

## Correlation Dynamics of Equity Markets in Pakistan and India: A comparative Study in the Context of Financial Crisis

Inayat Ullah, Rizwanullah and Madiha Khan

### ABSTRACT

*This paper examines the dynamic relationship among stock markets returns using daily data from April 2003, to December, 2011 for five equity market indices of developing and developed countries. We apply Johnson's Co-Integration and Unit-Root Tests to identify the correlation and co-integration of these five equity markets during the global financial crisis 2008. The analysis reveals a dynamic correlation between the equity markets of developing countries (i.e Pakistan and India) and developed countries (Europe). However the co-integration is weak among these countries which imply less intense spillover effect of the financial crisis on developing countries.*

**Key Words:** Correlation Dynamics, Equity Markets, Financial Crisis, Unit Root Test and Co-Integration.

### INTRODUCTION

The global financial and economic crisis presents considerable challenges to the Asian countries specially Pakistan. It has been observed that the real economy depends on well functioning capital markets, money markets and banking system (Campbel.R.Harvey, 2009). Nearly all of the global financial crises have affected Pakistan's economic and financial position one way or other way (Draz.U.Mohammad, 2011). In the history of Pakistan, Both internal matters and external problems have affected the financial markets during the five crises namely financial crisis of 1958, Financial crisis of 1974-75, Global crisis of 1979-82, Asian Crisis of 1997 and Global Financial Crisis of 2008 (Hussain, 2009).

This Paper examines the correlation and co-integration of some key financial variables of South Asian countries, namely Pakistan and India, by comparing it with the same variables of some advanced economies. These variables are Stock Market Indices of developed and developing countries namely FTSE London, MSCI emerging market Index, Bombay Stock Exchange, National Stock Exchange of India and the Karachi Stock Exchange. The focus of this paper is to monitor the spillover effect by finding out correlation and co-integration among these five major indices during the period 2003 to 2011.

#### **Key indicators to measure the effect of financial crisis on Pakistan:**

- FTSE 100 INDEX (Europe)
- MSCI Emerging Markets Index
- Bombay Stock Exchange(BSE Senex)
- National Stock Exchange of India (NSE)
- The Karachi Stock Exchange (KSE-100)

This research is an extension to be applied in South Asian Countries' Scenario, to the works done by Nathaniel Frank and Heiko Hesse (2009), Redalet and Sachs (1998), Jainping Mei (1999), Leora Klapper & Douglas Randall (2010), Erb Harvey & Viskanta(1996) and others. Current financial markets structures, their composition and variation were regularly observed both in Pakistan and emerging economies.

## LITERATURE REVIEW

Extending the Enterprise Survey Database, the World Bank's Financial Crisis Survey reported that according to some notable firms and institutions, the financial crisis has impacted their very existence (L.Klapper & D.Randall, 2010). As perceived by M. H. Koksal & E.Ozgul (2007) economic crisis has prompted a major strategy rethink amongst countries' businesses. According to the same research, the past 25 years economic history shows that economic crisis has affected companies in many ways. Combined with the fierce competition, in the marketplace, insufficient consumer demand for the products & services has forced some companies to close down or drop their production capacity (ibid). During the financial crisis, some companies' sales reduced as a result of cutting back R & D expenditures (M.H.Koksal & E.Ozgul, 2007).

The "global financial architecture"existing arrangements for international financial governance, needs to be reformed (Daniel Bradlow, 2009). These works suggest that international financial architecture needs to be critically analyzed and sources of its major flaws to be identified—thus to pave the way for its long term consolidation. The same analysis is strongly needed in the scenario of Pakistan where the ongoing financial crisis happens to be unfavorable to the economy. Asian Financial Crisis, often called "Asian Contagion" was a series of currency devaluation and other events that spread through many Asian markets including Pakistan. This crisis was stemmed somewhat by financial intervention from International Monetary Fund (IMF) and the World Bank, However because of considerable interdependence, market declines were also felt in United States of America (USA) and Russia as the Asian economies slumped (Investopedia).

The global financial crisis of 2008-09 actually had its roots in the closing years of 20th century, when U.S housing prices after being uninterrupted for a long time, began declining. Consequently, a \$10 trillion mortgage market went into a critical situation. Not only the United States was hit, but also china, France, Germany, United Kingdom, Japan and Australia among others were proportionally affected by the crisis. These countries began injecting a huge chunk of liquidity into their banking system. Although, around 2007, during the repercussion of the crisis in the US, emerging economies stock markets showed comparatively better performance. One of the notable up shots, which affected both advanced and emerging economies was the bankruptcy of the "Lehman Brothers"—America's largest financial service entity, on September 15th 2008.

Though there have been a lot of studies focused on the relationship between political changes and monetary policy, for example Aliesina (1987), Alesina & Cukierman (1990), less focus is given to the relationship between economic/political changes and the financial market volatility. Being increasingly a global issue, financial crisis in Pakistan is much important to address as it could lead the country into economic down turn.

Owing to Pakistan's unsustainable budget and trade deficits, financial crisis in Pakistan happened even earlier than Global financial crisis. Inflation in the mean time played a worse role in pushing the country into the crisis situation. At the same time, the Balance of Payment Problem raised when the entire donor community including U.S was passing through a severe turmoil. However, comparatively, because of the heavy government

borrowings, the banking system in Pakistan was not as vulnerable as were European Banks.

On the other hand, the Karachi Stock Exchange was badly affected by the ongoing financial crisis. Statistical data shows that, especially after 2007, the KSE witnessed the worst outcomes of its history as Pakistan's Credit Rating was placed "under Review". Meanwhile, uncertain economic-political situations furthered the KSE into a threatening situation (CRSS Report, 2009). Assessing the impacts of global financial crisis, Jarko Fidrmuc and Iikka Korhonen (2009) found that owing to more extensive trade and financial integration of Asian economies with the rest of the world, especially with U.S, the 2008th slowdown of the world economy was perceived to be more crucial for emerging Asian economies like Pakistan. It was noted that both China and India, have had remarkably stable growth before 2007, however in 2008 the global financial and economic crisis caused in a definite growth slowdown in both countries (ibid).

### POLICY RESPONSES

As a policy response to the financial crisis, some countries took various steps to minimize the overall impact of the crisis for example, interest rate reduction, recapitalization of financial institutions, increasing liquidity to banks and firms, fiscal stimulus, regulatory reforms and trade policy changes etc (UNESCO, 2009). It was found that unless the companies increase their sales volume, any other measure like cutting equity, reducing investments, working more with equity capital etc may not be sufficient to overcome the crisis (Zahir, 2005; Laitinen, 2000). Companies did succeed to some extent during the Asian financial crisis, when they, in order to maintain their sales volume, tried to find new foreign markets (Goad,1999). It was also examined that as a reaction policy, some companies increased their sales volume in the short run through reducing their prices during the crisis (Shama, 1992).

### METHODOLOGY

In order to analyze the impact of financial crisis, on Asian countries especially Pakistan, it is pertinent to use Times Series Data Analysis. A Time Series Data-set consists of observations on a variable or several variables overtime. Since past events can influence future events and lags in behaviour are prevalent in the social sciences, therefore we take time an important dimension in our data set. A key feature of time series data that makes it more difficult to analyze than cross-sectional data is the fact that economic observations like stock prices etc, can rarely, if ever, be assumed to be independent across time.

Another feature of time series data that can require special attention is the data frequency at which the data are collected. In economics, the most common frequencies are daily, weekly, monthly, quarterly, and annually. We have recorded Stock prices at daily intervals excluding Saturday and Sunday.

The Time Series variables in our case are five major indices namely KSE-100, BSE (SENEX) India, FTSE-100, MCSI and NSE.

Simplified Times Series Model:

$$\text{Log}(KSE_t) = \beta_0 + \beta_1 \log(BSE_t) + \beta_2 \log(FTSE_t) + \beta_3 \log(MSCI_t) + \beta_4 \log(NSE_t) + u_t$$

Where KSE is the Karachi Stock Exchange 100 index, BSE is the Bombay Stock Exchange, FTSE-100 is the Financial Times Stock Exchange London, MSCI is the emerging market index and NSE is the National Stock Exchange of India.

The Eight years historical data (2003 to 2011) were collected from above mentioned five indices. In order to apply the Time Series analytic model, Data were arranged in chronological order. Johnson Co-Integration test is carried out in order to find one way co-integration through critical value (t. statistics). In addition unit root test is carried out for all of the above five variables. In the Unit root test, Augmented Dickey-Fuller tests and Phillip Perron test are carried out using the simple Natural log return data of the above five variables.

### EMPIRICAL RESULTS

Table 1. Johnson co-integration test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.256032	645.3433	33.87687	0.0001
At most 1 *	0.212259	520.5950	27.58434	0.0001
At most 2 *	0.172334	412.7168	21.13162	0.0001
At most 3 *	0.155192	367.9843	14.26460	0.0001
At most 4 *	0.135679	318.1599	3.841466	0.0000

Table 2. Descriptive statistics.

	KSE-100	BSE	FTSE	MSCI	NSE
Mean	-0.000687	-0.000705	-0.000149	-0.000585	-0.000696
Median	-0.001253	-0.001368	-0.000563	-0.001538	-0.000932
Maximum	0.060418	0.118092	0.092646	0.176288	0.130539
Minimum	-0.082547	-0.159900	-0.093842	-0.205161	-0.163343
Std. Dev.	0.014695	0.017115	0.012621	0.022358	0.017444
Skewness	0.369296	0.082357	0.149520	-0.167646	0.222089
Kurtosis	5.184439	10.26254	11.32360	14.97976	11.73830
Jarque-Bera	484.5380	4808.820	6321.495	13088.01	6976.098
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	-1.501460	-1.542414	-0.326590	-1.279239	-1.522766
Sum Sq. Dev.	0.472032	0.640344	0.348218	1.092775	0.665176
Observations	2187	2187	2187	2187	2187

Table 3: Correlation

	<b>KSE</b>	<b>BSE</b>	<b>FTSE</b>	<b>MSCI</b>	<b>NSE</b>
KSE	1.000000	-0.023491	0.029986	-0.022181	0.007939
BSE	-0.023491	1.000000	-0.016318	-0.073771	-0.029941
FTSE	0.029986	-0.016318	1.000000	0.076739	0.005050
MSCI	-0.022181	-0.073771	0.076739	1.000000	-0.015367
NSE	0.007939	-0.029941	0.005050	-0.015367	1.000000

Table 4. Pair-wise Granger Causality Tests (Sample: 1 2187, Lags:2)

Null Hypothesis:	Obs	F-Statistic	Prob.
BSE does not Granger Cause KSE	2185	3.58927	0.0278
KSE does not Granger Cause BSE		4.65078	0.0096
FTSE does not Granger Cause KSE	2185	0.20248	0.8167
KSE does not Granger Cause FTSE		0.89694	0.4080
MSCI does not Granger Cause KSE	2185	0.85835	0.4240
KSE does not Granger Cause MSCI		1.69158	0.1845
NSE does not Granger Cause KSE	2185	0.99549	0.3697
KSE does not Granger Cause NSE		1.12703	0.3242
FTSE does not Granger Cause BSE	2185	0.71639	0.4886
BSE does not Granger Cause FTSE		0.33391	0.7162
MSCI does not Granger Cause BSE	2185	0.27824	0.7571
BSE does not Granger Cause MSCI		0.87025	0.4190
NSE does not Granger Cause BSE	2185	23.1652	1.E-10
NSE does not Granger Cause NSE		0.19389	0.8238
MSCI does not Granger Cause FTSE	2185	266.270	3E-104
FTSE does not Granger Cause MSCI		0.50398	0.6042
NSE does not Granger Cause FTSE	2185	1.77560	0.1696
FTSE does not Granger Cause NSE		2.60174	0.0744
NSE does not Granger Cause MSCI	2185	0.99472	0.3700
MSCI does not Granger Cause NSE		4.42376	0.0121

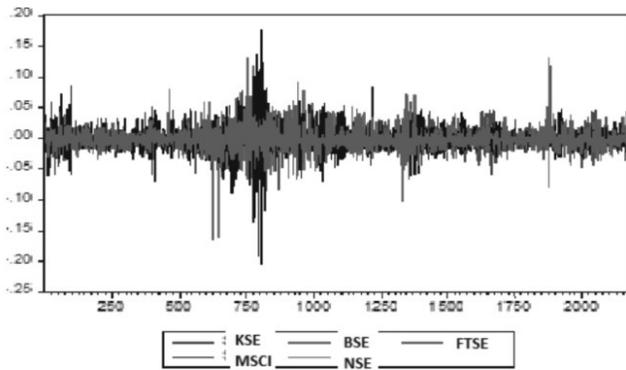


Figure 1. Correlation

The co-integration table shows that there is one way co-integration, e.g. increase in KSE is one way proportional to increase in the remaining four indices. It means that this is not necessary that the decrease in the four variables (BSE, FTSE, MSCI and NSE) must bring decrease in KSE. The reason may be the less integration of KSE with world's Leading Equity markets. The result also shows that the decrease in KSE may not cause proportional decrease in above four variables.

Descriptive statistics shows the data is normally distributed which means that the standard deviation follows the mean values in the five indices.

The correlation table shows that there is no multi-collinearity exists. The correlation value less than 0.8 means that there is no strong correlation exist and no multi-collinearity found.

Relatively weak correlation is shown in the data. BSE and MSCI have a negative correlation with KSE which shows that any ups and down in both of these indices may not proportionally influence the Karachi Stock Exchange. FTSE and NSE are however having a positive correlation with KSE but this correlation is not significant. BSE is however negatively correlated with all of the above indices which show somehow correlation between BSE and other world indices. FTSE has negative correlation with BSE but it has weak positive correlation with all other indices. MSCI reflects negative correlation with all indices except FTSE.

Unit Root Test Analysis:

According to research, a financial time series data is said to be integrated to order one i.e.,  $I(1)$ , if it get stationary after differencing. If two series are integrated to order one and a linear combination of these is stationary without requiring differencing, then the data streams are co integrated (Hassan Arshad & Javid Tariq, 2009).

Table 5. Unit Root Analysis

	ADF-Level	ADF-1st Diff	PP-Level	PP-1st Diff
KSE-100	2.919527	-46.80729	3.327205	-46.80729
BSE	2.124471	-46.69290	2.347545	-46.69290
FTSE	1.206877	-46.74379	1.710147	-46.74379
MSCI	2.262590	-47.64684	2.575957	-47.65247
NSE	2.257782	-46.76596	2.438805	-46.76596
1% Crit. Value	-3.433144	-3.433144	-3.433144	-3.433144
2% Crit. Value	-2.862661	-2.862661	-2.862661	-2.862661
3% Crit. Value	-2.567412	-2.567412	-2.567412	-2.567412

We first tested the stationary of the index series. For this purpose, the Augmented Dickey-Fuller (ADF) test for unit roots was used at level and first difference. Table 5 depicts the results of the Dickey-Fuller (ADF test), which clearly shows that the time series is not stationary at level but after we applied the first difference, the logarithmic transformations of the series became stationary. Thus, we can conclude that the series is integrated to the order of one  $I(1)$ .

The error terms should be statistically independent and data homoskedastic as required by the Dickey-Fuller test. However, for some data such assumptions may not be true, therefore we use another important test, the Phillips-Perron test, to test the stationary of the time series. Table-5 also displays the results of the Phillips-Perron test, which confirms the results of the ADF test. Thus, we can conclude that the series is  $I(1)$ .

### CONCLUSION

This paper examines the relationship among five major equity market Indices namely, KSE-100, BSE (SENEX), FTSE, MSCI and NSE during the financial crisis period from 2003 to 2011 by using multivariate co-integration analysis, Granger Causality test and unit root tests. The results provide evidences about the impacts of changes in the world's large equity markets due to financial crisis, on the equity markets of developing countries. In order to take an overall view of the impact on international financial crisis on the developing countries, this paper carries out multiple regression analysis on the four leading Stock Exchanges of the world with particular focus on Asian markets.

It is evident from analysis that there is one way co-integration, e.g increase in KSE is one way related to the increase in the remaining four indices. It means that it is not necessary that the decrease in the four variables (BSE, FTSE, MSCI and NSE) must bring decrease in KSE. The result also shows that the decrease in KSE may not cause proportional decrease in the above four variables.

Relatively weak correlation is observed. Bombay Stock Exchange (BSE) and MSCI emerging market indices have a negative correlation with KSE which shows that any ups and down in both of these indices may not proportionally influence the Karachi Stock Exchange. The reason is the less co-integration of KSE with the world's equity market. FTSE London and National Stock Exchange of India have however a positive correlation

with Karachi Stock Exchange but this correlation is not significant. BSE is however negatively correlated with all of the above indices which show somehow correlation between BSE and other world indices. It is also evident that MSCI Emerging market reflects negative correlation with all indices except FTSE.

From the analysis, we conclude that there is no significant impact of world equity markets on Pakistan's equity market. This assumption is confirmed from the probability values. Similarly BSE and MSCI co-efficients indicated negative behavior with changes in KSE-100 as compared to Europe, emerging market indices have a greater impact on Pakistan's equity market. It implies that Pakistan's equity market is somehow integrated with emerging markets including India. Generally, it is apparent that when there is increase in KSE, there is increase in all of the above variables e.g BSE, FTSE, MSCI, and NSE.

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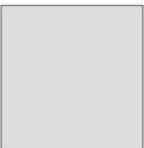
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**Inayat Ullah:** Lecturer at Centre for Disaster Preparedness & Management, University of Peshawar, Pakistan. M.Phil (in Progress) from University of Malakand, Chakdara, Dir (L). Area of Interest: Disaster Management and Finance and Banking  
e-mail: inayat\_90@hotmail.com



**Rizwan Ullah:** M.Phil Scholar, University of Malakand, at Chakdara, Dir (L). Area of Interest: Micro-Finance, Islamic Banking and Finance.  
e-mail: nawzirxyz@gmail.com



**Madiha Khan:** Lecturer in Management Sciences, Department of Management Studies, University of Malakand. Ph.D (Finance), UK. Area of Interest: Micro-Finance.  
e-mail: madihakhan786@gmail.com