

Financial Economics**Co-integration of Karachi Stock Exchange
(KSE) With Major Asian Markets****Asma Sarfraz¹, Sumbal Shehzadi², Haroon Hussain³, Mohsin Altaf⁴**

Abstract: The purpose of this research is to study the long run relationships and co movement among the stock markets of Pakistan and other Asian stock markets i.e. India, Malaysia and Indonesia. Over the period of Jan 1, 1998 to October 3, 2011. This paper examines the co-movement among stock markets of Pakistan, India, Malaysia and Indonesia. Descriptive statistics, correlation, co-integration tests are run to check the behavior and co movement of markets. Granger causality test is used to check the lead lag relationship. Impulse response tells about the one standard deviation change in market bring what standard deviation change in other market. Variance decomposition technique is used to decompose the variance in one market due to change in another market and due to its own dynamics i.e. economic and political conditions also affect the market. The results shows that the four markets Pakistan, India, Malaysia and Indonesia are weakly correlated with each other and find no co-integration. Variance decomposition shows that most of the change in above listed countries is due to their own factors. Number of studies has been conducted on developed markets like United States of America, United Kingdom, France, Japan Canada and underdeveloped countries, but this paper focuses on emerging markets of Asia.

Key words: Co-integration; augmented dickey fuller test; Phillips perron; granger causality; variance decomposition.

JEL Classification: G11

1. Introduction

Monetary and financial world is reshaping itself in global perspective. Liberalization in financial affairs is need of the today which eliminates the barrier due to explosion of technology. For the last few decades overseas investment is getting more popularity all around the world. Globalization open ways for

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prospective investor to invest their wealth in different economies, sectors and companies of their own preference so that risk factor can be branch out.

Co-integration technique has become famous approach for researcher and academicians for establishing the causality models and linkages. First co-integration technique was developed 19 years back by the (1981) Granger; (1987) Engle and Granger; and (1991) Hallman and Granger. (1952) Markowitz (1965) lintner and (1964) Sharp gives the portfolio diversification model. As according to modern portfolio theory, prospective investors should invest their wealth in different asset classes i.e. shares, bonds and stock, and make efficient portfolio from these asset classes, rather than to invest in one asset class. Favero and bonfiglioli (2005) examines the linkage among Germany and United States. Urbain and Corhay (1993) examine the links and association among the European stock markets. Number of study focuses on minimizing the risk through international portfolio diversification (Grubel, 1968, Errunza 1982, Sarnat and Levy 1970). This paper aspires to study the long run relationship among the promising stock markets of Asia i.e. Pakistan, India, Malaysia and Indonesia. If in a consequence markets are co-integrated with each other than the prospective investor could not get the advantage of portfolio diversification, and if they are not co-integrated with each other than the investors could get the advantage of portfolio diversification.

1.1 Objectives of the study

This research aims to attain the following objectives:

- (1) To find out the return methodology in the stock markets of Pakistan, India, Indonesia and Malaysia.
- (2) To find the links between the stock exchanges of Pakistan, India, Indonesia and Malaysia.
- (3) To find out that whether there exist opportunities for the portfolio diversification among the stock equity markets of Pakistan, India, Indonesia and Malaysia.

2. Literature Review

Roca (1999) observes the stock markets of United States of America, United Kingdom, Japan, Korea, Hong Kong, Singapore, Taiwan, and Australia. He uses weekly stock prices of these above listed 8 countries. He exercises co-integration technique to test out the long run relationship and co-movement among their equity markets. Results disclose that no co-integration exists among these 8 stock markets, but Australian stock market is influenced by the stock markets of US and UK. Iqbal et al (2008) examines the vibrant relationship among the stock markets of Pakistan, India and US by means of daily records of share prices covering the period of Jan 2003 to Dec 2009. Johansen and Juselius co integration technique is applied. Results depicts that no co-integration exist between the markets of US, Pakistan and India. Hassan et al (2008) investigates the long run relationship between Karachi stock exchange with the urbanized stock markets of the world, by using multivariate co-integration and results reveals that pair wise Karachi stock exchange is not co-integrated with the urbanized stock markets i.e. US, UK, Germany, Canada, Italy and Australia, and most of the variations in Karachi stock exchange are due to its own dynamics. Fadhlaoui et al (2008) explain the short and long run relationship between the seven urbanized equity markets i.e. US, UK, Canada, Italy Germany France, Japan and the central European emerging markets of Czech-republic, Hungary and Poland Co-integration test is applies, and the results reveals that no long term relationship exist between the stock markets of above listed countries. Subramanian (2008) observes the co-integration among the five most important stock markets of Asia i.e. Osaka stock exchange, Tokyo stock exchange, Shanghai stock exchange, Hong Kong stock exchange and Korean stock exchange. By using unit root test and co integration test, Result shows that these markets are integrated with each other so the prospective investors should not invest in these markets Subhani et al (2011) cross-examine the co-movement among the stock markets of Pakistan, Bangladesh, Nepal and India by taking the stock prices from May 1995 to May 2011. Results show that Karachi stock exchange is integrated Dhaka stock exchange, but not Co-integrated with the stock markets of India and Nepal. Sharma and Bodla (2011) observed the interlink ages among the stock markets of India Pakistan and Sri Lanka. By taking the indices from Jan 2003 – Dec 2002, using granger causality test, VAR and variance decomposition. Result depicts that the stock market of India does granger the stock markets of Pakistan and Sri Lanka. Onay (2007) explores the long run financial relationship of the stock markets of Bovespa and Istanbul Stock. By talking a time span of 10 years. Weekly data of the stock indices of (IBX) and (ISE100) are used in this research from 1995 to 2005. Cointegration technique is applied in this paper to find out the co movement, and causality test is also used in this research to check the lead lag relationship. The results reveal that there exist no co integration pair wise, and granger shows the unidirectional relationship. Bessler and Yang (2003) investigates the daily stock indices of the world's popular stock markets i.e. United

States, United Kingdom, Japan, Hong Kong, Germany, Switzerland, Canada, Australia, and France. Co integration, error correction modeling are applied. Results reveal that much of the fluctuations comes in United States markets is because of its own innovations and fluctuations, and it also affect by the stock equity markets of Germany, Hong Kong, France, Switzerland and United Kingdom but with minor percentage. Aksoy et al (2011) explores the stock equity markets of Turkey, Israel and Egypt talking time period from 2002-2010 to check out the short term relationship and long term relationship between these markets. Co- integration and correlation tests are applied to check this relationship. The results show that these above mention markets are co integrated with each other. Kucukkaya (2007) investigates the stock equity markets of United States and Turkey, to find the long run relationship. Unit root analysis, co integration analysis and causality test are used to find out the lead lag relationship. Results show that the United States market and Turkish stock market are not link with each other so; the investors can take benefit by investing their portfolio in these markets.

3. Data and Methodology

This study is based on monthly closing stock prices of Pakistan, India, Malaysia and Indonesia. These closing prices have been taken from **yahoo finance**. Time period consist of 14 years from *Jan, 1, 1998 to Oct, 3, 2011*. The continuous compounding is computed by the following technique.

$$RT = \ln (PT/PT-1)$$

Where:

RT = Return on month t

PT = Index closing prices on month t

PT-1 = Index closing prices on month $t-1$

Ln = Natural log.

Number of analysis can be conducted to check the long run relationship. 1. Descriptive statistics which explains the behavior of the data, 2. correlation technique which explains the strength and direction. 3. Multi-variate co-integration is used to check the co-movement but, before running this we will remove patterns from the data by using augmented Dickey Fuller and Phillip Perron test and make the data stationary. 4. Granger causality technique will use next to check the relationship. 5. Impulse response and variance decomposition technique will describes that whether one market have an effect on other market or not? And the results depicts that one market does not influenced by the other markets in fact it influence by its own dynamics.

4. Empirical Results

Table 1. Descriptive statistics

	KSE	BSE	KLSE	JSE
Mean	1.016772	1.013223	1.008325	1.01608
Median	1.019629	1.014543	1.009742	1.022971
Maximum	1.272666	1.282551	1.342349	1.28427
Minimum	0.638396	0.761099	0.752291	0.685781
Std. Dev.	0.096099	0.077665	0.073733	0.085129
Skewness	-0.50082	-0.12728	0.859607	-0.38897
Kurtosis	5.139809	3.567344	7.537094	4.892945
Jarque-Bera	38.37669	2.658446	161.8438	28.79545
Probability	4.64E-09	0.264683	0	5.59E-07

Table 1 exhibits the descriptive statistics, and represents the monthly returns of KSE, BSE, KLSE and JSE 1. 0167, 1. 0132, 1. 0083, 1. 016 respectively. Total number of observations is 167 for a time period of 14 years. The results of descriptive statistics show that Karachi stock exchange shows the highest average monthly return which is 1. 016%. The maximum return in Karachi stock exchange market in one month is 1. 27%, where as minimum return in one month is 0. 638%. The second highest average monthly return in Jakarta stock exchange is 1. 016% per month. The third highest average monthly return of Bombay stock exchange is 1. 013% and the fourth average monthly return of Malaysian stock exchange is 1. 008%

Karachi stock exchange shows the high risk which is 0. 09% per month. The Jakarta stock exchange shows 0. 085% risk per month. Bombay stock exchange shows 0. 077% risk per month and Malaysian stock exchange shows 0. 073% risk per month.

Table 2. Correlation matrix

	KSE	BSE	KLSE	JSE
KSE	1			
BSE	0.277093	1		
KLSE	0.187223	0.35801	1	
JSE	0.113957	0.473632	0.497853	1

Correlation technique is the statistical means used to evaluate the extent of relationship among different variables. When values of single variable are linked with other variable, Karl Pearson's coefficient of correlation can be used to evaluate the relationship among them. As this research study seeks to find out the

relationship between major Asian stock equity markets therefore we applied correlation technique. Table 2 presents the correlation matrix which explains that weak correlation is observed among Karachi stock exchange, Bombay stock exchange, Jakarta stock exchange and kuala-lumpur stock exchange. Bombay stock exchange is weakly correlated with Karachi stock exchange 0.2770. Karachi stock exchange is also weakly correlated with kuala-lumpur stock exchange 0.1872 and Karachi stock exchange is weakly correlated with the Jakarta stock exchange 0.1139. However relationship is significant and weak so, investor should invest in Jakarta stock exchange because of low correlation. Correlation technique is not appropriate technique because it does not deal with the cause and effect relationship so we will move toward co-integration technique.

Table 3. Unit Root Test

	ADF Level	ADF First Diff.	PP Level	PP First Diff.
KSE	-1.046566	-4.781220	-0.85770	-11.50622
BSE	-0.973788	-4.945540	-0.734525	-12.19158
KLSE	-1.148914	-4.945540	-1.072691	-10.74196
JSE	-0.057129	-4.937056	-0.477977	-10.64870
Critical Values				
1 %	-3.4720	-3.4720	-3.4720	-3.4720
5 %	-2.8794	-2.8794	-2.8794	-2.8794
10 %	-2.5762	-2.5762	-2.5762	-2.5762

Before applying co-integration we do the unit root analysis. Unit root analysis is used to authenticate the stationary of data. Two different analyses to make the data stationary were apply, Augmented Dickey Fuller (1979) and Phillips Peron (1988). Table 3 represents that data was not stationary at level because the Augmented Dickey Fuller values are less than critical values so the data become stationary at 1st difference because the ADF values are greater than critical values (minus sign will ignore). Than the Phillip perron test also shows that the data become stationary at 1st difference because the PP values are greater than the critical values. Now we can run co integration to check the co movement of markets.

Table 4. Multivariate Co-integration Analysis

	Hypothesis	Eigen value	Likelihood Ratio	Critical value 5%	Remarks
KSE	$r = 0$	0.155446	44.73363	47.21	No co- integration
BSE	$r \leq 1$	0.058254	17.53329	29.68	
KLSE	$r \leq 2$	0.044833	7.870074	15.41	
JSE	$r \leq 3$	0.003009	0.485229	3.76	

As the data become stationary at 1st difference, now we can apply co-integration test. Table 4 represents that there exist no co integration among the 4 stock markets, because the Eigen values and likelihood ratio of all above mentioned stock markets are less than critical values 5%, which mean there is no long term relationship between these markets.

Table 5. Bi-variate Co-integration Analysis

	Hypothesis	Eigen Value	Likelihood Ratio	Critical Value 5 %	Remarks
KSE- BSE	$r = 0$ $r \leq 1$	0.019583 0.012745	5.249295 2.065211	15.41 3.76	No Co- integration
KSE- KLSE	$r = 0$ $r \leq 1$	0.019547 0.101978	4.828261 1.650086	15.41 3.76	No Co- integration
KSE- JSE	$r = 0$ $r \leq 1$	0.057585 0.000497	9.628838 0.080054	15.41 3.76	No Co- integration
BSE- KLSE	$r = 0$ $r \leq 1$	0.006104 0.006267	11.15257 1.012205	15.41 3.76	No Co- integration
BSE- JSE	$r = 0$ $r \leq 1$	0.056692 0.000141	9.419007 0.225711	15.41 3.76	No Co- integration

KLSE-JSE	$r = 0$ $r \leq 1$	0.067426 0.007623	11.36171 0.122783	15.41 3.76	No Co- integration

Table 5 presents the bi-variate analysis. Table 5 represents that there is no co-integration exists between the stock equity markets of KSE, BSE, JSE and KLSE (because the Eigen and likelihood values of the markets are less than critical values 5%). Co-integration tells about the long term relationship between different data series, but it does not show the lead lag relation so, we further run the Causality test.

Table 6. Granger causality test

Null Hypothesis:	Observations	F-Statistic	Probability
BSE does Granger Cause KSE	161	4.037377	0.003857
KSE does not Granger Cause BSE		1.141113	0.339396
KLSE does Granger Cause KSE	161	3.914567	0.004701
KSE does not Granger Cause KLSE		6.980768	3.47E-05
JSE does Granger Cause KSE	161	3.059017	0.018541
KSE does not Granger Cause JSE		1.782366	0.135212
KLSE does not Granger Cause BSE	161	1.696782	0.153599
BSE does not Granger Cause KLSE		0.942403	0.441184
JSE does not Granger Cause BSE	161	2.383824	0.053835
BSE does Granger Cause JSE		2.566142	0.040468
JSE does not Granger Cause KLSE	161	0.281784	0.889429
KLSE does Granger Cause JSE		4.723718	0.001276
If it is less than 0. 05% than null is rejected and alternative is selected.			

To check the lead lag relation we run granger causality test. Table 6 presents the Granger causality test, which shows that there is one sided relation between markets. Bombay Stock Exchange brings change in Karachi Stock Exchange, but the Karachi Stock Exchange does not bring any changes in Bombay Stock Exchange and vice versa.

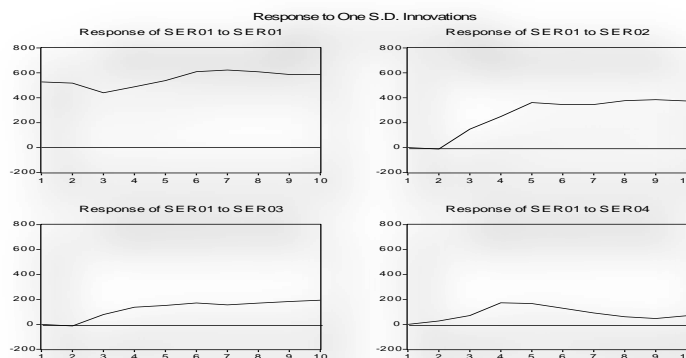


Figure 1. Impulse response

Figure 1, exhibits the Impulse response test which provides information about the response of Karachi stock exchange to one standard deviation change in Bombay stock exchange, Malaysia stock exchange and Jakarta stock exchange. It is graphical presentation of relationship in the VAR system.

Table 7. Variance decomposition of KSE

Period	S. E.	KSE	BSE	KLSE	JSE
1	0.085988	100.0000	0.000000	0.000000	0.000000
2	0.091562	91.09985	0.319530	1.482501	7.098123
3	0.095230	86.20488	5.234038	1.963902	6.597178
4	0.099238	80.72645	5.108231	1.808514	12.35680
5	0.104067	77.19725	6.459121	2.314091	14.02953
6	0.108284	77.64291	6.597290	2.137756	13.62204
7	0.110498	77.47240	6.341062	2.754381	13.43216
8	0.112984	76.04003	7.414407	2.764061	13.78150
9	0.116956	75.71611	7.235557	2.590696	14.45764
10	0.120094	75.45794	6.912691	2.485036	15.14434

The variance decomposition shows that Karachi stock exchange does not change due to change in other markets, the changing are in stock return of KSE is due to its own market fluctuations. As shown in the above table that 100% changes in Karachi stock exchange happens due to its own fluctuation and innovation in one period of time.

Table 8. Variance decomposition of BSE

Period	S. E.	KSE	BSE	KLSE	JSE
1	0.079024	8.072262	91.92774	0.000000	0.000000
2	0.081634	9.053625	89.36731	1.526808	0.052259
3	0.086675	9.472565	87.32746	1.392370	1.807604
4	0.090828	9.152728	86.99463	2.132278	1.720366
5	0.096720	8.884935	87.26482	2.085186	1.765058
6	0.101436	8.777837	87.50762	2.004300	1.710243
7	0.105828	8.955960	86.99674	2.004645	2.042660
8	0.109334	9.165251	86.55051	2.321727	1.962512
9	0.113354	9.071998	86.76524	2.328563	1.834198
10	0.117708	9.089809	86.97211	2.181349	1.756735

These results show that Bombay stock exchange brings 91. 927% change due to its own market fluctuations, and 8. 072% change due to Karachi stock exchange, rest of two does not have any impact on Bombay stock exchange.

Table 9. Variance decomposition of KLSE

Period	S. E.	KSE	BSE	KLSE	JSE
1	0.064779	0.881757	7.061467	92.05678	0.000000
2	0.070335	4.901415	7.049270	87.68835	0.360969
3	0.076414	4.881980	8.974064	84.98656	1.157399
4	0.078597	5.126060	8.590483	84.44845	1.835008
5	0.082670	8.723370	8.849636	80.35213	2.074865
6	0.087709	7.764861	10.01615	78.03004	4.188947
7	0.091229	7.177366	9.626931	77.79211	5.403598
8	0.094267	6.800538	9.445692	78.60833	5.145440
9	0.096289	6.521457	9.256702	79.14234	5.079500
10	0.099152	6.247096	10.31932	78.20757	5.226011

The result shows that 92.056% change in the kuala-lumpur stock exchange is due to its own market fluctuations, 7.0614% changes due to Bombay Stock Exchange, 0.881% change due to Karachi stock exchange but not affected by the Jakarta stock exchange in a one period of time.

Table 10. Variance decomposition of JSE

Period	S. E.	KSE	BSE	KLSE	JSE
1	0.075782	2.094783	27.81560	19.11641	50.97321
2	0.087733	3.995612	24.38633	31.98141	39.63664
3	0.092332	4.822541	22.97196	36.34987	35.85563
4	0.094333	6.222772	24.01324	34.83045	34.93354
5	0.099074	5.643802	27.21857	34.22306	32.91457
6	0.105770	7.027904	25.19028	37.42781	30.35401
7	0.111213	7.106750	24.57430	37.94013	30.37882
8	0.116347	7.730529	25.32785	38.60795	28.33367
9	0.118926	7.958040	25.49270	39.07765	27.47161
10	0.121973	7.795428	26.48920	38.66134	27.05402

This shows that 50.97321% changes in Jakarta stock exchange is due to its own market fluctuations, 27.81% change due to Bombay stock exchange, 19.11% change due to kuala-lumpur stock exchange in one period of time.

5. Conclusion

Karachi stock exchange is offering high risk and high return than any other above discussed markets. Markets are positively but weak correlated with each other. Co-integration results shows that there exists no co-integration among the Karachi stock exchange and other above discussed stock markets of Asia. And number of changes in Karachi stock exchange occurs due to its own factors. As the study reveals that no long run linkages and no co-integration are found in these markets so this means that prospective investor can invest their wealth in these markets in different assets classes or can make efficient portfolio by purchasing securities from these stocks markets.

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