Who is the Net Sender of Mean and Volatility Spillover in Emerging Equity Markets

by

Muhammad Hassan

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To my beloved parents, brother and sisters

CAPITAL UNIVERSITY OF SCIENCE & TECHNOLOGY

ISLAMABAD

CERTIFICATE OF APPROVAL

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Abstract

The prime objective of the study is to provide an evidence of transmission of volatility among BRICS countries Brazil, Russia, India, China, South Africa including Pakistan during the period from July 1st, 2000 to June 30, 2017. The reason for selecting of these equity stock markets is due to its rapidly emerging growth. For this purpose, daily stock returns of respective countries are examined by applying VAR model ARCH family model to explore the means and volatility spillover effect. Results show confirmed that the net sender is U.S market Results also shows that autocorrelation and heteroskdasticity exist except South African market it means ARCH (1) model can't apply on South African market. So, in this study, we also founds that there is no evidence of volatility transmission between U.S and South Africa. Correlation matric indicate that there is weak correlation among the variables. Unit root test has been applied for stationary of data and it has been found that all series were found integrated at first difference.

Johansen and Juselius co-integration test is applied to explore the long and short run relationship. Results also confirmed the same phenomena of stationary. The short term dynamics between stock market is tested by using Vector Error Correction (VEC). Granger Causality test is used for lead lag relationship between stock markets. Moreover asymmetric information is also exist which indicates that good and bad news have different impact on volatility means good news has less as compare to bad news.

Keywords: Volatility Spillover, Co-integration test, Victor Error Correction, Granger Causality.

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Abbreviations

AIC	Akaike Information Criterion
ADF	Augmented Dickey Fuller
BSE	Bombay Stock Exchange
BRICS	Brazil, Russia, India, China, South Africa
ECT	Error Correction Term
FPE	Final prediction error
JSE	Johannesburg Stock Exchange
MCX	Moscow Interbank Currency Exchange
MSCIE	Morgan Stanley Capital International Emerging
MSCI	Morgan Stanley Capital International
PSX	Pakistan Stock Exchange
PP	Phillips Perron
SSE	Shanghai Stock Exchange
SC	Schwarz information criterion
U.S	United States of America
VAR	Vector Error Correction

Chapter 1

Introduction

Mean and volatility spillover among different countries have been emerged an important domain for discussion in finance, academics and policy makers for thirty years. During the last three decades emerging economies have rapidly expended and equity markets played an important contribution in the development of economy. As world has become global village and financial liberalization have enabled emerging equity market to become more correlated and efficient (Zhou, Zhang and Zhang, 2012). Literature postulates that it is assessed that there is a high degrees of financial connection between the Global, U.S and developing equity market. Information spillover between markets can be estimated through means return and volatility. So the information transmission between markets is not only based on average return but also on shocks (Tauchen and Pitts 1983).

The essential idea of "market efficiency" is pretend to comprehend the working of stock market. Fama and French discussed the idea of market efficiency in 1970. As state that stock prices can't be forecasted efficiently because stock market is more sufficient and prices fully reflects all the available information, so there is less chances of earn abnormal gain. Market efficiency means that prices reflect to the arrival of new information and leads to affect the current prices of stock. Market Efficiency further divided in three categories, weak form market efficiency, semi-strong form market efficiency and strong form market efficiency assumes that current stock prices fully reflects historical information and on the basis of these information nobody can earn abnormal profit. Here historical stock prices mean

previous year stock prices and trading volume. This simply implies that past return has no relationship with coming year's returns are independent. Semi strong market efficiency deals with public information and if this information available with everyone then nobody can earn abnormal return. Abnormal gain can be achieved on the basis of more information. Strong form efficiency can be defined as private information. This assumes that current stock prices reflect to the available private information. This is an investment theory which deals that it is impossible for companies to set prices of cost of capital, so market will set the prices and companies must follow it.

Emerging markets are more attractive and investors explore emerging markets for the reason of high returns, as they often faster economic growth as measured by gross domestic product. Investors are more interested to make an investment in emerging economies because they offer high returns. Investment in developing equity markets comes with greater level of risk due to volatility in micro economic factors likes political instability, interest and inflation rates etc. With the passage of time, world market become interconnected and more efficient due to the information spillover from one market to another market .It has been also mentioned that US stock market is the most effective market in the global, in transmitting shocks to other markets in clear movements. So U.S is accepted as world major financial market which is considered financial leader in the context of information. Country risk level is also based on volatility and when volatility of a country equity market increase, the risk of the investor of that country naturally increase, due to this, some of the investors are likely to reduce their position to make an investment in this market (Engle, Gallo, Velucchi, 2012).

The reason for the expansion can follow new information on the benefit of the local ventures. Countries that are connected to this region through trade or other economic relations may discover their equity markets disturb also. The world index returns, and in all probability the US equity market returns, have a significant impact upon the variance of return is seen all over Brazil, Russia and India (Nikolova, 2007). International financial market integration has significantly expanded in the course of the most recent two decades. Distinctive components

have added to this observed globalization, including the execution of policies favoring financial related market deregulation, the advancement of new exchanging innovations, and the enthusiasm of worldwide speculators in the enhancing their financial portfolios in world resources markets. Money related reconciliation can conceivably yield many advantages for market participants and even countries.

The study is essentially inspired by some reasons: Firstly, the vast majority of the investigations that look at the mean and volatility spillover over worldwide stock, bond or commodity markets concentrate for the most part on market in the U.S, Japan and European countries while little attention is paid to emerging markets excluding South Africa and Pakistan .The emerging markets including South Africa. Pakistan has appreciated amazingly in previous three decades and increasing expanding impact on the world equity markets.

Generally literature provides evidence of dynamic spillover between the market as become more interdependent with fever arbitrage opportunity due to high flow of information (Savva, Osborn and Gill, 2009). This study focuses on measuring the impact of mean and volatility overflows of world index, U.S stock index to six emerging markets. The mean and volatility effects thus, are markers of the level of integration exhibited by these countries on a worldwide premise.

Volatility phenomena occurs between the two markets, however this study focuses on global and U.S to six emerging markets i.e. Brazil , Russia, India , China, South Africa and Pakistan, with the aim to analyses the level of integration due to globalization and internationalization. Internationalization is important for diversification. Literature supports that if countries stocks returns are not profoundly connected at that point there are no significant level of volatility overflow impacts and portfolios can be enhanced globally for the reason to minimize risk without affecting returns. However, if countries returns are highly correlated then it leads to small gain from diversification.

Mensi, et al, (2013) stats that emerging economies has developed at a fast pace and for expanding more attractive investment from foreign developed markets. Several studies like Liu et al. (2007) also explain that South Africa group has also a rapid dynamic economy, having a lot of exposure rapid financial market development.

The motivation behind this study is to investigate the mean and volatility spillover impact from the U.S and world equity market to emerging equity markets. All markets have U.S as one of their trading partner.

1.1 Supporting Theories

1.1.1 Efficient Market Hypothesis (EMH)

Existing literature postulates that volatility is mostly concerned with market information and transfer of information leads to volatility spillover. Efficient market hypothesis (EMH) state that stock market is reflects all available market information and supply and demand forces and due to this information current stock prices will effected. The market is efficient and more volatile where the market players act on market information. However literature supports that markets do move together, yet there is incomplete evidence as which market is the most powerful and which drives rest of the world.

Interdependence of stock market and volatility spillover across market is based on making efficient portfolio diversification. For this purpose, the study exploring the integration and volatility spillover of global equity index, U.S equity index on emerging markets.

1.2 Overview of Stock Markets

A brief overview of the markets examined is given below.

1.2.1 United States of America Stock Exchange

The main stock exchange of United States is New York Stock Exchange (NYSE) which is formally organized in 1817. It has 2800 listed no listed companies with market capitalization is $18,486 billion.

Major indices are:

- Dow Jones Industrial normal

- NYSE composite

- Standard and Poor (S&P500)

1.2.2   World Index

World indices previously Morgan Stanley Capital International (MSCI) is a market top weighted securities exchange list of 1656 world stocks kept up by MSCI Incorporation. It comprises of all the around developed market on the world as perceived by MSCI. This index incorporates securities from 23 countries barring emerging index. The MSCI index has been ascertained in 1969 in different form on the premise of price index, net or gross profit reinvestment, net and gross index in U.S dollars, Euro and local currencies.

1.2.3   Emerging Index

Emerging countries index is made by MSCI at first time to quantify equity market execution in worldwide developing market. It has formally initiated in 1988 with total capitalization of less than 1%. It is consist in 23 emerging economies. Emerging markets are more risky due to high return and high volatility. As such they also pay role in portfolio diversification and reduce overall risk.

1.2.4   Brazil Stock Exchange

Brazilian Stock Exchange symbol (Bovespa) is the largest stock exchange. It is located in South America and its headquarters is Sao Paulo. Its market capitalization is $837.77 billion.

1.2.5   Russian Stock Exchange

Russian Stock Exchange (MCX) was built up in 2011 with the emerging of two biggest exchanges the Moscow Interbank Currency Exchange (MICEX) and Russian Trading System (RTS). The trade begins its first sale of stock (IPO) in 2013.

1.2.6   India Stock Exchange

Bombay Stock Exchange (BSE) is world eleventh biggest stock trade with market capitalization is \$2 trillion in July, 2017 and more than 5500 companies publicly listed in BSE. BSA and NSE represent just 4% of Indian economy.

1.2.7   China Stock Exchange

In china there are two primary stock exchanges to be specific as Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE). Shenzhen Stock Exchange. Shanghai Stock Exchange is the world's 5th largest stock market by market capitalization at US \$3.5 trillion.

1.2.8   Pakistan Stock Exchange

Pakistan has three stock exchanges. Karachi Stock Exchange (KSE), Islamabad Stock Exchange (ISE) and Lahore Stock Exchange (LSE). Karachi stock exchange (KSE) is considered as representative national stock exchange that started working in 1949. The stock exchange merged and renamed as Pakistan Stock exchange in 2015. Total companies listed in Pakistan Stock Exchange are 568.

Karachi Stock Exchange renamed as Pakistan stock exchange (PSX) for the reason of capture the long term behavior of the market. Total companies listed in Pakistan stock exchange are 568.At first there are three stock exchanges in Pakistan to be specific Out of these stock exchanges, Karachi stock exchanges is dominating as far as volume, performance and no of companies listed in stock exchange.

1.2.9   South African Stock Exchange

The Johannesburg Stock Exchange (JSE) is an efficient primary and secondary market. Currently JSE is 19th largest stock exchange in capitalization in the world. The JSE is the formed in 1887.

1.3   Research Problem

Empirical literature provides that over the period of time it is observed that stock markets are integrated due to the reasons of globalization and financial liberalization.

So globalization and financial liberalization are empowering worldwide financial markets more correlated and this linkage among different equity markets is significant for financial specialists (Zhou, Zhang, Zhang, 2012). In addition to exploring the volatility spillover toward emerging market. We also examine magnitudes and directional volatility spillover from Global, U.S equity market to emerging equity market.

1.4   Research Question

With the passage of time, world equity market have become interconnected due to the flow of information from one market to the other market. World major information market is U.S which is considered as financial leader in the context of information. Similarly and global and regional markets also disseminate information that may have impact on regionally as well as globally. This situation rising following questions.

(01) Does global market influence the return and volatility of emerging equity market?

(02) Does U.s market inflow the return and volatility of emerging market?

(03) Does emerging market influence the return and volatility of BRICS markets?

1.5   Research Objectives

The prime objective of the study is to explain the flow of volatility from U.S and global to emerging markets. More specifically the objective of the study are:

 i. To examine the mean and volatility spillover from Global equity market to emerging markets.

 ii. To measure the mean and volatility spillover from U.S equity market to emerging markets.

1.6   Significance of the Study

This study employs a new spillover directional measure proposed by Diebold and Yilmaz, (2012). World financial markets are subject to each other, so the spillover from one market is transmitted to other market. Singh, Kumar, and Pandey (2010) contend that if two markets are integrated then any shocks of one market will influence mean and volatility of other market. The study reports regional markets have volatility spillover in emerging markets. For market participant and policymakers, the study findings provide pivotal information about volatility flows in emerging equity markets.

Whatever rest of the study is arranged as under: chapter II fundamentally covers the literature regarding the subject. Chapter III provides data description and methodology which contains the econometric model and section IV deals with discussion, limitation and future direction while chapter 5 conclusion of the study.

Chapter 2

Literature Review

Empirical studies of return- volatility behavior conduct are ample for developed stock market, the focus on developing and emerging stock market has started in recent days. The interest for these rising markets has emerged from the expanded globalization and integration of the world economies in general and that of the financial markets in specifically. The globalization and integration of these markets has made tremendous opportunity for global and regional investors to diversify their baskets of portfolios over the world.

A huge number of studies have been done to examine the means and volatility spillover behavior across the markets but emerging equity market still become more important regime due interrelationship of globalization, integration and financial Mensi, Hammoudeh, Carlos, Nguyen (2014) finds that emerging economies have become more internationally integrated. Interest in the integration of emerging equity market have produced in the wake of perusing a lot of work here, studies for example, Liu and Pan, (2007) concentrate on means and volatility overflow impact in the U.S and pacific basin stock market and the principle center of premium is relationships all over market, (Engle, Gallo, and Velucchi, 2012). Wang et al, (2016) using spillover index approach, explore volatility spillover across China's stock, commodity future and foreign trade market amid the time of 2005-2015. The study found that these four money related markets are feebly integrated. The equity market is the biggest sender of volatility overflow to different markets. U.S

market is more efficient than the worldwide market in transmitting returns and volatility spillover to the six developing countries (Liu, Ming-Shiun Pan 2009).

The financial position of the emerging markets have developed at a quick pace and ending up more incorporated in term of trade and investment. Studies also postulates that economies of the emerging markets are quickly developed and that by the year 2050 theses emerging markets will beat a large portion of the world richest nations (Bhar and Nikolova, 2007). And this will depend upon the emerging economies policies regarding trade. In addition, literature also shows that increase in the level of relationship of developing markets of equity return comes back with equity returns in the developed economies reduction in the diversification benefits (Bhar and Nikolova, 2007).

Volatility spillover is basically financial shocks from one market to another or transmission of information among the market and such shocks have been analyzed in different region of Europe, Asia and American. Empirical studies also postulates that volatility is based on correlation of return and if returns are highly correlated, it means spillover exist and vice versa. Global equity market returns, and in all probability the US equity market returns, have a critical impact upon the difference of profits seen across Brazil, Russia and India. China, South Africa and Pakistan. Using the spillover approach proposed by Diebold and Yilmaz (2012), measures both aggregate and directional volatility overflows. For this reason, the study use U.S stock, security, foreign trade and commodity market as assets classes with sample from January 1999 to January 2010. It discovered a huge volatility in these four markets during the time period.

Jiang, Stanley, (2016) uses the world equity index return, U.S equity index return and mean volatility spillover effect on six emerging market, including Pakistan, in order to explain the integration of these stock markets within their respective region. The study investigates volatility spillovers over the six markets and looks at the directional volatility overflows from or to a specific market. It also examine the net volatility overflows of each market and between each combine of markets to figure out which market is the net sender of volatility spillover on emerging equity market Gamba, et al, (2017) applies the approaches of evaluating the spillover

proposed by Diebold and Yilmaz to examine the reliance of volatilities of three basic series. These are world equity market, U.S equity market and emerging equity market. It demonstrates that when instability of a nation equity index rise, the risk to financial specialist in that nation normally increase and reduce their position (Engle, Gallo, and Marguerite, (2014). Maybe a standout amongst the most notable highlights of late financial has been the event of volatility overflow. The reality has persuaded the development of a substantial literature on financial co-integration and volatility transmission.

Mensi, Hammoudeh, Carlos, Nguyen (2014) analyzes the information transmission of worldwide market to BRICS (Brazil, Russia, India, China South Africa. Gilenko and Fedorova (2014) study the flows from international stock market amid, previously, then after the financial crises in BRIC countries. Moreover, the study propose that financial integration exists between rising countries previously and amid crises and gives the evidence that advanced markets impact the less advance markets rot after some time and support the spread the phenomena. This study inspects the reliance structure between the emerging equity markets of the BRICS countries.

Among the political, monetary and financial crises disturbs the world, the BRICS countries (Brazil, Russia, India, China and South Africa) show up as main stays of relative political soundness and financial prosperity. These nations exhibits political security and governments fit to do proclaimed projects and ready to remain in office. The monetary qualities exceed their shortcomings, showing moderately sensible financial risk.

There exists a tremendous literature on modeling and assessing total stock market volatility over the previous decade Choudhry (1996); Mecagni and Sourial (1999) and Kabir, et al. (2000).

Various values at risk models for measuring market risk require the measuring of unpredictability parameter. Portfolio diversification and supporting frameworks moreover require data on volatility as key information. Unpredictability is characterized as presenting some things of the benefits cost to switch either up or down. It is appeared that when stock markets demonstrate extended unpredictability

there is prosperity on part of the financial experts/financial specialist to lose confidence in the market and they tend to leave the market. The relation between instability what's increasingly, financial nuts/ and bolts is a debatable issue. Stock prices reflect information and speedier they are in holding decisively new information; more effective is the share trading system in apportioning resources. The upward move in volatility can be attributed to ingestion of new news about financial fundamentals or a couple of assumptions about them. This kind of instability isn't unsafe as there is no social cost related with it. However, if instability isn't illuminated by the level exhibited by the fundamental financial factors, there is a chance that stocks will be mispriced and this will prompt misallocation of benefits (Karmaka, 2006).

Integration of financial markets across countries has adjusted the way prices respond to news. Innovations beginning in one market diffuse to different markets following behavior which more often pressure the existence of relationship (Gallo, Otranto, 2006). Next to enhancing market efficiency, a conceivable impact is that the degree for worldwide diversification has diminished. In the cases we need to model, the transmission volatility begins from a "prevailing" market with a shock which is transmitted to alternate markets: as an impact they will show comparative spillover reactions.

Market efficiency theories clarify that in an efficient market stock price completely reflect accessible information. Market efficiency is characterized at three distinct levels. These three levels of EMH are disclosed as: weak form, semi-strong and strong form. Weak form of EMH affirms economic resources which effects all information obtained in the past prices. Semi-strong forms explain that prices affect all the openly accessible information. Finally, a strong set of efficiency that prices reflects all information on historical and private information, Fama (1970, 1991).

The implications of discovering co-integration for the Market Efficiency are indistinct. In the event that prices share a typical pattern in long run, this infers consistency of prices movement, which demonstrates that one market might be caused by different markets and consequently this will leads to inefficiency exists.

However, Dwyer and Wallace (1992), and Masih and Masih (2002) contend that the co-integration does not infer anything about effectiveness. Masih and Masih (2002) propose that consistency, recommended by co-integration, suggests that nothing about inefficiency. A market is inefficient just if by using consistency, financial specialists can procure risk adjustment abnormal returns.

The study is basically employs a new spillover dimension which is measured by (Diebold and Yilmaz, 2012) to analyses the volatility spillover of global, U.S equity market and their influence on emerging equity markets during the period (2000 - 2017). For this purpose, It employ Diebold and Yilmaz [2012], Liu, Pan and Bhar, (2007) and construct volatility spillover indexes using GARCH family model and VAR approach to examine the mean and volatility among equity market. This technique allows us a better understanding of return movements and volatility spillovers.

Global financial markets are related. News influencing value esteems in a single market may likewise change the essentials in equity markets if the organizations are adequately multinational in association or capacity. Such changes ought to happen all the while around the world with business sectors shut at that hour showing the change after opening. Since many markets exchange a significant number of similar resources, news influencing the benefits exchanged on one market ought to quite often have consequences for different markets. Engle et al. (1990,1992). This study is used to explore the means and volatility flow from Global, U.S equity market to six emerging equity market. There are some important studies which address either developing equity markets integration or not.

Eun and Shim, (1989) reports that there exists a significant relationship among the National securities exchanges. His research explores nine national stock markets of European countries. To capture the relationship and it applies VAR approach and founds that US market is the most efficient has impacts on different markets.

Kasa (1992) explore the relationship between equity markets of USA, Japan, England, Germany and Canada and found that there exist long run relationships among these equity markets. This, study applies co-integrated method. Choudhury (1997) examine the association among six Latin American Nations by using

data of eight years and found Long run relationship by adopting co-integrated analyses. In addition, granger causality techniques identify the causal relationship.

Masih and Masih, (1997) find out dynamic linkages among eight countries and used daily stock prices, which incorporates of developed markets of US, UK, Germany, Japan and four Asian developing markets Malaysia, Thailand, Singapore, Hong Kong data for 1992 to 1997 by apply VEC model, VAR model and Variance Decomposition, Results confirm the existence of co-integration among these countries. Bae, Zhang, (2014) state that stock market are more explained towards worldwide markets experience bigger price drops amid the 2008 financial crises.

Narayan, and Smyth (2003) study on four south Asian countries. Bangladesh, India, Pakistan and Srilanka by using daily data for the period, 1995 to 2001. For data analysis, various measurement like measure of central tendency, measure of dispersion, Variance Decomposition Analysis used and it is observed that in long run, stock prices in Bangladesh, Sri Lanka and India has cause and effect relation with stock price in Pakistan. In short run, Stock price in Pakistan cause and effects stock price in Sri Lanka and India, Bangladesh is exogenous having less connection because of its little size and market capitalization.

Lamba (2005) provides the existence of long run association between South Asian developing markets and advanced markets during the period of 1997 to 2003 by applying co-integration technique. Statistical outcomes show that equity markets of US, UK and Japan which has impact on Indian stock market. Additionally it found that the stock exchange of Pakistan and Sri Lanka are not influenced by the securities exchanges of developed nations in the midst of the whole time span. Moreover it is seen that the three South Asian stock exchanges are integrated with each other in moderate way.

Moreover long run association among stock equity markets of United Kingdom, United States of America, and Canada is examined by Kazi (2008). The study used yearly data for the period - 1945 to 2002 and test the stationarity and cause and effects relationship. To test the long run relationship, co-integration techniques is used. Outcomes show the existence of such relationship among these markets.

Hasan, Saleem and Abdullah (2008) explore the dynamic linkage of Pakistan stock market with the 9 developed equity markets of USA, and European countries by using weekly data during 2000-2006. Data id tested through Johansen and Juselius approach. It is found that Pakistani Equity market doesn't associated with these equity markets. However, the UK and USA stock market have little effect on Pakistan equity market. Bastos and Caiado (2010), investigate the integration among the worldwide equity market of 46 countries. This investigation look at the relationship of equity market returns from the period 1995 and 2009. The study analyze the association between the stock returns of developed and emerging nations. The data is taken for three distinct periods to look at whether association expanded after some time or not and show that association among emerging and developed nations markets is expanding after over time.

The real implication of the findings is that stock markets are co-integrated that potentially increase benefits via abnormal gain in foreign portfolio diversification. This is account for the market co-integration, abnormal benefits created through arbitraged away over the long term without obstructions or potential boundaries creating country risk conversion rate premiums. Moreover, if market is not co-integrated, there is no arbitrage movement in the market over the long run. In these situations there is potential for financial specialists to acquire long-run gain via worldwide portfolio diversification (Masih and Masih, 1997).

Empirical literature provides that U.S market is dominant in financial market. In last three decades market integration in emerging economies has increased due to financial free market of capital movement and market deregulation. However, the influence of Chinese market in this region is not much explored volatility and South Asian markets offer bright prospects for Chinese.

Cha and Oh (2000) analyze the association of US, Japan equity markets with the developing markets of Hong Kong, Korea, Singapore and Taiwan. The study found the co-movement between these markets. It further reports that after the financial crises of 1987 co-movement among these markets increased.

Different studies like Mensi, Hammoudeh, Reboredo, Nguyen (2014) analyze reliance that BRICS countries stock market return on world market, presented by

the S&P500.It reports the positive premium effect of BRICS countries returns before and after financial crises. In addition, the reliance is observed to be asymmetric in the tails of the return distribution where Russia, India and South Africa show both upper tail dependency and lower tail independence earlier and since the beginning of the financial crises. In the other side, Brazil and China demonstrate symmetric tail reliance also with respect to the worldwide stock market. By and large, the BRICS stock markets co-move with the world stock markets when the market is bullish markets, while they are autonomous when the market is bearish, except for Brazil. This proof of tail reliance suggests that BRICS stock markets are helpful for world financial specialists in bearish markets.

Wang et al. (2013) inspect the dynamics of correlation of U.S. market and ten other securities markets, while include South Korea, Thailand, Philippines, Taiwan, and Malaysia. The researcher demonstrates distinctive pattern of U.S. financial crises spillover on their markets.

The outside and the inner side spillover of the BRIC stock markets is analyzed by Gilenko and Fedorova (2014) by apply four-dimensional BEKK-GARCH-in-mean approach. During the pre-crises, some slacked intend to-mean spillover between the BRICS stocks markets. This study found that association between the advanced economies and emerging BRICS economies have significantly changed after the world crises.

Kasa (1992) founds that there is a single normal pattern driving the stock market of Canada, Germany, Japan, the UK and the USA. However, the literature which tests for integration purely between developing markets is moderately sparse Chen et al. (2002; Ng, 2002).

The present articles have added some small published material on interdependencies in developing markets through establishing stock market linkages in South Asian Region, during the year period 1995- 2001. It examine financial shocks between the series of global, U.S. to emerging countries i.e. Brazil, Russia, India, China, South Africa and Pakistan. For this, the study apply different econometrics methods like unit root approach, VAR approach and cause and effects approach, To examine the presence of any long-run connections, the study applies co-integration

approach and additionally stretch out the Granger causality examination to test the impulse response function.

H1: There is mean volatility spillover from U.S stock market to emerging equity markets.

H2: There is mean and volatility spillover from global market to emerging equity market.

Chapter 3

Methodology

3.1 Data Description

There are many techniques available to check the long and short run connection between the series. The long run association between different stocks is checked by using stock co. integration of different stock markets. The data comprises of daily equity return July 1st, 2000 to June 30, 2017. The stock markets indices are as follows:

Countries	Indices
World Index	Morgan Stanley Capital International(MSCI)
United States of America	Standard & Poor 500 index (S&P500)
Brazil	Bolsa de Valores do Estado de So Paulo(BVSP)
Russia	Moscow Interbank Exchange (MCX)
India	Bombay Stock Exchange (BSE)
China	Shanghai Stock Exchange (SSE)
South Africa	Johannesburg stock exchange(JSE)
Pakistan	Pakistan Stock Exchange (PSX)

Daily index return is calculated as,

$$\text{Daily Index Return} = \ln\left(\frac{P_t}{P_{t-1}}\right) \tag{3.1}$$

Where, ln is natural logarithm, P_t present day index price and P_{t-1} is last day price.

3.2 Econometric Methodology

This study use GARCH family approach to investigate the mean and volatility spillover among emerging equity markets. If apply ARMA - GARCH (1,1)-in-mean model or its variant as follows:

$$r_{i,t} = \phi_{i,0} + \phi_{i,1}r_{i,t} + \phi_{i,2}v_{i,t} + \phi_{i,3}\varepsilon_{i,t-1} + \varepsilon_{i,t} \tag{3.2}$$

$$v_{i,t} = \alpha_{i,0} + \alpha_{i,1}v_{i,t-1} + \alpha_{i,2}\varepsilon_{i,t-1} \tag{3.3}$$

Where, first equation is mean equation and second is volatility equation.

$r_{i,t}$ is the daily return of equity market i at time t,

$\varphi_{i,1}r_{i,t}$ Auto regressive term which tells us about past value has an effect on current value, $\varphi_{i,2}v_{i,t}$ is volatility effect means volatility has an association with return or not, $\varphi_{i,3}\varepsilon_{i,t-1}$ is moving average term which tells us about shocks. $\varepsilon_{i,t}$ is the residual which is normally distributed, and time varying variance, $v_{i,t}$. Each stock index return series is modeled as an ARCH (1,1) model in the mean equation to adjust for possible serial correlation in the data.

In second phase, mean and volatility spillover effects across the markets are estimated by obtaining the standardized residual and its square in the first stage and substituting them into other markets as follows:

$$r_{j,t} = \phi_{i,0} + \phi_{i,1}r_{j,t-1} + \phi_{j,2}v_{j,t} + \phi_{i,3}\varepsilon_{j,t-1} + \varepsilon_{i,t}\lambda_{i,2}e_{t,i} + \varepsilon_{i,t} \tag{3.4}$$

$$v_{j,t} = \alpha_{i,0} + \alpha_{j,1}v_{i,t-1} + \alpha_{j,2}\varepsilon_{i,t-1}^2 + \gamma_{j,1}e_{i,t-1}^2 \tag{3.5}$$

Where $e_{i,t}$ is the standardized residual series for the U.S or global markets, respectively for capturing the mean and volatility spillover effect from these two markets to BRICS countries. In order to examine the volatility spillover, the exogenous variable $e_{i,t}^2$ the square of the standardized residual series are included in the equation.

For data analyzes, following econometric approaches used.

- Descriptive statistics approach

- Correlation Matrix approach

- Mean and volatility spillover effect

- Unit root and co-integration analysis

- Vector Error correction model

- Impulse Response method

- Variance decomposition test

- Granger Causality techniques

3.2.1   Description Statistics

The study explain the statistical behavior by using of Mean, Median, minimum and maximum value in the data. For values in data, the values in Skewness, Kurtosis and variance along with Jarque-Bera are considered. Measure of dispersion i.e. Standard Deviation explain the stocks volatility of the data that how much returns deviate from means. Skewness explains either positive or negatively distributed. Kurtosis represents the flatness or peakness of the data and Jarque -Bera reports.

3.2.2   Correlation Matrix

Correlation matrix basically tells us about statistical relationship among the variables. It may be positive, negative or no relationship. Highly correlation may leads to multicolinarity in the data. However this is weaker technique due to explore the relationship and does not capture the lead lag phenomena. To consider this phenomenon, Co-integration and Granger Causality techniques are used.

3.2.3   Unit Root Test

Before applying (VAR) model it is required that all series should be stationary at same order. Stationary of data can be confirmed by using unit root test. Two types of test are used for stationarity. One is (ADF) test and second is (PPT). Phillip Peron Test is considered to be stronger test which has been used to support ADF test in fulfill the assumption of ADF. These two techniques have been applied in this study to check the stationary of global, U.S and six emerging equity markets.

3.2.4   Johnson and Juselius Con-Integration Test

Con-integration approach carried out to know that all series should be integrated in same order otherwise ARDL approach is preferable. It tells us about the long run relationship and also explores the co-movement among the series. Con-integration analyses do not explain cause and effect relationship.

3.2.5   Granger Causality Test

Co-integration technique is used to explain the long run relationship between the series. It does not consider lead lag association. Granger causality deals with cause relationship where on variable lead and other (which moves first and which follow) variable follow it. If series are no integrated it means no lag lead relationship exist among the series. If one variable is significant then unidirectional causality

relationship exists means that flow of information among the markets. If this relationship from both markets it means both the markets transmitting information. Granger Causality is used to predict future return based on past data.

3.2.6 Impulse Response

Impulse response tells us about variation in the series. It provides that how the creation of one series. It examines the shocks in its own markets and other market innovation. Impulses are show in graphically.

3.2.7 Variance Decomposition Approach

It explains the decomposition of variance and internal dynamics of volatility between different series. In the other word, it can be defined as decomposition of variance due to variation in same series or other series in previous days. It also explain the proportion other variable variance in the same variables.

3.2.8 Vector Error Correction Model

The model has a place with a class of different time series model which has been most ordinarily used for long-run stochastic pattern, also named as co-integration. It determines both short and long run impacts between the series.

Chapter 4

Results and Discussion

4.1 Descriptive Statistics Test

The statistical behavior of the data is explained by using descriptive statistics.

TABLE 4.1: Descriptive statistics of equity stock market.

	Mean	Median	Max	Min	Std. Dev	Skewness	Kurtosis	J-Bera
S&P500	0.000425	0.000145	0.038291	-0.04021	0.007710	-0.30302	5.413304	365.5458
MSCI	0.000815	0.000756	0.075660	-0.31237	0.015477	-5.69334	121.2554	833313.7
MSCIE	9.61E-07	0.000272	0.033234	-0.05128	0.008836	-0.24347	5.067435	266.3603
SSE	0.000215	0.000000	0.056036	-0.08873	0.014293	-1.17744	0.65718	3789.143
BSE	0.000404	0.000000	0.037035	-0.06120	0.008997	-0.30542	5.777844	477.6202
JSE	0.001943	0.000000	0.788877	-0.0612	0.039919	11.22027	191.6044	2129931
BVSP	-2.29E-05	0.000000	0.063887	-0.09211	0.014374	-0.02451	4.897974	212.828
PSX	0.000959	0.000526	0.044186	-0.04558	0.008328	-0.41432	6.552152	785.514
MCX	0.000251	0.000000	0.051218	-0.11419	0.01171	-0.58582	10.26442	3196.763

Table 4.1 reports the result of descriptive statistics of daily returns of stock markets during the period July 1st, 2000 to June, 30. Average daily return of JSE stock markets is 0.19% which is higher in market standard. Results reveal that mean returns of all markets are positive except Brazil stock market. Standard deviation of South Africa is empirically results shows that South African market is high risk and high return market. American market has minimum standard deviation of 0.7% which reflects that S&P500 stock market has less volatile in comparison to other emerging equity markets. Further results indicates that returns of emerging

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markets has negatively skewed, which shows large negative returns except South African stock market is positively skewed. Last one is kurtosis which is greater than 3 in value which mean distribution of returns are leptokurtic showing higher peaks than expected from normal distribution.

4.2 Correlation Matrix Test

Table 4.2 reports the results of Correlation analysis between global equity market and U.S equity market to emerging markets.

TABLE 4.2: Correlation matrix of equity stock market.

	S&P500	MSCI	MSCIE	BVSP	BSE	SSE	MCX	JSE	PSX
S&P500	1								
MSCI	-0.06441	1							
MSCIE	-0.02600	0.00343	1						
BVSP	0.44349	-0.0598	0.02677	1					
BSE	0.12013	0.01404	-0.04871	0.11589	1				
SSE	0.00596	0.00509	-0.00925	-0.01902	0.00131	1			
MCX	-0.06084	0.05510	0.01780	-0.00405	-0.03689	0.01015	1		
JSE	0.04463	0.03917	0.08237	0.02379	0.02223	0.01687	0.03716	1	
PSX	0.03214	0.02479	0.06166	0.03900	-0.00702	0.00516	-0.00717	0.01159	1

Results found that world equity market, emerging index and Russian market will be consider very weak negative correlation with S&P500. Table also shows that other markets has very weak positive correlation.

4.3 Mean and Volatility Spillover

A mean and volatility spillover phenomenon is mostly analyzed by using the ARCH/GARCH family model. GARCH framework comprises of different tests which has been used for measuring the means and volatility flow between the series. ARCH model can be used in the sets of variables which have an issue of autocorrelation and heteroscedasticity. The autocorrelation refer to the linkage among the series with its own lagged values. The heteroscedasticity deals with

variance of error term which isn't constant. These two issues can be tested by evaluating ARCH/GARCH frame work.

4.3.1 Mean and Volatility Spillover from U.S to Emerging Markets

The mean and volatility spillover from U.S to BRICS is tested by using ARMA-GARCH in mean model and results are reported in Table 4.3.1 Autoregressive and moving average term are significant and mean spillovers term is also positive and significant indicating mean spillover exist from U.S market to Brazil market. In the other hand, we can says that positive shocks increase volatility in Brazil market. GARCH term is insignificant indicating that volatility is not preserved by Brazil stock market. The variance equation indicates that their exists long term persistence of volatility in Russian market. ARCH and GARCH term is close to 1. Moreover volatility spillover is also observed from U.S market to Brazil market i.e shock from U.S market adds volatility in Brazil market. Results indicates that autoregressive and moving average term are significant while mean spillover term is insignificant indicating no spillover from U.S market to Russian emerging market. GARCH term is significant at 90% level of significant indicating the volatility is prevailing by Russian stock market. The variance equation indicates that their exists long term persistence of volatility in Russian market. ARCH and GARCH term is close to 1. Moreover volatility is also observed from U.S market to Russian market i.e shock from U.S market adds volatility in Russian market.

In Indian market, results indicate that significant positive mean spillover exists from U.S to Indian markets. So we can says that positive shocks increase volatility in Indian market. The variance equation also indicates that there exits of long term persistence of volatility in Indian market.

Table 4.3 also shows that autoregressive moving average term and mean spillover term is insignificant indicating no spillover from U.S market to China emerging market. GARCH term is insignificant indicating that volatility is not preserved by Chines stock market. The variance equation indicates that there is no exists

long term persistence of volatility in China market. In Pakistan market, results reveal that no mean spillover exist from U.S to Pakistan stock market. However, Variance equation indicates that that their exists long term persistence of volatility in Pakistan market. ARCH and GARCH term is closer to 1. Moreover volatility spillover is also observed from U.S market to Pakistani market i.e shocks from U.S market adds some volatility in Pakistani market.

TABLE 4.3: Mean and Volatility spillovers from U.S to emerging Markets indices estimated from ARMA (1,1)-GARCH (1,1) on daily stock return for the period of (2000-2017).

	U.S	Brazil	Russia	India	China	Pak
ϕ	0.002004	0.000139	0.002004	0.000776	0.000326	0.000866
	(3.050098)	(0.400034)	3.050098	(2.952678)	(1.165384)	(1.775434)
ϕ_1	-1.528454	1.120535	-1.528454	-0.145280	-1.441154	0.282055
	(-2.257682)	(2.661713)	(-2.257682)	(-0.703542)	(-1.677284)	(1.078171)
ϕ_2	1.555023	-1.138366	1.555023	0.195556	1.458817	-0.170237
	(2.294242)	(2.697018)	(2.294242)	(0.940895)	(1.697856)	(-0.640000)
ϕ_3	9.552570	0.248526	9.552570	0.687498	1.919259	1.919259
	(1.872467)	(0.086322)	(1.872467)	(1.049162)	(1.325735)	(1.325735)
λ		0.903467	-0.016738	0.172095	0.004498	0.020869
		(0.0000)	(0.4711)	(0.0000)	(0.7969)	(0.5807)
α_0	4.23E-07	0.000776	4.23E-07	4.61E-07	1.28E-06	4.23E-07
	(0.494261)	(2.952676)	(0.494261)	(0.941697)	(3.011414)	(0.494261)
α_1	0.088638	-0.145280	0.088638	0.096766	0.065950	0.088638
	(17.86432)	(0.703542)	(17.86432)	(15.83914)	(17.45720)	(17.86432)
α_2	0.892631	0.882599	0.892631	0.882559	0.930128	0.892631
	(169.6835)	(113.7430)	(169.6835)	(123.2095)	(248.7364)	(169.6835)
γ		5.45E-06	6.09E-06	23.48E-06	22.45E-7	6.09E-06
		(0.0000)	(0.0000)	(0.0000)	(0.5582)	(0.0000)

4.3.2 Mean and Volatility Spillover from World Market to Emerging Markets

The mean and volatility spillover from world market to emerging markets is tested by using ARMA-GARCH in mean model and results are reported in Table 4.4

Autoregressive and moving average term are significant and mean spillovers term is also positive and significant indicating mean spillover exist from world market to Brazil market. In the other hand, we can says that positive shocks increase volatility in Brazil market. GARCH term is insignificant indicating that volatility is not preserved by Brazil stock market. The variance equation indicates that their exists long term persistence of volatility in Russian market. ARCH and GARCH term is close to 1. Moreover volatility spillover is also observed from world market to Brazil market i.e shock from world market adds volatility in Brazil market. Results indicate that autoregressive and moving average term are insignificant while mean spillover term is significant indicating no spillover from world market to Russian emerging market. GARCH term is significant at 90% level of significant indicating the volatility is prevailing by Russian stock market. The variance equation indicates that their exists long term persistence of volatility in Russian market. ARCH and GARCH term is close to 1. Moreover volatility is also observed from world market to Russian market i.e shock from world market adds volatility in Russian market.

In Indian market, results indicate that significant positive mean spillover exists from world to Indian markets. So we can says that positive shocks increase volatility in Indian market. The variance equation also indicates that there exits of long term persistence of volatility in Indian market. Results also indicate that autoregressive moving average term and mean spillover term is insignificant indicating no spillover from world market to Chines emerging market. GARCH term is insignificant indicating that volatility is not preserved by Chines stock market. The variance equation indicates that there is no exists long term persistence of volatility in China market. In Pakistan market, results reveal that no mean spillover exist from world market to Pakistan market. However, Variance equation indicates that that their exists long term persistence of volatility in Pakistani market. ARCH and GARCH term is closer to 1. Moreover, volatility spillover is also observed from world market to Pakistani market i.e shocks from world market adds some volatility in Pakistani market.

TABLE 4.4: Mean and Volatility spillovers from emerging markets indices estimated from ARMA (1,1)-GARCH (1,1) on daily stock return for the period of (2000-2017)

	World Index	Brazil	Russia	India	China	Pak
ϕ	0.002004	0.001668	0.003482	0.000778	-0.001392	0.001020
	(3.050098)	(1.200329)	(4.003401)	(2.955445)	(-0.730084)	(2.002397)
ϕ_1	-1.528454	1.464091	-1.325595	-0.145080	-1.983514	0.315243
	(-2.257682)	(0.616836)	(-1.661895)	(-0.702335)	(-1.438613)	(1.511557)
ϕ_2	1.555023	-1.469839	1.341729	0.195343	2.007781	-0.252506
	(2.294242)	(-0.617429)	(1.679188)	(0.939544)	(1.456170)	(-1.204138)
ϕ_3	9.552570	-5.164200	-1.247087	1.679940	5.203284	-0.808964
	(1.872467)	(-0.529472)	(-1.002921)	(1.043995)	(1.331564)	(-0.376838)
λ		0.005389	-0.008653	0.172129	-0.004981	0.006675
		(0.0000)	(0.3710)	(0.0000)	(0.6569)	(0.4807)
α_0	4.23E-07	8.52E-06	3.93E-05	4.75E-07	0.000186	1.17E-05
	(0.494261)	(5.013182)	(12.51445)	(0.966105)	(6.262110)	(11.36349)
α_1	0.088638	0.060913	0.180497	0.096802	0.138744	0.158771
	(17.86432)	(8.521256)	(12.58831)	(15.82103)	(5.557247)	(12.27858)
α_2	0.892631	0.914102	0.733334	0.882346	0.568746	0.791389
	(169.6835)	(92.26558)	(52.20840)	(122.8263)	(8.184234)	(62.83371)
γ		-4.59E-08	6.09E-06	3.49E-06	-1.45E-05	1.05E-07
		(0.0000)	(0.0000)	(0.0000)	(0.3582)	(0.0000)

4.3.3   Emerging Index to Emerging Markets

The mean and volatility spillover from emerging to BRICS markets is tested by using ARMA-GARCH in mean model and results are reported in Table 4.5 Autoregressive and moving average term are significant and mean spillovers term is also positive and significant indicating mean spillover exist from emerging index to Brazil market. In the other hand, we can says that positive shocks increase volatility in Brazil market. GARCH term is insignificant indicating that volatility is not preserved by Brazilian market. The variance equation indicates that their exists long term persistence of volatility in Russian market. Moreover volatility spillover is also observed from emerging index to Brazil market i.e shock from emerging index adds volatility in Brazil market. Results indicate that autoregressive and

moving average term are insignificant while mean spillover term is significant indicating no spillover from emerging index to Russian market. GARCH term is significant at 90% level of significant indicating the volatility is prevailing by Russian stock market. The variance equation indicates that their exists long term persistence of volatility in Russian market. ARCH and GARCH term is close to 1. Moreover volatility is also observed from emerging index to Russian market i.e shock from emerging index adds volatility in Russian market.

In Indian market, results indicate that significant positive mean spillover exists from emerging index to Indian emerging markets. So we can says that positive shocks increase volatility in Indian market. The variance equation also indicates that there exits of long term persistence of volatility in Indian market.

Tables 4.5 also shows that autoregressive moving average term and mean spillover term is insignificant indicating no spillover from emerging index to China emerging market. GARCH term is insignificant indicating that volatility is not preserved by Chines stock market. The variance equation indicates that there is no exists long term persistence of volatility in China market. In Pakistani market, results reveal that no mean spillover exist from emerging index to Pakistani stock market. However, Variance equation indicates that that their exists long term persistence of volatility in Pakistan market. ARCH and GARCH term is closer to 1. Moreover volatility spillover is also observed from emerging index to Pakistani market i.e shocks from emerging index adds some volatility in Pakistani market.

TABLE 4.5: Mean and Volatility spillovers from emerging index to emerging markets indices estimated from ARMA (1,1)-GARCH (1,1) on daily stock return for the period of (2000-2017).

	Emerging Index	Brazil	Russia	India	China	Pak
ϕ	0.002004	0.005449	0.004731	0.000888	-0.002548	0.001384
	(3.050098)	(1.717257)	(3.240916)	(1.506875)	(-1.810157)	(1.422676)
ϕ_1	-1.528454	7.643513	-0.685610	0.096897	-0.367173	-0.103079
	(-2.257682)	(2.463524)	(-2.061080)	(3.150313)	(-0.539543)	(-0.167074)
ϕ_2	1.555023	-7.608263	0.763759	0.024654	0.362144	0.151660
	(2.294242)	(-2.445431)	(2.284332)	(0.727511)	(0.530088)	(0.244989)
ϕ_3	99.552570	-33.13026	-5.145633	0.731645	16.64265	1.010370
	(1.872467)	(-1.999731)	(-1.527903)	(0.189892)	(1.677604)	(0.340030)

	Emerging Index	Brazil	Russia	India	China	Pak
λ		-0.027967	0.129529	0.008994	0.057316	0.040973
		(0.5982)	(0.1265)	(0.7968)	(0.0885)	(0.0826)
α_0	4.23E-07	6.44E-06	1.44E-05	1.36E-05	2.06E-05	1.47E-05
	(0.494261)	(2.497651)	(3.766642)	(4.216936)	(6.224547)	(9.596916)
α_1	0.088638	0.036711	0.106781	0.172788	0.180403	0.142669
	(17.86432)	(5.150384)	(7.656342)	(8.817602)	(9.180988)	(9.486224)
α_2	0.892631	0.942994	0.842486	0.743689	0.709886	0.807697
	(169.6835)	(87.36079)	(42.97865)	(24.40507)	(25.47430)	(50.03323)
γ		-5.19E-08	4.92E-06	1.74E-06	-1.52E-06	-3.73E-06
		(0.9727)	(0.0594)	(0.3888)	(0.3064)	(0.0000)

4.4   Co-Integration Analysis

TABLE 4.6: Vector Auto Regression (VAR Technique).

Lag	0	1	2
AIC	100.8925	63.79535	63.76853*

The lag length is selected by using AIC and it is found 2.

4.5   Unit Root Analysis

Table 4.7 reports the results of unit root analyses performed by using ADF and PP tests.

TABLE 4.7: Unit Root Test-ADF and PP test at level and at first difference.

Variables	Augmented Dicky-Fuller Test at Level	Augmented Dicky-Fuller Test at 1st Difference	Philip-Perron Test at Level	Philip-Perron Test at 1st Difference
MSCI	0.878207	-53.98757	1.227572	-55.20883
MSCIE	-2.147080	-30.88897	-1.964370	-30.60594

Variables	Augmented Dicky-Fuller Test at Level	Augmented Dicky-Fuller Test at 1st Difference	Philip-Perron Test at Level	Philip-Perron Test at 1st Difference
S&P500	0.302178	-51.50638	0.510843	-73.16533
BVSP	-1.438141	-66.76266	-1.352095	-66.86105
MCX	1.322035	-64.38881	-1.299035	-64.35806
BSE	-0.081256	-62.78315	-0.007048	-62.70740
SSE	-1.766141	-65.28686	-1.730192	-65.31771
JSE	0.597688	-52.94409	1.324698	-53.03667
PSX	1.841776	-59.39169	2.021846	-60.94427
1%	-3.434762	-3.434762	-3.434762	-3.434762
5%	-2.863376	-2.863376	-2.863376	-2.863376
10%	-2.567796	-2.567796	-2.567796	-2.567796

Augmented Dickey Fuller test is based on certain assumptions that data is independently and identically distributed. Results show that ADF and PP statistics is non-stationary at level and it becomes linear nature (stationary). Philip Parron Test is conducted which explain the phenomena as this persistently of relationship. The results are conducted. As Cointegration/VAR analysis also be performed.

4.6   Johansen and Juselius Con-integration Test

Con-integration approach require that all series should be integrated in same order. The unit root analyses confirm the same. So Johansen and Juselius approach (1991) is used to explain the long run relationship between the series.

TABLE 4.8: Multivariate Co-Integration Test-Trace Statistics.

Equity Market	Hypothesis	Eigenvalue	Trace Statistics	Critical Value at 5%	Prob.**
S&P500	None*	0.170433	2296.557	111.7805	1.0000
BVSP	At most 1*	0.144422	1833.913	83.93712	1.0000
BSE	At most 2*	0.131355	1447.711	60.06141	1.0000
SSE	At most 3*	0.128614	1099.040	40.17493	0.0000
MCX	At most 4*	0.110402	758.1685	24.27596	0.0001
JSE	At most 5*	0.100076	468.5126	12.32090	0.0001
KSE	At most 6*	0.080364	207.4321	4.129906	0.0001

Trace test indicates 7 cointegrating eqn(s) at the 0.05 level.

TABLE 4.9: Multivariate Co-Integration Maximum Eigenvalue Statistics.

Equity Market	Hypothesis	Eigenvalue	Maximum Eigenvalue Statistics	Critical Value at 5%	Prob.**
S&P500	None*	0.170433	462.6446	42.77219	0.0001
BVSP	At most 1*	0.144422	386.2019	36.63019	0.0001
BSE	At most 2*	0.131355	348.6713	30.43961	0.0001
SSE	At most 3*	0.128614	340.8711	24.15921	0.0001
MCX	At most 4*	0.110402	289.6559	17.79730	0.0001
JSE	At most 5*	0.100076	261.0805	11.22480	0.0001
KSE	At most 6*	0.080364	207.4321	4.129906	0.0001

Max-eigenvalue test indicates 7 cointegrating eqn(s) at the 0.05 level.

Multivariate Co-integration analyses has been performed between the U.S market to BRICS markets. Results of Johnson and Julius Approach are verified through two different tests, one is Trace statistics and other is Maximum Eigenvalue test. Table 4.8 indicates the presence of seven cointegrating vector. The results have

been confirmed by using Maximum Eigenvalue statistics, the results are consistent with the results reported by t-statistics.

TABLE 4.10: Multivariate Co-Integration Test-Trace Statistics.

Equity Market	Hypothesis	Eigenvalue	Trace Statistics	Critical Value at 5%	Prob.**
MSCI	None*	0.144777	1719.257	83.93712	1.0000
BVSP	At most 1*	0.128727	1332.184	60.06141	1.0000
BSE	At most 2*	0.109257	991.1304	40.17493	0.0001
SSE	At most 3*	0.106913	704.7752	24.27596	0.0001
MCX	At most 4*	0.094303	424.9239	12.32090	0.0001
JSE	At most 5*	0.070061	179.7745	4.129906	0.0001
KSE	None*	0.144777	1719.257	83.93712	1.0000

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level.

TABLE 4.11: Multivariate Co-Integration Maximum Eigenvalue Statistics.

Equity Market	Hypothesis	Eigenvalue	Maximum Eigenvalue Statistics	Critical Value at 5%	Prob.**
MSCI	None*	0.144777	387.0730	36.63019	0.0001
BVSP	At most 1*	0.128727	341.0536	30.43961	0.0001
BSE	At most 2*	0.109257	286.3552	24.15921	0.0001
SSE	At most 3*	0.106913	279.8513	17.79730	0.0001
MCS	At most 4*	0.094303	245.1494	11.22480	0.0001
JSE	At most 5*	0.070061	179.7745	4.129906	0.0001
KSE	None*	0.144777	387.0730	36.63019	0.0001

Max-eigenvalue test indicates 6 cointegrating eqn(s) at the 0.05 level.

Multivariate Cointegration approach has been applied between the global market to BRICS markets. In above result, tables 4.3-4.5 and 4.11 indicate the existence

of six cointegration equations at the 0.05 level which means that there are six common patterns exist in our selected variables. These results also contend both according to multivariate cointegration trace statistics and multivariate maximum eigenvalue test.

TABLE 4.12: Multivariate Co-Integration Test-Trace Statistics.

Equity Market	Hypothesis	Eigenvalue	Trace Statistics	Critical Value at 5%	Prob.**
MSCIE	None*	0.203029	1310.647	111.7805	1.0000
BVSP	At most 1*	0.148622	990.8932	83.93712	0.0001
BSE	At most 2*	0.129671	764.1860	60.06141	0.0001
SSE	At most 3*	0.112799	568.4993	40.17493	0.0001
MCX	At most 4*	0.097483	399.8656	24.27596	0.0001
JSE	At most 5*	0.094056	255.3483	12.32090	0.0001
KSE	At most 6*	0.079142	116.1708	4.129906	0.0001

Trace test indicates 7 cointegrating eqn(s) at the 0.05 level.

TABLE 4.13: Multivariate Co-Integration Maximum Eigenvalue Statistics.

Equity Market	Hypothesis	Eigenvalue	Maximum Eigenvalue Statistics	Critical Value at 5%	Prob.**
MSCIE	None*	0.203029	319.7534	42.77219	0.0001
BVSP	At most 1*	0.148622	226.7072	36.63019	0.0001
BSE	At most 2*	0.129671	195.6867	30.43961	0.0001
SSE	At most 3*	0.112799	168.6337	24.15921	0.0001
MCX	At most 4*	0.097483	144.5174	17.79730	0.0001
JSE	At most 5*	0.094056	139.1775	11.22480	0.0001
KSE	At most 6*	0.079142	116.1708	4.129906	0.0001

Max-eigenvalue test indicates 6 cointegrating9 eqn(s) at the 0.05 level.

Multivariate Co-integration approach has been applied between the Emerging markets to BRICS markets. Tables 4.7-4.13 indicate the existence of six cointegration equations at the 0.05 level which means that there are six combinations exist in selected variables that are studying. These results also persistent both according to multivariate co-integration trace statistics and multivariate maximum eigenvalue test.

4.7 Vector Error Correction Model

4.7.1 Vector Error Correction Model U.S Market to Emerging Markets

Table 4.14 reports the results of Victor Error Correction Model indicating that short term relationship between U.S and emerging markets with adjustment of disqualification capture through ECT.

TABLE 4.14: Vector Correction Model (U.S Market to BRICS Markets).

Error Corr:	D(S&P500)	D(BVSP)	D(MCX)	D(BSE)	D(SSE)	D(JSE)	D(PSX)
CointEq1	-0.061311	-0.993586	-0.434058	0.750518	-0.420918	1.918749	-0.414275
	(0.02268)	(0.02981)	(0.05295)	(0.03609)	(0.03974)	(0.10629)	(0.03202)
	[2.70275]	[33.3353]	[-8.19729]	[20.7967]	[10.5929]	[18.0517]	[12.9389]
D(S&P(-1))	-0.753075	-0.639282	0.275736	-0.453336	-0.293735	-1.078463	-0.214930
	(0.02331)	(0.03063)	(0.04240)	(0.02892)	(0.03195)	(0.08908)	(0.02586)
	[-32.3046]	[-20.8714]	[6.50334]	[-15.6753]	[-9.19275]	[-12.1065]	[-8.30984]
D(S&P(-2))	-0.391286	-0.339850	0.159092	-0.228841	-0.112195	-0.530179	-0.073863
	(0.01889)	(0.02482)	(0.02897)	(0.01928)	(0.02192)	(0.06203)	(0.01764)
	[-20.7132]	[-13.6922]	[5.49234]	[-11.8715]	[-5.11944]	[-8.54661]	[-4.18797]
D(BVSP(-1))	0.040108	0.094998	-0.587748	-0.260356	-0.580559	-0.367027	-0.538676
	(0.02108)	(0.02770)	(0.01462)	(0.02161)	(0.01517)	(0.02655)	(0.01473)
	[1.90258]	[3.42972]	[-40.1966]	[-12.0477]	[-38.2622]	[-13.8224]	[-36.5602]
D(BVSP(-2))	0.014068	0.062807	-0.308212	-0.141828	-0.326326	-0.153007	-0.295686
	(0.01474)	(0.01937)	(0.01425)	(0.01610)	(0.01420)	(0.02004)	(0.01406)
	[0.95436]	[3.24289]	[-21.6353]	[-8.80892]	[-22.9776]	[-7.63570]	[-21.0318]
C	2.41E-07	-5.18E-07	3.56E-06	2.79E-06	1.06E-06	2.15E-05	-5.78E-07
	(0.00021)	(0.00027)	(0.00035)	(0.00024)	(0.00026)	(0.00082)	(0.00021)
	[0.00115]	[-0.00189]	[0.01022]	[0.01178]	[0.00402]	[0.02625]	[0.00275]

Table 4.14, the findings of the study indicated that their exit significant negative

relationship between U.S market and Brazilian market. The ECT is also significant and negative. The ECT is -.99% which shows that 99% of disequilibrium is adjusted in one period of time. Similar results on observed with Chines and Pakistani equity market. However speed of adjustment of disequilibrium is formed slow in case of Pakistan and China when ECT is -.42 and -.41 respectively.

U.S market has significant positive relationship with Russian market in Short run lagged on positive. The ECT is found negative and significant indicating 43% of disequilibrium is adjusted with one period. In case, India and South African market, it is observed ECT is significant and positive indicating that no adjustment of disequilibrium is made. However return of U.S market influence return of these markets at one lag. The disequilibrium of relationship is increase indicating that increase in U.S market return leads to decrease in return of Indian and South African market and vice versa.

4.7.2   Vector Correction Model (World to BRICS Markets)

Table 4.15 reports the results of Victor Error Correction Model indicating that short term relationship between world market to emerging markets with adjustment of disqualification capture through ECT.

TABLE 4.15: Vector Correction Model (World Market to BRICS Markets).

Error Corr:	MSCI	BVSP	MCX	BSE	SSE	JSE	PSX
CointEq1	-1.044989	-0.213395	0.251735	-0.103745	0.219870	-0.146828	-0.008507
	(0.03517)	(0.02990)	(0.03327)	(0.02458)	(0.02682)	(0.06503)	(0.01819)
	[-29.7106]	[-7.13621]	[7.56595]	[-4.22046]	[8.19745]	[-2.25790]	[-0.46762]
D(MSCI(-1))	0.023891	0.138423	-0.228113	0.067815	-0.158789	0.125009	0.004882
	(0.02820)	(0.02397)	(0.02680)	(0.01960)	(0.02159)	(0.05172)	(0.01445)
	[0.84723]	[5.77367]	[-8.51143]	[3.45954]	[-7.35561]	[2.41683]	[0.33776]
D(MSCI(-2))	0.024591	0.077013	-0.111656	0.018330	-0.099810	0.033795	-0.004274
	(0.01924)	(0.01636)	(0.01863)	(0.01332)	(0.01484)	(0.03512)	(0.00979)
	[1.27788]	[4.70717]	[-5.99256]	[1.37581]	[-6.72443]	[0.96240]	[-0.43643]
D(BVSP(-1))	0.217110	-0.613466	-0.551798	-0.600454	-0.587516	-0.703197	-0.556434
	(0.02370)	(0.02015)	(0.02125)	(0.01927)	(0.01990)	(0.01916)	(0.01926)
	[9.16154]	[-30.4481]	[-25.9631]	[-31.1610]	[-29.5168]	[-36.6975]	[-28.8975]
D(BVSP(-2))	0.098585	-0.275203	-0.269347	-0.283976	-0.321972	-0.305938	-0.284754
	(0.02263)	(0.01924)	(0.01962)	(0.01925)	(0.01890)	(0.01911)	(0.01905)
	[4.35680]	[-14.3051]	[-13.7257]	[-14.7484]	[-17.0326]	[-16.0068]	[-14.9439]
C	-1.69E-05	2.22E-06	1.86E-05	-9.88E-06	1.63E-05	1.31E-05	-1.25E-05

Error Corr:	MSCI	BVSP	MCX	BSE	SSE	JSE	PSX
	(0.00048)	(0.00041)	(0.00048)	(0.00033)	(0.00037)	(0.00088)	(0.00024)
	[-0.03490]	[0.00542]	[0.03912]	[-0.02977]	[0.04347]	[0.01493]	[-0.05112]

The findings of the study indicated that their exit significant negative relationship between world market and Brazilian market. The ECT is also significant and negative. The ECT is -21% which shows that 21% of disequilibrium is adjusted in one period of time. Similar results on observed with India, South Africa and Pakistani equity market. However speed of adjustment of disequilibrium is formed slow in case of India, South Africa and Pakistan where ECT is -.-10, -.14 and -.08% respectively.

World market has significant negative relationship with Russian market in Short run lagged on positive. The ECT is found negative and significant indicating 25% of disequilibrium is adjusted with one period. However return of world market influence return of these markets at one lag. The disequilibrium of relationship is increase indicating that increase in world market return leads to decrease in return of Russia and China market and vice versa.

4.7.3   Vector Correction Model (Emerging to BRICS Markets)

Table 4.16 reports the results of Victor Error Correction Model indicating that short term relationship between emerging to emerging markets with adjustment of disqualification capture through ECT.

TABLE 4.16: Vector Correction Model (Emerging to BRICS Markets).

Error Corr:	MSCIE	BVSP	MCX	BSE	SSE	JSE	PSX
CointEq1	0.171043	-0.131049	-0.284148	0.422801	0.508833	1.846033	0.404588
	(0.02297)	(0.04414)	(0.01345)	(0.02959)	(0.02497)	(0.09134)	(0.03408)
	[7.44610]	[-2.96905]	[-21.1192]	[14.2875]	[20.3793]	[20.2103]	[11.8703]
D(MSCIE(-1))	-0.024239	0.014898	0.188929	-0.338069	-0.360728	-1.163314	-0.272030
	(0.02299)	(0.04418)	(0.03165)	(0.03038)	(0.04103)	(0.12002)	(0.03072)
	[-1.05430]	[0.33724]	[5.96958]	[-11.1274]	[-8.79088]	[-9.69284]	[-8.85653]
D(MSCIE(-2))	0.033128	-0.012421	0.119216	-0.201470	-0.172742	-0.631061	-0.167529
	(0.01386)	(0.02664)	(0.03094)	(0.02672)	(0.03872)	(0.11005)	(0.02555)
	[2.38942]	[-0.46624]	[3.85283]	[-7.54023]	[-4.46084]	[-5.73443]	[-6.55674]

Error Corr:	MSCIE	BVSP	MCX	BSE	SSE	JSE	PSX
D(BVSP(-1))	0.305389	0.026341	-0.013955	-0.264619	-0.040796	-0.050074	-0.262646
	(0.01383)	(0.02658)	(0.03751)	(0.03348)	(0.03523)	(0.03875)	(0.03311)
	[22.0779]	[0.99104]	[-0.37203]	[-7.90309]	[-1.15811]	[-1.29217]	[-7.93322]
D(BVSP(-2))	-5.06E-06	-3.04E-05	-0.002243	-0.153439	-0.049539	-0.003573	-0.142781
	(0.00020)	(0.00038)	(0.02679)	(0.02690)	(0.02630)	(0.02716)	(0.02770)
	[-0.02547]	[-0.07958]	[-0.08373]	[-5.70498]	[-1.88356]	[-0.13155]	[-5.15447]
C	0.171043	-0.131049	-2.38E-06	-4.48E-06	-5.67E-06	-1.90E-05	-1.65E-05
	(0.02297)	(0.04414)	(0.00032)	(0.00026)	(0.00039)	(0.00109)	(0.00024)
	[7.44610]	[-2.96905]	[-0.00750]	[-0.01748]	[-0.01469]	[-0.01743]	[-0.06947]

4.8   Impulse Response Function

Results of Impulse response analyses are reports in Figures 4.1 and 4.2 provides the response of emerging markets due to one standard deviation shock. The response of Brazil market is minimum when the shock transmitted from U.S market is significantly responded by rest of the sample market. In general, variation appears to the cooling down in six periods.

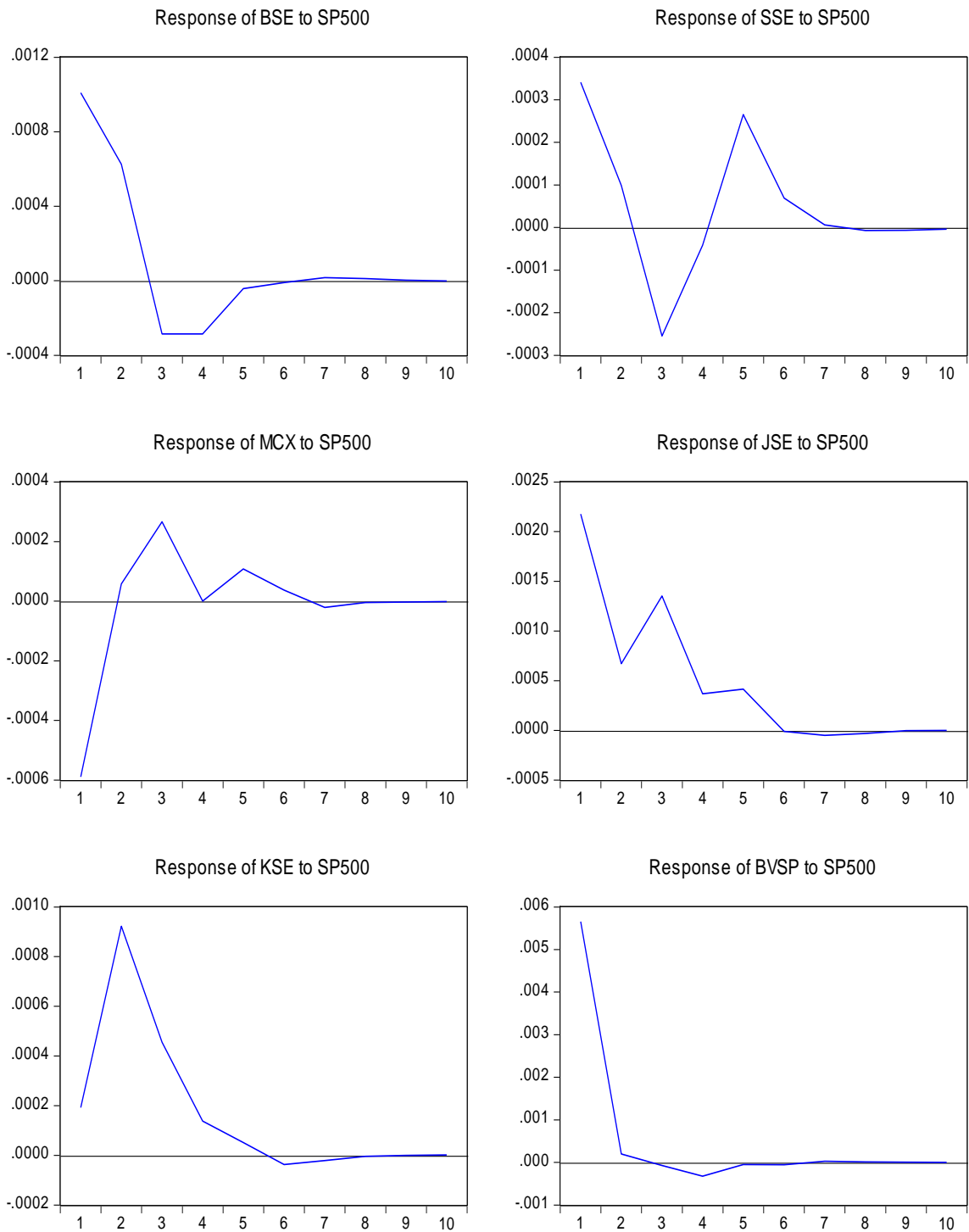Response to Cholesky One S.D. Innovations

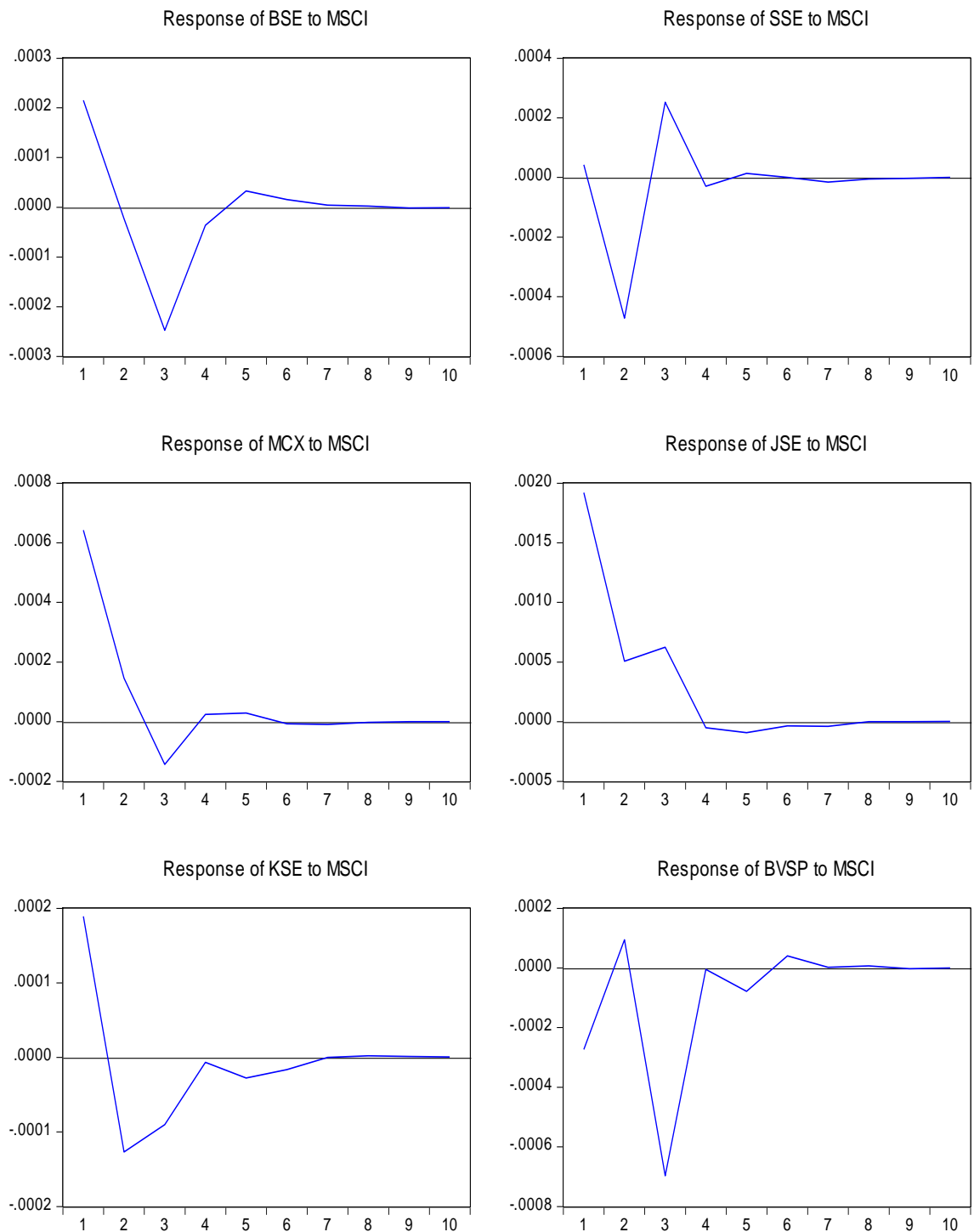FIGURE 4.1: U.S Market to emerging Markets.

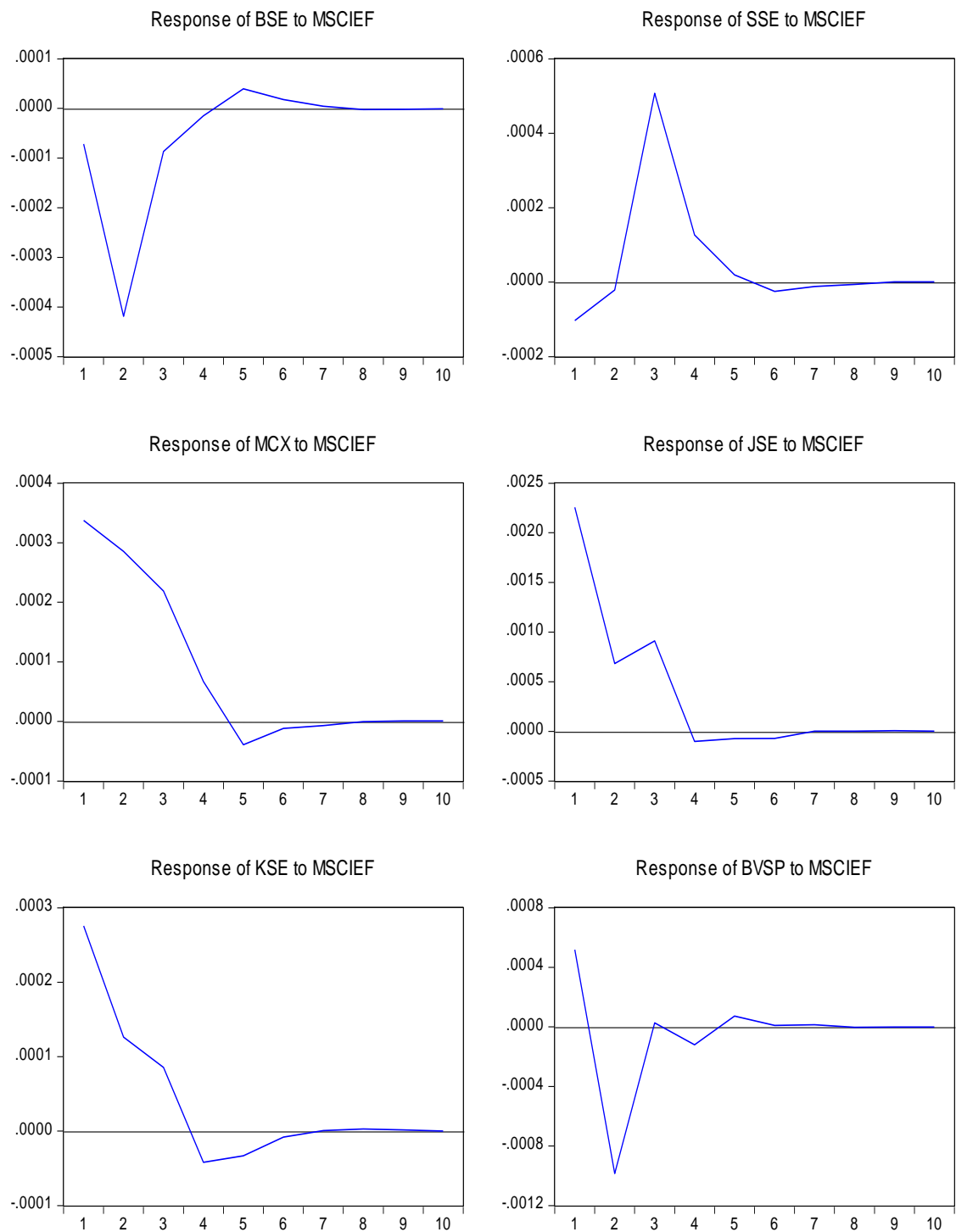FIGURE 4.2: World stock Market to Emerging Markets.

FIGURE 4.3: Emerging Index to Emerging Markets.

4.9   Variance Decomposition Test

The variance decomposition analyses is performed to explain the result of U.S, Global and emerging market is creating volatility in sample market.

TABLE 4.17: Variance Decomposition of BVSP.

Period	S.E.	BVSP	S&P500	MSCI	MSCIE
1	0.008111	82.89717	17.05721	0.034703	0.010916
2	0.008379	79.70278	16.79526	0.039881	0.264648
3	0.008661	78.90015	16.41018	0.226836	0.293543
4	0.008939	77.82699	17.30389	0.291622	0.287362
5	0.009240	78.07856	16.52811	0.294646	0.704378
6	0.009524	78.99127	15.64855	0.271316	0.787204
7	0.009760	78.91838	15.59255	0.302290	0.762639
8	0.010092	78.69256	15.87818	0.326724	0.742731
9	0.010395	78.45377	16.09347	0.332640	0.708046
10	0.010656	78.74633	15.89102	0.326669	0.686195

Table 4.17 reports the results of variance decomposition performed for Brazilian market. Results indicates that 82.89% volatility is due to its own dynamics. U.S market significantly influence the Brazilian market and its contribution is 15% to 17%. Emerging markets and Global markets do not have significant contribution in the volatility of the Brazilian market.

TABLE 4.18: Variance Decomposition of MCX.

Period	S.E.	MCX	S&P500	MSCI	MSCIE
1	0.008111	99.62276	0.189409	0.159148	0.001330
2	0.008379	99.21387	0.193587	0.151475	0.004805
3	0.008661	98.67210	0.181931	0.175536	0.046846
4	0.008939	98.43129	0.179352	0.186694	0.046561
5	0.009240	98.34210	0.207936	0.169636	0.094791
6	0.009524	98.42143	0.220435	0.183432	0.089065

Period	S.E.	MCX	S&P500	MSCI	MSCIE
7	0.009760	98.37146	0.210897	0.172766	0.086299
8	0.010092	98.41286	0.199972	0.162220	0.085164
9	0.010395	98.48037	0.187773	0.154314	0.082441
10	0.010656	98.55274	0.177040	0.146868	0.077560

Table No 4.18 reports the results of variance decomposition performed for Russian market. Results indicates that 99.62% volatility is due to its own dynamics. U.S market Emerging market and Global market do not have significant contribution in the volatility of the Russian market.

TABLE 4.19: Variance Decomposition of BSE.

Period	S.E.	BSE	S&P500	MSCI	MSCIE
1	0.008111	98.94120	0.592647	0.109780	0.033276
2	0.008379	97.93536	0.766120	0.104674	0.046851
3	0.008661	96.85165	0.969825	0.122215	0.220359
4	0.008939	94.86335	1.190225	0.148917	0.701640
5	0.009240	93.89661	1.497261	0.142509	1.159151
6	0.009524	93.44874	1.546544	0.138342	1.589994
7	0.009760	93.50907	1.476188	0.150743	1.590272
8	0.010092	93.63654	1.396135	0.143040	1.559773
9	0.010395	93.74998	1.320362	0.138300	1.580555
10	0.010656	93.75338	1.300512	0.131641	1.640570

Table No 4.19 reports the results of variance decomposition performed for Indian market. Results indicates that 98.94% volatility is due to its own dynamics. U.S market Emerging market and Global market do not have significant contribution in the volatility of the Russian market. U.S market and emerging market has some influences the Indian market and its contribution is 1% to 1.6%. However, Global markets do not have significant contribution in the volatility of the Indian market.

TABLE 4.20: Variance Decomposition of SSE.

Period	S.E.	SSE	S&P500	MSCI	MSCIE
1	0.008111	99.77165	0.028541	6.57E-05	0.000865
2	0.008379	98.72470	0.087045	0.125377	0.011868
3	0.008661	98.18590	0.201364	0.123676	0.137080
4	0.008939	97.93701	0.231378	0.144571	0.174214
5	0.009240	97.94559	0.224976	0.131040	0.183185
6	0.009524	97.94039	0.235295	0.173774	0.170200
7	0.009760	97.93533	0.268577	0.164011	0.174219
8	0.010092	97.93985	0.292325	0.158216	0.167561
9	0.010395	97.90492	0.294801	0.147653	0.161151
10	0.010656	97.96924	0.282611	0.139703	0.155511

Table No 4.20 reports the results of variance decomposition performed for Chines market. Results indicate that 99.77% volatility is due to its own dynamics. U.S market, Global market and emerging market do not have significant contribution in the volatility of the Chines market.

TABLE 4.21: Variance Decomposition of JSE.

Period	S.E.	JSE	S&P500	MSCI	MSCIE
1	0.008111	98.77378	0.237308	0.447028	0.419484
2	0.008379	98.23478	0.240537	0.602410	0.633136
3	0.008661	97.54858	0.322554	0.784002	0.792028
4	0.008939	97.30373	0.440521	0.763175	0.779991
5	0.009240	97.19700	0.411125	0.812623	0.783233
6	0.009524	97.17861	0.392869	0.773453	0.840405
7	0.009760	96.98673	0.390320	0.855112	0.930740
8	0.010092	96.90675	0.411102	0.885765	0.971554
9	0.010395	96.88930	0.422690	0.890413	0.992850
10	0.010656	96.88849	0.424022	0.911355	1.005129

Table No 4.21 reports the results of variance decomposition performed for South African market. Results indicates that 98.94% volatility is due to its own dynamics. However, U.S market, Global market and emerging market do not have significant contribution in the volatility of the South African market.

TABLE 4.22: Variance Decomposition of KSE.

Period	S.E.	KSE	S&P500	MSCI	MSCIE
1	0.008111	99.78822	0.033165	0.078032	0.002251
2	0.008379	98.73450	0.936420	0.070561	0.047172
3	0.008661	96.77748	1.114386	0.071381	0.190830
4	0.008939	96.39850	1.095009	0.143333	0.191458
5	0.009240	96.39179	1.214493	0.164597	0.261565
6	0.009524	96.76145	1.110201	0.146018	0.233100
7	0.009760	96.82402	1.094095	0.138319	0.221657
8	0.010092	96.81946	1.057019	0.139136	0.213083
9	0.010395	96.84349	1.092197	0.149206	0.210328
10	0.010656	96.87052	1.124922	0.149034	0.212491

Table No 4.922 reports the results of variance decomposition performed for Pakistani market. Results indicate that 99.78% volatility is due to its own dynamics. U.S market, global market and emerging market do not have significant contribution in the volatility of the Pakistani market.

4.10 Pairwise Granger Causality Test

Granger Theorem provides that if Co-integration movement exists among two time series then lead lag relationship must exit at least one direction. It may be unidirectional or bidirectional. If P-value is insignificant or more than 0.05 it means lead lag does not exist. The study examine causality effect between U.S market, global market and emerging markets. Table 4.23 provides the results of granger causality test. Granger Causality analyses explain the lead and lag relationship between signal sender and signal receptor markets.

TABLE 4.23: Pairwise Granger Causality Test from U.S Market to emerging Markets.

Null Hypothesis	Obs	F-Statistic	Prob.
D(BSE) does not Granger Cause D(SP500)	44.37	78.3075	4.E-34
D(SP500) does not Granger Cause D(BSE)		5.72728	0.0033
D(SSE) does not Granger Cause D(SP500)	4437	2.49806	0.0824
D(SP500) does not Granger Cause D(SSE)		2.42646	0.0885
D(MCX) does not Granger Cause D(SP500)	4437	0.74137	0.4765
D(SP500) does not Granger Cause D(MCX)		0.96726	0.3802
D(JSE) does not Granger Cause D(SP500)	2481	0.01508	0.9850
D(SP500) does not Granger Cause D(JSE)		10.3999	3.E-07
D(KSE) does not Granger Cause D(SP500)	4437	6.49419	0.0015
D(SP500) does not Granger Cause D(KSE)		14.1547	7.E-07
D(BVSP) does not Granger Cause D(SP500)	4437	0.31828	0.7274
D(SP500) does not Granger Cause D(BVSP)		2.60411	0.0741

The results indicate that U.S market has significant lead lag relationship with emerging market except Russian at different level of significance. U.S market leads Indian, South African and Pakistani markets at 95% level of significant where as it leads Brazil and China market at 90% level of significant. However, no lead lag relationship is observed with Russian market. The granger causality is bidirectional with Indian Pakistan and Chines markets where as it us unidirectional with Brazil and South African.

TABLE 4.24: Pairwise Granger Causality Test from Global Market to Emerging Markets.

Null Hypothesis	Obs	F-Statistic	Prob.
D(BSE) does not Granger Cause D(MSCI)	2481	3.43988	0.0322
D(MSCI) does not Granger Cause D(BSE)		1.02778	0.3580
D(SSE) does not Granger Cause D(MSCI)	2481	0.40400	0.6677
D(MSCI) does not Granger Cause D(SSE)		3.29533	0.0372
D(MCX) does not Granger Cause D(MSCI)	2481	0.79498	0.4517

Null Hypothesis	Obs	F-Statistic	Prob.
D(MSCI) does not Granger Cause D(MCX)		8.19800	0.0003
D(JSE) does not Granger Cause D(MSCI)	2481	1.19047	0.3034
D(MSCI) does not Granger Cause D(JSE)		0.99937	0.3683
D(KSE) does not Granger Cause D(MSCI)	2481	0.74709	0.4738
D(MSCI) does not Granger Cause D(KSE)		0.44654	0.6399
D(BVSPI) does not Granger Cause D(MSCI)	2481	0.20346	0.8159
D(MSCI) does not Granger Cause D(BVSP)		0.51300	0.5988

The results indicate that global market has insignificant lead lag relationship with emerging market except China and Russian market at different level of insignificance. Global market leads China and Russian markets at 80% level of significant However, no lead lag relationship is observed with India, Brazil, South Africa and Pakistani market. The granger causality is bidirectional with Indian Pakistan and Chines markets where as it us unidirectional with Brazil and South African.

TABLE 4.25: Pairwise Granger Causality Test from Emerging index to Emerging Markets.

Null Hypothesis	Obs	F-Statistic	Prob.
D(BSE) does not Granger Cause D(MSCIE)	1414	16.7399	7.E-08
D(MSCIE) does not Granger Cause D(BSE)		6.40760	0.0017
D(SSE) does not Granger Cause D(MSCIE)	1414	0.77362	0.4615
D(MSCIE) does not Granger Cause D(SSE)		0.55440	0.5745
D(MCX) does not Granger Cause D(MSCIE)	1414	0.22072	0.8020
D(MSCIE) does not Granger Cause D(MCX)		0.53743	0.5844
D(JSE) does not Granger Cause D(MSCIE)	1414	2.54606	0.0788
D(MSCIE) does not Granger Cause D(MSCI)		0.04114	0.9597
D(KSE) does not Granger Cause D(MSCIE)	1414	23.8506	7.E-11
D(MSCIE) does not Granger Cause D(KSE)		1.40736	0.2451
D(BVSP) does not Granger Cause D(MSCIE)	1414	86.3970	4.E-36
D(MSCIE) does not Granger Cause D(BVSP)		28.0248	1.E-12

The results indicate that emerging index has insignificant lead lag relationship with emerging markets except Indian market at different level of insignificance. Emerging index leads Indian, where as it leads Brazil and China market at 90% level of insignificant. However, no lead lag relationship is observed with other emerging markets. The granger causality is bidirectional with Indian markets.

TABLE 4.26: Pairwise Granger Causality Test between U.S market, global market and Emerging Markets.

Null Hypothesis	Obs	F-Statistic	Prob.
D(MSCI) does not Granger Cause D(SP500)	2481	4.36297	0.0128
D(SP500) does not Granger Cause D(MSCI)		3.81688	0.0221
D(MSCIE) does not Granger Cause D(SP500)	1414	15.8107	2.E-07
D(SP500) does not Granger Cause D(MSCIE)		44.5448	2.E-19
D(MSCIE) does not Granger Cause D(MSCI)	1414	1.49821	0.2239
D(MSCI) does not Granger Cause D(MSCIE)		0.34494	0.7083

Table 4.26, the results indicate that U.S market has significant lead lag relationship with global market and emerging market at different level. However, no lead lag relationship is exist between global and emerging markets. The granger causality is bidirectional relationship with global and emerging markets.

Chapter 5

Conclusion

5.1 Conclusion

The study use daily stock return for the selected emerging economies (Brazil, Russia, India, China, South Africa and Pakistan to analyze the mean and volatility spillover through time. The study use an Autoregressive Conditional Heteroskedasticity (ARCH) framework to analyzing the mean and volatility spillover from global, U.S equity market to emerging markets July 1st, 2000 to Jun 30, 2017 demonstrate the following: (1) the ARCH (1)-in- mean model fits the data for the most part well; the U.S market appear to be all the earmarks of being more compelling than the other market in transmitting mean and volatility spillover effects increase.

Emerging countries have a place with same economic area and have comparable economic corridor for the financial specialists, policy makers in numerous perspectives. Emerging equity markets has been chosen which were required to have resemblances in view of same financial, geographic and social condition. This research has been led to investigate among these equity markets. Six emerging markets were chosen Brazil (BVSP), Russia (MCX), India (BSE), China (SSE), South Africa (JSE), and Pakistan (PSX). Daily stock adjusted prices have been used to analyze this relationship.

Results also reveal that mean return is also positive except Brazilian market which has negative return. It revealed that among these six markets South African market has maximum standard deviation of 3.9% and high yield rate which reflects that South African market has more volatile as compare to other emerging markets. Most of the markets have negatively skewed which means most of the market return has negative return (least extraordinary values). The estimated value of kurtosis has more than 3 which mean distribution of returns are leptokurtic indicating higher peaks than anticipated from ordinary dispersion.

ARCH/GARCH family model has been applied, results indicates that U.S market has significant positive relationship with Brazil, Indian and Pakistani markets it means, mean and volatility spillover exist from U.S to these countries while insignificant relationship with Russia, and China equity market. Mean and volatility spillover from world to emerging markets is tested. Results indicates that there is significant positive mean spillover exist from Brazil, India and Pakistani markets and significant negative mean spillover exit between U.S to Russian market while insignificant relationship with China market.

Be that as it may, these higher yields are the state of being intensively interested for the financial specialization who need to get advantage from developing markets specifically by contributing or through in a roundabout way putting assets.

5.2   Recommendations

Based on empirical results it is recommended that South African investor can not enjoy benefits of diversification in the selected emerging equity markets of six countries i.e. Brazil, Russia, India, China, South Africa and Pakistan. Because Brazil, India, China and Pakistan is found to be most integrated market in these selected market. For financial specialist in SSE, they have the portfolio to invest in regional geographic emerging equity stock markets.

It is also recommended for all the investor from emerging market while making decision regarding investment must consider the financial shocks of volatility spillover

between the stocks market. However this study confirmed that there is no means and volatility spillover for South Africa.

5.3 Future Directions

This research study is based on limited to the selected six emerging equity stock markets of (Brazil, Russia, India, China, South Africa and Pakistan. It recommended that many other countries stocks markets should be selected for decision making and portfolio management. So the study used daily data of emerging equity markets and mainly focus on stocks volatility spillover. Many other assets clause and many other set of countries can be used for future research.

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