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# AN EMPIRICAL EXAMINATION OF LINKAGES AMONG KARACHI STOCK EXCHANGE AND EMERGING EQUITY MARKETS OF ASIA PACIFIC REGION

**ARSHAD HASSAN**
**Mohammad Ali Jinnah University, Islamabad, Pakitan**
**KHALID MAHMOOD AWAN**
**University of Sargodha, Sargodha, Pakistan**

## ABSTRACT

**This study analyses weekly stock indices for ten equity markets of Asia pacific region for the period January 1, 2001 to June 30, 2013 to explore the long run relationship among Karachi stock exchange and Asia Pacific equity markets . These markets include Hong Kong, Singapore, Indonesia, Korea, Malaysia, Pakistan, Taiwan, India and china. Multivariate Cointegration and VAR procedures are performed to observe the long term dynamic relationships among these market Results show that Karachi stock exchange is best performing market for the period under study as it offers the highest return at relatively low risk level. Multivariate Cointegration analysis provides an evidence of a single cointegrating equation among the markets studied. The results of the bivariate Cointegration tests indicate that the Pakistani stock market is not individually integrated with any of the emerging Asia Pacific markets except Hong Kong and Taiwan. Granger causality tests reveal a casual flow from Korea, Hong Kong, Taiwan and Indian indices to Karachi stock exchange index. This unidirectional causality is indicator of lead-lag relationship amongst them. Variance decomposition analysis shows that Karachi Stock Exchange (KSE) is exogenous as most of its vibrations are explained by its own unique shocks. Above results explain that international investors can derive the benefits of portfolio diversification and any volatility in emerging Asia Pacific markets does not expose the international investors in Karachi stock exchange to any immediate threat of spill over effect.**

## INTRODUCTION

Financial world is reshaping itself. Globalization has changed the entire landscape of financial world Equity markets for developing and developed markets are now becoming more closely interlinked. These markets have unique feature and country characteristics. Volume of empirical literature on the topic is an indicator of the fact that researcher has shown strong interest in the linkages among international stock markets and this interest has increased considerably after the liberalization of financial regulations in developed as well as developing countries. Technological developments in communications, trading systems, financial; innovation and service proliferation have created more opportunities for international portfolio investments. The interest is result of globalization which is accelerating the process of integration of international economies and financial markets.

In recent years, the new emerging equity markets have attracted the attention of international fund managers as an opportunity for portfolio diversification. This new dimension has intensified the interest of academics in exploring international market linkages. Thus, an analysis of the long-run co-movement of national stock prices and their short-term temporal relationships has taken a focus with reference to international portfolio diversification. So objective of the study is to understand the dynamic inter-linkages between Karachi stock exchange and the equity markets of Asia pacific region These countries include Hong Kong, Singapore, Indonesia, Korea, Malaysia, Pakistan, Taiwan, India and China. If these markets are independent then investors in these countries can invest to diversify their portfolio and the authorities in these countries need not worry about any contagious effects.

Paper is divided into four sections. Section 2 gives an overview of recent literature on the topic. Section 3 presents the data and methodology employed in the paper. Section 4 reports empirical results of various tests conducted. Section 5 concludes the paper and provides

policy implications of the result.

## LITERATURE REVIEW

Literature on inter linkages of equity markets across the globe is divided into two broader groups. Some studies used the ARCH/GARCH models to examine the contagious effects regionally or globally. Here emphasis is on to analyze the spillover/contagious effects of a shock from one country to another. Other group tested the interdependence of equity markets by using cointegration analysis based on vector auto regressive frame work. We are employing second approach to test the interdependence among equity markets of Asia pacific region so literature review contains only those studies that have used this approach to test the cointegration among national stock exchanges.

Glezakos, Merika, and Kaligosfiris (2007) examined the short and long-run relationships between major world financial markets and the Greek stock exchange for the period 2000-2006 using monthly data. Financial markets studied include USA, Japan, England, France and Italy, Belgium, Holland and Greece. The research methodology include testing for stationarity, Cointegration and Granger Causality in VAR model. The results showed the dominance of the USA equity market and the strong influence of DAX and FTSE on all other markets of the sample.

Wong, Penm, Terrell, and Lim (2004) investigate the relationship between the major developed markets of United States, United Kingdom and Japan with the emerging markets of Malaysia, Thailand, Korea, Taiwan, Singapore and Hong Kong. They found that Singapore and Taiwan were cointegrating with Japan while Hong Kong was cointegrating with the United States and the United Kingdom. No long run equilibrium relationship between Malaysia, Thailand and Korea and the developed markets of the United States, the United Kingdom and Japan was found. They also discovered that interdependence between most of the developed and emerging markets was on rise since famous Stock Market Crash of 1987 and that interdependence had significantly increased after financial crisis of East Asian countries in 1997. Therefore possibility of international portfolio diversification to minimize risk had significantly decreased after the Stock Market Crash of 1987.

Ibrahim (2005) studied the international linkage of the Jakarta equity market and evaluated the impact of the Asian crisis over the long run and short-run dynamic interactions among the equity markets of Indonesia and equity markets of two highly developed markets of the US and Japan. He also explored the long term relationship among Philippines, Thailand, Singapore and Malaysia which are major ASEAN markets. He used monthly data for the period; January 1988 to December 2003 and applied cointegration analysis and vector autoregressive technique. Long-run equilibrium relationship between Indonesia and developed markets of USA and Japan and south East Asian markets was examined by using cointegration tests suggested by Johansen and Juselius. Results revealed that Jakarta equity market did not share a long run relation with other South East Asian markets and equity markets of US and Japan. The equity market of Indonesia was found segmented from south East Asian Equity Markets. It was also found that US market exerts pressure on ASEAN markets. Vector error correction model and impulse response functions were used to examine the short-run causal nexus. Results provided evidence about the absence of short run interactions between the Jakarta stock exchange and other regional markets. Therefore Indonesian equity market offered an opportunity of global portfolio diversification. The study also cofirmed the stability of results in three different sample periods i.e , pre-crisis sample period, post crisis sample period and entire sample period.

Fazal and Saidi (2000) investigated the integration of Pakistani equity market with equity markets of USA, UK, France, Germany, Japan, Singapore and Hong Kong by using weekly General Price Index for KSE for the period Jan 1988 to December 1993. They used the Cointegration analysis, correlation analysis and error correction model. Correlation analysis showed low level of correlation between Pakistani market and other markets. Cointegration analysis suggested no long term relationship among the equity markets. Result provided evidence about existence of long term relationship among Karachi stock market and equity markets of US, UK and Japan. In order to capture the short term dynamics vector error correction model was used but results were not in line with long term behavior. Furthermore, no causal relationship was identified among equity markets of Pakistan ,UK and Japan markets. However , US market is wielding some effect on Pakistani market.

Roca (1999) investigated the price linkages between the equity markets of Australia and that of the U.S., U.K., Japan, Hong Kong, Singapore, Taiwan and Korea using weekly stock market data. He used Johansen Cointegration technique to determine the long run relationship between the price levels of the above countries and employed Granger causality test to determine the short run relationships. His results indicated no Cointegration between Australia and other markets. However, the Granger causality test revealed that Australia was significantly linked with the U.S. and the U.K.

Ghosh, Saidi, and Johanson(1999) examined the disaster of Asian Pacific stock markets by employing the vector autoregressive framework. Natural logarithm of

daily closing prices of stock market indices of Malaysia, India, Thailand, Philippine, Hong Kong, Korea, Taiwan, Singapore, Indonesia, US and Japan were tested to see the long term relationship by using Cointegration techniques. Results suggested that US market has unique relationship with Indian, Korean and Malaysian markets. Hong Kong market was significantly influenced by US market. However markets of Singapore , Indonesia and Philippine ware related to Japan. Markets of Taiwan and Thailand was not found cointegrated.

## METHODOLOGY

### Data Description

The study uses weekly indices of equity markets of Asian markets; namely Pakistan, Malaysia, Indonesia, India, China, Taiwan, Korea, Hong Kong, Australia and Thailand. Specifically, the stock indices under study are the All Ordinary Composite Stock Index (Australia), KS11 Stock Index (Korea), the Hang Seng Stock Composite Index (Hong Kong), the KSE 100 Share Index (Pakistan), the Kula Lumpur Composite Stock Index (Malaysia), the Jakarta Composite Stock Index (Indonesia), the Shanghai Stock Exchange Index (China), the Taiwan stock Index (Taiwan), and the Bombay Stock Exchange Index (India) and Strait Times index (Singapore). All stock index prices are taken from yahoo finance. The data cover the period from Jan 1, 2001 through June 30, 2013.

The continuously compounded rate of return is calculated by using the following formula

$$Rt = \ln (Pt / Pt\text{-}1)$$

### Methodology

Cointegration analysis with Vector auto regression framework is used to test the co movement of equity prices in different stock exchanges across the states. This study tests the dynamic interaction among the Karachi stock exchange and equity markets of emerging equity markets of Asia pacific region by using (i) Descriptive statistics, (ii) Correlation matrix, (iii) Cointegration tests, (iv) Granger causality test and (iv) variance decomposition analysis. The Cointegration technique and a vector auto regression model are used to study the long-run and short-run interactions.

Descriptive statistics provides information about mean return, skewness, kurtosis and risk of equity markets. Correlation analysis reports degree of association among variables. Cointegration analysis requires that time series should be integrated of same order so index series is examined to test the stationarity of data. The augmented Dickey-Fuller (ADF) test is used on the market index levels and their first differences to test for unit roots in the data. Dickey-Fuller tests assume that the errors terms independently and identically distributed. This condition may not be true in some case so Phillip-Perron test is also used as it permits the error terms to be weakly dependent and heterogeneously distributed.

If the market index series are integrated of the same order, then it is necessary to investigate that linear combination is stationary. Two or more non stationary time series are cointegrated if a linear combination of these is stationary. Cointegration tests are conducted by means of the method developed by Johansen (1988), and Johansen and Juselius (1990). The Johansen method applies the maximum likelihood procedure to determine the presence of cointegrating vectors in nonstationary time series. The Johansen maximum likelihood approach is based on the concept of vector autoregressive framework. Johansen and Juselius propose two likelihood ratio tests for the determination of the number of cointegrated vectors. One is the maximal eigenvalue test which evaluates the null hypothesis that there are at most r cointegrating vectors against the alternative of r + 1 cointegrating vectors. The maximum eigen value statistic is given by,

$$\lambda max = - T \ln (1 - \lambda r+1)$$

where $\lambda$ r+1,…,$\lambda$n are the n-r smallest squared canonical correlations and T = the number of observations.

The second test is based on the trace statistic which tests the null hypothesis of r cointegrating vectors against the alternative of r or more cointegrating vectors. This statistic is given by

$$\lambda \text{ trace} = -T \Sigma \ln (1 - \lambda i)$$

In order to apply the Johansen procedure, a lag length must be selected for the VAR. Akaike Information Criterion (AIC) is used to select the number of lags required in the cointegration test. If the market index series provide evidence cointegrating relationship then equity market will have a tendency to move together in the long run. Granger (1986); Engle and Granger (1987) explain that if two variables are cointegrated then Granger-causality must exist in at least one direction. As index series may share ordinary stochastic trends so dependent variables in the vector error correction model must be Granger-caused by lagged values of the error correction terms. Therefore, joint F-test can be applied to coefficients of each explanatory variable to explore the temporal Granger-causality among variables.

## EMPIRICAL RESULTS

Table 1 presents the descriptive statistics for weekly stock returns for the 10 emerging equity markets from Asia Pacific region i.e Pakistan, Malaysia, Indonesia, India, China. Taiwan, Korea, Hong Kong, Australia and Singapore

**TABLE 1**
**Descriptive Statistics**

| | Mean | Std. Dev. | Kurtosis | Skewness | Min | Max |
|---|---|---|---|---|---|---|
| KSE | 0.0040 | 0.0338 | 5.1885 | -1.2634 | -0.2010 | 0.1092 |
| AOrd | 0.0006 | 0.0220 | 7.8104 | -1.2663 | -0.1771 | 0.0810 |
| JKSE | 0.0038 | 0.0332 | 5.8882 | -1.0459 | -0.2404 | 0.1159 |
| KS | 0.0018 | 0.0345 | 4.7005 | -0.6701 | -0.2293 | 0.1703 |
| TW | 0.0006 | 0.0319 | 3.0874 | -0.1567 | -0.1308 | 0.1832 |
| HSE | 0.0005 | 0.0318 | 2.6443 | -0.2370 | -0.1782 | 0.1172 |
| KLSE | 0.0015 | 0.0196 | 4.4016 | -0.8309 | -0.1145 | 0.0665 |
| STI | 0.0007 | 0.0276 | 6.1986 | -0.5409 | -0.1647 | 0.1532 |
| BSE | 0.0024 | 0.0335 | 2.6333 | -0.4896 | -0.1738 | 0.1317 |
| SSE | -0.0001 | 0.0342 | 2.0432 | 0.0891 | -0.1490 | 0.1394 |

A careful examination of above statistics reveals that Karachi stock exchange offers the highest return of 0.4% per week whereas Indonesian stock market and Indian stock markets stand second and third offering 0.38 % and 0.24% weekly average return respectively. Korean stock markets show highest risk with a standard deviation of 0.0345. Chinese stock market stands second with reference to risk. Highest return is earned by Korean market in one week and highest loss is reported by Indonesian market in one week. With reference to Pakistani equity market , it can be said that Karachi stock exchange offers the highest return for a given level of risk. Results are in line with general assertion about Karachi stock market. Moreover, Returns are generally negatively skewed.

Table 2 shows the result of correlation analysis among equity markets of Pakistan, Malaysia, Indonesia, India, China. Taiwan, Korea, Hong Kong, Australia Thailand.

**TABLE 2**
**Correlation Analysis**

| | KSE | AOrd | JKSE | KS | TW | HSE | KLSE | STI | BSE |
|---|---|---|---|---|---|---|---|---|---|
| AOrd | 0.1646 | 1 | | | | | | | |
| JKSE | 0.1162 | 0.4570 | 1 | | | | | | |
| KS | 0.1785 | 0.5836 | 0.4359 | 1 | | | | | |
| TW | 0.1580 | 0.4429 | 0.3931 | 0.6304 | 1 | | | | |
| HSE | 0.1486 | 0.6877 | 0.4587 | 0.6512 | 0.5462 | 1 | | | |
| KLSE | 0.1410 | 0.4519 | 0.4789 | 0.4753 | 0.3979 | 0.5334 | 1 | | |
| STI | 0.1784 | 0.6910 | 0.4844 | 0.6673 | 0.5695 | 0.7761 | 0.5634 | 1 | |
| BSE | 0.1533 | 0.5407 | 0.4122 | 0.5315 | 0.4266 | 0.6037 | 0.4312 | 0.6277 | 1 |
| SSE | 0.0733 | 0.2292 | 0.2162 | 0.2190 | 0.1596 | 0.3234 | 0.2734 | 0.2274 | 0.167 |

Above Table 2 shows that Karachi stock exchange is not correlated with the equity markets of the Asian countries. Australian equity market appears to be strongly correlated with equity markets of Korea, Hong Kong and Thailand. Indian stock market is also correlated with equity markets of Australia, Korea, Hong Kong and Thailand. On the other hand, Chinese stock market is weakly correlated with far eastern equity markets. However some correlation is present among equity markets of far eastern countries it may be due to free flow of fund within region and economic integration of ASEAN.

Table 3 presents the results of unit root analyses. The pre-condition of series being integrated of same order is verified with the Augmented Dickey-Fuller (1981) and Phillips-Perron (1988) tests. The tests are applied to levels and first differences where the model includes a constant and a trend. The appropriate lag lengths are chosen according to AIC- Akaike Information Criterion.

**TABLE 3**
**Unit Root Analysis**

| | ADF Level | ADF Ist Diff | PP Level | PP Ist Diff |
|---|---|---|---|---|
| KSE | -1.443807 | -21.6852 | -1.305528 | -21.82218 |
| AORD | -1.487386 | -25.89356 | -1.522379 | -25.89659 |
| JKSE | -0.686235 | -12.31563 | -0.641139 | -26.64114 |
| KS11 | -1.506157 | -27.43493 | -1.487252 | -27.43334 |
| TW | -1.884692 | -26.11874 | -2.137838 | -26.23327 |
| HIS | -1.216137 | -25.68421 | -1.335846 | -25.75246 |
| KLSE | -0.488739 | -23.23151 | -0.705731 | -23.55487 |
| STI | -1.041754 | -24.26845 | -1.263718 | -24.47725 |
| BSE | -0.854038 | -15.16911 | -0.81573 | -25.03991 |
| SSE | -1.136944 | -23.73611 | -1.396518 | -24.11148 |
| 1% Critical Value | -3.440181 | -3.440181 | -3.440181 | -3.440181 |
| 5% Critical Value | -2.865769 | -2.865769 | -2.865769 | -2.865769 |
| 10% Critical Value | -2.56908 | -2.56908 | -2.56908 | -2.56908 |

The null hypothesis of a unit root is not rejected for the data series as calculated values are more than tabulated values and it is rejected for the first differenced data as calculated values are less than critical values at 5% level of significance. As indices series are difference stationary so all series are integrated of order one.

As all series are integrated of order one, so bivariate and multivariate Cointegration analysis of Johansen is performed. Analyses are made under the model with a constant and linear trend in the cointegration vector and the optimal lags are chosen to minimize AIC. Table 4 presents the results of the Johansen multivariate Cointegration analysis.

**TABLE 4**
**Multivariate Cointegration Analysis**
**Trace Statistics**

| No. of CE(s) | Eigen value | Statistic | Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.10 | 260.44 | 239.24 | 0.00 |
| At most 1 | 0.09 | 195.16 | 197.37 | 0.06 |
| At most 2 | 0.07 | 136.52 | 159.53 | 0.44 |
| At most 3 | 0.04 | 92.15 | 125.62 | 0.82 |
| At most 4 | 0.04 | 64.21 | 95.75 | 0.88 |
| At most 5 | 0.02 | 39.61 | 69.82 | 0.95 |
| At most 6 | 0.02 | 24.44 | 47.86 | 0.93 |
| At most 7 | 0.01 | 12.53 | 29.80 | 0.91 |
| At most 8 | 0.01 | 5.49 | 15.49 | 0.75 |
| At most 9 | 0.00 | 1.38 | 3.84 | 0.24 |

Trace test indicates 1 cointegrating equation at the 0.05 level. Max Eigen value test also confirms the same results. Results are also robust to selection of test type. A bivariate analysis for identification of pair wise long term relation ship among sock market indices has also been performed and results are stated in Table 5 below.

**TABLE 5**
**Bivariate Analysis Cointegration Analysis**

| Hypothesized No. of CE(s) | Eigen value | Trace Statistic | Critical Value0.05 | Prob. |
|---|---|---|---|---|
| KSE & AORD | | | | |
| None | 0.006 | 6.277 | 15.495 | 0.663 |
| At most 1 | 0.003 | 2.202 | 3.842 | 0.138 |
| KSE& JKSE | | | | |
| None | 0.009 | 6.837 | 15.495 | 0.597 |
| At most 1 | 0.001 | 0.854 | 3.841 | 0.356 |
| KSE& KS11 | | | | |
| None | 0.008 | 7.520 | 15.495 | 0.518 |
| At most 1 | 0.003 | 2.121 | 3.841 | 0.145 |
| KSE& TW | | | | |
| None* | 0.021 | 15.947 | 15.495 | 0.043 |
| At most 1 | 0.003 | 2.080 | 3.841 | 0.149 |
| KSE& HSI | | | | |
| None* | 0.021 | 16.427 | 15.495 | 0.036 |
| At most 1 | 0.004 | 2.554 | 3.841 | 0.110 |
| KSE & KLSE | | | | |
| None | 0.012 | 8.003 | 15.495 | 0.465 |
| At most 1 | 0.001 | 0.506 | 3.841 | 0.477 |
| KSE & STI | | | | |
| None | 0.017 | 13.201 | 15.495 | 0.108 |
| At most 1 | 0.003 | 1.995 | 3.841 | 0.158 |
| KSE & BSE | | | | |
| None | 0.014 | 11.123 | 15.495 | 0.204 |
| At most 1 | 0.003 | 1.772 | 3.841 | 0.183 |
| KSE & SSE | | | | |
| None | 0.005 | 5.630 | 15.495 | 0.739 |
| At most 1 | 0.004 | 2.338 | 3.841 | 0.126 |

Result of bivariate Cointegration analysis of Karachi stock exchange with Asia Pacific Markets indicate that trace statistics is less than the 5% critical value except Taiwan and Hong Kong stock exchanges. This indicates that KSE index is not pair wise cointegrated with AORD, JKSE, KS11, KLSE, STI, SSE and BSE of Indian stock exchange index. Above results suggest that KSE do not have a long-run equilibrium with Asia Pacific equity markets and thus offers an opportunity for portfolio diversification. The results of the bivariate cointegration tests indicate very clearly that the Pakistani stock market is not individually integrated with any of the far eastern markets, as the existence of a cointegrating relation between the Pakistani and any other index is strongly rejected from our tests. However, when the group of markets is considered together, we find that for "up to 4 weeks" lag intervals, there is evidence of a single cointegrating equation between all the markets studied. According to granger representation theorem, if markets are cointegrated, then granger causality must exist at least in one direction. However , Alexander (2001) points out that cointegration are not a pre-condition for lead-lag relationship and other common factors between time series can result in causality. Granger causality tests are employed to the first differences of indices to verify if there has been a causality running from one market to another in the short-run. The optimal lag length is set according to Akaike information criterion. Table 6 provides the results of pair wise analysis. Significant probability values are indicator of rejection of the null hypothesis.

**TABLE 6**
**Granger Causality Test**

| Null Hypothesis: | Obs | F-Stat | Prob. |
|---|---|---|---|
| RAORD does not Granger Cause RKSE | 649 | 2.364 | 0.095 |
| RKSE does not Granger Cause RAORD | | 0.805 | 0.448 |
| RJKSE does not Granger Cause RKSE | 649 | 0.192 | 0.825 |
| RKSE does not Granger Cause RJKSE | | 2.032 | 0.132 |
| RKS does not Granger Cause RKSE | 649 | 2.705 | 0.068 |
| RKSE does not Granger Cause RKS | | 2.217 | 0.110 |
| RTW does not Granger Cause RKSE | 649 | 6.592 | 0.002 |
| RKSE does not Granger Cause RTW | | 6.048 | 0.003 |
| RHSE does not Granger Cause RKSE | 649 | 2.888 | 0.056 |

| | | | |
|---|---|---|---|
| RKSE does not Granger Cause RHSE | | 0.547 | 0.579 |
| RKLSE does not Granger Cause RKSE | 649 | 0.710 | 0.492 |
| RKSE does not Granger Cause RKLSE | | 1.545 | 0.214 |
| RSTI does not Granger Cause RKSE | 649 | 3.520 | 0.030 |
| RKSE does not Granger Cause RSTI | | 0.885 | 0.413 |
| RBSE does not Granger Cause RKSE | 649 | 3.315 | 0.037 |
| RKSE does not Granger Cause RBSE | | 1.265 | 0.283 |
| RSSE does not Granger Cause RKSE | 649 | 0.744 | 0.476 |
| RKSE does not Granger Cause RSSE | | 0.999 | 0.369 |

It is found that HSE, TW, STI and BSE indices "Granger causes" KSE index. This granger causality is unidirectional at the 5% significance level. It means that KSE index follows above markets in the short run and there exists a lead-lag relationship between them. However no granger causality is found with Chinese equity market.

Finally, we conduct variance decomposition analysis to see as to what extent shocks to certain markets are explained by other markets. It provides some further evidence on the patterns of linkages amongst stock markets and enhances our insights about reaction of markets to system wide shocks. It also helps to the pattern of responses propagation over time. Table 7 gives the decomposition of forecast error variance for the variables whereas results for other markets are given in Appendix A.

**TABLE 7**
**Variance decomposition of KSE**

| | KSE | KLSE | KS | AORD | BSE | SSE | HSE | TW | STI | JKSE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 100.0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | 95.77 | 0.07 | 1.20 | 0.35 | 0.80 | 0.02 | 0.02 | 1.50 | 0.19 | 0.08 |
| 3 | 93.56 | 0.28 | 1.90 | 0.51 | 0.78 | 0.19 | 1.03 | 1.46 | 0.20 | 0.09 |
| 4 | 93.41 | 0.33 | 1.94 | 0.52 | 0.80 | 0.19 | 1.05 | 1.46 | 0.20 | 0.09 |
| 5 | 93.31 | 0.34 | 1.98 | 0.54 | 0.80 | 0.19 | 1.06 | 1.46 | 0.21 | 0.09 |
| 6 | 93.30 | 0.35 | 1.98 | 0.54 | 0.80 | 0.19 | 1.06 | 1.46 | 0.22 | 0.09 |
| 7 | 93.30 | 0.35 | 1.98 | 0.54 | 0.80 | 0.19 | 1.06 | 1.46 | 0.22 | 0.09 |
| 8 | 93.30 | 0.35 | 1.98 | 0.54 | 0.80 | 0.19 | 1.06 | 1.46 | 0.22 | 0.09 |
| 9 | 93.30 | 0.35 | 1.98 | 0.54 | 0.80 | 0.19 | 1.06 | 1.46 | 0.22 | 0.09 |
| 10 | 93.30 | 0.35 | 1.98 | 0.54 | 0.80 | 0.19 | 1.06 | 1.46 | 0.22 | 0.09 |

The Karachi stock market appear to be the exogenous as most of its shock is explained by its own unique variation. It can be seen that variation in Karachi equity market are greatly self explanative whereas Indian and Chinese markets are exerting some impact on Karachi stock exchange during 2001-2013. Results for remaining countries exhibit that far eastern markets exert significant impact on each other. Indian market is also found influenced by Hong Kong and Australian markets.

## CONCLUSION

This study focuses on investigating the integration of Karachi stock exchange with equity markets of Asia Pacific region to explore the opportunities for portfolio diversification. Descriptive statistics shows that Karachi stock exchange offers the highest return at relatively low risk level whereas Indonesian stock market is the most risky market. Correlation analysis reveals that Karachi stock exchange is not correlated with the equity markets of the Asian countries. However, Australian equity market appears to be strongly correlated with equity markets of Korea, Hong Kong and Singapore. Similarly, Indian stock market is also correlated with equity markets of Australia, Korea, Hong Kong and Singapore. As correlation analysis is a weak technique so Johansen (1991) cointegration test is employed to weekly stock price indexes of Pakistan, Malaysia, Indonesia, India, and China. Taiwan, Korea, Hong Kong, Australia Thailand on bivarite and multivariate settings. Multivariate Cointegration analysis indicates the presence of long term relationship by indicating the existence of at least one Cointegration equation. As pre requisite to integration analysis, index series are also tested for unit root and these are found to be integrated of order one I(1). Bivariate cointegration tests indicate that Pakistani stock market is not individually integrated with any other Asia pacific markets except China. Granger causality tests reveal a casual flow from AORD, KS11 and BSE indices to Karachi stock exchange index suggesting a unidirectional lead-lag relationship amongst them. Lower causal relationships that exist between the Karachi stock exchange and emerging equity markets suggest that opportunities for international portfolio diversification among these equity markets still exist. So investors can harvest the benefits of portfolio diversification. Further variance decomposition analysis reveal that Karachi stock market seems to be the exogenous as most of its shock is explained by its own variations. Therefore we can conclude that as Karachi stock market is cointegrated with emerging Asian markets so any financial crisis in Asia pacific region does not portray any immediate threat of spill over effect to investments in Pakistan.

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