School of Economics and Finance

Regional Financial Integration in the Gulf Cooperation Council Banking and Stock Markets

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

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ABSTRACT

The degree of integration across financial markets has received a great deal of attention, particularly over the last two decades. A significant number of researchers have investigated both regional and international asset market integration. The concept of "market integration" refers to the process of removal of capital controls, which means removal of impediments such as legal restrictions, transaction costs, taxes and tariffs next to the trade in foreign assets. The main objective of this research is to examine the degree of financial integration among the six stock markets in the Gulf Cooperation Council (GCC); namely, Bahrain, Kuwait, Oman, Qatar, Saudi and United Arab Emirates. The integration relationship amongst banking sector as a dominant in GCC financial system is examined to discover whether or not the integration in this sectors leads to an integration of whole stock market. Additionally, the linkages between GCC-equity markets and global markets represented by the US, EU and the oil have also been examined.

However, although researchers have discussed the extent of stock market integration in regional and global levels, the stock market integration in the Gulf Arab region has not been deeply investigated, particularly after the global financial crisis (GFC). In this regard, this research paid special attention in discussing the effects of GFC on the process of market integration. Yet, to attain the objectives of this thesis, the recent econometric techniques on weekly basis of stock market indices were used over the period, January 2005 to December 2013. The full sample period was divided into two sub-samples to capture time-varying integration in this region, before and aftermath of the 2008 financial crisis. The Quandt-Andrews unknown break-point test and Chow break-point test were conducted to determine if the null hypothesis of no significant breaks in time series data can be rejected. In addition, the return and volatility spillovers caused by global markets have also been investigated as a further analysis, applying the GARCH model.

Econometrics methodology starts with testing for the presence of unit roots in level time series data to find the order of integration among variables, using Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) tests, and the optimal lags have been chosen based on information criteria. Next, the study utilized the Johansen's cointegration approach (Johansen and

Juselius, 1990) for testing the long-run relationships between variables. After the cointegrating relationship has confirmed, the transmission mechanism is also tested using the vector error correction model (VECM). The Granger causality and exogeneity tests, based on VECM are tested to explore short-run dynamic relationships between variables. Finally, the dynamic effects of shocks in the markets under study are investigated by implementing variance decomposition and impulse response functions. For the purpose of fulfilling the objectives of this thesis, different VECMs are used as follows: *VECM-1*, which includes the six GCC stock markets and intends to investigate the long-term cointegrating relationships between the GCC stock markets themselves. The *VECM-2* includes the six GCC stock markets and international markets. The purpose of this model is to investigate the long-run cointegrating relationship between GCC stock markets and international markets represented by the United Sates, European Union and oil market. Finally, the *VECM-3* examines the cointegration relationships between the six GCC banking sectors, and considers the long-run cointegrating relationship between these sectors.

As a preliminary analysis, the results of unknown break-point tests indicated a structural break in data in July 2008 due to GFC. Moreover, the GARCH (1, 1) models show that all markets caricaturized by high levels of volatility in particular after the crisis period. The global spillovers of both return and volatility have had significant effect on the six GCC equity returns after the crisis period. The empirical results of the unit root test indicate that all variables show evidence of non-stationarity in level series data and stationarity in first differences. This implies that the variables are integrated in the same order $I(1)$. At the regional level, the results of the cointegration test for the six GCC stock markets suggest that they have long-run equilibrium relationships with each other over the two sub-periods as well as whole period. These relationships also found between the variables in the short-run, as confirmed by the results of error correction terms of the *VECM-1* and Granger causality test. The stock markets of Saudi and UAE dominate the other markets, as confirmed by the results of Likelihood Ratio (LR) and Gonzalo and Granger (1995) for testing the main driving force behind the Johansen's cointegrated system.

At the global level, the *VECM-2* examines the long-and short-term relationships between the GCC stock markets and global markets. Throughout the pre-crisis period, the maximum eigenvalues of the Johansen's cointegration test are failed to

capture any cointegration relationships between variables, while cointegrating relationships were found between variables after the global crisis. The results of the Granger causality test and the ECT suggest feeble dynamic relationships between these variables in the first sub-period. The variance decomposition and impulse response suggest that the Gulf Arab region were found to be more sensitive to changes in regional shock than global. This research also found that the number of cointegrating vectors of the *VECM-1* and *VECM-3* have increased after the crisis period. The results of the third model that examined the relationships between the GCC banking sectors indicate one cointegrating relationship between Gulf Arab banking during the pre-crisis period, while in the second sub-period, the results of the showed two cointegrating vectors linking the Arab Gulf banking industry in the long-term. Further, the Granger-causality test and ECTs of the *VECM-3* confirm the presence of dynamic short-run relationships between the variables over the two sub-periods.

As oil is the major revenue for the GCC region, it is axiomatic that stock markets in this region will be affected by any sharp fluctuations in the oil market. This will increase risks in GCC financial markets to a greater extent in other international markets. However, in early 2011, the so-called "Arab Spring" in the Middle East played a significant role in reducing the equity portfolio flow of foreign investments to stock markets in the GCC, especially in state of Bahrain.

According to the theory of rational expectations and efficient market hypothesis, the expectations of future stock prices are equal to optimal forecast using current available information. Hence, if equilibrium does exist, then the market indicators would function properly. This suggests that in an efficient market, it is possible to predict other prices based on one known price.

Although member states of the GCC have achieved their goals for building strong linkages among their capital markets, these countries should continue follow their economic policies, and more efforts should be devoted towards building regional economic union. This could be archived by consolidation of fiscal and monetary policies taking into account economic structure in each country. This strategy should be accompanied with other economic reforms such as building a strong regulatory and supervisory framework, privatization, increasing market capitalization to create a single stock market capable to compete in the era of globalization.

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Glossary of Terms

ADF	Augmented Dickey Fuller
AIC	Akaike information criterion
APT	Arbitrage Pricing Theory
ARCH	Autoregressive Conditional Heteroskedasticity
BBS	Bahrain Banking Sector
BHB	Bahrain Bourse
BSM	Bahrain Stock Market
CAPM	Capital Asset Pricing Model
DSM	Doha Securities Market
DW	Durbin Watson
EBS	UAE Banking Sector
ECT	Error Correction Term
ESM	UAE Stock Market
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GCC	Gulf Arab Cooperation Council
GDP	Gross Domestic Product
GFC	Global Financial Crisis
HQ	Hannan-Quinn criterion
IMF	International Monetary Fund
IRF	Impulse Response Functions
KBS	Kuwait Banking Sector
KPSS	The Kwiatkowski, Phillips, Schmidt, and Shin
KSE	Kuwait Stock Exchange
KSM	Kuwait Stock Market
LOOP	The Law of One Price
LR	Likelihood Ratio Test
MENA	Middle East and North Africa
MSM	Muscat Securities Market
OBS	Oman Banking Sector
OilB	Oil Brent
OilR	Oil Return
OLS	Ordinary Least Squares
OSM	Oman Stock Market
PP	Phillips and Perron
QBS	Qatar Banking Sector
QSM	Qatar Stock Market
S&P	Standard & Poor's
SBI	Saudi Banking Sector
SSM	Saudi Stock Market
TADAWUL	Saudi Stock Exchange
VAR	Vector Autoregressive Model
VDC	Generalized Forecast Error Variance Decomposition
VECM	Vector Error Correction Model

CHAPTER ONE

INTRODUCTION

1.1 Overview of the Research

Regional and global financial integration has substantially increased over the last few decades. There is no doubt that financial integration is playing a significant role in increasing capital flows between countries, particularly developed countries. The term “financial integration” refers to the process of removal of capital controls, which means removal of impediments such as legal restrictions, transaction costs, taxes and tariffs next to the trade in foreign assets.

Economists and other financial experts argue that increased integration with global financial markets is the key to impose market discipline on policymakers, and has helped to improve the quality macro-economic management. This issue has received a great deal of interest in most developed and developing market countries. Over the last few decades, a significant amount of research has been conducted into global and regional financial integration, particularly emerging markets. Emerging financial markets, in general, do not have high levels of market efficiency, nor the strict standards in accounting and securities regulation to be on par with advanced economies such as the United States, Europe and Japan.

According to economic and financial theory, an integrated financial market is a market where participants share relevant characteristics, namely, they use a single set of rules to deal other with financial instruments, have equal access to the financial instruments and services, and the markets are treated equally when active in the market. Based on the previous definition of financial integration, the markets must remove barriers to allow the free flow of financial services and capital across borders. In other words, in the absence of barriers generating country risk and exchange rate premium, financial assets of similar risk and liquidity are expected to achieve similar yields, irrespective of nationality or location.

This research examines the financial integration of stock markets in the Gulf Cooperation Council (GCC). In particular, the study focuses on six emerging markets

in this region, namely Bahrain, Kuwait, Oman, Qatar, United Arab Emirates and Saudi Arabia. The integration relationships amongst GCC-banking sectors as dominant sectors in the GCC financial systems are also examined. However, these markets are considered to be relatively active, compared to other Arab stock markets in the Middle East region. Additionally, this research also, examines integration between these markets and the global, developed markets representing economies of the EU and US. The Arab Gulf region is considered to be one of the richest in the world in terms of large proven crude oil reserves. However, financial integration and convergence are considered to be of the utmost importance in assessing the outcome of GCC deregulation policies aimed at improving the efficiency and performance of banking and financial systems.

The GCC countries were established in 1981 and include six Arab countries, namely, Bahrain, Oman, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates (UAE). The GCC is an oil-based region with the largest crude oil reserves in the world (486.8 billion barrels) representing, 35.7% of the world's total oil along with OPEC accounts for 70% of the world's total crude oil reserves. The GCC region ranks as the largest producer and exporter of petroleum, and plays a leading role in the world in general and OPEC in particular. One of the essential economic objectives of the GCC countries is to realize that intense dependence on one single exhaustible resource (Oil) is detrimental for genuine and sustained economic growth. Therefore, great efforts have been exerted over the past several years towards diversifying the economic bases of the Gulf countries. Strategies include promotional policies to attract more foreign capital, improving corporate governance, and enhancing financial and capital markets towards achieving economic and financial integration.

In recent years, countries in the GCC have dramatically grown their cross-border financial asset holdings from just under 10% of GCC GDP in 1980, to over 100% in 2007. In addition, market capitalization in the GCC has increased to $770.8 billion in 2012. Further, real GDP growth in the GCC countries is expected to reach 7.8% in 2011, as oil production expands to stabilize global oil supply in the face of unrest in the Middle East, which started in 2011. The strongest performer within the GCC region is Qatar where real GDP was projected to expand by 20%, while Saudi Arabia was expected to grow at 7.5% in 2011 (KAMCO, 2011). Oil is major revenue for this region, and GCC countries are major suppliers of oil in the world energy markets.

Stock markets are more likely to be susceptible to oil price volatility. This, which in turn, means the process of financial integration, is likely to be also affected. The financial markets in the Arab Gulf region have improved rapidly over the last decade. This improvement maybe attributed to several factors, such as, monetary stability, higher economic growth, and market liberalization.

Various measures have been developed for measuring financial integration, such as International Capital Asset Pricing (ICAPM), developed by Sharpe (1964), and Arbitrage Pricing Theory (APT), introduced by Ross (1976) . Some studies used correlation of the local financial market return with the world financial return as a measure of integration; others concentrated on the investment restriction or extent of efficiency as indicators of integration. A significant number of studies in financial economics focused on the issue of financial integration. Much of the recent research focused on the US and Europe, applying cointegration techniques to assess the degree of global or regional financial integration.

The cointegration methodology developed by Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990) has been widely used for market integration since first applied by Taylor and Tonks (1989), and Kasa (1992). A greater number of these studies applied recent econometric techniques, and focused on highly developed financial markets. However, a set of variables is defined as cointegrated if a linear combination of them is stationary (Engle and Granger, 1987) , (Brooks, 2008). More generally, a system of two or more time series that are non-stationary in levels and have individual stochastic trends, can share common stochastic trends. In such instance, series are said to be cointegrated, and may be interpreted as having a long-run equilibrium relationship (Hammoudeh and Choi, 2006). There are common factors that can move the variables over time. Thus, the idea behind the cointegration test is to determine whether a group of non-stationary series is cointegrated or not.

More generally, before estimating a multivariate dynamic model, it is imperative to determine whether these variables have a long-term relationship between them. There are several possible tests for detecting cointegration, and the relationships can be tested either on a bivariate base by applying Engle and Granger (1987), or a multivariate test based on autoregressive representation as proposed by Johansen (1988), and Johansen and Juselius (1990). This study employs the Johansen (1988),

Johansen and Juselius (1990), and Johansen (1995) methodology to implement cointegration test, since this approach provides more robust results when there are more than two variables in the system, as is the case in this research, and when the number of observations is greater than a hundred (Gonzalo, 1994), (Hammoudeh and Li, 2005). The Johansen (1988) and Johansen and Juselius (1990) technique was developed for assessing long-term relationships among economics variables. This procedure is based on the maximum likelihood estimation in a Vector Auto Regressive (VAR) model. Johansen's approach proposes two tests statistics to identify the number of characteristic roots that are insignificantly different from unity; these tests are the Trace test and the Maximum Eigenvalue test.

1.2 Significance of the Research

Due to the vital role that financial system plays in the economy as a key economic agent, issues of financial integration and convergence of stock markets in GCC are considered to be utmost important, particularly in terms of evaluating the outcome of GCC deregulation policies aimed ultimately at improving the efficiency and performance of the economic and financial sectors. The concept of integration between GCC markets has received a great deal of attention, and limited studies have been conducted to measure the degree of integration between these markets (for example, Assaf, 2003;Hassan, 2003;Darrat and Al-Shamsi, 2005;Al-Khazali *et al.*, 2006;Bley and Chen, 2006;Simpson, 2008b;Balli *et al.*, 2013a).

The inter-regional financial integration, which focuses on the relationships between markets within a particular region, is different from global integration, which examines the relationships between markets in the region and global markets. In this context, measuring cointegration between GCC and global markets (excluding oil) has not been widely investigated. However, the impact of oil prices on the GCC stock markets returns have received a great attention (for example, Hammoudeh and Aleisa, 2004;Zarour, 2006;Fayyad and Daly, 2011;Mohanty *et al.*, 2011) the findings of previous studies concluded that oil has a significant relationship with GCC stock markets returns, and this region receive a significant volatility from oil market. This finding could be intuitive, and attributed to the dependency of these economies on oil as major revenue. However, the nature of this relationship would be more accurate when the oil market examined along with developed markets.

Nevertheless, it has been called by several studies as future research to focus in sectoral analysis of GCC financial markets rather than total market index. In this regard, there has been relatively little literature published on the field of sectoral market integration in GCC region (see, for example, Simpson and Evans, 2004;Hammoudeh *et al.*, 2009;Maghyereh and Awartani, 2012b;Balli *et al.*, 2013a).

Given the above issues raised by previous studies, this research contributes to the body of knowledge related to financial integration and diversification opportunities in the GCC region in many aspects. Firstly, this research addresses the issue of financial integration in the GCC stock markets, regionally and globally, in the context of the global financial crisis (GFC), as one of the most recent significant economic events. The whole sample period is divided into two sub-periods before and after crisis to avoid the structural break in data caused by GFC. These sub-periods clarify how the integration of these markets behaves in terms of their response to the contagion effect of global financial crisis. Hence, it also examines time-varying cointegration and shows how the integration process of GCC markets has changed over the sub-sample periods.

Secondly, besides testing the cointegration relationship among GCC stock markets, this research also investigates the long-term relationships between GCC-banking sectors. The banking sectors have been chosen rather than other sectors, for two main reasons: First, there is no doubt that the banking sector, as indicated by the composition of GCC stock market indices and as born out in the analysis contained in this study is the biggest and most dominant sector in the GCC region (see, for example, Hammoudeh *et al.*, 2009;Espinoza *et al.*, 2011;Maghyereh and Awartani, 2012b). There is also substantive evidence to suggest that the economic health of any country or region is vitally dependent on the financial health of their banking sectors. Second, it has also been suggested that future research should focus on sectoral analysis for market integration rather than the entire market, and up to date there is no substantive research focused in an integration of GCC banking sector as a key agent representing the interplay of macro and microeconomic factors within the GCC region. Further, this analysis will also support the argument that banking sector is a major driver of the aggregate index of GCC equity markets.

Thirdly, at the global level, this research analyses the degree of integration between the GCC equity markets and global markets including oil market, interacted into a

single model. Analysis will be undertaken to discover whether these markets are linked to global markets, and how this region reacts to the shocks in global markets. This analysis provides a clear image about the linkage between the GCC stock markets and international markets. Further, this analysis considers the relative effects of the three global markets to identify which of these effects has the greatest impact on GCC-equity markets.

Fourthly, this research is one of the few researches used variance decomposition and impulse response function to identify the interaction mechanism of the six GCC markets regionally and globally. The variance decomposition and impulse response functions analysis add further support to the results of Johansen's cointegration test, Granger-causality, and Granger Block Exogeneity Wald test. Therefore, at the global level, the current research provides insights into the percentage of forecast error variance of the GCC stock markets and their response to shock in the global markets.

Fifthly, the GCC member states have taken several steps to achieve full economic and financial integration. The findings of this research can thereby assist politicians and policy-makers in GCC when implementing new policies regarding to market integration. Furthermore, the results can also be interpreted from the perspective of investors need to allocate their portfolio in an efficient manner.

1.3 Objectives of the Research

Given the above motivation, the main objectives of this study are twofold. First objective is to examine the degree of regional and global financial integration of the six GCC stock markets and how the integration between these markets has changed throughout the time. The second objective is to investigate the integration between GCC-banking sectors to observe if the integration in the banking sectors leads to integration of the GCC markets. In addition, this research inspects the spillover effects of global volatility on GCC stock market returns with special consideration to the 2008 global financial crisis.

In particular, this research will attempt to address the following issues and questions:

1. Identify and examine cointegration relationships between the GCC-equity markets at regional and global levels.
2. Investigate the cointegration relationships between the banking sectors in GCC countries.

3. Do all stock markets within the GCC countries achieve equilibrium or stability relationship in the long-term? This is in effect a measure of the degree of convergence and regionalization of financial markets.
4. Which market in the region has the most influence on other GCC equity markets in the short and long-term?
5. How do shocks caused by global markets affect equity markets in GCC region?
6. Oil is the major export for this region, and most countries are members of OPEC. The effect of oil return on stock markets returns are also examined, along with global markets.
7. This study aims to assist local and foreign investors, by providing accurate information regarding diversification opportunities across the Gulf Arab region, also strength and convergence of financial markets in these countries.

1.4 Data and Methodology

1.4.1 Data Source

This study employs weekly closing prices of six GCC stock markets, namely, Bahrain, Kuwait, Oman, Saudi Arabia, Qatar and the United Arab Emirates. As representative of developed markets, the study uses S&P500 as a proxy of the US; the EU350 represented the EU and Brent spot oil prices. The US and EU markets have been chosen because they are among the largest stock markets in the world, and play a vital role in their economies and in the economic world. Further, the GCC region has strong economic relationships with both markets.

The data were obtained from Standard and Poor's (S&P) database and DataStream, spanning the period from 3th January 2005 to 31st December 2013, taking holidays under consideration. Weekly data for crude oil price were sourced from the United States, department of energy, energy information administration (EIA).

1.4.2 Method of the Research

With the intention of measuring the financial integration in Arab Gulf region, this study reviews different financial and economic approaches that have been developed to measure the degree of financial integration. The empirical model used in this study was drawn from review of early theoretical models related to financial economics

theory in the capital asset pricing model (CAPM) and Arbitrage Pricing Theory (APT). In order to measure financial integration in the Arab Gulf region, this study uses recent advanced quantitative techniques based on lagged multivariate analysis to undertake cointegration and exogeneity tests. Optimally lagged data are examined in vector error correction model (VECM) based tests of cointegration, Granger-causality, variance decomposition and impulse response functions, to investigate integration of financial systems in GCC countries.

1.5 Structure of the Research

This research is organized into seven Chapters: Chapter one presents the scope of the thesis, including motivation, objectives, and methodology used in this research. Chapter two reviews theories and literature related to financial integration at regional and global levels. The Chapter begins with a revision of the concept of financial integration, moving on to early theoretical studies related to stock market integration, such as CAPM and APT for testing integration, and finally, the Chapter reviews the recent empirical studies related to financial integration.

Chapter three presents the background of the GCC financial markets, starting with a brief history and consideration of the economic and financial indicators of this region. Additionally, banking and oil markets' characteristics and their significant performance indicators are presented. Chapter four presents properties of the data used in this research, and discusses methodologies that have been used to examine financial integration. Such methodologies include unit root tests using Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS), VECM, Johansen's cointegration test, Granger-causality, variance decomposition and impulse response functions. The Chapter also discusses the structural-break test in data for all indices under the study. Spillovers of returns and volatility have also discussed in this Chapter.

Chapter five presents the main findings of the thesis, as a result of testing for dynamic relationships between the GCC equity indices, employing the test of Johansen's cointegration, followed by testing integration between the GCC and global markets. In relation to the sectoral market integration, this Chapter estimates the integration between GCC-banking sectors and the results are presented in last section of the Chapter.

Chapter six provides a discussion of the main findings, along with the contribution of the research to the body of knowledge. Chapter Seven concludes the thesis; and briefly overviewing the previous Chapters and considers the policy implications of the findings. Finally, the limitations and suggestions for future research are presented at the end of this Chapter.

CHAPTER TWO

THEORY AND LITERATURE

2.1 Introduction

The degree of integration across financial markets has generated a considerable body of studies, particularly over the last two decades. A significant number of researches have investigated both regional and international asset market integration. The concept of 'market integration' refers to the process of removal of capital controls, or impediments such as legal restrictions, transaction costs, taxes and tariffs next to the trade in foreign assets. The accepted definition of market integration is built on the law of one price (LOOP). This states that if two or more markets are integrated, then identical securities or assets are priced equally across borders. However, numerous early researches attempt to assess regional and global financial integration, and various techniques have been developed in order to measure financial market integration. Examples include correlation in returns between both domestic and international markets.

The purpose of this chapter is to review the early and current literature relating to financial integration. The chapter divided into four sections, providing an overview of financial market integration, presenting early theoretical studies relating to financial integration using CAPM and APT, and reviewing recent literature used current econometric techniques.

2.2 Overview of Financial Integration

The literature provides various alternative definitions of financial integration. However, one attractive definition is that financial markets are considered integrated when the law of one price holds. This definition stipulates that if two or more markets are integrated, then identical securities should be priced identically for both markets (Oxelheim, 2001). Baele *et al.* (2004) define financial markets as being integrated if all potential market participants shared the same relevant characteristics. In other words:

a. Financial markets face a single set of rules when they decide to deal with those financial instruments and or services.
b. They have equal access to the same set of financial instruments and services.

c. Markets treated equally when they are active in the market.

De Brouwer (2005) and Ho (2009) define financial integration as the process through which financial markets in an economy become more integrated with those in other economies, or in the rest of the world, implying an increase in capital flows and tendency for prices and returns in different countries to equalize. Based on previous definitions, if assets have identical risks and returns, then they should be priced identically, regardless of where they are transacted. Additionally, the integration of financial markets can be measured by comparing prices or returns of assets that are issued in deferent countries and generate identical cash flows (Pagano, 2002). Most theoretical studies examined markets' integration by looking at returns in two perfectly correlated portfolios of securities from different countries. However, to achieve full market integration, financial capital should be free to flow across borders without any restrictions or political regulations.

The literature of finance theory implies that returns of assets must be linked with the risk. This leads to one of the most important elements of financial integration that is 'risk-sharing'. This issue is widely accepted within an integrated region; portfolios need to be well diversified, and the degree of systematic risk should be identical across assets in the different countries. In this context, financial integration should offer additional opportunities to share risk and to smooth consumption inter-temporally (Baele *et al.*, 2004).

Financial integration faces many obstacles that can affect the process of such integration, either regionally or globally (Jappelli and Pagano, 2008). First, within one region, it is very common that currencies are different from country to country. In such case, fluctuations in exchange rates create additional risk, and even with no exchange rate fluctuations risk, transaction costs for currency conversion will include deviation from international arbitrage. The second barrier to financial integration is differences of regulation among countries, such as taxes, which can prevent financial intermediaries from competing across borders. Finally, uneven information between potential foreign and domestic entrants is also barriers to the market integration.

However, an integrated financial market should remove all formulas of barriers for trading of financial assets and the flow of capital, which means allowing for efficient allocation of financial capital for investments in different countries. The literature

suggests that greater financial integration allows for better allocation of capital (Levine, 2002). Furthermore, investors will be permitted to invest wherever they trust that these investments will be allocated to the most productive uses. Therefore, more productive investment opportunities will become available to some or all investors (Baele *et al.*, 2004). The literature also offers various techniques for measuring the degree of financial integration. However, based on a review of the literature, Pagano (2002) states that financial integration can be classified into four broad categories, and these have been computed and applied to assess financial integration in the European Union. These indicators are:

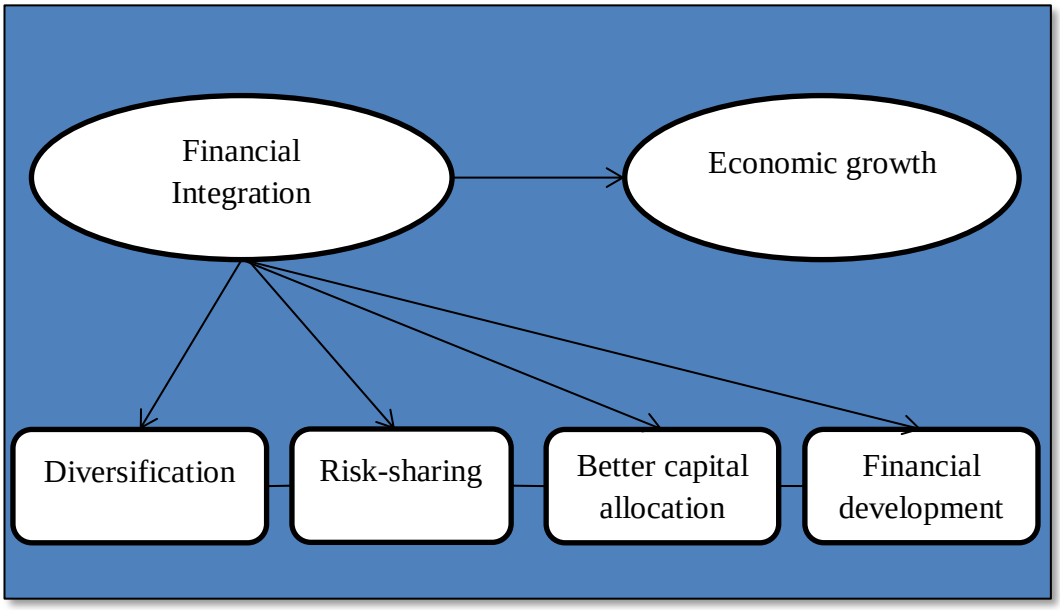
a. Credit and bond market integration.
b. Stock market integration.
c. Integration based on economic decisions of households and firms; and
d. Institutional differences that may induce financial market segmentation.

Similarly, Baele *et al.* (2004) suggest that financial integration can be measured by applying three broad categories; namely, price-based measures, news-based measures, and quantity-based measures. Price-based measures assess differences in prices or returns, based on assets pricing model, but it is difficult to estimates and requires a long time series of data to provide reliable estimates. Adam *et al.* (2002) and Baele *et al.* (2004) consider the correlation of stock market returns as an alternative indicator for assessing financial integration. In addition, local or global news is considered to play a vital role in controlling prices across financial markets (Babecky *et al.*, 2009).

A recent study conducted by Stavarek *et al.* (2011) suggests that, for evaluating financial integration of equity markets, quantity based indicators are the best measure. However, financial integration ultimately aims to increase production specialization, capital allocation, and economic growth (Obstfeld, 1995). Baele *et al.* (2004) propose four fundamental benefits of financial integration (refer Figure 2.1); risk-sharing, diversification, better capital allocation, and financial development for a higher economic growth. In addition, Levine (1997) finds that financial development robustly induces economic growth. Likewise, Quinn (1997) reports that capital account openness is strongly and positively associated with the economic growth. Other researchers, (for example, Levine and Zervos, 1996;Levine, 2002;Beck and Levine, 2004;Quinn and Toyoda, 2008), all suggest that there is a positive

relationship between financial development and economic growth. Pauer (2005) argues that the issue of financial integration has strong association with issues of stability and instability of financial system. For instance, financial integration leads to the stability of a financial system from different aspects, such as offering a higher degree of risk diversification, better capital allocation, and lower probability of asymmetric shocks which leads to development of a financial system and subsequent achievement of economic growth (Sharma and Bodla, 2010).

Figure 2.1: Linkage between financial integration and economic growth



Source: Munich Personal RePEc Archive (MPRA) 2011.

Several arguments are presented for costs of financial integration. However, regional or global financial integration may exhibit certain costs. Evidence of costs of financial integration are identified by numerous researchers (for example, Kraay, 1998;Arteta *et al.*, 2001;Edison *et al.*, 2002;Agénor, 2003;Edison and Warnock, 2003;Baele *et al.*, 2004), all of whom, claim that financial integration may negatively affect economic growth. Stavarek *et al.* (2011) summarize these costs as follows:

a. Concentration of capital flows and lack of access to financing for small countries.
b. Insufficient domestic allocation of capital flows.
c. Instability of macro-economic environment; and

d. Risks associated with foreign bank penetration, particularly in emerging markets.

There is therefore, argument about whether financial integration promotes or generates economic growth. The economic policy makers continue to look at achievement of high levels of financial integration to move their economies forward. Nevertheless, a systematic analysis of the literature suggests that it is difficult to establish a robust fundamental relationship between degree of financial integration and output of economic growth.

2.3 Financial Markets Integration: Evidence from Capital Asset Pricing Model and Arbitrage Pricing Theory

One of the initial research studies in the field of portfolio theory was the influential study undertaken by Markowitz (1952). In this study of "Portfolio Selection", Markowitz proposed how investors should choose their optimal portfolios. Later, Sharpe (1964) and Lintner (1965) expanded Markowitz's study, and developed one of the most famous financial equilibrium models. The capital asset pricing model (CAPM) proposes a linear and positive relationship between a security's expected return and its systematic risk.

A number of studies have been conducted to measure financial integration based on CAPM and APT. Ross (1976) proposed as a substitute model for examining how stock prices are determined. The main implication of the APT is that the expected return should be linearly associated to the covariance of assets, and with the return on the market portfolio. The APT model is determined by the expected return of the financial asset, which should be linked, to a number of macroeconomic factors.

Stehle (1977) was the first researcher to test market integration using CAPM framework. To test whether risk can be diversified in a segmented market rather than global markets, the author used stock prices indices for seven European countries, US, Canada and Japan during the period from December 1958 to December 1975. The results indicated that international risk factors are insignificant and therefore showed that international markets are segmented. However, several studies argue that the results of Stehle's procedure were inconclusive. Jorion and Schwartz (1986) and Chancharat (2009) investigated the issue of integration versus segmentation of the Canadian stock market relative to the North American market for the period 1968

to 1982. Based on the Stehle (1977) methodology, the authors compared international and national forms of the CAPM and developed different models to assess both integration and segmentation hypotheses. The results revealed that the Canadian market is not fully integrated, and there is a segmentation process for both domestic and inter-listed companies due to several obstacles such as legal barriers. In addition, the authors found that an international CAPM was not a good description of the pricing of Canadian securities, and evidence of segmentation in the pricing of Canadian share markets has taken place.

In a similar work, Mittoo (1992) applied CAPM and APT frameworks to re-examine the integration process of Canadian and US stock markets. Monthly rates of return for both Canadian and US equity markets were used for the period 1977 to 1986. Mittoo found that Canadian and US indices were moving from segmentation to integration over time, and this result is well-matched with previous study by Jorion and Schwartz (1986). However, the study provides evidence of market integration between Canada and US from the APT model, for the period 1982 to 1986 versus a segmentation case for the period 1977 to 1981. This study supporting the later study by Koutoulas and Kryzanowski (1994) who modified the more general and less restrictive IAPT and APT models to test the hypotheses of integrated and segmented for Canadian stock market relative to the markets in North America. Monthly data were used for the period 1969 to 1988, and both models indicated that the Canadian stock market is partly integrated with the American stock returns.

Errunza and Losq (1985) developed a formal model of international capital asset pricing, focuses on pricing implications of investment barriers to international capital markets. The authors proposed a mildly segmented market structure or, as it is known "market imperfect" which is unequal access for investors to financial markets. The authors test for inability of some investors to trade in a specific class of securities. Monthly total return data were obtained for the period, 1976 to 1980 for random sample of the US equity, as well as nine less-developed countries (LDC's). The authors classified the (LDC's) investors as unrestricted investors, while US investors were classified as restricted investors. The results provided support for the hypothesis of "mild segmentation." In particular, the authors found that foreign investors would require returns to be higher than in a case where there are no such barriers. Others researchers, such as Wheatley (1988) examined global market

integration, using monthly data from the period of January 1960 to December 1985, for stock markets of 18 country; namely, Australia, Austria, , Belgium, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, Netherlands, Norway, Singapore, Spain, Sweden, Switzerland, United Kingdom and the United States. Using a simple version of the consumption-based asset pricing model, the results showed little evidence that equity international markets are integrated and the asset-pricing model held for the period of study.

Koracjzk and Viallet (1989) compared domestic and international versions of the CAPM and APT models to investigate whether the APT model has greater explanatory power than the CAPM in national and international markets. The research also investigated whether international versions of the asset pricing models outperformed or underperformed in the single-economy versions, along with the effect of changes in the regulation of global financial markets on the deviations of returns from the expected asset pricing relations. The study covered the period 1969 to 1983 using monthly stock returns from four countries (France, Japan, United Kingdom and the United States). The results documented that multi-factor models tend to outperform single index CAPM models in both domestic and international forms. Further, the value-weighted CAPM has much larger pricing errors than the APT models in both domestic and international forms, particularly in their ability to explain seasonality of the asset returns. In addition, authors found evidence that the behavior of several models is affected by changes in the regulatory environment in international markets.

Gultekin *et al.* (1989) applied the APT model to test capital market integration between the US and Japanese markets. The researchers used weekly stock returns and divided the period of study into two sub-periods; January 1977 to December 1980 and January 1981 to December 1984. Multi-factor asset pricing models were developed to test the hypothesis of market integration in the US and Japan, and the results showed that governments are the source of international capital market segmentation before liberalization. Later on, Heston *et al.* (1995) examine the integration of capital markets in Europe and the US. As the prices of common risk factors between these two countries are identical, the authors found the markets were integrated. However, the authors also contended that both markets were affected by the size of those factors.

In summary, in assessing the degree of financial integration, a number of studies have used either the CAPM or APT models, or both approaches based on convergence of financial assets "law-of-one-price". However, the CAPM developed by Sharpe (1964) and Lintner (1965) assumed that markets are considered integrated if returns for various investments risks identical across markets (Heston *et al.*, 1995). In contrast, the APT model developed by Ross (1976) differs from CAPM model in that it assumes that stock prices are affected by several types of systematic risk.

2.4 Recent Empirical Studies of Assessing Financial Integration

A significant studies have been conducted to assess financial integration using recent econometrics techniques such as Johansen (1988) and Johansen and Juselius (1990), the vector autoregressive (VAR), vector error correction model (VECM), Granger-causality, variance decomposition (VDC) and impulse response functions (IRF). This section extensively reviews the most relevant studies, which have used recent techniques. It reviews the literature on integration of global financial markets and the important work related to GCC stock markets integration. Also, the most relevant literature of sectoral market integration and studies that have focused on the relationships between oil and stock markets in emerging and developed countries are reviewed in this section.

2.4.1 Integration of Global Financial Markets

The long-term relationships between global stock markets has been at the focus of interest since Grubel (1968) analyzed the benefits of international diversification. Since then, a number of researchers have focused on long-term relationships within an international context. Different methodologies have been used in testing the degree of financial integration among markets at regional and global levels. The cointegration methodology developed by Engle and Granger (1987), Johansen (1988), and Johansen and Juselius (1990) have been widely cited in the literature of market integration since first applied by Taylor and Tonks (1989), and Kasa (1992).

However, a greatest number of these studies were conducted by applying current econometric techniques and focused on highly developed financial markets. Kasa (1992) applied Johansen (1988) and Johansen (1991) for testing common stochastic trends in the equity markets of developed countries; namely, the US, UK, Germany, Canada and Japan. The author employed monthly and quarterly time series data from

January 1974 to August 1990. The main findings of this study indicated the presence of a long-term relationship, and there is a single common trend driving these equity markets.

Arshanapalli and Doukas (1993) investigated the linkage and dynamic interactions between the US and the five largest stock markets; namely, the US, UK Germany, Japan and France. The cointegration test was applied for assessing interdependence between these markets, and the results showed evidence that the degree of co-movements within these international markets increased significantly, with the exception of Japanese market. The results also showed that the US stock market has had a significant impact on the other European markets in the post-crisis period. In addition, the Japanese equity market was found to have no relationship with the US and other European markets during the pre-and post-Asian crisis period.

This argument was further supported by the study of Aggarwal and Park (1994), which examined the transmission of equity prices between the US, (S&P 500) and Japanese (Nikkei 225) using daily and overnight stock prices. The findings suggested that the US equity prices do not lead Japanese equity prices; the authors attributed this result to the problem of non-synchronous trading of the closing values of those markets.

Park and Fatemi (1993) found evidence of a weak linkage between the US, UK and Japanese equities, and the seven Pacific-Basin region; namely Australia, Hong Kong, Korea, New Zealand, Singapore, Taiwan and Thailand. The authors utilized daily rates of return measured in local currency for each market covering the period, January 1983 to 1990. Arshanapalli *et al.* (1995) test the linkage and dynamic interactions between the US and six major Asian stock markets over the period from January 1986 to May 1992, considering Asian financial crisis. Daily data of closing prices indices were used, taking into account time-zone differences. The authors applied multivariate Johansen's cointegration test (Johansen 1988), and VECM (Engle and Granger, 1987). The results did not support the previous study, provided evidence of a long-run relationship between the US and Asian markets after October 1987. That is the influence of the US market was found to be greater during the post-October 1987. Moreover, the study found that the five major Asian stock markets were more integrated with the US market and less integrated with Japanese's market.

Richards (1995) examined the long-run relationships among 16 developed equity markets; namely, Australia, Austria, Canada, Denmark, France, Germany, Hong Kong, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, UK and the US. To check the long-run relationship between these markets, the author employed the Engel-Granger and Johansen's cointegration techniques, and the results indicate that the indices of the 16 markets are not cointegrated. Similarly, Gjerde and Sættem (1995) analyzed dynamic interactions among 10 developed countries: the US, UK, Japan, Germany, France, Switzerland, Italy, Sweden, Denmark and Norway. Daily closing prices were used for the period, January 1984 to June 1994, and the results from the multivariate VAR framework and other econometrics techniques show an absence of causal relationships between markets under the study.

A dynamic interaction relationships between equity markets in the US and other developed countries has been also discussed by Hassan and Naka (1996). The study investigates dynamic relations among the US, UK, Japanese, and German equity markets, applying Johansen's cointegration approach. The researchers used daily time series data for the period, April 1984 to May 1991. Evidence of both long run and short-run equilibrium relationships among the four developed equities markets was found. The results also documented that the US stock market led the UK, Germany and Japanese markets in the short-run during the pre-and post-October 1987 crisis. These results provide further evidence that the US stock market is considered to be a major influence on other developed markets.

Chan *et al.* (1997) applied cointegration test to examine the long-run equilibrium relationship among 18 emerging and developed equity markets. The authors in fact studied seven different groups of nations; namely, North America, G7, four big European communities, European community, Scandinavian, European financial center and the Asian region. Using monthly stock indices, the results showed cointegration for only a small number of the markets under study. The results also suggested that the number of significant cointegrating vectors among these markets increased before the October 1987 stock market crash, and that markets were efficient individually. Crowder and Wohar (1998) found much less stability and predictability among the US stock market and four European industrialized countries by applying Johansen's multivariate cointegration method. A similar technique has

been used by Kanas (1998). The author applied the multivariate cointegration for assessing pair-wise cointegration between the US equity and each of the six largest European equity markets; namely, UK, Germany, France, Switzerland, Italy, and the Netherlands. Daily closing stock indices were used, covering the period of January 1983 to November 1996; the results show that the US stock market is not pair-wise cointegrated with any of the four European stock markets.

The Pacific Basin region also received a great deal of research interest in relation to international financial integration, and the US market found to be less integrated with the region than in Europe. Janakiramanan and Lamba (1998) suggested that the impact of the US stock market on the Pacific-Basin region has diminished over recent years with Indonesia's equity market becoming more integrated with the markets in this region. This contention is supported by Phylaktis (1999), and Ghosh *et al.* (1999), all of whom found evidence of cointegration. Further, the results suggested that the Pacific-Basin stock markets are less integrated with the US, and more so with Japan's market. Nevertheless, the lesson observed from this research is that the Pacific-Basin region exhibits regional integration rather than global integration, which basically dominated by the US.

Much more attention has been given to developed European markets, with focus on the linkage between the stock markets in the US and EU with other developed markets neither regionally nor internationally. Maysami and Koh (2000) examined the long-term relationships between stock markets in Singapore, Japan and the United States. The study applied the VECM for testing long-term equilibrium relationships between the US and Japanese markets, and the Singaporean stock market. Using monthly stock price indices, the author find a positive long-run equilibrium relationship between Singapore's stock market and both the US and Japanese market. The authors find that the Japanese stock market is the second largest market in the world. Additionally, a high degree of integration was confirmed by this research. A similar study conducted by Huang *et al.* (2000), the article explored the cointegration relationships between the stock markets of Japan, the US and the south China growth triangle (SCGT) region. The results suggest that the SCGT is not cointegrated with the US and Japanese stock markets; however, evidence of regionalization was found in the SCGT region between Shanghai and Shenzhen. In contrast, a short-term relationship took place between international

stock markets and the SCGT region, and the changes in US stock price had more impact on SCGT than on the Japanese market.

David (2000) and Soydemir (2000) found similar results, indicating that the US stock market, as a benchmark of international markets had a significant effect on other European and Asian equity markets. Darrat and Zhong (2002) examined the linkage between the US and Japanese stock market to be the core driving force for the eleven Asian-Pacific emerging stock markets. To that end, the Johansen and Juselius (1990) technique was applied as an efficient approach to examine cointegration. By employing weekly stock returns from November 1987 to May 1999, evidence of a robust cointegrating relationship was found, involving each of the eleven emerging markets with the two mature markets of the US and Japan.

Ratanapakorn and Sharma (2002) investigated the short-and long term relationships between six regions' share indices of the US, Europe, Eastern Europe, Asia, Latin America and Middle East. The period of this study has divided into two sub-periods, considering pre-Asian crisis, and during the Asian crisis. Daily data from January 1990 to March 2000 were obtained for each regional index for the two sub-periods. The results of the Granger-causality support the absence of cointegrating vectors before the crisis period, while one significant cointegrating vector was detected during the crisis period. Each market contributed significantly to the long-term equilibrium relationship.

Other researchers such as Yang *et al.* (2003) examined dynamic causal linkages of long-run and short-run relationships between the US and Japanese stock markets and ten Asian emerging stock markets. The study employed the VAR framework, and results found that both long-run cointegration relationships and short-run causal linkages among these markets were more integrated after the Asian financial crisis than before. Tahai *et al.* (2004) examined financial cointegration between G7 equity markets, including, Canada, France, Germany, Italy, Japan, UK and the US. Monthly share prices indices were used in this study for the period, March 1978 to December 1997. Using Johansen's cointegration and VECM methodology, the authors find a greater integration of the G7 financial markets. Voronkova (2004) found that the central European region was becoming more integrated with international markets. Daily closing prices indices were used covering almost 10 years to examine the existence of long-run equilibrium relationships between emerging central European

stock markets and the mature stock markets of the US and Europe. This study applied Gregory and Hansen (1996) residual-based test for cointegration which allowed for a structural break in cointegration relations.

Glezakos *et al.* (2007) explored the short-and long run relationship between major global financial markets with particular attention to the Greek equity market. The study employed monthly data from the period of 2000 to 2006, applied Johansen and Juselius (1990) VAR, Granger-causality, variance decomposition and impulse response functions. The results revealed that the US market has a significant effect on other advanced international financial markets. The results of variance decomposition and impulse response functions also show that the US market is highly responsive to primary domestic shocks. Moreover, the findings suggested that the Athens stock exchange is strongly affected by the markets of the German and US.

Hasan *et al.* (2008) implemented the multivariate cointegration test to investigate long-term relationships between the Pakistan stock exchange and eight developed-world markets; namely, Australia, Canada, France, Germany, Italy, Japan, UK and the US. The data set ranged from 2000 to 2006, and the results indicate that the integration has taken place between these markets, along with evidence of a long-term equilibrium relationship.

Later on, Tripathi and Sethi (2010) examined the cointegration relationships of the Indian stock market and the global markets of Japan, UK, US and China, using Johansen's cointegration, Engle-Granger cointegration and Granger's causality tests for the period, January 1998 to October 2008. The researchers find the Indian market is integrated with the global markets. The results also indicate several unidirectional causal relationships in most cases among these markets. Khan (2011) found the China, Malaysia and Austria are not cointegrated with the US, and these markets seem to be insensitive to the global market index. The author used Johansen (1998) and the Gregory and Hansen (1996) methodology to investigate cointegration relationships between variables under study.

Regional integration among the five Asian emerging markets was the focus of research by Hung and Cheung (1995). The study examined the long-term relationships using weekly data of five Asian emerging indices; drown from different sub-periods between 1981 and 1991. The results showed that, in the second sub-

period, there was evidence of cointegration only when the stock prices converted to the US Dollar, while no cointegration was found when stock prices were measured by local currency. The researchers attributed this difference to the depreciation of the US dollar throughout the late 1980s.

In yet another study conducted by Masih and Masih (1997) and focuses on dynamic linkages among national stock prices of four Asian newly-industrializing countries; Taiwan, South Korea, Singapore and Hong Kong with the global developed markets of Germany, Japan, UK and the US. Monthly closing share price indices were sourced for the period from January 1982 to June 1994. By applying the Johansen (1988) cointegration technique, results indicated that the four Asian stock markets were relatively cointegrated with global markets. In addition, the cointegration multivariate analysis showed that Taiwan and Singapore appeared as the most endogenous variables and evidence of less-sensitive of short-term relations to the shocks from developed markets.

Kleimeier and Sander (2000) found financial markets in six European countries are still segmented. The authors applied the cointegration technique to investigate the degree of integration in retail lending. Their results reflect that European lending rates are not completely integrated. Rangvid (2001) investigated the degree of integration of three major Europe countries using the cointegration approach over the period, 1960 to 1999. The findings indicated that the European stock markets have become increasingly integrated throughout the 1980s and 1990s. Others such as In *et al.* (2001) analyzed the dynamic interdependence, market integration and volatility transmission among three Asian equity markets: Hong Kong, Korea and Thailand. The research focused, in particular, on the period of Asian financial crisis from February 1997 to June 1998, and used daily stock returns for a total of 354 observations. The study applied the multivariate VAR-EGARCH model, which allows for testing potential asymmetries that may exist in the volatility transmission mechanism. The results indicate that Thailand established a greater relationship with the stock markets of Hong Kong and Korea during the crisis period.

Azman-Saini *et al.* (2002) empirically examined the existence of long-run relationships among the ASEAN-5 stock markets; namely, Indonesia, Malaysia, Philippines, Singapore and Thailand. Weekly share prices were examined, covering the period from January 1988 to August 1999. The authors applied the augmented

Granger-Causality test developed by Toda and Yamamoto (1995) for testing long-run relationships. The results of Granger causality demonstrate that the Singaporean equity market was not affected by other markets in the ASEAN-5, except the Philippines market in the long term. These results are compatible with the study of Masih and Masih (1997), which indicated that Singapore appears to be the most endogenous variable and less-sensitive in short-term relationships to shocks from developed markets. The findings also show evidence of opportunities for beneficial international portfolio diversification within the Asean-5 equity markets.

Fratzscher (2002) investigated the integration process in European equity markets since the 1980s. The author focuses on the changes in exchange rate volatility, through the use of GARCH model. The results indicate that European equity markets have only become highly integrated since 1996. Similar results were found by Aggarwal *et al.* (2004), who attempted to measure the degree of integration among 12 European financial markets; Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Spain, Sweden, and the UK. The study employed a new cointegrating procedure, which has ability to assess the extent of time-varying integration, and used daily share price indices of the period January 1988 to September 2002. The results show that degree of integration among European Stock markets increased particularly during the period 1997-1998.

Narayan *et al.* (2004) applied a multivariate cointegration framework and Granger-causality to examine the long-run relationships of the stock price indices of four Asian countries; namely, Bangladesh, India, Pakistan and Sri Lanka. The findings indicate that stock prices of Bangladesh, India and Sri Lanka are Granger-cause stock prices in Pakistan market in the long- term. Further, the Granger-causality test shows several unidirectional Granger-causal relationships among these markets. Aggarwal and Kyaw (2005) examined financial integration of three North American free trade agreement (NAFTA); namely, Canada, Mexico and the US through employing daily, weekly and monthly data for the period 1988 to 2001, including two sub-periods from 1988 to 1993 and 1994 to 2001. The findings reveal that the presence of cointegration among NAFTA equity markets for the post-NAFTA period. Additionally, after the passage of NAFTA, the US stock prices become more integrated with both Canadian and Mexican stock prices.

Other researchers such as Click and Plummer (2005), also applied the Johansen's cointegration technique to test whether the ASEAN-5 equity markets are integrated or segmented. The researchers used daily and weekly stock price indices span a set of period from July 1998 to December 2002. The results of analysis of both daily and weekly data reveal that after the Asian financial crisis, the ASEAN-5 equity markets were cointegrated.

Saab and Vacher (2007) found evidence of price convergence in average interest rate spreads among the community and economic ventral African monetary (CEMAC). However, the authors suggest that this practical fact is not supported by an increase in cross-border flows in retail loans and deposits, and price convergence may merely reflect excess liquidity in the region. Using a mix of quantitative and qualitative indicators, the results show that bank competition within the CEMAC, as a region is limited. Ndu and Kasibhatla (2007) applied Johansen's cointegration methodology to determine the presence of cointegration in (NAFTA), using daily stock closing prices indices and different sub-periods from 1994 to 2006. The authors provide evidence of cointegration relationships among the region in each sub-period as well as in the full period.

Chambet and Gibson (2008) applied the multivariate GARCH model to estimate the level of financial integration in emerging markets. The authors find that countries with an undiversified trade structure are becoming more integrated. In addition, this study suggested that countries less open to trade are more segmented. The main point in this study is analyzing relationship between a country's trade concentration and its level of financial integration.

Guillaumin (2009) investigated the degree of financial integration among nine East Asian countries for the period, 1988 to 2006, using the panel unit root and panel cointegration methodology. The study focused on high and middle-income countries, and the findings suggest that financial integration between high-income East Asian countries is stronger than middle-income countries particularly after Asian financial crisis. Vo (2009), examined financial integration of Asian bond markets over the period, 1990 to 2005. The author finds the analysis of multivariate cointegration did not indicate a high degree of international integration between the Australian and US bond markets with selected Asian bond markets. Likewise, Yu *et al.* (2010) found

differences between the degree of integration of mature and emerging Asian equity markets.

2.4.2 Stock Market Integration in the GCC Countries

The empirical research on global market linkages amongst emerging equity markets in the Arab Gulf countries and others in the Middle East have recently received a great deal of attention. Several studies investigate the relationships between these countries at a global level, particularly their relationships with oil market. However, limited work has focused specifically on inter-regional integration in these regions. Gunduz and Omran (2000) examined the common stochastic trends of five stock markets in the Middle East and North African countries (MENA); namely, Turkey, Israel, Egypt, Morocco and Jordan. The Johansen's cointegration approach is applied to investigate the long-term relationships among markets on a weekly basis for the period of 1997 to 2000. The results indicate absences of any cointegration relationships among those emerging markets.

Darrat *et al.* (2000) found the Middle East emerging stock markets; Egypt, Morocco, and Jordan are segmented internationally, while at the same time highly integrated within the region. The study employed monthly stock prices from the period of October 1996 to August 1999, and examine the degree of global and regional integration within this region. The empirical results of Johansen's cointegration, VECM and Granger-causality tests indicate the presence of long-term equilibrium relationships amongst the three equity markets over the long-term. These results suggested that these markets might offer more diversification opportunities for international investors.

Hassan (2003) investigated the presence of long-term dynamic relationships between three markets of GCC; namely, Bahrain, Kuwait and Oman. The study used weekly stock prices drawn from the period of October 1994 to August 2001. The results of Johansen's cointegration and Granger-causality tests indicated that stock markets of Bahrain and Kuwait were cointegrated with one cointegration vector, which allows for investors in each country to benefit from the information available in both markets in the long-term. However, the results also show that the Omani market is exogenous in a dynamic model. Similarly, Assaf (2003) used various techniques to examine the dynamic regional interactions among stock market returns from six members of GCC countries, using weekly stock indices from the period of January

1997 to April 2000. The findings provided significant evidence of inter-dependence among the GCC. In addition, the author finds that the Bahrain plays a dominant role in influencing other GCC stock markets, while the Saudi Arabia was found to be slow in responding to shocks originated in other GCC markets. As stated earlier, Saudi Arabia is the biggest market within the GCC region, and the Bahrain market is the smallest one; therefore, these results support the contention that Saudi Arabia has rigid financial institutions.

Darrat and Al-Shamsi (2005) investigated the interdependence of economic and financial systems among six GCC countries over the period from 1970 to 2001. This study used Johansen and Juselius (1990) cointegration technique to test for existence of financial and economic integration among the Arab Gulf countries. They found the presence of forceful long-term financial and economic relationships linking the GCC countries. Additionally, the findings also indicate that GCC countries failed to achieve full financial and economic integration. As a result of the findings, the authors suggest that more effort should be directed towards resolving any obstacles affecting the process of financial and economic integration.

Later on, Neaime (2005b) finds evidence of long-run equilibrium relationships amongst three GCC stock markets; Bahrain, Kuwait and Saudi, and suggests that these markets offer diversification potentials to international and regional investors.

Others such as Bley and Chen (2006) found evidence of increasing market integration within six GCC stock markets. The study examined the dynamic relationships between the GCC, using weekly stock prices indices during the period of January 2000 to September 2004. The results suggest that Saudi Arabia constitutes the bulk of GCC market capitalization, and dominates GCC market activities.

Al-Khazali *et al.* (2006) empirically examined whether the GCC equity markets are inter-regionally integrated. The study uses the Johansen and Juselius (1990) cointegration test to explore the degree of long-term relationships amongst the four GCC equity markets; Bahrain, Kuwait, Oman and Saudi Arabia. The results evidently suggest the existence of robust equilibrium relationships within these markets. As expected, and previously argued by Darrat and Al-Shamsi (2005), Saudi Arabia is playing a great role in the integration of stock markets in the Gulf Arab region. Further, the study found evidence of gradual removal of capital controls in

the four GCC countries, increasing the degree of market integration process in the region. Additionally, the authors suggested that the liberalization is an important and effective channel to build solid ties between the financial and capital markets of this region.

Simpson (2008b) found evidence of cointegration among six GCC stock markets and also suggests that the UAE market has the strongest influence in the system. These results are inconsistent with previous studies, indicating that Saudi Arabia leads other GCC stock markets. The study used daily data drawn from 2003 to 2005, and multiple linear regressions of unlagged data was undertaken for preliminary analysis, then optimally lagged data were examined using cointegration and Granger-causality tests.

Yu and Hassan (2008) considered global and regional financial integration of the MENA region. In order to examine the interdependence of stock prices within GCC and non-GCC as well as investigate their relationships with global markets, the authors used Johansen and Juselius (1990) and Engle and Granger (1987) methodology. The results documented the presence of market integration between GCC and non-GCC members. In addition, evidence of long-term relationships was found between non-GCC and global markets. In another study focused in the same region, Olusi and Abdul-Majid (2008) investigated integration between the MENA and the Eurozone equity markets. The study used weekly closing stock prices, drawn over the period, June 2000 to June 2006. The results showed evidence of segmentation between the MENA and Eurozone, which supported the contention that the linkages between both groups are quite weak.

Similarly, Alkulaib *et al.* (2009) investigated the long-term relationships between MENA and GCC markets, using the 'state space' procedure[1]. The results provided evidence that the GCC members have greater interaction and linkage between themselves, than MENA region and UAE leads other markets in the region. This surprising result is nonetheless compatible with Simpson's study, which found that the UAE stock market led the other five members of the GCC. The authors attributed

[1] The state space procedure is an appropriate test for jointly forecasting several related time series that have dynamic interactions based on Granger-causality test, taking into account the autocorrelations among the whole set of variables.

these findings to the rapid growth of the Emirates in recent years. Marashdeh and Shrestha (2010) found the GCC stock markets are not fully integrated, and there was no evidence of cointegration among this region or with the developed markets. The study used auto-regressive distributed lag (ARDL) approach to cointegration to examine the long-term relationships between GCC stock markets, and between GCC and developed markets. The results were different from previous studies using the same methodology to examine long-term relationships between the variables under study.

Espinoza *et al.* (2011) used capital flow data, interest rates and equity prices to investigate regional integration among six GCC bond markets over the period, 1993 to 2009. The researchers applied two widely used measures to assess financial integration of bond markets. The first measure is beta *(β)*-convergence, which evaluates the tendency for convergence between interest rates of the variables and benchmark rate. The second measure was sigma *(σ)*-convergence, which occurs if the cross-sectional distribution of a variable decreases over time. The results indicated that GCC are not fully integrated, and only some cointegration was found between Bahrain and Kuwait. These findings are compatible with previous studies, which used different methodology from the Johansen's cointegration technique. Recently, Chaudhry and Boldin (2012) found evidence of long-term equilibrium relationships between the equity indices of five GCC financial markets; namely, Abu Dhabi, Dubai, Kuwait, Oman, Qatar, and Saudi Arabia.

2.4.3 Sectoral Markets Integration

A few empirical studies have been conducted in relation to the sectoral market integration in the GCC member states, while advanced markets was the interest of a number of researches. One of the early significant studies that focused on financial integration of banking systems in European Union was conducted by Gual (1999). The author analyses the impact of deregulation and market integration policies on the structure of European banking markets, and argues two main points: concentration and competition in the European banking system. The results of this study showed from quantitative indicators that the direct effect of market size and competition on the level of concentration are the same whatever the nature of competition.

Years after, Gual (2004) examined various indicators of financial integration in the EU banking sector and investigates the impact of integration policies on the structure

and performance on banking industry. The results reveal that the single banking market policies in the Euro zone were in the right way to achieve their goals. Simpson and Evans (2004) found the stock market returns and banking returns in GCC markets are cointegrated and highly correlated, and also causality runs significantly one-way from banking returns to share market returns.

Pérez *et al.* (2005) analyzed the pattern of banking integration among the new member states that joined the European Union in May 2004. To that end, the author used data on cross country flows of banking assets published by (BIS) over the period 1999 to 2003. By employing linear regression, they found that new member European states in the Eurozone exhibit a similar level of banking integration in terms of inflows of banking assets received than the existing member assets.

Sorensen and Gutiérrez (2006) explore the Hierarchical cluster analysis to examine the degree of financial integration in the Euro area. In their study, they focused on the banking Industry, particularly in Europe during the period, 1998 to 2004. Through the use of this relatively uncommon technique to measure integration, the authors sought to answer the following questions: to what extent do Euro area countries cluster together? Which countries tend to be in the same clusters? How does the clustering of countries evolve over time? The results show that Euro area countries have become more homogenous in terms of economic and financial structures since the beginning of EMU.

Simpson (2008a) examined financial integration, interdependence and exogeneity between Euro-banking and Latin American banking systems, using daily stock indices for each of the country banking systems during the period, 1999 to 2004. The author applied Johansen's cointegration and Granger-causality tests to investigate the dynamic interaction within and between the two regions. The results showed evidence of long-term relationships within Latin American banking systems and contended that Euro-banking systems are interdependent and cointegrated. Moreover, the results also revealed evidence of interdependence and cointegration between Euro-banking and Latin American banking returns.

Hammoudeh *et al.* (2009) used a multivariate VAR (1)-GARCH (1,1) to examine the shock and volatility transmissions in three equity sectors; service, banking and industrial or insurance of Kuwait, Qatar, Saudi and the UAE. The authors find the

volatility among these sectors are generally significant, and document that the sector's fundamentals for these markets have more influence on volatility than shocks. They also find that the past own conditional volatility for these three sectors can be used to predict their future volatility. Further, the results indicate that the banking or financial sector appear to be the least volatile among the sectors, and they made a suggestion for investors to diversify their portfolios by investing in banking or financial sector specifically in Qatar, Saudi and the UAE.

Alexandroua *et al.* (2010) found evidence of negative volatility spillover among bank stock returns for different groups of European countries. The authors used multivariate GARCH return generating model to investigate the progress of integration in the European banking industry over the period 1990 to 2005. This study found the adoption of the Euro has a positive effect on the integration of the European banking industry. Casu and Girardone (2010) discussed whether an integrated financial system is necessary to increase efficiency of the Euro economy. They applied dynamic panel data models to the concepts of β-convergence and σ-convergence to assess the direction and speed of the banking markets integration over the period, 1997 to 2003. The results indicate that convergence towards a long-run relationship does not necessarily imply improvement of efficiency levels across European banks.

Balli and Balli (2011) examined the diversification opportunities in the EMU-sector equity indices. The authors focused on the return and volatility, and discussed whether or not the EMU-wide sectoral equity indices have affected by regional or global shocks. They suggest that most of the Euro-sector equity returns are explained mainly by the aggregate Euro equity index. They also indicated that, since the beginning of the EMU, the financial sector is found to be more affected by the aggregate Euro equity index. Maghyereh and Awartani (2012b) applied the beta-convergence and sigma-convergence tests to investigate banking sector integration in the GCC during the period of 1998 to 2009. The results indicated substantial convergence and homogeneity of banking markets in the six GCC countries, particularly through the transitional period of 2003 to 2009.

Recently, Balli *et al.* (2013a) pointed out the issue of sectoral market integration, and examined spillover effects of local and global shocks on the GCC-wide sector equity markets. The authors also investigated whether the effects of local and global shocks

have changed over time. They found evidence that these markets are mostly driven by their own volatilities, and concluded that the global shocks have decreased, while regional shocks changed positively. They also suggest that portfolio diversification within the selected GCC-equity sectors; namely, basic materials, telecom and utilities, generates better opportunities than a portfolio diversified across all the GCC-wide sectors.

Another work belongs to Eurozone was conducted by Balli *et al.* (2013b). The authors investigated the integration of the Europe and the US-wide sector equity indices, focusing on returns and volatility, and spillover effects caused by regional and global shocks. They found return spillovers are not significant enough to explain equity-sector returns. The study provides evidence that when the trend is incorporated into the volatility spillover model; the equity-sectors indices tend to react similarly to the local and global shocks. Balcılar *et al.* (2013) found partial segmentation of GCC markets from the global market. Specifically, the GCC-wide sectors are found to have positive risk exposure to global markets during the low and high volatility regimes, while, negative regional exposure found to global shocks at extreme volatility regime.

2.4.4 The Long-run Relationships between Oil and GCC Stock Markets

Oil is one of most important source of revenue in most GCC economies, and the importance of sufficiently measuring the relationship between oil and stock market performance has been recognized for a long time. A great number of researches focused on the relationship between macroeconomic variables such as GDP and oil, and stock market return in advanced markets. For example, Jones and Kaul (1996) examined the reaction of developed stock markets of Canada, UK, Japan, and US to oil prices shocks. The findings document that fluctuations in oil prices have detrimental effects on real stock returns in the US, Canada, Japan, and the UK. The results also show that the reaction of US and Canada equity markets are determined by the influence of oil shocks on cash flows, while the reaction of Japan and the UK are irresolute.

Huang *et al.* (1996) applied VAR procedure to investigate the relationship between oil prices and US oil company stock returns. The results revealed significant relationship between oil price changes and some of the US-oil companies' returns. Sadorsky (1999) suggested that both volatility and oil prices are playing important

roles in affecting real stock returns in the US stock market. The author also indicates that changes in oil prices impact on economic activity, while changes in economic activity slightly influence oil prices. The study provided evidence that oil price volatility has asymmetric effects on the US economy.

With the focus on GCC region, Hammoudeh and Aleisa (2004) examined the linkages and sensitivity of five GCC-members; namely, Bahrain, Kuwait, Oman, Saudi Arabia and UAE to the oil futures returns of the New York mercantile exchange (NYMEX WTI). The authors employed daily time series data drawn from the period of February 1994 to December 2001. The results document that Saudi Arabia has the greatest causal linkage with other GCC markets, and also indicate that only the Saudi stock return has a bi-directional causal relationship with changes in NYMEX WTI oil prices.

Zarour (2006) found the response of five GCC stock markets to shocks in oil prices increased after the rise in oil prices. The study applied VAR model to investigate this relationship over the period of May 2001 to May 2005, and used daily time series data. The results showed that only Saudi and Omani markets have the power to predict oil prices, and the Saudi is more sensitive to the shocks in oil prices and vice versa. Basher and Sadorsky (2006) provide strong evidence that oil price risk impacts on stock price returns in emerging markets. The study used an international multi-factor model, which allowed for both conditional and unconditional risk factors.

Hammoudeh and Choi (2006) found several long-term equilibrium relationships between five GCC-equity markets and the three global markets (WTI oil spot prices, the US 3 months Treasury bill rate, and the S&P index). Later on, Maghyereh and Al-Kandari (2007) examined the linkages between oil prices and equity markets in the GCC. The empirical analysis supports the contention that oil price impacts the stock price indices in GCC countries in a nonlinear fashion. Malik and Hammoudeh (2007) considered the concept of volatility and the shock transmission mechanism between the global crude oil market, US equity market and the stock markets of Bahrain, Kuwait and Saudi Arabia. The study used the GARCH model for testing daily stock indices drawn from the period from February 1994 to December 2001. The results indicated a significant interaction between the US and global oil markets. Results also show a momentous volatility spillover from the Saudi to the global oil market. Lardic and Mignon (2008) investigated the long-term relationship between

oil prices and economic activity in the US and the G7, using gross domestic product (GDP) as a proxy. Results indicated evidence for asymmetric cointegration between oil prices and GDP.

Arouri and Nguyen (2010) investigated the short-and long-term linkage between oil prices and equity markets in six GCC countries. Weekly time series data are used to avoid time difference problems within the global markets. The Granger-causality tests displayed strong positive linkages run from oil prices to stock markets of Qatar, Saudi Arabia and Emirates. Results from cointegration test reveal that only Bahrain has a long-run relationship with oil prices. However, these results are inconsistent with previous studies that investigated the relationships between oil prices and GCC markets. Arouri and Rault (2010) and Ravichandran and Alkhathlan (2010) find that oil price influences the GCC stock returns in the long-term and several bidirectional relationships were found between variables.

Focusing on return and volatility, Arouri *et al.* (2011b) found substantial volatility and return spillovers between world oil prices and GCC stock market returns. The study applied the VAR-GARCH approach, and used daily stock prices in order to adequately capture the strength of the dynamic interactions between oil and stock prices in the GCC markets. Moreover, for a purpose of controlling structural break in data, the authors divided the period of study into two sub-periods; normal period and the crisis period. The results support the existence of significant shock and volatility spillovers between oil market and GCC stock markets, particularly over the crisis period.

Fayyad and Daly (2011) investigated the relationship between oil price and stock market returns for seven countries (Bahrain, Kuwait, Oman, Qatar, UAE, UK and the US). Applying the VAR model, the authors find the predictive power of oil for stock returns increased after a rise in oil prices and during the GFC period. The results also indicate that Qatar, the UAE and UK show more responsiveness to oil shocks than others. Mimouni and Ali (2012) confirm the strong linkage between volatility of oil and stock markets returns in the GCC countries. In a more recent study, Jouini (2013) concludes that significant cointegration relationships were found between the GCC and oil prices.

In summary, greatest number of the previous studies used the cointegration technique to measure financial integration, and some of them applied mixed methods to examine the relationship between financial markets and other financial and economic factors such as the oil, exchange rates and GDP. The majority of the previous studies, which examined inter-regional integration in the GCC stock markets, have several shortcomings. For instance, they do not cover the global financial crisis and its contagion to stock markets in the region, and also less attention has been paid to the integration of GCC-sectoral markets such as banking sector. Further, previous studies do not explain clearly the strengths of both the global financial markets and the oil market, nor identify which market has sufficient power to drive GCC stock markets within a single model. Most of previous research related to GCC region, has not examined the cointegration relationships over several periods, and thus, have not controlled for time-varying relationships and structural breaks in data.

This research seeks to overcome many of the above shortcomings and contribute to literature in several ways. First, this research takes into account all of the GCC equity markets. Second, it uses longer time series up to date, including two separate time series to avoid problems of structural breaks in data, and consequently, controlling for time-varying cointegration. It also includes important events that may affect the financial and banking system integration, such as the GFC. Optimally lagged data are examined through the Johansen and Juselius (1990), within the VEC model, Granger-causality, variance decomposition and impulse response functions, to achieve the objectives of this research.

2.5 Conclusion

This chapter reviews the theoretical and empirical literature regarding the regional and global financial integration in both developing and developed markets. First, the chapter provides an overview of the concept of "financial integration" and discussed the relationships between market integration and economic growth. Early financial instruments such as CAPM and APT used to measure the degree of market integration are also reviewed in this Chapter. Second, this chapter extensively reviewed literature regarding financial integration regionally and globally, with great attention to the markets under study. Finally, the chapter explored empirical literature identifying the impact of oil price volatility on the GCC-equity returns.

There is no doubt that financial integration is playing a great role in growing capital flows between countries, particularly in developed countries. The degree of integration between GCC financial markets has received a great deal of attention, and several studies have been conducted to measure the degree of integration between these markets. The review of theories and literature puts forward several research issues that can be used as a base to establish solid research issues.

Based on a comprehensive literature review, a few important gaps were identified: (a) limited studies analyzing the cointegration relationships regionally and globally in the context of the global financial crisis, and thus, investigate whether or not, the process of market integration in the GCC region are subjected to the contagion effect of GFC. This will also investigate whether or not, the process of financial integration among GCC has changed over the time; (b) testing of cointegration at sectoral level such as banking sectors in the GCC financial markets are extremely scarce; (c) the empirical findings of previous studies concluded that oil has a significant relationship with GCC stock markets returns, and these region receive volatility from oil market. However, none of the previous studies have examined oil market along with developed markets in one single model. This thesis attempts to fill these gaps identified above and addresses the issues with the application of the recent advances in time-series econometrics.

Table 2.1: Summary of Selected Studies on Financial Integration

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
1	Kasa, K. (1992)	Monthly & quarterly data from 1974-1990	US, UK, Japan, Germany, and Canada.	Johansen (1988,1990), Cointegration test	Findings indicate the presence of long-run relationship among these markets and there is a single common trend driving these equity markets.
2	Arshanapalli and Doukas (1993)	Daily data from 1980- 1990	US, UK Germany, Japan and France.	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Evidence of degree of co-movements of these five international markets has increased significantly with the exception of Japan stock market. Additionally, the US stock market is found to have a significant impact on the other European markets in the post crisis period.
3	Arshanapalli, Doukas et al. (1995)	Daily data from 1986- 1992	US and six major Asian Stock Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Evidence of long-run relationship between the U.S and Asian stock markets after October 1987, and the influence of the U.S stock market is found to be greater during the post-October 1987.
4	Richards (1995)	Quarterly data from 1969 to 1994	sixteen developed equity Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results indicate that the indices of these sixteen markets are not cointegrated around the common component.
5	Hassan, M. K. and A. Naka (1996)	Daily data from 1984 - 1991	US, UK, Japan and German.	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results indicate that the U.S stock market is considering the major influence of the other developed stock markets.
6	Masih and Masih (1997)	Monthly data from 1982 - 1994	Four Asian Stock Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	The results indicate that the four Asian stock markets are relatively cointegrated with global stock markets.
7	Chan, Gup et al. (1997)	Monthly data from 1961 - 1992	Eighteen emerging and developed equity Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Evidence of cointegration only for a small number of the markets under the study. The result also suggests that these markets are efficient individually.

Table 2.1: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
8	Kanas (1998)	Daily data from 1983 to 1996	U.S, UK Germany, France, Switzerland and Italy	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results show that the US stock market is not cointegrated with any of the four European Stock markets.
9	Janakiramanan and Lamba (1998)	Daily data from 1988 to 1996	U.S and Pacific-Basin Stock Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test and VECM	Evidence from cointegration and VECM suggests that the Pacific-Basin stock markets are less integrated with the U.S stock market and more so with Japan's stock market.
10	Maysami and Koh (2000)	Monthly data 1988 to 1995	Singapore, Japan and the United States	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Researchers found that Japanese stock market is the second largest market in the world. Additionally, a high degree of integration has been confirmed by the authors.
11	Huang, Yang et al. (2000)	Daily data from 1992 to 1997	U.S and the South China Growth Triangle	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results suggest that (SCGT) is not cointegrated with the U.S. and Japanese stock markets, but evidence of regionally cointegration was found in the (SCGT) region between Shanghai and Shenzhen.
12	Rangvid, J. (2001)	Quarterly data 1960 to 1999	Three major EMU markets	The cointegration and the recursive tests.	The findings indicate that the European stock markets have become increasingly integrated throughout the 1980s and 1990s.
13	Darrat and Zhong (2002)	Weekly data from 1987 to 1999	U.S, Japan and Pacific-Basin stock markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	A robust cointegrating relation involving each of the eleven emerging market with the two matured markets of the U.S. and Japan.
14	Azman-Saini, W., M. Azali, et al. (2002)	Weekly data from 1988 to 1999	ASEAN-5 equity markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Evidence of cointegration among the ASEAN-5 equity markets was found.

Table 2.1: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
15	Ratanapakorn and Sharma (2002)	Daily data from 1990 to 2000	US, Europe, Eastern Europe, Asia, Latin America and Middle East	Johansen (1988), Johansen and Juselius (1990) cointegration test.	No cointegration observed before pre-crisis period while one significant cointegrating vector is detected during the crisis period, and each market contributed significantly to the long-run equilibrium relationship.
16	Tahai, A., R. W. Rutledge, et al. (2004)	Daily data from 1978-1997	G-7 Equity markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Full integration of international financial markets of G-7.
17	Aggarwal, R., B. M. Lucey, et al. (2004)	Daily data from 1987 - 2002	Main EU countries	Johansen (1988), Johansen and Juselius (1990) cointegration test.	The results show that degree of integration among European Stock markets increased particularly during the period 1997-1998.
18	Voronkova (2004)	Daily data from 1993 to 2002	Emerging EU, US and Europe.	Gregory and Hansen (1996) residual-based test for cointegration	The author found that central European equity markets are becoming more integrated with international markets.
19	Aggarwal, R. and N. N. A. Kyaw (2005)	Daily, weekly and monthly data from 1988-2001	NAFTA equity Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	The findings indicate presence of cointegration among NAFTA equity markets for the post-NAFTA period. Additionally, after the passage of NAFTA the US stocks prices are have become more integrated with both Canadian and Mexican stock prices.
20	Click, R. W. and M. G. Plummer (2005)	Daily & Weekly data from 1998-2002	ASEAN-5 equity Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results of this study reveal that after the Asian financial Crisis, the ASEAN-5 equity markets are cointegrated whether using daily or weekly data.
21	Ndu, C. and K. Kasibhatla (2007)	Daily data from 1994 - 2006	NAFTA equity Markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	A long-run equilibrium relationship (cointegration) among the North American equity markets in the post NAFTA period.

Table 2.1: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
22	Simpson, J. (2008)	Daily data from 1999 - 2004	Latin American and Europe	Multivariate cointegration analysis	Significant interactions are found between Latin American banking systems and the Euro-banking systems.
23	Hasan, Saleem et al. (2008)	Weekly data from 2000 to 2006	Pakistan stock exchange and eight developed Stock Markets	Multivariate cointegration analysis	Results of Johansen and Juselius multivariate cointegration analysis indicate that these markets are integrated and there is evidence of a long term equilibrium relationship between these markets.
24	Chambet and Gibson (2008)	Weekly data from 1995 to 2003	Emerging countries	GARCH model	The authors find that countries with an undiversified trade structure have more integrated financial markets. In addition, this study suggests that countries less open to trade are more segmented.
25	Bley, J. (2009).	Daily data from 1998 to 2006	Eleven EU Markets	Multivariate cointegration analysis	Euro stock markets became more integrated between 1998 and 2006.
26	Vo (2009)	Daily data from 1990 to 2005	Asian bond Markets	Multivariate cointegration analysis	The analysis does not indicate a very high degree of international integration between the Australian or US bond markets with selected Asian bond Markets.
27	Guillaumin, C. (2009)	Panel data from 1988 to 2006	East Asian countries	Feldstein–Horioka (1980) approach to cointegration	The results show that financial integration has taken place in high-income countries than middle-income countries. Additionally, financial integration is stronger in the Post-crisis period in East Asia.
28	Tripathi and Sethi (2010)	Daily data from 1998 to 2008	Indian, Japan, U.K, U.S. and China.	Johansen and Engle-Granger cointegration tests.	Researchers found that, with the exception of Japan stock market the Indian stock market is integrated with the global stock markets.

Table 2.1: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
29	Casu and Girardone (2010)	Annual panel data from 1997 to 2003	EU-15	Dynamic panel data models(GMM)	Researchers found evidence of convergence towards a common EU-15 average does not necessarily imply improvement of efficiency levels across Europe.
30	Alexandroua, Koulakiotisb et al. (2010)	Daily data from 1990 - 2005	Different groups of EU countries	GARCH model	Evidence of negative volatility spillovers among bank stock returns for different groups of EU countries that have been involved in the European economic and political integration.
31	Khan (2011)	Daily data from 1999 - 2010	US and 22 developing and developed countries	Johansen (1998) and the Gregory and Hansen (1996) cointegration tests	Findings implied that out of 22 stock markets, China, Malaysia and Austria are not cointegrated with the US and these markets seem to be insensitive to the global market index.
32	Yu, Fung et al. (2010)	Data from 1994 to 2008	Asian Equity markets	Different approaches	Degrees of integration between mature and emerging Asian equity markets are different.

Table 2.2: Summary of Selected Studies on Financial Integration in the GCC countries

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
1	Assaf, A. (2003)	Weekly data from 1997 - 2000	Six GCC stock markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Evidence of interdependence and feedback effects among GCC stock markets.
2	Hassan, A. (2003)	Weekly data from 1994 - 2001	Four GCC stock markets	Johansen (1988), Johansen and Juselius (1990) cointegration technique.	Results indicate that share prices in Kuwait, Bahrain, and Oman stock markets are cointegrated with one cointegrating vector.
3	Darrat, A. F. and F. S. Al-Shamsi (2005)	Monthly data from 1970 - 2001	Six GCC stock markets	Johansen and Juselius (1990) cointegration test.	Results from efficient cointegration tests indicate the existence of robust long-run economic and financial ties connecting together the six Gulf countries.
4	Bley, J. and K. H. Chen (2006)	Daily data from 2000 - 2004	Six GCC stock markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Diversification within the GCC region is still beneficial as market return behavior is yet far from homogeneous. Cointegration analysis has discovered the increase in the number of cointegrating vectors.
5	Al-Khazali, O., A. Darrat, et al. (2006)	Weekly data from 1994 - 2003	Four GCC stock markets	Johansen–Juselius (1990) cointegration test	The results indicate that these four Gulf markets exhibit a robust long-run (equilibrium) relation.

Table 2.2: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
6	Simpson, J. (2008).	Daily data from 2000 - 2003	Six GCC stock markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Evidence of cointegration of the UAE market with the other GCC markets in prices. Causality test shows that UAE was the major influence.
7	Marashdeh, H. A. and M. B. Shrestha (2010).	Monthly data from 2002 - 2009	Six GCC stock markets	Autoregressive distributed lag (ARDL)	Results of the empirical tests suggest that the GCC stock markets are not fully integrated and there still exist arbitrage opportunities between some of the markets in the region.
8	Espinoza, R., A. Prasad, et al. (2011)	Monthly data from 1993 - 2009	Six GCC stock markets	Sigma (σ)-convergence and Beta (β)-convergence. (Bond Markets)	Results suggest that there is some regional integration (Bahrain and Kuwait).
9	Chaudhry, M. and R. J. Boldin (2012)	Monthly data from 2004 - 2008	Abu Dhabi, Dubai, Kuwait, Oman, Qatar and Saudi	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results show that there is evidence of cointegration between the equity indices of these countries.

Table 2.3: Summary of Selected Studies on Sectoral Equity Integration

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
1	Simpson and Evans (2004)	Daily data from 2000 to 2003	GCC stock and banking markets	Regression analysis. Multivariate cointegration analysis, and Granger-causality.	Researchers found stock market returns and banking industry returns are highly and positively correlated. Also, cointegration has confirmed between stock markets and banking markets.
2	Pérez, Sala Fumás et al. (2005)	BIS data from 1999 to 2003	European Banking	Linear regression	New member European states in EU exhibit similar level of banking integration in terms of inflows of banking assets received than the existing member assets.
3	Simpson (2008)	Daily data from 1999 to 2004	Latin American Banking and Euro-Banking	Regression analysis. Multivariate cointegration analysis, and Granger-causality.	Results provide evidence of long-run relationships within Latin American banking systems and suggest that Euro-banking systems are interdependent and cointegrated.
4	Şendeniz-Yüncü, İ., L. Akdeniz, et al. (2008)	Quarterly data from 1987 to 2003	Eleven OECD countries	Johansen (1988), Johansen and Juselius (1990) cointegration Technique.	A long-run relationship between the banking sector and the real sector is supported by cointegration test results.

Table 2.3: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
5	Balli and Balli (2011)	Weekly data from 1992 to 2007	Euro-wide sector indices and world index.	Univariate AR-GARCH model.	The study found the aggregate world equity or global sector equity indices have not affected the EMU-wide sectoral equity indices since the beginning of the Euro.
6	Maghyereh and Awartani (2012)	Data from 1998 to 2009	Six GCC-banking sectors.	Sigma (σ)-convergence and Beta (β)-convergence.	Results indicate substantial convergence and homogeneity of banking markets in the six GCC countries, particularly through the transitional period starts from 2003 to 2009.
7	Balli et al. (2013b)	Weekly data from 2005 to 2012	GCC-wide sector indices and world index.	Univariate AR-GARCH model.	GCC-wide equity markets are mostly driven by their own volatilities. Also, the authors concluded that the global shocks to GCC markets have decreased, while regional shocks changed positively.
8	Balli et al. (2013c)	Weekly data from 1992 to 2009	Euro-wide sector indices and world-wide sector indices.	Multivariate AR-GARCH model.	The authors found return spillovers are not significant enough to explain equity-sector returns, and the reaction to regional and global shocks found to be similar.
9	Balcılar et al. (2013)	Three days/week, 2006 to 2013	GCC-wide equity sectors and global factors	GARCH, MS, and MV-MS	The authors found that the during the periods of high and extreme market volatility, the highly segmented GCC-wide equity sectors can serve as safe place for international investors.

Table 2.4: Summary of Selected Studies on the Relationship between Oil and Stock Market Returns

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
1	Hammoudeh, S. and E. Aleisa (2004)	Daily data from 1994 to 2001	NYMEX and five GCC markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Saudi has the most causal linkage with other GCC markets, with the exception of Oman. Only Saudi index can predict and be predicted by New York Mercantile Exchange oil future prices.
2	Hammoudeh, S. and K. Choi (2006).	Weekly data from 1994 to 2004	five GCC stock markets	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results of cointegration tests suggest that the eight GCC and global variables have several long-run equilibrium relationships and are co-driven by common stochastic forces.
3	Zarour, B. A. (2006).	Daily data from 2001 to 2005	five GCC stock markets	Vector auto-regression (VAR) analysis.	Predictive power of oil prices has been increased after the rise in oil prices, while both Saudi and Omani markets only have the power to predict oil prices.
4	Cong, R. G., Y. M. Wei, et al. (2008).	Monthly data from 1996 to 2007	Oil and Chinese stock market.	Multivariate vector auto-regression (VAR) model	Oil price shocks do not show statistically significant impact on the real stock returns of most Chinese stock market indices, except for manufacturing index and some oil companies.
5	Apergis, N. and S. M. Miller (2009).	Monthly data from 1981 to 2007	Australia, Canada, France, Germany, Italy, Japan, the UK and the US	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results show that different oil-market structural shocks play a significant role in explaining the adjustments in stock-market returns. But, the magnitude of such effects proves small.
6	Apergis, N. and S. M. Miller (2009).	Monthly data from 1981 to 2007	Australia, Canada, France, Germany, Italy, Japan, UK, US	Johansen (1988), Johansen and Juselius (1990) cointegration test.	Results show that different oil-market structural shocks play a significant role in explaining the adjustments in stock-market returns. But, the magnitude of such effects proves small.

Table 2.4: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
7	Arouri, M. E. H. and C. Rault (2010).	Weekly and monthly data from 2005 to 2008	GCC countries	Panel Granger causality test methodology.	Strong statistical evidence that the causal relationship is consistently bi-directional for Saudi Arabia. In the other GCC countries, stock market price changes do not Granger causes oil price changes, whereas oil price shocks Granger cause stock price changes.
8	Ravichandran, K. and K. Alkhathlan (2010).	Daily data from 2008 to 2010	GCC and NYMEX oil market	Co-integration and VEC model.	Results confirm that there is an influence of oil price change on GCC Stock markets returns in the long-term.
9	Fayyad, A. and K. Daly (2011)	Daily data from 2005 to 2010	Kuwait, Oman, UAE, Bahrain, Qatar, UK and USA	Vector Auto- regression (VAR) analysis.	Predictive power of oil for stock returns increased after a rise in oil prices and during the Global Financial Crises (GFC) periods.
10	Arouri, M., M. Bellalah, et al. (2011)	Weekly data from 2005 to 2008	GCC and Oil markets	Johansen and Juselius (1990) cointegration technique. And VEC model.	Strong positive linkages between oil price and the Stock markets have been found in Qatar, the UAE, and Saudi Arabia. Weak linkages found for Bahrain and Oman, but no short-term relationships between oil prices and the Kuwaiti stock market.
11	Fayyad, A. and K. Daly (2011).	Daily data from 2005 to 2010	oil Europe Brent Spot Price, five GCC markets,	MGARCH -BEKK	Results show that the volatility for the emerging markets of the GCC countries are relatively within the same level of volatility of the advanced markets of USA and UK.
12	Mohanty, S. K., M. Nandha, et al. (2011).	Weekly data from 2005 to 2009	GCC and oil Markets.	A linear factor pricing model.	Country-level analysis shows that there exists a significant positive relation between oil price changes and stock Market returns in GCC countries, except for Kuwait, during the June 2005–December 2009 period.

Table 2.4: Continued

No.	Author(s)	Data and Period of Study	Markets Studied	Method	Results
13	Arouri, M. E. H., A. Lahiani, et al. (2011).	Daily data from 2005 to 2010	GCC and oil markets.	VAR-GARCH model	Results point to the existence of significant shock and volatility spillovers between oil and stock markets in most cases, especially over the crisis sub-period.
14	Kapusuzoglu, A. (2011).	Daily data from 2000 to 2010	Istanbul Stock Exchange (ISE) and international Brent oil Market	Johansen (1988), Johansen and Juselius (1990) cointegration technique. And VEC model.	Results indicate a cointegrated relationship between each index and oil price (long term relationship) between each of the three indexes and oil price.
15	Mimouni, K. and M. A. Ali (2012).	Daily data from 2005 to 2010	GCC and oil Market	GARCH (1, 1)	Results found a strong relationship between the volatility of stock returns and the volatility of crude oil returns. This suggests that any price movements in one of these markets will impact the price movements in the other market.
16	Wang, Y., C. Wu, et al. (2013).	Daily data from 1999 to 2011	Major oil importing and exporting countries	Structural VAR analysis	Little evidence of non-linearity for most countries in our sample, suggesting that linear models can capture the relationship between oil price changes and stock market returns.

CHAPTER THREE

BACKGROUND OF GCC FINANCIAL MARKETS

3.1 Introduction

The Gulf Cooperation Council (GCC), established in 1981, consists of six member countries; namely, Bahrain, Oman, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates. The economies of the GCC countries are characterized by large oil producing sectors, and dependency on oil exports, which exposes them to the vagaries of international oil prices. The GCC countries produce about 20% of all world oil, representing around of 36% of world oil exports (Arouri *et al.*, 2011b). The main objective of this chapter is to outline the specific characteristics of the financial markets in the GCC region.

This chapter is organized as follows: following the introduction, the second section presents an overview of the main characteristics of the GCC financial markets. The third section presents an overview of the GCC-stock markets individually, and identifies the main indicators such, as market capitalization and performance of each market, and the last section concludes the chapter.

3.2 Overview of GCC Economic and Financial System

In recent years, countries in the GCC have dramatically grown their cross-border financial assets. Market capitalization in the GCC region has increased to $762.4 billion in 2012, as shown in Table 3.1. The real GDP growth in the GCC countries is expected to increase up to 5% in 2013, as oil production expands to stabilize global oil supply in the face of unrest in Libya, which started in February 2011. Saudi, as the largest producer and exporter of oil, is the main beneficiary of the shortage in Libyan oil supply. As reported in Table 3.1, Bahrain is the smallest producer of oil, with a production of 0.20 million barrels a day, followed by Oman and Qatar. Nevertheless, Qatar is the strongest performer within the GCC region, with its real GDP approximately 5.5% in 2012. Oil is a major source of revenue for the GCC region, and GCC countries are major suppliers of oil in the world energy markets, the stock markets and in particular banking markets as a dominant sectors in the GCC

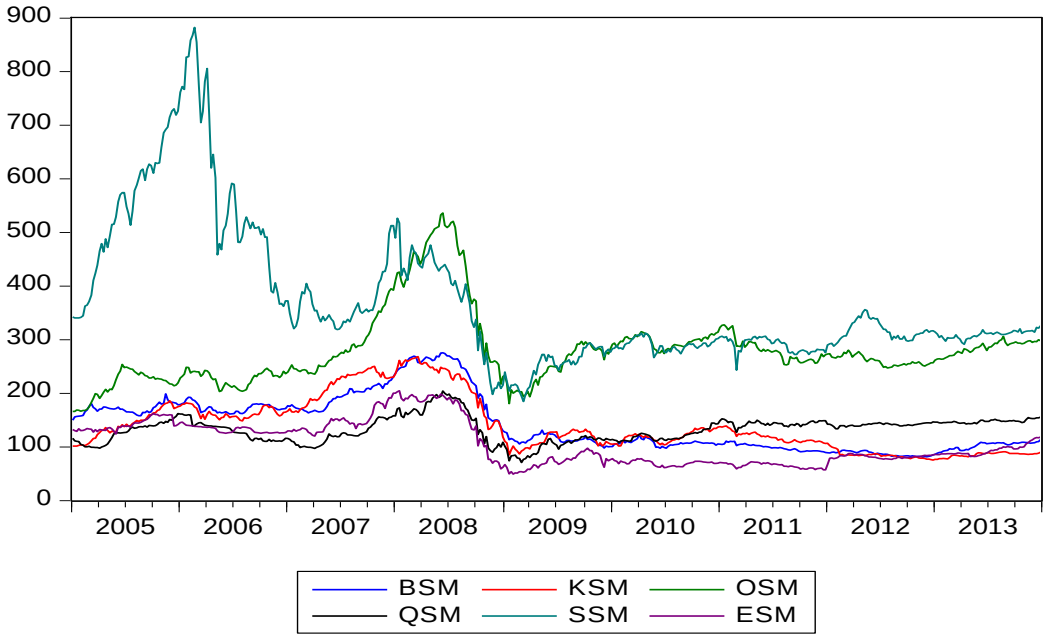
financial system, are more likely to be susceptible to oil prices volatility, which means the process of financial integration is likely to be affected.

Table 3.1: GCC Oil Production

Mb/Day	2008	2009	2010	2011	2012
Saudi	9.12	8.09	8.23	9.25	9.00
Kuwait	2.57	2.27	2.30	2.47	2.35
UAE	2.55	2.26	2.30	2.51	2.35
Qatar	0.84	0.77	0.82	0.82	0.82
Oman	0.67	0.72	0.77	0.78	0.81
Bahrain	0.18	0.18	0.18	0.19	0.20
GCC	15.93	14.29	14.60	16.02	15.53

Source: PFC, Samba Financial Group, 2012.

Figure 3.1: GCC Stock Markets Indexes



BSM: Bahrain stock market index, KSM: Kuwait stock market index, OSM: Oman stock market index, QSM: Qatar stock market index, SSM: Saudi stock market index and ESM: Emirates stock market index.

The financial markets in the Gulf Arab region have improved rapidly over the last decade. Such improvement maybe attributed to several factors; for example, monetary stability, and higher economic growth and market liberalization. As shown in Figure 3.1, the GCC financial markets collapsed sharply as a result of the GFC in latter half of 2008, and the response of GCC financial markets to the GFC was linked to the decline of global markets such as S&P500 and FTSE100. However, the

performance of the GCC financial markets has diverged from one to another; but, in general, all markets recovered together in early 2009.

Table 3.2 presented the stock market indicators for each country. Saudi Arabia has the largest market among GCC countries. The market capitalization of the Saudi is about 50% of the rest of GCC equity markets. Bahrain is the smallest market in the region, with market capitalization of 15,496 million and trading values of $ 271 million in late 2012. As stated above, all markets witnessed a sharp drop in share markets as a result of the GFC and unrest in Middle East in 2011. The implications of these events continue to affect the performance of these markets.

Table 3.2: Indicators of the GCC Stock Markets (Mln USD)

Market	Market Cap.		Trading Values		Companies Listed	
	2011	2012	2011	2012	2011	2012
Bahrain	16,513	15,424	246.00	252.00	49	47
Kuwait	100,928	101,080	20,845	25,791	229	214
Oman	19,698	22,266	2,535	2,716	114	115
Qatar	128,439	130,677	21,590	17,719	42	42
Saudi Arabia	338,791	373,405	286,945	501,417	150	157
UAE	113,984	126,619	15,338	19,295	128	123
Total	718,354	769,471	347,499	567,190	711	698

Source: Arab Monetary Fund (AMF) 2012.

The value of companies listed on GCC stock markets, however, has increased remarkably, compared to their values at post-crisis levels. With the exception of Qatari market, the aggregate market capitalization of the GCC increased by 6.6% to $769,354 billion compared to $718,354 billion at the end of 2011. Trading value for all countries increased significantly by 38.7% from $347,499 billion in 2011, to $567,190 billion in 2012. Further, the Saudi market still retain a position of leadership with the largest portion of both trading values, and trading volume as traded value reached $501,417 billion representing 90 % of the total trading values in all GCC markets.

Figure 3.2: Market Capitalization of the GCC Stock Markets

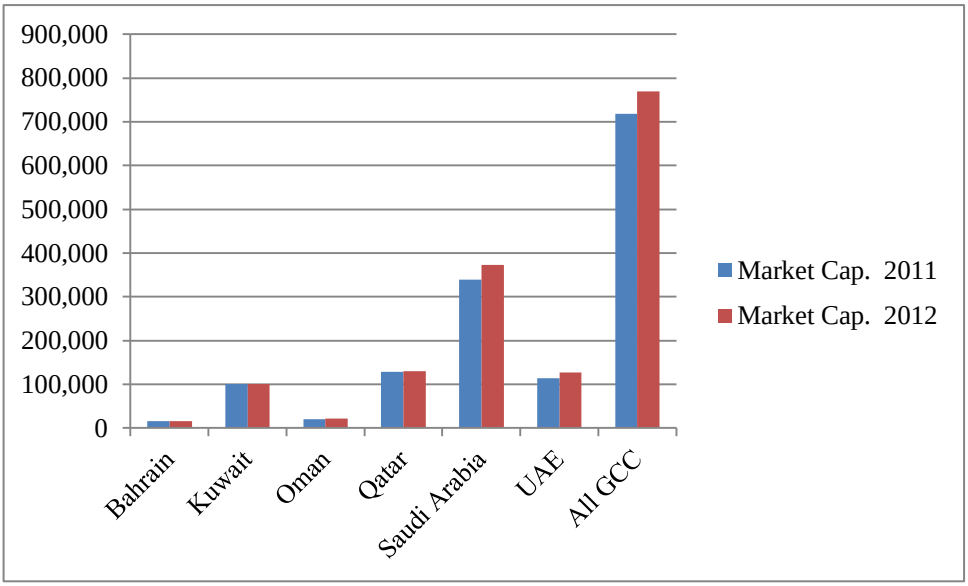
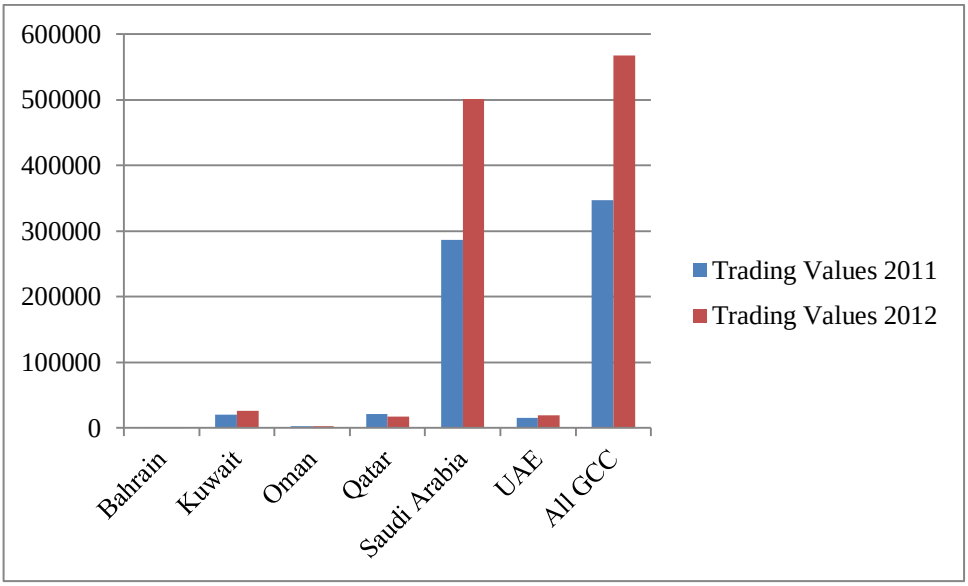


Figure 3.3: Traded Values of the GCC Stock Markets

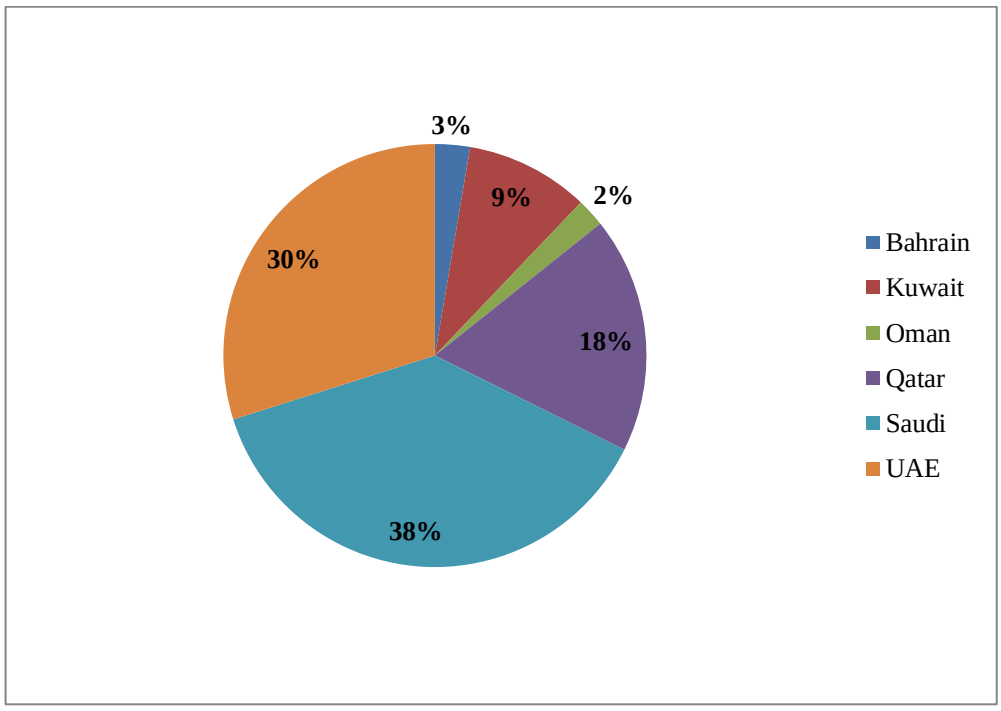


The banking sector in the GCC has also been improved dramatically over last decades. Following the capital adequacy of Basel II, the liberalization of financial services and the removal of barriers to local and forging investment in GCC countries were expected to increase efficiency and competition in the local banking

market, and support economic and financial integration (Awartani and Maghyereh, 2012). One of the main economic objectives of the GCC is to achieve economic and financial integration among the six members. However, the banking institutions in the Gulf Arab countries are mainly controlled by domestic shareholders. Bahrain and Oman have the most open banking markets with approximately 30%-40% of domestic banking assets held by foreign investors, while in the other GCC countries, the domestic banking is exclusively owned by domestic investors.

Nevertheless, despite the effect of the GFC on profitability of the GCC banking sector, most banking sectors recovered moderately in 2009. Figure 3.4 shows that the Saudi banking system is the most profitable sector in the GCC region, contributing approximately 38% of the total profit of the GCC banking markets. The second most profitable is the UAE's banking market with a share of 30%; Qatar contributes about 18% of the GCC banking market capitalization, followed by Kuwait, Bahrain and Oman with 9%, 3% and 2% respectively.

Figure 3.4: Net Profit of the GCC's Banking Market as 30.06.2011 (USD Mln)



The following are the main highlights of the structure of the individual GCC stock markets:

3.2.1 Kingdom of Bahrain

Bahrain bourse (BHB) was established as a shareholding company in 2010 to replace Bahrain stock exchange (BSE) that was established in 1987 according to Government decree, and the first Bahraini public shareholding company was established in 1957.

The Bahraini stock exchange officially commenced operations in June 1989 with 29 Bahraini shareholding companies listed (www.bahrainbourse.net). However, the equity market capitalization has risen from $6.6 billion in 2000 to $16.6 billion in 2012, suggesting that BHB is the lowest market in the region. The BHB opened up to foreign investors according to the an Government decree in 1999, allowing GCC's nationals to own up to 100% and non-GCC's nationals up to 49%, of a local company's shares.

There are 248 companies are listed at the BHB (Bahrain Annual Report 2012). The GDP of Bahrain has increased to 3.9% in 2012 compared to 2.1% in 2011. Despite the political crisis in Bahrain early 2011 the production of oil still stable at 0.18 million barrels a day. The market capitalization of Bahrain has decreased by 7% to reach 15,424 million USD in 2012 compared with 16,513 in 2011. In relation to the performance of BHB measured by both trading volume and values, Bahrain all share index increased by 6.83% and closed at 1,065.61 points at the end of 2012. The trading activity at BHB has witnessed a growth in the value of trades by 5.03% compared to 2011.

The banking sector in Bahrain, as in all GCC countries, dominates the BHB and captures the largest share in terms of value of shares traded. As shown in Table 3.3, the banking system in Bahrain has the greatest value of market capitalization followed by the Services sector (15.46%), the Investment sector (9.07%), industrial sector (6.97%), insurance sector (0.79%), and Hotels and tourism sector (0.63%). The Ahli United Bank came first among the most active Banks in Bahrain in terms of value of shares traded, with a trading value of BHD 50.02 million, this amount accounted for 45.37% of the total value of shares traded.

Figure 3.5: Sector Weight by Market Capitalization of Bahrain Market-2011

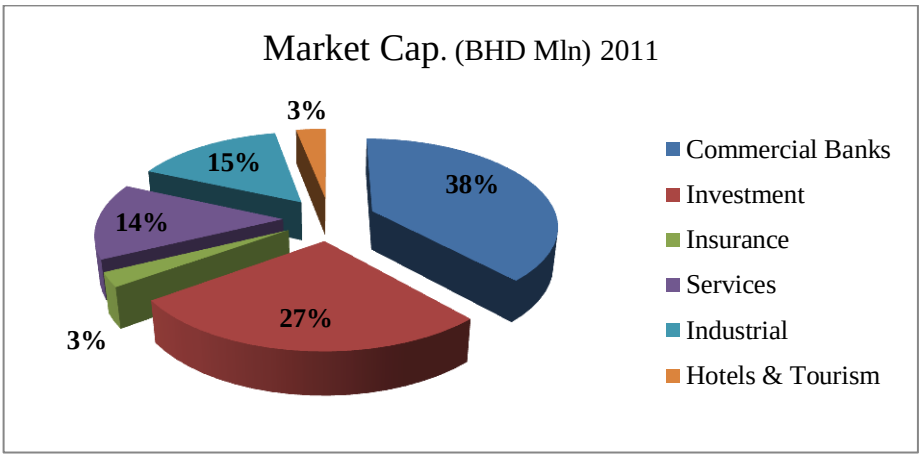


Figure 3.6: Sector Weight by Market Capitalization of Bahrain Market-2012

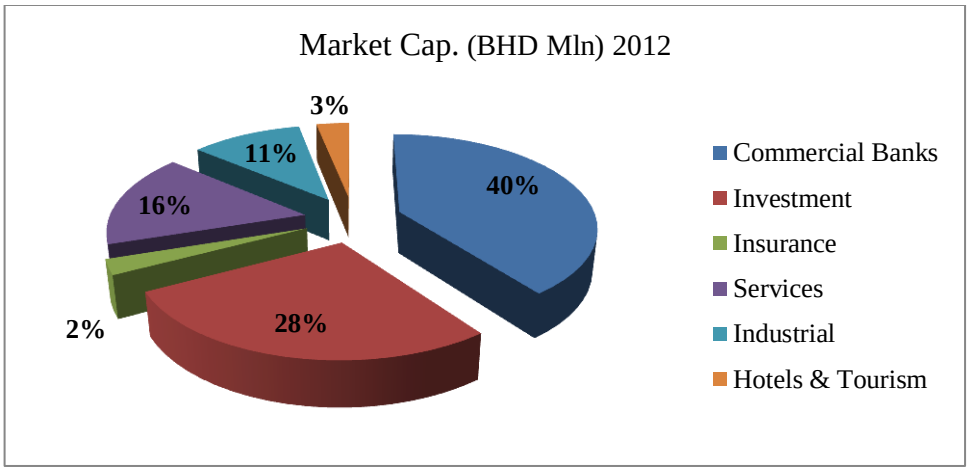


Table 3.3: Top 10 Bahrain Companies by Market Capitalization

No.	Company	Market Capitalization (BHD Mln) 2012
1	Ahli United Bank (Price in USD)	1,154
2	Aluminum Bahrain	613
3	Bahrain Telecommunications Co.	582
4	Arab Banking Corp. (Price in USD)	539
5	National Bank of Bahrain	453
6	Bank of Bahrain and Kuwait	335
7	Al Baraka Banking (Price in USD)	295
8	Investcorp Bank (Price in USD)	202
9	United Gulf Bank	195
10	ITHMAR Bank (Price in USD)	180

Source: Investment Research Dept. Asset Management KAMCO, 2012.

3.2.2 State of Kuwait

The share trading in Kuwait started in 1952, when the Kuwait National Bank (KNB) was established as the first public share holding company. Later on 14 of August 1983, the Kuwait stock exchange (KSE) was reorganized as an independent financial institution according to the Government decree. In 1995, securities trading became more efficient with the implementation of an electronic trading and settlement system. Investors from non-GCC countries were not allowed to invest directly in the Kuwaiti market, but would subscribe to overseas-based mutual funds trading in Kuwaiti securities. The KSE opened up to foreign investors in 1999, allowing GCC's nationals to own up to 100% and non-GCC's nationals up to 49% of a local company's shares. There are currently 214 companies listed on the KSE. However, equity market capitalization in the Kuwait stock exchange has risen from $100.928 billion in 2011 to $101.080 billion in 2012, while the GDP growth in Kuwait has decreased to 3.0% in 2012 compared to 4.5% in 2011. In relation to the performance of KSE, the Kuwait stock index has increased from 18% in 2011 to 19% in 2012, and, the trading value at the Kuwait exchange grown by 1.5%.

Figure 3.7: Sector Weight by Market Capitalization of Kuwait Market-2011

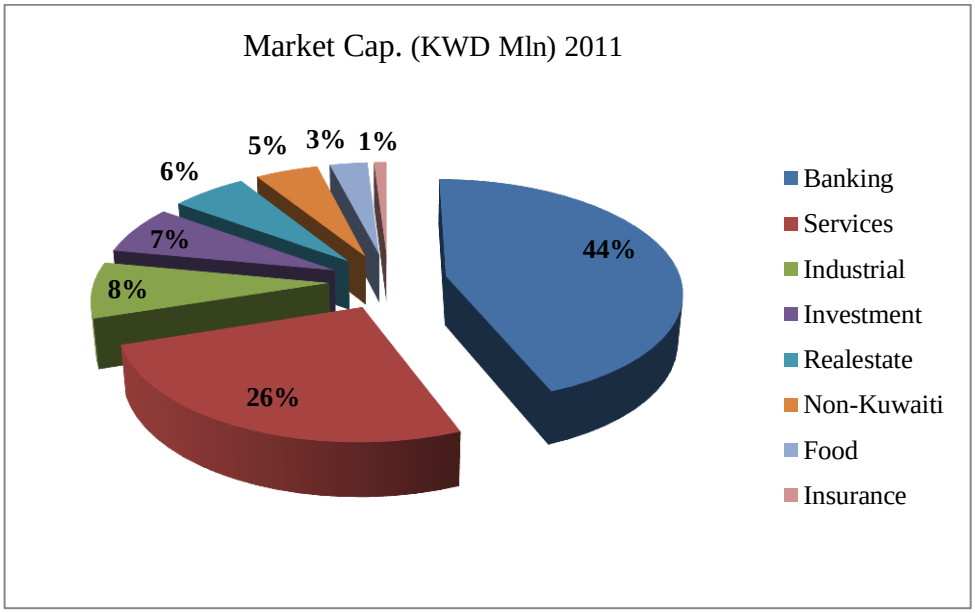


Figure 3.8: Sector Weight by Market Capitalization of Kuwait Market-2012

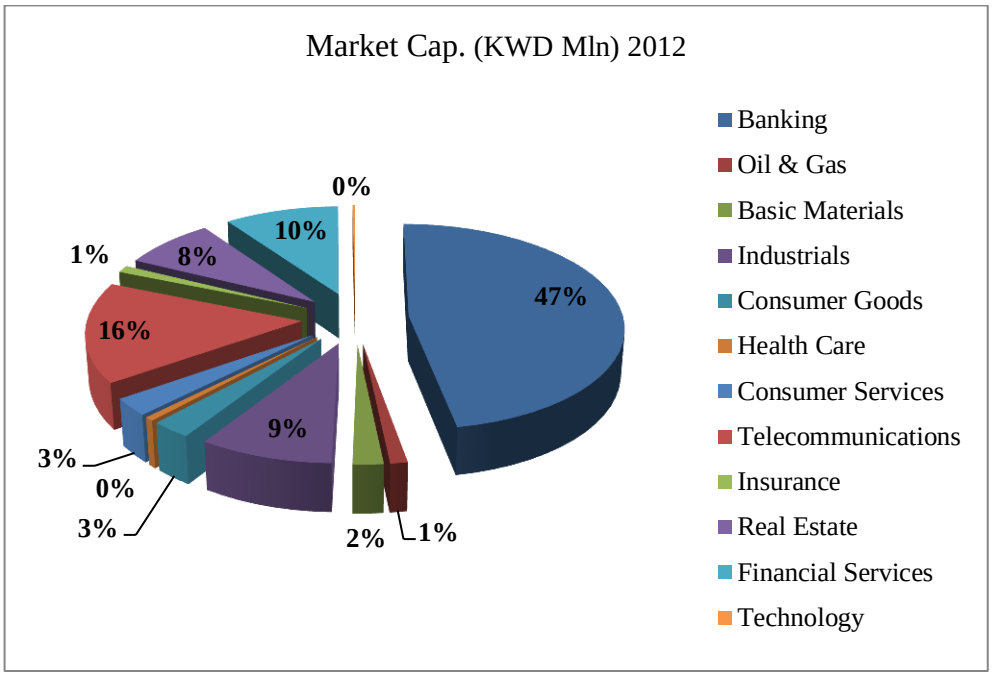


Table 3.4: Top 10 Kuwaiti Companies by Market Capitalization

No.	Company	Market Capitalization (KWD Mln) 2012
1	National Bank of Kuwait	4,179
2	Zain	3,339
3	Kuwait Finance House	2,352
4	National Mobile Co.	1,179
5	Boubyan Bank	1,119
6	Gulf Bank	1,106
7	United Ahli Bank	970
8	Commercial Bank of Kuwait	903
9	Ahli Bank	847
10	Burgan Bank	819

Source: Investment Research Dept. Asset Management KAMCO, 2012.

The banking sector in Kuwait dominates the KSE, and has the largest proportion in terms of the value of shares traded. As presented in Table 3.4, the banking system in Kuwait has the greatest value of market capitalization, followed by the telecommunications sector, and financial services sector with (10%) of total market capitalization. The National Bank of Kuwait came first among the most active banks

in Bahrain in terms of value of shares traded, with a trading value of KWD 4,179 million, accounting for 25% of the total value of the top Ten Kuwaiti Companies valued by market capitalization in 2012.

3.2.3 Sultanate of Oman

The Muscat securities market (MSM) was established in 1988 and reorganized as an automated trading and settlement system in 1998. It has the lowest capitalization of the GCC-stock markets. The Omani Government allows international investors up to 100% foreign ownership. The equity market capitalization in the Oman securities has risen from $19,698 billion in 2011 to $22,266 billion in 2012, while the GDP growth in Kuwait decreased to 3.5% in 2012 compared to 4 % in 2011. With regards to the performance of KSE; the trading value of MSM index has increased by 7.49% to reach 2,716 billion compared with 2,535 billion by the end of 2011.

The Omani banking sector, as in other GCC member states, dominates the MSM and captures the largest share in terms of the value of shares traded. As shown in Table 3.5, the banking system in Oman has the greatest value of market capitalization followed by the service and industrial sectors. Therefore, the financial service controls about 46% of total amount of MSM capitalization. Bank Muscat came first among the most active companies in Bahrain in terms of the value of shares traded, with a trading value of OMR 1,174 million that, accounting for 25.2% of the total value of the top Ten Omani companies valued by market capitalization in 2012.

Figure 3.9: Sector Weight by Market Capitalization of Oman Market-2011

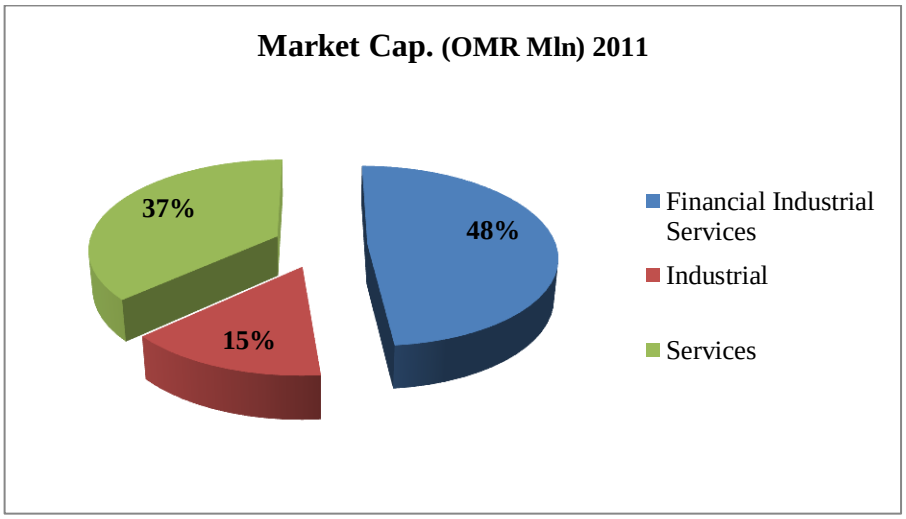


Figure 3.10: Sector Weight by Market Capitalization of Oman Market-2012

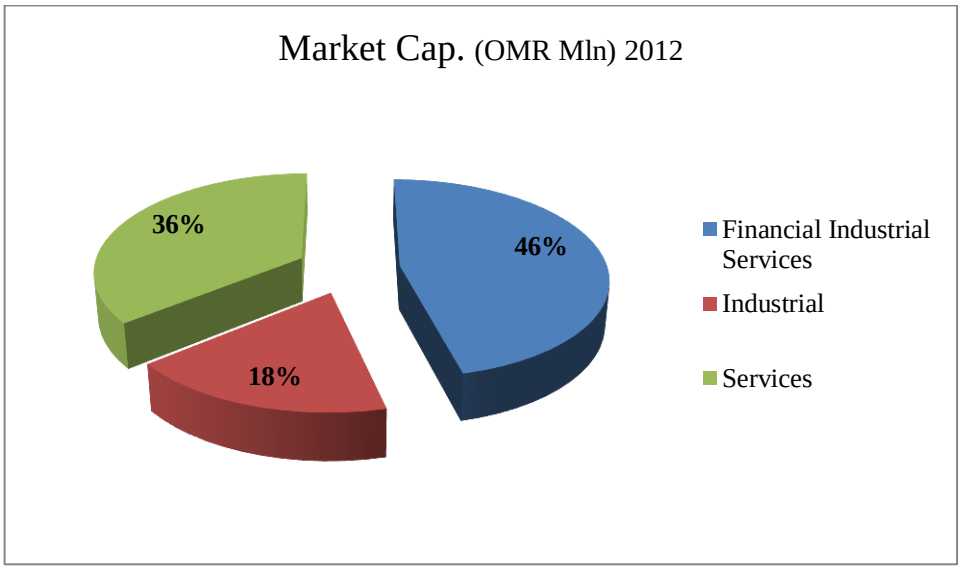


Table 3.5: Top 10 Omani Companies by Market Capitalization

No.	Company	Market Capitalization (OMR Mln) 2012
1	Bank Muscat	1,174
2	Oman Telecom Co.	1,103
3	HSBC Bank Oman	416
4	Bank Dhofar	393
5	National Bank of Oman	316
6	Omani Qatari Telecom	300
7	Raysut Cement	288
8	Shell Oman Marketing	239
9	Oman Cement Co.	213
10	Ahli Bank	213

Source: Investment Research Dept. Asset Management KAMCO, 2012.

3.2.4 State of Qatar

The Doha Securities Market (DSM) started trading in 1997, initially with 17 companies, and became fully automated in 2002 (Doha Stock). The foreign stock ownership in DSM is limited to GCC nationality only, with a maximum of 25%, and all investors are required to conduct trading activities through one of the ten currently authorized brokers. Over the period 2000-2004, Qatar was the second best performer, with an average annual index return of 28.3%. The economy of Qatar relies on oil and gas, which accounts for 50% of GDP, 85% of export earnings and 70% of

Government revenue. Oil and gas have made Qatar one of the world's fastest growing and higher per capita income countries in recent years.

The equity market capitalization in Qatar securities market, however, has risen from $128,439 billion in 2011 to $130,677 billion in 2012. Unlike other GCC stock markets, the trading value of the DSM Index decreased by 18% that is from 21,590 billion in 2011 to 17,719 billion in 2012.

The Qatari banking sector, as with other GCC members dominates the DSM and captured the largest share in terms of value of shares traded. As reported in Table 3.6, the Qatari banking system had the greatest value of market capitalization at the end of 2012, followed by the Industrial sector. Qatar National Bank came first among the most active companies in Qatar in terms of the value of shares traded, with a trading value of QAR 91,595 million that accounting for 26% of the total value of the top Ten Qatari Companies valued by Market capitalization in 2012.

Figure 3.11: Sector Weight by Market Capitalization of Qatar Market-2011

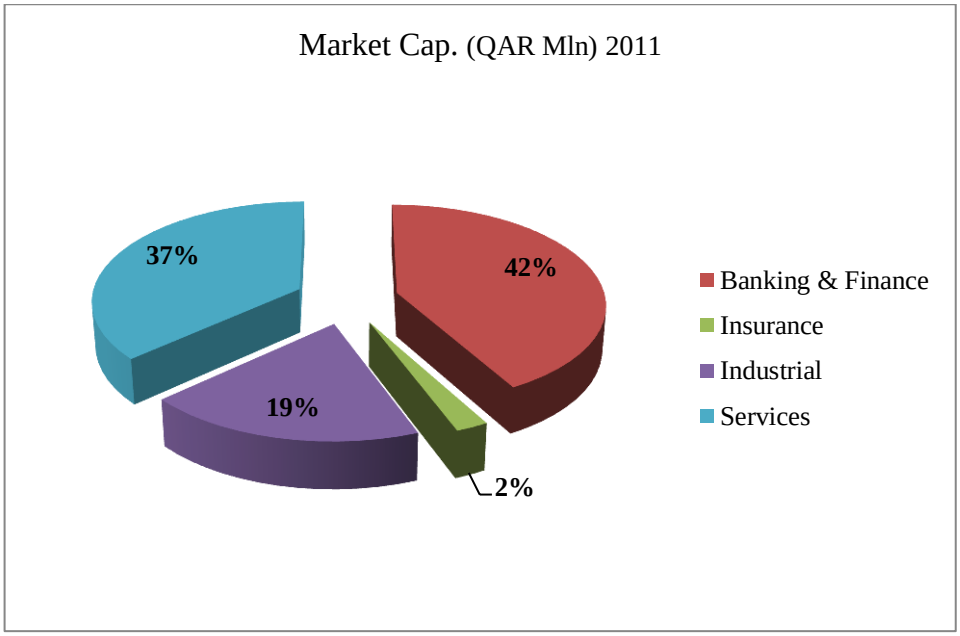


Figure 3.12: Sector Weight by Market Capitalization of Qatar Market-2012

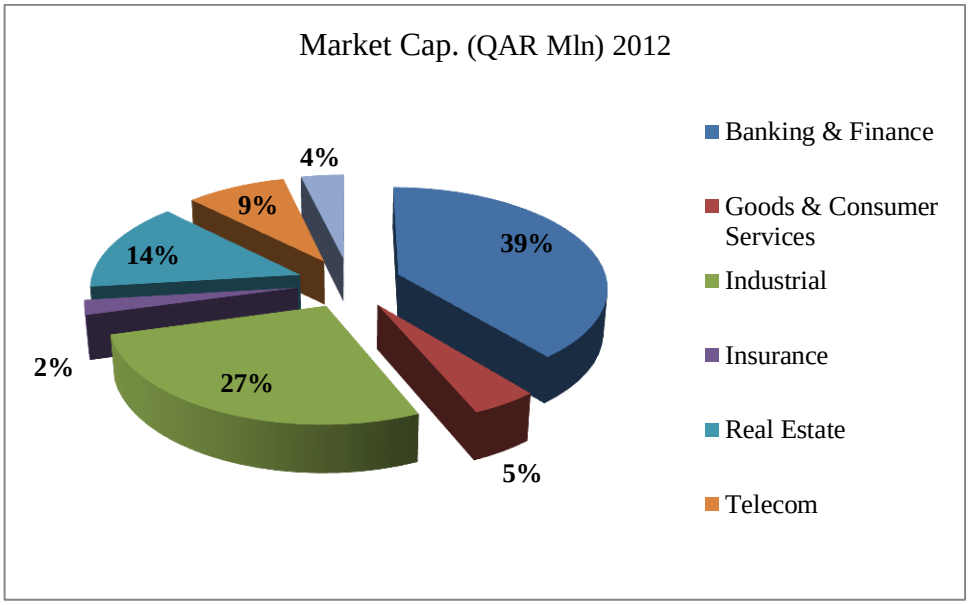


Table 3.6: Top 10 Qatar Companies by Market Capitalization

No.	Company	Market Capitalization (QAR Mln) 2012
1	Qatar National Bank	91,595
2	Industries Qatar	85,305
3	Ezdan Real Estate Co.	48,275
4	Qatar Telecom. (Q-Tel)	33,313
5	Masraf Al Rayan	18,593
6	Qatar Islamic Bank	17,722
7	Commercial Bank of Qatar	17,544
8	Qatar Fuel Co. (Wokod)	14,293
9	Qatar Electricity & Water Co.	13,240
10	Barwa Real Estate Co.	10,681

Source: Investment Research Dept. Asset Management KAMCO, 2012.

3.2.5 Kingdom of Saudi Arabia

The Saudi stock exchange (TADAWUL) is considered by far to be the largest market within the GCC region, with market capitalization of $373.4 billion at the end of 2012 (Arab Monetary Fund). In the mid of 1930s, the Saudi jointed stock companies when the Arab Automobile Company was established as the first joint stock company. In 1985, the Saudi Government placed all stock trading under the

supervision and control of the Saudi Arabian Monetary Agency (SAMA) and discontinued the broker-based stock trading system (www.Gulfbase.com). The electronic trading and settlement systems were implemented in 1988; then the market continuous moves forward towards advances in technology in financial system. The Kingdom of Saudi Arabia is an oil-based economy with the largest proven crude oil reserves in the world at 266.7 billion barrels. This amount represents 57% of the GCC reserves, 29% of OPEC, and almost 20% of the world's total reserves. The average oil production stood at 9.04 million barrels per day at the end of 2012. Further, the country ranked as the largest producer and exporter of petroleum in the world, and continues to play a leading role in OPEC, producing 28% of the total OPEC oil production (KAMCO 2012). GDP growth in Saudi has decreased to 3.8% in 2012 compared to 6.9 % in 2011.

With regards to the performance of Saudi market; the trading value of Saudi index has increased by 42% to reach 501.4 billion compared with 286.9 billion by the end of 2011. Unlike other GCC countries, the Petrochemical industries sector dominates the other sectors in the market and has the largest value of shares traded, followed by the banking sector.

Figure 3.13: Sector Weight by Market Capitalization of Saudi Market-2011

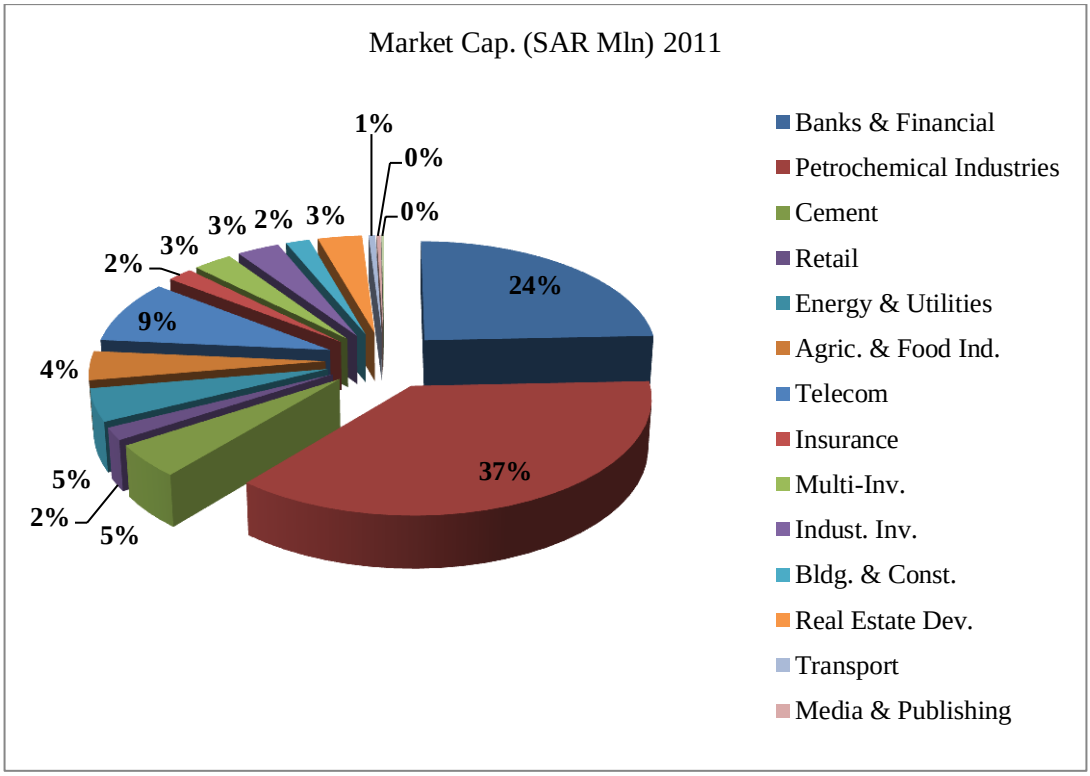
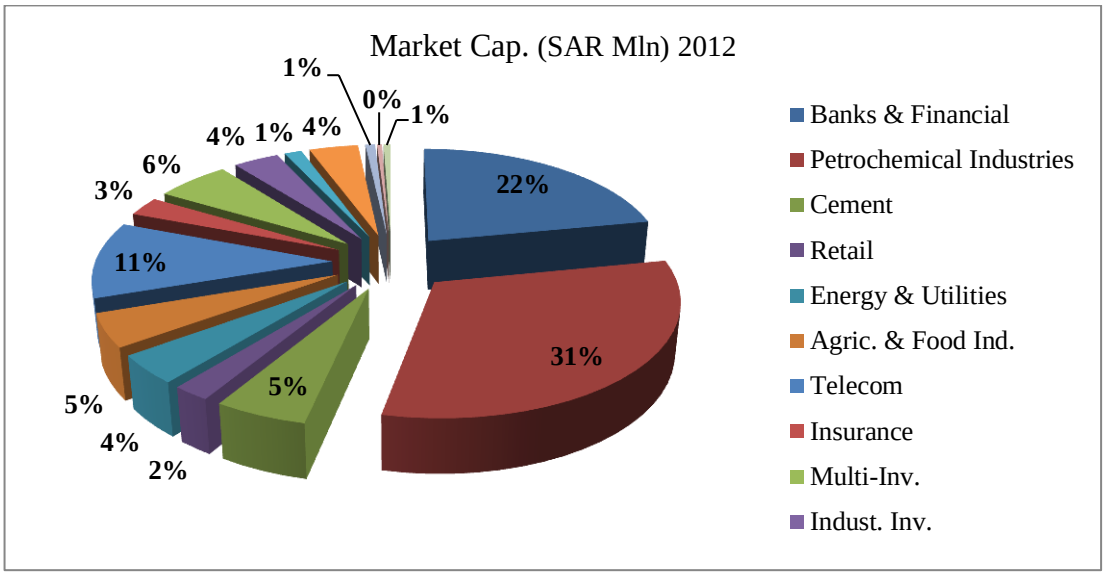


Figure 3.14: Sector Weight by Market Capitalization of Saudi Market-2012



As shown in Table 3.7, the Petrochemical industry has the greatest value of market capitalization followed by banking and financial system, and the telecom-sector controls around 11% of the total amount of Tadawul All-Share Index (TASI) Market capitalization. The Saudi Basic Industries Corporation came first amongst the most active companies in the Kingdom, with a trading value of SAR 269,250 million that accounted for 34% of the total value of the top Ten Saudi companies valued by market capitalization in 2012. The Al-Rajhi Bank is the second largest company in the Saudi market with, a total capitalization of SAR 97,500.

Table 3.7: Top 10 Saudi Companies by Market Capitalization

No.	Company	Market Capitalization (SAR Mln) 2012
1	Saudi Basic Industries Corp	269,250
2	Al-Rajhi Bank	97,500
3	Saudi Telecom	86,600
4	Kingdom Holding Co.	76,712
5	Saudi Electricity Co.	56,041
6	Al-Etihad Etisalat Co.	53,200
7	Saudi Arabia Fertilizers Co.	50,750
8	Samba Financial Group	40,230
9	Riyadh Bank	34,425
10	Saudi Arabian Mining Co.	29,970

Source: Investment Research Dept. Asset Management, KAMCO, 2012.

3.2.6 State of United Arab Emirates

The United Arab Emirates (UAE) is a federation of seven Emirates, including Abu Dhabi, Dubai, Sharjah, Ajman, Al-Fujayrah, Umm Al-Quwain and Ras Al-Khaima, all of which are governed by the Federal Supreme Council (FSC) of rulers. The Emirates Securities Market (ESM), established in 2000 is the combined market capitalization of Abu Dhabi Securities Market (ADSM) and Dubai Financial Market (DFM). The total capitalization of ADSM and DFM has raised the UAE stock market to its position as second largest market in the GCC region following, Saudi Arabia.

In recent years, Dubai became the financial and economic hub of the Gulf region, and most investors in UAE securities focus on the DFM. However, the equity market capitalization in the ESM has risen from $113.9 billion in 2011 to $126.6 billion in 2012. The trading value of ESM Index has increased by 20%, from 15,338 billion in 2011 to 19,295 billion in 2012. The banking sector in UAE, as in other GCC member countries dominates the ESM and captured the largest value of shares traded. As can be seen in Table 3.8, the banking system attracted the second greatest value of market capitalization at the end of 2012. Emirates telecom (Abu Dhabi) came first in ADSM, followed by the National Bank of Abu Dhabi, and EMAAR Properties (Dubai) is the largest company in DFM, followed by Emirates integrated telecom.

Figure 3.15: Sector Weight by Market Capitalization of UAE Market-2011

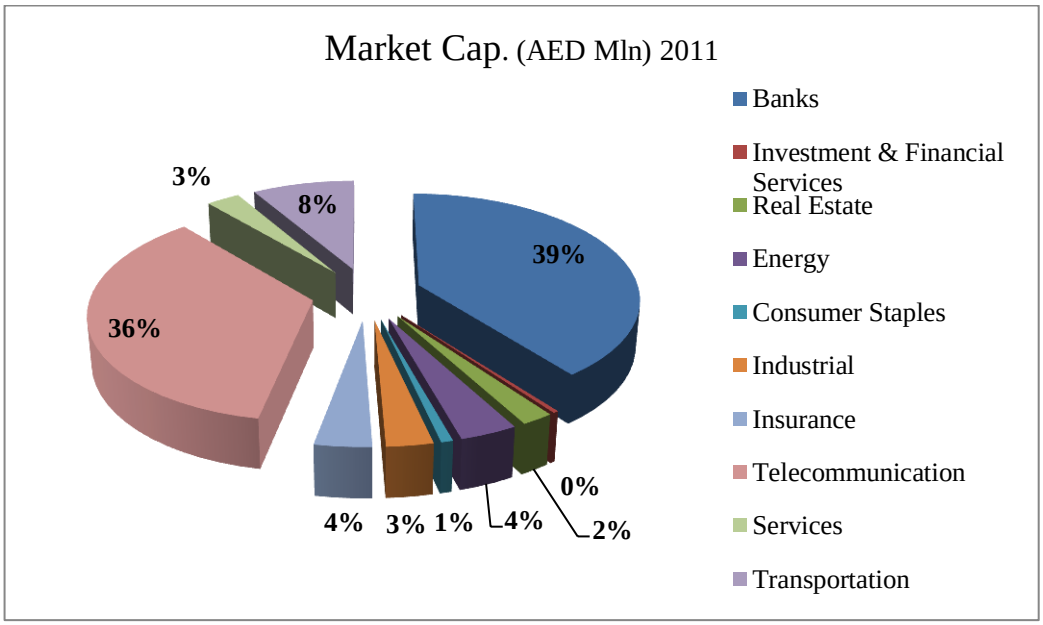


Figure 3.16: Sector Weight by Market Capitalization of UAE Market-2012

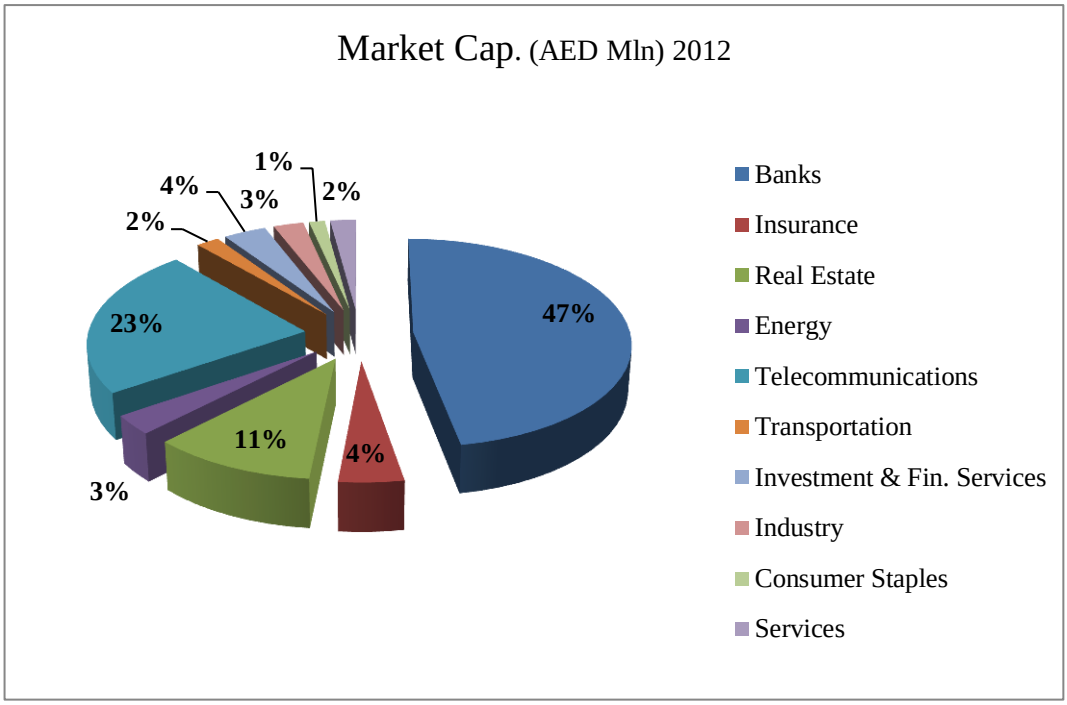


Table 3.8: Top 10 UAE Companies by Market Capitalization

No.	Company	Market Capitalization (AED Mln) 2012
1	Emirates Telecom. Co. (Abu Dhabi)	71,678
2	National Bank Of Abu Dhabi	39,908
3	First Gulf Bank (Abu Dhabi)	34,800
4	EMAAR Properties (Dubai)	22,842
5	Abu Dhabi Commercial Bank	16,843
6	Emirates Integrated Telecom. (Dubai)	15,954
7	Emirates NBD (Dubai)	15,840
8	Mashreq Bank (Dubai)	9,299
9	Abu Dhabi National Energy	8,466
10	Dubai Islamic Bank	7,632

Source: Investment Research Dept. Asset Management KAMCO, 2012.

3.3 Conclusion

This chapter briefly reviewed the structure of the six GCC stock markets; namely, Bahrain, Kuwait, Oman, Qatar, Saudi and UAE. The chapter presents key features of the GCC stock markets as a group, followed by an individual review of each market. The overview shows that all GCC countries share similar characteristics in their financial systems.

The Saudi stock market is the largest market in the region with market capitalization of 373.4 billion, and Bahrain is the smallest one. Due to oil price changes and the political crisis of the "Arab Spring" in the Middle East in 2011, the real GDP of GCC countries as a group has decreased to reach 3.7% at the end of 2012.

With the exception of Bahrain market, all GCC stock markets have increases in their market capitalization 2012 compared to 2011. Further, trading values for the countries increased from $347,499 million in 2011 to $567,190 million at the end of 2012. The value of listed companies decreased in the Bahrain, Kuwait and Emirates, while in other markets increased. With the exception of the Saudi market, all Gulf Arab equity markets are mainly dominated by the banking sector. This sector accounts for 40% of market capitalization in Bahrain Bourse, 40% in Kuwait, 47% in Oman, 39% in Qatar, 24% in Saudi, and 47% of total market capitalization in UAE.

CHAPTER FOUR

METHODS AND DATA ANALYSES

4.1 Introduction

The degree of price co-movement among financial markets has been widely used in recent studies as a method of estimating long-term relationships between either regional or global markets. The main aim of this chapter is to discuss the methods and data that have been used in this research. This research uses preliminary analysis to see how the data behaves; then the study moves to the main analysis through the utilization of unit root tests, Johansen-cointegration, Granger-causality, variance decomposition and impulse response functions. The Johansen's cointegration test, as mentioned in the second chapter, received a great deal of attention from number of economic and financial researchers.

The chapter is divided, into six sections. The second section presents the methodology and commences the method for the main analysis, using a dynamic model. The third section provides descriptive statistics of characteristics of stock price indices in the GCC region, selected developed markets, and the oil market. The fourth section overviews the procedure to test for the presence of structural changes in the data, at unknown points in time, so as to identify breaks during the period of research. The tests used here are the Andrews-Quandt and Chow tests. Then the chapter moves to the simple analysis of GARCH (1, 1) model and provides initial idea about the testing of shocks caused by global markets. The chapter concludes with an overall summary of its contents.

4.2 Diagnostic Tests

The validity of the model depends on Ordinary Least Square's assumptions (OLS) being met. These assumptions are: (1) the errors have zero mean; (2) the variance of the errors is constant and finite over all values of x_t ,(3) The errors are linearly independent of one another (no serial correlation in errors); (4) there is no relationship between the error and corresponding x variate; (5) the error has constant variance (homoscedasticity) (Brooks, 2008). However, failure to meet the OLS's assumptions, may lead to a misspecification model as well as spurious results. The assumption of homoscedasticity suggests that the variance of the residuals is

constant, while in most cases the model needs to specify into the auto-regressive conditional heteroscedasticity (ARCH) due to an inconstancy in the residuals, which means the variance of the errors changes over time. A common test for detecting heteroscedasticity is the White test (White, 1980). The White test can be conducted using two different approaches. Firstly, it is possible to use the *F*-test framework, and this involves estimating unrestricted regression and then running a restricted regression on a constant only (Brooks, 2008). Secondly, the value of R^2 for the auxiliary regression is an alternative approach that can be adopted does not require the estimation of a restricted regression. If one or more coefficients in the restricted regression are statistically significant, the value of R^2 for that equation will be relatively high; while if none of the variables is significant, R^2 will be relatively low.

In order to investigate dynamic relationships and possible diversification benefits for regional and international investors in the GCC region, the main analysis will rely mainly on the Johansen's cointegration approach, VECM, Granger-causality, variance decomposition and impulse response functions, to reveal short-and long term relationships among the variables. To that end, the procedure of the main analysis commences with a test of unit root in the time series data.

4.3 Unit Root Test

The unit root test is most commonly used for stationarity test of time series data. It is considered to be a preliminary step in testing for cointegration, as all series need to be integrated to the same order. In this context, a stationary series can be defined as one with a constant mean, constant variance, and constant auto-covariance for each given lag (Brooks, 2008).

Stationary time series data means that the behavior of time series data remains the same over time. Dissimilarity, for a non-stationary series, the effect of a shock will not remain the same over time, and can lead to spurious regression. The spurious regressions usually exhibit a high R^2 and low Durbin Watson (*DW)* statistic. In other words, if two variables unrelated with each other are trending over time, the result of this regression could have a high R^2 and significant coefficients estimates, and this because of the time series involved in the regression exhibit strong trend, then the high R^2, which observed, is due to presence of the trend not to a true relationship among the variables. However, the cointegration approach is based on variables

being integrated of order one, which means a non-stationary series are integrated of the same order. Thus, a first step requires that unit root tests to be conducted to test the data for their stationarity characteristics in order to determine the order of integration for each variable. The second step is the use cointegration test to determine whether the non-stationary time series data have common long-run relationships with each other. Three commonly-used tests will be employed in this investigation: the augmented Dickey-Fuller (Dickey and Fuller, 1979), the Phillips-Perron (Phillips and Perron, 1988), and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) (Kwiatkowski *et al.*, 1992).

4.3.1 The Augmented Dickey-Fuller (ADF)

Considering a simple AR (1) process, the basic features of unit root tests can be presented as follows (E-views guide pp. 383):

$$y_{t=}\, \rho y_{t-1} + \delta' x_t + \varepsilon_t \qquad (4.1)$$

Where x_t are optional exogenous regressors, which may consist of a constant, or a constant and trend, ρ and δ are parameters to be estimated, and ε_t is assumed to be white noise. If (ρ) y_{t-1}, y is a non-stationary series and the variance of y increases with time and approaches infinity. However, If (ρ) <1, y is a trend stationary series. Thus the hypothesis of trend stationary can be evaluated by testing whether the absolute value of (ρ) is strictly less than one. The standard Dickey-Fuller test is carried out by estimating equation (4.1) after subtracting (y_{t-1}) from both sides of the above equation as follows:

$$\Delta y_t = \alpha y_{t-1} + \delta' x_t + \varepsilon_t \qquad (4.2)$$

Where α=(ρ -1). The null hypothesis is that the variables under consideration have unit root. The null hypothesis of stationarity for all specifications, is β = 0, while the autoregressive term ($\delta \sum_{i=1}^{m} \Delta y_{t-i}$) is included to ensure the residual (ε_t) is serially uncorrelated.

Three ADF models are being estimated as follows:

$$\Delta y_t = \alpha_1 + \alpha_2 t + \beta y_{t-1}\, \delta \sum_{i=1}^{m} \Delta y_{t-i} + \varepsilon_t \quad (4.3)$$

$$\Delta y_t = \alpha_1 + \beta y_{t-1}\, \delta \sum_{i=1}^{m} \Delta y_{t-i} + \varepsilon_t \quad (4.4)$$

$$\Delta y_t = \beta y_{t-1}\, \delta \sum_{i=1}^{m} \Delta y_{t-i} + \varepsilon_t \quad (4.5)$$

Where, $y_t$is the share price series, ε_t is the residual term, and t is a time trend. The first model represented by equation (4.3) includes a constant term α_1 and a trend term $\alpha_2 t$. While the second model, represented by equation (4.4) includes a constant term only, the third model (4.5) does not include intercept and trend terms. However, to avoid autocorrelation in the errors, and decrease the power of the test statistics, the most important thing should be consider is to specify appropriate lags to the unit root test. There are several methods from which to choose the optimal lag, such as Akaike Information Criterion (AIC) and Bayes Information Criterion (BIC).

4.3.2 The Phillips-Perron (PP)

The Phillips and Perron (1988) (PP) developed a more comprehensive theory of unit root test. They proposed an alternative non-parametric method of controlling for serial correlation, without including the lagged difference error term, as the ADF test. The PP test was carried out by the following formula:

$$y_{t=} \rho y_{t-1} + \delta' x_t + \varepsilon_t \quad (4.6)$$

As ADF test, a constant, a constant and a linear time trend, or neither can be included in the test regression. Generally, PP test give the same conclusions as ADF and suffer from most of the same important limitations (Brooks, 2008).

4.3.3 The Kwiatkowski, Phillips, Schmidt, and Shin (KPSS)

The Kwiatkowski *et al.* (1992) KPSS for unit roots test also differs from other unit root tests, and is based on the null hypothesis that a time series is stationary or trend stationary around a level. According to the KPSS, the test is the Lagrange Multiplier test of the hypothesis is that the random walk has a zero variance. Additionally, the

KPSS statistic is based on residuals from the OLS regression of y_t on the exogenous variables, x_t. Thus,

$$x_{t=}\alpha_t + y_t + \varepsilon_t \qquad (4.7)$$

Where *t* is the deterministic trend, *y* is a random walk, and ε is a stationary error. The equation of the random walk can be expressed as follows:

$$y_{t=}y_{t-1} + \varepsilon_t \qquad (4.8)$$

The initial value of *y* (y_0) is nothing more than the intercept. Since the residual is stationary, a null hypothesis of trend stationary infers that the variance σ_e^2 equal to zero (McKenzie and Takaoka, 2009).

4.4 The Process of Multivariate Cointegration Test

A set of variables is defined as cointegrated if a linear combination of them is stationary (Engle and Granger, 1987) and (Brooks, 2008). More generally, a system of two or more time series that are non-stationary in levels and have individual stochastic trends can share common stochastic trend(s); in this case, those series are said to be cointegrated, and may be interpreted as a long-run equilibrium relationship among themselves (Hammoudeh and Choi, 2006).

There are common factors that can move the variables over time. Thus, the idea behind cointegration test is to determine whether a group of non-stationary series is cointegrated or not. Prior to estimating a multivariate dynamic model, it is imperative to determine whether these variables share a long-term relationship. There are several possible tests for detecting the cointegration relationships, in most cases can be tested either on a bivariate base by applying Engle and Granger (1987), or a multivariate test based on the Autoregressive representation (Johansen, 1988), (Johansen and Juselius, 1990). This research employs the Johansen and Juselius (1990) and (Johansen, 1995) methodology to implement cointegration test. This approach provides more robust results when there are more than two variables in the

system as is the case in this research, and when the number of observations is greater than a hundred as suggested by Gonzalo (1994), and Hammoudeh and Li (2005).

4.4.1 The Johansen's Test of Cointegration

Johansen (1988), and Johansen and Juselius (1990) developed a technique for assessing long-term relationships among economics variables. This procedure is based on the maximum likelihood estimation in a VAR model. Johansen's approach proposes two statistics tests to identify the number of characteristic roots that are insignificantly different from unity. These tests are, the Trace test, and the maximum eigenvalue. Brooks (2008) argues that economic theory will often have little to say on what an appropriate lag length is for a VAR system, and how long changes in the variables take to work through the system. Johansen cointegration test can be affected by the lag length criterion employed in the VECM; thus, it is essential to select the lag length optimally.

Nevertheless, it recommended using multivariate versions of the information criteria (Brooks, 2008), which include the Akaike information criterion (AIC), Likelihood Ratio (LR), Final Prediction Error (FPE) Schwarz Information Criterion (SC) and the Hannan-Quinn Information Criterion (HQ). This research uses the information criteria approach to select the appropriate order of the VECM. Johansen (1988) proposes two different Likelihood Ratio (LR) tests of the significance of these canonical correlations and, thereby the reduced rank of the π matrix: the Trace statistic (λ_{Trace}) and maximum eigenvalue (λ_{max}) tests, shown in equations (4.9) and (4.10) respectively.

$$\lambda_{trace}(r) = -t\sum_{i=1}^{k-1}\ln(1-\hat{\lambda}_i) \qquad (4.9)$$

and

$$\lambda_{max}(r, r+1) = -t\ln\left(1-\hat{\lambda}_{r+1}\right) \qquad (4.10)$$

Where, *r* represents the number of cointegrating vectors under the null hypothesis, *t* equals the number of usable observations, and λ represents the estimated value for the *i*th ordered eigenvalue (characteristic root) of the matrix π. Intuitively, the larger the $\hat{\lambda}_i$, the larger and more negative will be ln (*1-*$\hat{\lambda}_i$) and, as a result, the larger will be the test statistic (Brooks, 2008). The Trace test assesses the null hypothesis that

the number of distinct cointegrating relations is *r,* versus the alternative of *k* cointegrating relations, where *k* is the number of endogenous variables.

The maximum eigenvalue examines the number of cointegrating vectors against that number plus one (*r+1*) (Brooks, 2008). If the variables in X_t are not cointegrated, the rank π is zero, and all characteristics roots are zero. To determine the rank of the π matrix, the Trace and maximum eigenvalue statistics are compared to the nonstandard critical values from Osterwald-Lenum (1992) and Johansen and Juselius (1990), and are also given by most econometric software packages such as E-Views.

Nevertheless, for both tests, if the *t*-statistic is greater than the critical values (in absolute value), in this case, the null hypothesis of exactly *r*-cointegrated vectors is rejected. However, the Trace and maximum eigenvalue statistics may yield conflicting results. The common strategy adopted to deal with this problem is to test the estimated cointegrating vector and consider one choice based on the interpretability of the cointegrating relationships (Johansen and Juselius, 1990). Alternatively, (Kasa, 1992;Cheung and Lai, 1993;Luintel and Khan, 1999), showed that with the Johansen's cointegrating method, the result of Trace test is more robust than maximal eigenvalue statistic for testing cointegration.

The Johansen and Juselius (1990) cointegration test is employed in this research to investigate log level combinations of the price series of the GCC-equity markets, GCC-banking sector indices, as well as the global markets over the periods of study. The hypotheses to be tested for cointegration are:

H_1: The log level price series are cointegrated.

H_0: The log level price series are non-cointegrated.

4.4.2 The Vector Error Correction Model (VECM)

The VECM is a restricted VAR, designed for use with non-stationary series data that are known to be cointegrated. The model was initially introduced by Sargan (1984), and Hendry and Anderson (1977), and later popularized by Engle and Granger (1987). The main idea behind VECM is that if two variables have a long-run equilibrium relationship, then those variables are considered cointegrated but, at the same time, may exhibit a disequilibrium relationship in the short-term. In other words, shocks in a short-run relationship leads to disturb the long-run relationship

and causing disequilibrium in the long-term, and this disequilibrium relationship from one period is corrected in the next period (Engle and Granger, 1987). Thus, the VECM basically reconciles the behavior of short-run and long-run relationships. The general specification form of ECM can be presented as follows:

$$\Delta X_t = \sum_{i=1}^{k-1} \mathrm{r}_i \, \Delta X_{t-i} + \alpha \beta'^{X_{t-1}} + \mu + \varepsilon_t \qquad (4.11)$$

where: Δ is a first difference (returns), ΔX_t is the vector for first differences of the variables, r_i is a ($p \times p$) matrix representing short-term adjustments between variables in the system at *i*th lag, α is a ($p \times r$) matrix of speed of adjustments, β is a ($p \times r$) matrix of cointegrating vectors, μ is the ($p \times 1$) vector of constant, ε_t is a ($p \times 1$) vector of white noise error term, and (*k)* is the lag structure. The VECM is implemented to identify the speed of adjustment of ECT for the variables under study to achieve equilibrium relationship after a deviation has occurred in the system.

4.4.3 Granger Causality

The rationale behind the Granger-causality test is that if two variables are cointegrated, then Granger-causal relationship must exists in at least in one direction (Granger, 1969). More specifically, suppose two variables in a model (x_t and y_t), and x_t Granger cause y_t but y_t does not Granger cause x_t, in this example, the past value of x_t should be able to predict future value of y_t, while past value of y_t should not be able to forecast the variable x_t. Granger *et al.* (2000) suggest that the Granger-causality can be conducted as follows:

$$\Delta y_t = \alpha_0 + \gamma_1 (y_{t-1} - \phi x_{t-1}) + \sum_{i=1}^{k} \alpha_{1i} \, \Delta y_{t-i} + \sum_{i=1}^{k} \alpha_{2i} \, \Delta x_{t-i} + \varepsilon_{1t} \qquad (4.12)$$

$$\Delta x_t = \beta_0 + \gamma_2 (y_{t-1} - \phi x_{t-1}) + \sum_{i=1}^{k} \beta_{1i} \, \Delta y_{t-i} + \sum_{i=1}^{k} \beta_{2i} \, \Delta x_{t-i} + \varepsilon_{2t} \qquad (4.13)$$

Where, $(y_{t-1} - \phi x_{t-1})$ represents the error correction terms, and γ_1 and γ_2 represent the speed of adjustments. Failing to reject the null hypothesis of equation (4.12), which is $H_0 = \alpha_{21} = \alpha_{22} = \alpha_{23\ldots} \alpha_{2k} = 0$, and $\gamma_1 = 0$, implying that x_t does not

Granger cause y_t . Likewise, failing to reject the null hypothesis of equation (4.13) which is $H_0 = \beta_{21} = \beta_{22} = \beta_{23} \ldots. \beta_{2k} = 0$, and $\gamma_2 = 0$, suggesting that y_t does not Granger cause x_t. The dynamic Granger causality between variables can be explained as; when one variable is identified as the dependent variable (*y*) and the other as the explanatory variable (*x*), an implicit assumption according to Ramanathan and Cotrell (2002) is that, changes in the explanatory variable (*x*) cause changes in the dependent variable (*y*). Additionally, if (*x*) causes (*y*) and (*y*) causes (*x*), then a bi-directional relationship (feedback) exists.

This research examines the short-run Granger-causality between variables within a VECM framework. The test is implanted using (E-views 8 package) to estimate the direction of causality, and the ability of one variable to cause and caused the other variables. In the context, the short-run Granger causality test is conducted and applied to log level combinations of the all variables. The hypotheses to be tested as follows:

H_1: Log returns series (*x*), (*y*) Granger causes log returns (*y*) (*x*).

H_0: Log returns series (*x*), (*y*) Granger dose not causes log returns (*y*) (*x*).

4.5 Impulse Response Functions

Impulse responses trace the response of current and future values of each variable to a one-unit increase (or to a one-standard deviation increase, when the scale matters) in the current value of one of the VAR errors; assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error while holding the others constant makes most sense when the errors are uncorrelated across equations, in order to demonstrate how the impulse responses function operates, the VAR model is written as a Vector Moving Average (VMA) (Enders, 2004). The impulse responses function is implanted to investigate which of the exogenous variables have statistically significant impacts on the future values of each of the endogenous variables. In this research, the Cholesky decomposition method is applied to for ordering the variables, based on the high potential influence of other variables in the system, followed by the rank of ECT magnitude.

4.6 Variance Decomposition

The generalized forecast error variance decomposition (VDC) is an econometric technique used by many economists in the VECM context, for assessing the driving forces of business cycles. Given that many macroeconomic models can also be written in the VECM form, the variance decomposition indicates the amount of information each variable contributes to other variables in the auto-regression. The VDC is used to support the interpretation of a VECM, once it is fitted, and to determine how much of the forecast error variance of each of the variables can be explained by exogenous shocks to the other variables.

Variance decomposition offers a slightly different method for examining the VECM system dynamic. It gives the proportion of movements in the exogenous variables that are due to their own shock, versus shocks to the other variables. In this study, the Cholesky decomposition is used to order variables based on the high potential influence on other variables in the system followed by the rank of ECT magnitude.

4.7 Data Description and Preliminary Analysis

4.7.1 Data

This research utilizes weekly historic prices for the six GCC stock markets and global markets, namely; Bahrain, Kuwait, Oman, Qatar, Saudi, United Arab Emirates, United States, European Union and the Brent spot oil prices. The data set are also incorporate weekly stock indices of each GCC-banking sector as a sub-sector of the total stock market index. The US and EU stock markets are included in the analysis, where these markets are the largest developed markets in the world, and the Gulf Arab region has a robust economic relationships with these markets. Oil market is also involved in the study, and its effect on GCC stock markets returns are also examined along with global markets. Weekly stock prices indices are used to avoid common distortions of daily series that arising from non-synchronous trading[2]. The stock price indices for GCC and global markets are obtained from Standard and

[2] The trading days in the GCC stock markets are vary. For example, Saudi and Qatar stock markets are closed on Friday and Saturday, while Bahrain market takes only Saturday as a holiday and works on other week days. Further, the US and Europe stock markets are closed on Saturday and Sunday. Thus, to avoid inconsistency and non-synchronous trading problems, weekly stock price indices are used based on the Wednesday's closing prices.

Poor's (S&P) and DataStream database, while weekly spot oil prices were sourced from the US Department of Energy, Energy Information Administration (EIA). The study uses weekly time series data up to nine years span from 3 January 2005 to 31 December 2013, comprises 469 observations[3]. Otero and Smith (2000), demonstrate that, the reliability of the cointegration test depends more on total sample length than the number of observations. However, the length of the full sample used in this study is comparable to several relevant studies (see, for example, Hassan, 2003;Hammoudeh and Aleisa, 2004;Al-Khazali *et al.*, 2006;Balcılar *et al.*, 2013;Balli *et al.*, 2013a).

The full sample period of this research is divided into two sub-periods for two reasons: First, to avoid possible structural shifts in data due to mid-2008 global financial crisis (GFC), and second, for testing the strength of cointegration relationships between variables before and after crisis. The first sub-period includes 184 weekly observations (pre-crisis) spanning from 5 January 2005 to 9 July 2008 and the second sub-period (post-crisis) covers the period from 16 July 2008 to 25 December 2013. All indices are based on the US dollar from data supplier and do not include dividends, and drawn from small, medium and large capitalized firms. The weekly returns for all series are computed as logarithmic differences as follows:

$$100 * Log(P_t/P_{t-1}) \qquad (4.14)$$

where, P_t denotes the value of stock price for country *i* at time *t*. The definitions of the nine variables used in this research are presented in Table 4.1.

[3] The time series data for some of the GCC stock markets are unavailable before 2005.

Table 4.1 Definition of Variables

Variable	*Definition*
S&P of six GCC stock markets indexes	S&P prices indexes of six GCC-equity markets are broad market indicators that measure the set of investable stocks that have an aggregate market cap of 80% of the total market cap of these exchanges markets.
S&P of six GCC- banking sectors indexes	S&P prices indexes of six GCC-banking sectors are broad market indicators that measure the set of investable stocks that have an aggregate market cap of 70-80% of the total banking cap of these exchanges markets.
S&P Europe 350 price index	The S&P Europe 350 index is a unique equity index drawn from 17 major European markets, covering approximately 70% of the region's market capitalization.
S&P 500	The S&P 500 index covers approximately 75% of U.S markets capitalization, and is consider an ideal proxy for the total market in the US and global markets.
Crude oil Brent prices	The crude oil Brent prices reflects the spot oil prices for the specified periods.

Source: S&P fact sheet (2012), Energy Information Administration (EIA).

4.7.2 Testing for Structural Stability

It is acknowledged that the global financial crisis (GFC) has significance effect to the world financial markets in 2008. The financial markets in the GCC region are therefore, also expected to be affected by GFC downturn. To avoid the contagion of GFC that may lead to spurious results, the Quandt-Andrews unknown break-point test and Chow break-point test were conducted to determine if the null hypothesis of no significant breaks in time series data can be rejected. The idea of the Breakpoint Chow test is to fit the equation separately for each sub-period in order to identify if there are significant differences in the estimated equations.

The Quandt-Andrews break-point test seeks to identify if there are one or more unknown structural breakpoints in the sample for a specified equation. This test was provided by Quandt (1960) in the early works on structural breaks. Unlike Chow test for structural break, the Quandt-Andrews assumes that the breakpoint in data is unknown, and the breakpoints in the time series data are determined by highest Wald

statistic (Andrews, 1993;Andrews and Ploberger, 1994). The Chow test is an econometric tool to test whether the coefficients in two linear regressions on different data sets are equal. The idea of the Chow breakpoint test is to fit the equation separately for each subsample, and to see whether there are significant differences in the estimated equations. Thus, a significant difference indicates a structural change in the relationship. The procedures for this test is to split the data into sub-periods, and then estimating up to three models, for each sub-structure break, as well as for all data, and then comparing the RSS of each model. The restricted regression is the regression for the whole period, while the unrestricted regression is for the sub-period (Brooks, 2008). Therefore, the F test is implemented as follows:

$$Test\ Statistic = \frac{RSS - (RSS_1 + RSS_2)}{RSS_1 + RSS_2} \times \frac{T - 2K}{k} \qquad 4.15$$

Where, RSS_1 is the residual sum of squares for sub-period, RSS_2 is the residual sum of squares for the second sub-period, t is the number of observations, $2k$ is the number of regressors in the unrestricted regression, and k is the number of regressors in each unrestricted regression. The null hypothesis related to the structural change is that there is no structural change in the time series data, against the alternative hypothesis, which states that there is a structural change in the series.

The results of testing structural breaks of both tests are reported in Tables 4.2- 4.7. As displayed in Table 4.2, the result of Quandt-Andrews (model A) rejects the null hypothesis, which states that there is no breakpoint in data; rather the alternative hypothesis is accepted at 1% significance level. Therefore, the study accepts the breakpoint in data in this period. Further, as expected, the alternative hypotheses are also accepted for the second and third models as reported in Tables 4.3 and 4.4, which indicate that the breakpoint in data is between June and July 2008. The co-movements of the stock markets indices used in this study also confirmed these results.

Table 4.2: The Quandt-Andrews Unknown Breakpoint Test for Structural Stability of the GCC Stock Markets

Series	*Number of breaks compared*	*Statistics*	*Values*	*P -value*
BSM	328	LR F-statistic	148.998	0.0000
		Wald F-statistic	893.989	0.0000

Notes: The breakpoint in full period sample is specified in July 2008. The dependent variable in the regression model is the Bahrain market, and the other GCC stock markets are independent variables. BSM denotes the Bahrain stock market index.

Table 4.3: The Quandt-Andrews Unknown Breakpoint Test for Structural Stability of the GCC and Global Markets

Series	*Number of breaks compared*	*Statistics*	*Values*	*P -value*
BSM	328	LR F-statistic	66.218	0.0000
		Wald F-statistic	595.963	0.0000

Notes: The dependent variable in the regression model is the Bahrain market, the GCC and global stock markets are independent variables.

Table 4.4: The Quandt-Andrews Unknown Breakpoint Test for Structural Stability of the GCC-Banking Sectors

Series	*Number of breaks compared*	*Statistics*	*Values*	*P -value*
BSM	328	LR F-statistic	42.731	0.0000
		Wald F-statistic	256.386	0.0000

Notes: The dependent variable in the regression model is the Bahrain banking sector, and the other GCC banking sectors are independent variables. BBS denotes the Bahrain banking sector.

The results of the Chow breakpoint test for the three models are reported in Tables 4.5 - 4.7. The Chow test for the model (A) is defined by the following hypotheses:

H_0: The GCC-equity markets indices have no structural breakpoints.

H_1: The GCC-equity markets indices have structural breakpoints.

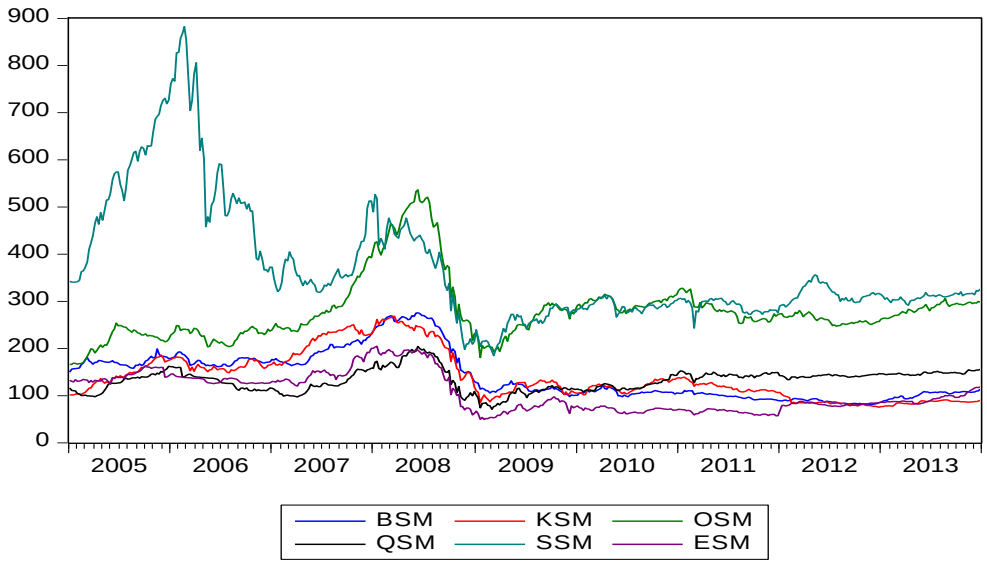
As seen, the date of the structural break in data has been defined in July 2008; this research used several experiments to define the exact date of the breakpoint in data, which was found to between 5th and 11th July 2008. The Chow test confirmed the results of the Quandt-Andrews test by specifying the date of structural breakpoint in 9th July 2008, therefore, that date is considered to be the first day of the crisis period. Table 4.5 indicates the rejection of the null hypothesis of model (A) at 1% level of significance, indicating structural break in the GCC stock markets, and Figure 4.1 broadly confirms this finding.

Table 4.5: Chow Test for Structural Stability of the GCC Stock Markets

Series	*Statistics*	*Values*	*P -value*
BSM	LR *F*-statistic	79.934	0.0000
	Wald Statistic	479.606	0.0000

Notes: The breakpoint in full period sample is specified as 9/7/2008. The dependent variable in the regression model is the Bahrain market, and the other GCC stock markets are independent variables.

Figure 4.1: Prices Movements of the GCC Stock Markets



For the model (B), the Chow test is defined as follows:

H_0: The global markets indices have no structural breakpoints.

H_1: The global markets indices have structural breakpoints.

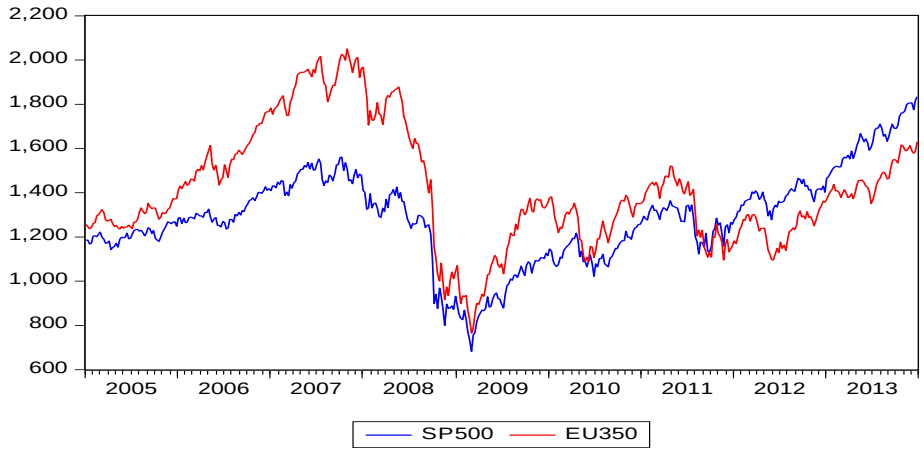
Table 4.6 indicates the rejection of the null hypothesis of the second model at 1% significance level, indicating structural break in the global markets.

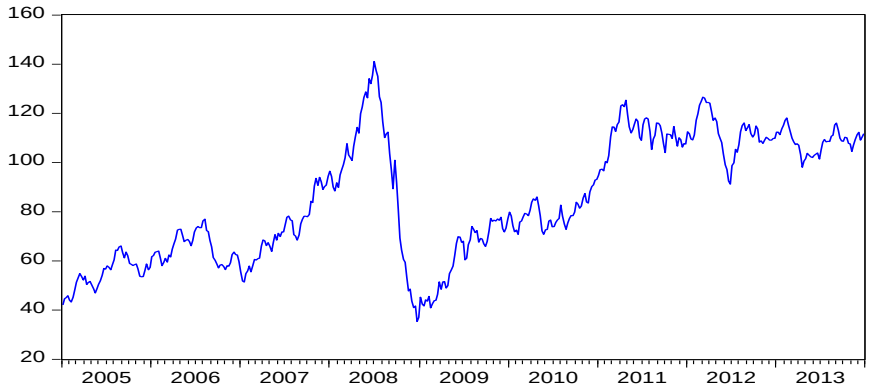
Table 4.6: Chow Test for Structural Stability of the GCC and Global Markets

Series	*Statistics*	*Values*	*P -value*
BSM	LR *F*-statistic	38.612	0.0000
	Wald Statistic	347.509	0.0000

Notes: The breakpoint in full period sample is specified as 9/7/2008. The dependent variable in the regression model is the Bahrain Stock Market, and the other GCC and global markets are independent variables.

Figure 4.2: Global Stock Markets





Oil Prices

The Chow test for the third model is defined as follows:

H_0: The GCC-banking sector indices have no structural breakpoints.

H_1: The GCC-banking sector indices have structural breakpoints.

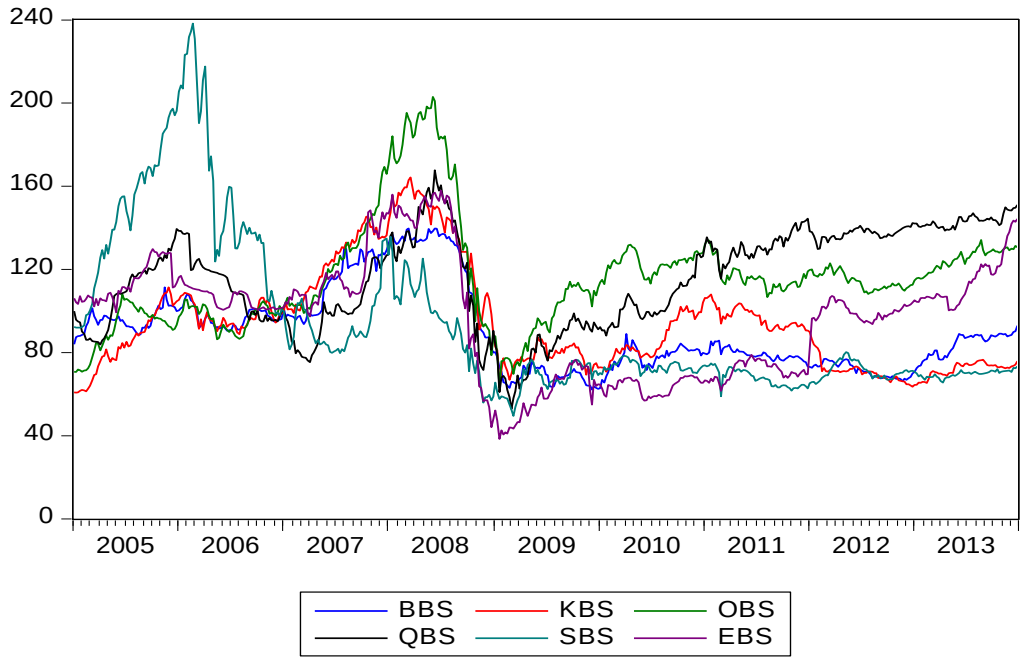
Table 4.7 indicates the rejection of the null hypothesis of the second model at 1% significance level, showing a structural break in six GCC-banking sectors, which also confirmed in figure 4.3.

Table 4.7: Chow Test for Structural Stability of the GCC-Banking Sectors

Series	*Statistics*	*Values*	*P -value*
BBS	LR *F*-statistic	20.486	0.0000
	Wald Statistic	122.920	0.0000

Notes: The breakpoint in full period sample is specified as 9/7/2008. The dependent variable in the regression model is the Bahrain banking sector, and the other GCC-banking sectors are independent variables. BBS denotes the Bahrain banking index.

Figure 4.3: Prices Movements of the GCC Banking Sectors



4.7.3 Descriptive Statistics

Descriptive statistics of weekly stock returns are presented in Tables 4.8 to 4.10. As can be seen, the highest average of return among the GCC stock markets is Oman with 0.0012, and the Bahrain market has the lowest average of return with the value of -0.0006. Standard deviation figures indicate that the UAE has a higher value of volatility of 0.0425, followed by the Saudi market with 0.0407, and Bahrain shows lowest volatility with only 0.0241. It can be observed from the full sample, that there is no relationship between high volatility and high return. The UAE and Saudi stock markets provide a clear example. Since all markets have negative skewness, the distribution of the return series for all variables appears to be non-normal; the coefficients of the kurtosis in all series exceeds three, indicating sharp peaks and fat tails leptokurtic distribution.

The Jarque-Bera[4] statistic and associated *p*-value are used to test the normality of distribution. With the *p*-value of zero for all variables, the null hypothesis of normal return distribution has been rejected. The pre-crisis statistics shows similar results, indicating that Oman still possess the highest average of return and Bahrain and Kuwait have the highest average of return among the GCC, and Saudi is the most volatile during this period. In the post-crisis sample, all variables show negative signs, Qatar and Saudi have the highest average of return with -0.0007, and the Kuwait the lowest with the value of -0.0032. In relation to volatility, UAE had the highest volatility, and the lowest is Bahrain stock market.

However, all periods exhibit non-normal distribution due to Jarque-Bera statistic and associated *p*-value, used to test for normality of distribution. With the *p*-value of zero for all variables, the null hypothesis of normal return distribution was rejected. Descriptive statistics of weekly stock prices of global markets are presented in Table 4.9. Results from full sample shows the oil market is the highest volatile with a standard deviation of 0.0393, while the S&P500 shows lowest volatility. The coefficients of the kurtosis for all variables exceed three, indicating sharp peaks and fat tails leptokurtic distribution. Oil market still have the highest average of return during the pre-crisis period, while in the post-crisis, the US stock market is the

[4] Jarque-Bera (JB) statistics $S2\ K\ 2\ n$ follows the chi – square distribution with 2 degree of freedom. However, for normally distributed variable, the skewness coefficient = 0, and the kurtosis coefficient = 3.

highest rate of return among the three global markets. Furthermore, it's notable that all markets have negative skewness, and the coefficients of the kurtosis exceed three, indicating sharp peaks and fat tails leptokurtic distribution. Thus, the distribution of the return series for all variables appears to be non-normal.

Table 4.8: Descriptive Statistics of the GCC Weekly Stock Returns

	BSM	KSM	OSM	QSM	SSM	ESM
Full Period: 3/01/2005 – 31/12/2013, n = 469						
Mean	-0.0006	-0.0003	0.0012	0.0006	-0.0001	-0.0002
Std. Dev.	0.0241	0.0316	0.0295	0.0343	0.0407	0.0425
Skewness	-1.4066	-1.5450	-1.7298	-1.8528	-1.5088	-1.5942
Kurtosis	10.538	12.122	15.501	16.471	10.749	17.503
Jarque-Bera	1262.4	1808.9	3281.0	3806.8	1348.5	4300.0
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	469	469	469	469	469	469
Pre-crisis: 3/01/2005 – 9/7/2008, n = 184						
Mean	0.0032	0.0044	0.0062	0.0028	0.0009	0.0019
Std. Dev.	0.0199	0.0248	0.0219	0.0271	0.0483	0.0265
Skewness	0.1111	-0.1836	-0.1474	-0.4787	-1.7514	-0.2636
Kurtosis	5.8862	3.1901	2.8316	7.2127	9.9858	8.2301
Jarque-Bera	63.896	1.3032	0.8791	142.30	465.66	210.69
Probability	0.0000	0.5212	0.6443	0.0000	0.0000	0.0000
Observations	184	184	184	184	184	184
Post-crisis: 16/07/2008 – 31/12/2013, n = 285						
Mean	-0.0030	-0.0032	-0.0020	-0.0007	-0.0007	-0.0015
Std. Dev.	0.0263	0.0350	0.0331	0.0382	0.0350	0.0502
Skewness	-1.7206	-1.7070	-1.8201	-2.0472	-0.9978	-1.5199
Kurtosis	10.4144	12.1101	14.9039	16.1635	9.3225	14.3003
Jarque-Bera	790.64	1120.00	1833.63	2248.84	520.15	1620.41
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	285	285	285	285	285	285

The correspondence between stock indices and respective markets is: BSM: Bahrain stock market; KSM: Kuwait stock market; OSM: Oman stock market; QSM: Qatar stock market; SSM: Saudi stock market and ESM: the UAE stock market.

The descriptive statistics of the GCC-banking sector indices are similar to those of the GCC-wide equity returns. As can be seen in Table 4.10, the full period of study indicate that the highest average of return among the GCC-banking sectors is hold by the Omani market, and Saudi is the lowest with the value of -0.0005. In regards to volatility, measured by standard deviation, Saudi is the highest volatility, and Bahrain is the lowest volatility with the value of 0.0251. For the pre-crisis period, Oman still hold the highest average of return among GCC-banking series and Saudi

had the lowest with the value of 0.0001. The post-crisis period shows that Qatar dominates the highest positive average of return, while others record negative returns, implying considerable influence of the GFC. Concerning volatility, Emirates has the highest volatility of 0.0472 and Bahrain, as before is the lowest. However, all series have negative skewness, and the distribution of the return series for all variables appears to be non-normal. The coefficient of the kurtosis in all markets exceeds three, indicating sharp peaks and fat tails leptokurtic distribution. The Jarque-Bera statistic and the associated *p*-value suggest that the null hypothesis of normal return distribution for all series has been rejected.

Table 4.9: Descriptive Statistics of Weekly Global Markets Returns

	S&P500	EU350	OilB
Full Period: 3/01/2005 – 31/12/2013, n = 469			
Mean	0.0009	0.0006	0.0021
Std. Dev.	0.0264	0.0267	0.0393
Skewness	-0.9647	-0.8827	-0.2541
Kurtosis	11.828	6.2533	5.4119
Jarque-Bera	1592.28	267.16	118.47
Probability	0.0000	0.0000	0.0000
Observations	469	469	469
Pre-crisis: 3/01/2005 – 9/7/2008, n = 184			
Mean	0.0002	0.0014	0.0065
Std. Dev.	0.0181	0.0176	0.0345
Skewness	-0.4342	-0.7790	-0.1432
Kurtosis	3.4913	4.4174	2.3546
Jarque-Bera	7.5904	33.8281	3.8012
Probability	0.0225	0.0000	0.1495
Observations	184	184	184
Post-crisis: 16/07/2008 – 31/12/2013, n = 285			
Mean	0.0013	0.0001	-0.0007
Std. Dev.	0.0306	0.0312	0.0420
Skewness	-0.9860	-0.7894	-0.2314
Kurtosis	10.5577	5.1853	6.0747
Jarque-Bera	721.92	86.010	114.40
Probability	0.0000	0.0000	0.0000
Observations	285	285	285

The correspondence between stock indices and respective markets is: S&P500: the US stock market; EU350: European stock market; Oil: oil Brent indices.

Table 4.10: Descriptive Statistics of the GCC Weekly Banking Returns

	BBS	KBS	OBS	QBS	SBS	EBS
Full Period: 3/01/2005 – 31/12/2013, n = 469						
Mean	0.0002	0.0005	0.0013	0.0009	-0.0005	0.0007
Std. Dev.	0.0251	0.0295	0.0318	0.0363	0.0427	0.0406
Skewness	-0.0045	-1.3646	-1.0113	-1.7169	-0.8505	-1.3875
Kurtosis	6.4436	11.629	14.965	15.426	9.6922	15.531
Jarque-Bera	231.23	1597.2	2871.5	3241.0	929.74	3212.1
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	469	469	469	469	469	469
Pre-crisis: 3/01/2005 – 9/7/2008, n = 184						
Mean	0.0027	0.0046	0.0052	0.0024	0.0001	0.0021
Std. Dev.	0.0238	0.0250	0.0234	0.0290	0.0515	0.0276
Skewness	0.4654	-0.0849	-0.1904	-0.3923	-1.1228	0.4875
Kurtosis	6.5283	3.0787	3.1641	6.1978	8.3100	11.5033
Jarque-Bera	101.530	0.2669	1.3110	82.665	253.44	558.58
Probability	0.0000	0.8751	0.5192	0.0000	0.0000	0.0000
Observations	184	184	184	184	184	184
Post-crisis: 16/07/2008 – 31/12/2013, n = 285						
Mean	-0.0014	-0.0021	-0.0012	0.0001	-0.0009	-0.0002
Std. Dev.	0.0259	0.0318	0.0360	0.0403	0.0361	0.0472
Skewness	-0.2097	-1.6818	-0.9899	-1.9364	-0.2647	-1.4877
Kurtosis	6.2458	12.8433	14.2841	15.4307	9.3866	13.0789
Jarque-Bera	126.75	1280.4	1553.1	2006.0	485.97	1306.8
Probability	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	285	285	285	285	285	285

The correspondence between stock indices and respective market-sectors is: BBS: Bahrain banking sector; KBS: Kuwait banking sector; OBS: Oman banking sector; QBS: Qatar banking sector; SBS: Saudi banking sector and EBS: the UAE banking sector.

4.7.4 The Co-Movements of the Variables under Study

Figure 4.4 shows the stock markets indices for the six GCC countries; namely, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE. As can be seen, there is co-movement among the markets over the full period of study. This implies that these markets share common stochastic trend and they tend to drift together over time. Also, predication of the market's returns would be much possible.

The Saudi market experienced high volatility over the period, January 2007 to July 2008, due to several effects such as speculation of stock prices by the small investors. The Omani market also follows the same direction of Saudi stock market; this may explain the link between these two markets, which is stronger than between

others in this period. In addition, there is a similarity of movement of stock markets indices for the rest of the GCC markets; that is Bahrain, Kuwait, Qatar and United Arab Emirates. Moreover, all markets are sharply declined in 2008, due to the GFC, and started to rise again after the first quarter in 2009. With the exception of the Saudi Arabia and UAE, all GCC financial markets increased gradually, and reached their peaks at the end of fourth quarter in 2007. In the case of Saudi Arabia and UAE, the stock prices decreased in the third quarter of 2007, and started to increase gradually thereafter. In the first quarter of 2008, all GCC stock markets sharply declined due to GFC, and started their recovery in the fourth quarter of 2008. Figure 4.5 shows the stock markets indexes for the three global markets. As displayed, the EU350 Index (Europe) ranks as the highest market, followed by S&P500 (US). Likewise, the global markets sharply declined due to GFC, and started their recovery in the fourth quarter of 2008.

The GCC-main sectoral indexes are presented in Figure 4.6. It is notable that GCC composite banking sector has the highest rate of return and dominates other sectors in the markets. The study goes more specifically as mentioned earlier to the analysis of banking sector integration as the main sector determines the directions of the whole market. The co-movement of banking-sectors is identical to the general index of the GCC share markets. Figure 4.7 shows the six GCC-banking indexes; as shown, there are co-movements among the markets. The Omani banking index experienced high prices over the period January 2007 to October 2008. In addition, there is a similarity of movement in banking markets indices and the rest of GCC-banking sectors (Bahrain, Kuwait, Qatar and the UAE).

However, quite clear that all GCC-banking flee in 2008 due to contagion of GFC, and started to rise again after the first quarter in 2009. With the exception of the Saudi Arabia and UAE, all GCC-equity markets increased and gradually reached their peak at the end of fourth quarter of 2007. In the case of the Saudi Arabia and UAE, the banking price indexes decreased in the third quarter of 2007, and started to increase gradually. During the first quarter of 2008, all GCC-banking sharply declined due to GFC, and started their recovery in the fourth quarter of 2008.

Figure 4.4: GCC-Stock Markets Indexes

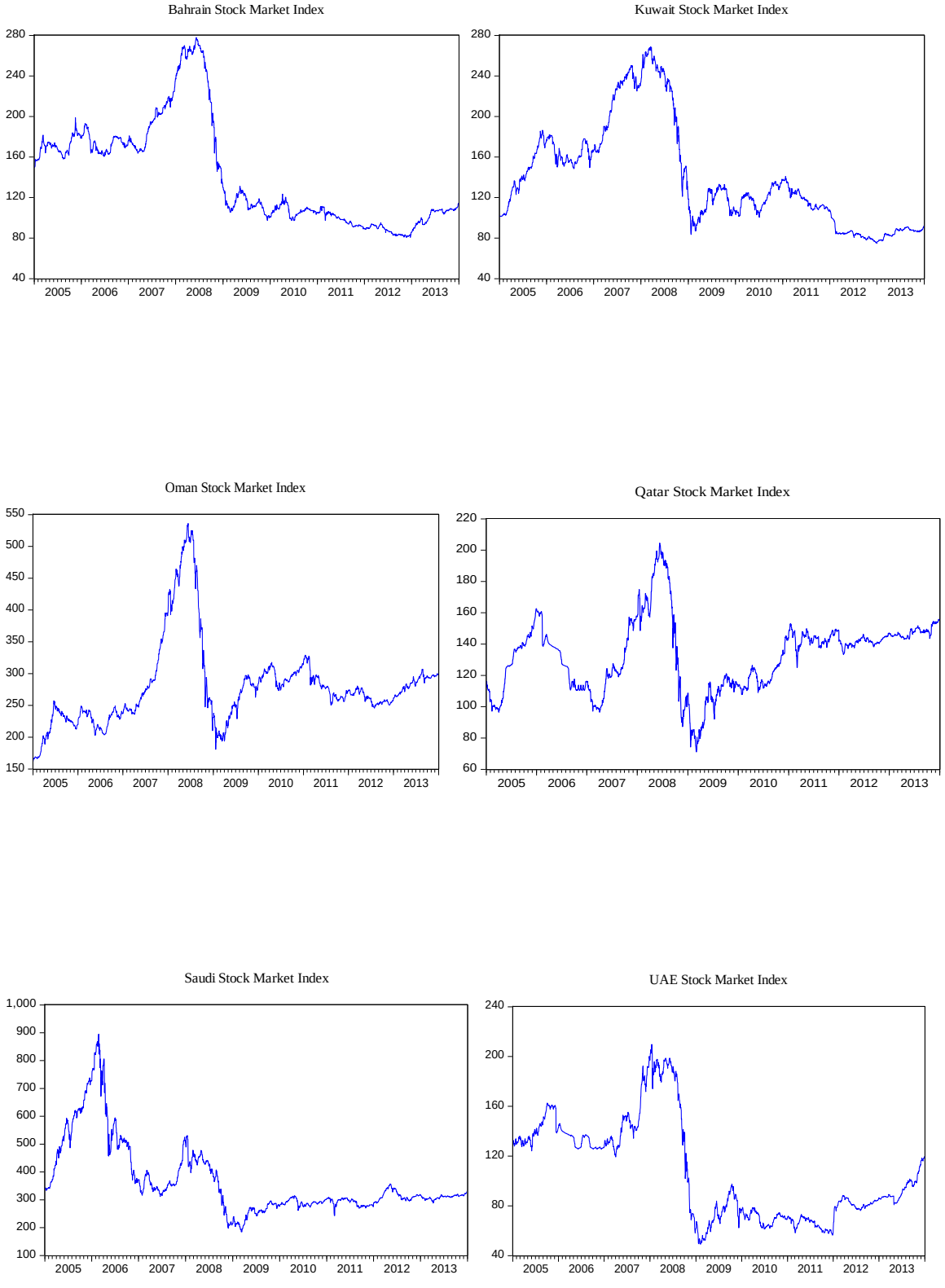


Figure 4.5: Co-Movement of Global Markets

Figure 4.6: Composite GCC Sectoral Indexes

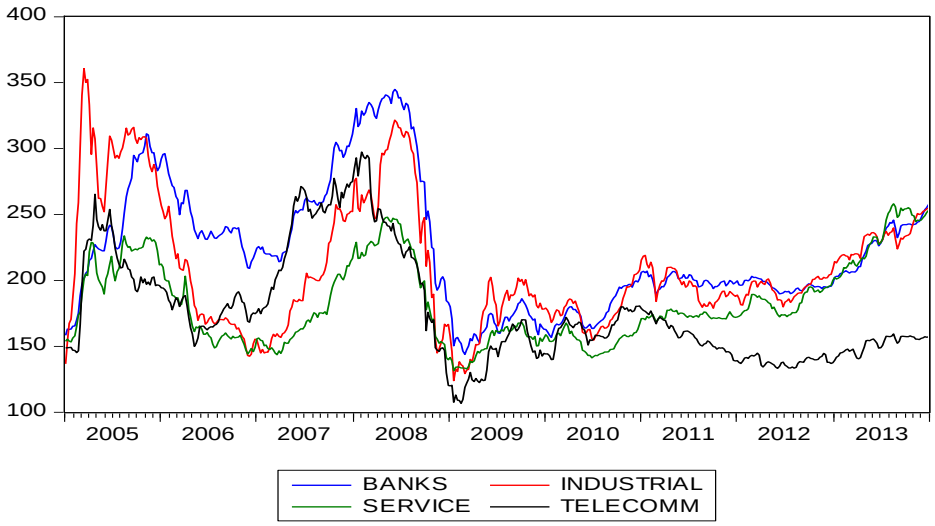
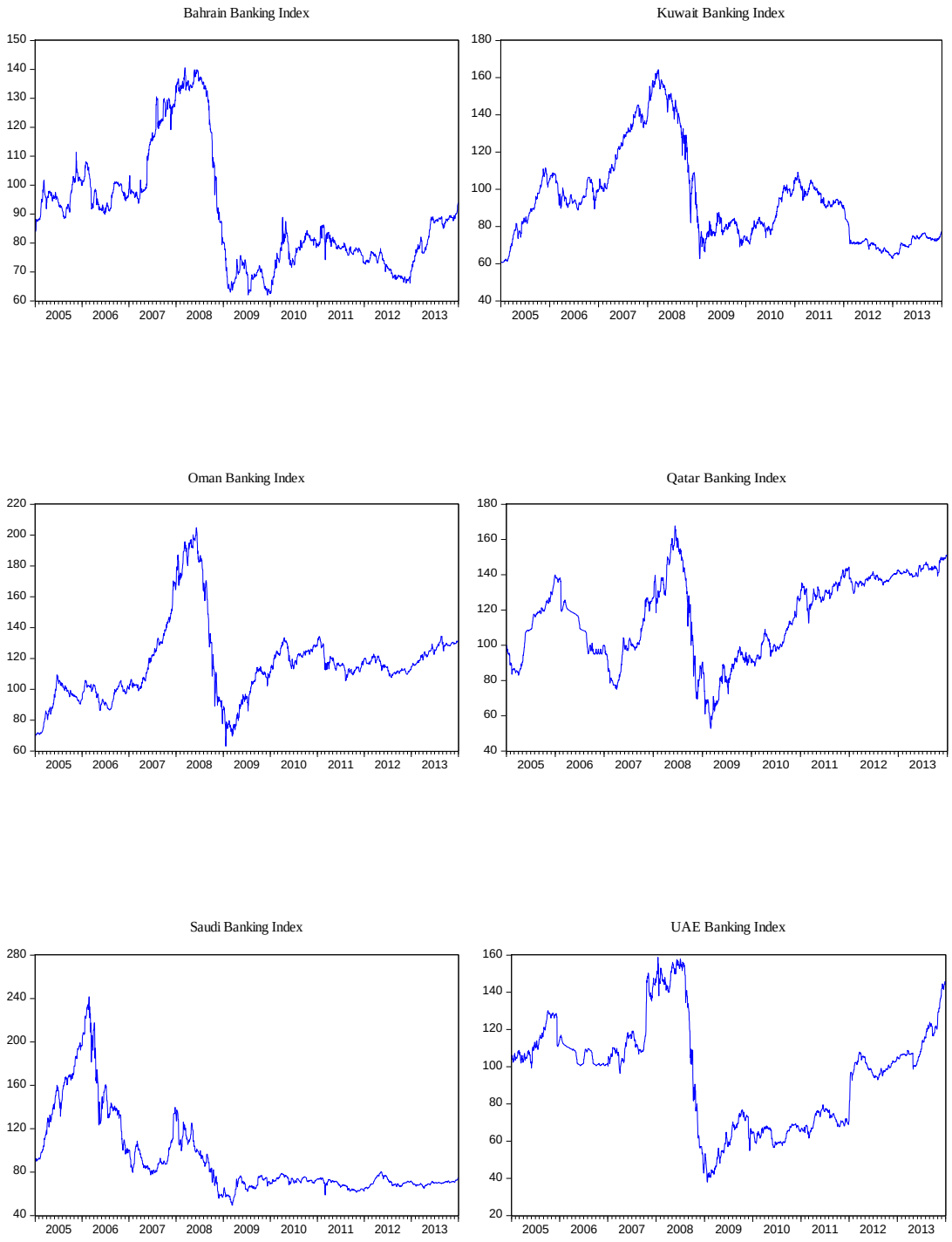


Figure 4.7: GCC-Banking Indexes



4.8 Contemporaneous Correlations Interactions

The correlation matrixes of market returns are reported in Tables 4.11 and 4.12. As seen in Table 4.11, the correlations between the GCC-equity markets are generally positive and stand with the average of 0.20%, implying that these markets are moving in the same pattern. The table shows higher correlations amongst indices during the post-crisis period, reached in the average of 0.56. The correlations between the GCC and advanced markets recorded negative signs in most cases, for example, the correlations between the US and all other markets, with the exception of Qatar. The post-crisis period clearly shows that the correlations between the GCC-equity markets and global markets increased considerably, span between 0.11 (US and Bahrain) and 0.51 (EU and Qatar).

Table 4.11: Correlations Matrix of the GCC and Global Market Returns

	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	US	EU
Pre-crisis: January/2005 – July/2008								
Kuwait	0.2125							
Oman	0.2755	0.2686						
Qatar	0.0852	0.0858	0.2018					
Saudi	0.1337	0.2779	0.3304	0.1246				
UAE	0.0975	0.2430	0.2235	0.2135	0.2243			
US	-0.1125	-0.0879	-0.1227	-0.1157	0.0116	-0.0437		
EU	-0.0011	-0.0674	0.0162	0.0008	0.0761	0.1491	0.3911	
Oil	-0.0146	-0.0676	0.0790	0.1523	0.0734	0.0698	-0.1036	0.2001
Post-crisis: July/2008 – December/2013								
Kuwait	0.5607							
Oman	0.5523	0.5141						
Qatar	0.5483	0.5416	0.7170					
Saudi	0.4764	0.3659	0.5600	0.6221				
UAE	0.5311	0.4653	0.6731	0.6485	0.6046			
US	0.1121	0.2470	0.2221	0.3130	0.1954	0.2133		
EU	0.2620	0.3041	0.4734	0.5069	0.4115	0.3785	0.6113	
Oil	0.1897	0.1787	0.4038	0.2955	0.3126	0.3608	0.3291	0.5859

Table 4.12 presents the correlation coefficients of the GCC-banking sectors. The interactions of market returns of GCC-banking sectors are generally positive, and the average of correlations coefficients is a 0.17 in the pre-crisis period. The highest correlations found between Saudi and Oman (0.33), while the lowest between Bahrain and UAE (0.034). The contemporaneous of market correlations amongst variables have significantly increased during the post-crisis period. Notably, the highest correlations initiated between Qatar and Oman (0.68), and the lowest

correlations found between Saudi and Kuwait (0.19). Further, the average of market correlations increased from 0.017 in the pre-crisis period to 0.43 during the post-crisis period, suggesting a substantial influence of the GFC on the GCC economies.

Table 4.12: Correlation Matrix of the GCC-Banking Sector Returns

	Bahrain	Kuwait	Oman	Qatar	Saudi
Pre-crisis: January/2005 – July/2008					
Kuwait	0.1490				
Oman	0.2174	0.2977			
Qatar	0.1222	0.0646	0.1672		
Saudi	0.1063	0.2436	0.3329	0.0849	
UAE	0.0339	0.2673	0.1430	0.1553	0.1399
Post-crisis: July/2008 – December/2013					
Kuwait	0.2892				
Oman	0.3565	0.3783			
Qatar	0.3483	0.4700	0.6812		
Saudi	0.3312	0.1868	0.4480	0.4691	
UAE	0.3867	0.3229	0.6370	0.5881	0.5109

4.9 Analysis of Return and Volatility Spillovers

The returns of financial markets often exhibit volatility clustering or volatility pooling, suggesting that the variance of financial time series is not constant. The ARCH model is specifically designed to model and forecast variance and the variance of a dependent variable is defined as a function of exogenous variables, which consists of the lagged dependent and other lagged exogenous variables. The model was introduced by Engle (1982) and generalized as GARCH by Bollerslev (1986) and Taylor (1986). The basic ARCH model can be specified as follows:

$$Y_t^2 = \beta_0 + \beta_1 X_{t-1}^2 + u_t \qquad (4.16)$$

The model given by equation (4.16) would be extended to the general form where the error variance depends on q lags of squared errors, which would be specified as follows:

$$Y_t^2 = \beta_0 + \beta_1 X_{t-1}^2 + \beta_2 X_{t-2}^2 + \ldots \beta_p X_{t-p}^2 + u_t \quad (4.17)$$

The equation (4.17) is called an ARCH (p) model, where p represents the number of autoregressive terms in the model. The ARCH-LM test and other diagnostic tests are used to check whether the time series exhibit ARCH affects or serial correlation in the residuals, which suggesting the use of GARCH model. Unlike ARCH (1.1) model, the GARCH (1, 1) model allows the conditional variance to be dependent upon its own previous lags.

In other words, the conditional variance of u at time t depends not only on the squared error term in the previous time period as in ARCH (1,1) but also on its conditional variance in the previous time period (Gujarati, 2003).

The basic GARCH (1, 1) model can be written as:

$$\sigma_t^2 = \alpha_0 + \alpha_1 u_{t-1}^2 + \alpha_2 \sigma_{t-1}^2 \quad (4.18)$$

Where σ_t^2 is the conditional variance, and it is a one period forward estimate for the variance calculated based on the past information. According to equation (4.18) the GARCH (1, 1) can be presented as follows:

$$h_t = \alpha_0 + \alpha_1 h_{t-1} + \alpha_2 u_{t-1}^2 \quad (4.19)$$

The conditional variance (h_t) presented in equation (4.19) is a function of three terms: the mean (α_0), ARCH and GARCH terms. The ARCH term represents information about volatility from the past period, measured as the lag of the squared residual from mean equations (u_{t-1}^2), while GARCH term reflecting last period forecast variance h_{t-1}. The GARCH (1,1) model enables us to measure the volatility of returns using conditional variance (h_t), and the degree of volatility can be calculated by sum of ($\alpha 1 + \alpha_2$) and lies between (0-1).

The return, volatility and persistence of shocks to volatility for all variables are examined by applying univariate AR-GARCH (1, 1) models. The parameters estimates of the AR-GARCH (1, 1) models for both sub-periods are reported in

Table 4.13, and results show less volatility in stock retunes during the pre-crisis compared to post-crisis period. The stock returns in Oman and Saudi exhibit the highest level of volatility compared to other markets in the region.

Table 4.14 presents the constant spillover model for the GCC and global equity returns before and after GFC. The idea behind this model is to show the influence of global markets volatility on the behavior of GCC stock market returns during the both sub-periods. Throughout pre-crisis period, with the exception of Oman and Saudi markets, the results show that the estimates of mean and variance equations are statistically insignificant. Oman and Saudi as mentioned earlier display significant volatility clustering during the two sub-samples. The sum of estimated coefficients ($\alpha_1+\beta_1$) in the volatility equation is less than unity for all markets; implying satisfaction with stationarity of the time series indices, which means the volatility of GCC and global markets exhibit persistent behavior overtime.

During the post-crisis period, evidence of return and volatility spillovers is found from global markets to the six GCC stock markets in particular from European and oil markets. Overall, the findings of this analysis document that the GCC stock returns do not revealed significant foreign spillovers prior the GFC downturn. The findings have changed dramatically during the post-crisis period as seen in the second part of Table 4.14. Return spillovers from European index influences all markets at 1% significance level, and oil market also has significance spillover return to all markets with the exception of Bahrain and Oman (non-rich oil exporters).

The sum of estimated coefficients ($\alpha_1+\beta_1$) in the volatility equation is less than unity and greater than 0.80 for all markets except Kuwait stock return. Overall, the findings emphasis the spillovers of return and volatility caused by global markets have increased after the GFC in the mid of 2008. For more details, Figure D.1 in appendix (D) provides the returns for individual GCC stock markets and global returns over the whole period.

Table 4.13: Stock Return Volatility

Variables	α_0	α_1	β_1	$\alpha_1 + \beta_1$
Pre-crisis (5/1/2005 – 9/7/2008)				
BSR	0.0002	0.0901	0.3939	0.4840
KSR	0.0003**	0.3361*	0.1391	0.4752
OSR	0.0008***	0.0389	-0.9050***	-0.866
QSR	0.0002*	0.5653	0.3481*	0.9134
SSR	0.0002	0.1897*	0.7375***	0.9272
ESR	0.0006	0.2189**	-0.0909	0.1280
USR	0.0016	0.0290	0.9571***	0.9861
EUR	0.0033***	0.2290*	0.6596***	0.8886
OilR	0.0008	-0.0708	0.3161	0.2453
BBR	0.0007	0.1981	0.2352	0.4333
KBR	0.0002	0.2329	0.3294	0.5623
OBR	0.0048**	0.0503	0.7735***	0.8238
QBR	0.0002*	0.6400	0.3501**	0.9901
SBR	0.0002	0.1887*	0.7629***	0.9516
EBR	0.0005***	0.3566***	0.0261	0.3827
Post-crisis (16/7/2008 – 25/12/2013)				
BSR	-0.0007	0.2133**	0.7724***	0.9857
KSR	-0.0005	0.0298**	0.9647***	0.9945
OSR	0.0017*	0.1676***	0.8066***	0.9742
QSR	0.0010	0.1372**	0.6743***	0.8115
SSR	0.0017	0.3613***	0.6202***	0.9815
ESR	0.0018	0.2157**	0.7372***	0.9529
USR	0.0052***	0.4725***	0.5085***	0.9810
EUR	0.0028**	0.2467***	0.7194***	0.9661
OilR	0.0017	0.0757**	0.9055***	0.9812
BBR	-0.0005	0.2080**	0.7771***	0.9851
KBR	0.0002	0.3862	0.5792***	0.9654
OBR	0.0017*	0.1734***	0.8087***	0.9821
QBR	0.0012	0.1042***	0.8695***	0.9737
SBR	0.0007	0.2117**	0.7842***	0.9959
EBR	0.0023**	0.3200**	0.6536***	0.9736

Note: BSR: Bahrain stock return, KSR: Kuwait, OSR: Oman, QSR: Qatar, SSR: Saudi, ESR: UAE, USR: US stock return, EUR: EU stock return and OilR is the Oil return. BBR denotes to Bahrain banking return, and KBR: Kuwait banking return... etc. *, **, *** are the significance at 10%, 5% and 1% level respectively.

Table 4.14: Constant Spillover Model for the GCC and Global Equity Returns

Pre-crisis (05/01/2005 – 09/07/2008)					*Mean Equation*			*Variance Equation*		
Variables	α_0	α_1	β_1	$\alpha_1 + \beta_1$	φ_{US}	φ_{EU}	φ_{Oil}	η_{US}	η_{EU}	η_{Oil}
BSR	8.27710	0.11039*	0.69240*	0.80279	-0.17766**	0.09474	-0.05520	0.00116	-0.00179	-0.00064
KSR	0.00034***	0.29333**	0.15020	0.44353	-0.00620	-0.06996	-0.01343	-0.01054***	0.00127	0.00142
OSR	5.20050	0.03764	0.85541***	0.89305	-0.13143	0.04092	0.04204	-0.00756**	0.00370	-0.00030
QSR	0.00047**	-0.05149	0.45911*	0.40762	-0.18625	-0.03016	0.12600*	0.00769**	-0.00751*	-0.00413**
SSR	0.00123***	0.16965***	0.45854***	0.62819	0.06103	0.30627	0.14494	-0.03980***	0.00246	-0.01779***
ESR	0.00046	-0.04224***	0.45756	0.41532	-0.20632*	0.31112*	-0.02045	0.00934*	5.82800	0.00180
Post-crisis (16/07/2008 – 25/12/2013)					*Mean Equation*			*Variance Equation*		
Variables	α_0	α_1	β_1	$\alpha_1 + \beta_1$	φ_{US}	φ_{EU}	φ_{Oil}	η_{US}	η_{EU}	η_{Oil}
BSR	2.77010***	0.21548***	0.76082***	0.9763	-0.05567	0.15078***	-0.01645	-0.00159*	-0.00046	0.00034
KSR	0.00032***	0.46964***	0.25006***	0.7197	0.05930	0.15166***	0.09615***	0.00037	-0.00812***	0.00138**
OSR	1.29900***	0.09811***	0.86235***	0.96046	0.00820	0.23874***	0.01394	0.00125***	-0.00285***	0.00040*
QSR	0.00010***	0.35318***	0.57003***	0.92321	0.01872	0.18909**	0.10593**	-0.00171	-0.00318**	0.00230***
SSR	0.00010***	0.47930***	0.44855***	0.92785	-0.14872***	0.20679***	0.14146***	-0.00246	0.00022	-0.00073
ESR	6.33300***	0.28605***	0.66295***	0.94900	-0.05592	0.28425***	0.19986***	-0.00020	0.00264	-0.00145

Note: BSR: Bahrain stock return, KSR: Kuwait stock return, OSR: Oman stock return….etc. The spillover model for the six GCC stock markets and global markets is formulated as follows:

$$R_{s,t} = \alpha_0 + \alpha_1 R_{s,t-1} + \varphi_{US,t-1} R_{US,t-1} + \varphi_{EU,t-1} R_{EU,t-1} + \varphi_{Oil,t-1} R_{Oil,t-1} + \eta_{US,t-1} V_{US,t-1} + \eta_{EU,t-1} V_{EU,t-1} + \eta_{Oil,t-1} V_{Oil,t-1} + \varepsilon_t \quad (4.20)$$

where $R_{s,t}$ is the weekly stock return of each GCC-equity index. $\boldsymbol{\varphi}$ and η are the return and volatility spillover effects of global markets. . *, **, *** are the significance at 10%, 5% and 1% level respectively.

4.10 Hypotheses and Models Specification

The issue of financial integration in the Arab Gulf region has received a great deal of attention in the research literature, and several empirical studies examined the degree of financial integration in the GCC countries from different aspects. The section below briefly presents the hypotheses and model specification used in this research.

4.10.1 Hypotheses

The findings of earlier research relevant to this study indicate the existence of robust long-term equilibrium relationships amongst the GCC financial markets (see, for example, Assaf, 2003;Hassan, 2003;Simpson and Evans, 2004;Darrat and Al-Shamsi, 2005;Al-Khazali *et al.*, 2006;Bley and Chen, 2006;Simpson, 2008a;Chaudhry and Boldin, 2012;Maghyereh and Awartani, 2012a). Those studies have used the Johansen's cointegration methodology to examine the cointegration process amongst GCC-equity markets. Significant research suggest that GCC stock markets are fully integrated, and the Saudi market is leading other financial markets in the region (see, for example, Assaf, 2003;Hammoudeh and Aleisa, 2004;Darrat and Al-Shamsi, 2005).

The first hypothesis in this research tests whether or not the six GCC-equity markets are cointegrated. The second hypothesis examines the short and long-run relationships between GCC stock markets and global markets, and the third hypothesis examines whether or not the six GCC-banking sectors are also cointegrated. Based on the objectives of the research, drawn from literature, this thesis will address the following hypotheses in optimally lagged models as follows:

Hypotheses of Model A

H_{1a}: The long-run relationships exist between the six GCC-equity markets.

H_{1b}: The short-run relationships exist between the six GCC-equity markets.

Hypotheses of Model B

H_{2a}: The six GCC-equity markets are segmented from global markets in the long-term.

H_{2b}: A shock on global market can directly affect the GCC-equity markets in the long-term.

Hypotheses of Model C

H_{3a}*:* The long-run relationships exist between the six GCC-banking sectors.

H_{3b}*:* The short-run relationships exist between the six GCC-banking sectors.

4.10.2 Model Specification

In order to test the hypotheses of this research, there were three dynamic models drawn from the theory and literature, were utilized Engle and Granger (1987), Johansen (1988) and Johansen and Juselius (1990). Model (A) specified to test whether the Gulf Arab markets are cointegrated (long-term equilibrium relationship). Model (B) sought to examine whether there is a statistically significant long-term relationship between the six GCC-equity markets jointly, and the major global markets, and finally, model (C) aims to examine the existence of long-term relationships between the GCC-banking sectors.

As stated earlier, this research employs lagged dynamic models based test on cointegration and Granger-causality tests. Therefore, the first stage is to test for unit roots (stationarity) in the level variables as well as in the first differences for each series, applying the three common unit root tests; namely, the ADF test (Dickey and Fuller, 1979), PP (Phillips and Perron, 1988), and the KPSS test (Kwiatkowski *et al.*, 1992). These tests are carried out considering both constant and deterministic trend in time series data. The second stage tests for the presence of cointegration in the GCC share price indices, through the Johansen and Juselius (1990). Based on the Johansen's cointegration technique, this research uses VECM and Granger-causality test as follows:

$$Y_t = A_1 X_{t-1} + A_2 X_{t-2} + \cdots + A_k X_{t-k} + \varepsilon_t \qquad (4.21)$$

where:

- Y_t is a vector of endogenous variables, being stock price index in level series for a segmented GCC stock market at times $_t$ to $_{t-1}$ where *n* is the optimal lag.
- X_{t-1} is the vector of exogenous independent variables (GCC price index in level series) at time *t*.
- A_1 ..... A_K are matrices of coefficients to be estimated, ε_t is the error term.

In the VEC model, each variable was treated as an endogenous variable; therefore, the main model will be repeated for each market as the dependent variable. In the dynamic model, the Bahrain market is treated as the endogenous variable, and the other five GCC markets treated as exogenous variables[5].

Model A:

$$BSR_t = A_1 KSR_{t-1} + A_2 OSR_{t-2} + A_3 QSR_{t-3} + A_4 SSR_{t-4} + A_5 ESR_{t-5} + \varepsilon_t \quad (4.22)$$

where, BSR_t is the Bahrain stock return at time t as dependent variable, and the independents variables in the right equation are the five GCC stock returns.

Model B*:*

$$BSR_t = A_1 KSR_{t-1} + A_2 OSR_{t-2} + A_3 QSR_{t-3} + A_4 SSR_{t-4} + A_5 ESR_{t-5} + \\ + A_6 USR_{t-6} + A_7 EUR_{t-7} + A_8 OILR_{t-8} + \varepsilon_t \quad (4.23)$$

where, USP denotes US stock market index, EU is the European Union share price index, and $OilP$ denotes oil Brent price index. The third model specified to capture the long-run relationship between GCC-equity markets and the three global factors. The variance decomposition and impulse response function will be also tested to see the reaction of GCC stock markets, as one group to the shocks on global stock markets. In addition, this model referred to models (A), applying VEC framework and Granger-causality tests to each market.

Model C*:*

$$BBR_t = A_1 KBR_{t-1} + A_2 OBR_{t-2} + A_3 QBR_{t-3} + A_4 SBR_{t-4} + A_5 EBR_{t-5} + \varepsilon_t \quad (4.24)$$

where, BBR_t is Bahrain banking return at time t as dependent variable, and the other independents variables in the right equation are the five GCC-banking returns.

The Engle and Granger (1987) representation theorem suggests that dynamic relationships between two cointegrated variables can be examined within an ECM. The VEC framework can capture the short-term equilibrium dynamics relationship

[5] Bahrain is a smallest market capitalization among GCC region, thus it is more likely to be driven by other GCC stock markets. This assumption has confirmed by the VEC model where the Bahrain has the highest explanatory power among the six GCC stock markets.

between the two time series. Additionally, it also provides an appropriate technique to examine the Granger-causality between those variables. Suppose that all share price series have at least one vector cointegration equation, then, the model will be transformed into VEC framework for each market. However, Granger's theorem, Engle and Granger (1987) states that if two variables are cointegrated, then Granger-causal relationships must exist at least in one direction.

Testing of Granger-causality between the variables can be examined by applying either a Wald χ^2 test, or a joint *F*-test, to the coefficients of each explanatory variable in the VEC model (Hassan, 2003). This thesis uses the Wald χ^2 test to examine the Granger-causality relationships between variables.

4.11 Conclusion

The main objective of this chapter is to review the methodology and data of the research from an examination of level series in descriptive statistics; to an investigation of market integration by examining optimally lagged multivariate models. The econometrics methodology starts with a procedure of preliminary analysis of the data properties. Next, for the main analysis of the optimally lagged model, this chapter presents the recent techniques used for testing financial integration. These techniques included the Johansen's cointegration test, VECM, Granger-causality, variance decomposition and impulse response functions.

The second section of this chapter reviewed the level series data used in this research. First, the data sources were described, along with the structural stability and descriptive statistics for all variables. Third, this chapter examined the evidence of the co-movements of all markets, providing an initial indication of the strength of contemporaneous long-term equilibrium relationships between variables. Analyses of return and volatility as well as cotemporaneous correlations between variables are presented in the fourth section, and finally, this chapter presents the hypotheses and models employed in this study.

Descriptive statistics for all variables indicates high degree of market volatility (measured by standard deviation) in particular after the crisis period. This result is confirmed later by the findings of GARCH (1, 1), employed to measure the return and volatility. Furthermore, the findings of cotemporaneous correlations and the

constant spillover model for both sub-periods, clearly suggest significant spillovers of returns and volatility caused by developed markets only after the GFC crisis. These findings are deeply investigated using various econometrics techniques. These techniques are presented in the following chapter.

CHAPTER FIVE

MAIN FINDINGS

Introduction

The main purpose of this chapter is to present the main findings of the study. The chapter will present different econometrics techniques that were recently used to investigate financial integration. The estimation procedures began with unit root test to find the order of integration among variables. Next, if the variables are integrated in the same order, then the Johansen cointegration test is performed to identify the dynamic long-run relationships between variables. However, with the existence of cointegration between variables, the transmission mechanism between variables is tested. The Granger causality and exogeneity tests based on VECM are used to explore the short-and long-run dynamic relationships between variables. Finally, the dynamic effects of the shocks in the markets under study are investigated by implementing variance decomposition and impulse response functions. The focus of testing cointegration tests involves both sub-periods and the full period of study.

This chapter is divided into three sections; the first section presents the findings of regional integration relationships between the six GCC-equity markets. The second section examines cointegrating relationships between the GCC and global markets, represented by S&P500, EU350 and oil. The third section focuses on the findings of the cointegrating relationships amongst GCC-banking sectors as the dominant sectors in GCC financial system.

In order to investigate the long-run relationships between variables, the full period of this study is divided into two sub-periods: pre-crisis, from January 2005 to July 2008, post crisis (crisis period and thereafter) from July 2008 to December 2013. The cointegration test is applied at different VECMs as follows: First, the VECM-1, which included the six GCC equity markets, and examines the long-run cointegrating relationship between GCC countries. Second, the VECM-2 included equity markets in GCC countries and global markets, aims to investigate the long-run cointegrating relationships between the six members of GCC region and developed markets. Finally, the VECM-3 explores the cointegration relationships between the GCC-banking sectors. These three VECMs models are basically reflect the three main hypotheses presented in the previous chapter.

5.2 Testing Intra-regional Integration of the GCC Stock Markets

5.2.1 Unit Root Tests

The first step for testing regional financial integration in the six GCC-equity markets is to test for stationarity of weekly time series for each market. The test can be undertaken by testing the means of unit root; that is examining the presence of unit root in the levels and first differences of each series with the assumption of a stochastic intercept, and both intercept and trend in each individual series. The unit root test is most commonly used for stationarity test of time series data. It is also considered as a preliminary step for testing for cointegration, as all series need to be integrated to the same order. In this context, a stationary series will be defined as one with a constant mean, constant variance, and constant auto-covariance for each given lag (Brooks, 2008).

Stationary time series data means that the behavior of time series data remains the same over time. Conversely, for a non-stationary series, the effect of a shock will not remain the same over time, and can lead to spurious regression. A spurious regression usually exhibits a high R^2 and low Durbin Watson (*DW)* statistic. Accordingly, the statistics relating to the initially computed ADF, PP, and KPSS unit root test for the two sub-periods as well as the full period are reported in Table 5.1. The results exposed that the null hypothesis of the existence of a unit root in the levels cannot be rejected for all series. The values of the *t*-statistic for both tests, ADF and PP, are greater than the critical values, resulting in acceptance of the null hypothesis for the presence of unit root in the level series. The results of these three tests over three periods in case of first differences show that all variables are stationary and statistically significant at 1% level, as the *t*-statistic is smaller than, the critical values for all variables. Therefore, all variables appear to be non-stationary in levels, and stationary in the first differences, which means integration of the first degree $I(1)$.

Table 5.1: Unit Root Tests for the GCC and Global Stock Indices, in Levels and First Differences

Markets	period	Levels			First Differences			Levels			First Differences		
		Intercept only in the model						*Intercept and trend in the model*					
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Bahrain	Pre-crisis	-0.4199	0.2892	1.1959	-11.583***	-11.611***	0.3050	-0.7862	-0.7862	0.3613	-11.658***	-11.652***	0.0930
	Post-crisis	-1.7907	-0.9865	0.6378	-19.547***	-19.914***	0.0986	-1.1312	-1.4262	0.1896	-21.243***	-21.456***	0.0356
	Full period	-1.9441	-0.7641	1.5021	-10.112***	-16.132***	0.1753	-2.3524	-1.3654	0.1896	-6.5635***	-16.985***	0.5983
Kuwait	Pre-crisis	0.5727	0.5584	1.5310	-12.935***	-13.070***	0.1509	-0.4616	-1.7145	0.1762	-12.985***	-13.104***	0.1049
	Post-crisis	-1.2265	0.6398	0.3269	-15.102***	-15.565***	0.0889	-0.1980	-3.5658	0.2589	-15.315***	-15.639***	0.0968
	Full period	-1.7983	-0.9146	1.4887	-7.8896***	-16.26***	0.1536	-2.1236	-1.9863	0.2896	-8.697***	-16.989***	0.1986
Oman	Pre-crisis	1.9951	2.0113	1.2848	-9.5007***	-9.2992***	0.7023	0.2593	0.2165	0.3695	-9.5511***	-9.4270***	0.1753
	Post-crisis	-1.2669	-1.5398	0.8968	-17.568***	-17.963***	0.0963	-1.4612	-1.9931	0.2093	-18.047***	-18.611***	0.0986
	Full period	-2.9863	-1.3986	0.3986	-2.8563***	-16.88***	0.1175	-2.9539	-1.9631	0.1893	-4.8914***	-17.742***	0.1448
Qatar	Pre-crisis	0.1734	-0.1057	0.5231	-11.249***	-11.202***	0.2921	-0.5435	-0.7646	0.2661	-11.281***	-11.201***	0.1536
	Post-crisis	-2.6530	-0.974	1.0762	-10.984***	-10.28***	0.0741	-4.8084	-2.575	0.1293	-19.265***	-19.291***	0.0936
	Full period	-1.8963	-1.8963	0.1936	-16.856***	-16.563***	0.0836	-1.4337	-1.6392	0.1933	-10.478***	-15.537***	0.0986
Saudi	Pre-crisis	-1.7515	-1.5885	0.5963	-10.405***	-10.330***	0.2215	-2.3940	-2.1923	0.1946	-10.441***	-10.364***	0.1415
	Post-crisis	-1.3218	-1.5365	0.1123	-19.126***	-19.453***	0.0789	-1.4183	-1.1512	0.1119	-19.294***	-19.365***	0.0191
	Full period	-1.500	-1.646	0.8891	-10.936***	-13.032***	0.0896	-1.9863	-1.8653	0.1713	-13.639***	-16.193***	0.0968
UAE	Pre-crisis	-0.6760	-0.7996	0.8842	-12.405***	-12.391***	0.1370	-1.4777	-1.6025	0.3327	-12.394***	-12.367***	0.0682
	Post-crisis	-1.4492	-2.3653	0.9638	-10.770***	-10.325***	0.1896	-1.3250	-2.6398	0.1098	-5.1364***	-5.9863***	0.1016
	Full period	-0.9636	-0.9326	1.2368	-9.789***	-9.9681***	0.1193	-1.7523	-1.8420	0.1986	-15.532***	-12.986***	0.1986
US	Pre-crisis	-1.4881	-1.5709	1.2667	-15.988***	-15.930***	0.2248	-0.4743	-0.7813	0.2493	-16.118***	-16.110***	0.1002
	Post-crisis	-1.9331	-1.3982	0.9632	-11.896***	-10.896***	0.0596	-2.5869	-2.3971	0.4975	-18.156***	-18.777***	0.2363
	Full period	-1.4986	-1.3965	0.9963	-17.325***	-16.869***	0.2096	-1.239	-1.226	0.5011	-16.421***	-17.745***	0.1536
EU	Pre-crisis	-1.4080	-1.4489	1.4419	-11.498***	-11.566***	0.2696	-0.0729	-0.5672	0.2486	-10.612***	-11.628***	0.1237
	Post-crisis	-1.748	-1.856	0.229	-10.07***	-10.06***	0.121	-1.846	-1.963	0.226	-15.635***	-15.417***	0.1854
	Full period	-1.504	-1.454	1.042	-13.66***	-13.64***	0.190	-1.284	-1.230	0.405	-11.397***	-12.638***	0.1179
Oil	Pre-crisis	0.7643	1.5065	1.2881	-11.871***	-11.906***	0.4704	0.3476	0.0301	0.2998	-12.082***	-12.118***	0.1485
	Post-crisis	-1.8896	-2.8631	0.7536	-18.968***	-18.423***	0.9361	-2.9912	-2.5895	0.4837	-18.875***	-18.388***	0.1156
	Full period	-1.1566	-1.1251	2.8963	-28.563***	-28.536***	0.0996	-1.6541	-1.3323	0.3143	-28.112***	-28.896***	0.0369

Note: ADF, PP, and KPSS denote the Augmented Dickey–Fuller test, Philips-Perron test, and the Kwiatkowski, Phillips, Schmidt, and Shin test for unit roots, respectively. The optimal number of lags was chosen according to the Schwarz Information Criterion (SIC), provided that the lags yield white-noise residuals. *** denotes to the statistical significance of 1% level.

5.2.2 Lag length selection

The Johansen's cointegration test can be affected by the lag length used in the VAR; therefore, it is essential to select an optimal lag length prior to the estimation of VECM and cointegration test (Gujarati, 1995). Different procedures have been used to determine the number of lag length included in the system. The most popular procedure is information criteria procedure, and the three information criteria widely used are: Akaike Information Criterion (AIC), Schwarz's Bayesian Information Criterion (SBIC) and Hannah-Quinn Criterion (HQIC).

This research uses the AIC for selecting an appropriate lag length to be included in the system for each sub-period. In addition, a lag exclusion Wald test is used to ensure that the research did not lose important information when selecting the lag length. The LM-autocorrelation test is also employed to confirm no serial correlation with the lag length selection, and the results are reported in Table 5.2.

Table 5.2: Lag Length Selection Criteria of VECM-1

Lag	LR	FPE	AIC	SC	HQ
Full Period: January/2005 – December/2013 (3 weeks lags)					
0	NA	6.360017	58.02151	58.07496	58.04255
1	9926.660	2.871008	36.50242	36.87654*	36.64968*
2	82.22689	2.831008	36.48778	37.17014	36.74882
3	63.51018	2.791108*	36.4753*	37.50325	36.88747
4	59.06731*	2.890008	36.50838	37.84452	37.03428
Pre-crisis: January/2005 – July/2008 (1 week lag)					
0	NA	55.53916	55.47588	4.780116	55.43273
1	3111.502	38.59219*	38.14924*	9.632008*	37.84717
2	89.40800	39.09540	38.27279	1.121201	37.71179*
3	58.84215*	39.76852	38.56623	1.000109	37.74631
4	44.74933	40.51840	38.93644	1.131209	37.85761
Post-crisis: July/2008 – December/2013 (1 week lag)					
0	NA	2.551014	50.19978	50.27747	50.23094
1	4637.090	1074925*	33.21478*	34.07614*	33.75042
2	121.7387	12084554	33.33430	34.34424	33.73935*
3	84.50303	11318840	33.26800	34.74406	33.85998
4	79.21927*	14725996	33.53233	35.15696	33.99370

* Indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan- Quinn information criterion.

5.2.3 Multivariate Johansen's Cointegration

The unit root tests provided robust evidence of integration among the GCC-equity indices at the same order *I(*1). Thus, the Johansen and Juselius (1990) (henceforth, JJ) is applied to examine the long-run equilibrium relationship between these markets. According to the JJ, testing for the existence of cointegration between variables in a system requires the use of maximum Likelihood method. To that end, both Trace statistic (λ_{Trace}) and maximum eigenvalue (λ_{max}) are tested considering two alternative models, with-and without liner trend[6]. The null and the alternative hypotheses are defined in both sub-periods and the full sample as follows:

H_0: The returns series of the GCC-equity markets are not cointegrated.

H_1: The returns series of the GCC-equity markets are cointegrated.

Table 5.3 presents the results of the JJ for the full sample period in two model versions: (a) a model with intercept but no trend in the cointegration equation and VAR test; and (b) a model with intercept and trend in the cointegration equation and no trend in the VAR. The empirical findings of both λ_{Trace} and λ_{max} support the absence of cointegrating vector(s) between variables ($r = 0$), thus, the null hypothesis for no cointegrating vectors amongst variables cannot be rejected. The λ_{Trace} of the second model indicate one cointegration vector, since its corresponded statistic exceeds the critical value at 5% significance level. Further, the λ_{max} is still showing no cointegration between variables, implying contrasted result with λ_{Trace}. However, the influence of GFC cannot be ignored, and a model with dummy variable should be implemented.

A dummy variable representing GFC is used, takes the value of zero for each week in the pre-crisis period and takes the value of one thereafter. The second part of Table 5.3 reports the results of JJ test when the dummy variable is taken into account. As seen in both model versions, the λ_{Trace} and λ_{max} statistics both exceed

[6] E-views 8 software package provides 5 options for deterministic trend specification. The case 1: no intercept and trend in data, case 2: cointegrating equation has intercept and data have no trend, case 3: cointegrating equation has intercept and data have no linear trend, case 4: both cointegrating equation and data have intercept and linear trend, and case 5 assumes that data has quadratic trends but the cointegrating equations have linear trends. Theory and econometrics literature recommend the use of case 2 if none of the visual plots of the series and unit root tests show the presence of a trend in the series, while case 3 for the series which have stochastic trends, case 4 if some of the series are trend stationary, and cases 1 and 5 are infrequently used in practice.

their linked critical values, indicating the presence of one cointegrating vector amongst the six GCC-equity markets and the null hypothesis is therefore being rejected. Specifically, the λ_{Trace} of 113.39 is greater than critical value of 103.84; likewise, the λ_{max} of 42.92 is greater than critical value of 40.95. This suggests that there is a significant influence of GFC on the process of financial integration in the GCC region during the full period of study, and more details about how this integration has changed overtime may certainly be useful.

Table 5.3: Multivariate (JJ) Test of the GCC Stock Markets for the Full Period

Null hypotheses	Alternative hypotheses	*Trace statistic*		*Max-Eigen statistic*	
		Statistics	Critical values (5%)	Statistics	Critical values (5%)
Full Period: Jan,2005 – Dec,2013					
Without liner trend					
r = 0	*r = 1*	102.57	103.84	33.879	40.956
r ≤ 1	*r = 2*	68.697	76.972	27.473	34.805
r ≤ 2	*r = 3*	41.224	54.079	22.789	28.588
r ≤ 3	*r = 4*	18.434	35.192	8.3171	22.299
With liner trend					
r = 0	*r = 1*	99.847**	95.753	33.413	40.077
r ≤ 1	*r = 2*	66.434	69.818	27.424	33.876
r ≤ 2	*r = 3*	39.009	47.856	21.960	27.584
r ≤ 3	*r = 4*	17.049	29.797	8.2780	21.131
Full Period: Jan,2005 – Dec,2013 (includes exogenous dummy variable representing GFC)					
Without liner trend					
r = 0	*r = 1*	113.39**	103.84	42.926**	40.956
r ≤ 1	*r = 2*	70.469	76.972	28.281	34.805
r ≤ 2	*r = 3*	42.187	54.079	24.045	28.588
r ≤ 3	*r = 4*	18.142	35.192	8.8350	22.299
With liner trend					
r = 0	*r = 1*	110.10**	95.753	41.257**	40.077
r ≤ 1	*r = 2*	68.844	69.818	28.079	33.876
r ≤ 2	*r = 3*	40.764	47.856	24.036	27.584
r ≤ 3	*r = 4*	16.728	29.797	8.7614	21.131

Notes: *r* represents the number of cointegrating vectors. * denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.

Table 5.4 presents the results of JJ test before and after crisis period. The two kinds of models (with-and without liner trend) are taken into account. The purpose of this analysis is to investigate whether the long-run equilibrium relationships amongst GCC stock markets have changed over the time. As reported in the table, during the pre-crisis period, the λ_{Trace} statistic in both models suggests presence of one cointegrating vector, while the λ_{max} statistic has shown contradictory results. The

results of JJ analysis for the post-crisis period indicate that the λ_{Trace} and λ_{max} statistics both exceed their associated critical values, suggesting the presence of one cointegrating vector amongst the six GCC-equity markets, while the second model indicates two cointegrating vectors tie these markets together in the long-term. In other words, the λ_{Trace} statistic value of 171.20 is greater than critical value of 95.75 and the λ_{max} of 98.57 is greater than the critical value of 40.07, at 5% level of significance; and, similarly, the λ_{Trace} of 48.27 is greater than the critical values of 33.87, and the λ_{max} of 98.57 is greater than the critical value of 40.07 at 5% level of significance. This results indicate acceptance of the alternative hypothesis, that $r = 2$, and rejection of the null hypothesis, $r \leq 1$. Overall, the results soundly conclude that the degree of cointegration has increased after the crisis period.

Table 5.4: Multivariate (JJ) Test of the GCC Stock Markets (Sub-periods)

Null hypotheses	Alternative hypotheses	*Trace statistic*		*Max-Eigen statistic*	
		Statistics	Critical values (5%)	Statistics	Critical values (5%)
Pre-crisis: January,2005 – July,2008					
Without liner trend					
r = 0	*r = 1*	113.16**	103.84	35.465	40.956
r ≤ 1	*r = 2*	77.699**	76.972	31.884	34.805
r ≤ 2	*r = 3*	45.814	54.079	20.883	28.588
r ≤ 3	*r = 4*	24.931	35.192	13.278	22.299
With liner trend					
r = 0	*r = 1*	100.48**	95.753	35.072	40.077
r ≤ 1	*r = 2*	65.410	69.818	31.257	33.876
r ≤ 2	*r = 3*	34.152	47.856	16.057	27.584
r ≤ 3	*r = 4*	18.094	29.797	10.584	21.131
Post-crisis: July,2008 – December,2013					
Without liner trend					
r = 0	*r = 1*	125.60**	103.84	64.307**	40.956
r ≤ 1	*r = 2*	61.295	76.972	23.321	34.805
r ≤ 2	*r = 3*	37.974	54.079	13.373	28.588
r ≤ 3	*r = 4*	24.601	35.192	11.486	22.299
With liner trend					
r = 0	*r = 1*	171.20**	95.753	98.574**	40.077
r ≤ 1	*r = 2*	72.628**	69.818	34.606**	33.876
r ≤ 2	*r = 3*	38.022	47.856	18.150	27.584
r ≤ 3	*r = 4*	19.871	29.797	9.4843	21.131

Notes: r represents the number of cointegrating vectors. * denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

The normalized restriction of cointegrating vector in both sub-periods is reported in Table 5.5. The results from the pre-crisis period indicate that Emirates stock market has the most significant coefficient behind the long-run relationship followed by Bahraini market. The analysis from the post-crisis period suggests that Saudi and UAE have the greatest influence amongst the region and dominates their long-run equilibrium relationship.

Table 5.5: Normalized Cointegrating Vector of the VECM-1

Period	CE	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE
Pre-crisis	CE1	1.0000	-0.0714	-0.0809	-0.0615	0.0370*	-0.8407***
Post-crisis	CE1	1.0000	0.0000	-0.1162	0.0866	-0.5879***	-0.8251***
	CE2	0.0000	1.0000	0.1775	0.1705	0.2428**	-0.4255***

Notes: The cointegration equations are normalized to the Bahrain market. *, ** and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

The statistical significance of each variable in the cointegrating system is tested through the LR test proposed by Johansen (1991). The results of LR test for both sub-periods are displayed in Table 5.6. As presented in the table, the pre-crisis period show that with the exception of Bahrain and UAE, all variables were found statistically insignificant, and therefore, do not contribute significantly to the cointegrating vector. Data from post-crisis period suggests that Bahrain, Saudi and UAE are in significant cointegration relationships, and the Saudi market has the greatest value of the χ^2_β statistic.

Table 5.6: Restrictions on the Cointegration Vectors of the VECM-1

Markets	*Pre-crisis*		*Post-crisis*	
	χ^2_β	*p*-value	χ^2_β	*p*-value
Bahrain	2.9491	0.0859	20.154	0.0000
Kuwait	[0.8137]	0.3670	[1.0988]	0.2945
Oman	[0.1480]	0.7004	[1.1579]	0.2819
Qatar	[0.0174]	0.8948	[0.3977]	0.5282
Saudi	[0.4283]	0.5127	21.898	0.0000
UAE	3.6474	0.0561	11.625	0.0006

Note: χ^2_β denotes Chi-squared statistic test for the significance of cointegrated system. Numbers in parentheses indicate that Chi-squared statistics fail to reject the null hypothesis that the *i* th endogenous variables are not significance to the cointegrated system with respect to the β parameters.

Giving the significant of UAE and Saudi markets behind the cointegrating vector for both sub-periods, the study implements further analysis to identify the permanent driving forces in each other GCC-equity markets over the full period. To address this intriguing point, the study performs two procedures proposed by Johansen (1991), and Gonzalo and Granger (1995). Recall that the intention of this analysis as mentioned is to test whether the UAE or Saudi or perhaps both are the main driving forces for each of the other GCC stock markets in a long-term.

Gonzalo and Granger (1995) find that decomposition of common long-memory documented that the cointegrated system *I*(1) can be represented by the sum of a permanent and transitory components. The test employs LR statistic as follows:

$$-T = -t \sum_{i=n+1}^{r} \ln \frac{(1 - \hat{\lambda}_{i+m-n})}{(1 - \hat{\lambda}_i)} \qquad (5.1)$$

where T is the sample size, $\hat{\lambda}_i$ and $\hat{\lambda}_{i+m-r}$ represent the solution to the unrestricted and restricted eigenvalue statistics. The LR statistic follows a χ^2 distribution with $(n - r) \times (n - m)$ degrees of freedom.

A single component series of each GCC stock market is tested with both Saudi and UAE stock markets within a trivariate cointegration system. As presented in Table 5.7, the results of trivariate JJ tests support the presence of at least one cointegrating vector linking each of GCC stock market to both UAE and Saudi stock markets. The null hypothesis of no cointegration between variables has been rejected at 5% level of significance. Next, the main driving force of GCC stock markets is tested, employing Gonzalo and Granger (1995), and the results as shown in Table 5.8 suggest that UAE is an important market to other GCC countries, but Saudi stock market is the most important in driving the trivariate cointegrated systems.

Further analysis of Gonzalo and Granger (1995) is applied based on multivariate JJ cointegrated system. The results displayed in Table 5.9, indicating that Saudi stock market has the greatest value of Chi-squared statistic, implying an importance of Saudi market as a main driving force contributing to the regional financial integration in the GCC region. These results soundly support the fact that Saudi market is the largest market in the Arab Gulf region. With the exception of Kuwait, the other GCC markets cannot be overlooked from contributing to the long-term relationship particularly UAE and Bahrain.

Table 5.7: Trivariate JJ Test of the GCC Stock Markets

Markets	Models	*Trace Statistic* H_0: $r = 0$ H_1: $r = 1$	*Max- Statistic* H_0: $r = 0$ H_1: $r = 1$	*Trace Statistic* H_0: $r \leq 1$ H_1: $r = 2$	*Max- Statistic* H_0: $r \leq 1$ H_1: $r = 2$
Bahrain	M1	66.589**	47.407**	19.182**	16.711**
	M2	63.251**	47.407**	15.844**	14.358**
Kuwait	M1	53.051**	39.913**	13.137	11.286
	M2	49.787**	39.845**	9.9423	9.8949
Oman	M1	35.819**	24.902**	10.917	9.6094
	M2	35.401**	24.835**	10.566	9.5407
Qatar	M1	36.901**	21.6638	15.237	9.8830
	M2	36.798**	21.660**	15.137	9.8398
C.V 0.95	M1	35.192	22.299	20.261	15.892
	M2	29.797	21.131	15.494	14.264

Note: M1 denotes to a model with intercept and no trend in the cointegrating vector and test VAR. M2 indicates to a model with intercept and trend in both cointegrating system and the VAR test. The two stars (**) indicates rejection of null hypothesis of no cointegration amongst variables at 5% significance level.

Table 5.8: Gonzalo-Granger Permanent Driving Test of Trivariate JJ System

Markets	Degrees of freedom	*r*	H_{0a}: *Saudi is not a permanent driving force of the trivariate cointegrating system*	H_{0a}: *The UAE is not a permanent driving force of the trivariate cointegrating system*
			χ^2	χ^2
Bahrain	1	2	36.950***	31.932***
Kuwait	2	1	28.927***	25.951***
Oman	2	1	14.547***	13.762***
Qatar	2	1	14.652***	10.225***

Note: the LR test is the Likelihood ratio statistic distributed as χ^2 with degrees of freedom equal to (3-*r*) (3-*m*), and r is the number of cointegrating vector, and *m* is the dimensions of the restriction matrix. The structural break in data caused by the GFC downturn is taken into account by including a dummy variable in the VAR as a basis for a trivariate JJ cointegrating test. The optimal lags have been chosen based on AIC and supported by L-M serial correlation test.

Table 5.9: Gonzalo-Granger Permanent Driving Test of the Whole JJ System

Markets	Degrees of freedom	*r*	χ^2
Bahrain	4	2	27.986***
Kuwait	5	1	4.6696*
Oman	5	1	28.131***
Qatar	5	1	25.702***
Saudi	5	1	37.526***
UAE	5	1	32.807***

Note: the LR test is the Likelihood ratio statistic distributed as χ^2 with degrees of freedom equal to (6-*r*) (6-*m*). The dummy variable is included into a VAR of the full sample period.

5.2.4 The Vector Error Correction Model

Since the cointegrating relationship between the GCC stock markets is confirmed, the next step is to estimate the vector error correction model (VECM) taken from the cointegration analysis, in order to link the short-run values of each market to its long-run values (Equation 4.11). The VECM determines the speed of adjustment towards equilibrium relationship in the dynamic model following a disturbance, where a larger (α) coefficient indicates a stronger speed of adjustment to long-run equilibrium relationship.

The results reported in Table 5.10 show the estimation of the (α) coefficients for the six GCC-equity markets, indicating the speed of adjustment process of the short-run disequilibrium towards the long-run equilibrium relationship. In the pre-crisis period, the results show that Bahrain, Kuwait and Saudi have negative signs of α-coefficient, and these coefficients are statistically significant at 5% and 1% levels. During the post-crisis period, the first cointegrating equation indicate that Bahrain, UAE and Qatar have the highest values of error correction terms with -0.0643, -0.0882 and -0.1178 respectively, and these markets are also statistically significant at 1% level. The implication behind these findings is that a deviation of named markets from the long-run equilibrium relationships following their short-run relationships disturbance are corrected by about 6%, 9% and 12% respectively each day. The rest of GCC-equity markets also indicated fast speed to equilibrium, and these variables are highly significant. The statistical significance of adjustment coefficients of the ECTs is tested in order to determine whether the long-term equilibrium relationships drive the endogenous variables to convergence in equilibrium relationship over the time. Such testing of the adjustment coefficients is known as testing weak exogeneity of

endogenous variables with respect to the parameters of the cointegrating equations (β). The LR test for the adjustment coefficients of the error-correction terms, which measures deviations from the long-run equilibrium relationship, is conducted over the two sub-periods. The results of the pre-crisis period show that, with the exception of Bahrain and UAE, the *p*-values of all variables reject the null hypothesis, indicating all variables are weakly exogenous, supporting the results of the ECTs. The second sub-period revealed that the null hypothesis of the weak exogeneity for all variables has been rejected at 1% significance level.

Table 5.10: The Speed of Adjustment of the VEC (VECM-1)

	D(BSM)	D(KSM)	D(OSM)	D(QSM)	D(SSM)	D(ESM)
Pre-crisis						
CointEq1	-0.1069***	-0.0766	0.0695	-0.0210	-0.3176	-0.0177*
Log likelihood	-0.3382.6					
AIC	37.76493					
		Statistic	***P-value***			
Serial correlation LM test		46.5050	0.1128			
Skewness		57.0818	0.0000			
Kurtosis		483.958	0.0000			
Normality (Jarque-Bera test)		541.040	0.0000			
Post-crisis						
CointEq1	-0.0643***	-0.0342	-0.2545***	-0.1171***	-0.3074***	-0.0882***
CointEq2	-0.0503**	-0.0733***	0.0595	0.0044	-0.0094**	-0.0196*
Log likelihood	-4369.44					
AIC	33.1183					
		Statistic	***P-value***			
Serial correlation LM test		24.2908	0.9313			
Skewness		21.8667	0.0013			
Kurtosis		369.648	0.0000			
Normality (Jarque-Bera test)		391.515	0.0000			

Notes: ECT stands for the error-correction terms in the VEC equations. The number of lags is based on the AIC. All variables are first differences of logs. *, ** and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

Table 5.11: Restrictions of the Adjustment Coefficients of VECM-1 for Testing Weak Exogeneity of the Endogenous Variables

Markets	*Pre-crisis*		*Post-crisis*	
	χ^2_α	*p*-value	χ^2_α	*p*-value
Bahrain	7.5702	0.0227	9.8595	0.0016
Kuwait	[2.2100]	0.1371	[1.7327]	0.1880
Oman	[3.2401]	0.1978	28.0251	0.0000
Qatar	[0.3526]	0.5526	25.6874	0.0000
Saudi	[0.5759]	0.4479	34.6242	0.0000
UAE	5.1559	0.0759	13.1948	0.0002

Notes: Numbers in parentheses indicate that the LR-tests fail to reject the null hypothesis that the *i* th endogenous variable is weakly exogenous with respect to the β parameter.

5.2.5 Granger Causality Test

Following the cointegration analysis and estimating VECM, the next step in the cointegration procedure is to investigate the nature of the short-run relationships between the GCC-equity markets. The Granger-causality test is applied to capture the dynamic short-run relationships over the two sub-periods. The results of Granger-causality test are presented in Table 5.12.

The results of the Granger-causality for the pre-crisis period indicated that, in the case of Bahrain as dependent variable, the Chi-squared statistic and associated *p*-values for testing explanatory power of the exogenous variables showed three unidirectional relationships running from Oman, Saudi and the UAE to the Bahrain market at 1% level of significance. With the Kuwaiti market as dependent variable, the result indicates bidirectional Granger-causal relationship with UAE at 1% level of significance. In relation to Oman and Saudi, the results revealed the absence of any Granger-causal relationships with other GCC stock markets, while Qatar shows a unidirectional relationship caused by Omani market.

When the UAE is treated as a dependent variable, the Chi-squared statistics and associated *p*-values show two unidirectional relationships run from Kuwait and Saudi at 1% level of significance. The results also revealed that with the exception of Bahrain and UAE, other markets are less caused by each other, and can be thus regarded as weakly exogenous.

The empirical results from the Granger-causality for the post-crisis period have changed dramatically. Bahrain showed two unidirectional relationships run from both Kuwait and Saudi markets at 1% and 5% levels of significance respectively. One bidirectional relationship is detected between Kuwait and UAE at 1% level of significance. Such a bidirectional causal relationship is also exists between Oman and Saudi at 1% level of significance. When Qatar was treated as the dependent variable, the Chi-squared statistics and associated *p*-values show one bidirectional relationship between Qatar and UAE at 5% level of significance. Further, one unidirectional relationship is found from Kuwait to Qatar at 1% level of significance.

In the case of Saudi as dependent variable, the result of the Granger-causality test showed two bidirectional Granger causal relationships between the Saudi market and both Oman and UAE at 5% level of significance. Finally, when the UAE was treated

as a dependent variable, the result of the test showed three bidirectional relationships, at 5% and 1% level of significance caused by Kuwait, Qatar and Saudi stock market.

Table 5.12: Granger Causality/ Block Exogeneity Wald Test of the GCC Stock Markets

Granger causality test based on the VECM-1

Pre-crisis

	Dependent variables							
	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	*causes*	*ECTs*
Bahrain		3.9118*	1.8467	0.0001	0.2569	1.9870	1	-0.106***
Kuwait	3.0799		1.9993	1.1972	3.3621	4.9735**	1	-0.0766
Oman	6.7613***	0.1161		14.37***	1.9423	1.1841	2	0.0695
Qatar	0.2824	0.0545	1.7851		1.0115	1.2074	0	-0.0210
Saudi	7.1812***	2.5564	0.7312	0.0891		5.4421**	2	-0.3176
UAE	5.1945**	3.4621*	0.7428	0.0950	0.2569		2	-0.0177*
caused	3	2	0	1	0	2	8	

Post-crisis

	Dependent Variables							
	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	*causes*	*ECTs*
Bahrain		6.2783	7.5777	4.7292	6.5798	9.9343	0	-0.0643***
Kuwait	19.428***		18.667***	25.77***	8.6441	20.965***	4	-0.0342***
Oman	3.0645	9.0586		6.6798	28.00***	5.7526	1	-0.2545***
Qatar	8.8134	1.3395	8.2489		10.517	13.682**	1	-0.1171***
Saudi	14.850**	7.8678	23.16***	11.634*		14.372**	4	-0.3074***
UAE	6.8491	17.891***	24.28***	15.213**	14.246**		4	-0.0882***
caused	2	1	3	3	2	3	14	

*, ** and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

5.2.6 Variance Decomposition

Theoretically, the generalized forecast error variance decomposition (VDC) measures the percentage of the forecast error of a market return that is explained by another market. In other words, it indicates a relative impact that the forecast error of one market has upon another market within the VAR system (Assaf, 2003). Table 5.13 presents the variance decomposition of the 5, 10, and 15 weeks forecast error for each market. Each row in the table indicates the percentage of forecast error variance explained by the market indicated in each column.

The pre-crisis period indicate that most GCC-equity markets are weakly exogenous in the sense that the percentage of the error variance accounted by their innovations, ranged between 51% and 89%. The Emirates market's innovations influence most of

the GCC-stock markets at different time horizons. For instance, at a 15 weeks horizon, 30% of forecast error variance in the Bahrain market is explained by UAE, 5% and 11% forecast error variance of Kuwait and Saudi are also explained by UAE. Moreover, Kuwait and Qatar are the least exogenous markets within the region during the pre-crisis period, for example, only 11% of Kuwait error variance explained by other markets; mainly 1.60% explained by Bahrain, 2.4% by Oman, 0.40 by Qatar, 1.41% by Saudi, and 1.20% explained by the UAE.

Throughout the second sub-period, the findings of the variance decomposition clearly exposed that the GCC-equity markets have more exogenous power than in the first period. The proportion of the regional explanatory power is quite strong, reaching in the best cases 70% for Qatar, 63% in Saudi and 55% for UAE after 15 weeks. The causal relationship between Bahrain and Saudi market is confirmed here, whereas Saudi explains 9.7% of forecast errors variance in Bahrain, and 15.2% forecast errors variance in Saudi is explained by Bahraini market.

5.2.7 Impulse Response Functions

The estimated impulse response functions (IRF) offers an additional technique to examine the transmission mechanism between variables. More specifically, the responsiveness of dependents variables is examined to identify the effects of a shock to a VAR system. In this context, the IRF is conducted to test how the endogenous variable in GCC-equity markets responds to innovations from other markets in the system. Table 5.14 and appendix (A) present the accumulated response of GCC stock markets to one standard deviation shock in all markets. The per-crisis period indicates that Bahrain market has a positive response to its own shock. Further, Qatar, Oman and Saudi response positively and significantly to the one standard deviation shock in Bahraini market, while Kuwait, Qatar and the UAE show less responsive than others. The results of post-crisis period have changed dramatically, indicating that Bahrain provided a positive response to its own shock, and all GCC stock markets responded positively and significantly to the shock in Bahrain market.

Table 5.13: Variance Decomposition of the GCC Stock Market Returns

Market explained	Horizon (Weeks)	By innovations in						
		BSM	KSM	OSM	QSM	SSM	ESM	All GCC*
Pre-crisis								
	5	88.487	2.3484	4.6781	0.2024	0.7586	3.5252	11.512
BSM	10	68.942	3.3537	9.7549	0.4309	0.5618	16.956	31.057
	15	51.757	3.8148	13.083	1.1080	0.3603	29.875	48.242
	5	2.4015	94.350	0.5980	0.0806	2.0821	0.4870	5.6492
KSM	10	1.3375	92.964	1.5691	0.1531	1.8065	2.1690	7.0352
	15	1.6058	89.258	2.3995	0.4039	1.4137	4.9185	10.741
	5	18.851	0.8695	74.782	0.1513	4.3755	0.9692	25.217
OSM	10	22.029	0.4889	70.920	0.3417	5.6500	0.5696	29.079
	15	24.195	0.3635	68.383	0.4995	6.1909	0.3667	31.616
	5	3.3472	1.3760	22.942	71.382	0.1115	0.8409	28.618
QSM	10	4.0820	1.0986	26.374	67.062	0.2257	1.1568	32.937
	15	4.3680	1.0108	27.411	65.720	0.2677	1.2209	34.279
	5	0.1999	1.2091	0.3700	0.3111	88.984	8.9253	11.015
SSM	10	0.2675	0.9100	1.1327	0.2145	87.285	10.189	12.714
	15	0.4418	0.8400	1.8059	0.1530	85.854	10.905	14.145
	5	10.728	3.2184	2.9329	2.2928	2.4925	78.334	21.665
ESM	10	12.331	2.7232	2.6348	2.4207	2.6645	77.225	22.774
	15	12.831	2.5609	2.3133	2.5234	2.6100	77.160	22.839
Post-crisis								
	5	91.000	2.8697	1.6428	2.6203	1.5370	0.3293	8.9992
BSM	10	83.040	3.0728	5.0913	3.8441	4.4185	0.5330	16.959
	15	69.614	3.3453	8.9161	6.0753	9.7720	2.2772	30.386
	5	27.909	60.105	4.3536	1.5820	4.1758	1.8736	39.894
KSM	10	31.022	52.880	6.7893	1.3062	4.7429	3.2591	47.119
	15	27.930	52.105	8.4281	1.8564	7.3893	2.2897	47.894
	5	17.024	20.670	55.328	0.2842	5.4072	1.2848	44.671
OSM	10	12.384	21.741	55.330	0.7254	8.8333	0.9843	44.669
	15	7.3269	20.119	55.231	1.4876	14.023	1.8111	44.768
	5	23.793	25.731	3.8360	41.621	2.8686	2.1496	58.378
QSM	10	22.046	31.107	5.4857	33.257	5.9526	2.1500	66.742
	15	17.083	33.479	7.5173	29.233	11.169	1.5164	70.766
	5	18.982	10.155	2.2964	16.579	51.700	0.2846	48.299
SSM	10	17.355	16.126	2.8380	15.985	44.830	2.8640	55.169
	15	15.243	20.387	6.0098	12.792	36.509	9.0570	63.490
	5	19.265	14.470	12.276	2.4283	1.4109	50.148	49.852
ESM	10	19.811	15.390	17.768	1.1235	1.3889	44.516	55.483
	15	14.876	14.885	21.110	0.7607	2.7363	45.630	54.369

Cholesky Ordering: Bahrain, Kuwait, Oman, Qatar, Saudi, and UAE. * All GCC denotes the total percentage of forecast error variance of each GCC-equity market, explained by other GCC-equity markets.

Table 5.14: Impulse Response Analysis of the Six GCC Stock Markets

Market responding	Period (Weeks)	To one standard deviation shock in:					
		BSM	KSM	OSM	QSM	SSM	ESM
Pre-crisis							
	5	2.7160	0.5935	0.1954	0.2158	-0.3158	2.7160
BSM	10	1.9900	1.2185	0.3303	0.2503	-0.5240	1.9900
	15	1.5602	1.7378	0.3553	0.1457	-0.6288	1.5602
	5	0.9152	4.4630	-0.2332	-0.6463	0.1045	0.9152
KSM	10	0.9525	4.5248	-0.6387	-1.0704	0.0432	0.9525
	15	0.9162	4.6448	-1.0878	-1.2691	-0.0786	0.9162
	5	2.6297	0.9950	5.5443	-0.4207	-0.6173	2.6297
OSM	10	3.1803	0.8312	5.1852	-0.9015	-1.3367	3.1803
	15	3.5728	0.8226	4.9036	-1.3666	-1.9906	3.5728
	5	0.3208	0.8382	1.3807	2.5804	0.4500	0.3208
QSM	10	0.3710	1.0312	1.5036	1.8179	0.6340	0.3710
	15	0.4716	1.1329	1.4765	1.3369	0.6061	0.4716
	5	1.8847	4.6253	3.8460	6.1588	17.877	1.8847
SSM	10	0.3790	4.2318	2.3179	9.6027	13.819	0.3790
	15	-0.9044	4.5517	1.6129	11.1252	11.606	-0.9044
	5	0.4803	1.2710	0.7877	0.6708	0.1786	0.4803
ESM	10	0.4983	1.4818	0.6435	0.6219	0.0419	0.4983
	15	0.5145	1.7029	0.5049	0.4998	-0.0402	0.5145
Post-crisis							
	5	2.4442	0.1020	1.2566	-0.3072	-0.0062	-0.3567
BSM	10	2.5159	-0.2593	1.9351	0.0999	0.6522	-0.5779
	15	2.1147	-0.7715	2.0834	0.0224	0.9413	-0.7412
	5	1.9485	2.5183	1.5668	-0.4044	-0.6905	-0.7990
KSM	10	2.1274	1.4914	1.6670	-0.3757	0.7697	-1.4688
	15	1.6912	0.8681	1.7095	-0.3982	1.2200	-1.4230
	5	3.5557	1.6857	6.2332	0.7237	0.5805	-0.7315
OSM	10	3.7492	0.7479	6.5091	1.0949	2.6925	-1.3408
	15	3.2489	-0.1022	6.5094	1.1236	3.4621	-1.7877
	5	2.0520	1.3771	1.5043	2.1254	-0.1680	-0.7304
QSM	10	1.9793	0.7899	1.8191	2.2061	0.8783	-0.9936
	15	1.7065	0.3427	1.8909	2.0476	1.2982	-1.0968
	5	4.5292	1.6394	3.0172	3.6049	3.5890	0.0902
SSM	10	4.6601	0.2630	5.1922	3.5888	4.5978	-0.6144
	15	4.0404	-1.1014	5.8648	3.0257	4.7928	-1.3849
	5	1.4266	0.8780	2.0870	1.1264	0.1437	1.7085
ESM	10	2.0193	0.1131	2.4269	1.0618	0.7940	1.0949
	15	1.7771	-0.5330	2.3551	1.1330	1.0021	0.5676

The results also indicate that both Kuwait and Oman exert negative response to one standard deviation shock in Qatar. The magnitude of the Saudi market response has increased during the second sub-period to 4.53 at week 5, compared to 1.88 at the same time in the pre-crisis period. The post-crisis period also shows that most GCC stock markets response negatively to one standard deviation shock in the UAE. In general, the results of IRF support results of variance decomposition, indicating a strong explanatory power of these markets after the crisis period.

5.3 Testing the Dynamic Relationship between the GCC and Global Stock Returns

The main objective of the second model is to explore the dynamic long-and short-run relationships between the GCC stock markets and global developed markets. The relevant literature suggest that stock markets in the Middle East and North Africa (MENA) including GCC countries are mainly segmented from the global markets (see, for example, Neaime, 2005b;Yu and Hassan, 2008;Cheng *et al.*, 2010;Marashdeh and Shrestha, 2010). However, focusing in volatility and diversification opportunities, other researchers have found less influence of developed markets on the Gulf Arab markets (see, for example, Bley and Chen, 2006;Balcılar *et al.*, 2013;Balli *et al.*, 2013a).

The empirical results of market integration between the six GCC countries and western countries are presented in this section. As stated in the introduction to this chapter, the second model (VECM-2) aims to test the cointegration relationships between the Gulf Arab region and international markets (including oil). Following the procedure for testing cointegration amongst GCC stock markets at a regional level, the first step for testing cointegration globally is to test for stationarity of weekly individual time series for each series. The test is conducted by testing the means of unit root, examining the presence of unit root in the levels of each series, with the assumption of a stochastic intercept, and both intercept and trend in each individual series.

5.3.1 Unit Root Tests

The ADF, PP, and KPSS unit root tests are employed over the three sub-periods to examine whether the price series of the GCC stock markets and global markets are stationary $I(1)$ or non-stationary. The hypotheses to be tested for a unit root are:

H_0 ADF and PP: The level price series is non-stationary.

H_1 ADF and PP: The level price series is stationary.

H_0 KPSS: The level price series is stationary.

H_1 KPSS: The level price series is non-stationary.

The results of the three tests are reported previously in Table 5.1. The null hypothesis of the existence of a unit root cannot be rejected for all series in the case of level series. The values of *t*-statistic for both tests, ADF, PP and KPSS (in first differences) are greater than the critical values. This means acceptance of the null hypothesis for the presence of unit root in the level series.

In the case of first differences, the results of these three tests show that all variables are stationary and statistically significant at 1% level, as the *t*-statistic is smaller than critical values for all variables at different periods. The KPSS confirmed the results of ADF and PP tests, Therefore, all variables appear to be non-stationary in levels and stationary in the first differences, reflecting integration of the first degree *I*(1).

5.3.2 Lag Length Selection

Different procedures were used to determine the number of lag lengths in the cointegrated systems. The lag exclusion Wald test is used to ensure that the research did not lose important information by selecting lag length. The LM-Autocorrelation test was also used, and indicated no serial correlation with the lag length selection for all periods. Table 5.15 presents the lag length selection criteria of the VECM-2. The AIC is used, which also found to be satisfied with the LM- autocorrelation test as well as the lag exclusion Wald test.

5.3.3 Multivariate Johansen's Cointegration

Having established the weekly time series properties and the lag length has been selected. The next step is to test for the presence of cointegration between the nine variables in the VECM-2. This requires use of the maximum likelihood method (Johansen and Juselius, 1990). Both, the Trace statistic and maximum eigenvalue are tested in two different models.[7] The null and the alternative hypotheses for testing cointegration amongst variables are defined as follows:

H_0: The returns series of the GCC-equity markets are segmented from the global markets.

H_1: The returns series of the GCC-equity markets and global markets are cointegrated.

[7] Model (a): includes an intercept but no trend in the cointegration equation and VAR test. Model (b): a model with intercept and trend in the cointegration equation and no trend in the VAR.

Table 5.15: Lag length selection criteria of the VECM-2

Lag	LR	FPE	AIC	SC	HQ
Full Period: January/2005 – December/2013 (4 weeks lags)					
0	NA	1.290027	87.9674	88.12827	88.03073
1	12700.36	1.155015	60.21916	61.10390*	60.56746
2	320.3949	8.920014	59.94581	61.45443	60.47908*
3	121.6885	8.501214	59.91531	62.24781	60.83355
4	112.7069	7.92001*	59.8458*	63.05639	61.20322
5	114.9335	1.001115	60.07362	63.85388	61.56181
6	109.7512*	1.099515	60.15386	64.65799	61.92701
Pre-crisis: January/2005 – July/2008 (1 week lag)					
0	NA	7.400124	82.80502	82.96467	82.86975
1	3917.402	1.791115	60.4604*	62.25796*	61.30878*
2	177.2661	1.470015*	60.58045	63.49376	61.69033
3	107.1570*	1.821115	60.65547	65.12561	62.46792
4	75.39626	2.720015	61.02822	66.93519	63.42324
5	75.49169	2.880382	61.42720	66.17515	64.12520
6	76.15028	2.920017	62.52826	67.03519	64.41329
Post-crisis: July/2008 – December/2013 (5 weeks lags)					
0	NA	2.110023	79.24662	79.36375	79.29360
1	6164.894	4.201213	56.90944	58.08080*	57.37933*
2	237.6730	3.011013	56.57596	58.80154	57.46874
3	135.2875	3.166513	56.61761	59.89741	57.93329
4	136.7221	3.231013	56.63329	60.96731	58.37187
5	164.7502	2.892213*	56.50685*	61.89510	58.66833
6	114.2829*	3.160013	56.57730	63.01978	59.16168

* indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan-Quinn information criterion.

Table 5.16 reports the results of JJ cointegration test from the full period of study. Under model (a), and with the absence of a dummy variable which used previously to represent the structural break in data, both the Trace statistics and maximum eigenvalues indicate the absence of any cointegration relationships between variables, while model (b) indicates two cointegrating vectors according to the λ_{Trace}. The results from the JJ cointegrating procedure (including dummy variable) are found to be slightly different. The λ_{Trace} in both model versions reports three cointegrating vectors, while λ_{max} shows no cointegration relationships linking these variables in the long-term. Overall, the null hypothesis for non-cointegration between GCC stock markets and global markets cannot be rejected according to the maximum eigenvalue statistics.

Table 5.16: Multivariate (JJ) Test of the GCC and Global Markets (Full Period)

Null hypotheses	Alternative hypotheses	*Trace statistic*		*Max-Eigen statistic*	
		Statistics	Critical values (5%)	Statistics	Critical values (5%)
Full Period: Jan,2005 – Dec,2013					
Without liner trend					
r = 0	*r = 1*	225.427	208.437	54.8326	59.2400
r ≤ 1	*r = 2*	170.595	169.599	47.6422	53.1878
r ≤ 2	*r = 3*	122.952	134.678	31.2510	47.0790
r ≤ 3	*r = 4*	91.7017	103.847	30.4653	40.9568
With liner trend					
r = 0	*r = 1*	218.53**	197.370	54.8320	58.4335
r ≤ 1	*r = 2*	163.69**	159.529	46.5472	52.3626
r ≤ 2	*r = 3*	117.1527	125.615	31.2031	46.2314
r ≤ 3	*r = 4*	85.9495	95.7536	30.4215	40.0776
Full Period: Jan,2005 – Dec,2013 (includes exogenous dummy variable representing GFC)					
Without liner trend					
r = 0	*r = 1*	239.57**	208.437	54.8369	59.2400
r ≤ 1	*r = 2*	184.73**	169.599	47.0138	53.1878
r ≤ 2	*r = 3*	137.72**	134.678	39.9499	47.0790
r ≤ 3	*r = 4*	97.7749	103.847	30.7610	40.9568
With liner trend					
r = 0	*r = 1*	233.90**	197.370	54.8356	58.4335
r ≤ 1	*r = 2*	179.07**	159.529	46.3300	52.3626
r ≤ 2	*r = 3*	132.74**	125.615	38.7490	46.2314
r ≤ 3	*r = 4*	93.9929	95.7537	30.7518	40.0776

Notes: *r* represents the number of cointegrating vectors. * denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

The results of JJ cointegrating system for the two sub-periods are presented in Table 5.16 respectively. The findings of the λ_{Trace} and λ_{max} for a model includes an intercept but no trend in the cointegration vector, support the absence of cointegration relationships between variables. The null hypothesis that the six GCC stock markets and the global markets are not cointegrated ($r = 0$) against the alternative hypothesis ($r = 1$) cannot be rejected. The results from model (b), which includes intercept and trend in the cointegration vector, indicate that λ_{Trace} supports the presence of one cointegrating vector connecting these variables together in the long-term. However, the λ_{max} statistic is still showing no cointegration relationships in both model versions during the pre-crisis period.

The results of the JJ cointegration test obtained from the post-crisis period have changed considerably. Both λ_{Trace} and λ_{max} statistics have confirmed the presence of two cointegrating vectors linking the nine variables together in the long-term. The λ_{Trace} of 301.57 is greater than the critical value of 208.43; and the second Trace

statistic of 195.53 exceeds its associated critical value of 169.59. Further, the statistic of λ_{max} (106.04) is greater than the critical value of 59.24, and the second critical value of 53.18 is lesser than the maximum eigenvalue of 71.12 at 5% level of significance. These results supports accepting of the alternative hypothesis that $r = 2$, and rejection of the null hypothesis ($r \leq 2$).

Table 5.17: Multivariate (JJ) Test of the GCC and Global Markets (Sub-Periods)

Null hypotheses	Alternative hypotheses	*Trace statistic*		*Max-Eigen statistic*	
		Statistics	Critical values (5%)	Statistics	Critical values (5%)
Pre-crisis: January,2005 – July,2008					
Without liner trend					
r = 0	*r = 1*	207.992	208.437	58.0727	59.2400
r ≤ 1	*r = 2*	168.911	169.599	40.6539	53.1878
r ≤ 2	*r = 3*	131.265	134.678	34.8884	47.0789
r ≤ 3	*r = 4*	96.3765	103.847	27.3916	40.9568
With liner trend					
r = 0	*r = 1*	212.92**	197.370	57.1893	58.4335
r ≤ 1	*r = 2*	155.7385	159.529	40.5852	52.3626
r ≤ 2	*r = 3*	115.1533	125.615	34.5889	46.2314
r ≤ 3	*r = 4*	80.5644	95.7537	25.1567	40.0776
Post-crisis: July,2008 – December,2013					
Without liner trend					
r = 0	*r = 1*	301.57**	208.437	106.04**	59.2400
r ≤ 1	*r = 2*	195.53**	169.599	71.120**	53.1878
r ≤ 2	*r = 3*	124.4161	134.678	45.6752	47.0789
r ≤ 3	*r = 4*	78.74087	103.847	31.2266	40.9568
With liner trend					
r = 0	*r = 1*	287.06**	197.370	100.18**	58.4335
r ≤ 1	*r = 2*	186.88**	159.529	70.804**	52.3626
r ≤ 2	*r = 3*	116.076	125.615	45.6741	46.2314
r ≤ 3	*r = 4*	70.40221	95.75366	29.8630	40.0775

Notes: *r* represents the number of cointegrating vectors. * denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

The statistical significance of the cointegrating equation is tested for all variables through the LR test (Johansen, 1991) to identify the variables that cannot be excluded from the cointegrated system. Table 5.18 reports the statistical significance of each variable in the cointegrating vector, tested in relation to the exclusion of variables from the VECM-2 when testing the long-term relationship. The results from the pre-crisis period indicate that three variables out of nine can be excluded from the cointegration space. This is represented by the Chi-squared statistics (χ^2_β) and associated *p*-values; the variables concerned are the three global markets plus the

UAE stock market. In the post-crisis period, the findings indicate that all variables significantly contribute to the long-term equilibrium relationship and none of them can be excluded from the cointegrating equation. The results find Bahrain as a more open market compare to other GCC stock markets, has the greatest participation in the long-term relationship between variables at a global level.

It has been confirmed that the global markets (excluding oil), have not been participating in the JJ cointegrated space over the full period, and the pre-crisis period. This implies that the markets in the region are leading the route of co-movement towards the cointegrating system.

Table 5.18: Restrictions on the Cointegration Vectors of VECM-2

Markets	*Pre-crisis*		*Post-crisis*	
	χ^2_β	*p*-value	χ^2_β	*p*-value
BSM	4.2352	0.0395	35.825	0.0000
KSM	6.2503	0.0124	27.999	0.0000
OSM	4.4942	0.0340	25.841	0.0000
QSM	6.7248	0.0095	19.628	0.0002
SSM	3.2679	0.0706	22.533	0.0000
ESM	[5.2106]	0.9981	17.419	0.0005
US	[1.0346]	0.3090	26.270	0.0000
EU	[2.0373]	0.9813	10.612	0.0140
OIL	[0.5332]	0.4652	16.567	0.0008

Note: χ^2_β denotes Chi-squared statistic test for the significance of cointegrated system. Numbers in parentheses indicate that Chi-squared statistics fail to reject the null hypothesis that the *i* th endogenous variables are not significance to the cointegrated system with respect to the β parameters.

5.3.4 The Vector Error Correction Model

The cointegrating relationships between the six GCC-equity markets and the three global markets have been confirmed from both JJ test's statistics only during the post-crisis period, and Trace statistic shows one cointegrating vector in a model with intercept and trend. The next task after testing for cointegration is to estimate the VECM taken from cointegration analysis to link the short-run values of each market to its long-run values.

As mentioned previously, the VECM determines speed of adjustment towards an equilibrium relationship in a dynamic model following a disturbance; that is, where a larger (α) coefficient indicates a stronger speed of adjustment to a long-run

equilibrium relationship. Table 5.19 displays the results of VECM over the two periods of study. As shown in the table, the pre-crisis period shows negative signs of the α-coefficients for all variables with the exception of Bahrain, Saudi and oil market. The UAE and Kuwait are highly significant, indicating a high speed of adjustment towards a long-run equilibrium relationship.

The α-coefficients also showed that the speed of adjustment is relatively slow for other markets, such as Oman, Saudi and oil market. This means that a deviation of these markets takes a while to adjust their deviation from short-run relationships to the long-run equilibrium relationships.

The results of the post-crisis period indicate that the error correction coefficients of all variables are negative and highly significant with the exception of Omani market. Bahrain shows a high speed of adjustment towards a long-run equilibrium relationship after disturbance and also statistically significant at 1% level. This implies that the deviation of Bahraini market from long-run equilibrium relationship following disturbance of the short-run relationship is corrected by approximately 5.6% each week, which is faster than other variables in the system.

The LR test for the adjustment coefficients of the error-correction terms, measuring deviations from a long-term equilibrium relationship, is performed for testing weak exogeneity over the two sub-periods. The results of the pre-crisis period as described in Table 5.20 showed that all variables are weakly exogenous, with the exception of Kuwait, Qatar, UAE and the European market, all of which indicated by high statistics of Chi-squared and significant *p*-values. These findings are supported by the results of ECTs for these variables as presented in Table 5.19. The second sub-period revealed that with the exception of both Bahrain and Kuwait, the null hypothesis of the weak exogeneity for all variables is rejected at 1% level of significance.

Table 5.19: The Speed of Adjustment of the VEC (VECM-2)

	D(BSM)	D(KSM)	D(OSM)	D(QSM)	D(SSM)	D(ESM)	D(US)	D(EU)	D(OIL)
Pre-crisis									
CointEq1	0.0100	-0.0290**	-0.0769*	-0.0259*	0.1112	-0.0178***	-0.3149	-0.4705**	0.0096
Log likelihood	-5403.47								
AIC	60.5656								
		Statistic	***P-value***						
Serial correlation LM test		86.9076	0.3066						
Skewness		46.1956	0.0000						
Kurtosis		536.158	0.0000						
Normality (Jarque-Bera test)		582.354	0.0000						
Post-crisis									
CointEq1	-0.0564**	0.0076**	-0.3701*	-0.1707***	-0.2615***	-0.1195***	-0.7554**	-1.1310***	-0.0807***
CointEq2	0.0489	0.0014	0.4490**	0.2388**	0.0404	0.1267**	-0.1149	0.5223	0.0245
CointEq3	0.0089	0.0191	-0.1016*	-0.0466**	0.1872***	-0.0101	0.3930*	0.1812	-0.0055
Log likelihood	-7442.65								
AIC	56.7071								
		Statistic	***P-value***						
Serial correlation LM test		74.6235	0.6780						
Skewness		27.9827	0.0010						
Kurtosis		297.760	0.0000						
Normality (Jarque-Bera test)		325.742	0.0000						

Notes: ECT stands for the error-correction terms in the VEC equations. The number of lags is based on the AIC and Schwarz criteria. All variables are first differences of logs.*, ** and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

Table 5.20: Restrictions of the Adjustment Coefficients of the VECM-2

Markets	*Pre-crisis*		*Post-crisis*	
	χ^2_α	*p*-value	χ^2_α	*p*-value
Bahrain	[0.2067]	0.6493	[5.6771]	0.1284
Kuwait	12.949	0.0015	[3.6701]	0.2993
Oman	[0.9669]	0.6166	29.653	0.0000
Qatar	9.8820	0.0071	33.543	0.0000
Saudi	[1.7077]	0.1452	25.976	0.0000
UAE	16.029	0.0003	14.411	0.0024
US	[3.5472]	0.1697	16.532	0.0008
EU	9.2539	0.0097	21.218	0.0000
Oil	[1.0164]	0.6015	18.979	0.0002

Notes: Numbers in parentheses indicate that the LR-tests fail to reject the null hypothesis that the *i* th endogenous variable is weakly exogenous with respect to the β parameter.

5.3.5 Granger Causality Test

The presence of cointegration among the variables suggests that causality among the specified variables of the system exists in at least one direction, but does not delineate the direction of the causality. Therefore, the next step in the cointegration analysis procedure is to investigate the nature of the short-term dynamic relationships between the GCC-equity markets and the global markets. The Granger-causality test within VECM is applied to examine the dynamic short-run relationships between the nine variables over the two periods of study. The hypotheses to be tested over the three periods are:

H_0: There are no dynamic short-run relationships between returns of the GCC-stock markets and global markets.

H_1: The dynamic short-run relationships exist between returns of the GCC-stock markets and global markets.

The results of Granger-causality test for first sub-period as reported in Table 5.21 showed that, in the case of Bahrain is dependent variable, the results of Granger-causality test reveal that the Chi-square statistics indicates a bidirectional causal relationship between Bahrain and Kuwait stock at 5% significant level of significance, while Kuwait revealed a unidirectional relationship runs from Saudi market at 1% level of significance. In regards to Omani market as dependent variables, the results illustrate two unidirectional relationships at 1% level of significance. Qatar indicates a unidirectional relationship caused by Omani market, while Saudi market does not show any Granger-causal relationships with other

markets during the pre-crisis period. In the case of the UAE, the results of Granger-causality indicate one bidirectional Granger-causal relationship with the US market at 5% level of significance. In regards to the global markets, the results indicate no significant Granger-causal relationships with the GCC countries, with the exception of the European market.

Different results observed from the post-crisis period. The dynamic relationships between variables are becoming stronger than first sub-period. The Chi-squared statistic and associated *p*-values for testing explanatory power of Bahraini market shows two bidirectional relationships between Bahrain and both Kuwait and Qatari market at 5% level of significance, and a unidirectional relationship is detected caused by the European market at 5% level of significance. Similarly, Kuwait and Omani market also show bidirectional relationships with UAE and the US at1% and 5% level of significance respectively.

In the case of Qatar as a dependent variable, the Chi-squared statistics and associated *p*-values display two-bidirectional relationship between Qatar and both Bahrain and UAE at 5% significant level. Furthermore, a unidirectional relationship is also identified between Qatar and the US stock market. In the case of Saudi as dependent variable, the result of Granger-causality test came up with one unidirectional Granger causal relationship with Qatari market, while two bidirectional relationships are found between Saudi and both Oman and oil market at 1% and 5% levels of significance.

When UAE treated as dependent variable, the results show two bidirectional relationships at 5% level of significance from Oman, Qatari market. In the case of developed markets, the result of Granger-causality test show two bidirectional relationships between the US and European market at 1% significant level, and between oil and the US at 1% level of significance. Further, Saudi causes oil market in a bidirectional relationship at 5% level of significance.

Table 5.21: Granger causality/ Block Exogeneity Wald test of the GCC Stock Markets and Global Markets

Granger causality test based on the VECM-2
Dependent variables

Pre-crisis

	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	US	EU	Oil	*causes*	ECTs
Bahrain		5.2250**	1.3030	0.2232	0.3963	3.3608*	0.3972	0.2330	0.8612	2	0.0100
Kuwait	4.9523**		1.5437	0.9253	1.4168	1.3221	0.4886	6.3804**	0.4066	2	-0.0290**
Oman	0.9358	0.0382		16.821***	0.8209	2.5994	0.0114	0.0144	1.9140	1	-0.0769*
Qatar	0.7944	0.0416	0.7832		0.9663	1.3901	0.2215	0.2023	0.1562	0	-0.0259*
Saudi	1.1787	4.4118**	7.2490***	0.4522		0.2497	2.6377	1.8842	0.0193	2	0.1112
UAE	0.3054	3.2660*	1.9434	0.0216	0.0034		2.2764	0.1951	3.1118*	2	-0.0178***
US	0.3468	0.3273	3.1678*	1.0731	1.0961	5.6762**		39.4882***	1.4113	3	-0.3149
EU	0.0748	0.2062	9.8581***	2.1199	0.1667	0.6140	0.9463		0.0306	1	-0.4705**
Oil	0.0884	0.0011	0.0045	0.7058	0.0414	0.2730	0.6424	7.0067**		1	0.0096
caused	1	3	3	1	0	2	0	3	1	14	

Granger causality test based on the VECM-2
Dependent variables

Post-crisis

	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	US	EU	Oil	*causes*	ECTs
Bahrain		12.081**	14.784**	15.912***	7.731	11.131**	4.533	6.181	5.8660	4	-0.0564**
Kuwait	13.867**		7.465	5.469	3.777	12.159**	8.682	6.270	11.307**	3	0.0076**
Oman	3.252	13.407**		3.515	20.236***	0.745	13.108**	6.595	9.860*	4	-0.3701*
Qatar	13.085**	2.227	7.775		19.035***	14.434**	6.295	4.288	8.553	3	-0.1707***
Saudi	2.928	6.669	11.389**	5.466		4.089	6.398	5.263	13.749**	2	-0.2615***
UAE	7.390	12.034**	20.777***	24.443***	7.064		13.212**	6.593	9.9010*	5	-0.1195***
US	10.986*	2.053	11.842**	13.800**	8.190	10.202*		52.352***	28.040***	6	-0.7554**
EU	13.943**	4.729	6.756	5.756	1.754	6.529	20.548***		20.492***	3	-1.1310***
Oil	6.585	8.233	1.675	2.368	14.240**	9.180	19.507***	2.871		2	-0.0807***
caused	4	3	4	3	3	4	4	1	6	32	

*, **and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

5.3.6 Variance Decomposition

Variance decomposition indicates a relative impact that the forecast error of one variable has upon another variable within the system. In this research, it is used to measures the percentage of the forecast error of a market return that is explained by another market in the VECM system. Further, it provides the proportion of the movements in the exogenous variables that are due to their own shock, versus shocks to the other variables.

Table 5.22 presents variance decomposition of the 5, 10, and 15 weeks forecast error for each GCC-equity market and global markets over the two periods of the study. Each row in the table indicates the percentage of forecast error variance explained by the market indicated in each column. The results of variance decomposition for the pre-crisis period illustrate that the stock markets in the Arab Gulf region are much more sensitive towards a shock within the region than the global markets. For example, after 15 weeks, the group of GCC explains 37.3% of forecast error variance of Qatar, while global markets collectively explain only 7% of the forecast error variance of the Qatari market. The Europe index innovations have the greatest influence on all markets with the exception of Qatar and the UAE, which being mainly explained by the European index.

The findings for the post-crisis period have changed considerably, whereas the global variables in the system have more influence power than in the pre-crisis period. For instance, at 15-weeks horizon, the percentage of the global explanatory power is relatively strong, reaching in the best cases 17% for the Qatari market. With the exception of Saudi stock market (which being explained by oil), the US index influences all GCC-equity markets. For example, 5.3% and 11.4% of forecast error variance in Bahrain and Qatar are explained by the S&P500.

However, all GCC countries are still more sensitive to regional shock than they are to the global shocks. The global markets are not found to exert any dramatic impact in leading this region to long-run equilibrium relationship, while, eternal forces have much power to affect GCC-equity markets, and thus leading them to equilibrium relationship in the long-term.

Table 5.22: Variance Decomposition of the GCC and Global Market Returns

Market explained	Horizon (Weeks)	By innovations in				
		US	EU	Oil	GCC*	Global*
Pre-crisis						
BSM	5	0.1348	0.0414	0.0229	3.4656	0.1991
	10	0.1782	0.1808	0.0244	3.1704	0.3834
	15	0.2036	0.3380	0.0250	2.8753	0.5665
KSM	5	0.2921	0.0762	0.0208	13.642	0.3891
	10	0.2306	0.2867	0.0185	14.792	0.5357
	15	0.1923	0.4907	0.0167	15.342	0.6996
OSM	5	4.4267	3.4674	0.0525	18.753	7.9466
	10	4.8683	5.3800	0.0658	22.955	10.314
	15	4.8584	6.6646	0.0680	26.542	11.591
QSM	5	3.7828	0.6385	0.7518	29.483	5.1732
	10	5.0121	0.4709	1.0545	34.642	6.5375
	15	5.4640	0.3326	1.1846	37.326	6.9811
SSM	5	0.1204	0.0614	0.0015	7.9370	0.1833
	10	0.1560	0.4678	0.0009	9.5671	0.6247
	15	0.2027	1.0209	0.0006	12.117	1.2242
ESM	5	4.2315	0.0954	0.4044	21.378	4.7314
	10	4.8581	0.0534	0.5289	23.655	5.4403
	15	4.9765	0.0807	0.5659	24.942	5.6231
Post-crisis						
BSM	5	4.2309	0.8979	1.4429	10.718	6.5717
	10	5.8491	0.4390	1.3661	21.184	7.6541
	15	5.3945	0.3110	1.0664	33.282	6.7718
KSM	5	1.1605	0.2848	1.8883	37.753	3.3336
	10	3.6249	0.1261	2.1978	45.550	5.9488
	15	3.5963	0.0950	2.3753	45.506	6.0666
OSM	5	6.9133	0.9874	0.3516	49.271	8.2523
	10	7.2647	1.6523	0.5992	55.204	9.5162
	15	6.2942	2.5143	0.4256	58.199	9.2341
QSM	5	6.5342	0.3083	1.4742	62.718	8.3168
	10	10.736	0.4281	4.3957	70.036	15.559
	15	11.416	0.5762	5.0909	73.481	17.083
SSM	5	2.4564	0.5863	2.3786	52.643	5.4212
	10	2.0871	0.8939	10.991	62.262	13.972
	15	1.4600	1.4155	11.573	70.463	14.448
ESM	5	1.4262	1.1329	0.9698	47.010	3.5289
	10	3.5733	0.8402	1.2006	53.157	5.6141
	15	3.4920	0.5355	0.9456	55.128	4.9731

Notes: *GCC denotes the total percentage of forecast error variance of each GCC stock market explained by other GCC stock markets.*Global: denotes the total percentage of forecast error variance of the US, EU and oil markets explained by other GCC stock markets.

5.3.7 Impulse Response Functions

Having Granger-causing relationships in the two periods of study indicates that there may be predictive power in explaining return variations in some of the price series examined. The impulse response functions show for how long and to what extent price series returns react to unanticipated shocks (or) changes. Recall that the estimated IRF offers an additional technique to examine the transmission mechanism between variables. In this context the IRF is conducted to test how the endogenous variable in each GCC stock market responds to innovations from international markets. Thus, the IRF investigates how fast the price of each GCC stock markets responds and returns to equilibrium after a shock in the US, EU, and oil market.

Brooks (2008) suggests that, in relation to variance decompositions and impulse responses, theory does not provide an obvious ordering of the series and some sensitivity analysis should be undertaken. With this in mind, the Cholesky ordering is considered. The accumulated responses of the GCC stock markets to one standard deviation shock in global markets are reported in Table 5.23, and graphically presented in Figure (B) in appendices.

The results of IRF for the first sub-period indicate that all markets response negatively and insignificantly to one standard deviation shock on the global markets, with the exception of the US stock market, which shows positive influence. This implies that these markets exhibit negative relationships with the global markets during the pre-crisis period. The results of IRF are found to be statistically significant after the crisis period. During the post-crisis period, the results show that all GCC stock markets response positively and significantly to the one standard deviation shock in international markets.

Summarizing the findings of the impulse responses, they confirm the direction of the JJ cointegration test and causality among the variables in both sub-periods. The results reveal that in the long run the S&P index is a significant determinant of almost all markets particularly after the crisis period, supporting and confirm the findings of variance decomposition.

Table 5.23: Impulse Response Analysis of GCC and Global Markets

Market responding	Period (Weeks)	To one standard deviation shock in:		
		US	EU	Oil
Pre-crisis				
	5	0.2000	-0.1190	0.2080
BSM	10	0.6810	-0.2582	0.2246
	15	1.0749	-0.2296	0.1174
	5	0.3163	0.1115	-0.2376
KSM	10	0.7881	0.2357	-0.4658
	15	1.2623	0.3528	-0.6041
	5	-0.9406	0.8307	0.0240
OSM	10	-1.2947	1.2189	0.4181
	15	-1.2667	1.4248	0.8269
	5	0.5024	-0.6938	0.0384
QSM	10	0.5321	-0.7921	-0.2247
	15	0.4639	-0.6852	-0.4294
	5	2.1592	-4.0713	-3.0321
SSM	10	3.5468	-6.678	-5.4094
	15	4.5494	-7.8736	-6.9316
	5	0.9223	-0.5425	-0.1549
ESM	10	1.2765	-0.5346	-0.3975
	15	1.3308	-0.3446	-0.4997
Post-crisis				
	5	1.0569	1.0243	0.1095
BSM	10	1.3052	0.864	-0.4351
	15	1.4847	0.5734	-0.7613
	5	0.5143	0.7918	0.3066
KSM	10	1.0107	0.9659	-0.1279
	15	1.2055	0.9185	-0.3317
	5	2.5682	1.0654	-0.4654
OSM	10	3.5523	0.9433	-1.1028
	15	4.0966	0.8394	-1.5998
	5	0.9469	0.5781	0.0731
QSM	10	1.7635	0.3891	0.1982
	15	1.9131	0.2737	-0.0577
	5	2.7242	0.9382	0.0888
SSM	10	4.2246	1.2358	0.6718
	15	4.4567	1.1228	0.0656
	5	0.5499	0.9415	0.0859
ESM	10	1.3306	0.5868	-0.1277
	15	1.5155	0.2811	-0.3885

5.4 Testing Dynamic Relationship between the GCC-Banking Sectors

This section aims to test the cointegration relationships among the GCC-banking sectors. As discussed in the literature review, the financial system in the Gulf Arab countries is dominated by the banking sector. However, testing for cointegration between the GCC-banking sectors provides additional support for regionalization of financial integration in the GCC countries.

The literature on the sectoral market integration within the GCC region is scarce and few works have been undertaken to test the long-run relationship at sectoral level within this region (see, for example, Simpson and Evans, 2004;Maghyereh and Awartani, 2012b;Balcılar *et al.*, 2013;Balli *et al.*, 2013a). This thesis contributes to the literature by investigating the long-and short-run equilibrium relationships amongst the six GCC-banking sectors, and shows the strength of cointegrating relationships over the time. The first step for testing cointegration in the GCC-banking sector indices is to test for stationarity of the weekly time series for each series. The test is conducted by testing the means of unit root, examining the presence of unit root in the levels and first differences of each series, with the assumption of a stochastic intercept, and both intercept and trend in each individual series.

5.4.1 Unit Root Tests

The statistics of the initially computed ADF, PP, and KPSS unit root test for two sub-periods and the full period of study are reported in Table 5.24. The null hypothesis of the existence of a unit root in the levels cannot be rejected for all level series. The values of the *t*-statistic for both ADF and PP tests are greater than the critical values. This means acceptance of the null hypothesis for the presence of unit root in the level series.

In case of first differences, the results of these three tests for the three sub-periods show that all variables are stationary and statistically significant at 1% level, as the *t*-statistic is smaller than the critical values for all variables at different periods. Therefore, all variables appear to be non-stationary in levels and stationary in the first differences reflecting integration of the first degree.

Table 5.24: Unit Root Tests for the GCC Banking Sectors, in Levels and First Differences

Markets	period	Levels			First Differences			Levels			First Differences		
		Intercept only in the model						*Intercept and trend in the model*					
		ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS	ADF	PP	KPSS
Bahrain	Pre-crisis	-0.7122	-0.1453	1.0123	-9.5235***	-9.3658***	0.2385	-0.7368	-0.7862	0.0612	-9.5239***	-9.5235***	0.0896
	Post-crisis	-1.1301	-0.9365	0.5368	-15.325***	-15.456***	0.8921	-1.0365	-0.9212	0.1365	-15.365***	-15.389***	0.1036
	Full period	-1.8422	-0.9531	1.4536	-7.5698***	-8.5634***	0.1635	-1.2365	-1.1236	0.1896	-7.3652***	-7.8986***	0.1789
Kuwait	Pre-crisis	-0.4253	-0.4536	1.4532	-8.8963***	-8.2525***	0.1426	-0.3526	-0.6523	0.1762	-8.3659***	-8.2365***	0.1023
	Post-crisis	-1.0235	-0.9398	0.2235	-13.552***	-13.323***	0.0456	-0.1456	-1.0653	0.1338	-13.896***	-13.146***	0.1893
	Full period	-1.6536	-1.8563	1.3651	-5.5258***	-7.6352***	0.1123	-1.3652	-1.3255	0.1139	-5.5635***	-5.5636***	0.1032
Oman	Pre-crisis	-0.8912	-1.5236	1.1598	-7.3256***	-7.1235***	0.5362	0.0635	0.1236	0.1355	-7.5235***	-7.2365***	0.0365
	Post-crisis	-1.1235	-1.2358	0.5635	-11.569***	-11.389***	0.0911	-1.1365	-1.2836	0.2093	-11.236***	-11.236***	0.1005
	Full period	-2.3256	-1.2354	0.1235	-2.8563***	-2.8963***	0.1098	-2.3236	-1.3658	0.1325	-2.5698***	-2.735***	0.1125
Qatar	Pre-crisis	-0.1123	-0.1057	0.5231	-9.1253***	-9.2589***	0.1256	-0.3526	-0.6536	0.0023	-9.2365***	-9.1235***	0.0123
	Post-crisis	-0.9652	-0.3963	1.0653	-11.5968	-11.012***	0.0211	-1.0084	-0.3563	0.1120	-11.123***	-11.453***	0.1365
	Full period	-1.4536	-1.6745	0.1896	-6.3652***	-6.3654***	0.0193	-1.1385	-1.5256	0.1756	-6.3658***	-6.258***	0.9596
Saudi	Pre-crisis	-0.1325	-1.4815	0.5963	-8.3654***	-8.5896***	0.1289	-0.2364	-1.0326	0.0123	-8.3256***	-8.279***	0.0423
	Post-crisis	-1.1422	-1.4361	0.1123	-12.136***	-12.148***	0.0653	-1.1238	-1.1189	0.1696	-12.123***	-12.874***	0.1191
	Full period	-1.9623	-1.146	0.4543	-6.3659***	-6.2369***	0.0369	-1.8636	-1.1356	0.1163	-6.2795***	-6.7854***	0.9968
UAE	Pre-crisis	-0.5635	-0.6536	0.8842	-10.321***	-10.896***	0.0563	-0.3652	-0.4536	0.2365	-10.279***	-10.325***	0.0235
	Post-crisis	-1.3526	-1.5563	0.9638	-12.365***	-12.798***	0.2365	-1.2369	-1.6398	0.1097	-12.896***	-12.365***	0.1016
	Full period	-0.9986	-0.5635	1.1235	-9.6831***	-9.9181***	0.1125	-9.0589	-1.0238	0.1236	-9.365***	-9.5243***	0.9982

Note: ADF, PP, and KPSS denote the Augmented Dickey–Fuller test, Philips-Perron test, and the Kwiatkowski, Phillips, Schmidt, and Shin test for unit roots, respectively. The optimal number of lags was chosen according to the Schwarz Information Criterion (SIC), provided that the lags yield white-noise residuals. *** denotes to the statistical significance of 1% level.

5.4.2 Lag length selection

As revealed in Table 5.25, in the pre-crisis period, the optimal number of lags has been chosen based on AIC. The AIC indicates that two-week lags should be included in the system (k =2). The test also found to be satisfied with the LM-autocorrelation test and the lag exclusion Wald test. In the post-crisis period, the AIC also indicates two weeks optimal lags, while in the full sample period three weeks lag have been chosen according to the AIC.

Table 5.25: Lag length selection criteria of the VECM-3

Lag	LR	FPE	AIC	SC	HQ
Full Period: January/2005 – December/2013 (2 weeks lag)					
0	NA	2.888014	50.32069	50.42829	50.36306
1	9137.621	584366.6	30.30553	30.73590*	30.47498*
2	92.72717	555216.7*	30.25426*	31.00742	30.55081
3	53.78265	574672.1	30.28849	31.36443	30.71213
4	38.28169	615459.9	30.35667	31.75539	30.90741
Pre-crisis: January/2005 – July/2008 (2 weeks lag)					
0	NA	1.633113	47.44663	47.55471	47.49047
1	2737.772	2255477	31.65588	32.41248*	31.96275*
2	75.17849	2143843*	31.60376*	33.00886	32.17366
3	60.31915	2205476	31.62865	33.68226	32.46158
4	37.52069	2606712	31.78926	34.49137	32.88522
Post-crisis: July/2008 – December/2013 (3 weeks lag)					
0	NA	5.966011	44.14141	44.21991	44.17291
1	4533.266	39508.41	27.61147	28.16096*	27.83194*
2	112.3368	33490.86	27.44588	28.46636	27.85533
3	76.96733	32257.73*	27.40748*	28.89895	28.00592
4	55.71272	33591.19	27.44633	29.40879	28.23374

* indicates lag order selected by the criterion. LR: sequential modified LR test statistic (each test at 5% level). FPE: Final prediction error. AIC: Akaike information criterion. SC: Schwarz information criterion. HQ: Hannan- Quinn information criterion.

5.4.3 Multivariate Johansen's Cointegration

The Johansen's cointegration test (Johansen and Juselius, 1990) is applied based on the VECM framework to examine the long-run equilibrium relationship between the GCC-banking sectors. Both Trace statistic (λ_{Trace}) and maximum eigenvalue (λ_{max}) are tested. Tables 5.26 and 5.27 present the results of JJ for the two sub-periods as well as the full period of study. The null and the alternative hypotheses are defined in both sub-periods and the full sample as follows:

H_0: The returns series of the GCC-banking sectors are non-cointegrated.

H_1: The returns series of the GCC- banking sectors are cointegrated.

Table 5.26 presents the results of the JJ for the full sample period in a model with intercept but no trend in the cointegration equation and VAR test; and also tested in a model with intercept and trend in the cointegration equation and no trend in the VAR. A dummy variable representing GFC is used, takes the value of zero for each week in the pre-crisis period and takes the value of one thereafter. In both model versions, the empirical findings of λ_{Trace} and λ_{max} support the absence of cointegrating vectors between variables ($r = 0$), thus, the null hypothesis for no cointegrating vectors between variables cannot be rejected.

Table 5.26: Multivariate (JJ) Test of the GCC Banking Sectors for the Full Period

Null hypotheses	Alternative hypotheses	*Trace statistic*		*Max-Eigen statistic*	
		Statistics	Critical values (5%)	Statistics	Critical values (5%)
Full Period: Jan,2005 – Dec,2013					
Without liner trend					
r = 0	*r = 1*	84.364	103.847	32.942	40.956
r ≤ 1	*r = 2*	51.422	76.972	21.798	34.805
r ≤ 2	*r = 3*	29.623	54.079	15.172	28.588
r ≤ 3	*r = 4*	14.451	35.192	8.4317	22.299
With liner trend					
r = 0	*r = 1*	83.186	95.753	32.833	40.077
r ≤ 1	*r = 2*	50.352	69.818	21.588	33.876
r ≤ 2	*r = 3*	28.764	47.856	15.164	27.584
r ≤ 3	*r = 4*	13.600	29.797	8.0477	21.131
Full Period: Jan,2005 – Dec,2013 (includes exogenous dummy variable representing GFC)					
Without liner trend					
r = 0	*r = 1*	115.879**	103.847	54.370**	40.956
r ≤ 1	*r = 2*	61.508	76.972	24.830	34.805
r ≤ 2	*r = 3*	36.678	54.079	18.787	28.588
r ≤ 3	*r = 4*	17.890	35.192	8.1369	22.299
With liner trend					
r = 0	*r = 1*	111.60**	95.753	50.96**	40.077
r ≤ 1	*r = 2*	60.641	69.818	24.769	33.876
r ≤ 2	*r = 3*	35.872	47.856	18.786	27.584
r ≤ 3	*r = 4*	17.085	29.797	7.9704	21.131

Notes: *r* represents the number of cointegrating vectors. * denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.

As seen in the table, both model versions, which included dummy variable indicate that the λ_{Trace} and λ_{max} statistics are greater than their linked critical values, indicating the presence of one cointegrating vector between the six GCC-banking sectors, and the null hypothesis is then being rejected. In more details, the λ_{Trace} of 115.87 is greater than critical value of 103.84, and similarly, the λ_{max} of 54.37 is greater than critical value of 40.95. Likewise, in a model with intercept and trend in data, the λ_{Trace} of 111.60 is greater than critical value of 95.75, and the λ_{max} of 50.96 exceeds its critical value of 40.07.

Next, the JJ test in both sub-periods is conducted to explore whether or not the cointegrating relationships between banking-industry in GCC region have changed over the time.

Table 5.27: Multivariate (JJ) Test of the GCC-Banking Sectors (Sub-periods)

Null hypotheses	Alternative hypotheses	*Trace statistic*		*Max-Eigen statistic*	
		Statistics	Critical values (5%)	Statistics	Critical values (5%)
Pre-crisis: January,2005 – July,2008					
Without liner trend					
r = 0	*r = 1*	111.48**	103.84	43.61**	40.956
r ≤ 1	*r = 2*	67.864	76.972	32.613	34.805
r ≤ 2	*r = 3*	35.250	54.079	14.280	28.588
r ≤ 3	*r = 4*	20.970	35.192	10.376	22.299
With liner trend					
r = 0	*r = 1*	101.49**	95.753	41.99**	40.077
r ≤ 1	*r = 2*	59.496	69.818	28.650	33.876
r ≤ 2	*r = 3*	30.846	47.856	11.922	27.584
r ≤ 3	*r = 4*	18.924	29.797	10.317	21.131
Post-crisis: July,2008 – December,2013					
Without liner trend					
r = 0	*r = 1*	135.41**	103.84	51.62**	40.956
r ≤ 1	*r = 2*	83.795**	76.972	38.83**	34.805
r ≤ 2	*r = 3*	44.956	54.079	20.078	28.588
r ≤ 3	*r = 4*	24.877	35.192	13.843	22.299
With liner trend					
r = 0	*r = 1*	130.80**	95.753	51.60**	40.077
r ≤ 1	*r = 2*	79.197**	69.818	38.76**	33.876
r ≤ 2	*r = 3*	40.428	47.856	18.705	27.584
r ≤ 3	*r = 4*	21.723	29.797	12.832	21.131

Notes: *r* represents the number of cointegrating vectors. * denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.

The results from pre-crisis period as reported in Table 5.27, both λ_{Trace} and λ_{max} in both models indicated one cointegrating vector linking the GCC-banking indices together in the long-term. The null hypothesis that $r = 0$ is then rejected, and the alternative hypothesis is accepted at 5% significance level (r =1). The findings from both λ_{Trace} and λ_{max} during the second sub-period show the existence of two cointegrating vectors at 5% level of significance, linking the log returns of GCC-banking sectors in the long-term. This suggests rejection of the null hypothesis of no-cointegration relationships between these variables and acceptance of the alternative hypothesis that $r = 2$. These results, as expected, provided additional support of regional financial integration in the Gulf Arab region.

The conclusion of the JJ tests shows that the GCC-banking sectors have long-run equilibrium relationships with each other in the two sub-periods and also in the full period includes dummy variable. The pre-crisis period shows one cointegrating equation, while the post-crisis indicates two cointegrating equations between variables. The full period also displays one cointegrating vector connecting the GCC-banking in the long term.

In next task, the normalization restriction and the statistical significant of all variables in the cointegrating system are tested. Table 5.28 outlines the normalization restriction of cointegrating equations for the set of GCC-banking sectors. Both sub-periods revealed the significance of the coefficients of all variables in the JJ cointegrating system. However, the statistical significant of each variable in the system is tested, employing restrictions on coefficients of the cointegrating vector developed by Johansen (1991).

Table 5.28: Johansen Normalization Restriction Imposed of VECM-3

Period	CE	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE
Pre-crisis	CE1	1.0000	-0.5039**	1.0316***	-1.4905***	0.6552***	-0.6972**
Post-crisis	CE1	1.0000	0.0000	-0.7292***	0.2013	1.8802***	-0.1921**
	CE2	0.0000	1.0000	-0.0771	-0.4335***	0.1097	0.6808

Notes: The cointegration equations are normalized to the Bahrain-banking sector. *, ** and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

As seen in Table 5.29, the first sub-period indicate that all variables showed significance entrance to the cointegrating equations, with the exception of the UAE and Bahrain. The Chi-squared values and their associated *p*-values for both Bahrain and the UAE banking-sector support the null hypothesis that these banking sectors are not significant to the cointegrating system for the period before crisis. The results of LR test after the crisis period indicate that all variables contribute significantly in the cointegrating system and none of them can be excluded from the JJ system. Further, the Saudi banking system shows the greatest Chi-squared values in both sub-periods. This may leads to further analysis to identify whether or not the Saudi banking sector is the main driving force for other sectors in the JJ system.

Table 5.29: Restrictions on the Cointegration Vectors of VECM-3

Markets	*Pre-crisis*		*Post-crisis*	
	χ^2_β	*p*-value	χ^2_β	*p*-value
Bahrain	[2.5401]	0.1109	11.882	0.0026
Kuwait	3.2740	0.0703	11.485	0.0032
Oman	6.7718	0.0092	11.160	0.0037
Qatar	9.4927	0.0020	14.333	0.0007
Saudi	13.268	0.0002	22.164	0.0000
UAE	[1.6609]	0.1974	15.229	0.0004

Note: χ^2_β denotes Chi-squared statistic test for the significance of cointegrated system. Numbers in parentheses indicate that Chi-squared statistics fail to reject the null hypothesis that the *i* th endogenous variables are not significance to the cointegrated system with respect to the β parameters.

The test of Gonzalo and Granger (1995) is applied to identify whether the Saudi-banking sector is the permanent driving force behind the JJ cointegrated system. The results reported in Table 5.30 are soundly rejecting the null hypothesis that any of the six GCC-banking sectors is not a main driving force in the cointegrated system. However, Saudi and the UAE are showing largest Chi-squared values, implying that these countries may have supreme power in driving others to the long-run equilibrium relationship.

Table 5.30: Gonzalo-Granger Permanent Driving Test of GCC-Banking Sectors

Markets	Degrees of freedom	*r*	$\boldsymbol{\chi^2}$
Bahrain	5	1	20.971^{***}
Kuwait	5	1	19.069^{***}
Oman	5	1	25.155^{***}
Qatar	5	1	23.731^{***}
Saudi	5	1	34.812^{***}
UAE	5	1	34.478^{***}

Note: The LR test is the Likelihood ratio statistic distributed as χ^2 with degrees of freedom equal to (6-*r*) (6-*m*). The dummy variable is included into a VAR of the full sample period.

5.4.4 The Vector Error Correction Model

Having established the cointegrating relationship between the GCC-banking indices, the VECM taken from the JJ cointegration analysis is performed to link the short-run values of each GCC banking sector to its long-run value. The VECM determines the speed of adjustment towards an equilibrium relationship in the dynamic model following a disturbance, where a larger (α) coefficient indicates a stronger speed of adjustment to a long-run equilibrium relationship.

Table 5.31 provides the results of the VECM over the two sub-periods. The first sub-period indicates that Bahrain and Saudi banking-sectors, both exhibit negative signs and statistically significant at 1% level. In the post-crisis period, the first cointegration equation reveals that with the exception of Kuwait, the GCC-banking indices all report negative signs and statistical significance at 1% level. Oman, Bahrain and the UAE have the highest values of error correction terms, with -5.5%, -5.7% and -0.7.3% respectively, and all of them are statistically significant at 1% level, indicating that the speed of adjustment towards an equilibrium relationship for these variables is faster than other variables in the system.

Table 5.31: The Speed of Adjustment of the VEC (VECM-3)

	D(BBS)	D(KBS)	D(OBS)	D(QBS)	D(SBS)	D(EBS)
Pre-crisis						
CointEq1	-0.0433***	0.0102	0.0144	0.0456**	-0.1391***	0.0093
Log likelihood	-2731.38					
AIC	31.7487					
		Statistic	***P-value***			
Serial correlation LM test		27.9428	0.8292			
Skewness		87.077	0.0000			
Kurtosis		1063.91	0.0000			
Normality (Jarque-Bera test)		1150.99	0.0000			
Post-crisis						
CointEq1	-0.0577***	0.0006	-0.0558**	-0.0926***	-0.1141***	-0.0736***
CointEq2	0.0100	-0.0413*	-0.0435*	-0.0097	0.0475***	-0.0357
Log likelihood	-3763.64					
AIC	27.7696					
		Statistic	***P-value***			
Serial correlation LM test		47.1772	0.1006			
Skewness		59.3194	0.0000			
Kurtosis		1094.52	0.0000			
Normality (Jarque-Bera test)		1153.84	0.0000			

Notes: ECT stands for the error-correction terms in the VEC equations. The number of lags is based on the AIC. All variables are first differences of logs. . *, ** and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

Table 5.32 shows the results of weak exogeneity test conducted by using the LR test. Results from the pre-crisis period indicate that, with the exception of Bahrain, Qatar and Saudi, the *p*-values of the other variables reject the null hypothesis of weak exogeneity of the endogenous variables, indicating that these variables are strongly exogenous. The results from post-crisis period reveal that the six GCC-banking sectors are strongly exogenous; therefore, the null hypothesis of a weak exogeneity for all variables has been rejected at 1% significant level.

Table 5.32: Restrictions of the Adjustment Coefficients of VECM-3 for testing Weak Exogeneity of the Endogenous Variables

Markets	Pre-crisis		Post-crisis	
	χ^2_α	*p*-value	χ^2_α	*p*-value
Bahrain	7.3488	0.0067	14.398	0.0007
Kuwait	[0.3862]	0.5342	11.212	0.0036
Oman	[0.4881]	0.4847	25.407	0.0000
Qatar	4.5923	0.0321	25.444	0.0000
Saudi	6.8977	0.0086	25.205	0.0000
UAE	[0.1774]	0.6736	27.842	0.0000

Notes: Numbers in parentheses indicate that the LR-tests fail to reject the null hypothesis that the *i* th endogenous variable is weakly exogenous with respect to the β parameters.

5.4.5 Granger Causality Test

The next step after estimating the VECM and confirmed that the variables were cointegrated is to investigate the nature of the dynamic short-term relationships between the GCC-banking sectors, through the application of the Granger-causality test (Granger, 1969;Granger, 1986a). In order to obtain the short-term effect, the variables are estimated based on the VECM (in first differences), which also represented the return of each GCC-banking sector.

The results of the Granger-causality test for the pre-crisis period presented in Table 5.33 indicate that, when Bahrain is the dependent variable, there is two bidirectional relationships between Bahrain and both Kuwait and Oman at 5% level of significance, as such, the null hypothesis for non-causality relationships has been rejected. Kuwait-banking sector shows two unidirectional relationships at 10% level of significance, caused by Saudi and the UAE. Further, there is a bi-directional causal relationship between Kuwait and Bahrain at 5% level of significance. The null hypothesis of non-causal relationship between those variables is soundly rejected.

In relation to the Oman as the dependent variable, the results reveal one bidirectional relationship with Bahrain, and two unidirectional relationships. For Qatari market, the results show only one unidirectional relationship comes from Saudi. In the case of Saudi as being dependent variable, the results indicate a unidirectional relationship caused UAE at 5% level of significance, and finally, when the UAE treated as dependent variable, the Chi-squared statistic and associated *p*-value show one unidirectional relationship running from Qatar at 5% level of significance.

The results of the Granger-causality test for the post-crisis period are varied. Bahrain banking-sector displayed one bidirectional relationship with Saudi at 1% level of significance. Further, there is a unidirectional causal relationship running from the Kuwaiti banking-sector to Bahrain 10% level of significance.

Table 5.33: Granger Causality Test of the GCC-Banking Sectors

Granger causality test based on the VECM-3

Pre-crisis

	Dependent variables							
	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	*Causes*	*ECTs*
Bahrain		8.874**	8.517**	3.094	8.932**	0.351	3	-0.043***
Kuwait	8.754**		6.938*	2.398	1.155	0.055	2	0.010
Oman	9.369**	0.438		22.24***	5.768	3.622	2	0.014
Qatar	2.950	2.869	2.686		3.589	9.745**	1	0.045**
Saudi	2.023	6.933*	8.325**	0.135		0.742	2	-0.139***
UAE	1.769	7.326*	2.339	5.811	1.472		1	0.009
Caused	2	3	3	1	1	1	11	

Post-crisis

	Dependent Variables							
	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE	*Causes*	*ECTs*
Bahrain		3.243	1.750	4.790	10.246***	6.971*	2	-0.057***
Kuwait	6.833*		8.294**	20.70***	2.198	6.562	3	0.001
Oman	2.189	6.059		6.251	15.92***	2.105	1	-0.055**
Qatar	1.717	3.319	6.094		3.449	8.235**	1	-0.092***
Saudi	11.701***	8.856**	8.452**	8.580**		0.617	4	-0.114***
UAE	0.677	9.720**	12.10***	9.000**	10.136**		4	-0.073***
Caused	2	2	3	3	3	2	15	

Notes: *, ** and *** represent statistical significance at the 1%, 5% and 10% levels respectively.

In the case of Kuwait as the dependent variable, the results reveal two unidirectional relationships caused by Saudi and Emirates at 5% level of significance. Oman also reports a bidirectional relationship with Saudi at 5% significant level. When Qatar banking-sector is treated as a dependent variable, the Chi-squared statistics and associated *p*-values showed one bi-unidirectional relationship with the UAE at 5% level of significance. Similarly, in the case of Saudi as the dependent variable, the results showed two bidirectional relationships with Bahrain and Oman at 1% level of significance, and a unidirectional relationship detected from UAE. Finally, when the UAE treated as the dependent variable, the result of the Granger-causality test shows one bidirectional relationship at 5% level of significance with Qatar, implying an important feedback between them.

5.4.6 Variance Decomposition

The variance decomposition is conducted to measure the percentage of forecast error of a banking-sector return explained by another banking sector in the GCC region. Table 5.34 present the variance decomposition of the 15 weeks ahead forecast error for each GCC-banking sector over the two sub-periods. Each row in the table indicates the percentage of forecast error variance explained by the variable indicated in each column. The results of both sub-periods as presented in the table indicate that most of the GCC-banking sectors are relatively less exogenous; that is the percentage of the error variance accounted for by innovations ranged between (41% - 85%). The results from the pre-crisis period indicate that both Bahrain and Oman innovations influence most of the other variables at different time horizons. For instance, 10.5% and 7.6% of forecast errors variance in Kuwait and Oman is explained by Bahrain. Similarly, 17.5% and 8.6% of forecast errors variance in Qatar and Emirates are explained by Oman.

The bidirectional causal relationship, which found previously between Bahrain and Kuwait, is supported here; Bahrain banking explains 10.5% of forecast error variance for Kuwait, and vice versa. In addition, the UAE is less sensitive to the GCC-explanatory power (regional shock), where other GCC countries explain 22.5% of its error variance. That is, 1.7% explained by Bahrain, 6.4% by Kuwait, 8.6% by Oman, 3.5% by Qatar and 2.1% explained by Saudi after 15 weeks.

Table 5.34: Variance Decomposition of Six GCC-Banking Sectors

Market explained	Horizon (Weeks)	By innovations in						
		BBS	KBS	OBS	QBS	SBS	EBS	All GCC*
Pre-crisis								
BBS	5	88.277	9.1195	1.4502	0.9243	0.1029	0.1261	11.723
	10	79.754	10.153	0.9147	6.2794	1.9015	0.9959	20.245
	15	74.116	10.205	0.8595	9.4169	3.2653	2.1358	25.883
KBS	5	10.619	80.025	1.2671	0.4153	2.0883	5.5839	19.974
	10	10.631	77.521	1.4649	0.8580	2.3162	7.2073	22.478
	15	10.570	77.44	1.3657	1.2166	2.1680	7.2360	22.556
OBS	5	12.278	3.0697	84.701	0.2622	4.7651	0.9231	21.298
	10	11.253	2.7883	86.399	0.7617	5.0816	1.7146	21.600
	15	10.665	1.7070	87.041	0.9834	7.0553	2.5482	22.958
QBS	5	3.6147	0.8338	7.1870	85.292	1.6757	1.3968	14.708
	10	3.4322	0.8065	12.567	74.974	6.7726	1.4472	25.025
	15	3.4142	0.9625	17.5813	65.698	11.3687	0.9745	34.301
SBS	5	1.6205	4.3240	12.4060	4.5808	77.036	0.0321	22.963
	10	3.0589	3.7086	8.9390	18.074	64.517	1.7017	35.482
	15	3.4741	3.5512	6.8816	25.460	57.02	3.6116	42.978
EBS	5	1.2209	9.1010	3.7027	3.5813	0.2617	82.1324	17.867
	10	1.5987	7.2454	6.5486	3.9836	1.2231	79.4005	20.599
	15	1.7145	6.4706	8.6486	3.5360	2.1388	77.4916	22.508
Post-crisis								
BBS	5	89.439	5.6229	2.2993	0.2835	2.2276	0.1272	10.560
	10	80.270	6.3253	2.7119	0.9312	9.6872	0.0738	19.729
	15	75.473	4.7615	2.8533	0.9870	15.843	0.0811	24.526
KBS	5	13.074	77.394	0.1353	1.2202	4.4976	3.6778	22.605
	10	16.991	70.227	0.3709	0.6784	3.3775	8.3553	29.773
	15	17.832	65.150	0.6297	0.5197	2.9788	12.8883	34.849
OBS	5	8.0673	8.5800	77.594	0.5338	3.8565	1.3674	22.405
	10	6.7982	6.7632	77.136	0.3846	6.8978	2.0200	22.863
	15	5.0392	5.0325	76.723	0.7417	8.9436	3.5198	23.276
QBS	5	8.7124	28.085	9.0243	44.903	6.0077	3.2662	55.096
	10	8.1782	27.139	7.3571	41.130	11.260	4.9337	58.869
	15	6.5156	22.700	6.5624	42.986	14.672	6.5627	57.013
SBS	5	4.6973	9.2243	16.438	4.3192	63.968	1.3517	36.031
	10	4.0580	13.868	25.689	3.4973	51.335	1.5511	48.664
	15	6.3918	12.595	31.968	3.1841	43.391	2.4693	56.608
EBS	5	3.1497	4.1522	24.270	1.4603	1.7627	65.2050	34.795
	10	1.8817	2.6508	25.353	1.2215	1.2932	67.5998	32.400
	15	2.0704	4.1087	25.065	1.9964	1.2264	65.5322	34.467

Cholesky Ordering: Bahrain, Kuwait, Oman, Qatar, Saudi, and UAE. * All GCC denote the total percentage of forecast error variance of each GCC-banking, explained by other GCC-banking sectors.

The findings of the variance decomposition for the post-crisis period, reported in in the second part of the table, show that the six variables in the system have more exogenous power than the pre-crisis. The percentage of regional explanatory power is quite strong reaching, in the best cases, 57% for Qatar and 56% for Saudi at time horizon 15-weeks. The banking sector innovations in Saudi can explain 16% and 9% of the error variances in both Bahrain and Oman, and 32% of the error variance in Saudi explained by Omani-banking, reflecting the strong financial and economic relationships between these countries.

5.4.7 Impulse Response Functions

The impulse response functions (IRF) tests how the endogenous variable in GCC responds to innovations from other GCC-banking indexes in the system. In other words, the IRF investigates how fast the price of each GCC-banking responds and returns to equilibrium after a shock in the Bahrain-banking index.

Table 5.35 and the appendix (C) show the accumulated response of the GCC banking returns to their own shocks and one standard deviation shocks from each other. The pre-crisis period indicates that Bahrain has a positive response to its own shock and all GCC-banking response positively and significantly to the shock in Bahrain after one week. The Kuwait, Saudi and Oman are most responsive to the shock in Bahrain, and, generally, all variables react after one week and commence the long-run equilibrium relationship.

The results of the IRF for the post-crisis period indicated that Bahrain still possesses a positive response to its own shock and all GCC-banking sectors response positively and significantly to the shock in Bahrain Banking after one week. Kuwait-banking index is the most responsive to the shock in Bahrain-banking, and all markets react after two weeks and commence an equilibrium relationship. Further, the responses from Kuwait and Oman banking sectors to one standard deviation shock in Bahrain-banking are very fast, positive and statistically significant. Saudi and the UAE response positively up to week 7.

The Saudi-banking sector responses negatively to the shock in Bahrain after one week, and then reverted back to the equilibrium relationship. The results of the IRF also reveal that Kuwait and Oman both response negatively to one standard deviation shock in Qatari banking system. The magnitudes responses of all GCC-banking

sectors show negative responsive to one standard deviation shock in banking system in the UAE, indicating considerable results from the pre-crisis period.

Table 5.35: Impulse Response Analysis of Six GCC-Banking Sectors

Market responding	Period (Weeks)	To one standard deviation shock in:					
		BBS	KBS	OBS	QBS	SBS	EBS
Pre-crisis							
BBS	5	1.8805	0.9684	-0.0364	0.0843	-0.2957	0.4414
	10	1.6326	1.2760	-0.3089	0.1731	-0.5871	1.0429
	15	1.5946	1.3481	-0.3094	0.1375	-0.6844	1.2145
KBS	5	1.1428	2.5207	0.2067	-0.3064	0.3413	-0.1574
	10	1.2493	2.5945	0.0438	-0.5949	0.1117	0.5209
	15	1.4010	2.5283	-0.0955	-0.6972	-0.1682	0.9140
OBS	5	1.0343	0.3981	2.5568	-0.2066	0.3014	-0.0006
	10	1.2916	0.8287	2.1243	-0.4525	-0.0263	0.3040
	15	1.5025	1.1483	1.7465	-0.6675	-0.3270	0.5062
QBS	5	0.0800	0.1624	0.5806	2.5315	0.5259	0.8626
	10	0.4163	0.3087	1.0574	1.7639	0.9246	0.7511
	15	0.5954	0.4906	1.0689	1.3548	0.8835	0.8327
SBS	5	-0.0434	0.8713	1.3360	1.8984	5.3309	0.9471
	10	-0.2637	0.9529	-0.4222	3.0733	3.3612	2.2494
	15	-0.1629	0.6960	-0.7514	3.4842	2.5805	2.4245
EBS	5	0.7805	0.9985	0.3594	0.6014	-0.0509	2.5292
	10	1.1435	0.7143	0.5320	0.6361	-0.1182	1.8197
	15	1.3201	0.6742	0.5391	0.6227	-0.2470	1.5010
Post-crisis							
BBS	5	1.5534	0.3069	0.4948	0.0153	-0.0897	0.0305
	10	1.2659	0.2562	0.8472	0.1392	0.0880	-0.0393
	15	1.0030	0.2467	1.1111	0.3024	0.3219	-0.1101
KBS	5	0.8979	2.0364	0.0664	-0.1353	-0.6924	-0.5259
	10	0.9748	1.3207	0.3387	0.0731	-0.1420	-0.7767
	15	0.9004	0.9638	0.6483	0.1554	0.2382	-0.8476
OBS	5	0.9566	0.6641	2.3074	0.3433	-0.0819	-0.2615
	10	0.7400	0.5467	2.3307	0.8484	0.7010	-0.4753
	15	0.5044	0.5774	2.4101	1.1651	1.2660	-0.6109
QBS	5	0.9527	1.6321	0.9668	2.2555	-0.5172	-0.4601
	10	0.8049	1.3180	1.1443	2.5967	0.0842	-0.7343
	15	0.5930	1.2242	1.3699	2.7975	0.5596	-0.9055
SBS	5	0.6096	0.5738	0.8850	0.6025	1.5481	-0.0515
	10	0.5065	0.4905	1.0726	0.5861	1.3780	-0.1150
	15	0.4069	0.4482	1.2193	0.6077	1.3534	-0.1759
EBS	5	0.8364	0.5225	1.6518	0.6881	0.3778	1.8740
	10	0.7737	0.2558	1.5862	1.2944	0.6819	1.2902
	15	0.6144	0.2286	1.5873	1.7344	0.8529	0.8837

5.5 Conclusion

This chapter outlined the findings in relation to examined regionalization and globalization of the GCC-equity markets. First, presentation of the findings started with the regional financial integration among the six GCC-stock markets and testing for long-and short-term relationships among these markets over the period of study on a weekly basis. Second, the relationships between the GCC-equity markets and their links to three global markets (S&P500, EU350 and oil) were tested using efficient JJ cointegration test, and finally, the sectoral cointegrating relationships between the six GCC-equity markets were examined, represented by investigation of the dynamic relationships between GCC-banking sectors.

The results of the cointegration test for the six GCC-equity markets (VECM-1) indicated that these markets have a solid long-term equilibrium relationship with each other over the two sub-periods as well as the full period of study, and a number of cointegrating vectors have increased after the crisis period. The integration was also found between the six GCC-markets in the short-term as confirmed by results of the ECTs and Granger-causality test.

At the global level, the results of the maximum eigenvalues of JJ cointegration test indicated the absence of any cointegrating relationships during the full period of study. Further, both tests of the JJ did not report any long-term relationships between the six GCC stock markets and global markets in the first sub-period, while two cointegrating vectors were observed during the post-crisis period.

The short-term dynamic relationships between the GCC-equity markets and the global markets were also tested. The results of the Granger causality test and the ECTs of the VECM-2 suggest feeble dynamic relationships between these variables, particularly prior the crisis period. Additionally, the variance decomposition and impulse response functions both document that the equity markets in the GCC region are most sensitive to regional shocks than global.

The results of the VECM-3, which analyzed the relationships between the six GCC-banking sectors, reveal identical results as the VECM-1. The results obtained from the JJ cointegration test support the presence of cointegration relationships between variables in both sup-periods and the whole period, and this cointegrating linkage have increased after the GFC downturn.

CHAPTER SIX

DISCUSSION

6.1 Introduction

The main objective of this research is to examine the regional financial integration of GCC-stock markets. The relationship between the GCC-stock markets and global markets were also tested using Johansen's cointegration technique (JJ) developed by Johansen and Juselius (1990) to identify the long-term equilibrium relationship between those markets. The Granger-causality test was tested to examine the dynamic short-term returns linkage between the variables. A significant long-term equilibrium relationship identified by the JJ cointegration test provides evidence of a long-term relationship amongst the six GCC-equity markets in both sub-periods and also the full period. Further, this research finds the degree of financial integration in the GCC region was increased after the global financial crisis in 2008.

The results of the JJ analysis suggests the absence of any cointegration relationships between the GCC and global markets prior the crisis period, and the short-term analysis also showed less impact of global market on GCC stock market returns.

This chapter discusses the findings of this research in relation to the hypotheses, theory and previous studies. Firstly, consideration is going to long-term relationships between the six GCC stock markets, regionally and globally. Further, the results of market integration between the GCC-banking sectors will also be discussed. Secondly, the short-run relationships at regional and global levels are discussed in relation to the models and hypotheses.

6.2 Unit Root Test

Analysis of the cointegration relationship between variables began with the unit root test to determine the stationarity of the variables. The research employs ADF, PP and KPSS tests to examine the presence of unit root for level series and first differences of all variables under study. The performance of three unit root tests is considered based on literature. The ADF test as a conventional test performs with the presence of serial correlations in time series data, while the PP test, is conducted to verify the ADF results, particularly when there is a structural break in data (Phillips and Perron,

1988). To ensure the robustness of both ADF and PP Tests, the KPSS (Kwiatkowski *et al.,* 1992) was also conducted.

The null hypothesis of all series have unit root (non-stationary) was tested against the alternative hypothesis, that all series are stationary. In the case of level series data, the null hypothesis that the series has unit root cannot be rejected for all series, which means that all series are non-stationary over the three sub-periods, and the results show similarity between three unit root tests.

The research then applied the three unit root tests in the case of first differences, and the results provided rejection of the null hypothesis at 1% level of significance for all series, and acceptance of the alternative hypothesis that all series are stationary over the three-periods of study. A stationarity of time series data in first differences is supported by previous studies (for example, Hassan *et al.*, 2003;Darrat and Al-Shamsi, 2005;Neaime, 2005a;Chaudhry and Boldin, 2012). These studies suggest that the level series prices of all markets are stationary in first differences. The residuals of all models were also tested and no unit root was found in the case of first differences over the three study periods.

6.3 Evidence of Long-term Relationships between the GCC-Stock Markets

Since all series were found to be integrated at the same order $I(1)$, these variables were thought to exhibit a long-term relationship. The research then undertakes a further analysis to examine the cointegration relationships between the six GCC-financial markets over the two sub-periods and the full period. The hypothesis for testing a long-term relationship between the six variables is formulated as follows:

H_{1a}: *The long-run relationships exist between the six GCC-equity markets.*

Support for the first hypothesis can be seen in the findings of this research (refer Tables 5.3 and 5.4), where it is demonstrated that there is a long-term equilibrium relationship binding the six GCC-stock markets together over period of study. The Trace statistic of the JJ cointegration test showed one cointegrating vector among these markets in the pre-crisis period, and this cointegrating relationship has increased during the post-crisis period (crisis and recovery period). Such high level of cointegration indicated by the number of cointegrating vectors in the second sub-period, suggests that equity markets in this region were very closely linked during the GFC and recovery period after March 2009. The results of the Trace statistics

value for the pre-crisis period, confirmed one cointegrating equation, linking the GCC-markets in the long-term. This result suggested accepting the formulated hypothesis that all markets in the GCC region are cointegrated during the pre-crisis period. The result of the JJ cointegration analysis for the post-crisis period indicates that both Trace statistics and maximum eigenvalues confirmed the existence of two cointegration equations between the GCC-stock markets. This result indicates acceptance of the alternative hypothesis, and rejection of the null hypothesis. In the full sample period, the Trace statistics and the maximum eigenvalues both indicate one cointegrating vector linking the GCC-markets in the long-term. This acknowledges the presence of long-term equilibrium relationships between the GCC countries, and as expected, providing robust evidence of financial integration in this region. The existence of a single cointegrating vector linking the equity markets in the GCC region during the full period supports the robust long-term stability, linking these economies together.

Results from error correction term (ECT) of the *VECM-1* confirm the findings of the JJ cointegration test (refer Table 5.10). During the pre-crisis period, the adjustment coefficients of Bahrain, Kuwait and Saudi displayed negative signs and statistically significant at 1% and 5% levels. This implies that the speed of the adjustment process of these markets in the short-run disequilibrium, towards the long-term equilibrium relationship, is faster than other markets. The VECM also revealed the speed of the system after crisis period is faster than before, implying robust relationships between variables after the crisis period.

However, evidence of a robust cointegration relationships among the GCC-financial markets come as a result of several factors that make these markets move together in the long-term; for instance, the GCC countries are major suppliers of oil in the world energy markets, therefore, the financial system in these countries is more likely to be susceptible to movements oil prices, which means the process of financial integration is more likely to be affected, and subsequently consistent in moving in the same direction in the long-term.

The acceptance of the hypothesis H_{1a} is supported by theory and previous relevant studies (for example, Assaf, 2003;Hassan, 2003;Darrat and Al-Shamsi, 2005;Al-Khazali *et al.*, 2006;Bley and Chen, 2006;Simpson, 2008b;Chaudhry and Boldin, 2012) all examined the dynamic interactions among stock market returns of Gulf

Arab countries using recent techniques based on multivariate Johansen's cointegrating analysis. Review of the previous studies indicates evidence of robust cointegration relationship between the GCC-equity markets in the long-term. The combined findings confirm that these markets are linked together and share a common stochastic trend in the long-term. The strength of the cointegration relationship between the GCC-equity markets has increased during the post-crisis period (crisis and recovery period). In this regard, (Dickey *et al.*, 1991;Bley and Chen, 2006) suggest that the increase in cointegrating vectors imply robust long-term equilibrium and stable relationships between variables.

Nevertheless, there are several factors that might affect the strength of financial integration in the GCC region, either positively or negatively. Bekaert (1995) and Bekaert *et al.* (2003), argue that market integration or segmentation is significantly influenced by the economic and financial policies applied in each country.

Al-Khazali *et al.* (2006) find evidence of gradual removal of capital controls in the four GCC countries; namely, Bahrain, Kuwait, Oman and Saudi Arabia, increased the degree of market integration process in the region. The authors examined the cointegration relationship between these markets, before and after market liberalization in 1997, and contended that liberalization is an important and effective platform to build solid relationships among the financial and capital markets of this region.

The global financial crisis (GFC), which began about mid of 2008, is another factor affected the process of financial integration in the GCC countries. The post-crisis period indicated increases of cointegrating vectors during the crisis period, as well as the recovery period. This implies as stated before, the strength of relationships between these markets, all of which dropped in July 2008 and started to recover in March 2009 (refer Figure 4.1).

The Wald test for the adjustment coefficients of the error-correction terms, which measures deviations from the long-term equilibrium relationship, indicated that all markets are strongly exogenous during the post-crisis period; this result supports the ECT of the VECM, and further confirmed the cointegrating relationship between these markets.

In relation to normalization of the cointegrating coefficients for the pre-crisis period, it can be observed that 8.4% increases in the Bahrain stock market index if the UAE market increases for 1% in the long-run. In contrast, a 1% decreases in the Saudi market would increase the Bahrain stock market index by 3%. The normalized cointegrating coefficients after crisis period shows that Saudi and UAE dominate other GCC-stock markets in the long-term. The coefficients of the Saudi and UAE have negative signs and statistically significant at 1% level. Further, it can be expected that, if Saudi market increases for 1%, the Bahrain stock market will increase by 5.8%. Similarly, an increase of 1% in the UAE will cause 8.2% increase in the Bahrain stock market in the long-term.

The question that may arise is: Which market has the most influence on the other markets in the region over the two periods of study? Several previous studies have examined the financial integration in the Gulf Arab region and found significant role of Saudi Arabia as a largest market in leading others towards the ling-run equilibrium relationship. To find the main driving force within the cointegrated system in each sub-period, this research applied the process of Gonzalo and Granger (1995) for testing the null hypothesis that the Saudi and UAE are not the main driving force behind the cointegrated system. The statistical significance of Saudi and UAE in the JJ cointegrating systems were supported by results of LR-test (refer Table 5.6).

The results of the Gonzalo and Granger (1995) for testing the main driving force in cointegrated system indicate that Saudi is the most important in driving other variables towards the cointegration relationship with the Chi-square statistic of (37.5), followed by UAE (refer Tables 5.8 and 5.9). These findings reflect the fact that Saudi is the largest market capitalization in the region, and the route of co-movement towards the cointegrating system is led by Saudi market. In addition, the findings also support the fact that Emirates has witnessed rapid growth during recent years. The hypothesis that the Saudi stock market is a dominant within the GCC region is becoming soundly accepted throughout the full period and both sub-periods, similarly, Emirates cannot also be excluded from the cointegrating system.

The findings of the test developed by Gonzalo and Granger (1995) are supported by previous studies (for example, Darrat and Al-Shamsi, 2005;Al-Khazali *et al.*, 2006). They all conclude that Saudi Arabia is plying a significant role in leading other GCC countries to the long-run equilibrium relationship. Specifically, Darrat and Al-

Shamsi (2005) find the GCC countries are sufficiently compatible to form a viable regional integration; the result of the JJ cointegration analysis showed a robust long-term equilibrium relationship linking their economic and financial systems together. The researchers stated that Saudi Arabia is a dominant force in the region as it has the largest market capitalization within GCC. Similarly, Al-Khazali *et al.* (2006) point out that the four GCC markets; namely, Bahrain, Kuwait, Oman and Saudi share a common stochastic trend that binds the four Gulf markets together in the long-term. The calculated Chi-squared statistic to test the null hypothesis that the Saudi equity market is not the main driving force behind the cointegrated system is very large and statistically significant at 1% level, concluding that the Saudi is an important force contributing to the intra-regional integration among equity markets in the GCC region.

To find out the change of cointegration relationships between variables over the time, the study compared the number of cointegrating vectors in each sub-period. The findings exposed an increase of cointegrating vectors during the post-crisis period. In this context, Bley and Chen (2006) provide evidence of increasing market integration in the six GCC countries over the sub-periods of, 2000 to 2002, and from 2002 to 2004, comparing the cointegrating vectors in both sub-periods. This procedure was widely applied in several relevant works (see, for example, Chan *et al.*, 1997;Ravichandran and Maloain, 2010). Moreover, Chaudhry and Boldin (2012) indicated that the higher levels of cointegrating vectors, suggest potential hedging candidates.

6.4 Short-run Relationships between the GCC-Stock Markets

The research utilized the Granger-causality, based on VECM, to investigate the short-run relationships between the GCC-stock markets. The block exogeneity Wald test, with a Chi-square statistics used to examine the existence of Granger-causal relationships between variables when all the specified variables interacted in the system. Further, within VECM, variance decomposition and impulse response functions were tested to confirm exogeneity. The hypothesis for testing short-run relationships between members of GCC region is formulated as follows:

H_{1b}: The short-run relationships exist between the six GCC-equity markets.

The results of the Granger-causality test for the pre-crisis period indicated limited causal relationships between the equity markets of GCC region. For example, unidirectional relationships were detected between Oman and Qatar, and between Saudi and Bahraini market at 1% level of significance. From these findings (see chapter 5 for more details). The null hypothesis (H_{0b}) for non-causal relationships between variables is therefore rejected. The ECTs of Kuwait, Oman and Qatar are insignificant, indicating an insignificant adjustment and slow movement towards a long-term relationship (refer Table 5.10). This finding supports the results of LR test, confirming the weak exogeneity for those markets (refer Table 5.11).

Evidence of exogeneity for Bahrain and the UAE is confirmed by the results of the LR test, where the Chi-squared statistics are slightly large to reject the null hypotheses of weak exogeneity for these markets. Further, the coefficients of the ECTs are negative and highly significant, indicating a significant adjustment towards a long-term relationship.

During the post-crisis period, the result of the Granger-causality test indicated 14 Granger-causal relationships. Both unidirectional and bidirectional relationships were also found between the six markets. The Granger causal relationships between variable have been increased, and several bidirectional relationships were confirmed between these markets. Based on these findings, the null hypothesis of non-causal relationships between these markets cannot be accepted. The ECTs of the six GCC-equity markets are negative, and highly significant, indicating a substantial adjustment towards a long-term relationship. These results were confirmed by the Chi-squared statistics of the LR test, shown in Table 5.11; necessitating rejection of the null hypothesis of weak exogeneity for these markets.

The empirical results deduced from variance decomposition indicate that the magnitude of a movement in Emirates stock market in the pre-crisis period is influencing most of the other markets in the region at different time horizons. The influential of the Emirates market is supported by the fact that Emirates' economy has grown rapidly in recent years, and the results is also supporting the outcomes of ECTs of the VECMs.

The impulse response analysis reveal that all markets in the region response positively and significantly to the regional shock after two weeks, and started their

shifts to a new equilibrium relationship shortly, implying transitory deviations from the long-run relationship (refer to Table 5.14, and Figures A.1, A.2 in appendices).

The results of variance decomposition and IRF for the GCC stock markets are consistent with the results of the JJ cointegration test, indicating that all markets are cointegrated, and the Bahraini market as endogenous variable has a stronger explanatory power in the short-run particularly before crisis period. The results of the IRF for the two samples are consistent with the results of the Granger causality and variance decomposition, again indicating strong dynamic relationships between these markets after GFC downturn. Overall, the findings are found to be in accordance with several relevant studies. For instance, Assaf (2003) finds substantial evidence that the Bahrain as more open market plays a dominant role in influencing other GCC-equity markets, while Saudi showed slow response to shocks created by other markets experiencing institutional inflexibility in the financial system. The results are consistent with the findings of this research in that the GCC-stock markets are integrated, and the Saudi Arabia takes some time to respond to shocks in other GCC-markets.

Others such as Hassan (2003) finds the stock markets of Bahrain and Kuwait are cointegrated with one cointegration vector which allows for investors in each country to benefit from the information available in both markets in the long-term. However, the results also show that the Oman stock market is exogenous in the dynamic model compared to the Bahrain and Kuwait markets. Moreover, Simpson (2008a) finds evidence of cointegration among GCC stock markets and also suggests that, the Emirates-stock market is the strongest exogenous market in the system. The findings of this thesis also confirmed that the cointegrating relationships were increased during and after the global financial crisis, indicating a strong long-run relationship with the oil market.

In summary, this research finds long-run equilibrium relationships among the GCC-indices, and the dynamic short-run relationships between the variables were also confirmed. The previous studies are found in line with the results of JJ cointegration test and other econometrics techniques, supporting a solid long-and short run dynamic relationship between variables in particular after the crisis period.

6.5 Long-term Relationships between the GCC-Equity Markets and Global Markets

The relevant literature suggests that stock markets in the Middle East and North Africa (MENA) including GCC countries are mainly segmented from the global markets (see, for example, Neaime, 2005b;Yu and Hassan, 2008;Cheng *et al.*, 2010;Marashdeh and Shrestha, 2010). This implies that foreign investors can achieve the diversification benefits by allocating part of their portfolios to these developing markets. However, by focusing in volatility and diversification opportunities among these markets, other researchers were found less influence of developed markets on the Gulf Arab markets (see, for example, Bley and Chen, 2006;Balcılar *et al.*, 2013;Balli *et al.*, 2013a). However, in recent years, the GCC countries have become more linked with global markets due to their dependency on oil.

Nevertheless, further analysis was undertaken to examine the cointegration relationships between the stock markets in GCC region and global markets (including oil). The hypothesis for testing long-term relationship between the nine variables over the period of study was formulated as follows:

H_{2a}: The GCC-equity markets are segmented from the global markets in the long-term.

During the full period of study and also prior the crisis period, the results of maximum eigenvalues of the multivariate JJ cointegration analysis suggest the absence of any cointegration relationships between the six members of GCC and global markets (refer Tables 5.16 and 5.17). However, the Trace statistic suggests that one cointegrating vector exists only in a model including intercept and trend in data. These results have changed dramatically during the second sub-period, whereas both statistics support the presence of two cointegrating vectors linking the six states of GCC and the three global markets in the long-term. This suggests that the cointegration relationships between GCC region and global markets has taken place only after the crisis period in the mid of 2008. The hypothesis (H_{2a}) is therefore accepted for the first sub-period, and cannot be accepted in the second sub-period.

The results of LR test for testing statistical significance of each variable behind the cointegrated system support the outcomes of JJ cointegration test. The Chi-secured statistics for the three developed markets clearly indicate that these markets can be

excluded from the cointegrated system (refer Table 5.18). Further, the results of LR-test also indicate that these markets are weakly exogenous in the system.

The preliminary analysis of this research shows that the GCC-price indices exhibit similar co-movements with the global markets. This implies that these markets could have common trade or financial linkage between them. However, this findings is contradicts with the findings of JJ cointegration analysis, which indicates no cointegration relationship between the GCC and international markets particularly during the pre-crisis period. It should be noted that the similarity of co-movements between the GCC and global markets does not necessarily follow that the same markets would be integrated.

However, the cointegrating relationships, which found at a global level may attribute to the significance linkages between GCC economies and oil. The GCC countries are considered major suppliers of oil in the world energy markets, thus, the financial systems in these countries are more likely to be susceptible to oil prices changes, which means the process of financial integration is more likely to be affected, and subsequently consistent in moving in the same direction in the long-term.

Accordingly, the acceptance of the hypothesis H_{2a} is supported by theory and several studies related to this research. Most of these studies focused in the relationships between the GCC stock markets and oil (for example, Hammoudeh and Aleisa, 2004;Hammoudeh and Choi, 2006;Zarour, 2006;Arouri and Nguyen, 2010;Fayyad and Daly, 2010;Ravichandran and Alkhathlan, 2010;Fayyad and Daly, 2011) All of the studies examine the dynamic interactions among stock market returns of the Gulf Arab countries and the oil market which represents one of the global markets in this thesis.

A summary of previous studies support the presence of robust cointegration relationships ties the GCC-equity markets with the oil market together in the long-term. This implies that these markets linked to oil and share a common stochastic trend in the long-term. For instance, Hammoudeh and Aleisa (2004) suggest that Saudi has the strongest causal linkage with other GCC-markets, with the exception of Oman. Further, those authors found that only the Saudi stock market index can predict and be predicted by the New York Mercantile Exchange oil future prices.

Zarour (2006) finds the response of five GCC stock markets to shocks in oil prices increased after the rise in oil prices. The results also indicated that only the Saudi and Oman markets have the power to predict oil prices, and Saudi is more sensitive to shocks in oil prices and vice versa. Hammoudeh and Choi (2006) suggest that the GCC and global variables (oil, the US S&P500 index and the US T-bill) have several long-term equilibrium relationships, and co-driven by common stochastic forces. This results support the findings, indicating the long-term relationships could be exist between the GCC and the global markets in a model including oil market and also the US S&P500 index. Moreover, Fayyad and Daly (2011) investigated the relationship between oil and stock market returns for seven countries (Bahrain, Kuwait, Oman, Qatar, UAE, UK, and the US). They found the predictive power of oil for stock returns increased after a rise in oil prices and during the GFC period.

The previous studies suggest that increases of cointegrating vectors imply robust long-term equilibrium and stable relationships between variables (see, for example, Dickey *et al.*, 1991;Bley and Chen, 2006). In this context, the findings showed that the strength of cointegration relationship between the GCC-equity markets and the three global markets has established significantly during the post-crisis period (crisis and thereafter). The GFC, which began in middle of 2008, has affected the process of financial integration within the GCC countries. The findings evidently showed increases of cointegrating vectors during the post-crisis period, implying establish of long-run relationships between respective markets.

Based on the current literature, the influence of a significant event on the proses of market integration is often examined by comparing the number of cointegrating vectors in the periods before and after such an event (Ravichandran and Alkhathlan, 2010). However, support of the H_{2a} hypothesis can be seen in the findings of this study where it is demonstrated that there is long-term equilibrium relationship binding the GCC-stock markets and global markets after the crisis period.

Recently, Balcılar *et al.* (2013) found partial segmentation of GCC markets from the global market. Specifically, authors found the risk exposure of GCC-wide sectors behave positively to global shocks during the low and high volatility regimes, while, negative regional exposure found to shocks at extreme volatility regime. Despite differences in methodology used in this study, these results are supporting to some extent the findings of GARCH analysis (refer Table 4.14), indicating that GCC-

equity markets are more sensitive to the shocks in return and volatility caused by the global markets, specifically aftermath of the 2008 financial crisis.

6.6 Dynamic Effects of the Shocks in Global Markets

The frameworks of variance decomposition and impulse response functions are tested to capture the effect of the shocks in global markets on the behavior of GCC stock markets returns. The hypothesis for testing the dynamic effects is formulated as follows:

H_{2b}: A shock in global markets can directly affect the GCC stock markets in the long-term.

The results of generalized forecast error variance decomposition (VDC) and impulse response functions (IRF) for the GCC stock markets and the three global factors are consistent with the results of JJ cointegration test, indicating that the index return variations in the GCC stock markets dependents to greater extent on shocks from the region rather than from the outside (global shocks), and the explanatory power of the regional shocks have increased over time (refer Table 5.22). The global markets are not found to exert any dramatic impact in leading this region to long-run equilibrium relationship, while; eternal forces have much power to affect GCC-equity markets, and thus leading them to equilibrium relationship in the long-term. These findings are partly support the hypothesis (H_{2b}) in that the effect of global markets in some extent exists, and also found to be insignificant compares to the force of regional shocks.

Surprisingly, the oil market innovations do not appear to have greatest influence, and the GCC stock markets were explained mainly by the European index. In this context, Hammoudeh and Choi (2006) documented that the GCC-equity markets are found directly sensitive to changes in liquidity, interest rates and corporate profits, which are indirectly sensitive to oil returns. However, in regards to the post-crisis period, the results showed that the global variables in the system have more influence power than the first period. With the exception of Saudi, all GCC countries were explained by the US stock market, and the forecast error variance in Saudi was the only one explained by oil market. This finding in fact, supports the bidirectional relationship found between oil and Saudi market during the post-crisis period (refer Table 5.21). These findings also found to be consistent with theory and related

previous studies (for example, Hammoudeh and Aleisa, 2004;Hammoudeh and Choi, 2006;Choi and Hammoudeh, 2010;Fayyad and Daly, 2010;Arouri *et al.*, 2011a).

6.7 Evidence of Long-term Relationships between the GCC-Banking Sectors

The multivariate JJ cointegration test within the VECM was applied to examine the long-term equilibrium relationship between the six GCC-banking sectors. As mentioned earlier, the literature on the sectoral market integration within the Arab Gulf countries is limited and only few works have been undertaken to test the long-run relationship within this region (see, for example, Simpson and Evans, 2004;Maghyereh and Awartani, 2012b;Balcılar *et al.*, 2013;Balli *et al.*, 2013a).

However, this thesis investigates the long-run equilibrium relationships amongst the six GCC-banking sectors. The hypothesis for testing long-term relationships between variables for the period of study is presented as follows:

H_{3a}: *The long-run relationships exist between the six GCC-banking sectors.*

The results of multivariate JJ cointegration analysis of the third model indicated one cointegrating vector linking the six GCC-banking industries in the long-term (refer Tables 5.26 and 5.27). The Trace statistic values for all variables is greater than critical values, therefore, the null hypothesis of H_{3a} has been rejected. The results of the post-crisis period showed three cointegrating relationships among the GCC-banking indexes, suggesting the existence of a stable equilibrium relationship, linking these banking indices in the post-crisis period. In the full period (included dummy variable), the results exposed one cointegration relationship among the six banking sectors in the GCC region. This means acceptance of alternative hypothesis H_{3a} over the three periods of study; there is a common factor connecting the GCC-banking markets together in the long-term.

The results of the Gonzalo and Granger (1995) for testing the main driving force in the cointegrated system indicated that all GCC-banking contribute significantly to building long-run relationship with each other. It also indicated that the Chi-squared statistics for the banking systems in Saudi and the UAE are greatest than other variables (refer Table 5.30). This implies that the banking sector in GCC countries is working as a mirror reflects the performance of GCC stock markets. It has been

recalled that Saudi is the largest market capitalization in the region, and the route of co-movement towards the cointegrating system is led by its market.

The results of the ECTs of the *VECM-3* confirm the findings of the JJ cointegration test. The adjustment coefficients of GCC-banking systems during the post-crisis period provide negative signs, and statistically significant at 1% level (refer Table 5.31). The results indicated a rapid speed of adjustment coefficients of the GCC-banks in the short-run disequilibrium to a long-term equilibrium relationship, and again, Saudi showed the largest Chi-squared statistic, followed by the UAE.

6.8 Short-run Relationships between the GCC-Banking Sectors

The research applied the Granger-causality test, based on the VECM to investigate the short-run relationship between the GCC-banking sectors over the two sub-periods. The Block Exogeneity Wald test, with a Chi-square statistic was used to identify the existence of Granger-causal relationships between variables when all the specified variables interact in the system. Further, within VECM, variance decomposition and impulse response functions were tested to confirm the long-term relationship and exogeneity. The hypothesis for testing a short-run relationship between the variables is formulated as follows:

H_{3b}: There is a short-run Granger causal relationship between GCC-banking sectors

The results of Granger-causality test of the *VECM-3* indicated several unidirectional and bidirectional relationships between variables in the system. For example, the Kuwaiti banking is Granger causes Bahrain-banking at 5% level, and the Bahrain being caused by Kuwait Banking at 5% level. This suggests that Kuwait banking sector can provide certain information to predict banking price index of Bahrain. The null hypothesis (H_{3b}) for testing non-causality relationships between the GCC-banking sectors is rejected, as indicated by the Chi-squared statistics and associated *p*-values.

The findings of the post-crisis period also indicated that there are bidirectional relationships between Bahrain and Saudi at a 5% significance level, while numbers of unidirectional relationships were observed between the six variables. For example, the Saudi-banking Granger causes the Bahrain and Qatar Banking markets at 5% level of significance, and Kuwait is Granger causes Bahrain, Qatar, and UAE

Banking markets at 1% and 5% levels of significance. This implies that the null hypothesis (H_{3b}) is also being rejected in the second sub-period.

Prior the crisis period, there is evidence of exogeneity for the Bahrain, Qatar and Saudi, being confirmed by the results of the LR test (refer Table 5.32). The ECT of the Kuwait, Oman and the UAE are positive and statistically insignificant, indicating slow adjustment towards a long-term relationship, thus, the null hypothesis of weak exogeneity of those markets has confirmed, while the post-crisis period showed that all variables are strongly exogenous.

The results of VDC for the GCC-banking sectors are found to be consistent with the results Granger-causality test, indicating that all markets are interacted in the system and exert significant relationships with each other particularly after the crisis period. The bidirectional relationships between variables have been confirmed in some cases, for example, Bahrain and Kuwait, and between Oman and both Saudi and the UAE. In addition, the findings of VDC for the six GCC-banking sectors support the hypothesis indicate that the explanatory power of the regional shocks is greater than the global one. These results in fact, completely matched the results of the VDC for the aggregate index of the GCC stock markets, implying that banking sector is the dominant and also the main driver of the GCC stock market index. Similarly, results from the IRF for both sub-samples are consistent with results of the Granger causality and the VDC, indicating strong dynamic relationships between these markets after the GFC downturn.

Despite the scarcity of studies on the sectoral market integration particularly in the Gulf Arab region, the acceptance of the hypothesis H_{3a} is supported by several studies. For instance, Simpson and Evans (2004) found the stock market returns and banking industry returns were highly and positively correlated. The study also found stock and banking returns is cointegrated and causality runs significantly one-way from banking returns to share market returns. The authors used Johansen's cointegration technique and Granger-causality test to examine the interdependence of banking markets in the GCC countries.

The results of GARCH analysis of the six GCC-banking sectors showed positive and significant volatility particularly after the crisis period (refer Table 4.13). these findings are supported by Hammoudeh *et al.* (2009). They investigate the shock and

volatility transmissions in three equity sectors (service, banking and industrial or insurance) of four GCC countries; namely, Kuwait, Qatar, Saudi and the UAE. The authors found the volatility among these sectors are generally significant, and documented that the sector's fundamentals for these markets have more influence on volatility than shocks. This implies that the past own conditional volatility for these three sectors can be used to predict their future volatility. They also indicated that the banking or financial sector appear to be the least volatile among the sectors, as the banking sector is the dominant sector in most GCC-equity markets. The study finally has made a suggestion for investors to diversify their portfolios by investing in banking or financial sector specifically in Qatar, Saudi and the UAE.

The findings of the previous study are supported with recent study conducted by Balli *et al.* (2013a). The authors provide evidence that GCC-wide equity sectors are mostly driven by their own volatilities. The study also examines whether or not the effects of local and global shocks have changed over the time, and concluded that the global shocks have decreased, while regional shocks changed positively. These findings are in some extent consistent with the results of this research, indicating that GCC-equity markets and specifically banking sector reacted significantly from regional shocks than the global.

Maghyereh and Awartani (2012b) find substantial convergence and homogeneity of banking markets in the GCC countries, particularly through the transitional period of 2003 to 2009. They suggest that the integration of banking sector could be of interest to regional economists and government policy makers as they debate that investment need to diversify into other industrial sectors.

Nevertheless, the number of cointegrating vectors among the GCC-banking indices have increased during the post-crisis period, implying robust cointegrating relationships, and also similar movement of the aggregate share market for each country (refer Figures 4.4 and 4.5). This suggests that the equity markets in these countries are mainly driven by financial sector, particularly banking system. The thesis also found that Saudi and Emirates banking industries showed leadership positions among the region (refer Table 5.30).

Having long-run relationships among GCC-banking sectors could be comparable to other studies have discussed this issue in other regions such as Eurozone. For instance, Simpson (2008a) examined interdependence and exogeneity between Euro-banking and Latin American banking systems, using daily stock indices for each of the country banking system. The study provides evidence of long-term relationships within Latin American banking systems and contended that Euro-banking systems are interdependent and cointegrated. Also, Balli and Balli (2011) found that most of the Euro-sector equity returns are explained mainly by the aggregate Euro equity index. They also suggest that, since the beginning of the EMU, the financial sector (banking, financial services and insurance) is found to be more affected by the aggregate Euro equity index.

The results clearly exposed that GCC-banking markets are integrated with each other, which implies that these markets do share long-run equilibrium relationship. This consequently means that the potential of regional investors for obtaining atypical profits through portfolio diversification is limited. However, local and foreign investors can still achieve arbitrage profits through portfolio diversification in the short-term even with the lake of opportunities in the long-term.

The banking system in the Gulf region is considered more advanced than other Arabic countries. The liberalization of financial services and the removal of barriers to local and forging investments were expected to increase efficiency and competition in the local banking markets, and support economic and financial integration (Maghyereh and Awartani, 2012b). This strategy in fact was successful and achieves one of the main goals of the GCC countries; namely, building strong relationships among the financial and capital markets within the region.

6.9 The Contributions of the Study

The degree of integration between financial markets has for decades been a controversial topic in both financial and macroeconomic literature. Regardless of extensive empirical research, there is yet no clear answer to what degree the financial markets are integrated. However, this thesis has sought to contribute to the research by employing various advanced econometrics approaches in order to determine the degree of financial integration in GCC countries regionally and globally.

This thesis has made substantial contributions to the body of knowledge related to financial integration in the GCC region. First, to the author's knowledge, this is one of the early studies if not the first study to address the issue of financial integration in the GCC stock markets regionally and globally in the context of the global financial crisis. The full sample period was divided into two sub-periods, before and after crisis to avoid the structural break in data caused by GFC. Hence, the thesis examined time-varying cointegration and showed how the integration process of GCC stock markets has changed over the sub-sample periods. The behavior of returns and volatility of these markets with global markets are also examined. To date, no work undertaken on weekly time series data up to date, including the crisis period (GFC).

Second, at the global level, this thesis analyzed the cointegration of the six GCC-equity markets with global markets including the oil market. This analysis has made a clear image about the relative effects of the three global markets, and consequently, identified which of these effects has the greatest impact on GCC-equity markets. After extensive review of the literature, most of previous studies include either oil market or developed markets. Third, this thesis examined the sectoral market integration in GCC countries, focusing on banking sector as a dominant sector in the GCC-equity markets. The study implemented banking sector in each GCC country and investigated the linkages between those sectors. There is substantive evidence to suggest that the economic health of any country or region is vitally dependent on the financial health of their banking sectors. Limited number of studies was conducted to examine cointegration relationships in Gulf Arab area at a sectoral level.

Fourth, this thesis is one of the few researches used variance decomposition and impulse response function to identify the interaction mechanism between the GCC markets and with three significant factors represented global markets. The variance decomposition and impulse response functions analysis added further support to the results of Johansen's cointegration test, Granger-causality, and Granger Block Exogeneity Wald test. Therefore, at the global level, the current research provided insights into the percentage of forecast error variance of the GCC stock markets and their response to shock in the global markets before and after the global financial crisis. The great numbers of relevant previous studies have only used Johansen's cointegration and Granger causality tests.

6.10 Conclusion

This research investigates the financial integration, contemporaneous long-term equilibrium relationships, and short-term dynamic relationships within the GCC financial markets. The study uses weekly data from January 2005 to December 2013, support is provided in this research for all of the hypotheses and therefore for the underlying theory and empirical literature that was utilized to formulate these hypotheses.

Considering the unit root tests including the ADF, PP and KPSS tests, the results indicated that each of the series is non-stationary when the variables are defined in levels, while first differencing removes time dependency in the data where the first differenced specified variables and errors of these relationships are stationary and integrated in the first order. Therefore, all residuals of the linear combination of first differences are stationary. The stationarity of the series used in this thesis was supported by theory and previous literature review.

At the regional level, the multivariate JJ cointegration analysis of *VECM-1* resulted in cointegrating relationships between the group of GCC stock markets over the two sub-periods and the whole sample of study. This result also found in the *VECM-3*, which specified to test banking market integration among the region. This implies that the law of one price (LOOP) holds for both models. Further, evidence has been provided indicated that the long-term relationships between these variables have increased during the post-crisis period. These results also supported by relevant studies, indicating that there are common factors linking these markets together in the long-term. Furthermore, this finding reflects the existence of a stable, meaningful linkage between these financial markets.

The Granger Block Exogeneity Wald test, ECT analysis, variance decomposition and impulse response functions are conducted to establish existence of causality among variables in the short-term. Evidence of Granger causal relationships found between variables under the study. The results of Granger-causality showed significant short-run relationships between the GCC stock markets and also between banking markets over the period of study.

At the global level, the multivariate JJ cointegration analysis of *VECM-2* resulted in partial cointegrating relationships between GCC stock markets and global markets

(including oil).These findings have been deeply discussed and concluded that the power of global shocks has little effect on the GCC-equity markets compare to the regional power. However, the partial cointegration relationships between the GCC and global markets comes as a result of several factors that make these markets move together in the long-term. One of these factors is that, the GCC countries are major suppliers of oil in the world energy markets, and consequently, the financial systems are more likely to be susceptible to the oil prices changes, which means the process of financial integration is more likely to be affected, and subsequently consistent in moving in the same direction in the long-term.

CHAPTER SEVEN

SUMMARY AND CONCLUSION

7.1 Introduction

This thesis has empirically examined regional financial integration in GCC countries; namely, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE. The relationships between the GCC financial markets and global markets were also investigated. Economists and other financial experts argue that increased integration with global financial markets is a key to imposing market discipline on policymakers, and improving the quality of macroeconomic management. This issue has received a great deal of interest in most developed and developing markets.

Over the last few decades, a significant amount of research has been conducted into regional and global financial integration, but only a few such studies have focused on emerging markets. However, due to the vital role that financial system plays in the economy, the issues of financial integration and convergence of stock markets in GCC are considered to be utmost important. This importance is expressed in terms of evaluating the outcome of deregulation policies in the GCC, aimed ultimately to improve the efficiency and performance of the economic and financial sectors.

The literature provides various alternative definitions of the concept of financial integration. However, one attractive definition is that financial markets are considered integrated when the law of one price holds. This definition stipulates that if two or more markets are integrated, then identical securities should be priced identically for both markets. Nevertheless, most of the theoretical studies have examined markets integration by looking at returns in two perfectly correlated portfolios of securities from different countries. However, to achieve full market integration, financial capital should be free to flow across borders without any restrictions or political regulations. This Chapter is divided into four sections. Following the introduction, Section two presents a summary of the empirical findings. Section three discusses the policy implications of the empirical findings, and finally, Section four presents suggestions for future research.

7.2 Research Summary

This thesis initially presented the objectives of the research, significance, and methodology for data gathering and analysis. Chapter two presented a review of the theory and empirical literature related to financial integration. The purpose of this Chapter is to review the early and current literature relating to regional and global financial integration. Early theoretical methods for examine market integration such as Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) is presented in the first Section of second chapter.

The CAPM approach proposes a linear and positive relationship between a security's expected return and its systematic risk. The CAPM developed by Sharpe (1964) and Lintner (1965) assumes that markets are considered integrated if returns for various investments risks are identical across markets (Heston *et al.*, 1995). In contrast, the APT model developed by Ross (1976) differs from the CAPM model in its assumption that stock prices can be affected by several types of systematic risk.

In the second section, the Chapter reviews recent methodology that has been widely used for assessing market integration. The most common technique that has been used to investigate long-term relationships is the Johansen's cointegration methodology (Johansen and Juselius, 1990). Additionally, other methodologies such as ARDL, ARCH, and GARCH are also reviewed in this Chapter. Sectoral market integration at both regional and global levels is also reviewed in this Chapter, and finally, the Chapter reviews the interdependence of the GCC stock markets and global markets.

Chapter three focuses on the background of the main indicators of the GCC financial markets. The Chapter begins with a brief analysis of the general economic features of these six countries. The GCC countries commenced liberalization of their stock markets during the late 1980s and mid-1990s. The first country to liberalize its stock market was Bahrain in 1988; allowing foreign investors to have 30% access to the Bahrain Stock Exchange. In 1989, Kuwait and Oman also liberalized their stock markets by removing all restrictions for foreign investment. As a result of this liberalization, along with several privatization programs, portfolio equity started to flow to stock markets in the region. The stock markets in the GCC region achieved considerable improvement in the past decade due to several factors such as the

achievement of higher economic growth, monetary stability, stock market reforms, privatization, financial liberalization and institutional framework for investors.

In relation to the development of these stock markets in the region, analysis of the main market indicators for each stock market was presented. These indicators include market capitalization, trading value, turnover ratio, and the number of listed companies in each market. It was found that the Saudi is the dominant in the region, and its market capitalization is the largest. Further, the turnover ratio in Saudi, which is an index of market liquidity, is considered to be the most active among all GCC stock markets. The highest level of market capitalization, as a percentage of the GDP, was in Saudi. This high rate could reflect the importance of the stock market in the national economy; it could also reflect the importance of the market in Saudi from both regional and international perspectives.

Chapter four reviews the methodology and data of the research, beginning with an examination of level series in descriptive statistics, and then to examine optimally lagged multivariate models. The econometrics methodology starts with a procedure of the main analysis of the optimally lagged model; and this chapter reviews recent techniques used for testing financial integration, such as Johansen's cointegration, VECM, Granger-causality, variance decomposition and impulse response functions.

The second section of chapter four presents the level series data used in this research. First, the data sources are described, along with structural stability and descriptive statistics for the GCC financial markets in general and banking sectors in particular. Statistics for the global markets, including the oil market, are also reported. Further, the chapter briefly presents evidence of the co-movements of the all markets at both regional and global levels, providing initial indication of the strength of contemporaneous relationships of long-term equilibrium and short-exogeneity. Finally, the model and the hypotheses of this research are presented, following by analysis of the GARCH (1, 1) model.

The findings of this research are presented in chapter five. This chapter intensively reports the results of the econometrics techniques used to investigate regionalization and globalization of the GCC financial markets over the period from January 2005 to December 2013. At regional level, the chapter begins with the regional financial integration amongst the six GCC countries, and testing for long-term and short-run

relationships between these markets. Second, the cointegrating relationships have also been examined between the GCC and global markets, and finally, the study presents the findings of sectoral market integration in the GCC region, focusing in banking sector.

7.3 Main Findings of Research

The procedure for testing market integration begins with testing unit roots in level series, the JJ cointegration test, VECM, Granger-causality, variance decomposition and impulse response functions. The unit root test is the most commonly technique used for stationarity test of time series data. It is also considered as a preliminary step in testing for cointegration, as all series need to be integrated at the same order $I(1)$. Stationary time series data means that the behavior of time series data remains the same over time. However, dissimilarity for a non-stationary series suggests that the effect of a shock will not remain the same over time, and can lead to spurious regression.

The results indicate that the null hypothesis of the existence of a unit root in the levels cannot be rejected for all series in the case of level series. The values of *t*-statistic of the both tests ADF and PP are greater than the critical values, which means acceptance of the null hypothesis for the presence of unit root in the level series. The results of unit root tests for three periods in case of first differences show that all series are stationary and statistically significant at 1% level, as the *t*-statistic is smaller than critical values for all variables at different periods. Thus, all variables appear to be non-stationary in levels, and stationary in first differences, which means these variables are integrated of the first degree $I(1)$.

It well known that the JJ cointegration test can be affected by the lag length used in the VAR, hence, it is essential to estimate a VAR model and select an optimal lag length prior the cointegration test. The results of VAR model for both regional and global levels show the stability of the three models and the number of optimally lags length has been chosen based on Akaike Information Criterion (AIC).

The preliminary analysis shows that the GCC-price indices exhibit similar co-movements with each other and with the global markets. The contemporaneous correlations and the constant spillover model of all variables clearly suggest that

significant spillovers of return and volatility are detected aftermath of the 2008 financial crisis.

On a regional basis, the results of the JJ test for the *VECM-1* show that there are long-term equilibrium relationships linking the GCC stock markets over the two sub-periods as well as the full period. These cointegration relationships have increased after the crisis period, indicating a significant influence of GFC on the performance of market returns of this region. At the global level, the results of the *VECM-2* illustrate the absence of any significant long-term equilibrium relationships linking the GCC stock markets and global markets prior the crisis period. Further, in the full period, the results of maximum eigenvalues of the JJ cointegration analysis suggest the absence of any cointegration relationships between variables. However, the JJ test detects two cointegrating vectors linking the GCC stock markets and the global markets over the post-crisis period.

The results of JJ test of the *VECM-3*, which considers the relationships between the banking sectors in GCC indicates at least one cointegrating vector ties the six banking sectors together in the long-term. Further, the long-and short run relationships between these markets have increased after the crisis period.

The liberalization and market efficiency of the GCC financial markets are considered one of the main determinates for increasing the degree of financial integration among these countries. Additionally, this thesis found evidence of the relationship between the GFC downturn and the process of market integration. The thesis also provides evidence that the decline of GCC-equity markets in July 2008 is subjected to the contagion of the GFC, which also affect most international markets.

To investigate the dynamic relationships between variables in the short-run, the study used Granger-causality, variance decomposition and impulse response functions over the two sub-periods. At the regional level, the results of the Granger-causality test within VECM indicate the existence of short-run causal relationships among the GCC stock markets in both sub-periods. This suggests that these markets influence each other in the short-term since the bi-directional and unidirectional relationships were found between them. Moreover, the results also show that the banking sectors in this region influence each other in a short-term, and these relationships have increased after the crisis period.

Globally, the results from Granger-causality reveal some causal relationships between the GCC stock markets and global markets in particular after the crisis period. Saudi is the one market was found to have a bi-directional Granger causal relationship with the oil market. This outcome is supported later by the results of variance decomposition and impulse response functions.

The results of variance decomposition for the pre-crisis period indicate that most GCC Stock markets are exogenous in the sense of percentage of the error variance accounted by their innovations. The Omani market innovations influence most of GCC stock markets at different time horizons, while Kuwait and Bahrain were the least exogenous markets within the GCC in pre-crisis period. These results are consistent with the findings of Granger-causality, where the Omani market Granger causes Qatar, Saudi and the UAE.

Throughout the post-crisis period, the findings of the variance decomposition showed that the variables in the system have more exogenous power than the pre-crisis period. The percentage of the foreign explanatory power is quite strong in the stock markets of Qatar, Saudi and UAE. The Bahraini market innovations influence most of GCC stock markets at different time horizons. The variance decomposition for the full period indicated that all variables in the system still possessed less endogenous power as in the post-crisis period. Further, as in the pre-crisis period, the Bahrain market innovations influence most of GCC stock markets.

Similarly, the results of variance decomposition for the GCC banking markets over indicate that three markets out of six (Qatar, Saudi and the UAE) were relatively exogenous in the sense to the percentage of error variance accounted for by their innovations, and the Kuwait market innovations influence most of GCC banking markets at different time horizons.

The contention that Saudi Arabia and in less degree the UAE are the most important markets in driving other states towards an inter-regional integration is undoubtedly important. Thus, further analysis has been taken by decomposing the GCC-share prices into their permanent components by means of Johansen (1991) and Gonzalo and Granger (1995) approaches. The conclusion of both tests indicates that Saudi and the UAE are the most important markets in leading others towards the long-term relationship.

At global level, the results of variance decomposition for the pre-crisis period showed that GCC stock markets are much more sensitive to a shock within the region, than the global markets. However, oil market innovations have the greatest influence on the Bahrain and Kuwait markets, while other GCC stock markets were explained mainly by the European financial index (EU350). These results are consistent with the findings of the Granger-causality test, where the European index Granger causes all GCC stock markets except for Bahrain. During the post-crisis period, the findings of the variance decomposition show that the global variables in the system have more influential power than the first period. However, Oman, Qatar, Saudi and UAE are become more sensitive to regional shock, rather than global.

Regionally, the results of IRF show that the Bahrain market has a positive response to its own shock. It also reveals that all GCC stock markets responded positively and significantly to shock in Bahrain market after two days horizon. For instance, the Oman and Saudi markets are the most responsive and reactive to the shock in Bahraini market after one day, then commenced towards an equilibrium relationship. Further, the other GCC markets also responded to one standard deviation shock in Bahrain market in a positive and highly significant manner.

The results of IRF for the first sub-period indicate that all markets response negatively and insignificantly to one standard deviation shock on the global markets, with the exception of the US stock market. The responses of the GCC share markets to one standard deviation shock on the US market presented a persistent positive response from all markets whit the exception of Oman. This suggests that these markets are associated with the American market to greater extent than the European and oil markets. The second sub-period shows statistical and significant response from equity markets in GCC to one standard deviation shock on the global markets, supporting and confirm the findings of the JJ cointegration test and variance decomposition.

7.4 Implications of the Findings

The most significant findings of this research is that the cointegrated stock markets in the GCC countries can be regarded in the long-term as a common regional market characterized by similar factors of systematic risk. This has implications for both policy-makers in regulating existing policies in the GCC, and investors looking to

allocate portfolios in an efficient manner. According to Granger (1986b), in a weak form of market efficiency, it is possible to predict the long-term price movements of the other markets based on historical data, since they share the same stochastic trend and long-term equilibrium. In this context, Granger (1986a) claims that:

"*If x_t , y_t are a pair of prices from a jointly efficient speculative markets, they cannot be cointegrated, if the two prices were cointegrated, one can be used to help forecast the other and this would contradict the efficient market assumption*" (Granger, 1986, p. 218). This argument was criticized by a number of researchers (for example, Baffes, 1994;Engel, 1996;Ahlgren and Antell, 2002) all indicate that cointegration does not contradicts the efficient market hypothesis. In this regard, Ahlgren and Antell (2002)Ahlgren and Antell (2002)Ahlgren and Antell (2002)Ahlgren and Antell (2002)Ahlgren and Antell (2002) argues that:

"Cointegration does not necessary rule out stock market efficiency, and that is because market efficiency does not rule out predictable stock returns but rule out arbitrage opportunities from predictable returns" (Ahlgren and Antell, 2002, p. 852).

Accordingly, having cointegration between GCC stock markets does not necessary rule out that those markets are efficient. However, the empirical findings of this research indicate that the GCC stock markets are integrated with each other, and these cointegrating vectors have increased aftermath of the 2008 financial crisis. Furthermore, these markets are reacted sharply to the crisis shock in the US and Europe since the second half of 2008, as evidenced by the sharp drop in the markets' indices. This is due to the fact that the GCC financial markets are affected by changes in the global financial markets.

The preliminary analysis shows that the GCC-price indices exhibit similar co-movements with each other and with the global markets. Additionally, the cotemporaneous correlations and the constant spillover model of all variables, clearly suggests significant spillovers of returns and volatility caused by developed markets after the crisis period. However, it should be noted that the similarity of co-movements between markets does not necessarily follow that the same markets would be integrated.

For the issues of portfolio diversification, the empirical findings in this research have several important implications on both regional and global levels. The results exposed that the GCC financial markets are integrated over the two sub-periods and also the full period, implying the existence of the law of one price (LOOP). Further, the banking market also found to be integrated regionally and plays a vital role in leading the aggregate market index of the GCC countries. This implies that the potential of foreign investors to obtain abnormal profits through portfolio diversification in the GCC is limited in the long-term; therefore, abnormal profits will be arbitraged away in the long-term. The results of the study also demonstrate that regional banking market integration has much do with economic and financial market integration, with one of the objectives of agreements, such as that in the GCC, to foster the removal of barrier to free trade in financial services.

The significant level of cointegration in GCC region can be attributed to similarities in economic and financial system. As it well known, the GCC economies mainly rely on oil and gas exports with fixed exchange rate systems. In addition, the liberalization of financial markets that has already taken place in most GCC countries is also considered to be one of the reasons for increasing the cointegration relationships in this region.

Although no arbitrage opportunities are expected within the GCC in the long-term, the national and forging investors will still eligible to attain arbitrage profits through the portfolio diversification in the short-term. The results of ECTs of the VECMs indicated that Kuwait, Oman and Qatar have the lowest speed of adjustment towards long-term relationships, particularly prior the crisis period. This suggests that investors can invest in these markets to obtain abnormal profits through portfolio diversification.

Saudi market has the lowest speed of adjustment towards common stochastic equilibrium relationship during the pre-crisis period. This is due to the fact that the Saudi Arabia has had more legal and regulatory impediments for foreign investments than other GCC stock markets. Thus, the GCC nations have received more opportunities to diversify their risks by redirecting their investments in the Saudi market. However, Saudi Arabia has removed recently some of the most-restricted regulations and barriers, and the green light has been given to foreign investors for

diversifying their portfolios in this country. This is one of the Saudi Government policies to boost non-oil industries.

The empirical findings of the JJ cointegration test reports 'weak' cointegration relationships between equity returns of GCC and global markets. Further, the analysis of Granger-causality also indicates significant weak exogeneity of developed markets, specifically from the returns of the S&P 500 and oil index. This implies that the equity returns in GCC are partly segmented from the international markets, particularly before the crisis period. These findings could be attributed to differences in financial systems and economic policies between respective markets.

As oil is the major revenue for the GCC region, it is axiomatic that stock markets in the GCC will be affected by any sharp fluctuations in the oil market. This will increase risks in GCC financial markets to a greater extent in other international markets. However, in early 2011, the so-called "Arab Spring" in the Middle East played a significant role in reducing the equity portfolio flow of foreign investments to stock markets in the GCC region, especially in state of Bahrain. This abnormal event increased obstacles for these markets to recover from after the shock of the global financial crisis.

To summarize, member states of the GCC have taken important steps to achieve their goals to build a strong linkages among their capital markets, which result ultimately at stabilizing of financial system and increasing economic growth in this region. The GCC countries should continue follow their economic policies aimed at increasing the degree of economic and financial integration. Further, more efforts should be devoted towards building regional economic union, which could be archived by consolidation of fiscal and monetary policies taking into account economic structure in each country. This should be accompanied with other economic reforms such as, building a strong regulatory and supervisory framework, privatization, increasing market capitalization to create a single stock market capable to compete in the era of globalization.

7.5 Limitations of the Study and Suggestions for Future Research

As with most research there were various limitations, which restricted the boundaries of what could and could not be accomplished in this thesis. These limitations are mainly related to the areas that could not be covered within the scope of this

dissertation. The availability of data used in this study was limited and for most countries such as Oman, Qatar and the UAE are not available from reliable source before 2005. However, it was more importantly to capture the period of financial crisis, which taken place in 2008.

The thesis has focused on banking sector as a key agent of financial system in the GCC countries. However, the validity of the thesis could be stronger when other sectors are included in this research. However, several routes for future research that can be derived from this thesis could be summarized as follows:

- The financial systems in the Gulf Arab region consists more capital markets, such as real-estate, industry, telecommunication and services. It would be useful if future research could extend the scope of data source to include these sectors at regional and global levels. Accordingly, future extended research can clarify financial and economic factors, and thus, facilitate a process of harmonization among the GCC countries.
- It would also be most interesting if future research turns attention to risk returns by using time-varying Beta values in order to determine the efficiency of the GCC-wide sector indices.
- Future research can be conducted to examine volatility and stock market efficiency at sectoral levels. These issues have received a great deal of attention recently, and such study can be conducted either regionally or globally.

APPENDICES

Appendix (A)

Figure A.1 Impulse Response Analysis of Six GCC Stock Markets (Pre-crisis)

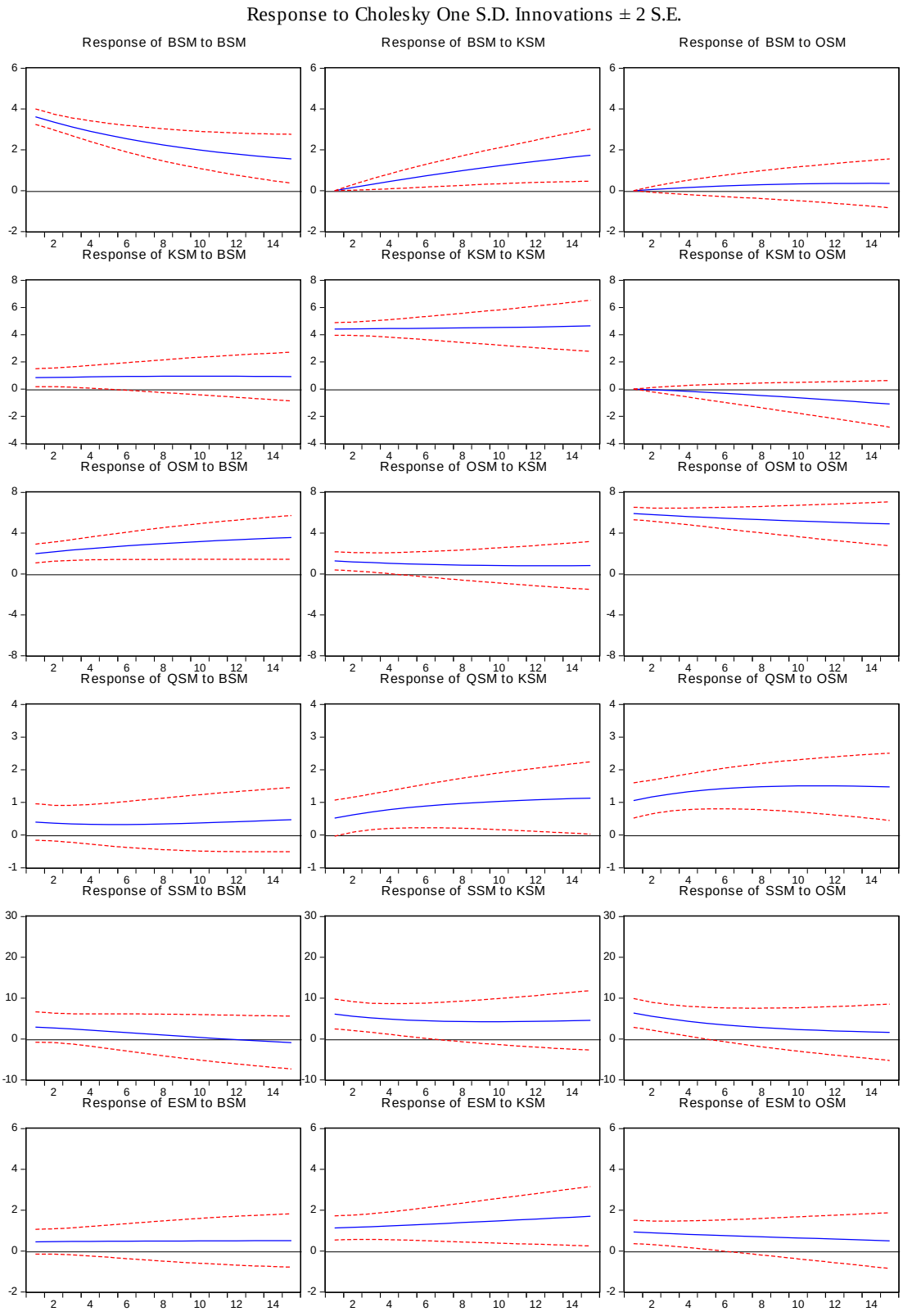


Figure A.1: Continued

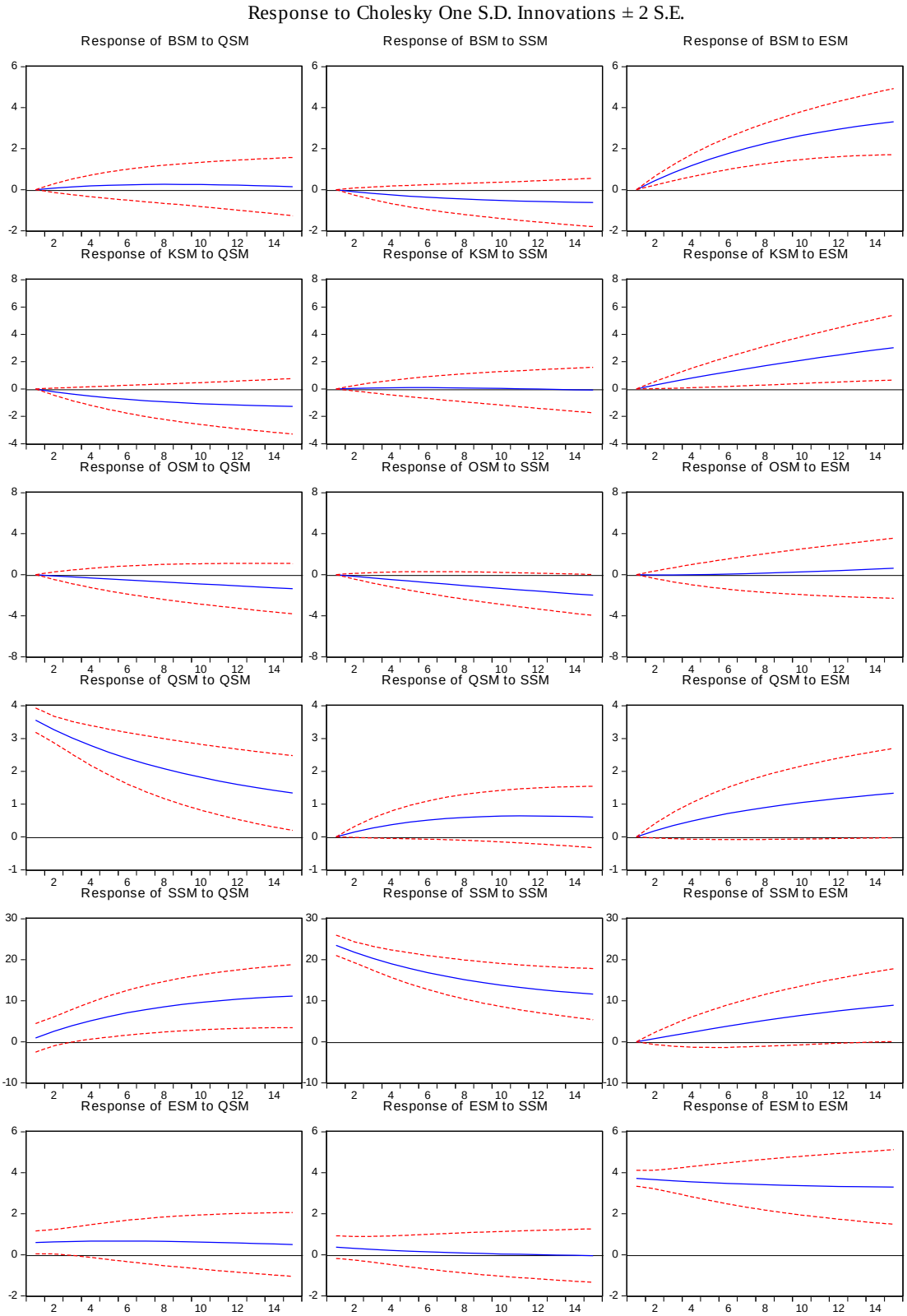


Figure A.2 Impulse Response Analysis of Six GCC Stock Markets (Post-crisis)

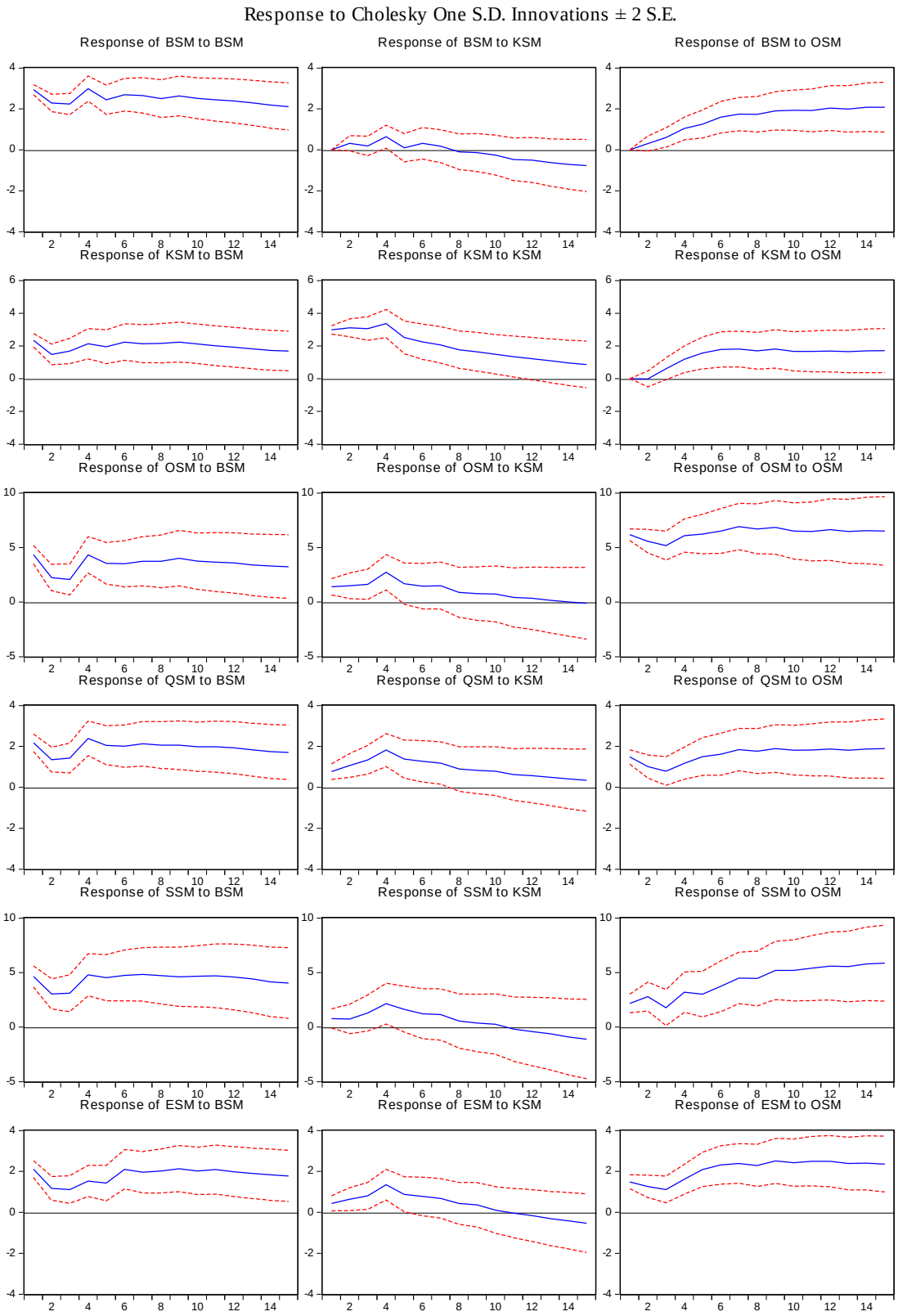
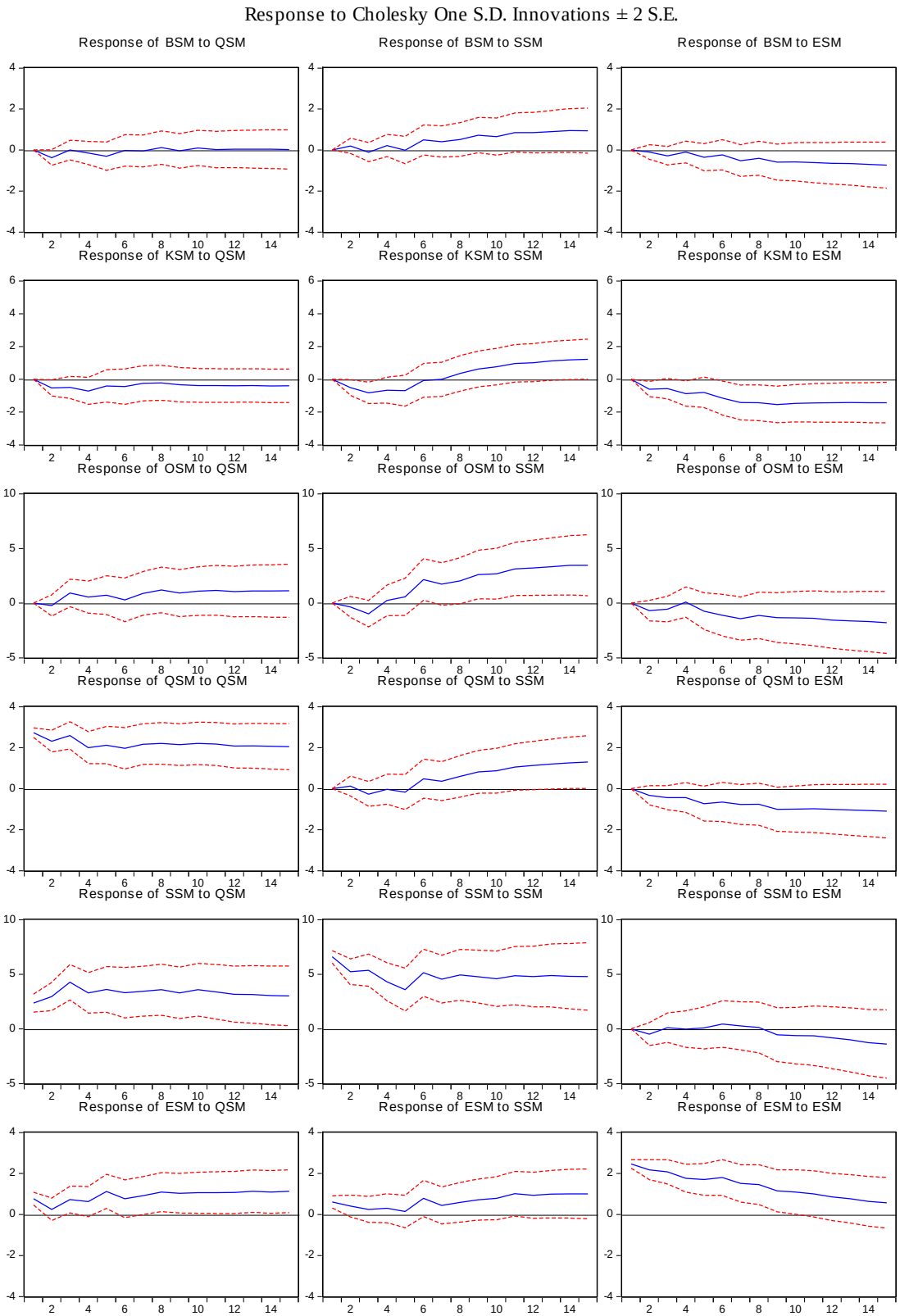


Figure A.2: Continued



Appendix (B)

Figure B.1 Accumulated Response of the GCC Stock Markets to One S.D Shock in Global Market Innovation (Pre-crisis)

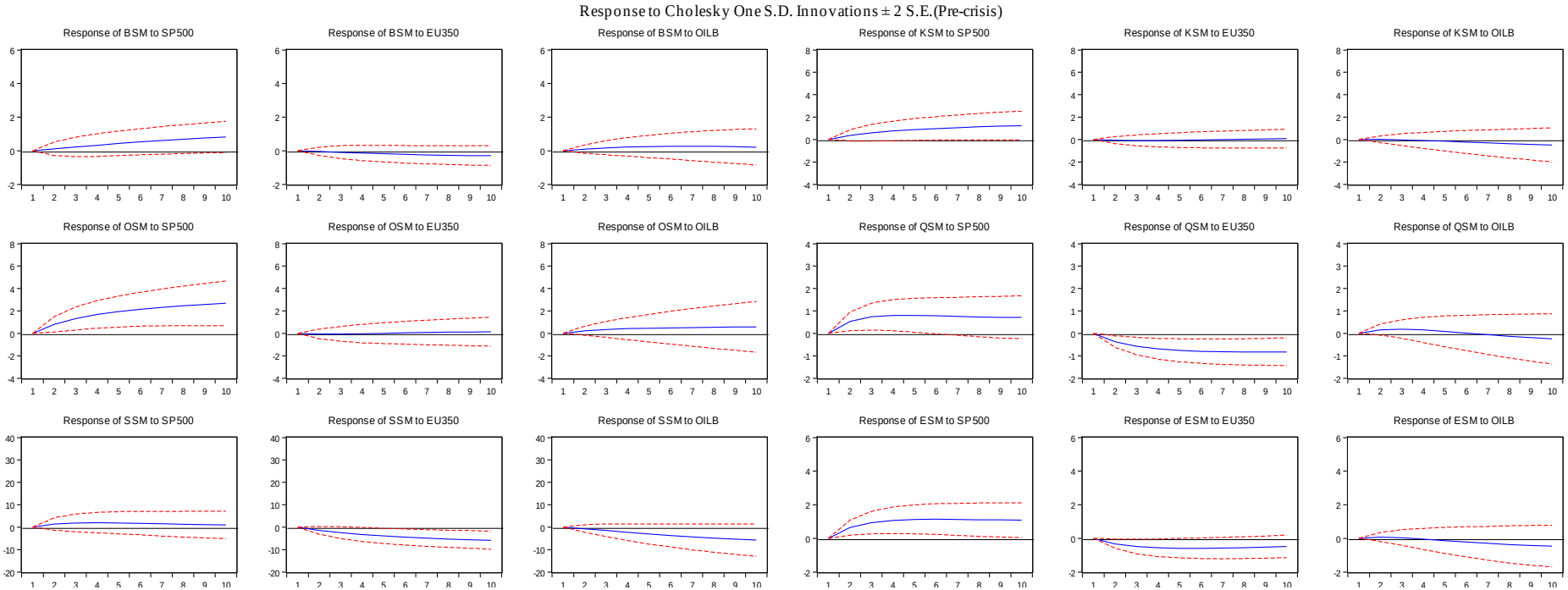
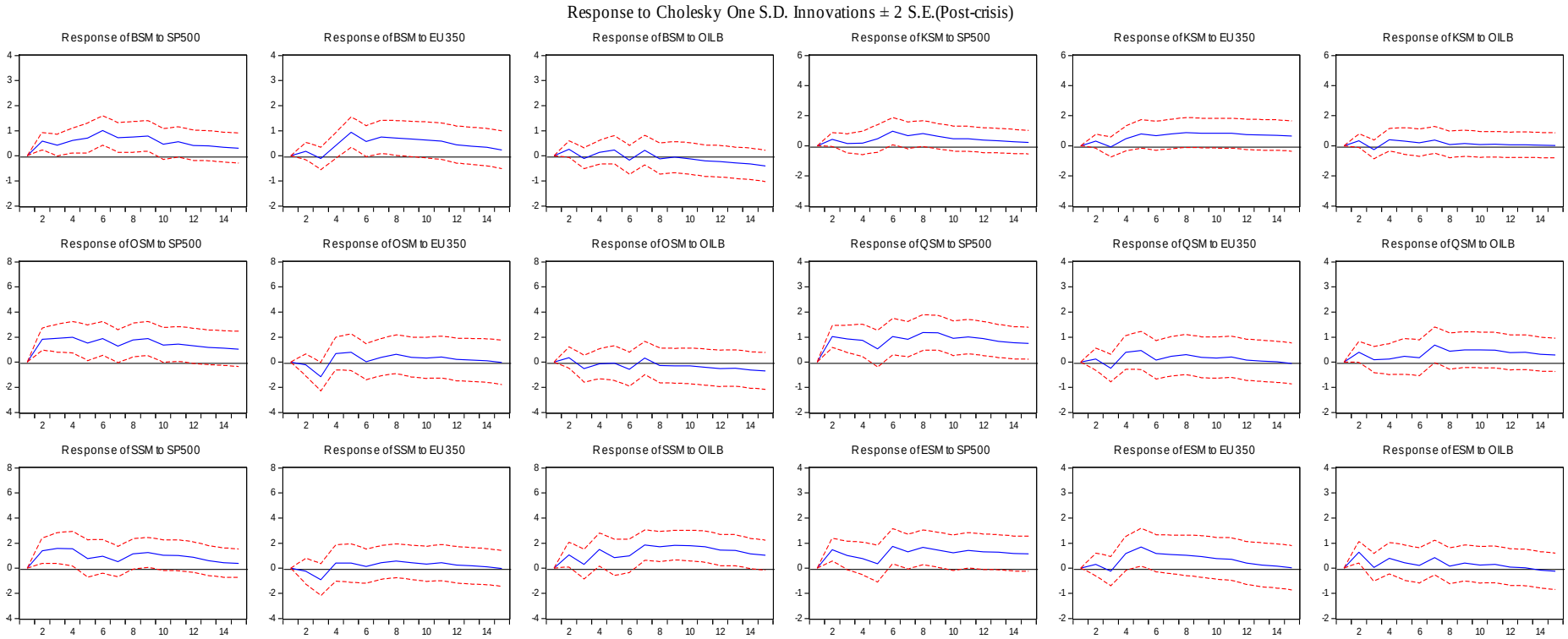


Figure B.2 Accumulated Response of the GCC Stock Markets to One S.D Shock in Global Market Innovation (Post-crisis)



Appendix (C)

Figure C.1 Impulse Response Analysis of Six GCC-Banking Sectors (Pre-crisis)

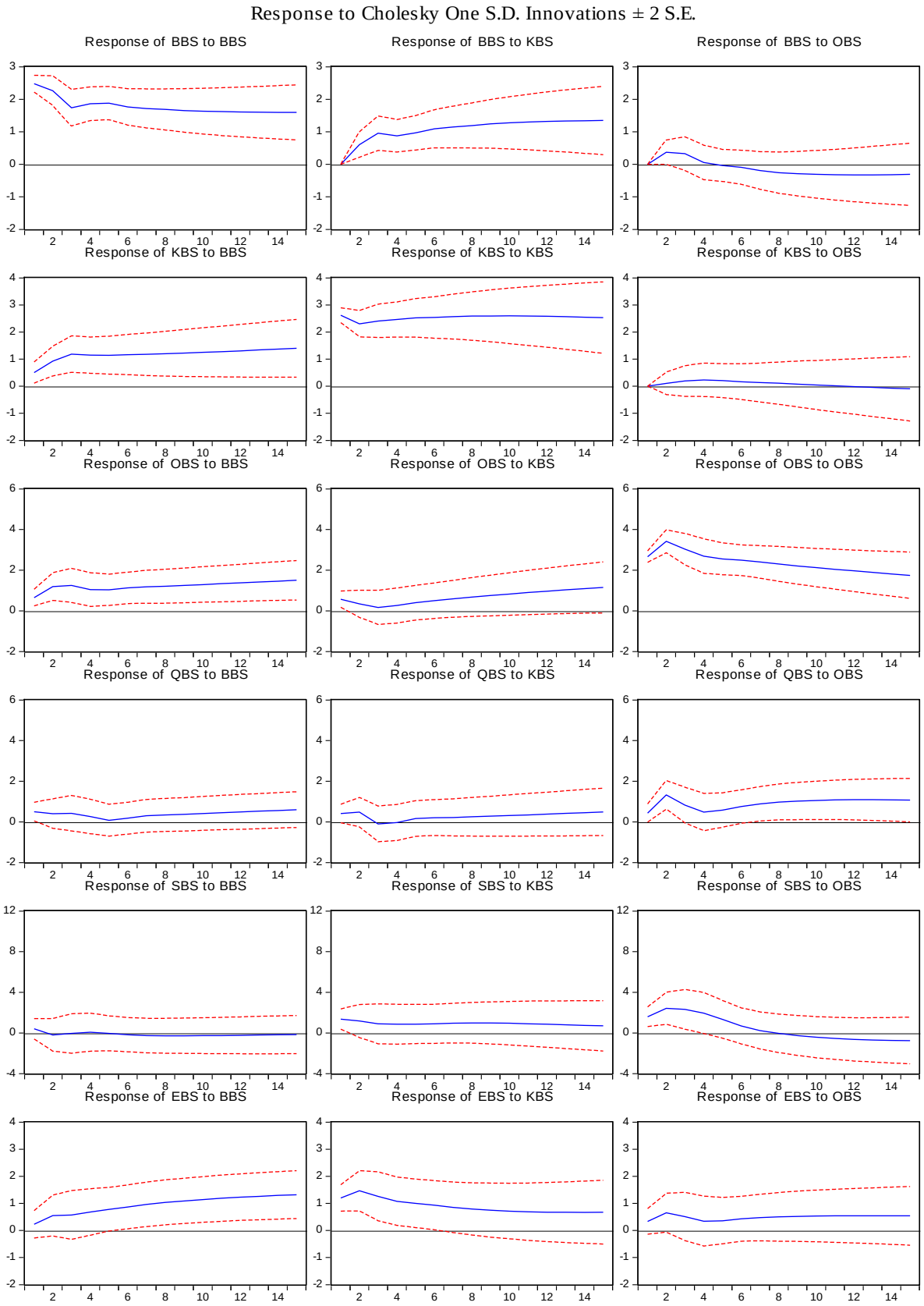


Figure C.1: Continued

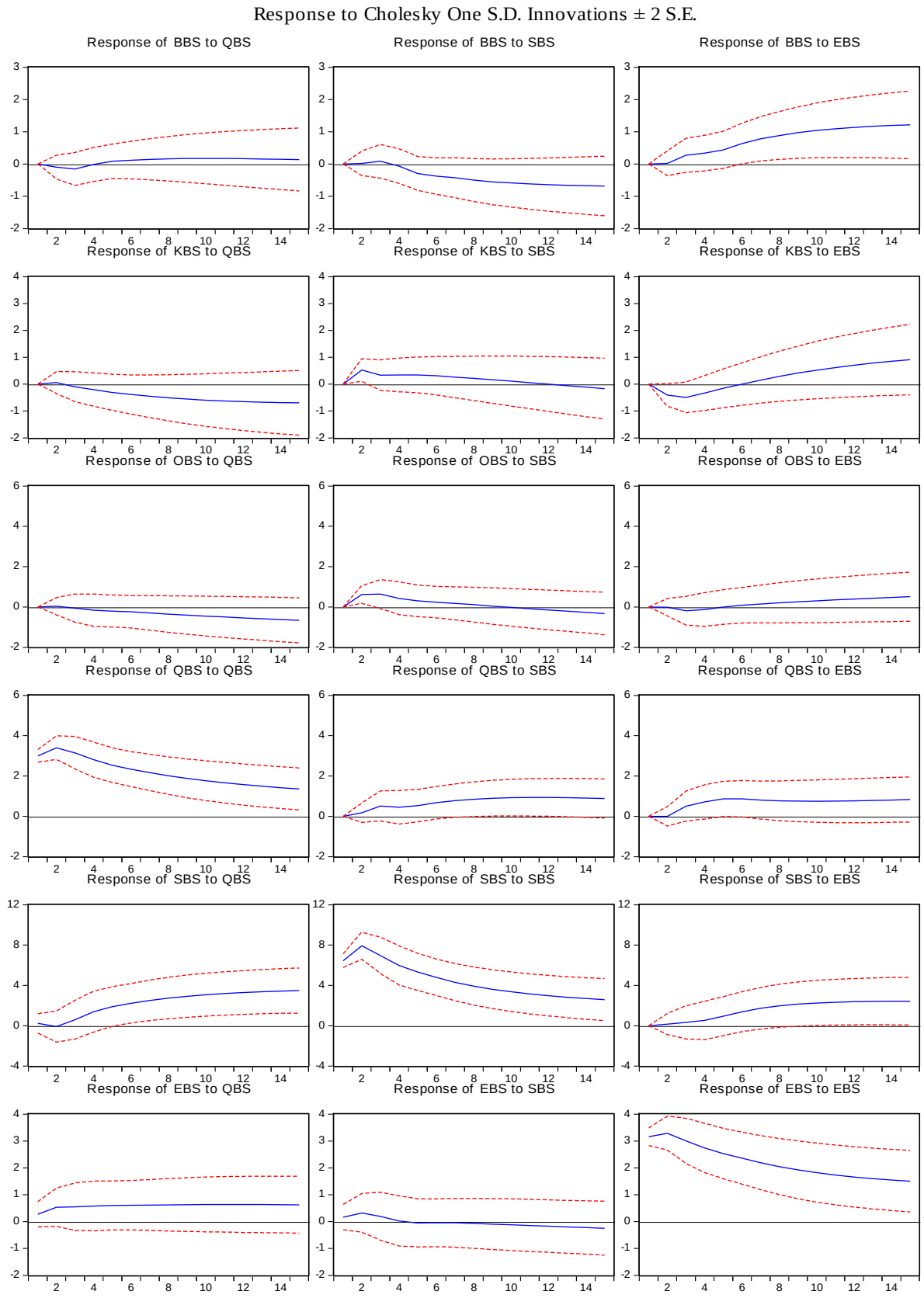


Figure C.2 Impulse Response Analysis of Six GCC-Banking Sectors (Post-crisis)

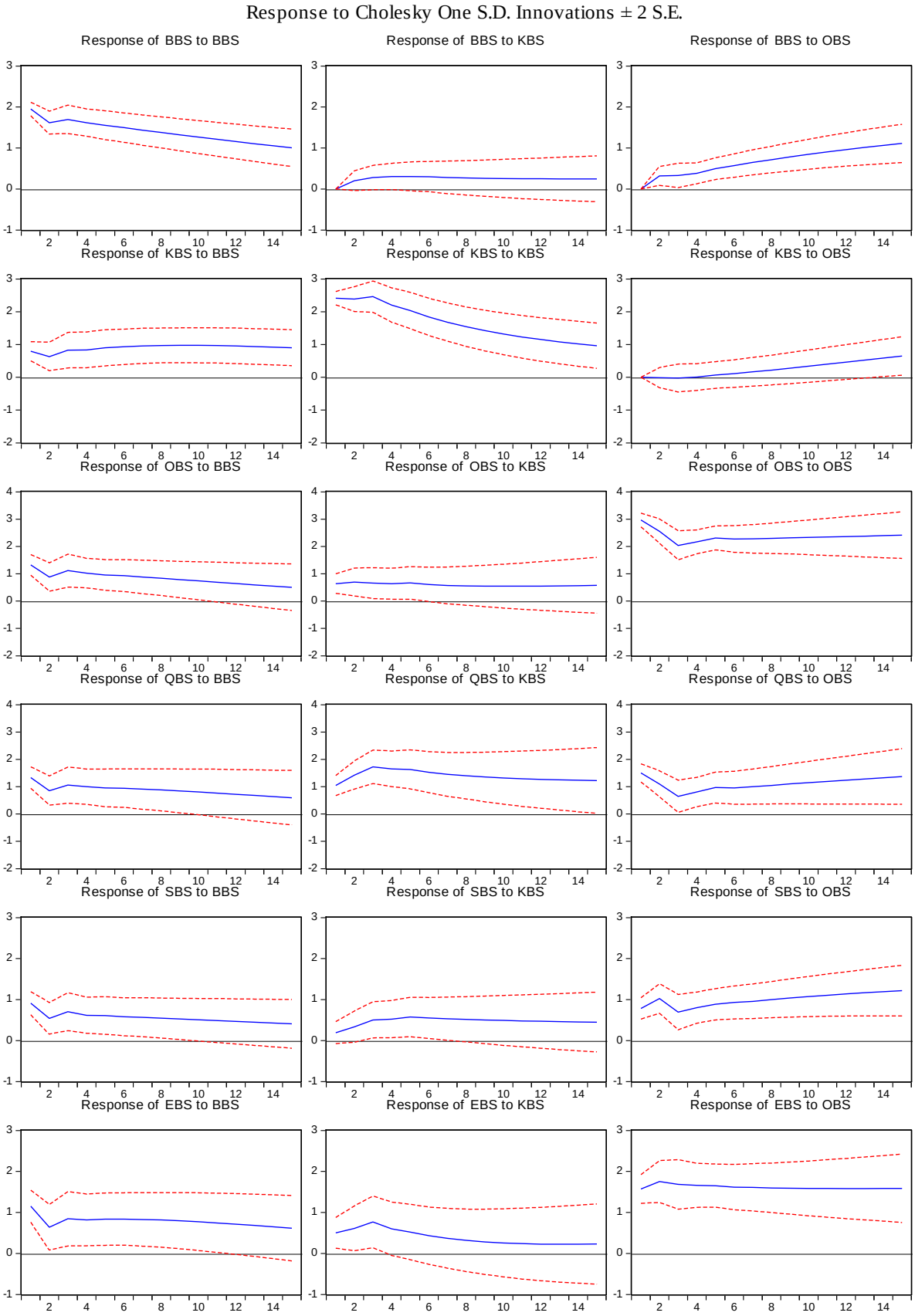
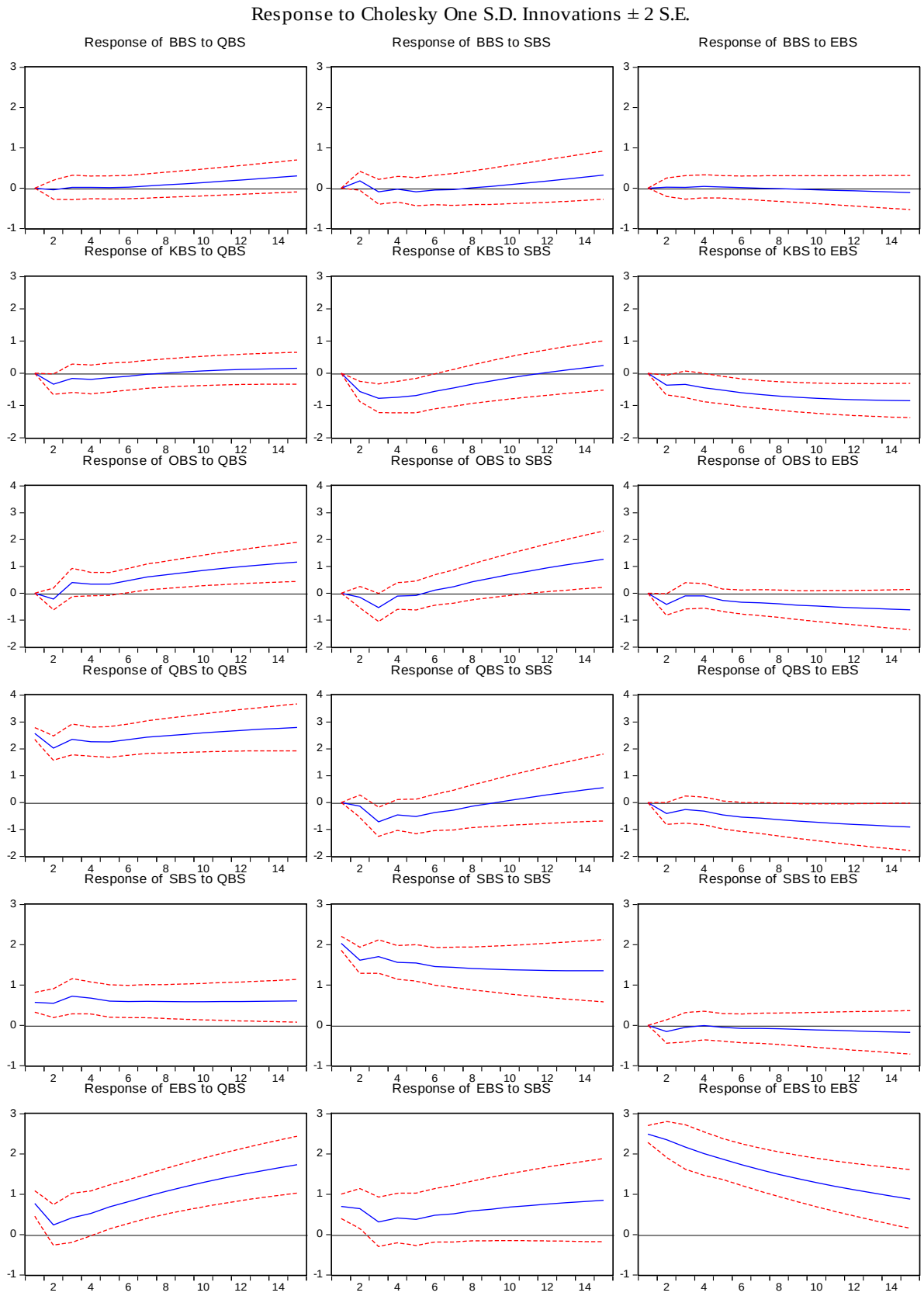


Figure C.2: Continued



Appendix (D)

Figure D.1: Returns of GCC Stock Markets and Global Markets

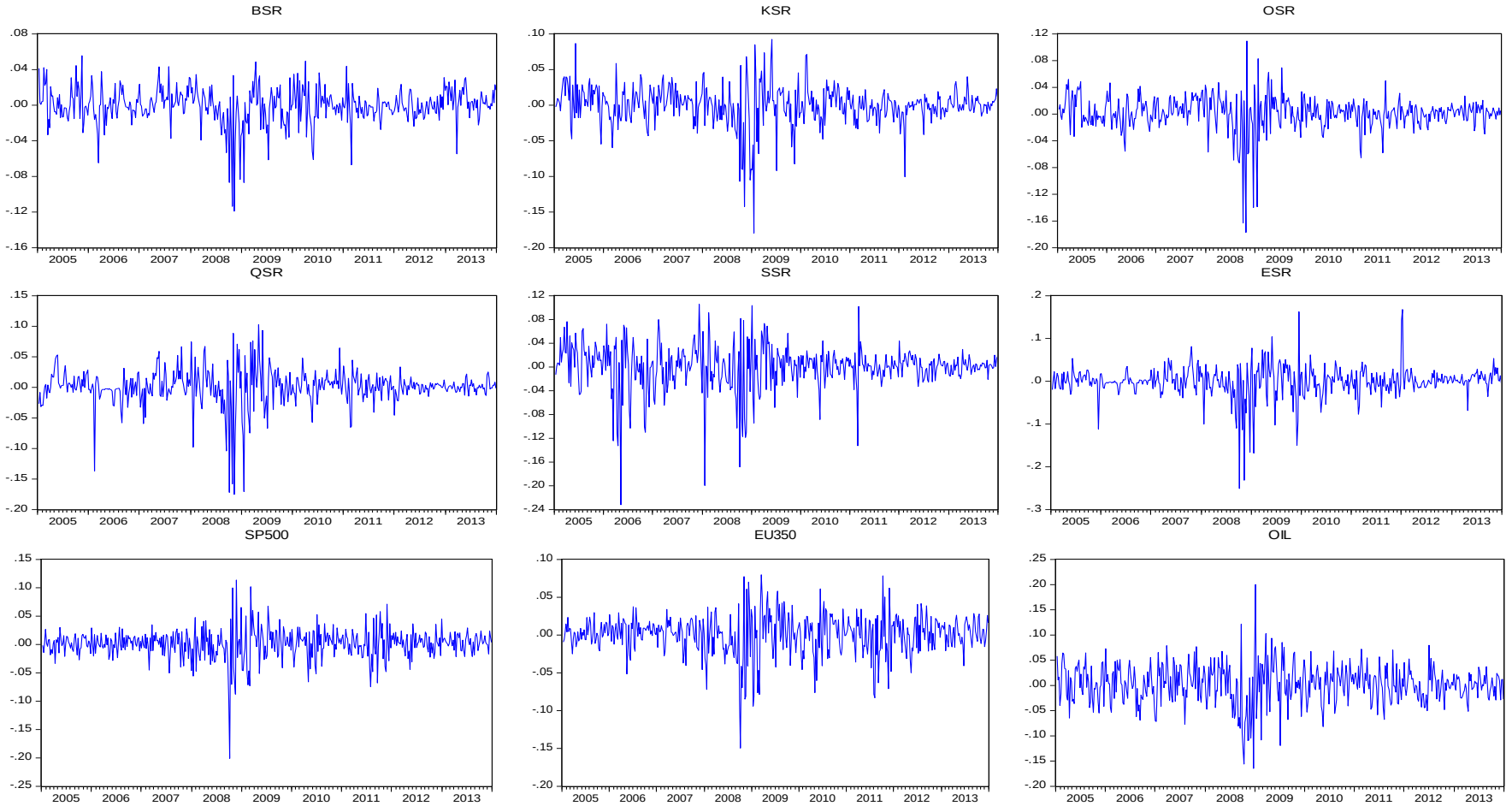
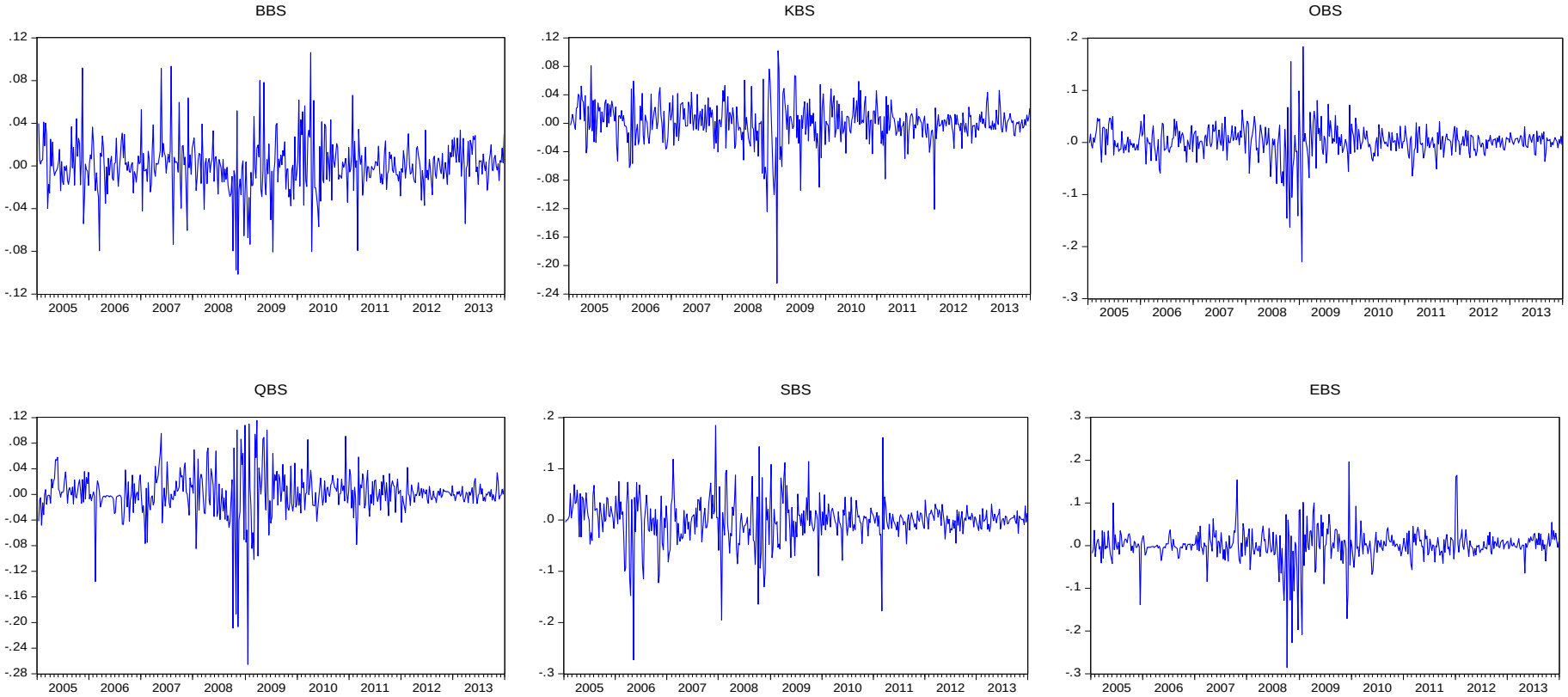
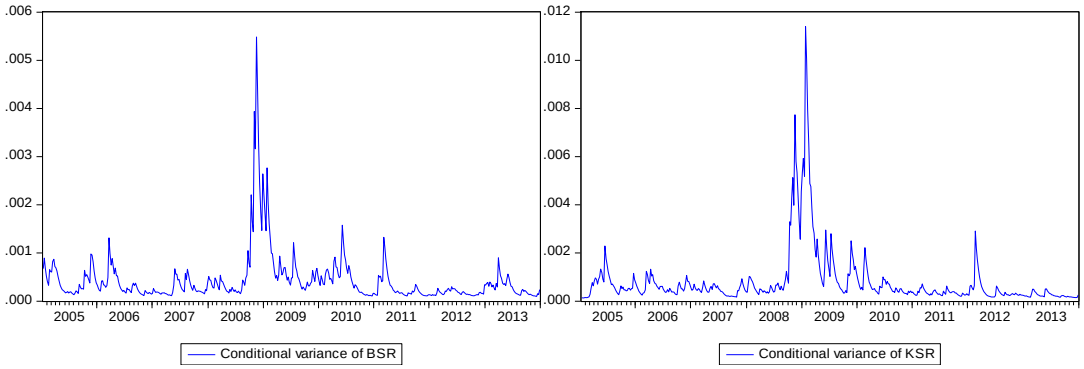


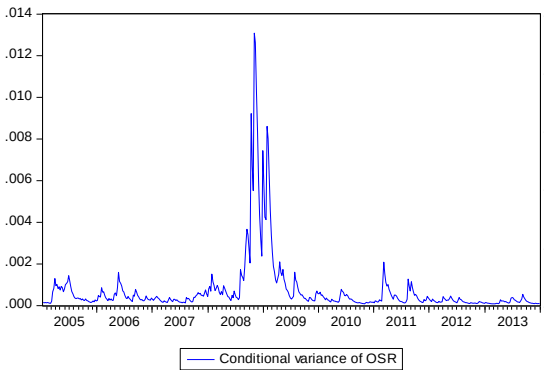
Figure D.2: Returns of GCC Banking Sectors

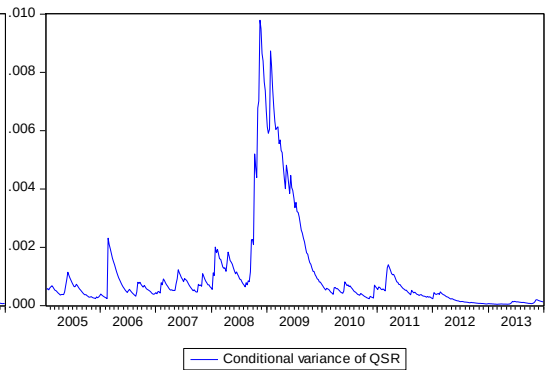


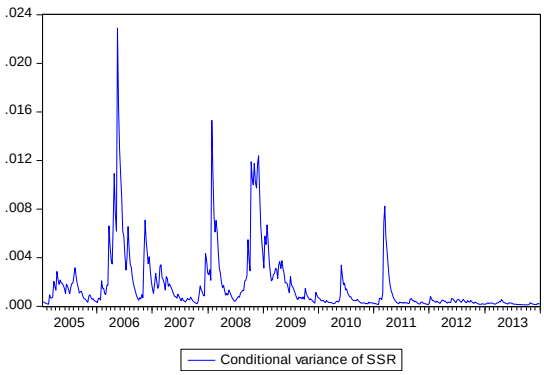
Appendix (E)

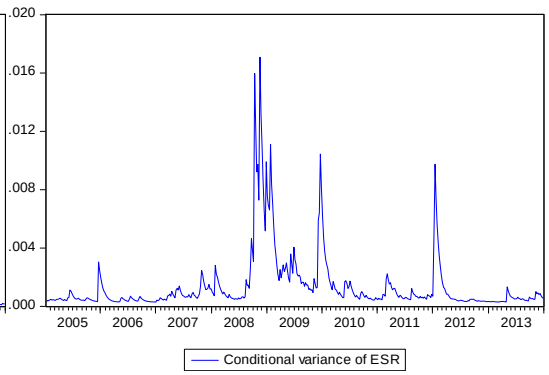
Figure E.1: Conditional Variance of GCC Equity Returns











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