Comovement of Stock Market Returns Between Pakistan and Asian Countries from Long- and Short-Run Perspectives

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Abstract
The purpose of this study is to investigate the long- and short-run comovement of stock market returns of Pakistan with developed and emerging Asian countries over the period 1995-2014 using ARDL cointegration approach and rolling window correlation. We find long- term and short- run cointegration relationships of Pakistan's stock market returns with developed and emerging Asian countries but for most of the cases in bivariate analysis we find the impact of developed and emerging Asian equity markets on Pakistan but not in opposite direction. Further, we come across with low values of time varying correlation, indicating that Pakistan may be the attractive avenue for international investors for greater diversification benefits. We also observe that comovement of stock market return is a time variant phenomenon and find greater comovement in the periods of financial crises relative to tranquil periods due to contagion or spillover of asset prices.
Keywords: Comovement of stock returns, Pakistan, developed and emerging Asian countries, ARDL cointegration approach, Rolling window correlation

During the last few decades, the movement towards a harmonized stock market has increased due to tight economic and financial integration among the countries of the world. The rise of several developing nations has unfastened a number of channels of cross border relationships. Technological advancement, liberalization of markets and elimination of legal control are the other main factors that contribute toward economic integration. This economic integration has significant impact on the comovement of stock market returns. Furthermore, strong economic integration among different economies plays a key role in shock transmission, dispersing the financial crises and has strong inference for portfolio investment (Kenourgios and Samitas, 2011). A major shock in the equity market of one country may spread to those countries' stock markets to which it has strong economic connection. Thus, the study of cointegration of stock market returns is crucial for understanding the degree of economic integration and interdependency of different markets around the world.

One aspect of the study of cointegration of stock market returns takes into consideration whether the investor is interested in short-term investment or long term investment (Candelon, Piplack and Straetmans, 2008). Short-term investors are normally interested in the high frequencies of cointegration of stock market returns i.e. short- run

fluctuations whereas the long-term investors consider the low frequencies of cointegration of stock returns i.e. long-run fluctuations. The second aspect is the identification of contagion which shows that the allocation of asset is dependent on regime. The benefits of international portfolio diversification are greater in the period large shocks than in the period of little turmoil.

The purpose of current study is to investigate the comovement of stock market returns of Pakistan with Developed and Emerging Asian equity markets. To achieve high diversification benefits, investors continuously search such markets which provide them maximum return with minimum risk. International portfolio diversification is an efficient way to gain higher risk-adjusted returns compare to domestic portfolios. Asia plays an incredibly dynamic role in the world economy despite the facts that several countries in this region exhibit low growth. Due to decrease in demand from the advanced economies, Asian countries shift their resources to fulfill regional demands. This results in high cross-countries trade and investment activities which enhances the economic and financial integration among the Asian economies. Pakistan is a country where economic situation is not as bright as it should be. Pakistan economy is going through several ups and downs over the last two decades because of high inflation, unemployment, political instability and especially terrorism and thus local investors feel domestic investment insecure.

Despite of the weak economic condition, Pakistan adopted the policies of liberalization and made several reforms in financial sector 1990s. These reforms led in economic growth and improved the country's credit rating and as a result foreign investor started showing confidence in Pakistani market. Also other factors like improving cross country relations, introduction of successful GDR, high investment by foreign firms and banks and decreasing investment barriers contributed significantly to the integration of the Pakistani market with other markets in the region.

Therefore, the objectives of the study are:

- To investigate the comovement of stock market returns of Pakistan with developed and emerging Asian countries in order to explore the diversification opportunities in Pakistani Stock markets for Asian investors.
- To capture the time varying nature of these comovements over tranquil and crises periods.

The contribution of this paper to the literature of stock market cointegration is twofold. First, against previous studies, the current study analyzes the cointegration of Pakistani stock market with developed and emerging Asian equity markets because of the difference in basic characteristics of developed and emerging stock markets such as market size, liquidity, market accessibility and geographical. Also to capture the

time varying behavior of comovement, the study also analyzed the comovements over different economic regime i.e. Asian crises 1997-1998 and Global financial crises 2008-2011.

Second, the study has used Autoregressive Distributed Lag (ARDL) model to investigate long-run equilibrium and short-run casualty relationships. This cointegration technique has some advantages over other cointegration models as: 1) In comparison to other cointegration techniques, the ARDL approach can be applied to the variable of order *I(1)* and/or *I(0)*; 2) this technique is helpful in estimating long-run cointegration relationships and long-term coefficients; 3) there is no problem of endogenous regressors and serial correlation of residuals with this model as associated with other approaches like Engle and Granger (1987); and 4) different number of lags for different variable can be used in this model.

Further, there may be present structural changes in the comovement of stock market return because of major financial crises due to which the interrelationship between different stock market varies over time. To trace such time varying relationship between different stock markets, the current study has considered time varying correlation by rolling window which is a symmetric indicator of the interrelation between stock markets.

Literature Review

In the line with modern portfolio theory by Markowitz (1952) and CAPM by Sharpe (1964), investors may diversify the risk of their portfolio by investing in such group of assets that show different behavior to same event. So, in order to reduce the risk of their portfolios investors should avoid to invest in those assets which are highly correlated. The early seminal empirical work on comovement of stock market returns used correlation to investigate the short-term linkages (Grubel, 1968; Levy and Sarnat, 1970; Solnik, 1974). The results of these studies showed low correlation among the equity markets, revealing the possibilities of international portfolio diversification. Researchers started cointegration techniques in early 1990, with Kasa (1992) being one of the earliest of such studies. Most of these studies considered developed markets or their relationship with emerging markets and concluded that stock market integration among the developed markets have increased. Another major conclusion of these studies is that emerging stock markets are becoming integrated and thus the opportunities for portfolio diversification have diminished over time (Chowdhury, 1994; Harvey, 1995).

Motivation for investing in international markets arises from the fact that investor believes that international equity markets have lower correlation than domestic one. In doing so, the issue of equity market comovement has been studied by various researchers. Some researcher documented high comovement of stock market return at international

level while other found little or no evidence of comovements. Loh (2013) empirically investigated the stock market cointegration of Asia-Pacific with European and US economies using wavelet coherence method. The result of this study showed stock market returns of Asia-Pacific, Europe and the United States exhibit long-run equilibrium relationships. Kargi (2014) analyzed the comovement of stock market returns among G7, BRICS and MATIK countries over the period 1962- 2012. Using time series data, his results revealed that equity markets of G7, BRICS and MATIK are highly cointegrated. Zhang and Li (2014) studied the stock markets integration between China and US. Using daily return, they found no comovement of stock market returns between these two economies. Similarly, Graham, Kiviaho and Nikkinen (2012) found high degree of comovement between the emerging economies and United States although the strength of comovement differs country by country.

Several researchers studied the contagion impact of crises and revealed mixed results. Arouri, Hammoudeh, Lahiani and Nguyen, (2013) investigated the pattern of comovement between the emerging markets of Latin America with US using the DCC-GARCH and BEKK-GARCH model. They found no contagion impact during the periods of Mexican crisis of 1994, the Asian crisis of 1997-1998, and the global financial crisis of 2008-2009. Arouri, Bellalah and Nguyen (2010) applied DCC-GARCH model to explore the time variations in comovement of stock market returns in Latin American countries and found that comovement of equity market is regime dependent phenomenon and equity markets returns show high correlation during the periods of crises. Similarly, Gjika and Horvath (2013) applied asymmetric dynamic conditional correlation multivariate GARCH model and concluded diversification benefit decrease significantly during the periods of great volatility in Central European countries due to high correlation between their stock market returns. Yarovaya and Lau (2016) and Zhang and Li (2014) found an upward trend in comovement of equity returns during the periods of crises.

A number of studies are available on the comovement of stock market returns in Asia. Dhanaraj and Gopalaswamy (2013) analyzed the stock market linkage among Hong Kong, Singapore, India, China, Taiwan and Philippines. Using Granger causality tests and forecast error variance decomposition they found strong comovement of equity returns among these markets. Guillaumin (2009) used Feldstein-Horioka model and showed that equity market integration has increased in Asia region in recent years. In the same fashion, Yu, Fung and Tam (2010) studied comovement of stock market returns between developed and emerging market Asian economies and found different degree of integration between emerging and developed markets. Huyghebaert and Wang (2010) investigated the integration among stock markets of seven key East Asian countries that any shock in the stock markets of Singapore

and Hong Kong has significant impact on other markets in Asia except China.

Very few studies are available on the cointegration of Pakistani stock market with other Asian markets. Husain and Saidi (2000) analyzed the stock market linkage of Pakistan with Japan, Singapore, Hong Kong, Germany, UK and USA using Engle and Granger cointegration approach. They found little evidence of stock market of integration with these major equity markets. Narayan, Smyth and Nandha (2004) studied the dynamic linkage of the stock markets of Pakistan, India, Sri Lanka and Bangladesh. Using a temporal Granger Causality technique they found long-run and short-run cointegration among the sampled equity markets. Subhani, Hasan, Mehar and Osman (2011) examined the equity markets integration among the South Asian nations including Pakistan, India, Bangladesh and Nepal. Applying Johansen cointegration analysis that found that there is stock market linkage between Pakistan and India but there is no linkage between Pakistan and other south Asian equity markets. Shezad, Jan, Gulzar and Ansari (2014) concluded that KSE-100 has short-run relationships with China, Japan and Taiwan. Similarly, Khan and Aslam (2014) found cointegration relationships between Pakistan's stock market with developed and emerging Asian markets.

The above literature related to the comovement of stock market returns revealed that comovement of stock market returns at international level has increased due to strong economic and financial linkage which decreases the diversification opportunities for international investors. Furthermore, very few studies are available related to comovement of Pakistani stock returns with those of markets and those available have mixed results. So, these factors motivate us to reinvestigate the comovement of Pakistani stock market returns with developed and emerging Asian countries to see the Pakistani stock markets as a possible avenue for international investors in their portfolio risk diversification

The study analyzed the comovement of stock market return between Pakistan and sampled Asian markets in the line of framework in figure 1.

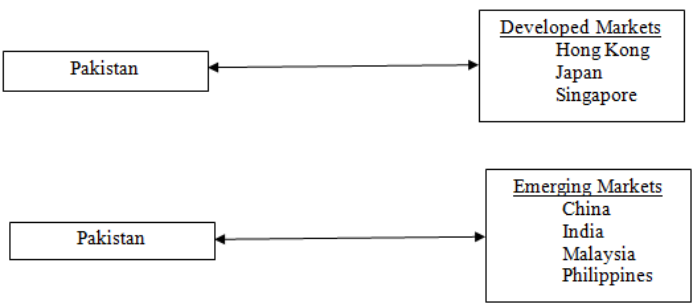


Figure 1: Schematic Diagram of Comovement of Stock Market Returns between Pakistan and Emerging Asian Markets

Hypotheses of the study are:

H_1: There are significant comovement of stock market returns between Pakistan and developed economies of Asia.

H_2: There are significant comovement of stock market returns between Pakistan and emerging economies of Asia.

Research Methodology

To study the comovement of equity returns between Pakistan and other Asian countries, this study considers Hong Kong, Japan and Singapore (developed markets) and China, India, Malaysia and Philippines (emerging market). According to Morgan Stanley Capital International (MSCI), Hong Kong, Japan and Singapore are the developed and dominant markets of Asia. The reason for taking these markets is to explore whether or not Pakistani stock markets follow these developed markets of Asia. The preference of the selected emerging market is done on the basis of their economic importance in Asian region as they are considered as advanced emerging Asian markets by Fitch-owned BMI Research. Furthermore, these sampled economies have strong economic and bilateral trade relationships with Pakistan. This study covers a sample period from January 1995 to December 2014 using daily frequency of data. As this time period contains two major crises of the world, the Asian Crises of 1997-98 and the Global Financial Crises of 2008-11, this period help us to capture the behavior of comovement during the crisis and tranquil periods. The data related to stock return are taken from MSCI database and to make it homogenous across different stock markets and to avoid currency risk the data are expressed in US dollar terms.

ARDL model for cointegration

In the study Autoregressive Distributed Lag (ARDL) model, proposed by Pesaran, Shin and Smith (2001), is applied to investigate the long-run cointegration relationship as well short-run causality between different stock markets. Previous studies used this model for investigating the cointegration between different economic variables (Bildirici and Türkmen, 2015; Dahal, 2015), analyzing comovement of stock market returns between different economies (Agyapong, 2014; Karim and Karim, 2012) and determinants of comovement of stock market returns (Bekhet and Matar, 2013; Fonseca, 2016). The ARDL model used in this study is given as:

$$\Delta lnY_t = \alpha + \beta t + \emptyset lnY_{t-1} + \sum_{k=1}^{n} \emptyset_k lnX_{k,t-1} + \sum_{i=1}^{p} \vartheta_i \Delta lnY_{t-i} + \sum_{k=1}^{n} \sum_{i=0}^{pk} \varphi_k \Delta lnX_{k,t-i} + \varepsilon_t \quad (1)$$

Where

ΔlnY and ΔlnX_k are natural log of regressand and regressor respectively, where *k=1, 2,….., n* and *n* is the number of independent variables. $\emptyset$ and $\emptyset_k$ denote the long-run while ϑ_i and φ_k show the short-run estimates. Schwarz Information Criterion is applied to determine the optimal numbers of lags $(\hat{p}, \hat{p}_1, \hat{p}_2, \dots \dots, \hat{p}_n)$.

On the basis of model in equation 1, we estimate the comovement of stock market returns between Pakistan and other Asian countries in multivariate and bivariate setting. In multivariate setting two models are considered: 1) Pakistan is considered as dependent variable and three developed Asian economies (Hong Kong, Japan and Singapore) as independent variables; 2) Pakistan is taken as dependent and the four emerging Asian markets (China, India, Malaysia and Philippines) as independent variables. For bivariate analysis, the study analyzes the comovement of stock market returns of Pakistan one by one with developed and emerging Asian countries: *first*, we consider Pakistan as dependent variable and each developed or emerging economy as independent variable; *second,* each developed or emerging market is taken as dependent variable and Pakistan as independent variable.

To find the long-run equilibrium relationships between the variables, the null hypothesis is set as $\emptyset = \emptyset_1 = \emptyset_2 = \dots\dots\dots = \emptyset_n = 0$. Two critical values *I(0) and I(1)* are determined for the purpose of rejection of null hypothesis. If the observed F-statistics is greater than the upper bound critical value then there are long-term equilibrium relationships between the variables

The following Error correction model is applied to check short-term relations between the variables:

$$\Delta Y_t = \gamma(1, \hat{p}) EC_{t-1} + + \delta \Delta v_t + \sum_{j=1}^{\hat{p}-1} \partial_j^* \Delta Y_{t-j} + \sum_{k=1}^{k} \sum_{j=0}^{\hat{q}_{i-1}} \beta_{ij}^* \Delta X_{i,t-j} + \varepsilon_t \quad (2)$$

Where $\gamma(1, \hat{p})$ is the error correction term coefficient, ∂_j^* and β_{ij}^* are short-run coefficients and v_t vector of deterministic variables.

Granger causality

If the ARDL model proves the cointegration relationships between the variables, then Vector Error Correction (VEC) model is applied for establishing Granger causality between the variables. In the case of no cointegration Vector Autoregressive (VAR) model is used, provided that the variables are *I(1)*. The short term causality between two variables is determined using the following Vector Error Correction (VEC)

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=0}^{n} \varphi_i \Delta X_{t-i} + \theta_1 EC_{t-1} + e_t \quad (3)$$

EC_{t-1} is the Error correction term, β_i, φ_i and θ_1 are the parameter to be estimated where θ_1 shows the speed of adjustment towards equilibrium after a shock. The null hypothesis for short-run causality is formulated as $H_0: \varphi_i = 0$. The significance of short run causality is established through F-statistics of the lagged independent variables.

Time varying Analysis

A rolling analysis is often used for the time series model in order to judge the model stability over time. If the parameters of the time series model changes at some point due to any reason during the sample, then the rolling window estimates captures this instability. In contrast to GARCH or stochastic volatility models, those have tendency to capture high frequency variation in volatility and covolatility, the rolling estimates can better determine the underlying smooth structural changes in the long run.

Consider that y_{1t} and y_{2t} are two univariate time series over the sample $t = 1, \dots \dots, T$, then n-period rolling sample covariance and correlation are given as:

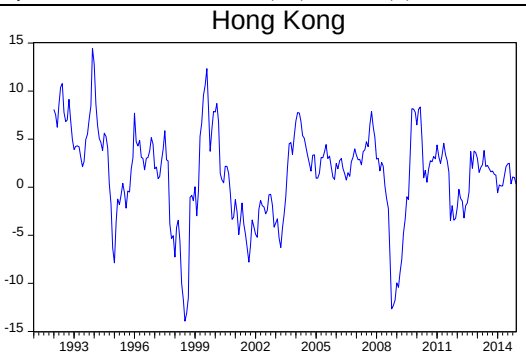
$$\hat{\sigma}_{12,t}(n) = \frac{1}{n-1}\sum_{t=0}^{n-1}(y_{1t-i} - \hat{\mu}_{1t}(n))(y_{2t-i} - \hat{\mu}_{1t}(n))$$

$$\hat{\rho}_{12,t}(n) = \frac{\hat{\sigma}_{12,t}(n)}{\hat{\sigma}_{1,t}(n)\hat{\sigma}_{1,t}(n)}$$

$\hat{\sigma}_{12,t}(n)$ and $\hat{\rho}_{12,t}(n)$ are the rolling sample covariance and correlation respectively having a window width n. $\hat{\mu}_t(n)$ is the rolling mean, also called *n-period simple moving average*.

Analysis and Results

The trending behavior of stock market of Pakistan and developed and emerging Asian countries is shown in figure 2. The figure clearly shows that all equity markets exhibit common dynamic pattern revealing that there is some cointegration among the sampled stock market returns. All the stock markets experienced greater instability and volatility in periods of great turmoil i.e. Asian Crises of 1997 and Global Crises of 2008. Thus, this primary analysis reveals some potential comovement among the sampled Asian stock markets.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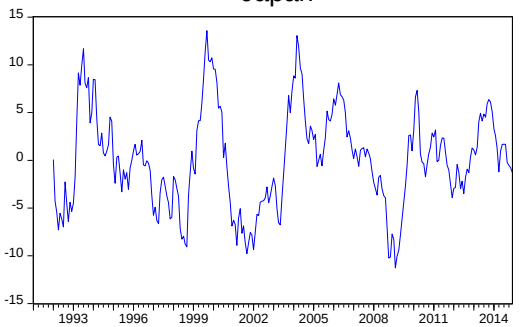
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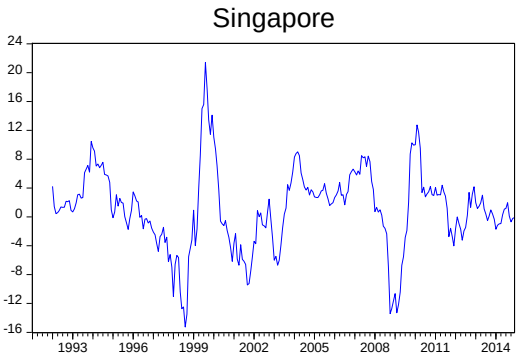
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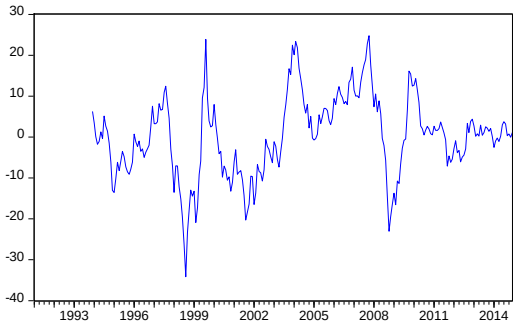
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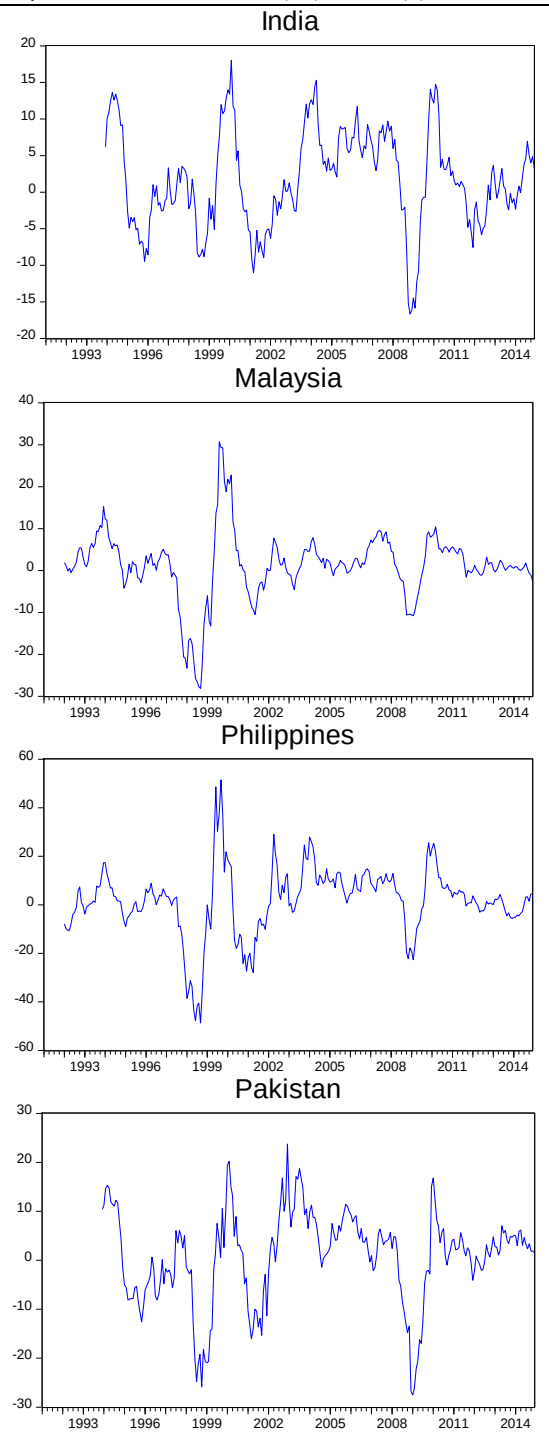


Figure 2: Dynamic patterns of stock market returns

The descriptive statistics of different stock markets is shown in table 1. The table shows that Hong Kong and Japan have the highest

average stock return but the stock returns of Japan exhibit least volatility than other Asian markets revealing that stock markets of Japan are potential attractive avenues for investor. The negative values of skewness for most of the stock markets give an indication of negative returns. The values of Ex. Kurtosis show platykurtic distribution for the most of the data.

Table 1: *Descriptive statistics of sampled Asian countries stock market returns over the entire period*

	Mean	Std. Dev.	C.V.	Skewness	Ex. kurtosis
Pakistan	6.197	0.152	0.025	-1.411	1.160
Hong Kong	8.503	0.137	0.016	-0.275	-0.336
Japan	8.069	0.053	0.007	-0.353	-0.111
Singapore	7.862	0.060	0.008	0.575	-0.870
China	4.141	0.082	0.020	0.303	-0.871
India	4.712	0.116	0.025	-0.426	-0.806
Malaysia	6.268	0.120	0.019	-0.151	-1.089
Philippines	5.081	0.158	0.031	-1.036	0.186

The unconditional correlation between the Pakistan and sampled Asian equity markets is shown in table 2.

Table 2: *Unconditional Correlation between the sampled Asian market returns over the entire period*

	Pakistan	Hong Kong	Japan	Singa-pore	China	India	Indo-nesia	Philippines
Pakistan	1							
Hong Kong	0.558**	1						
Japan	0.450**	0.413**	1.000					
Singapore	0.622**	0.943**	0.464**	1.000				
China	0.548**	0.715**	0.527**	0.780**	1.000			
India	0.604**	0.876**	0.207**	0.884**	0.598**	1.000		
Malaysia	0.645**	0.816**	0.373**	0.904**	0.863**	0.770**	1.000	
Philippines	0.634**	0.828**	0.264**	0.888**	0.510**	0.907**	0.793**	1.000

**indicates significance level of 5%

The results indicate that stock market returns of Pakistan exhibit positive correlation with the sampled Asian stock markets revealing that comovement of stock market returns between them. In order to robust these results, the study applied ARDL cointegration model to gain a valid conclusion.

As a prerequisite for ARDL model, unit root test is applied to all the series of equity return to check their order of integration. The results of ADF unit root test shown in table 3 indicates that all the series are *I(1)*, and so ARDL approach can be applied to establish cointegration between the equity markets.

Table 3. *Augmented Dickey- Fuller Unit root tests over the entire period.*

	At level		At first difference	
	With constant	With constant & trend	With constant	With constant & trend
Pakistan	-1.791	-2.375	-15.36***	-15.390***
Hong Kong	-1.854	-2.927	-13.931***	-13.904***
Japan	-2.358	-2.311	-7.296***	-7.314***
Singapore	-1.277	-2.296	-14.119***	-14.113***
China	-1.413	-1.739	-14.122***	-14.162***
India	-0.678	-2.411	-14.169***	-14.152***
Malaysia	-1.021	-1.936	-11.237***	-11.286***
Philippines	-1.137	-2.625	-7.698***	-7.697***

***indicates significance level of 1%

First multivariate analyses are performed to investigate the comovement of Pakistan stock market returns with developed and emerging Asian economies. Model 1 in table 4 shows the results of multivariate analysis in case when Pakistan is considered as dependent variable and three developed Asian economies as independent variables. The result shows that there are long-run equilibrium relationships between Pakistan and developed Asian markets over all the sampled periods except the first tranquil period of 1995-1996. Similarly, model 2 in table 4 indicates the results for the case while Pakistan is taken as dependent and the four emerging Asian markets as independent variables. The result reveals the evidence of cointegration between Pakistan and emerging stock markets over the entire period and in crises period of 1997-1998 and 2008-2011 and tranquil period 1999-2007.

Table 4. *F- Statistics for multivariate cointegration along with estimates of error correction term*

	Tranquil period (1995-1996)	Crises period (1997-1998)	Tranquil period (1999-2007)	Crises period (2008-2011)	Tranquil period (2012-2014)	Entire period (1995-2014)
Model 1	2.001	7.831***	7.116***	7.937***	6.121**	8.906***
	-	(-0.108***)	(-0.081***)	(-0.119***)	(-0.074***)	(-0.131***)
Model 2	2.662	14.312***	8.299***	14.457***	1.421	9.311***
	-	(-0.213***)	(-0.116***)	(-0.234***)	-	(-0.075***)

Note: The first value of each model shows the F- statistics and the second value in brackets shows the estimate of error correction term. For model 1, the lower bound critical values are 3.47 (10%), 4.01 (5%) and 5.17 (1%) whereas the upper bound critical values are 4.45 (10%), 5.07 (5%) and 6.36 (1%) and for model 2, The lower bound critical values are 3.03 (10%), 3.47 (5%) and 4.40 (1%) whereas the upper bound critical values are 4.06 (10%), 4.57 (5%) and 5.72 (1%) (see Pesaran et. al 2001).

***indicates significance level of 1%

**indicates significance level of 5%

*indicates significance level of 10%.

The results of bivariate analyses are shown in table 5. The analyses provide the evidence of long-run equilibrium relationships between Pakistan and developed Asian economies in bivariate setting except the tranquil period of 1995-1996. The results further reveal that, in most of the cases, there are cointegration relationships when Pakistan is considered as dependent variable but no evidence of cointegration when developed markets are taken as dependent variable, revealing the dominant nature of developed Asian markets. The bivariate analyses between Pakistan and emerging Asian equity markets reveal that all the Pakistan and emerging stock markets pair show long–run equilibrium relationship and over the entire period except Pakistan/Malaysia pair which provide no evidence of cointegration in the two sub periods i.e. 1995-1996 and 2012-2014.

Table 5. *F- Statistics for bivariate cointegration along with estimates of error correction term*

	Tranquil period (1995-1996)	Crises period (1997-1998)	Tranquil period (1999-2007)	Crises period (2008-2011)	Tranquil period (2012-2014)	Entire period (1995-2014)
Pakistan/ Hong Kong	3.440	16.095***	8.953**	13.511***	14.664***	9.628***
	-	(-0.182***)	-0.061***	(-0.179***)	(-0.198***)	(-0.053***)
	4.963	7.834**	4.113	11.698***	3.741	8.347**
	-	(-0.078***)	-	(-0.137***)	-	(-0.047**)
Pakistan/ Japan	4.473	13.129***	9.575**	14.631***	13.999***	8.602**
	-	(-0.134***)	(-0.077***)	(-0.203***)	(-0.142***)	(-0.072***)
	3.552	10.668***	7.752**	10.253***	9.825***	7.376**
	-	(-0.093***)	(-0.48***)	(-0.135***)	(-0.076***)	(-0.037**)
Pakistan/ Singapore	7.325**	15.842***	8.423**	19.340***	6.912*	9.775**
	(-0.057***)	(-0.175***)	(-0.073***)	(-0.207***)	(-0.042**)	(-0.083***)
	5.864	9.332**	5.337	16.634***	3.242	4.123
	-	(-0.083***)	-	(-0.183***)	-	-
Pakistan/ China	8.133**	18.615***	14.255***	13.391***	10.563***	18.758***
	(-0.053***)	(-0.181***)	(-0.126***)	(-0.151***)	(-0.117***)	(-0.136***)
	7.471**	14.893***	10.004***	11.615***	9.474**	10.304***
	(-0.044**)	(-0.117***)	(-0.088***)	(-0.078***)	(-0.074***)	(-0.091***)
Pakistan/ India	11.392***	15.469***	10.385***	15.768***	10.394***	11.185***
	(-0.102***)	(-0.163***)	(-0.103***)	(-0.207***)	(-0.065***)	(-0.092***)
	10.111***	13.150***	9.736***	13.314***	11.212***	16.217***
	(-0.096***)	(-0.117***)	(-0.071***)	(-0.175***)	(-0.094***)	(-0.135***)
Pakistan/ Malaysia	5.914	17.263***	14.531***	15.493***	3.814	12.648***
	-	(-0.109***)	(-0.176***)	(-0.229***)	-	(-0.168***)
	3.276	18.862***	13.774***	12.309***	5.632	9.113**
	-	(-0.145***)	(-0.141***)	(-0.164***)	-	(-0.119***)
Pakistan/ Philippines	8.152**	20.961***	14.127***	17.621***	13.571***	13.922***
	(-0.52***)	(-0.153***)	(-0.111***)	(-0.193***)	(-0.194***)	(-0.118***)
	7.830**	15.147***	9.642***	10.111***	11.926***	9.847***
	(-0.047***)	(-0.127***)	(-0.092***)	(-0.151***)	(-0.146***)	(-0.053***)

Note: The first value of each model shows the F- statistics and the second value in brackets shows the estimate of error correction term. Also, in each cell, the first value of F- statistics and ECM term belong to the model when first country equity of the countries equity pair is taken as dependent variable and second value of F- statistics and ECM term belong to the model when second country equity of the countries equity

pair is taken as dependent variable. The lower bound critical values are 5.59 (10%), 6.56 (5%) and 8.74 (1%) whereas the upper bound critical values are 6.26 (10%), 7.30 (5%) and 9.63 (1%) (see Pesaran et. al 2001).

***indicates significance level of 1%
**indicates significance level of 5%
*indicates significance level of 10%.

The short term causality between equity market returns of Pakistan and those of developed and emerging Asian economies is shown in table 6. The results reveal that there are short-term causality relationships of Pakistan with developed and emerging markets of Asia. Furthermore, over the entire periods and the periods of tranquil, there is mostly unidirectional short-term causality running from developed and frontier Asian countries to Pakistan showing that any shock in the stock prices of developed and emerging Asian countries has significant impact on the stock prices of Pakistan in short- term but changes in the stock prices of Pakistan have no impact on the stock prices of developed and emerging Asian countries.

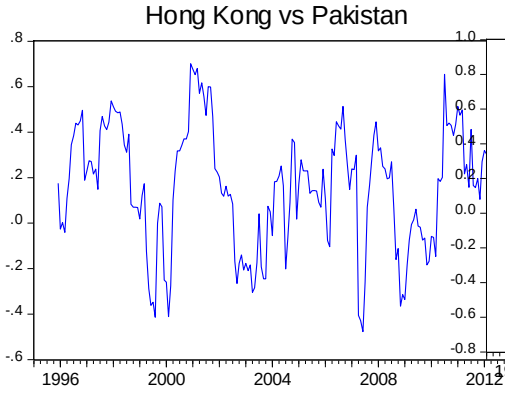
Table 6. *F- Statistics Short- run Granger causality (Pakistan and developed and emerging countries of Asia)*

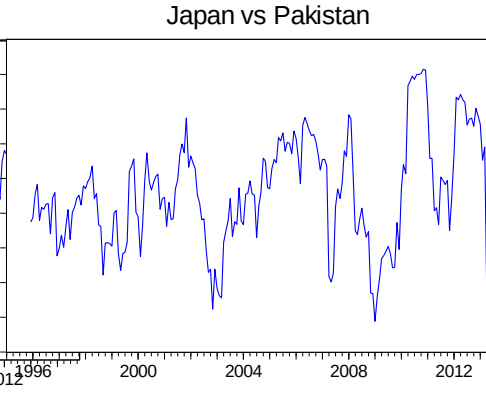
	Tranquil period (1995-1996)	Crises period (1997-1998)	Tranquil period (1999-2007)	Crises period (2008-2011)	Tranquil period (2012-2014)	Entire period (1995-2014)
Pakistan/ Hong Kong	1.679^{var} 1.198^{var}	9.652*** 6.142***	4.042** 1.772^{var}	9.425*** 6.528***	4.528** 1.682^{var}	7.049*** 1.447
Pakistan/ Japan	1.006^{var} 0.669^{var}	12.256*** 9.425***	7.856*** 1.472	9.265*** 7.934***	8.294*** 1.182	7.213*** 1.621
Pakistan/ Singapore	4.526** 0.698^{var}	7.234*** 5.325***	6.235*** 4.611*** var	8.428*** 6.362***	7.333*** 1.280^{var}	7.524*** 1.233^{var}
Pakistan/ China	9.029*** 5.328**	11.843*** 9.328***	8.247*** 7.481***	17.016*** 14.354***	10.321*** 8.458***	12.664*** 10.524***
Pakistan/ India	9.341*** 7.658***	8.348*** 7.764***	7.814*** 5.009**	19.374*** 17.451***	9.035*** 8.543***	13.431*** 11.927***
Pakistan/ Malaysia	1.168^{var} 1.573^{var}	11.263*** 9.435**	4.728** 1.024	12.744*** 10.415***	1.473^{var} 1.297^{var}	8.279*** 8.135***
Pakistan/ Philippines	4.986** 1.581	12.735*** 10.982***	8.315*** 6.589***	14.817*** 12.746***	8.568*** 1.031	5.571** 4.394**

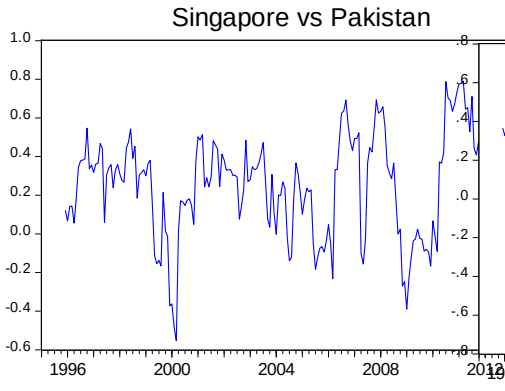
In each cell, the first value of F- statistics belongs to the model when first country equity of the countries equity pair is taken as dependent variable and second value of F- statistics belong to the model when second country equity of the countries equity pair is taken as dependent variable.

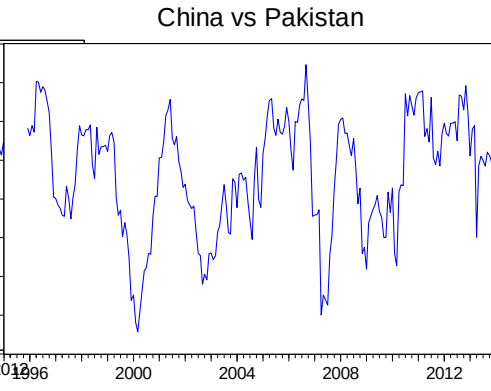
^{var} indicates Granger causality estimated by VAR model
***indicates significance level of 1%
**indicates significance level of 5%

To reflect potential symmetric effects and the extent of comovement, the time varying correlation with 365-days window is run on the return of different Asian equity markets. The figure shows the rolling window correlation between the developed and emerging Asian equity markets. Indeed, Pakistan and the emerging and developed stock markets exhibit comovement, since the rolling window correlation is positive for most of the periods. It is also clear from the figure, that the correlation between Pakistan and the developed and the emerging Asian equity market exhibit fluctuation overtime, with almost negative correlation during some periods. The most persistent correlation among these pairs of Pakistan and emerging equity markets can be seen between the Pakistan and India.









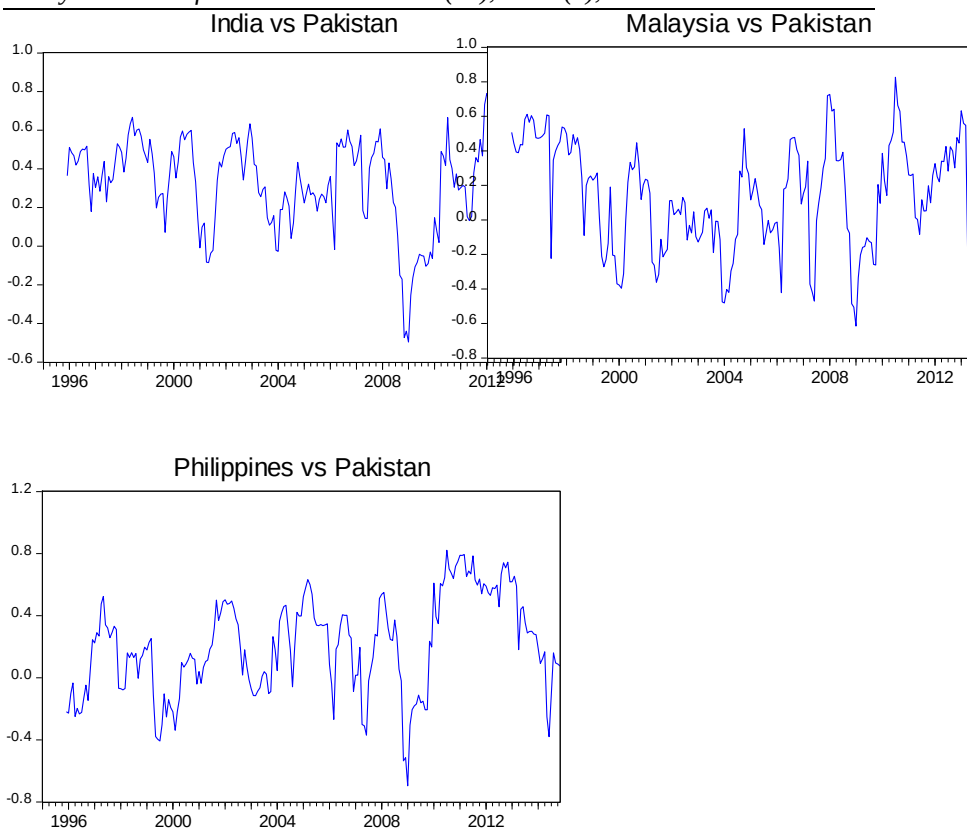


Figure 7: Rolling Window Correlations of Stock Market Returns between Pakistan and Developed and Emerging Asian Countries

The table 7 shows average correlation of Pakistan with different Asian equity markets. The greater average correlation is shown by the pairs of equity markets of India/Pakistan (0.514), followed by Singapore/Pakistan (0.462) and the lowest Japan/Pakistan (0.186). The tables 7 also depicts that there are highest average correlations in the periods of turmoil than in the periods of tranquil due to contagion or spillover of assets prices.

Table 7. Rolling Window Correlation

	Tranquil period (1995-1996)	Crises period (1997-1998)	Tranquil period (1999-2007)	Crises period (2008-2011)	Tranquil period (2012-2014)	Entire period (1995-2014)
Hong Kong / Pakistan	0.243	0.526	0.117	0.433	0.214	0.365
Japan / Pakistan	0.013	0.014	0.109	0.427	0.055	0.186
Singapore /	0.265	0.544	0.210	0.494	0.322	0.462

Pakistan						
China / Pakistan	0.125	0.462	0.024	0.558	0.181	0.414
India / Pakistan	0.428	0.459	0.339	0.671	0.292	0.514
Malaysia / Pakistan	0.300	0.579	0.019	0.556	0.257	0.350
Philippines / Pakistan	0.116	0.190	0.148	0.427	0.353	0.307

From the above results it can be observed that stock market returns of Pakistan have cointegration relationships with developed and Asian markets. These results are consistent with Khan and Aslam (2014) and Shezad et al. (2014) who investigate the comovement of stock market returns with with major Asian economies. Most of the bivariate analyses reveal that developed Asian stock markets have strong impact on Pakistani stock markets but stock markets of Pakistan have no impact on the stock market returns of these developed countries. The strong impact of the developed Asian economies on developing markets like Pakistan is that stock markets of the developed economies are dominant and have the capacity to generate significant information in Asia region (Patel and Shah, 2016). Despite of the long and short run cointegration, the value of time varying correlations are low. It is due to fact that in most bivariate analysis we find asymmetric effect of the developed and emerging Asian countries on Pakistan. The low values of time varying correlation indicates that diversification benefits exist for international investors in Pakistan equity markets.

We also observe changing behavior of the comovement during tranquil and crises periods. In most of the cases in multivariate and bivariate analyses, the results give no evidence of cointegration during periods. Against the tranquil period, there is long-term equilibrium and short-term causality relationships of stock market returns between Pakistan and the developed and emerging Asian economies. Consistent with Yarovaya and Lau (2016) and Zhang and Li (2014), the strong comovements during the period of turmoil are due to contagion or spillover between assets.

Conclusion

The purpose of this study is to investigate comovement of stock market returns of Pakistan with developed and emerging economies of Asia. Applying ARDL model and rolling window correlation, it is deducted from the analyses that although there are long and short-run cointegration relationships of Pakistan stock market with developed and emerging Asian countries but for most of the cases in bivariate analysis we find strong impact of developed and emerging Asian equity markets on Pakistan but not in opposite direction. Further, values of time varying correlation give the evidence of low comovement of stock market returns

between Pakistan and other sampled Asian countries and thus international investors can use Pakistan stock market as an attractive tool for diversification. The results also depicts that there is greater comovement of stock market returns during the period of crises than tranquil periods due to contagion or spillover between assets.

The results of the study have some implication for investors and policy makers. This will be useful to investors to look up risk management and enhance their portfolio returns through diversification of their stocks risk. Investor may diversify their risk on the basis of magnitude of the comovement between the different equity markets in question. The established relations between Pakistan and developed and emerging Asian countries enable the international investor to make profitable use of the money by considering Pakistan as an important market to invest. The results can be considered as a base by policy makers in Pakistan to make sound economic decisions and devise strategies to regulate the equity markets; especially the stock markets of Pakistan are sensitive to developed Asian markets. Such relationships may be useful in forecasting the behavior of the Pakistani stock markets both in short-and long-run.

There are also some suggestions for future research work. The future studies may consider other emerging as well as frontier markets of Asia to see the stock market comovements of Pakistan with them. Frontier markets are less developed markets and are risky, but the returns that they can provide make them a valuable addition to any portfolio. The rational here is that developed, emerging and frontier stock markets react differently to any shock in global economy. So, even a small difference in comovement can help the international investors to diversify their portfolios. Researchers can also investigate the stock market linkage between Pakistan and developed emerging Asian countries and their relationship global factors by applying panel data cointegration models instead of time series approaches. Panel models consider both the cross-sectional and time series dimension for analysis and thus protect against unobserved factors that can show significant relation with the regressors of the model.

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