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Portfolio Diversification in Global Equity Markets and the Role of Global Financial Crisis

Ghulam Ali Bhatti (Corresponding author)
Department of Business Administration, University of Sargodha, Sargodha, Pakistan
Email: Ghulamali_bhatti@yahoo.com

Talat Islam
Department of Business Administration, University of Sargodha, Lahore, Pakistan
Email: talatislam@yahoo.com

Abdul Rehman
PMAS – Arid Agriculture University, Rawalpindi, Pakistan
Email: abdulrehman@uaar.edu.pk

Abstract

The main focus of the current study was to investigate 33 major stock indices on a weekly basis to fill the void concerning fresh information in the context of co-movement of markets as a result of the Global Financial Crisis. Factor analysis was applied through two methods, principle component (PC) and maximum likelihood (ML), as both of these methods are widely accepted. The assumption of normality is not required in the PC method, whereas ML demands data normality. To check normality, Kolmogorov-Smirnov Test was applied. All the markets except a few Asian markets (e.g. Hong Kong, China, Japan and Philippine) have significant values which indicate the abnormality of data; therefore, principal component analysis was applied.

Global stock markets were divided into three groups and affects of the crisis on their co-movements were judged by applying rotated factor analysis. Results of the analysis revealed that American and Asian equity markets demonstrated a linear interaction. However, European markets were prone to the financial crisis of 2007.

Findings of this study are of great value for investors, as they can develop their future investment plans to optimize the benefits of diversification. American, Asian, and European regional investors can spread their investment portfolios by adding new investment proportions of all regions. This study is conducted on global data taking the financial crisis of 2007 as the main event that could affect stock markets. This study is new in nature, as none of the previous researchers have conducted study in this domain.

Keywords: portfolio diversification, factory analysis, stock prices, global financial crisis.

1. Introduction

During this era of globalization, investors are interested in global and regional investment portfolios rather than local investment portfolios. Mega globalization and financial liberalization since the late 1980s has increased the movement of International capital, which has enhanced the competitiveness of firms internationally. In emerging economies,

this has been a major factor of industrialization. This tendency has attracted international investors who sense an opportunity to diversify their investment portfolios. As explained by Sharpe (1964) in his seminal paper, diversification can remove unsystematic risk within investment portfolios. However, global portfolios are capable of reducing the systematic risk (Abbas et al., 2013; Hoque, Stepien and Su, 2012; Berger et al., 2011; Berger and Pukthuanthong, 2012). Therefore, the investigation into the movement of international equity markets is one of the sources of information for the construction of investment portfolios and hedging decisions (Pukthuanthong and Roll, 2009). The past two decades have witnessed the introduction of many innovative changes in the behavior of equity markets which constantly require fresh information. Horvath and Petrovski (2013) were among the first to undertake a comparative study on central and south Eastern Europe; however, early researchers have not produced any comprehensive study which covers the movement of equity markets from a global prospective. This is a simple motivation behind the current study which will fill the vacuum in empirical research.

Portfolio diversification through Mean-variance approach was introduced by Markowitz (1952) in his seminal paper “Portfolio Selection" and this framework were supported by many researchers thereafter (e.g. Loh, 2013; Eun and Shim, 1989; Lessard, 1973; Solnik, 1974). Therefore, international investors are interested in the stocks of those countries which are inversely related to one another. Their normal course of interaction is in the opposite direction. Some early researchers examined the evidence of opposite movements among main financial markets (Hilliard, 1979; Panton et al., 1976; Ripley, 1973).

The analysis regarding movements among equity markets has become important issue because of its implications for investor regarding asset allocation and risk management (Rua and Nunes, 2009). This topic has become inspiring catch all in the eyes of researches since the seminal work of Grubel (1968) on the benefits of international diversification. In fact, a number of recent researchers have focused on co-movement of stock prices (Rua and Nunes, 2009; Brooks and Del Negro, 2006). Most of the researchers have observed a non-systematic movement among stock markets over the time. For instance, some of them has observed increasing co-movement of stock markets since international financial crises of 1987 and Asian financial crisis of 1997 and US subprime crisis (e.g. Li et al., 2012; Kizys and Pierdzioch, 2009; Brooks and Del Negro, 2004; Arshanapalli and Doukas, 1993; Meric and Meric, 1997), while others have observed inverse co-movement (e.g. Hilliard, 1979; Panton et al., 1976; Ripley, 1973). Nevertheless, the direction of causality was not found to be similar during both the Asian crisis of 1987 and the subprime crisis of 2007. Volatility transmission was directed by Asian equity markets towards the US equity markets during the Asian Crisis, while this case was reversed during the subprime crisis (Yoshida, 2011).

Concurrently, the literature does not display latest results to explain the behavior of equity markets covering all global regions and earlier studies are not able to provide latest guidance to global investors. So, there is need to shed light on the potential benefits of portfolio diversification (Rua and Nunes, 2009) to see the behavior of equity markets. The current boom and bust in global equity markets demonstrates the haphazard behavior resulting from a wave of economic recessions. The majority of investors lost their wealth during the recent global world crisis in 2007. They are well advised to update their information and to revise their investment portfolio to avoid any unexpected future

losses. Moreover, Rua and Nunes (2009) and Baker et al. (2012) observed that stock investors face problems with the estimating prospective price movement in the time of global financial crises. Therefore, the rationale for conducting this study is to provide investors with fresh and efficient information acquired through statistical tools. This study intends to fill this void using subprime crisis data to determine the co-movement behavior of global equity markets. Investors' puzzling and chaotic frame of mind is considered and addressed amicably in the current study. Therefore the results of this study are extracted by comparing the subprime crisis period of 2007 into two sub-periods (pre-crisis and post crisis). Section two of this paper will give a brief summary of literature review, and the third section will explain the methodology and details of data. The fourth section contains the estimated results in addition to an interpretation of results. The fifth section provides a discussion about the contribution and implications of results. The sixth and final section will present the conclusion in view of the results of the analysis.

2. Literature Review

Empirical literature regarding the benefits of international diversification has been available since the 1960s. Grubel (1968) used mean-variance methodology to reduce a country's systematic risk in international diversification. This risk-adjusted diversification was studied by many researchers such as (Bekaert and Harvey, 1995, Divecha et al., 1992, Wilcox, 1992, Speidell and Sappenfield, 1992). Some notable studies applied co-integration methodology to reveal the function of emerging equity markets for the diversification of risk (Gilmore et al., 2005, Gilmore and McManus, 2002, Dunis and Shannon, 2005, Naranjo and Porter, 2007, Ozdemir, 2009).

Co-movement among the stock indices is investigated by using different methodologies. Traditionally, degree and correlation direction were applied to diversify portfolio risk. With the increase in the number of markets, this bivariate technique has become inappropriate and has been gradually replaced with multivariate techniques. Ripley (1973) used data of 19 international stock markets for the period 1960 to 1970 to investigate the pattern of variation among these markets by applying factor analysis. Results showed a low degree of variability in stock markets in Canada, Netherlands, Switzerland, and USA, whereas Japan and South Africa demonstrated a high degree of association.

Hui and Kwan (1994) also used factor analysis to investigate markets of the Asia Pacific region and USA. Results revealed that Japan, Taiwan, Hong Kong, and US markets were categorized into different factors which showed that these countries are suitable for diversification. Furthermore, Naughton (1996) also employed factor analysis to investigate the correlation between developed and Asian markets. Findings of the study revealed low correlation between developed and Asian markets, with the U.S, Hong Kong, and Australia were grouped in the same category with Japan and Korea in a separate group. Taiwan and Philippines were also allocated as a separate factor. However, it was concluded that potential diversification was available in Asian equity markets.

Meric and Meric (1997) investigated the existence of co-integration in European markets using factor analysis, focusing on the pre and post periods of the 1987 crisis, and reported three statistically significant factors before the crash but only two factors were identified after the crash,. These results suggested that co-movement among the markets increased due to the crisis. Tuluca and Zwick (2001) used data from thirteen equity markets to reveal the Asian crisis impact on international equity markets. Factor analysis was applied and analysis reported that all markets other than Asian markets were found in one factor, whereas Asian equity markets were divided into two groups. Therefore, the study suggested that potential diversification was reduced in the case of long-run diversification.

The linkages among fifteen international equity markets were examined by Illueca and Lafuente (2002) through applied factor analysis. The findings indicate that four factors were generated through analysis of North and South America, Asia, and Europe. Hui (2005) used factor analysis to examine the potential benefits of diversification for Singaporean investors using the data of Asian Pacific markets including the US market. The findings suggested that large and developed markets such as Australia, US, and Japan are relatively better for Singaporean investors. The Taiwanese stock market is also used for diversification but Singapore, Thailand, South Korea, Philippines, and Hong Kong market are not candidates for risk reduction. The study by Valadkhani, Chancharat and Harvie (2008) explored the co-movements of stock market indices by using ML and PC methodologies. Data was based on monthly stock indices of thirteen countries from 1987-2007. Asian countries fall into the first factor, while developed countries were classified in the second factor. Consistency in results was found in the case of both ML and PC methods. It was reported that Asian stock returns were showing high correlation which reduces the diversification potential within these markets. In the same way, the developed markets stock returns were found to be highly correlated. Liu et al., (2014) explored downside risks for euro-zone countries and study period is divided into pre-crisis and post crisis periods. They discovered that diversification should not be optimized if investment is made within euro-zone markets. Finally, findings suggest that investors should make investments in both Asian emerging markets and developed markets.

Table 1: Review of Past Studies

Year	Authors	Study Period	Countries	Variables	Methods	Findings
2001	Bilson Brailsford Hooper	1985 To 1997	20 emerging countries	World market return, Money supply, Goods price, Real activity, Exchange rate, Country risk, Trade sector, Interest rate, Regional index, Price to earnings ratio, Dividend yield	Regression, Factor Analysis	A little evidence of commonality is found at regional level. Country cointegration with regional markets should be considered.
2009	Rua Nunues	1973 To 2007	Developed countries	Stock Returns data from different sector of each economy such as oil and gas, basic materials, industrials, consumer goods, healthcare, consumer services, telecommunications, utilities, financials, technology	Wavelet Analysis	Concurrent relationship of international stock returns in relation to time and frequency is analyzed which gives better understanding for stock co-movement
2012	Hwang	2000 To 2010	Asian-Pacific and U.S. market	Weekly stock returns of Australia, China, New Zealand, Singapore, Taiwan, and US	DCC-GARCH TAR-GARCH	It is suggested that diversification benefit is reduced during financial crisis. Global investors have substantial opportunities in China.
2012	Gupta Guidi	1999 To 2009	India and Developed Asian Stock Markets	Daily closing stock indices of India, Hong Kong, Japan, US, and Singapore	VAR GARCH	Study found that markets of these countries are not co-integrated on long-term basis, whereas a short-run relation exists among these markets
2012	Graham Kiviaho Nikkinen	2001 To 2010	22 Emerging Market Indices	Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan,	Wavelet Analysis	Co-movement between all emerging markets and US market is relatively higher at lower frequencies. Furthermore, this frequency

				Thailand, and Turkey		differs country by country.
2012	Madaleno Pinho	1997 To 2009	International Stock Markets	Daily stock prices of FTSE 100, DJIA 30, Nikkei 225 and Bovespa	Wavelet Analysis	Study reported that homogeneous co-movement among international markets could not be found. Financial crisis has significant effect among the stock prices over the time. Geographical and economic ties among the markets are also having significant effect on the movement of international stock markets.
2012	Akoum Graham Kiviaho Nikkinen Omran	2002 To 2010	GCC	Stock market returns data of Egypt, Jordan, Saudi Arabia, Kuwait, Qatar and UAE	Wavelet Analysis	A moderate co-movement of stock market is found when the frequency is high; however, this co-movement is relatively high when low frequency data is analyzed.
2014	Kiviaho Nikkinen Piljak Rothovius	2000 To 2010	European Frontier Market and US Market	Estonia, Latvia, Lithuania, Bulgaria, Croatia, Romania, Slovakia, and Slovenia	Wavelet Analysis	The study found that co-movement of frontier stock market varies at varying degree of frequency over the time.
2014	Aloui HKiri	2005 To 2010	GCC Countries	Stock Indices of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE	Wavelet Analysis	Results show that frequency of co-movement is increased among GCC countries' stock after 2007
2014	Guidi Ugur	2000 To 2013	South-Eastern European (SEE) and Developed Countries	Stock prices of Bulgaria, Croatia, Romania, Slovenia and Turkey, Germany, UK, and USA	Dynamic Cointegration	Results suggest the benefits of portfolio during period 2007 to 2013. Furthermore,

						time-varying co-integration exists between South-Eastern European (SEE) and developed countries.
2014	Yang Lee Shie	1992 To 2007	Eight East Asian Stock Prices	Australia, Hong Kong, Malaysia, Philippines, Singapore, Korea, Thailand, Taiwan	Equal Variance Test	Current study considered the cross-section dependence and long-run variance and postulated that trading relations and geographical ties among the markets are main factors to determine the relationship of East Asian Markets.

Hui, Tsui and Chua (2010) used data from eleven equity markets namely: Thailand, Taiwan, Singapore, Philippines, Malaysia, New Zealand, Korea, Japan, Indonesia, Hong Kong, and Australia as well as US market to investigate portfolio potency by diversifying the systematic risk of these economies. The study results were obtained by using factor analysis for both pre and post crisis periods. It is suggested that benefits of diversification would increase when dividends are included in returns. Some of the other studies on portfolio integration are discussed in the table 1. The aforementioned literary discussion is evidence of different methodologies used by previous researchers; however, the focus of this study is to examine the co-integration between global equity markets in order to investigate the benefits of regional portfolio diversification.

Presence of co-integration means these markets are moving jointly in the long run. In Modern Portfolio Theory (MPT), the key determinant of optimal portfolio is that the correlation between the securities must be negative or their relationship should be weak. Cross-economy diversification can be achievable only when equity markets are not moving very closely with each other. A high return through minimizing risk in general can be attained without stepping into broader diversification (Bailey and Stulz, 1990). Therefore, the results of this study will be beneficial to Asian portfolio investors. The finding of study can be utilized to reduce systematic risk through investment diversification. The main objectives of this study are:

- To examine the co-movement of global equity markets among Asian, American and European equity markets.
- To measure the impact of subprime financial crisis 2007 over the linkages of stock returns of these markets cited above.

3. Data and Methodology

The main stock index of every country was used as a proxy to determine the co-movement among these countries for diversification. The indices which were used as proxy are mentioned in Table 1. Data of these 33 stock indices (including 12 Asian, 8 American and 13 European Markets) was analyzed form 1 January, 2000 to 10th September, 2010 which was obtained from Econostats. According to Brooks (2008) it is preferable that financial raw data should converted into log-runs; therefore, all indices series were converted into returns series. The formula of continuous compounding returns was employed as follows:

$$r_t = \ln\left(\frac{p_t}{p_{t-1}}\right)\times 100$$

Here: r_t denotes the continuous compounded return at time t. $\ln$ is used for natural log and p_t is used for value of index at time t. These returns series will be helpful to remove the auto-correlation among the series that exist as usual in the financial time series. It is suggested that constant correlation can measured only after eliminating auto-correlation among the series. If the stock returns are found stationery on the same level, then estimation can be made using original series. To estimate co-movement of two variables, the correlation coefficient test is applied. Factor analysis, a multivariate technique, is suitable to examine the correlation coefficient more than two variables (Johnson and Wichern, 2002).

Factor analysis technique is useful to find out maximum and minimum degree of relationship among the variables by dividing into the different groups. Additionally, it is the collection of statistically tools which are applicable to divide the correlated data into different factors according to their degree of association to one another. Factor analysis is done through two types of methods such as PC and ML which are widely used in analysis. The assumption of normality is not required in the principle component method, whereas ML demands the normality of the data.

In the process of Principle component Analysis, Eigen value 1 was considered to extract the factors. Factors having Eigen Value below 1 was not considered because of low percentage of variances. To measure the differentiated effect of extracted factor from original variables, we used Varimax rotation. A Varimax rotation has the quality to make easy as possible to identify each market with single factor and it can maximize the variance of square loadings. KMO & Bartlett's test was used to check the sample adequacy. The values of KMO were 0.92, 0.878 and 0.96 for Asian, American and European markets respectively. Bartlett's Test of Sphericity for all the markets was less than 0.05 fulfill the criteria recommended by Kaiser, 1974.

In factor analysis, we use the data of original variables attributing linear combination and arrive at uncorrelated set of latent variables to take advantage from the variance through their components. The factor analysis model can be explained for a k set of multivariate variables as under:

$$r_1 - \mu_1 = \alpha_{11} f_1 + \alpha_{12} f_2 + ... + \alpha_{1m} f_m + \varepsilon_1$$
$$r_2 - \mu_2 = \alpha_{21} f_1 + \alpha_{22} f_2 + ... + \alpha_{2m} f_m + \varepsilon_2 \quad (1)$$
$$r_k - \mu_k = \alpha_{k1} f_1 + \alpha_{k2} f_2 + ... + \alpha_{km} f_m + \varepsilon_k \quad (2)$$

We can present it in matrix form as:

$$r - \mu = \mathrm{A}F + \varepsilon \quad (2)$$

Where $r = (r_1, r_2, ..., r_k)$ stands for multivariate vector with $m < k$ for stock returns; $\mu = (\mu_1, \mu_2, ..., \mu_k)$ denotes vector mean; $F = f = (f_1, f_2, ..., f_k)$ stands for common factor in vector; $\mathrm{A} = \alpha_{ij} = k \times m$ where α_{ij} denotes factor loading if ith variable on the ith factor and $\varepsilon = \varepsilon_1, \varepsilon_2, ..., \varepsilon_k$ is the error term of r_i.

4. Methods of Factor Analysis

Principal Component Analysis (PCA) and ML methods are commonly employed while analysing orthogonal factor model. In PCA, number of common factors specification and normality of the data is not required. This method is used on the basis of correlation and covariance matrixes. On the other hand, ML method requires that number of common factors must be specified before analysis and normal density function is the base of this method. First, we can explain PCA method in the following way:

Here, $\left(\hat{\lambda}_1, \hat{\zeta}_1\right), \left(\hat{\lambda}_2, \hat{\zeta}_2\right), ..., \left(\hat{\lambda}_k, \hat{\zeta}_k\right)$ are assumed the pairs of Eigen values and $\hat{\Sigma}_r$ is the eigenvetors for covariance matrix's sample. Where latent common factors would be assumed less as compared to original variables and would be $m < k$. However, factor loading matrix will be demonstrated as:

$$\hat{\mathrm{A}} = \hat{\alpha}_{ij} = \left[\sqrt{\hat{\lambda}_1, \hat{\zeta}_1} | \sqrt{\hat{\lambda}_1, \hat{\zeta}_1} | ... | \sqrt{\hat{\lambda}_m, \hat{\zeta}_m} | \right] \quad (3)$$

The matrix $\hat{\Sigma}_r - \hat{\alpha}\hat{\alpha}'$ contains diagonal elements estimated definite variances. It denotes that $\hat{\Psi} = \text{diag} \left[\Psi_1, \Psi_2, ..., \Psi_k \right]$ and $\hat{\Psi}_i = \hat{\alpha}_{ii,r} - \Sigma_{j=1}^{m} \hat{\alpha}_{ij}^2$, and $\hat{\alpha}_{ij}^2$ is $(i,i)^{th}$ element of $\hat{\Sigma}_r$. The communalities will be estimated by $\hat{c}_i^2 = \hat{\alpha}_{i1}^2 + \hat{\alpha}_{i2}^2 + ... + \hat{\alpha}_{im}^2$. Using this method the error matrix associated with our approximation is equal to $\hat{\Sigma}_r - \left(\hat{\alpha}\hat{\alpha}' + \hat{\Psi}\right)$ which should ideally less than or equal to $\hat{\lambda}_{m+1}^2 + \hat{\lambda}_{m+2}^2 + ... + \hat{\lambda}_k^2$. Hence the resulting approximation error is determined by the sum of squares of the excluded eigenvalues. The estimated factor loadings will not be changed by the increase of m number of common factors.

On the other hand, we assume the normality of both common factors (F) and specific factors (ε) in ML method. So, it is concluded that r remains normal with μ, the mean value and covariance matrix $\Sigma_r - \left(\alpha\alpha' + \Psi\right)$. However, ML method can applied to estimate A and Ψ condition is that $a'\Psi_{-1}\alpha = \Delta$, which is a diagonal matrix. It can be used sample mean as a proxy for μ. However, using this method numbers of common factors is predetermined.

4.1 Factor Rotation

If p is assumed as $m \times m$ orthogonal matrix, then following relations can be expressed as: $\alpha\alpha' + \Psi = \mathrm{A}PP'\mathrm{A}' + \Psi$ and $r - \mu = \mathrm{A}F + \varepsilon = \mathrm{A}^*F^* + \varepsilon$ and where $\mathrm{A}^* = \mathrm{AP}$ and $F^* = \mathrm{P}'\mathrm{F}$. The communalities and the specific variances remain same in the orthogonal transformation. We find an orthogonal matrix named, P for the transformation of the factor model. This value is easy to explain the loadings on the common factors. These factors are rotated in the m-dimensional space through transformation.

There are many methods which are used to rotate the common factors but it is evidenced in the literature that varimax is commonly used by the researchers (Hui and Kwan, 1994). It is explained further; Here, we considered the rotated matrix for factor loading as: where, $\mathrm{A}^* = \alpha_{ij}$ and c_i^2 shows the ith communalities, then $\tilde{\alpha}_{ij}^* = \alpha_{ij}^* / c^i$ can be described as the rotated coefficients through scaling the positive square root of communalities. We select the P orthogonal matrix in such a way which maximizes the quantity of V therefore, V is as:

$$V = \frac{1}{k}\sum_{j=1}^{m}\left[\sum_{j=1}^{k}\left(\tilde{\alpha}_{ij}^*\right)^4 - \frac{1}{k}\left(\sum_{j=1}^{k}\tilde{\alpha}_{ij}^{*2}\right)^2\right] \qquad (4)$$

This relationship can be explained in such a way that V is the maximized value which shows the maximum possible spread of loading squares on every factor. In this way, the common factors will be shown in large groups whereas; the columns of rotated matrix will show the coefficients very small.

5. Data Analysis

The stock returns of 33 equity markets namely: Italy (MIB-30), Netherlands (AEX), Greece (ATG), Austria (ATX), Belgium (BEL20), France (CAC), Germany(DAX), UK (FTSE-100), Finland (HEX25), Spain (Madrid), Swiss (Zur), Turkey (Istbul-100), Russia (Mos. Time), India (SENSEX), Sri Lanka (CSE), Hong Kong (HSI), China (SHCOMP), Indonesia (JCI), Malaysia (KLSE), Korea (KOSPI), Pakistan (KSE100), Japan (Nikkei-225), Singapore (STRAITS), Taiwan (TWI), Philippine (PHILAD), Mexico (IPC), USA (NASDAQ), USA (S&P500), Canada (TSX), Brazil (BOVESPA), Peru (LIMA), Argentina MERVAL), Venezuela (IBC) is used in this study with weekly frequency of the data covering period from 1 January, 2001 to December, 2013.

Table 1: Descriptive Statistics (European, Asian and American Stock Markets)

Name of Countries	Proxy	Min	Max	Mean	SD	Skewness	Kurtosis
		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
European Markets							
Austria	ATX	-29.03	15.94	0.4649	6.115	-1.644	5.597
Belgium	BEL20	-23.22	12.84	-0.0378	5.594	-1.28	2.837
Finland	HEX25	-24.48	25.16	-0.3551	7.870	-0.429	1.575
France	CAC	-22.08	16.61	-0.2031	6.333	-0.887	2.225

Germany	DAX	-29.33	19.37	0.2197	6.657	-1.05	3.121
Greece	ATG	-32.67	19.83	**-0.6661**	8.885	-0.728	1.282
Italy	MIB-30	-18.07	15.35	-0.3808	5.854	-0.608	0.484
Netherlands	AEX	-23.12	13.03	-0.3083	6.236	-1.104	1.992
Russia	MOS.TIME	-83.18	57.58	1.1602	13.690	-1.137	10.964
Spain	Madrid	-18.89	16.9	-0.0142	6.673	-0.462	0.625
Switzerland	Zur	-16.09	12.21	0.0096	**4.487**	-0.797	1.424
Turkey	ISTBUL-100	-20.68	43.4	**1.2706**	**9.712**	0.619	1.663
UK	FTSE-100	-22.76	16.65	0.5555	5.389	-1.092	3.209
Asian Markets							
China	SHCOMP	-28.8	24.12	0.0311	8.70367	-0.557	1.447
Hong Kong	CSE	-25.45	15.76	0.2386	6.37564	-0.689	1.593
India	SENSEX	-19.81	26.55	1.0557	7.68395	-0.211	0.642
Indonesia	JCI	-29.1	17.55	1.5077	7.00258	-0.853	2.147
Japan	Nikkei-225	-14.36	13.42	**-0.0204**	5.72917	-0.089	-0.063
Korea	KOSPI	-26.31	18	0.7614	6.55077	-0.536	1.23
Malaysia	KLCI	-12.46	12.1	0.6473	**4.29426**	-0.243	0.519
Pakistan	KSE100	-41.98	22.73	**1.8484**	8.07129	-1.1	5.414
Philippines	Philad	-25.46	17	0.9405	6.27965	-0.478	1.767
Sri Lanka	CSE	-48.14	31.92	0.9893	**9.1299**	-0.38	6.059
Taiwan	TWI	-21.04	18.8	0.2958	6.68751	-0.243	0.741
Singapore	STRAITSTIMES	-27.36	19.3	0.3241	5.78514	-1.017	4.261
American Markets							
Mexico	IPC All Sh	-31.28	41.93	1.4963	10.66235	-0.047	1.543
USA	US(NASDAQ)	-29.82	16.29	1.0369	6.96525	-0.569	1.796
USA	S&P 500	-18.55	10.62	0.2447	**4.24955**	-1.294	3.31
Canada	TSX	-16.97	16.08	**1.2503**	5.81302	-0.424	0.339
Brazil	BOVESPA	-41	35.5	1.5311	9.23236	-0.023	4.026
Peru	LIMA	-61.73	47.6	1.21	**12.7506**	-0.645	6.511
Argentina	MERVAL	-19.52	11.64	0.6019	5.73832	-0.773	0.978
Venezuela	IBC	-18.42	10.23	0.1789	4.56974	-0.803	1.43

Table 1 represents the descriptive statistics which include Minimum Values, Maximum Values, Mean, Standard Deviation, Skewness and Kurtosis. The Highest mean return values were shown as bold but not italic. Highest value is found in Turkey among European markets and Pakistan among Asian markets. Canada has highest mean return among American markets. However, negative market returns (values bold and italic)

were found in the markets of Greece from Europe and Japan from Asia. The Standard Deviation value represents the volatility of the markets. Findings reveal that stock market of Turkey from Europe, Sri Lanka from Asia and Peru from America shown as (Bold but not italic) were found to be highly volatile having a values 9.7124, 9.1299, and Peru 12.7506 respectively. Stock market of Switzerland from Europe, Malaysia from Asia, and S&P 500 from America shown as (Bold and italic) were found less volatile as compared to others.

5. 1 Asian Markets

Table 2 shows the results of correlation between Asian markets. The highest correlation was found in the markets of Singapore and Indonesia (i.e. r = .713 at 5% level of significance). Second highest correlation was found between the markets of Hong Kong and Korea (i.e. r = .680). A strong correlation exists between the markets of Singapore and Malaysia (i.e. r= .677). The data for other markets includes: Singapore and Philippines, r = .665, India and Singapore, r = .654, Singapore and Taiwan, r = .653, Indonesia and India , r = .639, Malaysia and Indonesia, r = .633, Philippines and Indonesia, r = .606, Taiwan and India, r = .603, Taiwan and Malaysia, r = .579, Philippines and India, r = .543, Philippines and Malaysia, r = .536, Malaysia and India, r = .535, Taiwan and Indonesia, r = .521. However, a non-significant relation was observed for Hong Kong's stock market with China, Indonesia, and Philippines stock markets. Similarly, no relationship was observed between Korea and Indonesia, Pakistan with Malaysia and Singapore.

Table 2: Correlation Matrix (2001-2013) Asian Markets

Counries	1	2	3	4	5	6	7	8	9	10	11
China	1										
Hong Kong	.045	1									
India	.281**	.145	1								
Indonesia	.273**	.072	.639**	1							
Japan	.181*	.185*	.450**	.396**	1						
Korea	.000	.680**	.157	.013	.235**	1					
Malaysia	.323**	.028	.535**	.633**	.289**	.054	1				
Pakistan	-.073	.144	.087	.053	.189*	.288**	.013	1			
Philippines	.250**	.026	.543**	.606**	.336**	.078	.536**	.228**	1		
Sri Lanka	-.047	.224**	.150	.213**	.090	.213**	.098	.095	.059	1	
Taiwan	.271**	.179*	.603**	.521**	.455**	.263**	.579**	.118	.490**	.135	1
Singapore	.345**	.144	.654**	.713**	.409**	.122	.677**	.011	.665**	.114	.653**

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 3: Rotated Component Matrix for the Period 2001-2013 (Varimax Rotation) Asian Markets

Name of Countries	Factors				
	1	2	3	4	5
China	.269	.050	-.044	-.091	**.911**
Hong Kong	.050	**.889**	-.014	.132	.061
India	**.809**	.123	.008	.034	.040
Indonesia	**.833**	-.072	.010	.211	.085
Japan	**.597**	.314	.125	-.254	-.198
Korea	.073	**.883**	.187	.065	-.013
Malaysia	**.769**	-.057	-.041	.095	.228
Pakistan	.049	.157	**.960**	.029	-.054
Philippines	**.741**	-.093	.332	.017	.145
Sri Lanka	.126	.190	.037	**.922**	-.090
Taiwan	**.771**	.243	.019	-.037	.050
Singapore	**.869**	.064	-.047	.043	.172
% of Variance Extracted	35.77	15.224	9.092	8.355	8.315
Cumulated % of Variance Extracted	35.77	50.994	60.086	68.442	76.757

For analysis, Principal Component Technique was applied. Eigenvalue of different factors was considered to identify the factors and finally five factors were kept having total variance of 76.757%. Table 3 illustrates the results after varimax rotation. First, five factors explain i.e. 76.757% of variance. By comparing factor weights, the first two factors were picked as having maximum variance among the five. Factor one relatively explained large variance (i.e. 35.770%) and this factor contains markets from India, Indonesia, Japan, Malaysia, Philippines, and Singapore. Hence, co-movement exists between these six markets. The second factor explains 15.224% of the variance containing markets from Hong Kong and Korea. China, Pakistan and Sri Lanka have demonstrated independent co-movement behavior.

Table 4 represents the sub-period analysis in which markets were divided into two sub-groups. The first group contains data from January 2001 to July 2007 (Before Global Financial Crisis) and the second group contains data from July 2007 to December 2013 (After Global Financial Crisis). The purpose of the subgroup analysis was to identify the markets' behavior before and after Global Financial Crisis.

The sub-period study depicts that co-movements exist among the markets of India, Indonesia, Taiwan, and Singapore having 30.330% of variance explained by factor one before Global Financial Crises. Factor two shows the linkage between Hong Kong and Korea, whereas factor three presents a linkage between Japan and Pakistan. Behavior of China and Sri Lanka was found to be independent. However, the market clusters were changed after crisis. Increase in variance that is 40.723% indicates that co- movement of markets has strengthened after crisis. Factor one show the co-movement among China,

India, Indonesia, Japan, Malaysia, Philippines, Taiwan, and Singapore after crisis. Factor two indicates the co-movement between Hong Kong and Korea has strengthened after crisis, but remaining markets of Japan, Pakistan and Sri Lanka were reflecting independent behavior after the crisis.

Table 4: Sub-Period Factor analysis before and after Global Financial Crisis (Varimax Rotation)

Name of Countries	Factors				
	1	2	3	4	5
Sub-Period (Jan, 2001 - July, 2007)					
China	.025	.080	.091	**.866**	-.087
Hong Kong	.051	**.861**	.070	.162	.165
India	**.706**	.007	.309	.049	.089
Indonesia	**.773**	-.129	.038	-.006	.233
Japan	.209	.073	**.811**	.226	.124
Korea	.018	**.911**	.107	-.100	-.058
Malaysia	.765	-.075	-.196	.166	-.146
Pakistan	-.097	.240	**.602**	-.458	-.203
Philippines	.705	.020	.215	-.205	-.081
Sri Lanka	-.052	.090	.025	-.056	**.928**
Taiwan	**.795**	.153	.089	.185	-.069
Singapore	**.877**	.134	-.070	-.031	-.080
% of Variance Extracted	30.330	14.286	10.340	9.638	8.815
Cumulated % of Variance Extracted	30.330	44.616	54.956	64.594	73.409
Sub-Period (July, 2007 - December, 2013)					
China	**.687**	.092	-.172	-.482	-.324
Hong Kong	.041	**.922**	.024	.096	.012
India	**.815**	.146	-.009	.076	.195
Indonesia	**.863**	-.017	.039	.199	.169
Japan	**.506**	.174	.067	-.084	**.779**
Korea	.082	**.899**	.146	.126	.135
Malaysia	**.868**	.052	.081	.127	.082
Pakistan	.095	.149	**.963**	.042	.057
Philippines	**.815**	-.064	.301	-.020	.011
Sri Lanka	.251	.265	.021	**.874**	-.086
Taiwan	**.674**	.277	.205	.058	.322
Singapore	**.892**	.073	-.104	.041	.193
% of Variance Explained	40.723	15.841	9.469	9.149	7.958
Cumulative % of Variance Explained	40.723	56.564	66.033	75.182	83.140

Table 5: Summary of the impact of Global Financial Crisis on Asian Markets

Factors	Before Crisis (Jan, 2001 - July, 2007)	After Crisis (August, 2007 - December, 2013)
Factor 1	India, Indonesia, Taiwan, Singapore	China, India, Indonesia, Japan, Malaysia, Philippines, Taiwan, Singapore
Factor 2	Hong Kong, Korea	Hong Kong, Korea
Factor 3	Japan, Pakistan	Pakistan
Factor 4	China	Taiwan
Factor 5	Sri Lanka	Japan

Summary of the results presented in Table 5 shows that integration among Asian Markets is changed to a greater extent after crisis. Before crisis, their movement was found in three different clusters, but after crisis their movement was confined into two clusters. Consistent behaviour was not observed among these markets before and after the crisis period. Only four markets (India, Indonesia, Taiwan, and Singapore) were integrated before crisis, but after crisis China, Japan, Malaysia and Philippines stock markets were also indicating their movement with the markets integrated before crisis. Therefore, it is clearly derived from the results that co-movement of stock markets enhanced after crisis.

5.2 American Markets

Table 6 represents the correlation matrix of American stock markets. A strong correlation exists between the markets of US (S&P 500) and Canada (r = .809 at 5% level of significance). Similarly, Canada was noticed to have strong correlation with Brazil (r =.735). Some other relationships are: a strong correlation exists between Brazil and US (S&P 500) having an r value of .678, Correlation of US (NASDAQ) stock market found to be very week with Argentina, Brazil, Canada, Mexico, and Peru. Relationship of Venezuela was found in a similar fashion with Argentina, Brazil, Canada, and Peru.

The Kaiser- Mayer- Olikin (KMO) measure was reported as 0.886 which shows the sampling adequacy, whereas the Bartlett Test of sphericity explains that alternate hypothesis can be accepted having significant value. However, it can be inferred that the correlation matrix is not an identity matrix. Using Principal Component Analysis, the markets are scattered into five factors containing 100% of Variance.

Table 6: Correlation Matrix (Jan, 2001 – December, 2013) American Markets

Countries	1	2	3	4	5	6	7
Argentina	1						
Brazil	.398(**)	1					
Canada	.398(**)	.735(**)	1				
Mexico	.309(**)	.242(**)	.270(**)	1			
Peru	.172(*)	.059	.131	.444(**)	1		
Venezuela	.049	.049	.004	.163(*)	.070	1	
Nasdaq	.003	.038	.027	.032	.070	.150	1
S&P500	.357(**)	.678(**)	.809(**)	.171(*)	.143	.061	.042

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 7 demonstrates the results after running varimax rotation. First factor explains 30.823% of the variance including three markets i.e. Brazil, Canada, and US (S&P500). Results depict that the state of co-movement exists among these three markets. Remaining four factors explain 16.484%, 13.780%, 12.647% and 12.524% of the variance respectively. Second factor indicates interlink between Mexico and Peru. Each of these three factors shows the independent behavior of markets including Argentina, Venezuela and US (NASDAQ). Results suggest the non-existence of market co-movement or it can be inferred that these markets are independent in their movement and are not intertwined with any other market.

Table 7: American Markets Rotated Component (Varimax Rotation) Matrix for the Period 2001-2007

	Component				
	1	2	3	4	5
Argentina	.161	.067	**.952**	.005	-.030
Brazil	**.861**	-.040	.097	-.026	.101
Canada	**.925**	.034	.137	.008	-.023
Mexico	.099	**.748**	.308	-.058	.164
Peru	-.055	**.883**	-.133	.090	.053
Venezuela	.042	.165	-.024	.085	**.975**
US (NASDAQ)	.022	.035	.002	**.992**	.081
US (S&P500)	**.914**	.048	.027	.050	-.010
% of Variance Explained	51.161	28.592	15.668	4.020	.559
Cumulated % of Variance Explained	51.161	79.752	95.421	99.441	100.000

The behavior of the American markets before and after Global Financial crises is presented in Table 8 and a summary of results is represented in Table 9. Before Global Financial Crises, first factor includes Brazil, Canada, and US (S&P500) with a variance value of 30.937% that proves the existence of co-movement among the markets. Second factor indicates interlink between Mexico and Peru. Remaining markets disclosed independent behavior before crisis. After the crises, Argentina, Mexico, and Venezuela emerged into the factor one cluster and the variance increased to 51.161%. Therefore, Argentina, Brazil, Mexico, Venezuela, and US (NASDAQ) are merged into one group represented by factor one and their co-movement become strong after Global Financial Crises. Hence, results of the study point out that Global financial crisis have a strong effect on American Markets in the context of stock market integration.

Table 8: Sub-Period Factor (Varimax Rotation) analysis before and after post-crisis American Markets

Name of Country	Factors				
	1	2	3	4	5
Sub-Period (Jan, 2001 - July, 2007)					
Argentina	.161	.067	**.952**	.005	-.030
Brazil	**.861**	-.040	.097	-.026	.101
Canada	**.925**	.034	.137	.008	-.023
Mexico	.099	**.748**	.308	-.058	.164
Peru	-.055	**.883**	-.133	.090	.053
Venezuela	.042	.165	-.024	.085	**.975**
US (NASDAQ)	.022	.035	.002	**.992**	.081
US (S&P500)	**.914**	.048	.027	.050	-.010
% of Variance Explained	30.937	17.210	13.113	12.568	12.491
Cumulated % of Variance Explained	30.937	48.146	61.259	73.318	83.318
Sub-Period (August, 2007 - December, 2013)					
Argentina	**.985**	.090	-.038	.092	-.111
Brazil	**.731**	**.608**	-.303	.035	.047
Canada	.262	**.789**	-.094	**.548**	.002
Mexico	**.985**	.103	-.122	.059	.031
Peru	-.003	-.166	**.986**	-.026	.003
Venezuela	**-.858**	**-.511**	.013	-.026	.037
US (NASDAQ)	**.902**	-.117	.375	.067	.166
US (S&P500)	.001	.987	-.154	-.046	-.017
% of Variance Explained	51.161	28.592	15.668	4.020	.559
Cumulated % of Variance Explained	51.161	79.752	95.421	99.441	100.000

Summary of the results presented in Table 9 shows the integration among American Markets. Co-movement of American market changed in pre-and post-crisis. Factor one displays co-movement of Brazil, Canada, and US (S&P 500) pre-crisis period but this factor is added by Argentina, Mexico, and Venezuela in post-crisis periods. On the other hand, factor two showed Mexico and Peru in one couple, whereas Brazil, Canada, and Venezuela constructed a new group after crisis. It can derived from the results that co-movement among American market is largely influenced due to global financial crisis.

Table 9: Summary of the impact of Global Financial Crisis on American Markets

Factors	Before Crisis (Jan, 2001 - July, 2007)	After Crisis (Aug, 2007 - December, 2013)
Factor 1	Brazil, Canada, US(S&P500)	Argentina, Brazil, Mexico, Venezuela, US (NASDAQ)
Factor 2	Mexico, Peru	Brazil, Canada, Venezuela
Factor 3	Argentina	Peru
Factor 4	US (NASDAQ)	Canada
Factor 5	Venezuela	No

5.3 European Markets

Table 10 represents a correlation matrix that suggests a positive correlation among all European equity markets. Results revealed a high strong relationship between the markets of Netherlands and Belgium having r value .845 whereas r value .817 discloses an extremely strong relationship between Netherlands and Italy and similar relationship is found between Netherlands and Swiss having r value .817. Among the majority of the markets, a strong correlation exists between Belgium and Italy, UK with Germany and Greece. Furthermore, Turkey has a strong association with Finland, Italy, Netherland, and Swiss and similarly, Switzerland has strong relationship with Belgium and Italy. On the other hand, Spain has strong association with France and Italy whereas Netherlands has high connectivity with Austria. In the same way, Italy has a strong relationship with Austria and Finland. The majority of markets revealed a degree of association in excess of 50%.

Kaiser-Mayer-Olikin (KMO) analysis reports 0.954 values that show the sampling adequacy and the Bartlett Test of Sphericity having significant value urged to accept alternate hypothesis that explains that the correlation matrix was not an identity matrix. Using Principal Component Analysis, the markets are classified into five factors that explain 85.252% of the variance.

Table 10: Correlation Matrix (2001-2013) European Markets

Name of Countries	1	2	3	4	5	6	7	8	9	10	11	12
Austria	1											
Belgium	.773 (**)	1										
Finland	.519 (**)	.594 (**)	1									
France	.455 (**)	.603 (**)	.586 (**)	1								
Germany	.160 (*)	.155	.289 (**)	.401 (**)	1							
Greece	.262 (**)	.286 (**)	.262 (**)	.432 (**)	.666 (**)	1						
Italy	.745 (**)	.806 (**)	.701 (**)	.627 (**)	.132	.253 (**)	1					
Netherlands	.729 (**)	.845 (**)	.692 (**)	.655 (**)	.171 (*)	.188 (*)	.817 (**)	1				
Russia	.551 (**)	.442 (**)	.315 (**)	.287 (**)	.137	.164 (*)	.464 (**)	.438 (**)	1			
Spain	.524 (**)	.655 (**)	.544 (**)	.718 (**)	.298 (**)	.336 (**)	.710 (**)	.669 (**)	.337 (**)	1		
Swiss	.610 (**)	.766 (**)	.661 (**)	.648 (**)	.233 (**)	.248 (**)	.767 (**)	.817 (**)	.298 (**)	.641 (**)	1	
Turkey	.404 (**)	.444 (**)	.590 (**)	.475 (**)	.225 (**)	.214 (**)	.561 (**)	.535 (**)	.255 (**)	.473 (**)	.513 (**)	1
UK	.202 (*)	.205 (*)	.354 (**)	.468 (**)	.794 (**)	.681 (**)	.201 (*)	.232 (**)	.174 (*)	.290 (**)	.315 (**)	.316 (**)

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 11: Rotated Component Matrix for the Period 2001-2013 (Varimax Rotation) European Markets

Name of Countries	Factors				
	1	2	3	4	5
Austria	**.821**	.123	.025	.071	.393
Belgium	**.876**	.098	.263	.087	.167
Finland	**.580**	.207	.167	**.593**	.026
France	.415	.346	**.705**	.235	.037
Germany	.025	**.901**	.110	.118	.034
Greece	.172	**.847**	.151	-.068	.062
Italy	**.780**	.046	.337	.299	.209
Netherlands	**.826**	.059	.301	.283	.137
Russia	.283	.082	.100	.099	**.922**
Spain	.461	.168	**.767**	.173	.139
Switzerland	**.789**	.153	.302	.284	-.061
Turkey	.277	.130	.188	**.854**	.115
UK	.083	.894	.079	.224	.037

% of Variance Explained	32.857	19.977	12.043	11.603	8.771
Cumulated % of V. Explained	32.857	52.834	64.878	76.481	85.252

Table 11 illustrates the results after varimax rotation. First five factors explain i.e. 85.252%_of variance. By comparing factor weights, we first picked three factors having maximum variance among the five. The first factor, which explains a relatively large variance of 32.857%, contains markets Austria, Belgium, Finland, Italy, Netherlands, and Switzerland. Hence, co-movement exists between these six markets. The second factor explains 19.977% of the variance and contains markets of Germany and Greece. The third factor's explained variance is 12.043 and it includes couple of France and Spain, whereas factor four explained variance is 11.603% and a couple of Finland and Turkey is highlighted by this factor. Out of European markets, only Russia is showing an independent behavior.

Table 12 presents the behavior of European markets before and after Global Financial crises and Table 13 reports the summary of this table. Pre-Global financial crisis period demonstrates the proof of interrelation through explained variance value 32.642% reported in first factor. Out of European markets, six equity markets namely, Belgium, Finland, France, Italy, and Netherlands are moving on a one cluster. Second factor explained variance value is 20.150% which indicates that equity markets of Germany, Greece, and UK are linked in one group. Similarly, third factor highlighted the co-movement between Finland and Turkey through explained variance of 12.810%. Additional explained variance values are 10.764% and 8.060% which demonstrates that no connectivity among equity markets of Austria and Russia with other European markets. After the crisis, variance explained by factor one was 39.320% which refers to the existence of interrelation among the equity markets of Austria, Belgium, Finland, Italy, Netherlands, and Switzerland. Second factor revealed that a cluster exists among the equity markets of Germany, Greece, and UK having explained variance of 20.683%. The behavior of equity markets of Spain, Russia, and Turkey demonstrated independent behavior after crisis. Keeping these results in view, it can be depicted that co-integration among European markets remain similar in pre and post-crisis period.

Table 12: Sub-Period Factor analysis before and after Global Financial Crisis (Varimax Rotation) European Markets

Name of Countries	Factors				
	1	2	3	4	5
Sub-Period (Jan, 2001 - July, 2007)					
Austria	.391	.004	.080	**.841**	.090
Belgium	**.757**	.019	-.017	.484	.046
Finland	**.560**	.184	**.630**	-.052	-.003
France	**.833**	.338	.141	.022	.023
Germany	.081	**.920**	.078	-.078	.040
Greece	.111	**.890**	-.042	.134	-.141
Italy	**.662**	-.025	.446	.422	.099
Netherlands	**.835**	.029	.289	.278	.149

Russia	.147	-.015	.046	.083	**.979**
Spain	**.842**	.155	.165	.094	.125
Switzerland	**.749**	.056	.307	.381	.021
Turkey	.211	.111	**.887**	.109	.050
UK	.137	**.890**	.204	-.033	.086
% of Variance Explained	32.642	20.15	12.81	10.764	8.06
Cumulated % of Variance Explained	32.642	52.793	65.603	76.367	84.427
Sub-Period (August, 2007 - December, 2013)					
Austria	**.866**	.152	.025	.343	.100
Belgium	**.881**	.121	.262	.169	.131
Finland	**.819**	.213	.235	.148	.205
France	.424	.371	.655	.034	.249
Germany	.114	**.900**	.134	.074	.055
Greece	.163	**.850**	.199	.071	-.112
Italy	**.822**	.079	.401	.233	.077
Netherlands	**.884**	.069	.239	.168	.153
Russia	.365	.123	.101	**.899**	.078
Spain	.453	.189	**.791**	.122	.102
Switzerland	**.800**	.227	.313	-.048	.186
Turkey	.498	.178	.267	.122	**.749**
UK	.113	**.889**	.044	.040	.304
% of Variance Explained	39.32	20.683	12.584	8.499	6.782
Cumulated % of Variance Explained	39.32	60.003	72.587	81.086	87.869

Table 13: Summary of the Impact of Global Financial Crisis on European Markets

Factors	Before Crisis (Jan, 2001 - July, 2007)	After Crisis (August, 2007- December, 2013)
Factor 1	Belgium, Finland, France, Italy, Netherlands, Spain, France, Switzerland	Austria, Belgium, Finland, Italy, Netherland, Switzerland
Factor 2	Germany, Greece, UK	Germany, Greece, UK
Factor 3	Finland, Turkey	Spain
Factor 4	Austria	Russia
Factor 5	Russia	Turkey

Summary of the results presented in Table 13 shows that integration among Asian Markets remained same to a greater extent in pre-and post-crisis. Before crisis, their movement is found in three different clusters, but after crisis their movement is confined in two clusters. Stock markets presented by factor one are similar in pre- and post-crisis except France which got separated from the market of this factor. Market in factor two remained unchanged and co-movement of Finland and Turkey was found before crisis

which cannot be continue after crisis. Finland has changed its co-movement from Turkey and moved into the factor one markets. Therefore, it can be concluded that co-movement of European market is not display any vital change in both periods.

There is strong correlation exist, having value more than 0.80, between some of the World markets. It's suggested that multi-collinearity should be considered if correlation between two variables is more than 0.80. We have checked and find no multi-collinearity between two markets because all the values of VIF (Variance Inflation Factor) are less than 10 or even less than 5 which shows strong evidence for no multi-colinearity (Neter, Wasserman, and Kutner, 1989; Hair, Anderson, Tatham, & Black, 1995) Furthermore, all the values of tolerance level are less than 0.10 recommended by Cohen et al., (2003).

6. Discussion and Practical Implications

"Diversification can help reduce portfolio risk" was the base for this study. Due to the imperfect correlation among international markets, it is possible that, risk that is systematic in one market might unsystematic in other economy or global market. Emerging markets are usually less informally efficient, less liquid and more volatile as compared to the developed markets along with many institutional and structural differences. Therefore, generous diversification benefits can be obtained by the investors in developed markets over emerging markets. At the same time, recent studies have identified that by investing in the emerging markets investors can diversify their risks (Yang, Lee and Shi, 2014; Guidi and Ugur, 2014). Thus, it has become essential to understand the global movement of stock markets to reduce the investor's risks. Keeping this in mind the current study is divided into further three studies: study 1(Asian markets); study 2 (American markets); study 3 (European markets).

Developing countries' economies are not well diversified as compared to the economies of developed countries and fewer financial products have made the emerging markets less mature. In addition, some of the restrictions like over-weighting and short selling which distort the investors' decision of investment. As a result, purely domestic investments in emerging markets are largely mean-variance inefficient. Because of this, researchers have investigated the investors' benefits in emergent markets like Asia (Yang, Lee and Shi, 2014). Asian Markets' comparative results revealed that co-movement of developed equity markets of this region remained similar in both pre-crisis and post crisis periods. Therefore, investors of these markets should diversify their portfolios into emerging markets to earn the arbitrage benefits. Pacific Asian investors should move their investment into south-Asian countries. Comparing the results of this study with Hui (2005), the co-movement among Asian pacific markets have been increased significantly, but Asean-5 countries have emerged into separate cluster except Singapore. However, developed countries investors should actualize their investment in Asean-5 countries.

In Study two, the co-movement of American markets is analysed and a positive co-integration is shown post-crisis period by emerging markets of Brazil and Canada. Specifically, it is revealed that US investors are not jumping into less developed equity markets of this region because the co-movement among US markets and emerging American are clustered into a low degree of co-movement. Solink (1974) commented that US investors can eliminate almost half of their portfolio risks by diversifying their investment in European and US markets rather only to invest in US markets. Favouring the same, Lessard (1974) avowed that diversifying in international markets benefit in reducing risks. According to Harvey (1995), US investors can reduce their risks up to 6 percent by investing in emerging markets as there exists low correlation between developed and emerging markets. Therefore, US investors should divert their interest into developing markets vis-a-vis less developing markets and try to investigate the real investment opportunities. Furthermore, results envisaged the impact of global financial crisis in this region and co-integration is increased among the equity markets.

Study 3 encompassed the analysis of equity markets from Euro area markets. A plausible shift in investment is visualized in results by upturning of a new block of co-movement among UK, Belgium, Netherlands and Austria. This tendency indicates that investors initiated to pull out their investments from countries that are concurrently under financial distress. In a most recent study, Guidi and Ugur (2014) noted that there exists a weak cointegration between SEE markets (i.e. Romania and Turkey etc.) and developed markets of UK and Germany. That is why most of the European investors (i.e. UK and Germany) are extracting their investments from the countries under crisis. In addition to this they further commented that this investment might not be helpful for those investors who want to invest for short term period. Therefore, the study suggests that European investors should invest for long term or make inter regional investment portfolio specifically in Middle East countries or MENA countries as well as in Russian emerging states.

7. Limitations of the Study

This research split the data into three regions: Asia, Europe and Americas. Therefore, analyses is helpful in regional prospective in the better way rather than global prospective. The analysis is not presenting a broad platform of guidance for investors. The regional connectivity is not focused in the study. However, study is supportive for regional investors and global inventor can derive some practical updated information about regional investment activities. For future research, it is suggested that a comprehensive study should be conducted using thorough data of equity markets in global prospective.

8. Conclusion

Factor analysis is a technique that can be applied to select stock markets for portfolio investment to avoid market specific systemic risk. The objective of the paper was to investigate the impact of Global Financial Crises on the co-movement of Asian, European and American Markets. For the purpose of analysis, 33 major equity markets were classified into three regional groups (Asian, European and American Markets). Rotated Factor Analysis technique was applied on all three groups and the behavior of

these markets was investigated before and after the Global Financial Crises periods in the context their co-movement. Results show that Asian and American Markets documented a strong linear association before and after financial crises but the behavior of European markets were changed in terms of their co-movements and an additional cluster was built among Netherlands, Austria, Belgium and UK equity markets. Hence, the co-integration among remained similar in both periods. Only UK and Austria changed their cluster and joined a new cluster with Netherlands and Belgium. However, European regional investors can diversify their investment risk by revising their investment portfolio. They should diversify their investment into both distinct clusters. In case of American and Asian market, no major change is highlighted before and after crisis periods. It is suggested that regional investors of American and Asian markets should investigate the new insights inter-regional markets. Furthermore, European regional investors should extent their investment portfolio by adding new investment proportion from American as well as Asian markets.

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