13474	0.7142
NIKKIE225 does not Granger Cause FTSE100	117	0.30689	0.5807
FTSE100 does not Granger Cause NIKKIE225		0.57702	0.4490
NIKKIE225 does not Granger Cause SP500	117	0.66956	0.4149
SP500 does not Granger Cause NIKKIE225		1.14847	0.2861

Table 11. Variance decomposition

Period	**S.E.**	**KSE100**	**FTSE100**	**NIKKIE225**	**SP500**	**AORD**
1	0.084251	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.096898	96.26628	3.414789	0.176196	0.044947	0.097793
3	0.112714	82.02209	13.00073	2.350811	1.703229	0.923142
4	0.124943	80.87588	14.43704	2.293317	1.564386	0.829372
5	0.135963	81.84077	13.91727	2.048802	1.458753	0.734404
6	0.145888	81.11818	14.82831	1.972708	1.388984	0.691821
7	0.155176	80.09357	15.72253	2.024853	1.459329	0.699710
8	0.164077	79.78380	16.10966	1.999661	1.429616	0.677268
9	0.172422	79.65702	16.31626	1.956150	1.414436	0.656136
10	0.180393	79.38133	16.63339	1.939897	1.402065	0.643314

On the base of results, we can conclude that KSE has long run association with developing as well as developed countries. There is a unidirectional causality between KSE, Colombo and BSE30 among the developing countries. This means that movement in KSE leads toward movement in Colombo and BSE30. On the other hand, variance decomposition of KSE shows that mostly variation in the return of KSE is due to its internal factors.

There also exist a long run relationship between KSE and developed. There also exist unidirectional causality between the developed stock exchanges and KSE. This causality is found between KSE, AORD, Nikkie225, S&P 500 and FTSE100. These developed stock exchanges granger cause by KSE100.

This study has practical implication for the purpose of international diversification. The investor will be able to know the behavior of stock exchanges and can invest in the stock by checking the causality between these stock exchanges and can earn a reasonable return.

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