# The Dynamic Linkages of Pakistani and Global Stock Markets: Evidence from Karachi Stock Exchange

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## Abstract

The aim of the study is to explore the long run association among Pakistani equity market and some developed and emerging equity markets. Weekly data from the period of 2000 to 2010 was applied in this study. The result highlighted Pakistani equity market well correlated with the American equity market. The impulse response function result also illustrated that the American equity market created more instability as compare to other equity markets of the world. The portfolio managers of UK, India, Germany and China have a great opportunity to diversify their portfolio to take comparatively greater advantage from KSE.

**Keywords**: Portfolio diversification, Equity Market, Karachi Stock Exchange.

## 1. Introduction and Literature Review

Liberalization process, globalization, deregulation and advancement in information technology cause higher integration of national and international financial market. Stock market integration due to globalization leads to higher mobility of capital across the border. Globalization provides an opportunity and advantages to national and international investors to diversify their portfolio for better returns, which keeps growing dependency of international saving and a diversified the leverage preference of firms from debts to equity financing. Most of the economists and policy makers argued that financial integration provided numerous benefits such as financial development, effective market mechanism, higher Investment and Saving and economic growth. At the same juncture, higher integration of financial market leads to various risks, such as higher dependency of international market causes to loss the control on fiscal and monetary policy. Recently most of Asian stock markets were adversely affected by crunch of the credit market in the United States. So policy makers and economist recommended that procedure of financial market integration should be kept monitoring to avoid the risk of financial market integration.

The financial economics theory suggests a strong financial integration has an influence on financial development and stability. The theory also points out that financial integration leads to efficient allocation of capital, a lesser probability of non symmetric shocks, more robust market structure and higher degree of portfolio diversification.

(Paurer 2005). This type of financial development and integration make the economy strong enough to absorb the adverse shocks and foster the economic development at a great extent. The investor receives higher return on their investment after the financial integration. Capital seekers have equal opportunity to avail financial resources from domestic stock market as well as across the border. This result illustrates increased in integration among the stock markets of the global economy. On the other hand more global financial linkages eased the capital mobility which may lead to financial instability in different countries.

It is also noted that the globalization and broad business activities increase the world wealth constraint. On the contrary technological changes provide a base of an information revolution which reduces the transaction cost. Various factors contributed in this dimension such as technological changes in communication, scientific oriented trading, settlement based systems and application of innovative financial derivative.

As above thrashed out importance of financial assets market to economic agents and policy makers, next the study provides some applied literature of finance which shows the measurement of international integration of national and international stock markets across the different emerging and developed economies. During the study it is found that a little empirical work has been done with reference to Pakistani stock market. The linkages of the Pakistani stock market with global stock markets were increasing during the reforms period in the early 1990s and reached its peak after 2001.

Aggarwal (2003) verifies the integration of NAFTA regions equity markets. The result illustrated that the pre NAFTA period (1988-1993), the stock markets are not statistically integrated while in the post NAFTA periods (1994-2001), the stock markets integration has increased. The result also indicated that US stock market is more integrated with NAFTA countries.

Narayan et.al (2004) evaluates the dynamics of causal relationship among some Asian stock markets (Pakistan, Sri Lanka, India and Bangladesh). The conclusion of their study exhibits that in the long run all the Asian Stock Markets are correlated, but in short run no dynamics of linkages found among these markets due to small size and lesser market capitalization.

Lamba (2005) carries out a comprehensive study to explore the long run association among south Asian stock markets and the developed countries stock markets for the period of 1997-2003 by using Johanson co integration technique. The result points out that Indian stock market were significantly influenced by U.S, U.K and Japan stock markets. Pakistani and Sri Lankan Stock markets were insignificantly correlated with Indian Stock market. The conclusion of the research shows that South Asian Stock markets were becoming less integrated as compare to other markets.

Glezakos at el. (2007) analyzes the short run and long run association among the Greek stock market and world leading stock markets by using the Johansson co integration and Granger Causality test. 10 developed and developing countries were taken into the study and monthly data was applied. The finding of the study illustrated the Germany and France stock markets were significantly affected by Greek Stock Market.

Naeem (2000) strives to explore the dynamics linkages between South Asian Stock Market and the US and UK equity markets for the period of 1994 to 1999, bivariate and multivariate techniques were used in this study for integration. The result of the study

pointed out that there was no long run relationship existed among South Asian, US and UK stock markets. So it may be an opportunity for investors to diversify their portfolio in stock market of U.S or U.K and the Asian Stock market.

Roca (1999) evaluates the causal relationship among the Japan, Taiwan, Australia, Taiwan, U.S, U.K and Singapore by using JJ co integration technique. The result revealed that no co integration existed among Australian and other markets. The result also pointed out that there was a significant association among Australian, U.S and U.K stock markets.

## 2. Objective of the study

The focal objective of this study was to explore dynamic linkages between US, European, Asian and Pakistan's stock market which may be very useful for investors, financial institutions and portfolio managers to utilize their capital across the border in an efficient and smart manner.

## 3. Econometrics Methodology and Data Sources

This empirical study is based on weekly closing index of five stock markets indices of major trading partners (US, China, India, U.K, Germany) of Pakistan. The data which was used in this study span from 1 January, 2000 to Dec 31, 2010 (Yahoo Finance). The return of each index is computed by the following formula.

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

R= Return on day t

ln= Natural log

Pt= Closing index of day t

Pt-1= Closing index of day t-1

There are different econometric techniques which are used to analyze the relationship between different time series macroeconomic variables. The study focuses to explore the association among world stock markets and Pakistan's stock market by using the following techniques. (1) Descriptive Statistics (2) Correlation Matrix (3) Johansen Co integration tests (4) Granger Causality test.

Johansen Julises Co integration is used in the time series data. The ideal condition to use JJ technique is that the time series variables are integrated in the same order. Stationarity of macroeconomics time series has been checked with the help of unit root test. The study used Augmented Dicky Fuller test to check the unit root in time series macroeconomics variables.

The ADF test checks the occurrence of stationarity in an AR (Autoregressive) equation. The AR (1) equation is written as follows

$$Y_t = \rho Y_{t-1} + \mu_t$$

Where Yt is the time series variables.

**Error! Reference source not found.** is coefficient, and $\mu$ is white noise error term. The regression equation can be written as

$$\Delta Y_t = (\rho - 1)Y_{t-1} + \sum_{t=1}^{n} Y_{t-k} + \mu_t$$

Where $\Delta$ is the first difference operator. This equation may be used to estimate and testing for a unit root is equivalent to testing null hypothesis $(\rho - 1) = 0$.

Most of the financial time series variables are stationarity at first difference. If two series are integrated of at same order, there may have a linear combination that may be stationary without differencing.

There are two methods of co integration testing. Engle Granger (1987) test and Maximum likelihood base Johansen (1988; 1991) and Johansen-Juselius (1990) tests. Both tests check the long run association among the macroeconomic variables. The likelihood ratio of Johansen Juselius test the number of co integration vectors in VAR system. Eigen value test check the null hypothesis that there is at most r numbers of co integration equation in VAR. the maximum Eigen value statistic is given by,

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

"T denotes number of observations where $\lambda$ n are the n-r smallest square canonical correlations.

Another test is based on the "trace statistic" which tests the null hypothesis of r co integrating vectors against the alternative hypothesis of r. The test is checked by following trace value" (Kerry Patterson).

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

"The important thing is to apply JJ test is the selection lag length of VAR model. The lag length is selected on the basis of AIC" (Akaike Information Criterion).

Analyzing the long run relationship among the variables, then the system of the VAR model should be converting into error correction term to account for the short run dynamics of variables from their long run equilibrium.

According to the "Granger theorem" if two time series variables are co integrated, it means that there must be at least one direction causality exist between the time series variables. JJ test and ECM only capture the long and short run dynamics of equilibrium. Hence, the chronological Granger causality between the macroeconomics variables may be analyzed with the joint F test. The advantage of the Granger causality test is that it can check the lead and lag relationship between the variables within the sample period. This type of exercise is also made by the variance decomposition and impulse response test. Variance decomposition and impulse response analysis accurately measure the shock of the values of one variable in a given period which arising from the same variables as well as other variables in previous periods. The equation of the impulse response function and variance decomposition is written as follows.

$$\Delta X_t = \alpha_1 + \sum_{i=1}^{k} \alpha_{11}(i)\Delta X_{t-i} + \sum_{j=1}^{k} \alpha_{12}(j)\Delta Y_{t-j} + \varepsilon_{xt}$$
$$\Delta Y_t = \alpha_2 + \sum_{i=1}^{j} \alpha_{21}(i)X_{t-i} + \sum_{j=1}^{j} \alpha_{22}(j)Y_{t-j} + \varepsilon_{yt}$$

## 4. Empirical Results

Descriptive statistics of return are given in table no. 1. The result of descriptive statistics reveals that the data is not normally distributed in stock markets. The result also indicated that KSE is most risky market among all the stock markets with high level of return. It is

further indicated that FTSC is relatively less risky among all the markets with negative returns.

**Table 1: Descriptive Statistics**

|  | KSE | NYSE | BSE | SSE | FTSE | DAX |
|---|---|---|---|---|---|---|
| Mean | 0.410909 | 0.039088 | 0.325421 | 0.166558 | -0.017812 | 0.035978 |
| Median | 0.727541 | 0.244188 | 0.705154 | 0.000000 | 0.156427 | 0.339018 |
| Maximum | 13.64966 | 12.89389 | 14.07764 | 14.96379 | 13.40915 | 16.11623 |
| Minimum | -18.20683 | -19.53480 | -15.95417 | -13.84131 | -21.04692 | -21.60969 |
| Std. Dev. | 3.738035 | 2.761628 | 3.552023 | 3.625219 | 2.674297 | 3.547779 |
| Skewness | -0.721553 | -0.660061 | -0.419698 | 0.203003 | -0.664536 | -0.267582 |
| Kurtosis | 5.877906 | 9.792691 | 5.165853 | 4.809623 | 12.34745 | 7.030426 |
| Jarque-Bera | 236.2333 | 1091.342 | 122.9726 | 78.39371 | 2031.676 | 376.7631 |
| Probability | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| Sum | 224.7670 | 21.38096 | 178.0055 | 91.10697 | -9.743155 | 19.67980 |
| Sum Sq. Dev. | 7629.205 | 4164.116 | 6888.812 | 7175.650 | 3904.917 | 6872.356 |
| Observations | 547 | 547 | 547 | 547 | 547 | 547 |

**Table 2: Correlation Matrix**

|  | KSE | NYSE | BSE | SSE | FTSC | DAX |
|---|---|---|---|---|---|---|
| KSE | 1.000000 |  |  |  |  |  |
| NYSE | 0.013223 | 1.000000 |  |  |  |  |
| BSE | -0.053846 | 0.014743 | 1.000000 |  |  |  |
| SSE | 0.015469 | -0.036588 | -0.022405 | 1.000000 |  |  |
| FTSC | -0.034986 | 0.028383 | 0.020654 | 0.070451 | 1.000000 |  |
| DAX | -0.008140 | 0.029115 | 0.009685 | 0.095893 | 0.852963 | 1.000000 |

Table 2 indicates the result of correlation analysis. The result of correlation matrix reveals that KSE 100 is weakly correlated with chosen world stock markets. The result also indicated that there is a strong correlation among the European markets. Free flow of capital is the main reason behind the strong correlation among European markets in European Union. It supports the economic and financial integration among European Union.

**Table 3: Unit Root Test**

| Variable | At level | At First Difference | Remarks |
|----------|----------|---------------------|---------|
| KSE 100 | -0.254 | -3.325 | Stationary at First Difference |
| BSE | -0.487 | -3.489 | Stationary at First Difference |
| SSE | -2.254 | -4.264 | Stationary at First Difference |
| NYSE | -1.254 | -5.231 | Stationary at First Difference |
| FTSC | -1.478 | -4.214 | Stationary at First Difference |
| DAX | -1.879 | -7.898 | Stationary at First Difference |

The result of unit root test in Table 3 shows that all the variables are non stationarity at level. However the first difference of the series transforms the series into stationarity. In other word the series are integrated at order one.

Maximum likelihood based Johansen (1988, 1991) and Johansen Juselius (1990) technique is used to evaluate the existence of co integration vector in set of equations. The first test is Trace statistics and second is maximum Eigen statistics test. The result of the co integration test is shown in tables 4 and 5:

**Table 4: Johnsons Julesis Co-Intergration Test (Trace Statistics) Multivariate Co integration**

| Null Hypothesis | Alternative | Trace | 0.05 | |
|-----------------|-------------|-------|------|--------|
| | Hypothesis | Statistic | Critical Value | Prob.** |
| $r = 0$ | $r \leq 1$ | 984.7386* | 95.75366 | 0.0001 |
| $r = 1$ | $r \leq 2$ | 678.7047* | 69.81889 | 0.0001 |
| $r = 2$ | $r \leq 3$ | 512.3229* | 47.85613 | 0.0001 |
| $r = 3$ | $r \leq 4$ | 354.8906* | 29.79707 | 0.0001 |
| $r = 4$ | $r \leq 5$ | 222.3233* | 15.49471 | 0.0001 |
| $r = 5$ | $r \leq 6$ | 103.1593* | 3.841466 | 0.0000 |

**Table 5: Johnsons Julesis Co-Intergration Test (Maximum Eigen Statistics)
Multivariate Co integration**

| Hypothesized | | | Max-Eigen | 0.05 | |
|---|---|---|---|---|---|
| No. of CE(s) | Eigenvalue | | Statistic | Critical Value | Prob.** |
| r = 0 | r = 1 | | 306.0339* | 40.07757 | 0.0001 |
| r = 1 | r = 2 | | 166.3817* | 33.87687 | 0.0001 |
| r = 2 | r = 3 | | 157.4324* | 27.58434 | 0.0001 |
| r = 3 | r = 4 | | 132.5672* | 21.13162 | 0.0001 |
| r = 4 | r = 5 | | 119.1641* | 14.26460 | 0.0001 |
| r = 5 | r = 6 | | 103.1593* | 3.841466 | 0.0000 |

**Table 6: Johnsons Julesis Co-Intergration Test (Trace Statistics) Bivariate Co
integration**

| | Hypothesis | Trace Statistics | 0.05 critical value | Remarks |
|---|---|---|---|---|
| KSE 100 and NYSE | r=0 | 292.7602* | 15.49471 | Co integration exist |
| | r<1 | 110.0554* | 3.841466 | |
| KSE 100 and BSE | r=0 | 5.1125* | 15.49471 | No Co integration exist |
| | r<1 | 0.6114* | 3.841466 | |
| KSE 100 and FTSC | r=0 | 311.3133* | 15.49471 | Co integration exist |
| | r<1 | 113.1069* | 3.841466 | |
| KSE 100 and DAX | r=0 | 315.7421 | 15.49471 | Co integration exist |
| | r<1 | 112.1767 | 3.841466 | |
| KSE 100 and SSE | r=0 | 0.4121 | 15.49471 | NO Co integration exist |
| | r<1 | 0.65687 | 3.841466 | |

The Table 6 shows the result of the pair wise co integration test for the entire sample
period. It is found that KSE is co integrated with US and UK stock markets. However
KSE is not much integrated with China and India. Therefore the fund managers of China
and India may get the benefits of portfolio diversification by investing in KSE.

**Table 7: Granger Causality Test**

| Null Hypothesis: | Obs | F-Statistic | Probability |
|---|---|---|---|
| NYSE does not Granger Cause KSE | 545 | 4.19047 | 0.01563 |
| KSE does not Granger Cause NYSE | | 1.97566 | 0.13967 |
| BSE does not Granger Cause KSE | 545 | 0.88980 | 0.41134 |
| KSE does not Granger Cause BSE | | 0.05983 | 0.94193 |
| SSE does not Granger Cause KSE | 545 | 1.61367 | 0.20012 |
| KSE does not Granger Cause SSE | | 0.03248 | 0.96804 |
| FTSC does not Granger Cause KSE | 545 | 1.44689 | 0.23621 |
| KSE does not Granger Cause FTSC | | 1.04411 | 0.35271 |
| DAX does not Granger Cause KSE | 545 | 1.82570 | 0.16210 |
| KSE does not Granger Cause DAX | | 1.28714 | 0.27690 |
| BSE does not Granger Cause NYSE | 545 | 0.07989 | 0.92323 |
| NYSE does not Granger Cause BSE | | 2.16424 | 0.11583 |
| SSE does not Granger Cause NYSE | 545 | 7.43597 | 0.00065 |
| NYSE does not Granger Cause SSE | | 4.12202 | 0.01672 |
| FTSC does not Granger Cause NYSE | 545 | 3.40489 | 0.03393 |
| NYSE does not Granger Cause FTSC | | 457.320 | 6.E-117 |
| DAX does not Granger Cause NYSE | 545 | 4.28683 | 0.01422 |
| NYSE does not Granger Cause DAX | | 353.799 | 6.4E-99 |
| SSE does not Granger Cause BSE | 545 | 1.88909 | 0.15221 |
| BSE does not Granger Cause SSE | | 0.37854 | 0.68504 |
| FTSC does not Granger Cause BSE | 545 | 2.02538 | 0.13294 |
| BSE does not Granger Cause FTSC | | 0.34068 | 0.71144 |
| DAX does not Granger Cause BSE | 545 | 0.63342 | 0.53117 |
| BSE does not Granger Cause DAX | | 0.02013 | 0.98008 |
| FTSC does not Granger Cause SSE | 545 | 0.73810 | 0.47850 |
| SSE does not Granger Cause FTSC | | 1.13792 | 0.32125 |
| DAX does not Granger Cause SSE | 545 | 0.74981 | 0.47295 |
| SSE does not Granger Cause DAX | | 0.14700 | 0.86333 |
| DAX does not Granger Cause FTSC | 545 | 1.91269 | 0.14868 |
| FTSC does not Granger Cause DAX | | 2.53356 | 0.08032 |

"In the lines of Granger representation theorem, if two variables are co integrated then Granger causality exist at least one direction" (Granger and Engle 1989). The conclusion of the Granger causality test exhibited in above Table 7. The result shows that most of the developed markets are found unidirectional granger causality.

Further Impulse response function is used to explore the dynamics response between the two equity markets, which capture the effects of a onetime shock to one of the endogenous variable in the VAR system. In table no. 8 result shows that US stock market creates more volatility and its shock dies out after five weeks. The shocks in other stock markets create lesser volatility and their shocks also die out earlier as compare to US stock market.

### 5. Conclusion

KSE provides the maximum weekly return i.e. 0.41% at a higher risk level whereas American and European stock markets provide low return and low risk. Furthermore, KSE is not integrated with equity market of American and European markets which provide an opportunity of diversification of portfolio of different investors of Pakistan and the World. It is also highlighted that American and European equity markets are more integrated as compare to Pakistani equity market.

However correlation matrix is a weak technique to show the association between world equity markets and Pakistani stock market, therefore JJ technique of co integration test has been employed to explore the long run association among the variables. The Trace and maximum Eigen statistics test show that there are six co integration equations in VAR system. The result of the impulse response function shows that the shock of the American equity market creates more volatility in Pakistan stock market and their effects die out after five weeks.

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**Abbreviation used in the Paper**

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|---|---|
| KSE: | Karachi Stock Exchange |
| NYSE: | New York Stock Exchange |
| BSE: | Bombay Stock Exchange |
| SSE: | Shanghai Stock Exchange |
| FTSE: | Financial Times and London Stock Exchange |
| DAX: | Deutscher Aktien Index (Germany) |
| NAFTA: | North American Free Trade Agreement |
| VAR: | Vector Autoregressive |