Financial Contagion and Globalization: Evidence from South Asian Countries

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Info Articles

Abstract

This study investigates the contagion and globalization between the South Asian (Pakistan, India, Bangladesh and Sri Lanka) and five largest economies (US, UK, China, Japan and Germany) stock markets. Daily stock returns data from 1st July 1997 to 30th June 2015 consisting of total 4695 observation is analyzed. DCC GARCH is applied to calculate the conditional correlation coefficients to overcome the issue of heteroscedasticity. Null hypothesis of no globalization got rejected eleven times out of twenty while the hypothesis of no contagion got rejected six times. Further analysis of conditional correlation coefficients confirmed the impact of 9/11 attacks, Subprime mortgage crises and Europeans debt crises on the Indian market. Impact of 9/11 attacks also found on Pakistani and Sri Lankan stock exchanges, while Dhaka stock exchange remained independent of all shocks. In sum, the South Asian stock markets remained isolated from the global shocks except India. Isolation of South Asian stock markets from the global shocks is due to their lower integration with the global markets. This study provides some useful recommendations to the investors and policy makers. Results suggests that Indian stock exchange get contagion impact from the major economies, so authorities of India should have to take measure to decouple the market from the global shocks. The markets of Bangladesh, Sri Lanka and Pakistan are not properly integrated with global financial system, so the authorities of these countries should have to take proper steps to liberalize the markets. This paper presents the first empirical study on financial contagion and globalization of South Asian countries.

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INTRODUCTION

Contagion and globalization both have the tendency to raise in market co movements, thus both can be confused. Rise in correlation in both cases is expected but practical consequences of both are different for the investors. In globalization rise in markets co movements is gradual but permanent while in contagion instantaneous rise in co movements is expected. In the latter case investors should have be more careful because high volatility in international markets can be compounded with the decline in diversification protection due rise in markets co movements.

Several explanations exist to explain this phenomenon of rise in financial markets integration. First, business firms are now becoming more diversified internationally in their finances operations, and sales. As result, they are now more exposed to international business cycle than before ever, due to co movements in markets has been increased. Second home bias of investors in portfolio hedging may have been declined. As consequence marginal investor in United States equity market may not be an American, so the role of country specific investor sentiments has been decreased. Third possible explanation is, rise in stock markets co movements is due to different financial crises and likely be a temporary phenomenon (Brooks & Negro, 2004)

Simple Correlation coefficients are conditional on volatility and biased upward, thus tend to be higher during the turmoil periods when markets are more volatile due to heteroscedasticity. Correlation coefficients unadjusted for heteroscedasticity will traditionally find the evidence of contagion (Forbes & Rigobon, 2002). It is also well documented that correlation between the markets is not constant but varies over time (Huang, Tu, & Chou, 2015; Longin & Solnik, 1995). DCC GARCH model (Engle, 2002) is applied in this study to calculate the conditional correlation coefficients between the markets to overcome the issue of heteroskedasticity and time varying correlation.

South Asian countries has experienced long period of high economic growth and is among of the fastest growing regions of the world. In 2014 annual GDP growth of the region was 6.9% and will increase to 7.1% in 2015 and to 7.6% by 2017. Total GDP of region in 2014 was $ 2.608 trillion. Total population of the region in 2014 was 1.721 billion; region has the largest working age population in world. South Asian counties will play the important role in global development in future[1].

From the south Asian region Pakistan, India, Bangladesh and Sri Lanka are included in the study. Selection of these countries from the region is made on the basis of availability of data. Contagion and globalization of these four countries from the south Asian region is checked with reference to US, UK, China, Japan and German stock exchanges in this study, selection of these countries is made due to the fact that they represents the five largest GDP economies of the world, due to their influence on world economy and their economic and financial linkages with the south Asian countries. Study also checked the impact of Asian crises, dot com bubble, 9/11 attacks, subprime mortgage crises and European debt crises on the pairwise correlation coefficients of the south Asian countries and five major economies.

Although this definition of contagion rises in correlation during the turmoil period is restrictive but it contains some important advantage. First, it provides straightforward methodology to test for contagion if occurs, by simply comparing the market correlations during the stable and turmoil period, one can test the contagion. Contagion is the significant increases in market correlation during the turmoil periods. Second it allows dealing with different types of crises[2], which is in accordance with the stance taken by this study.

This Study tends to investigate the contagion and globalization between the south Asian countries and five largest economies. Study also checked the impact of Asian crises, dot com bubble,

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[1] The data of economic indicator is taken from the World Bank development indicators.

[2] It is assumed that all crises share common features of increase in correlation at least (Brière et al., 2012). If all crises are singular cases with no common characteristics, then finding any regularity, as contagion is pointless.

9/11 attacks, subprime mortgage crises and European debt crises on the pairwise correlation coefficients of the south Asian countries and five major economies.

Research questions

1. Whether the conditional correlation between the South Asian and five major economies equity markets has increased over time or not?
2. Do South Asian markets get contagion effect from five major economies?
3. What impact did different crises had on conditional correlation coefficients of the south Asian and five major economies equity markets?

Research objectives

1. To check whether linkage between the financial markets has increased over time or not.
2. To test the contagion between the south Asian and five major economies equity markets (US, China, Japan, UK, and Germany).
3. To check the impact of Asian crises, dot com bubble, 9/11 attacks, subprime mortgage crises and European debt crises on the pairwise correlation coefficients of the south Asian and five major economies stock markets.

The issue of financial contagion and globalization is equally important for the academicians, investors and policy makers. Correlations among return series is a key tool in risk control and portfolio management. Markowitz (1952) model of diversification is based on the covariance matrix of returns, lower the correlation coefficients higher will the benefits of the diversification. Therefore, it is important for investors to know whether stock markets are interlinked, whether their linkage remains stable or changes with time, has financial markets witnessed increased integration over the time, what impact did different crises had on financial markets integration is order to properly their manage portfolios. The issue is equally important for policy makers also, because if stock markets are closely linked with each other then there is a danger of shocks transmission from one market to others.

This will require proper planning and close cooperation among the authorities of these countries to avoid these negative effects.

LITERATURE REVIEW

Literature on both contagion and globalization is well documented. King and Wadhwani (1990) first test the contagion using correlation mechanism. The results suggested that cross markets correlation between the USA, UK and Japanese markets has significantly increased after 1987 stock market crash, which confirms the contagion. They concluded that contagion propagate from one market to the other by investor attempt to draw the information from the price changing mechanism of the other markets.

Study conducted by Longin and Solnik (2001) found that correlation between the markets in not relates to market volatility but related to the market trends, correlations tends to be of higher in bear market but not in bull. For that they analyzed the monthly data five equity markets US, UK, France, Germany and Japan.

While Corsetti et al. (2005) by uplifting the unrealistic restrictions imposed by the (Forbes & Rigobon, 2002) somehow find the evidence of contagion. Out the sample of seventeen, 16 countries give significant results for interdependence and at least 5 for contagion. For that he conducted bivariate correlation analysis with focus on October 1997 Hong Kong stock market crisis.

Chiang et al. (2007) applied DCC GARCH model proposed by of (Engle, 2002) to overcome the problem of heteroscedasticity. Daily stock returns of nine Asian countries from 1990 to 2003 were used in the study. Results confirmed the contagion effect during the Asian crises. Shift in variance of correlation coefficients also observed during the crises. Syllignakis and Kouretas (2011) also applied DCC GARCH model to examine the time varying correlation among weekly stock return of US, Russian, German and seven CEE countries from 1997 to 2009. Results supported the contagion effect between US, German and CEE markets, particularly during 2007 crises. Exchange rates and monetary variables also significantly explained the movement in correlation coefficients.

Chen and Siems (2004) assess the effect of terrorist attacks on global equity markets by applying event study methodology. They investigate the response of US markets to 14 terrorist attacks dated back to 1915. Global markets response to two terrorist events, Iraq's attack on Kuwait 1990 and 9/11 attacks also assessed. Results suggests that resilience of US markets increased over time and also that the US markets recovered earlier than the global markets, partially due to the strong banking and financial system that provides enough liquidity to minimize panic and promote stability. According to Straetmans et al. (2008) lower tail beta's of the markets increased economically and statistically after the 9/11 attacks. While Darrat, et al. (2012) found that Pacific Basin region markets linkages both internally with in region and externally with USA weakens after the September 11 attacks. They examined the equity market linkages with in Pacific Basin region and with external markets mainly US and Japan. Results also suggest that PB regional markets are internally interlinked and have external relation with US rather than Japan.

Study conducted by Bartram and Bodnar (2009) found that subprime mortgage crises effect the performance of all regions, sectors and countries equity markets. Financial sector experienced more stress than no financial sector during the whole period but the effect was same on both during the peak of crises. Increase in correlation between the markets also observed during crises leads to reduction in diversification benefits. Study conducted by Chen et al. (2014) also find the evidence of contagion between the US and Chinese markets during subprime crises. Results revealed that time varying lower tail Kendall's τ was 1.87 times higher during the crises period on average, increased by 87%, confirms the contagion. Drastic fluctuation in lower tail dependence was also observed, so static measures of correlation may be misleading. While Dooley and Hutchison (2009) found during the subprime mortgage crises emerging markets remained isolated form the developments in US markets from 2007 to September 2008. But after the September 2008 following the bankruptcy of Lehman Brothers, policy measure taken by emerging markets to avoid crises proved inadequate. Morales and Callaghan

(2014) also found no evidence for contagion from US in worldwide framework or regional form during the subprime mortgage crises. For that they checked the contagion from US to other markets in wordlwide framework by applying different econometris models.

While Study conducted by Sandoval and Franca (2012) found that high volatility in markets leads high correlation, markets tends to behave same way during the crises. For that they analyzed daily data from 1980 to 2010 including 1987 stock market crash, 1998 Russian crises, 2001 dot com bubble, 9/11 and 2008 global crises by using eigenvalues and eigenvectors of correlation coefficients. Chan et al., (2011) also confirmed the tranquil and crises regimes. They investigate the relationship between the financial assets, commodities and real estate by applying Markov switching model. Results also confirm the flight from quality during the tranquil regime and flight to quality during the crises in also found. Kenourgios and Padhi (2012) confirmed the global effect of Russian default and subprime crisis, regional aspect of the Asian crisis and isolated nature of Argentine turmoil.

Fidrmuc & Korhonen (2010) investigate the global crises transmission to India and China. Very low co movements between the business cycles of China and India and OECD countries observed, which confirms the decoupling. However subprime crises similarly effect the emerging Asian and OECD economies, which is against decoupling. Finally, results suggested that stronger trade ties increase business cycle co movement. Study conducted by Bekiros (2014) also ends up with finding no consistance evedence of decoupling was found. Results confirmed the increase in international integration of BRIC countries after the subprime crises.

Limited literature on contagion in south Asian markets is available. Few studied have been found who checked the contagion impact of different crises on south Asian markets. Bahng (2003) investigated the interdependence between Indian and Asian emerging markets since 1990. The results confirmed that influence of MSCI Asian index on Bombay Stock Exchange has increased after and during the Asian crises. Lamba (2005) examine the short term and long term relationship

between the selected south Asian markets and developed markets over the period of July 1997 to Dec 2003 by applying vector error correction and multivariate co integration framework. Results showed that Indian get influence from the US, UK and Japanese market, influence also persist after the 9/11 attacks and Asian crises. Pakistani and Sri Lankan market remained isolated from the developed markets during entire period.

Results of the study conducted by (Ali & Afzal, 2012) revealed that subprime crises has the negative impact on Indian and Pakistani stock returns and enhanced the volatility but impact on Indian market was stronger than Pakistan. For that they analyzed the daily data of BSE 100 and KSE 100 indices from 1/1/2003 to 31/8/2010 by applying EGARCH model. Abbas et al., (2013) also find the evidence of volatility transmission between the Pakistan and other regional equity markets India, china and Sri Lanka. Evidence of unidirectional volatility transmission from US, UK, Japan and Singapore to Pakistan, India, china and Sri Lanka was also found.

Study conducted by Abbas et al., (2012) found that the performance of the Pakistan textile sector has significantly decreased during the subprime crises. While Study conducted by Sohail and Javid (2014) found no evidence of contagion on Karachi stock exchange in subprime crises. For that they examined the impact of subprime crises on under and over reaction of Karachi stock exchange. Results revealed that KSE did not take the effect of crises. No under or over reaction in case of KSE is found during and after the crises. Study conducted Hossain (2013) also find no evidence of contagion to in 2007 great recession but in context of Bangladesh stock exchange. For that purpose they checked the correlation between the world GDP and general index of Dhaka stock exchange. Results suggested that no significant correlation exists between world GDP and Dhaka stock exchange.

Berben and Jansen (2005) investigated the changes in correlation pattern among US, Japanese, UK and German stock markets over the period of 1980 to 2000 by applying bivariate GARCH model on weekly data. Correlation among the US, UK and German Stock exchanges have doubled but the correlation of Japanese market remained same

during the period. Study conducted by Morana and Beltratti (2008) also confirmed the globalization. Monthly stock returns data over the period of 1973 to 2004 used in study, confirms the progressive market integration among US, UK, Japanese and German stock markets. Evidence for increasing trend in correlation coefficients and positive linkage between correlation and volatility also found. Brière et al., (2012) also confirmed the increase in market correlation between same assets classes over the time. Separate test for the contagion and globalization using data set consisted of: government bonds, high-yield corporate bonds, investment grade corporate bonds and equities of four geographical areas U.S., U.K., Eurozone and Japan confirmed the correlations instability and point to combination of flight to quality and globalization, while no evidence for contagion in equity markets was found.

While Gilmore et al. (2008) investigate the short run and long run co movements between the stock markets of Central European countries and developed European Union countries from July 1995 to Feb 2005 by applying principle component and dynamic integration analysis. Despite of decade long process of alignment between central European and European Union countries evidence of gradual increase in equity markets integration not found. Study conducted by Yeyati and Williams (2012) revealed that business cycles of emerging countries have decoupled from developed economies gradually while the cross market co movement of financial markets remained high or even increased during past few years.

Existing literature on financial contagion and globalization has been reviewed in detail in previous section. Studies applied different methodologies to check the globalization and contagion among the financial markets. Overall mixed evidence is found regarding the contagion and globalization. Some studies found the evidence of globalization (Berben & Jansen, 2005; Morana & Beltratti, 2008) while others did not confirm the growing integration between the markets (Gilmore et al., 2008, among others). Some researchers confirmed the contagion (Chiang et al., 2007; Syllignakis & Kouretas, 2011) while others did not find the evidence of contagion (Brière et al., 2012; Forbes & Rigobon, 2002). This study extends the

work of (Brière et al., 2012) to south Asian stock markets to separately test the financial contagion and globalization. Furthermore DCC GARCH is applied to estimate the time varying conditional correlation coefficients to overcome the problem of heteroskedasticity and time varying nature of correlation coefficients. Study also checked the impact of five selected global crises (Asian crises, dot com bubble, 9/11 attacks, subprime mortgage crises and European debt crises) on the conditional correlation coefficients of the south Asian and major economies stock exchanges. Very few studies have done such a detailed investigation of the time varying correlation coefficients of the south Asian markets.

METHODS

Daily data of equity stock indices from 1st July 1997 to 30th June 2015, consisted of total 4695 observations is used in this study. All stock prices are in local currency[3] and are daily closing values. If the values were missing on a particular day due to public holiday or any other reason, then it is supposed that the prices will remain same as previous days. All the data is obtained from econ stats and form the stock exchanges of respective countries.

From south Asian region Pakistan, India, Bangladesh and Sri Lanka are included in the study. Selection of these countries is made on the basis of availability of data. The data set consisted of the local stock indices of the Pakistan (KSE 100), India (SENSEX), Sri Lanka (CSE All Share) and Bangladesh (DGEN and DSEX)[4]. Moreover, the S&P 500 is used for US, DAX for German, NIKKEI225 for Japan, FTSE100 for UK and SSE composite for Chinese stock exchange. The selection of US, Chinese, Japanese, UK and German stock indices is made due the fact that they

represent the five largest GDP economies of the world, their influential role in world economy and also due to their economic and financial linkages with the south Asian markets. As per conventional approach, returns of each stock index are calculated as the first difference of natural log in order to conduct further analysis.

A well-known and major problem with the use of daily stock data of across countries is the nonsynchronous periods for the different markets around the globe, as they are not open at the same time. This problem can be addressed by using weekly or monthly data essentially giving up on inspecting higher frequencies. This approach leads to smaller samples. Sensitivity tests by Forbes and Rigobon (2002) show that using daily, two day average or weekly returns has no significant impact on results. Analysis of Chiang et al. (2007) also found no significant difference using daily vs. two day average returns, therefore this study used daily data instead of giving up high frequencies.

DCC GARCH model proposed by the (Engle, 2002) is applied to measure the conditional correlation between the markets. The applied methodology requires that return series should be stationary and must possess ARCH effect. As a consequence, we start performing unit root tests to check the stationary of the each series. Afterwards, ARCH LM test is employed to verify the ARCH effects in the data.

This study applied DCC GARCH[5] model to estimate dynamic conditional correlation coefficient, proposed by Engle (2002). Applied methodology has three advantages over other estimation methods. First, the DCC GARCH estimates the conditional correlation coefficients of the standardized residuals and thus directly accounts for heteroskedasticity[6]. Secondly DCC GARCH has the ability to examine multiple asset

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[3] Expressing stock prices in local currencies restricts the changes to the movements in stock prices only thus avoid distortions induced by exchange rate movements (Syriopoulos, 2007; Voronkova, 2004).
[4] DGEN is used for Dhaka stock exchange until 31st July 2013, after that closing prices of DSEX are used to represent the Dhaka stock exchange because DGEN was closed after 31st July 2013.

[5] DDC GARCH is also applied by (Chiang et al., 2007; Syllignakis & Kouretas, 2011) to estimate the time varying conditional correlation.
[6] Forbes and Rigobon (2002) found that that simple correlation tests are biased and inaccurate due to heteroskedasticity. Therefore, during the crises when markets become more volatile, estimates of simple correlation coefficients are biased upward and tend to increase.

returns without adding too many parameters[7]. Third, it consider the time varying nature of correlation while estimation[8]. The resulting estimate of time varying correlation coefficients provides dynamic trajectories of correlation behavior for national stock index returns in a multivariate setting. This information enables us to analyze the correlation behavior during multiple regime shifts in response to shocks and crises.

Recent literature suggests that correlations between the cross countries stock markets have increased in the last 20 years. This phenomenon is linked to the globalization. To test the globalization total sample of 18 years is broken into two sub periods each of 9 years of equal length from 1st July 1997 to 30th June 2006 (*period*1) and from 1st July 2006 to 30th June 2015 (*period*2). Since the aim of this test is to detect an evolving phenomenon, so the precise break date is not crucial. Moreover, slight shift in break date does not affect the results. Therefore study has opted for a symmetrical choice, which is more accurate. If the average correlation has increased significantly in latter period (*period*2) as compared to earlier period (*period*1) this will confirm the globalization (Brière et al., 2012). One tail t test is applied to test the increase on mean correlation during the latter period[9]. Null hypothesis against the one tailed alternative of increase in average correlation is tested.

Null hypothesis:

Difference = correlation $(period2 - period1) \leq 0$

Alternative hypothesis:

Difference = correlation $(period2 - period1) > 0$

Rejection of null hypothesis will confirm the globalization. Rejection of null implies that the correlation in the latter period is higher than the earlier.

Study cover the five different types of crises currency crises, stock market crash, confidence (terrorist attacks), corporate bankruptcy and sovereign debt cries. It is supposed that all crises at least share some common characteristics regarding increase in the co movements during the turmoil periods. It is rational to consider contagion as a common phenomenon in all type of crises. Conversely, if all crises are singular events that share no common features then try to find any regularity, such as contagion is pointless.

To test the contagion, comparison of correlation segregating crises periods from calm is made. If average correlation during the crises is high than in calm periods then it will confirms the contagion (Brière et al., 2012). One tailed t test of increase in correlation during the crises period is applied. Null hypothesis against the alternative of increase in average correlation during the crises periods is tested.

Null hypothesis:

Difference = correlation (crises) – correlation (calm) ≤ 0

Alternative hypothesis:

Difference = correlation (crises) – correlation (calm) > 0

Rejection of null hypothesis will confirm the contagion, which means that average conditional correlation during the turmoil periods is higher that the calm periods. Table: 1. shows the start and end dates of the crises used in the study. These dates are based on the previous literature.

Impact of different crisis on the dynamic conditional correlation coefficients is checked and additional insights into the potential explanatory factors that drive the stock market correlations is provided in this section. The effect of different crisis events on the conditional correlation coefficients is of particular interest, since in crises periods the need and the benefits portfolio diversification are higher. Specifically, study used five dummy variables for five different crises to investigate the correlation changes associated with different crises

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[7] Other dynamic multivariate model like diagonal VECH model consumes too many degree of freedom with the addition of one series.

[8] It is well documented that correlation between the markets is not constant but varies over time (Huang et al., 2015; Longin & Solnik, 1995; Syllignakis & Kouretas, 2011).

[9] One tailed t test is also applied by (Kenourgios & Padhi, 2012) to compare the average time varying conditional correlations.

events. Time varying correlation coefficients are regressed with the each of the subsequent dummy variable: $DM_{1,t}$ is a dummy variable for the Asian crises (17/10/1997 to 1/13/1998), $DM_{2,t}$ t for dot com bubble (3/10/2000 to 9/27/2002), $DM_{3,t}$ for the 9/11 attacks (9/11/2001 to 11/11/2001), $DM_{4,t}$ for subprime mortgage crises (9/7/2008 to 3/10/2009), and $DM_{5,t}$ for the European debt crises (1/1/2010 to 6/30/2015). The value of the dummy variables is equal to 1 for the crises periods and zero otherwise. Positive and highly significant coefficients of dummy variables will indicate the increase in correlation coefficients during the crises.

$$\rho_{ij,t} = a_0 + \sum_{k=1}^{5} \alpha_k + e_{ij,t} \quad \text{............ (1)}$$

Granger causality test

Correlation coefficients do not tell us about the direction of the causality. To check the short term unidirectional and bidirectional causality relationship between the south Asian and major economies markets study applied granger casualty test (Granger, 1969). Causality is the ability of one return series to affect the other. If one market has effect on other market it is a unidirectional causality but if both markets has effect on each other then it is bidirectional causality.

$$\Delta y_t = \emptyset + + \sum_{i=0}^{k1} \lambda_i \Delta x_{t-i} + \sum_{i=1}^{k2} \delta_i \Delta y_{t-i} + \mu_t \quad \text{............ (2)}$$

If H0: $\lambda_i = 0$ is got rejected in equation 13 then it means variable x cause y ($\Delta x \rightarrow \Delta y_t$) and exist unidirectional causality.

$$\Delta x_t = \emptyset + \sum_{i=0}^{k1} \gamma_i \Delta y_{t-i} + \sum_{i=1}^{k2} \delta_i \Delta x_{t-i} + \mu_t \quad \text{............ (3)}$$

If H0: $\gamma_i = 0$ is got rejected in equation 14 then it means y cause to x ($\Delta y_t \rightarrow \Delta x$) but If both null hypothesis got rejected then it confirms bidirectional causality between the variables x and y. Results of Granger causality test are very sensitive to the number of lags used in the right side of the equation. So the lag selection on the right side of the equation made on the basis of AIC.

RESULTS AND DISCUSSIONS

Descriptive statistics tells us about the properties of the data like mean, median, standard deviation, maximum and minimum. Table: 2 summarize the descriptive statistics of the all the stock markets. Pakistan has highest returns 0.000651 in the given markets while the mean returns of japan are almost zero (0.000001) minimum in all markets. Indian market has the highest Standard deviation (0.015834) in all countries while USA has the lowest standard deviation (0.011933). Skewness tells us about the symmetry of the data, symmetric data has 0 skewness. It can be seen that most of the returns series are negatively skewed except Bangladesh and Sri Lanka which are positively skewed. Kurtosis of all the markets is higher the 3, which means all the returns of all the markets are leptokurtic. Jarque Bera test tells us about the normality of the data, null hypothesis of normal distribution got rejected at high level of significance in all the return series, which means that none of the given return series is normally distributed.

DCC GARCH can be applied only on the stationary series. Mean and variance of a stationary series remains same over the time. Unit root test are used to check the stationarity of the data. ADF and PP tests are applied to check the stationarity of the data. Selection of lags in ADF is made on the basis of Akaike information criterion Table: 3 contain the results of ADF and PP. It can be seen that null hypothesis of data has a unit root is got rejected at high level of significance in all return series by both ADF and PP. which means that all return series are stationary, so DCC GARCH can be applied.

In order to apply DCC GARCH it is also required that series should possess ARCH effect. So ARCH LM test is applied to check the ARCH effect in the data. Results of test are given in table: 4. Null hypothesis of data has no ARCH effect got rejected at high level of significance for all countries, which confirms the presence of arch effect in all series. Selection of lags in ARCH model is made on the basis of AIC, maximum up to five lags. Results of ADF, PP and ARCH LM test confirmed the stationarity and ARCH effect of data so we can proceed with the application of DCC GARCH.

DCC GARCH model is applied to estimate the conditional correlation coefficients, to overcome the problem of heteroscedasticity (Forbes & Rigobon, 2002, among others) and time varying nature of correlation coefficients (Huang et al.,

2015; Longin & Solnik, 1995). Table: 5 repot the both average conditional and unconditional correlation coefficients of the selected south Asian countries with five largest economies of the world. Comparison of conditional and unconditional correlation coefficients revealed the inequality of both, so unconditional correlation coefficients may lead to biased conclusion[10]. All the analysis of this study is based on dynamic conditional correlation coefficient estimated through DCC GARCH. It can be seen that south Asian markets have relatively low correlation with the major markets (Lamba, 2005), even negative in some cases. As discussed earlier, literature evidences an increase in the correlation coefficients over last few decades between the global equity markets. So the South Asian markets provide a substantial risk diversification benefits to international investors.

Literature suggests an increase in correlation coefficients between same asset classes over the last 20 years; this phenomenon is associated with globalization. To test the globalization we break the whole data into two subsamples of equal length of 9 years each and compare the average correlation of both periods. Increase in the latter period ($period2$) correlation as compared to earlier period ($period1$) will confirm the globalization (Brière et al., 2012). Results of the test are summarized in table: 6. It can be seen that out of 20 pair wise correlation null hypothesis of no increase in correlation got rejected 11 times, so some evidence in favor of globalization is found (Brière et al., 2012; Corsetti et al., 2005). Null hypothesis of no increase in correlation is got rejected all five times in case of India, so strong evidence of globalization is found in Indian markets. In case of Pakistan and Sri Lanka null hypothesis got rejected three times. No signs of globalization are found in Bangladeshi equity market, which means that integration of Bangladeshi equity markets has not increased with global markets during the sample period.

Contagion test consists of comparing the correlation coefficients, segregating crises periods from the calm periods. Increased correlation during the crises periods than calm ones will confirms the contagion (Brière et al., 2012). Results of null hypothesis against the one tailed alternative hypothesis of increase in conditional correlation during the crises periods are summarized in table: 7. It can be seen that 6 correlation coefficients out of total 20 has increased significantly during the crises, somehow confirming the contagion (Corsetti et al., 2005) between south Asian and major the markets. Null hypothesis is got rejected all five times in case of India, so strong evidence of contagion is found in Indian market. Out of other 15 pair wises correlation only one has increased in crises, which means that other south Asian countries remained isolated form the global shocks. Results suggests that in south Asian region only Indian market take the contagion impact, all other markets remained relatively independent of contagion during the crises (Lamba, 2005). This may be due to the lower integration of south Asian region with the other economies. It can also be concluded that chances of contagion increase with the rise in correlation between the markets (Mendoza & Quadrini, 2010), because from the south Asian region, Indian market has the highest correlation with the global markets and also is the only market which take the contagion impact during the crises in south Asian region.

Conditional correlation coefficients are regressed with the dummy variables of five selected crises periods $DM_{1,t}$ for Asian crises, $DM_{2,t}$ for dot com crises, $DM_{3,t}$ for 9/11 attacks, $DM_{4,t}$ for subprime mortgage crises and $DM_{5,t}$ for the European debt crises, to check the impact of external shocks on conditional correlation coefficients and to analyze the time series behavior of correlation coefficients. Positive and significant coefficients of dummy variables will confirm the increase in correlation during that crises period. Results of the regression are summarized in table: 8. It can be seen that coefficients of $DM_{1,t}$ and $DM_{2,t}$ [11]is most of the cases are negative while

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[10] Simple Correlation coefficients are conditional on volatility and biased upward, thus tend to be higher during the turmoil periods when markets are more volatile due to heteroscedasticity. (Forbes & Rigobon, 2002).

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[11] It is also argued that during the dot com bubble Indian stock market was more closely linked to the

coefficients of $DM_{3,t}$, $DM_{4,t}$ and $DM_{5,t}$ are positive and statistically significant in case of India, which confirms the increase in correlation of Indian stock market with major economies during 9/11 attacks, subprime mortgage crises and European debts crises. This is may be due to the increased financial liberalization and increased participation of foreign investors in Indian stock markets.

$DM_{3,t}$ Is statistically significant and positive for Pakistan, so Pakistani equity markets take the impact of 9/11 attacks. For Sri Lankan correlations some of $DM_{3,t}$ and $DM_{4,t}$ coefficients are significant. Which means that Sri Lankan stock exchange somehow get the impact of 9/11 and subprime mortgage crises. Bangladesh remained isolated from the global markets all shocks in the whole period (Hossain, 2013). In some cases coefficients of dummy variable are also negative, which confirm the negative impact of crises on correlation coefficients, this phenomenon is called decoupling. Since there is no regularity in the negative coefficients so the evidence of decoupling is not conclusive (Felices & Wieladek, 2012). In sum from the south Asian economies only India gat the impact of crises while other remained relatively isolated from the global shocks (Lamba, 2005). This is may be due to the lower integration of south Asian markets with the global markets.

Form all the five crises considered 9/11 attacks impacted the south Asian countries most, this is may be due to the direct involvement of the region in issue. In other cases all south Asian markets except India remained isolated from the shocks this is may be due to the lower integration of south Asian markets with global markets.

Correlation does not tell us about the direction of the causality. To check the short term

NASDAQ rather than S&P 500 index. Decision to include S&P 500 is taken because it represents the whole economy while NASDAQ represents the IT firms more; purpose of this is to investigate the linkage between the whole economies rather than a sector. Another reason is that I also include other crises in the study whose impact is more prominent in S&P 500. Furthermore (Lamba, 2005) examined the relationship of NASDAQ and Indian stock market ends up with finding no long run relationship between NASDAQ and NSE indices.

unidirectional and bidirectional relationship between the south Asian and major economies study applied granger casualty test. Since test is very sensitive to the number of lags used on the right side of equation, so the selection of lags is made according to AIC. Table: 9 contain the results of granger causality test. Results suggest unidirectional causality from US, UK and German stock markets to India, Pakistan and Sri Lanka. Which means that US, UK and German stock exchanges has direct short term influence on the south Asian markets, while China and Japan does not granger cause south Asian countries. Unidirectional casualty form India and Pakistan to japan is also observed. Bangladesh does not have any unidirectional or bidirectional causality relationship with major economies.

Mixed results are found in literature regarding contagion and globalization in emerging markets. This study is aimed to check the financial contagion and globalization between four selected south Asian (Pakistan, India, Bangladesh and Sri Lanka) and five largest economies (US, China, Japan, UK and Germany) equities markets. In this context daily stock indices data of all countries from 1st July 1997 to 30th June 2015 is used. DCC GARCH model (R. Engle, 2002) is applied to measure the pair wise dynamic conditional correlations coefficients between the markets to overcome the issue of heteroscedasticity (Forbes & Rigobon, 2002) and time varying nature of correlation coefficients (Longin & Solnik, 1995). DCC requires the stationary and ARCH effect possessing series for the implementation. So ADF and PP test are applied to check the stationarity of the data. Results confirm the stationarity of all the time series. ARCH effect in all series is also found by ARCH LM test.

South Asian stock markets showed relatively low correlation with the major economies markets, even negative in some cases (Lamba, 2005). Since literature has identified increase in correlation coefficients between the stock markets around the globe in last three decades, south Asian markets provides a substantial risk diversification opportunity to international investors. Furthermore comparison of conditional and unconditional correlation coefficients revealed the inequality of both, so unconditional correlation coefficients may

be biased conclusion. All the analysis of this study is based on the dynamic conditional correlation coefficients estimated through DCC GARCH.

To test the globalization we break the whole data into two subsamples of equal length 9 years each and compare the average correlation of both periods. Out of 20 pair wise correlation null hypothesis of no increase in correlation got rejected 11 times, so some evidence in favor of globalization is found (Brière et al., 2012; Corsetti et al., 2005). Strong evidence of globalization is found in Indian markets. Null hypothesis of no increase in correlation is rejected all five times. In case of Pakistan and Sri Lanka null hypothesis got rejected three times. No signs of globalization are shown by Bangladeshi equity market.

Contagion test consists of comparing the correlation coefficients, segregating crises periods from the calm periods. Results suggest the increase in 6 correlation coefficients out of total 20 during the crises period, somehow confirming the contagion (Corsetti et al., 2005) between south Asian and major the markets. Null hypothesis is got rejected all five times in case of Indian market. Out of other 15 pair wises correlation only one has increased in crises. This shows that from the south Asian markets only Indian market take the contagion impact, all other markets remained relatively independent of contagion during the crises (Lamba, 2005). This may be due to the lower integration of south Asian region with the other economies. It is also can be concluded that chances of contagion increase with the increase in the linkage between the markets (Mendoza & Quadrini, 2010), because Indian market has the highest correlation with global markets among all the south Asian markets and also is the only market that take the contagion impact during the crises in south Asian region.

To check the impact of external shocks on conditional correlation coefficients and to analyze the time series behavior of correlation coefficients, correlation coefficients are regressed with the dummy variables of five selected crises. Results suggests that coefficients of $DM_{3,t}, DM_{4,t}$ and $DM_{5,t}$ are positive and statistically significant in case of India, which confirms the increase in correlation of Indian stock market with major economies during 9/11 attacks, subprime mortgage

crises and European crises. $DM_{3,t}$ is statistically significant and positive for Pakistan, so Pakistani equity markets take the impact of 9/11 attacks. For Sri Lankan correlations some of $DM_{3,t}$ and $DM_{4,t}$ coefficients are significant. Which means that Sri Lankan stock exchange somehow get the impact of 9/11 and subprime mortgage crises. Bangladesh remained isolated from the global markets all shocks in the whole period (Hossain, 2013).

In sum from the south Asian economies only India get the impact of crises while other countries remained relatively isolated from the global shocks (Lamba, 2005). This is may be due to the lower integration of south Asian markets with the global markets. Form all the five crises considered 9/11 impacted the most to south Asian countries; this is may be due to the direct involvement of the region in issue. In other cases all south Asian markets except India remained isolated from the shocks this is may be due to the lower integration of south Asian markets with the other world.

To check the short term unidirectional and bidirectional relationship between the south Asian and major economies we applied granger casualty test. Results suggest unidirectional causality from US, UK and German stock markets to India, Pakistan and Sri Lanka. Which means that US, UK and German stock exchanges has direct short term influence on the south Asian markets, while China and Japan does not granger cause south Asian countries. Unidirectional casualty form India and Pakistan to japan is also observed. Bangladesh does not have any unidirectional or bidirectional causality relationship with major economies.

It is a well-established fact that financial development spurs high economic growth. But financial liberalization works as a two edge sword. Uncontrolled and unregulated liberalization of financial markets can lead to an unstable system more exposed to external shocks at the same time rigorously regulated system may restrict the financial development. So for a stable and developed financial system policy makers must have to create a balance between the regulation and innovation. Based on the results, study provides some use full recommendations to the investors and policy makers.

Firstly, South Asian stock markets showed a relatively lower level of correlation with the major

economies stock markets, even negative in some cases, so south Asian markets provides a substantial risk diversification opportunity to international investors.

Secondly, comparison of conditional and unconditional correlation coefficients revealed the inequality of both coefficients. So that any results based on the unconditional correlation confidents may be misleading.

Thirdly, correlation of Bangladeshi, Sri Lankan and Pakistani equity markets is very low with global stock markets; Bangladesh even showed negative correlation with UK and Germany, which means that these markets are not properly integrated in global financial system. So the authorities of these countries should have to take proper steps to liberalize the markets.

Finally, results suggests that Indian stock exchange get contagion impact from the major economies, so authorities of India should have to take measure to decouple the market from the global shocks.

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