Oil and stock market interlinkages: The case of the GCC bloc

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Abstract

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Motivated by increased stock market integration, gaps in the literature and the recent financialization of oil markets, this thesis studies the behaviour of the fledgling Gulf Cooperation Council (GCC) stock markets against innovations in international financial markets and oil prices. The key results of the thesis highlight the relative segregation of the GCC markets and the importance of the EU and the UAE in determining the inter- and intra-regional equity linkages, respectively. In terms of their reactions to oil shocks, similar to the financial markets of oil-exporting nations, the GCC markets are stimulated by oil precautionary demand shocks during bearish phases, yet, the intensity of the impact is significantly more pronounced. Also, oil price change is a key factor of the US-GCC and EU-GCC stock market interdependence. Finally, oil innovations display upper tail dependence with US-GCC and EU-GCC correlations. The dissertation contributes to the existing literature by remapping the information transmission mechanism in the GCC by examining the inter- and intra-regional linkages in the GCC while considering both mean and variance linkages. Additionally, using the Kilian (2009) method, the thesis contributes to the literature by examining oil shocks influence on the GCC markets in contrast to their counterparts in oil-exporting and importing economies. Notably, this research characterises the oil-equity relation depending on the type of oil shock, the energy profile of the country and the state of the financial market. Finally, for the first time in the macroeconomic literature, the thesis establishes oil as a key macroeconomic determinant in the GCC stock market interdependence. The results present the GCC as a fresh destination to welcome funds from global investors and portfolio managers interested in cross-country diversification benefits. Also, oil price change is presented as a tool to forecast equity correlations which is vital for portfolio construction and balancing efforts. The outcome of the thesis conveys information for domestic policymakers in the GCC attempting to formulate macroeconomic policies. Finally, the outcomes contribute to academic efforts in understanding the interrelations between financial markets in the context of emerging/frontier markets.

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Chapter 1

Introduction

This doctoral dissertation studies the behaviour of the Gulf Cooperation Council (GCC) markets against innovations in oil and international financial markets. The thesis examines the dynamics of the GCC by assessing three different but related empirical research perspectives. First, the thesis examines the GCC stock market linkages with global markets. The second perspective investigates the impact of different oil price shocks on the GCC markets during different market conditions. Third, the dissertation decomposes the GCC stock market interdependence into oil and relevant macroeconomic variables.

The motivation behind the thesis stems from two major innovations in international finance: first, the global equity return synchronisation; second, the oil fracking revolution and the, so-called, financialization of oil markets. The key results of the thesis highlight the relative segregation of the GCC markets and the importance of the EU and the UAE in determining the inter- and intra-regional linkages, respectively. Also, oil price change is a major determinant of US-GCC and EU-GCC stock market correlations. Finally, in terms of their reactions to oil shocks, similar to the financial markets of oil-exporting nations, the GCC markets are stimulated by oil precautionary demand shocks during bearish phases, yet, the intensity of the impact is significantly more pronounced.

Over recent decades, nations have experienced increasing globalisation and consequently higher levels of economic and financial integration (Beine et al., 2010). Increasing stock market integration occurs due to a rise in cross-border flows, lower financial barriers (Agénor, 2001) and technological advancements in trading (Issing, 2001). The empirical evidence shows that interdependence among international equity markets is growing (e.g., Forbes and Rigobon, 2002; Kim et al. 2005; Longin and Solnik, 1995; Morana and Beltratti, 2008). This is detrimental to the benefits of international diversification and increases the transmission of shocks among financial markets (Karolyi and Stulz, 1996).

Despite their increased volatility, emerging markets enjoy high mean returns and low levels of linkages with developed markets (Bekaert and Harvey, 1997). Consequently, during the 1990s, compared with developed markets, emerging markets became a popular destination for individual and institutional investors seeking cross-country diversification benefits (Bekaert and Urias, 1996), in response, financial markets have become more integrated (Bekaert, 1995). This propensity in emerging markets caused them to co-move with developed markets and to display similar cycles. Having said that, the efforts of global diversification strategies in emerging markets have been increasingly hindered (Kearney and Lucey, 2004). This fact opens the door for newer hubs to welcome the flow of capital from investors seeking cross-country diversification.

A new interest has emerged in a subset of emerging markets known as frontier markets and sometimes referred to as “emerging emerging” markets, which are typically the smallest, least liquid, and, importantly, least integrated markets (Bley and Saad, 2012). Chen et al. (2014) state that frontier countries, which are in the early stages of economic development, generally demonstrate long-run growth potential. They add that the frontier markets of today are often compared to the emerging markets of the late 1990s. Despite the higher transaction costs that characterise frontier markets, this does not eliminate the diversification benefits investors receive from allocating capital to these markets (Marshall et al., 2015).

GCC stock markets are understudied and some are classified as frontier markets (Balcilar et al., 2015), as the GCC nations go through an economic and financial liberalisation process (Bley and Chen, 2006; Al-Khazali et al, 2006; Akoum et al., 2012). Also, they initiate structural reforms and regulations aimed at permitting foreign investors to access their financial markets, thus improving liquidity (Al Janabi et al., 2010; Arouri and Rault, 2012). Consequently, in 2014, the MSCI upgraded the classification of the UAE and Qatar to emerging markets. Saudi Arabia joined the MSCI list of emerging markets in 2019. This leaves the markets of Kuwait, Oman and Bahrain as frontier markets. In addition to constituting tax havens, the member states of GCC jointly account for 40% and 23% of proven oil and gas reserves respectively (Sedik and Williams, 2011). Accordingly, the GCC markets enjoy robust economies, good macroeconomic fundamentals, comparable GDP per capita to developed nations, high credit rating (see Chapter 2 for details) and display unique behaviour towards oil innovations (Awartani and Maghyereh, 2013). The importance of oil to the GCC economies has motivated academic research studying the connection between the GCC markets and oil innovations (Hammoudeh and Aleisa, 2004; Malik and Hammoudeh, 2007; Mohanty et al., 2011; Awartani et al., 2013; Jouini and Harrathi, 2014).

Despite the current popularity of green energy as an alternative to traditional hydrocarbon energy sources, recent technological advances in tight (shale) oil extraction has revived this sector in the US into one of the largest global oil producers. Hydraulic fracturing, commonly known as "fracking" is a technology to extract natural resources such as crude oil. After perforating dense rocks by drilling, huge quantities of water mixed with sand and chemical additives are inserted under high pressure. This opens up fissures in the rock, through which the formerly enclosed gas or oil is then extracted. Combined with horizontal drilling methods, hydraulic fracturing enables access to natural resources which previously could not be extracted by conventional methods (Gandossi, 2013). Remarkably, despite the oil price collapse, oil production from the US Permian Basin continued to increase through 2016 (Kleinberg et al., 2018). Furthermore, according to the EIA, shale oil is present in large quantities in China, Argentina, Russia, Australia, Mexico, northern Europe, Algeria and South Africa. Given that environmental regulations in China and some of the above-mentioned nations are less stringent than in Europe and other Western countries, oil, as a source of energy, will continue to be of considerable importance to the global economy.

Between 2007 and 2016, there have been remarkable fluctuations in the oil price from $145 to $30; despite this, investors consider the oil market as a profitable alternative destination for funds given the positive correlation with inflation and low correlation with equities (Silvennoinen and Thorp, 2013). The increased activity of investors in oil markets without interest in the commodity itself is referred to as the financialization of oil markets. Alquist and Kilian (2010), Hamilton and Wu (2012) and Sadorsky (2014) report an increasing importance of the financialization of oil (see Figure 5.2). Fundamentally, the growing presence of financial speculators and arbitrageurs in oil futures increase the linkages between oil and stock returns. Accordingly, some academic research attempts have established a link between oil and global equity markets (Park and Ratti, 2008; Wang et al., 2013; Sadorsky, 1999; Kilian and Park, 2009; Bastianin and Manera, 2018; Degiannakis et al., 2014). Again, such trends hint at a lower diversification and hedging potential for investors in oil markets. Further, these recent trends pose a threat to financial market stability and convey imminent risk spillovers. Thus, understanding how domestic stock indices react to oil innovations is vital for policy markets and portfolio managers.

The thesis aims to examine the behaviour of the GCC stock markets against innovations in international financial markets and oil prices. In particular, I try to investigate the following questions: first, how does information flow in the GCC markets? Where do inter-regional innovations come from? Given their richness in hydrocarbon reserves, do GCC markets react differently to oil shocks in comparison to global markets? Does oil influence GCC stock market comovements with global markets? In other words, I try to examine the level of GCC markets integration globally and the relevance of oil to this process.

To answer these questions, the thesis is comprised of a contextual chapter and three empirical chapters. Chapter 2 reviews the literature of the understudied GCC bloc while focusing on three theoretical fundamentals including portfolio diversification, market integration and financial contagion. A fourth section discusses the link between oil prices and financial markets. Additionally, the chapter provides background information on the particularities of the GCC financial markets in terms of capitalisation, openness to international investors and liquidity. Additionally, the chapter touches on issues like the significance of oil, the impact of the 2008 Subprime financial crisis, and the correlations of the GCC markets with the US, Japan and the UK in the era of Quantitative Easing.

The first empirical chapter, Chapter 3, examines interdependence and spillover dynamics in the GCC region. Chapter 4 investigates the impact of oil shocks on the GCC markets alongside a sample of markets from oil-importing and exporting nations. Chapter 5 considers oil as one of the influencers of US-GCC stock market interdependence.

The main findings of the thesis highlight the relative segregation of the GCC markets and the importance of the EU and the UAE in determining the inter- and intra-regional linkages, respectively. As highlighted in Chapter 2, trade and geographical proximity can explain the EU-GCC links while market liberalisation mirrors the UAE dominance in the GCC information transmission. Moreover, in terms of their reactions to oil shocks, similar to the financial markets of oil-exporting blocs, the GCC markets are stimulated by oil precautionary demand shocks during bearish phases, yet, the intensity of the impact is significantly more pronounced. Remarkably, while Chapter 2 highlights the diverse levels of oil dependence among GCC nations, this does not translate into significant differences in terms of links between oil shocks and GCC financial markets. Finally, oil price change is a major determinant of the US-GCC stock market correlation.

The above-mentioned results can help GCC policymakers in their efforts to preserve financial market stability against potential spillovers from global equity markets. From an investor’s point of view, the thesis presents the GCC as a fresh destination to achieve global equity diversification. Also, the thesis presents oil as a predictive tool to forecast equity market returns and comovements.

Chapter 3 seeks to detail a clear picture of the inter- and intra-regional linkages between major international stock markets and the GCC region. The GCC bloc is a group of frontier or emerging markets that offer potential diversification opportunities for international portfolio managers. The chapter considers both correlation and return and volatility spillovers between the GCC and the US, the EU, and Japan. Using weekly data over the period from 2004 to 2019 and implementing the ADCC model for correlations and the Diebold and Yilmaz spillover index, I uncover the strength of correlations and the main sources of spillover effects.

The key findings reveal that the EU displays the highest degree of correlation with the GCC bloc and is the most important originator of spillovers to the GCC region. This result runs counter to the literature, where the primary focus is on the US and oil as the major source of influence in the GCC market. Intra-regionally, contrary to the view of Saudi dominance, the UAE, represented by Dubai and Abu Dhabi, is the main transmitter of information in the GCC.

Chapter 3 points out that, compared to the BRIC bloc, the GCC exhibits a lower degree of integration with major financial markets. This, in turn, is a sign of potentially higher diversification opportunities. Further, within the GCC bloc, there is clear and consistent evidence of disengagement between the GCC markets. Saudi, Qatar and UAE are moving towards greater integration while Bahrain and Kuwait (and Oman, to a lesser extent) demonstrate segmentation both regionally and globally. This decoupling pattern between the GCC countries carries essential information to global investors. Such heterogeneity across the markets within this region mean that international investors will not be able to treat each country as a single bloc. This characterisation of individual markets should help in improving investment choices and market portfolios for global investors.

From a domestic policy perspective, the results suggest that policymakers must be cognisant of the EU as a major source of spillovers, in addition to the US. Equally, intra-regional spillovers play a prominent role, with the UAE acting as a gateway for spillovers from international developed markets, a role intensified after the 2014 inclusion of the UAE in the MSCI emerging market index. Additionally, policymakers need to be aware of intra-regional spillovers arising from Qatar, Saudi and Oman. Moreover, notwithstanding the view that own-volatility innovations are considerably higher than volatility spillovers in the GCC markets, episodes of noticeable volatility spillovers can be observed arising from major macroeconomic events such as Federal Reserve policy changes (e.g. interest rate increases in 2006 and 2016, and the 2013 taper tantrum).

Notably, a larger role than previously recognised for the EU in determining the strength of correlations and spillovers is observed. Further, the UAE is identified as the main gateway for spillovers into the bloc. These results are important to academics in understanding the evolution of market linkages, for investors in building portfolio and engaging in risk management and for policymakers in recognising how movements in international markets can impact the domestic.

The second empirical essay, Chapter 4, examines the impact of oil shocks on the GCC equity markets in contrast to other markets in oil-exporting and importing economies. The objectives of Chapter 4 are as follows: first, the extent to which the different oil shocks are able to explain the variations in equity returns. Second, how the energy profile of a country is factored into the interlinkages amongst oil shocks and equity returns. Third, to find out if asymmetry is observed in equity markets reactions to oil innovations during different market conditions.

The empirical analysis is conducted on a monthly basis from January 2002 to May 2018 and incorporates the equity return series of the US, the UK, Germany, Italy, Spain, and France, Japan, South Korea, China, India to represent oil-importers, and Russia, Norway and Canada, Saudi Arabia, Abu Dhabi, Dubai, Qatar, Oman, Kuwait and Bahrain to portray oil exporters. The analysis involves two steps; first, a structural Vector Autoregressive (VAR) model is postulated, including oil production, oil global demand and oil prices (See Kilian, 2009). The shocks are extracted from the system as supply, demand and precautionary demand variants. Second, the shocks are introduced to a quantile regression framework to distinguish the effects of these shocks on stock returns in diverse market states, from bullish to bearish. It is worth mentioning that other global factors are included in the regressions to control for their effects. These factors are the Global Economic Policy Uncertainty Index and the “fear index” or stock market uncertainty.

The findings point to the following: first, the markets of the US and many oil-exporters (i.e. Saudi Arabia, Norway, Kuwait, Qatar, Oman, and Dubai) are positively stimulated by precautionary demand shocks during bear market conditions. The influence is stronger among the GCC markets, which echoes the heavy reliance on oil in the GCC bloc. Second, among the US and the oil-exporting nations of Russia, Canada, Dubai, Kuwait, Qatar and Oman, the precautionary demand shocks have a daunting effect on stock market volatility during boom phases. Third, oil importers of Asia are robustly resilient to oil price shocks while the EU importers display similar behaviour to a lesser extent.

Chapter 5 attempts to determine the significance of oil as a force behind the comovements of stocks among major oil importers and exporters. Specifically, I consider the US and the GCC as the dominant global oil importer and exporters. In addition to oil innovations, the decomposition of the US-GCC correlation controls for global factors and local macroeconomic variables (VIX, business cycle fluctuations, the inflation environment, and monetary policy stance) in sample ranging from December 2002 to December 2016.

The results show oil price change, US interest rates and the VIX index as key explanatory variables for the US-GCC correlation. Sub-sample analysis unveils an increasing impact of oil on the US-GCC correlation over time. Further, the oil impact is more pronounced in the upper tail of the correlation’s conditional distribution. Alternative specifications of oil price such as NOPI and SOP confirm the significance of oil price in explaining interdependence in the US-GCC pair. Furthermore, examining the EU-GCC correlation supports the role of the oil return in explaining its movement. The EU-GCC correlation is also sensitive to oil return volatility, which may result from the expansion of the US shale oil industry which is able to offer some insulation from shocks.

The results show that oil price changes, US interest rates and the VIX index are key explanatory variables for the US-GCC correlation. Knowing how oil affects stock market movement will allow international investors to predict market movements and seek diversification opportunities. Policymakers should also include oil when forming policies directed at financial stability as high interdependence is associated with financial spillovers (Karolyi and Stulz, 1996). This is notably important as the results support greater upper tail dependence when correlations are highest.

This dissertation contributes to the literature by remapping the information transmission flow in the GCC. Characterizing the GCC markets behaviour in response to oil shocks is another contribution made possible using the Kilian (2009) method. Finally, for the first time in energy finance literature, oil price is presented as a macroeconomic determinant of GCC market comovements with the US and the EU. Whilst the core contribution of the dissertation is in the field of emerging markets finance, nonetheless, the dissertation makes a number of contributions to several strands of literature including international finance, energy finance, stock market interdependence, and macroeconomic literature. Therefore, the overall contribution of the dissertation is in merging these several strands of literature to provide a vivid image of the GCC stock markets as an understudied subdivision of emerging markets. A detailed description of the contribution of each empirical chapter is given below.

Chapter 3, in particular, contributes to the literature of international finance, wherein stock market linkages is a main theme. Indeed, the chapter enriches the literature on the interrelationships between developed and emerging equities by focusing on the stock markets in the GCC bloc, which represent an increasingly attractive investment destination, yet are still a marginally investigated subdivision of emerging markets. In detail, this is the first attempt to take a broader outlook on the GCC bloc inter- and intra-regionally where linkages in mean and variance are modelled using both correlation and spillover analysis. The use of the Diebold and Yilmaz spillover methodology has many advantages: the framework permits the inclusion of all countries in one system, which produces more reliable results. Additionally, the methodology models both return and volatility spillovers separately and in a dynamic manner. The chapter contributes to the literature by expanding the scope of interactions as the examination includes major global developed markets (i.e. the US, the EU, and Japan). Therefore, Chapter 3 deviates from classical GCC literature, wherein the focus is exclusively on the US and oil; hence, the chapter sheds lights on the geography of information transformation mechanisms in the GCC bloc.

Chapter 4 contributes to academic efforts in understanding the interrelations between energy and equity markets. In particular, for the first time in the literature, the influence of oil on GCC equity markets is conducted using the Kilian (2009) decomposition wherein oil price innovations depend on their underlying sources as supply, demand and precautionary demand. Additionally, Chapter 4 contributes to the literature by comparing the GCC markets reactions to oil shocks with other oil-exporters. This highlights the relation between the dependence on oil in the economy and domestic equity markets reactions to oil shocks. Econometrically, Chapter 4 contributes to the literature by combining the Kilian (2009) methodology with the quantile regression framework to test the influence of oil price shocks on global equity markets in oil importing and exporting nations. In essence, while the original methodology of Kilian (2009) and Kilian and Park (2009) relies on impulse responses from oil shocks to stock returns in a structural VAR, this study examines the impact of oil shocks on the conditional quantiles of return series. The former methodology focuses on the magnitude and time span of the shocks, while the latter emphasises the significance of oil shocks in different market conditions from booming to bearish.

Chapter 5 contributes to both energy finance and the macroeconomic literature by establishing oil price as a key macroeconomic determinant of equity market comovements. This is accomplished by combining three research aspects; first, the interdependence among international stock markets; second, the analysis of the determinants of equity markets comovements; third, the oil impact on financial markets. Furthermore, to the best of my knowledge, this is the first attempt to analyse macroeconomic influences on the GCC stock market interdependence wherein both mean and tail dependence are examined. This chapter contributes to the stock market interdependence literature by applying the Markov switching model to assess the stability of correlations. This method does not require predetermined dates of breaks, and unlike the Bai and Perron (2003) method, this technique does not require the trimming of observations to determine structural breaks. Finally, while the literature apply NOPI and SOP to test oil influence on stock returns, this is the first attempt to apply these specifications to establish a link between oil and stock market interdependence.

Chapter 6 summarises the main results of the thesis and draws some implications for investors and policymakers. Also, acknowledging the fact that nothing is perfect, the final chapter points to potential weaknesses in the dissertation and suggests interesting possible paths of future research.

Chapter 2
Theory and GCC background

2.1 Literature review

This literature review is based around four theoretical fundamentals; financial market integration, portfolio diversification, financial contagion and a fourth subsection discusses the link between oil prices and financial markets. Given that the first subsection is the main theoretical framework for Chapter 3 and Chapter 5, it will be more comprehensive than the rest of the subsections.

2.1.1 Financial market integration and information transmission

Early attempts in this field of literature rely on the Capital Asset Pricing Model (CAPM), which is based on the assumption that world capital markets are perfectly integrated. This set includes studies of a world CAPM (Harvey 1991), a world CAPM with exchange risk (Dumas & Solnik 1995) and a world Arbitrage Pricing Theory (APT) (Solnik 1983). Bekaert and Harvey (1995) provide evidence of time-varying equity risk premium, indicating the importance of accounting for this time variation. Pukthuanthong and Roll (2009) state that despite evidence of the increasing integration of global equity markets, the literature does not provide a universal measure of integration. Using monthly equity market data from emerging and developed markets and various empirical methods, Billio et al. (2017) maintain that all measures illustrate similar long-run integration patterns. While financial integration is comprised of different characteristics of complex linkages across financial markets, the focus here is on international equity prices convergence.

Rising international integration of financial markets has motivated empirical research to examine the mechanism through which stock market movements are transmitted globally. This field of academic research evaluates how stock market returns in one nation affect those of another and their prospective implications for security pricing, global investing strategies and regulatory policies.

Early research concentrated on the biggest developed markets of the time. Eun and Shim (1989) postulate a nine-market vector auto-regression system (VAR) using daily data from the period January 1980 to December 1985. They find that the US stock market is by far the most influential in the world, reflecting the dominant position of the US in the global economy. Additionally, no single market innovations explain their own variance. An average of 26% of a country's error variance is explained by collective innovations in foreign markets. The US is the most exogenous market with about 89% of its variance explained by its own innovations. Empirical results indicate that Canada is the fastest to respond to US innovations due to the “same region factor” or overlapping trading hours. Hamao et al. (1990) examine linkages among the US, Japan and the UK. The authors make use of a GARCH model and intra-daily data stretching from 1985 to 1988. The investigation of spillover effects in returns and return volatility demonstrate an asymmetric effect in both moments, as considerable spillover effects are observed in the conditional mean from the US to Japan, and from the UK to the US, but not from Japan to the UK.

Theodossiou and Lee (1993) provide evidence of mean and volatility spillovers across five developed markets using weekly data from 1980 to 1991, namely the US, Japan, the UK, Canada, and Germany. They model the conditional mean and variance of the return process using a GARCH-in-means representation in a multivariate system. They find that the magnitude of volatility spillovers originating in the US and transmitting to Canada is smaller than those originating in the UK. This produces evidence against the importance of the geographical proximity role in spillovers. Using the spillover index of Diebold and Yilmaz and monthly data from 1990 to 2013, Tsai (2014) examines the spillover effect in five major stock markets, the US, the UK, Germany, Japan, and France. He finds that information transmission among these stock markets increases substantially after 1998 due to the recent increase in transnational investments. Morana and Beltratti (2008) state that linkages across stock markets seem to have increased over time, particularly for the US and Europe, while the trend is inconsistent in Japan. Diebold and Yilmaz (2015) attribute the relative segmentation of the Japanese market to the long recession that affected the Japanese economy during the 1990s.

Other studies examine spillovers and linkages from an intra-regional perspective among developed markets. Karolyi (1995) inspects the dynamics of returns and volatility between Canada and the US stock markets using daily data from 1981 to 1989. He postulates a VAR BEKK GARCH model to describe the joint return dynamics of the two markets. Karolyi finds that US return innovations are more significant and persistent for subsequent returns of non-inter-listed Toronto stocks,[1] signifying that investment barriers associated with differences in foreign ownership restrictions, differences in tax regimes and accounting disclosure requirements might be imperative considerations for the dynamics of international stock market comovements.

In Europe, Baele (2005) investigates the extent to which globalisation and regional integration influence equity market interdependence. He measures the magnitude and time-varying nature of volatility spillovers from the aggregate European (EU) and US market to 13 European equity markets from 1980 to 2001. He uses weekly data and a regime-switching model to allow the shock sensitivities to change over time. Results indicate that both the EU and US shock spillover augmented considerably over the 1980s and 1990s, though the rise is more pronounced for EU spillovers[2]. Baele (2005) attributes his findings to higher trade integration, equity market development, and low inflation among the EU bloc. Similarly, Fratzscher (2002) investigates shock spillovers from the US to the EU equity markets. He finds that the transmission of shocks from the Euro area has become more important compared to shocks from the US market. Encouraged by high economic integration and cooperation among Norway, Finland, Denmark and Sweden, Booth et al. (1997) uses a multivariate EGARCH model to investigate the information transmission in that region. The sample stretches from May 1988 to June 1994. The investigation of price and volatility spillovers finds weak evidence of price and volatility spillovers among Scandinavian stock markets as each market's returns and volatilities are strongly dependent on their own past values.

Emerging financial markets have become the subject of extensive research because of their booming economies and the diversification opportunities they provide to global investors. Bekaert and Harvey (1997) find that stock market returns in emerging markets are high and foreseeable but lack strong correlations with major markets. However, with an increasing degree of integration with world markets their capability to enhance and diversify international portfolios will diminish.

While Bekaert and Harvey (1997) construct a volatility spillover model consisting of two sources of volatility, local and world factors, Ng (2000) extends the volatility spillover

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[1]Canadian stocks with dually listed shares in New York and Toronto
[2] During the 1980s European shocks explained on average about 8% of local variance, and 23% by the end of the 1990s

model of Bekaert and Harvey (1997) by assuming three sources of volatility shocks; local sources, regional shocks originating in Japan and world shocks are represented by those of the US. She conducts her investigation on a sample of weekly returns from January 1980 to December 1996, with markets including Hong Kong, Korea, Malaysia, Singapore, Taiwan and Thailand. The first step entails the estimation of a bivariate GARCH model describing the joint dynamics of US and Japanese conditional returns and variance. In the second stage, a univariate volatility spillover model for each Pacific Basin country is estimated in which volatility surprises from Japan and the US manifest themselves through that country's error term. The findings illustrate that both regional and world factors play an important role in market volatility in the Pacific Basin region, although the world market influence tends to be greater. Theodossiou and Lee (1993) attribute this to evidence against geographical proximity's positive impact on market linkages. These results are inconsistent with the findings of Janakiramanan and Lamba (1998), as they argue that markets that are geographically and economically adjacent exert significant influence upon each other.

While Bekaert and Harvey (1997) find that capital market liberalisation often leads to a higher correlation between local and international markets, Ng (2000) elaborates and finds that the relative importance of the regional and world market factors are influenced by important liberalisation events (such as the introduction of country funds and changes in foreign investment restrictions), fluctuations in currency returns, and volume of trade.

Kim and Rogers (1995) examine liberalisation effects on market linkages, namely opening up South Korea's equity market by allowing foreigners to directly own shares in the stock market. They examine the consequences on the relationship between the stock markets of Korea, Japan, and the United States. The study evaluates GARCH models to quantify the prominence of volatility spillovers from Japan and the US on the mean and variance of South Korean returns. Such spillovers have increased since the announced opening. Asian emerging markets pursued policies aimed at financial liberalisation during the late 1980s and early 1990s (Bekaert et al, 2003). Li and Giles (2015) examine the linkages of stock markets across the USA, Japan and six pacific Asian developing nations: China, India, Indonesia, Malaysia, the Philippines and Thailand; over the period ranging from January 1993 to December 2012. The volatility spillover is modelled through an asymmetric multivariate generalized autoregressive conditional heteroscedastic model. The same authors find significant unidirectional shock and volatility spillovers from the US market to both the Japanese and the

Asian emerging markets. It is also found that the volatility spillovers between the US market and the Asian markets were stronger and bidirectional during the Asian financial crisis.

Other emerging market researchers examine equity market linkages in South America. For example, Lahrech and Sylwester (2011) examine the integration of four Latin American equity markets with the US stock market. The data ranges from 1988 to 2004 and the sample includes Argentina, Brazil, Chile and Mexico. The examination uses dynamic conditional correlation (DCC GARCH) between each market and the US. They find that the conditional correlations between US and other Latin American[3] equity returns have extensively increased, indicating higher regional integration.

Another strand of academic research in emerging markets considers the intra-regional linkages between emerging market blocs. It is worth mentioning that this field of research controls influences from dominant mature markets (US), while conducting the analysis. For example, Fujii (2005) uses daily returns and GARCH models to conduct the residual cross-correlation function (CCF) tests to investigate cross-market causality both in the first and second moments of stock returns between 1990 and 2001. The empirical results reveal significant causal linkages both within each region and across the two regions. This causality fluctuates substantially over time and tends to escalate during financial crises. The empirical results also point out that pairwise causality between countries across different regions varies considerably more over time, when compared with pairwise causality within each region. This may be due to geographical distance effect, or, as Lucey and Zhang (2010) argue, the fact that countries with smaller cultural distances exhibit relatively higher stock market co-movement.

Yarovaya et al (2016) examine intra- and inter-regional transmission of information across ten developed and eleven emerging markets in Asia, the Americas, Europe and Africa using both stock indices and stock index futures. They make use of daily data ranging from 2005 to 2014 for the purpose of analysing return and volatility spillovers via the spillover index of Diebold and Yilmaz (2009, 2012). Their findings demonstrate that markets in general are more susceptible to domestic and region-specific volatility shocks than to inter-regional contagion. Also, they affirm that return spillovers are higher in magnitude than volatility spillovers in all markets generally and in emerging markets particularly. The spillovers between emerging and developed markets are weaker than those between

[3] Except Chile.

developed markets. Thus, the benefits of international portfolio diversification are best achieved by investing in emerging markets in different geographical zones.

Balli et al. (2015) study the dynamics of equity market integration among emerging and developed markets using GARCH family models and weekly data, covering the period from 2000 to 2013. In order to do so, they investigate the return and volatility spillovers from developed markets (Europe, Japan and the US) into the financial markets of emerging countries in Asia, and the Middle East and North Africa (MENA)[4] region. Based on constant and trend spillover models, they find evidence of significant transmissions from developed to emerging markets. The results from variance ratios indicate the dominance of US shocks across all emerging markets. Moreover, the results show that shock spillovers from major developed markets exert heterogeneous effects on their emerging counterparts. These results illustrate the different stages of financial and economic development experienced by the Asian and MENA emerging countries in recent years. For Asia, the results demonstrate return and volatility spillover from the US. MENA is also dominated by the US shocks; however, the EU and Japan also have a noticeable influence.

The empirical literature dedicated to the study of financial markets in the Middle East is scarce. Reasons for this include their relative novelty, investment restrictions and political instability in the region. International investors share the view of academic researchers, as MENA's portion of total FDI (foreign direct investment inflows) and foreign portfolio inflows (FPI) have remained low relative to other emerging regions worldwide. On the contrary, Neaime (2016) argues that the MENA region’s financial markets offer significant growth and diversification potentials. Furthermore, after examining financial integration in the MENA region, he concludes that some MENA countries have matured and thus co-integrated with global markets. He states that the long term benefits of integration will have some drawbacks on stability. Karolyi and Stulz (2003) explain the process further by stating that the higher integration and growing importance of capital flows increase interdependence between markets and, consequently, a shock in one market could affect another.

Neaime (2012) maintains that African MENA markets seem more integrated than GCC markets. Yu and Hassan (2008) observe that a long-run equilibrium relationship is strengthening between MENA and US stock markets, as financial liberalisation of the MENA region is rapidly undergoing progress. They also find cointegration between the GCC and

[4] GCC a sub economic bloc in the broader MENA region stock markets.

non-GCC groups. Yet, segmentation of stock markets in the GCC bloc from the developed stock markets is evidenced by negative correlations, suggesting the possibility for diversification for global investors. They further demonstrate that the US stock market has significant volatility spillover effects in most MENA countries. Own-volatility spillovers are generally higher than cross-volatility spillovers for MENA stock markets. Maghyereh et al. (2015) apply a DCC GARCH model of Engle and a Spillover Index of Diebold and Yilmaz to examine the linkages between the US and the MENA region. They chose the five biggest and most active stock exchanges in the region (Egypt, Jordan, Saudi Arabia, Tunisia, and Turkey) over fifteen years stretching from 1998 to 2013. The average conditional correlation between the US and Egypt increased from 8.6% to 39.8%. Likewise figures in Saudi Arabia augmented from 11.1% to 23.5%.

These results show higher interdependence between the US and MENA equity markets during periods of high stress. In terms of volatility spillovers, results from the DY spillover index indicate a steep appreciation in the influence of the US, as the contribution rose to 78% following the subprime crises, after it was a marginal 6%. Moreover, the Saudi market is the dominant force in the MENA region, especially in the post-crisis period, as the spillover index shows that the Saudi market is a net giver when combined with any MENA market. The researchers conclude that MENA stock markets are moderately correlated and are weakly integrated with the US market in normal conditions. In stress periods, however, the transmission progression from the US increases dramatically and MENA markets become more integrated among themselves.

Overall, the literature seems to support higher equity market integration among advanced countries regardless of the region. However, this tendency is more pronounced between the US and developed Europe. Comovements are generally higher intra regionally than across different regions. Developing stock markets in the Americas exhibit relatively higher regional integration while emerging Asian markets are influenced mainly by their own innovations and to a lesser extent by global factors. Finally, the MENA markets, generally, and the GCC markets, particularly, are still segmented as they only recently began the integration process. This phase already took place during the late 1980s and 1990s in other emerging markets.

The literature studying the stock market linkages in the GCC region has three main areas of focus: first, the extent of market integration or interdependence between GCC equity markets; second, the spillover of shocks from world markets into the GCC markets; third, the sensitivity of equity prices to oil fluctuations.

In the first strand of literature, Bley and Chen (2006) examine the impact of increased stock market activity in the GCC, and the GCC's path towards economic integration on the return behaviour and the dynamic relationships among the individual GCC stock markets. Their results show that although GCC stock markets are not homogeneous, they are increasingly integrated, but this integration still lags behind their levels in the advanced markets. In a work similar to that of Bley and Chen (2006), Al-Khazali et al. (2006) analyse the effect of deregulation and integration efforts on information transmissions and find that measures taken to liberalize capital markets in the GCC contribute significantly to the recent increase in linkages among these markets. Additionally, Espinoza et al. (2011) conclude that the GCC equity markets are more integrated among themselves than many emerging stock markets. Neaime (2016) states that GCC countries have made significant steps to enhance intra-regional financial integration which contribute towards further development of these financial markets.

In terms of the nature of intra-regional interrelationships, Assaf (2003) examines the dynamic relationships among six GCC markets through the weekly period running from 1/15/1997 to 4/26/2000 using VEC models. He finds strong evidence of interdependence and feedback among these markets. He observes that Bahrain's more open market plays a dominant role in influencing the other GCC markets, while Saudi Arabia's more segmented market is slow to receive shockwaves from those markets. Abraham and Seyyed (2006) investigate the volatility spillovers across two stock markets in the GCC region, namely, the oil-based economy of Saudi Arabia and the trading-centred economy of Bahrain. The research uses daily data from 1998 to 2003 and a bivariate EGARCH model. Results from a bivariate conditional volatility model show that there is an asymmetric flow of information from the smaller Bahraini market to the larger Saudi market: the conditional volatility in the Saudi market is significantly affected by innovations or shocks in the Bahraini market. Alkulaib et al. (2009) use daily market indices over 6 years, from 3 January 1999 to 31 December 2004. They argue that the UAE stock market leads all the markets in the region due to the tremendous growth of the UAE's equity market in recent years, and the relentless efforts in promoting itself as the biggest financial hub in the Middle East. Alkulaib et al. find that, compared to the MENA region, the GCC markets are financially more integrated.

Hammoudeh and Alesia (2004) investigate the interlinkages among five GCC countries[5] (Bahrain, Kuwait, Oman, Saudi Arabia and UAE) and their sensitivity to oil futures return changes. They depend on a VEC model and daily data ranging from February 15, 1994 to December 25, 2001. Their findings indicate that the Saudi market has the highest causal linkages with other GCC countries, while the Kuwaiti market is the most segmented. Awartani et al. (2013) attribute the dominance of the Saudi market in the GCC bloc to higher market capitalisation and liquidity. Finally, Hammoudeh and Alesia (2004) indicate that GCC markets in general react to oil price movements. Interestingly, only the Saudi stock returns exert influence on oil.

These studies point to a high degree of financial integration among GCC equity markets. However, in terms of which GCC market is the main driver, results are conflicting, as Bahrain, UAE and Saudi Arabia are each perceived to assume a leading role, depending on the study. These differences may have two causes: first, the GCC is a young dynamic bloc with high fluctuations[6] , instability[7] and bold liberalisation efforts; second, the various methodologies applied might yield a variety of outcomes.

The second strand of research examines the linkages between GCC and global markets. Hammoudeh and Li (2008) paved the way by investigating sudden changes in volatility for five GCC stock markets, using the iterated cumulative sums of squares algorithm. They find that the GCC stock markets are more sensitive to major global factors than to local and regional factors.

Based on a GARCH model and daily data from 1999 through to 2005, Yu and Hassan (2008) detect statistical evidence for segmentation of stock markets in the GCC group. They also find negative correlations between GCC and developed markets, implying that investors in GCC stocks stand a good chance to gain from international diversification of financial risks. Moreover, in terms of cross-volatility effects in the GCC stock markets, only the US has a strong influence on all GCC stock markets including Bahrain, Oman and Saudi Arabia.

[5] Qatar was excluded in this analysis.
[6] GCC is sensitive to geopolitical factors.
[7] Bahrain was a more developed financial market both in terms of size and diversity compared to her regional peers. For example, in 2000, 41 companies were listed in the Bahraini equity market, while other GCC markets were not constructed. Moreover, Bahrain hosted nearly 200 financial institutions and more than 100 insurance companies (Assaf, 2003). However, since the political unrest in 2011, Bahrain seems to have lost its reputation as a major financial hub in the GCC.

Lastly, intra-regional cross-volatility effects among GCC countries were absent. Hammoudeh and Choi (2006) use the Vector Error Correction model (VEC) and weekly data from February 15, 1994 to December 28, 2004, to examine the GCC equity returns and their relationships with three global factors: the oil price, the US S&P 500 index, and the US T-bill rate. Results from the variance decomposition imply that the principal percentages of total variations in the GCC index returns come from local or other GCC shocks over the forecast horizon. The oil price accounts for 30 percent of Oman's and 19 percent of Saudi Arabia's total variations. The S&P 500 and T-bill rate effects on the GCC markets over the same forecasting horizon are less than 1 percent, and therefore smaller than the effect of the oil price shocks. Khalifa et al. (2014) use weekly data from 2004 to 2011 to investigate the volatility transmission among six GCC stock markets and other international markets (Oil-WTI prices, S&P 500 index and MSCI-world). The authors adopted the Multi-Chain Markov Switching (MCMS) approach of Gallo and Otranto (2008). Their findings reveal strong interdependence (bidirectional spillover) of the S&P 500 index with the stock markets of Saudi Arabia and the UAE, and volatility spillover from the S&P 500 index to Oman and Kuwait.

Sedik and Williams (2011) analyse the impact of global and regional spillovers on the GCC equity markets. They use monthly data from 2000 to 2010 and a trivariate GARCH model to identify the degree of spillovers, and their transmission mechanisms. The model results indicate that regional volatility spillovers are highest in the UAE and Oman, and smallest in Kuwait. Meanwhile the US (global) spillovers were highest in the UAE, lowest in Saudi Arabia, and insignificant in Bahrain. The researchers stress that the GCC stock markets are vulnerable to financial shocks from global and regional sources, especially during the 2008 global crisis. Alotaibi and Mishra (2015) examine the spillover effects from (global) US and the regional (Saudi) market on the remaining five GCC stock markets; namely Bahrain, Kuwait, Qatar, Oman and the UAE. Weekly stock market indices data from June 2005 to May 2013 and various bivariate GARCH models (BEKK, constant conditional correlation and dynamic conditional correlation) are incorporated. The regional spillover effects from Saudi Arabia to each GCC market are found to be positive and significant in four GCC markets (Kuwait Oman, Qatar, UAE), while negative and significant in Bahrain. The US spillover effects are highly significant and positive for all five GCC markets. Unsurprisingly, the Saudi effects on Qatar and the UAE are greater in magnitude as compared to global spillover effects in these markets.

Both Sedik and Williams (2011) and Alotaibi and Mishra (2015) use the UAE index instead of the Abu Dhabi and Dubai all share indexes. Additionally, the authors state that Kuwait is the least affected by regional spillovers while Bahrain is the most segmented globally.

Awartani et al. (2013) investigate return and volatility spillover effects from the US and the Saudi market to the GCC equities using Diebold and Yilmaz VAR. Similar to Sedik and Williams (2011) and Alotaibi and Mishra (2015), they model the spillover transmission on the assumption of Saudi Arabia being the regional dominant player, and the US as the global force. The focus of the study is on the changing nature of transmissions following the Global financial meltdown in 2008. They find that the role of US equities in the information flow has become dominant.

2.1.2 Crisis transmission and contagion

Are international stock market comovements driven by information about economic fundamentals or are they simply driven by market contagion? The fundamental view of contagion and spillover explains the propagation of shocks across countries via real channels. The papers in this literature include explanations based on bilateral trade, trade of similar goods with a common market, and monetary policy coordination and macro similarities (see Corsetti et al., 2005). Alternatively, Forbes and Rigobon (2002) define financial contagion as a significant increase in correlations after a shock to an individual country. In other words, contagion exists if markets show significant increase in co-movement during a period of crisis compared with periods of stability. Such phenomenon could be explained by inefficiencies in banking sectors or investor herding.

Beirne et al. (2013) use trivariant GARCH to study the volatility spillovers from advanced stock markets to emerging equity markets in a sample of 41countires, motivated by the fact that spillover results are difficult to compare across countries as they are based on different methodologies, time periods, and data frequencies. They overcome this deficiency by applying an identical specification to a large set of emerging markets in four regions: Asia, emerging Europe, the Middle East and North Africa, and Latin America. They also analyse the changes in the transmission during times of high stress in mature markets. The empirical results indicate that spillovers from mature markets influence the dynamics of the variances of returns for the tested local and regional emerging stock markets, and that spillover parameters do change during times of turbulence in mature markets. Interestingly, some emerging market economies receive spillovers from mature markets exclusively during times of turbulence.

In the GCC, Aloui and Hkiri (2014) apply the wavelet squared coherence approach to examine the long and short term dependencies during the period from 2005 and 2010. The researchers uncover that the occurrence of the subprime financial crisis has increased the degree of co-movement between all the GCC stock markets. The authors state that, the increasing of GCC stock market coherence during the historical financial crisis periods particularly at high frequencies validates the contagion hypothesis during turbulent periods. Neaime (2016) shows that shocks from the US affect GCC stock markets significantly. While the 2008 financial crisis had disturbing consequences on the UAE, Kuwait and Qatar, Neaime (2016) maintains that the crisis was transmitted mainly through the financial and trade channels. Finally, in a recent study, Abid et al. (2019) examine contagion from the US to MENA equity markets and study the role of energy price fluctuations in the dependence between US and MENA equity markets. Using daily data for the period January 1, 2004 to November 1, 2018 and a multifactor model, they find a strong contagion effect originating from the US to GCC[8] equity markets. Interestingly, Abid et al. (2019) suggest that the oil and gas markets play important roles in strengthening the dependence between the GCC and US equity markets during episodes of market turmoil.

2.1.3 Portfolio diversification

Markowitz (1952) developed the first framework in portfolio management by illustrating the possibility to decrease the risk of a portfolio due to cross-correlations among assets. Portfolio diversification, modern portfolio theory, was developed to find the optimum portfolio based on the trade-offs between risk and return. The main theme is that investors have to consider how each security co-moves with all other securities in the portfolio. This is because accounting for these comovements enhances the risk-adjusted return of a portfolio.

Constantinides and Malliaris (1995) argue that the asset allocation decision is one aspect and developing a theory of interest rate determination, instead of portfolio selection, is another. They add that although both aspects are interrelated, they require different

[8] GCC markets are part of the Middle East and North Africa (MENA) bloc.

methodologies. The former requires deterministic calculus for the decision of maximizing a consumer's utility subject to a budget constraint. At the same time, portfolio selection involves making a decision under uncertainty.

The CAPM explains the investor's portfolio selection and assumes that the investor considers only the first two moments of the probability distribution of returns. Given the mean portfolio return, the investor chooses a portfolio with the lowest variance of returns, and the investment horizon is a single period. Finally, transaction costs and taxes do not exist, and investors can sell assets short. Fama (1976) and Roll (1977) argue that testing the CAPM is equivalent to testing the market's mean-variance efficiency. Thus, the capital asset pricing theory is not testable unless all individual assets are included in the market. There are two reasons why using a proxy for the true market portfolio does not solve the problem: first, the proxy itself may be mean-variance efficient even when the true market portfolio is not; second, the chosen proxy may be inefficient even though the true market portfolio is actually efficient.

Elton and Gruber (1997) state that as the analyst needs to measure betas and the variances of indexes, multi-index models, the building blocks for APT theory, are also used by portfolio managers to understand the sensitivity of the portfolio to different economic influences and to help the manager to predict how the indexes will change in the next period. Thus, APT models can be used to reformulate mean-variance portfolio theory in a more informative way to managers.

Furthermore, international diversification is identified as an important risk reduction tool. Early empirical studies in this area demonstrate that international diversification is beneficial for investors. Within this, Solnik (1974) examines international diversification stock markets. He finds that an internationally diversified portfolio is 50% less risky than a US security-based portfolio. Recently, due to lower financial barriers (Agenor, 2001) and rapid technological advancements in trading (Issing 2001), nations experienced globalisation and consequently integration in terms of economic and financial standings (Beine et al., 2010). Consequently, the efforts of global diversification strategies in emerging markets have been increasingly hindered (Kearney and Lucey, 2004). Beine et al. (2010) refer to this as the dark side of integration; they argue that securing gains from global diversification can be challenging especially during market turbulence due to tail dependence.

Frontier markets constitute an alternative hub of investing to both developed and emerging markets; despite being risky, they offer abundant profits and growth potential. Investors are keenly aware of the concept that high profits cannot be separated from the possibility of higher risks, and frontier markets demonstrate this concept to the fullest. In order to allocate large amounts of funds to frontier markets, investors must be confident that frontier markets are worth the risk, which highlights the significance of choosing the right set of frontier markets. Girard and Sinha (2008) examine the risk premiums of 360 stocks from 19 frontier markets. They observe that frontier markets have greater return potential than both emerging and developed markets. On the negative side, Marshall et al. (2015) show that frontier market spreads are on average over 2.5 times greater than spreads in the US market, which can be attributed to the significantly lower liquidity of frontier markets. Marshall et al. (2015) find that the GCC markets are among the lowest in terms of transaction costs as Qatar records the bottommost spread. Marshall et al. (2015) maintains that the diversification benefits of frontier markets prevail when investors rebalance every three months or more (to encounter transaction costs). Berger et al. (2013) state that frontier markets' volatility tends to be idiosyncratic. Therefore, they offer diversification benefits through risk-reducing potential.

In the GCC context, Neaime (2006) finds Bahrain to be the dominant market that is causing unidirectional changes in both the Saudi and Kuwaiti markets, and in both the mean and variance. He also argues that these GCC markets offer diversification benefits for international investors. Hammoudeh and Choi (2006) suggest that the volatility of the GCC returns is primarily explained by domestic and GCC specific shocks rather than by global factors, indicating international diversification benefits for global investors. Using monthly return data on the Bahraini, Kuwaiti, Saudi Arabian and US equity markets, Abraham et al. (2001) estimate the efficient allocation of assets from these four indices. They suggest that there are significant diversification benefits for investors from portfolios that include both US and GCC markets. While less optimistic than Abraham et al. (2001), Khalifa et al. (2014) maintain that there is a room for diversification gains between the WTI, US and MSCI-World, and the GCC markets. They argue that sensitivity of GCC markets to global shocks has increased. Thus, the scope of diversification opportunities depends on the state of the market.

From a sectoral standpoint, Hammoudeh et al. (2009) use a VAR-GARCH model to examine the volatility transmission for the service, financial and industrial sectors of Kuwait, Qatar, Saudi Arabia and the UAE. They state that past idiosyncratic volatilities matter more than past shocks and that there are volatility spillovers between the sectors within the individual countries. They also find that the optimal portfolio weights favour the financial sector for Qatar, Saudi Arabia and the UAE, and the industrial sector for Kuwait. Balli et al (2013) find that the GCC-wide sector equity markets are driven by their own volatilities. They indicate that the effect of global shocks on the volatility of GCC sector returns has been decreasing, whereas regional shocks have been affecting the sector indices with a positive and significant trend. Balcılar et al. (2015) recommend enhancing the world portfolio with positions in the GCC to improve risk-adjusted returns.

In terms of oil-GCC linkages, Hammoudeh and Eleisa (2004) examine the linkages among daily GCC market and oil returns and find that the GCC markets are weakly connected with oil prices. Later works in this area of research oppose this view; for example, Jouini and Harrathi (2014) indicate the presence of spillover effects among GCC stock and oil markets. Mohanty et al. (2011) document a positive relationship between oil and GCC markets from an aggregate and industrial perspective. Arouri and Rault (2010) suggest that international diversification benefits can be achieved by including assets from both net oil-importing countries and GCC countries. They show that stocks from most GCC countries have positive sensitivities to oil price changes. These stocks can be included in a portfolio of stocks from oil-importing countries, generally with negative sensitivities to oil price changes. Such a strategy should lead to a lower risk, since the constituted portfolio is weakly affected by oil price shocks.

Based on the (aforementioned) view that shocks to oil prices impact net-oil exporting and net-oil importing countries differently; Mimouni et al. (2016) argue that an increase in oil prices is good news for the GCC stock markets as oil proceeds are a key generator of wealth in these countries. Contrary to that, oil impact on stock markets in net-oil importing is projected to be negative due to its impact on the cost of production. Likewise, Mimouni et al. (2016) demonstrate that the patterns of correlations in the GCC countries differ from developed and emerging markets. They maintain that pairwise correlations are low and stable in GCC markets. Thus, they conclude that GCC markets offer reasonable opportunities for portfolio diversification benefits. Empirically, Mimouni et al. (2016) conclude that there is substantial evidence that the inclusion of GCC markets in international portfolio management improves the diversification performance of a portfolio. Hammoudeh and Choi (2007) argue that, when compared to Mexico, another big oil producer, the GCC markets are less inter-connected with both world capital and oil markets. Hence, they provide better equity portfolio diversification than Mexico. Using daily data from January 2004 to May 2016, Maghyereh et al. (2017) employ a DCC GARCH model to estimate dynamic correlations and hedge ratios between crude oil, gold and GCC equities. The findings suggest that while oil and gold are beneficial to portfolio diversification for GCC investors, both commodities are not good hedges against stock fluctuations.

2.1.4 Oil and financial markets

Oil prices and financial markets are interlinked under the umbrella of the economy. The literature pins down theoretical transmission mechanisms by which oil price changes influence the behaviour of stock markets. For example, through the stock valuation theory, Mohanty and Nandha (2011) oil price changes can alter a firm’s future cash flows either positively or negatively, depending on whether the firm is an oil-consumer or oil-producer. Also, as rising oil prices result in increased production costs, Basher and Sadorsky, (2006) argue that monetary policy makers increase short-term interest rates in response to higher inflationary pressures. Higher interest rates increase borrowing costs and reduce cash flows to companies. Brown and Yücel (2002) argue that rising oil prices cause higher uncertainty in the real economy, hence, increased oil prices will shrink demand for irreversible investments which decrease expected cash flows. Finally, Bjornland (2009) maintains that, in oil exporting nations, increased oil prices tend to lead to a transfer of wealth from oil-importing economies to oil-exporting ones which allow for increased government purchases, individual consumption and overall wealth.

Given the importance of oil to GCC economies, the first strand of literature explores long-term relationships between oil prices and GCC stock indices. Within this, Hammoudeh and Aleisa (2004) use the Johansen cointegration framework and daily data for the years 1994 to 2001. The authors document that Saudi Arabia has the strongest linkages with oil prices. Hammoudeh and Choi (2006) use a VEC model to analyse the relationship among GCC stock markets and oil prices. They report a long-run equilibrium relationship among them. Maghyereh and Al-Kandari (2007) use a nonlinear cointegration approach and daily data from 1996 to 2003. The empirical results suggest the existence of non-linear linkages between the equity markets of Bahrain, Kuwait, Oman, and Saudi Arabia and the WTI price index. In the same vein, Arouri and Rault (2012) explore the long-run linkages between oil prices and GCC markets. They use a bootstrap panel cointegration method and the Seemingly

Unrelated Regression (SUR) framework. They provide evidence of long-run dependencies across the GCC and oil markets. Furthermore, the SUR results show that the higher prices of oil have a positive impact on the GCC markets, with the exception of the Saudi market. Using the NARDL method of Shin et al. (2014), which allows one to analyse both short run and long run asymmetric adjustment patterns in stock prices in response to positive and negative shocks in oil prices, Siddiqui et al. (2019) report that during the 2014 - 2016 oil price slump, negative oil price changes had larger effects on equity prices than positive oil price changes in the GCC markets. Considering long and short term interactions, Akoum et al. (2012) use the wavelet coherency methodology for weekly data for the period 2002 to 2011. The findings show that GCC stock returns and OPEC basket oil returns display comovements in the long term. In a seemingly unrelated regression framework, Mohanty et al. (2011) examine the relationship among the crude oil prices and equity returns in Bahrain, Kuwait, Oman, and Qatar. They use stock returns at country and industry levels and weekly data for the period 2005-2009.

As for the GCC stock markets, a major constituent of research studies volatility spillovers between oil and stock markets. Within this, Malik and Hammoudeh (2007) investigate shock and volatility transmission between oil prices and equities of Saudi Arabia, Kuwait, and Bahrain. The study exploits a BEKK GARCH and daily data from 1994 to 2001. Their empirical results show that volatility spills from oil to the GCC. Uniquely, in Saudi Arabia, Malik and Hammoudeh (2007) report a bidirectional volatility transmission. Arouri et al. (2011) use a VAR–GARCH model to study the volatility interactions between oil prices and GCC markets. Their results reveal evidence of volatility spillovers between oil markets and the GCC equity markets, particularly during market turbulence. Awartani and Maghyereh (2013) use the Diebold and Yilmaz (2009, 2012) spillover index to investigate the dynamic spillover of return and volatility between oil and equities in the Gulf Cooperation Council Countries during the period 2004 to 2012. They indicate that return and volatility transmissions are bi-directional and more pronounced in the aftermath of the Subprime Crisis. The authors maintain that despite the bi-directional transmission between oil and GCC markets, oil prices constitute the larger source of spillovers. Using daily data over the period 2010–2017 and based on copula functions, Mokni and Youssef (2019) show that the GCC markets have a positive relationship with oil prices with varying degrees of persistence. In particular, the Saudi market demonstrates the highest degree of persistence in dependence with oil prices. Likewise, Mokni and Youssef (2019) report that the dependence between oil and the six GCC stock markets increased substantially after the oil price collapse of 2014.

Guesmi and Fattoum (2014) use an asymmetric GJR DCC GARCH model to measure dynamic conditional correlations between oil importing countries (USA, Italy, Germany, the Netherland and France) and four oil-exporting countries (United Arab Emirates, Kuwait, Saudi Arabia and Venezuela). They find that conditional correlation coefficients increase positively in response to aggregate demand (precautionary demand) and oil price shocks due to global business cycle fluctuations or global stress periods. Finally, Ashfaq et al. (2019) use daily data from 1st September 2009 to August 31st, 2018 for three oil exporting countries (Saudi Arabia, United Arab Emirates, Iraq) and four oil importing countries (China, Japan, India, South Korea) stock indices with spot crude. The researchers measure correlations and spillovers between oil prices and equities using DCC and BEKK GARCH models. The results show great shock and volatility correlation in the period of the oil crisis of 2014-2016. The authors conclude that the stocks of oil exporting countries are more sensitive to oil shocks and volatility than oil importing countries.

2.2 Overview of the GCC bloc

2.2.1 Background

The Cooperation Council for the Arab States of the Gulf is a regional organisation of six members: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. In 1981[9] the Gulf Cooperation Council (GCC) leaders signed the Unified Economic Agreement with the objective of realising coordination, integration and cooperation among member states in various economic affairs. By 1983 the GCC had implemented the exemption of most domestic products from custom duties and travel between member states. A preferential trade arrangement led to the creation of a free trade agreement in agricultural and industrial products in addition to free movement of production elements. In 2002, the GCC decided on the gradual implementation of a unified economic agreement aimed at establishing a single market. A customs union agreement was signed in January 2003, and a single common external tariff of five percent was applied. Moreover, The GCC declared common market status in 2008, granting GCC citizens equal treatment in all economic activities. Espinoza et

[9]http://www.gcc-sg.org/en-us/AboutGCC/Pages/Primarylaw.aspx

al. (2011) point to improvements in regional financial integration in the GCC bloc, as demonstrated by the high degree of accessibility, very flexible labour markets and open capital accounts.

This chapter provides a brief overlook of the proposed monetary union in section 2.2.2. Oil significance to GCC nations is presented in section 2.2.3. Following that, the Sovereign Wealth Funds, financial markets, institutional investors and financial integration are topics discussed within sections 2.2.4 to 2.2.8. Finally, the chapter is concluded with a rolling window correlation exercise wherein GCC market comovements are assessed against those of the US, the UK and Japan.

2.2.2 Policy coordination and monetary union

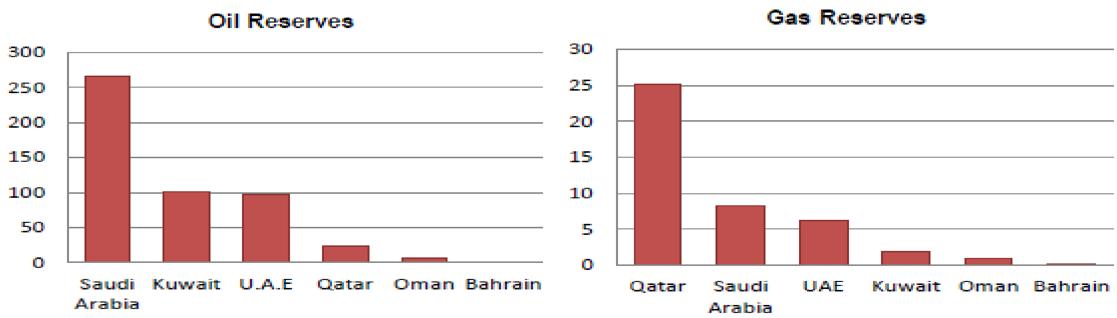
The GCC countries form a homogeneous union, sharing a common history, language, and culture. They are mainly oil exporters, open to trade and imported labour. Therefore, it is argued that the GCC countries already have credentials for a currency union. For example, in an IMF study, Berengaut and Elborgh-Woytek (2006) maintain that the GCC bloc meets the conventional standards for a single currency among its members in terms of proximity, size, fluctuations of output, trade structure, and inflation performance. Alotaibi and Mishra (2017) document coordinating efforts among the GCC nations on both monetary and fiscal levels, where both interest and inflation rates should be within a margin of 2% of the GCC average. Also, fiscal and public spending must not pass 3% and 60% of GDP, respectively. The member countries of the GCC agreed in 2003 to peg their currencies to the US dollar (Kuwait later pegged the Kuwaiti Dinar to an undisclosed basket of currencies) and to maintain parity (Khan, 2009). This makes the US dollar an external anchor for monetary policy. It is worth mentioning that, although the GCC currencies have been pegged to the US dollar, a single GCC currency is expected to encourage trade and financial integration and facilitate foreign direct investment.[10] In 2010, the GCC member countries approved the Statute of the Monetary Council of the GCC, which focuses on the development and coordination of the monetary and exchange rate policies for national currencies.

[10] Some disagreements still exist, and the recent Qatari diplomatic crisis is expected to delay this step further.

2.2.3 Oil significance

Oil, the main export commodity, constitutes around 75% of export receipts and about 85% of fiscal revenues. Globally, the GCC bloc accounts for 40% and 23% of proven oil and gas reserves, respectively. Also, the GCC claims over 70% of OPEC's[11] spare crude capacity (Sedik and Williams, 2011). Within the bloc, Figure 2.1 demonstrates that Saudi Arabia is by far the richest in oil reserves, while Qatar assumes the top position in natural gas reserves.

FIGURE 2. 1 OIL AND GAS RESERVES IN THE GCC



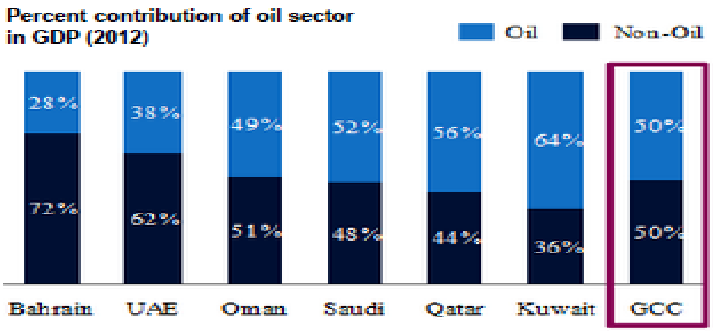
Note. Oil and gas reserves in the GCC as of 2012 in thousands of millions of barrels and trillion cubic feet respectively

Source: MORRA Capital[12]

As depicted in Figure 2.2, in 2012, hydrocarbon revenues as a percentage of GDP varied from 28% in Bahrain to 64% in Kuwait. The GCC overall reliance on oil revenues remains high and averages 50%. Given the depletable nature of oil, such high dependence pauses a threat to long run GDP growth. At the same time, petroleum prices during the last 10 years have fluctuated sharply from an all-time high of $145 in 2007 to $29 in early 2016 (see Figure 2.3). While this can exacerbate output volatility, OPEC oil production quotas are another issue influencing the economic cycle (Tazhibayeva, 2008).

[11] New supplies of oil from the US, Russia and Canada have reduced OPEC's ability to control prices.
[12] http://www.morracapital.com/blog_files/O&G.pdf

FIGURE 2. 2 OIL CONTRIBUTION TO GDP



Note. Oil contribution as a percentage of GDP as of 2012.

Source: IMF and MORRA Capita

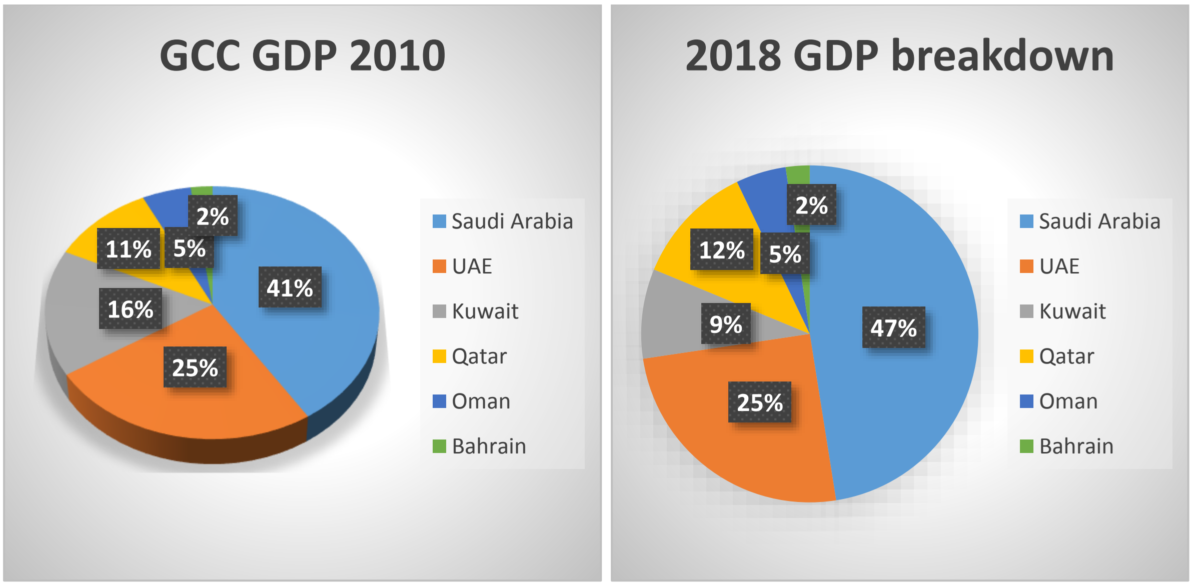
FIGURE 2. 3 10-YEAR WTI OIL PRICE CHART

Note. West Texas Intermediate oil price chart from 2000 to 2017.

Source: Macrotrends.net

Amidst the collapse of oil prices, the high dependence on hydrocarbon profits in Kuwait resulted in a stunning decrease in Kuwait's GDP growth. Additionally, Figure 2.4 shows that the Kuwaiti contribution to the overall GDP of the GCC dropped from 16% in 2010 to 9% in 2018.

FIGURE 2. 4 GCC COUNTRIES' CONTRIBUTION TO TOTAL GDP

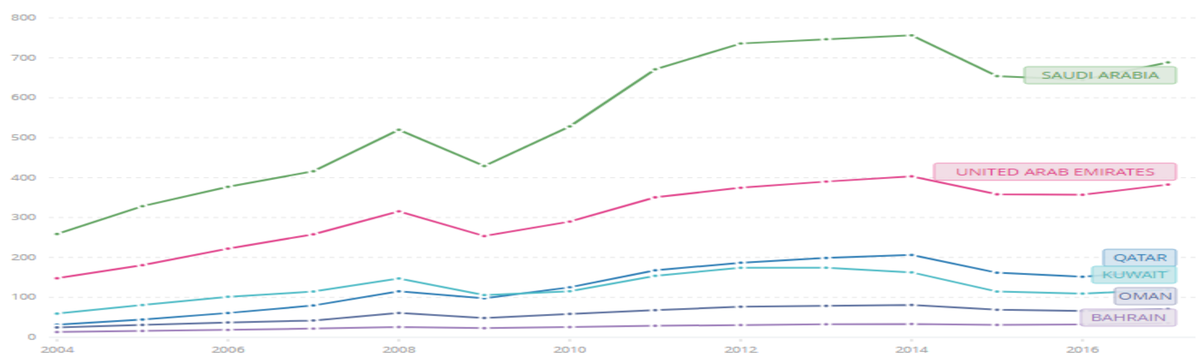


Note. GCC GDP breakdown amongst member states.

Source: World Bank.

Looking at Figure 2.5, we see that the recent reduction in oil prices induced deterioration in GDP growth as oil still dominates revenue generation in the region.

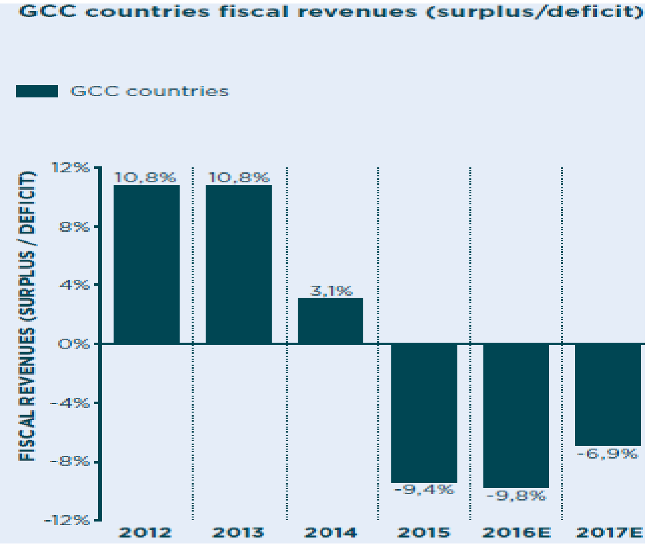
FIGURE 2. 5 OIL PRICE DROP HINDERS GCC EXCEPTIONAL GDP GROWTH



Note. GDP growth in Saudi Arabia, the UAE, Qatar, Bahrain, Kuwait and Oman.

Source: World Bank

FIGURE 2. 6 OIL PRICE DROP EFFECTS ON FISCAL SURPLUS



Note. Fiscal surplus turns to deficit after the 2014 oil price collapse.

Source: International Monetary Fund (Economic outlook 2016 Oct), Value Partners analysis[13]

Examining Figure 2.6, the extraordinary fiscal surplus flipped to a deficit in 2015, reflecting the oil price collapse from late 2014. Figure 2.7 illustrates that the decline in oil prices also affected the GCC equity markets. The slide in the indices started with the oil price collapse in September 2014 and continued throughout 2015. Figure 2.7 shows that oil price decline universally affected GCC markets; the first shock taking place in September 2014, coinciding with the beginning of the oil price downturn. March 2015 brought another shockwave that could be linked to a further deterioration in the oil price, reaching $44. Finally, in addition to oil, Figure 2.7 shows that the Arab Spring depressed the GCC markets in 2011 and the Qatari crisis had serious ramifications on Qatari stocks in 2017. This highlights sensitivity towards regional geopolitical factors.

[13] http://www.valuepartners.com/wp-content/uploads/2016/12/MENA-REGION-122016-DIGIVERSION.pdf

FIGURE 2. 7 OIL CRISIS INFLUENCE OVER THE STOCK MARKET PERFORMANCE

GCC Historical Performance	Index	2010	2011	2012	2013	2014	2015	2016	2017	2018
Kuwait	All Share Index	25.5%	-16.2%	3.0%	8.4%	-3.1%	-13.0%	2.3%	5.6%	5.2%
Saudi Arabia	TASI	8.2%	-3.1%	6.0%	25.5%	-2.4%	-17.1%	4.3%	0.2%	8.3%
Dubai	DFM General Index	-9.6%	-17.0%	19.9%	107.7%	12.0%	-16.5%	12.1%	-4.6%	-24.9%
Abu Dhabi	ADX General Index	-0.9%	-11.7%	9.5%	63.1%	5.6%	-4.9%	5.6%	-3.3%	11.7%
Qatar	QE 20 Index	24.8%	1.1%	-4.8%	24.2%	18.4%	-15.1%	0.1%	-18.3%	20.8%
Bahrain	Bahrain All Share Index	-1.8%	-20.1%	-6.8%	17.2%	14.2%	-14.8%	0.4%	9.1%	0.4%
Oman	MSM 30 Index	6.1%	-15.7%	1.2%	18.6%	-7.2%	-14.8%	7.0%	-11.8%	-15.2%

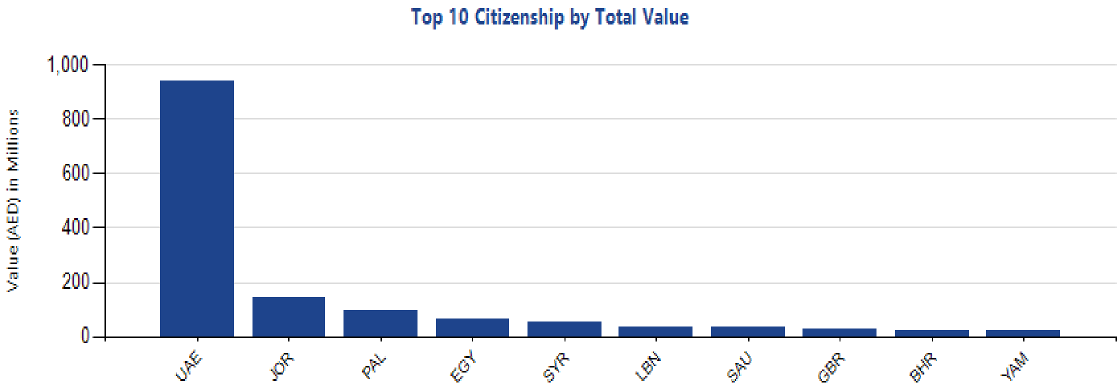
Note. GCC stock market performance from 2010 to 2018. The negative numbers in 2015 mirror the oil price collapse in late 2014.

Source: KAMCO Research

At the country level, Figure 2.7 shows that the reaction to the 2014 oil price drop was immediate in the case of Saudi Arabia, Kuwait and Oman; stock indices in these countries dipped by 2.4%, 3.4% and 7.2%, respectively. Nevertheless, in 2015, while oil prices collapse persisted, a common decrease in all GCC equity markets took place; the losses were 17.1% in Saudi Arabia, 16.5% in Dubai, and around 15% in Oman and Bahrain. The surprising result was the 4.9% decrease in the Abu Dhabi Stock Exchange (ADX), as the emirate is known to be floating on rich oil reserves and has a less-diversified economy when compared with neighbouring Dubai. Abu Dhabi’s ability to reduce the impact of oil price decreases on the ADX can be attributed to the UAE inclusion in the emerging market index in 2014. In fact, this may plausibly be a factor in channelling capital towards Abu Dhabi from non-GCC sources.

Figures 2.8 and 2.9 illustrate the changing profile of investors in the ADX in terms of the percentage of value of shares traded.

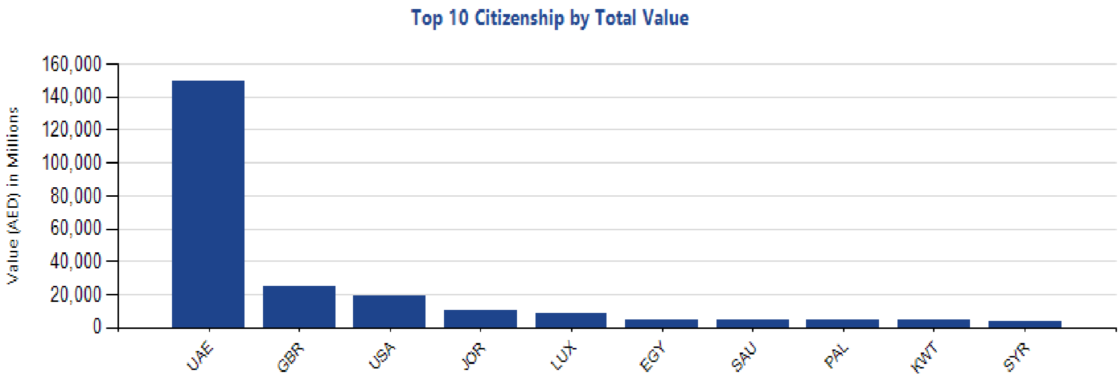
FIGURE 2. 8 NATIONALITIES OF INVESTORS IN THE ADX FROM 2011 TO 2014 BY TOTAL VALUE OF TRADING



Notes. United Arab Emirates (UAE), Jordan (JOR), Palestine (PAL), Egypt (EGY), Syria (SYR), Lebanon (LBN), Saudi Arabia (SAU), Great Britain (GBR), Bahrain (BHR) and Yemen (YAM).

Source: Abu Dhabi Security Exchange

FIGURE 2. 9 NATIONALITIES OF INVESTORS IN THE ADX FROM 2015 TO 2017 BY TOTAL VALUE OF TRADING



Notes. United Arab Emirates (UAE), Jordan (JOR), Palestine (PAL), Egypt (EGY), Syria (SYR), Saudi Arabia (SAU), Great Britain (GBR), Luxemburg (LUX), Kuwait (KWT) and the United States of America (USA).

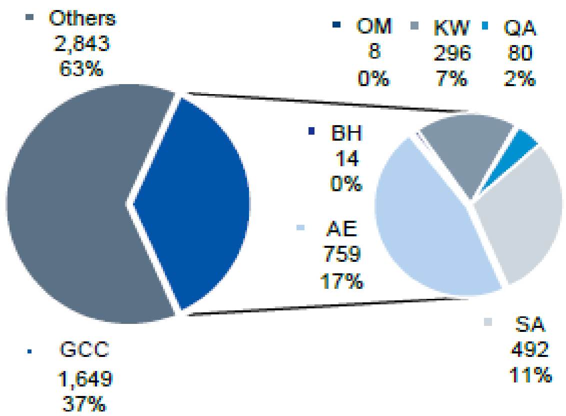
Source: Abu Dhabi Security Exchange

Prior to 2014, a considerable trading value used to originate from investors hailing from nearby Arabic and GCC nations. This trend, however, diverged sharply after 2014, with the majority of foreign funds coming from the UK and the USA. In fact, the oil crisis had extreme regional ramifications that may not necessarily affect global investors. Regionally, Arabic and GCC investors may have endured losses in nearby markets forcing them to liquidate their positions in the ADX, and therefore increasing market stress.

2.2.4 Sovereign wealth funds

The previous section discussed oil relevance to GCC economies and markets; this section sheds light on how the oil-generated wealth is reallocated. The GCC countries invest oil proceeds in either local or international industries in order to convert the volatile and depletable oil revenue into a steady financial source of prosperity. This practice is commonly used by other oil-rich countries like Norway. The proceeds of these funds could be used in the long run to finance government[14] expenses and pensions. As can be seen in Figure 2.10, in 2011, the Gulf countries held an estimated $1,649 billion of assets or 37% from global holdings of Sovereign Wealth Funds (SWF).

FIGURE 2. 10 GCC SHARE IN GLOBAL SWF IN $ BILLION AS OF 2011



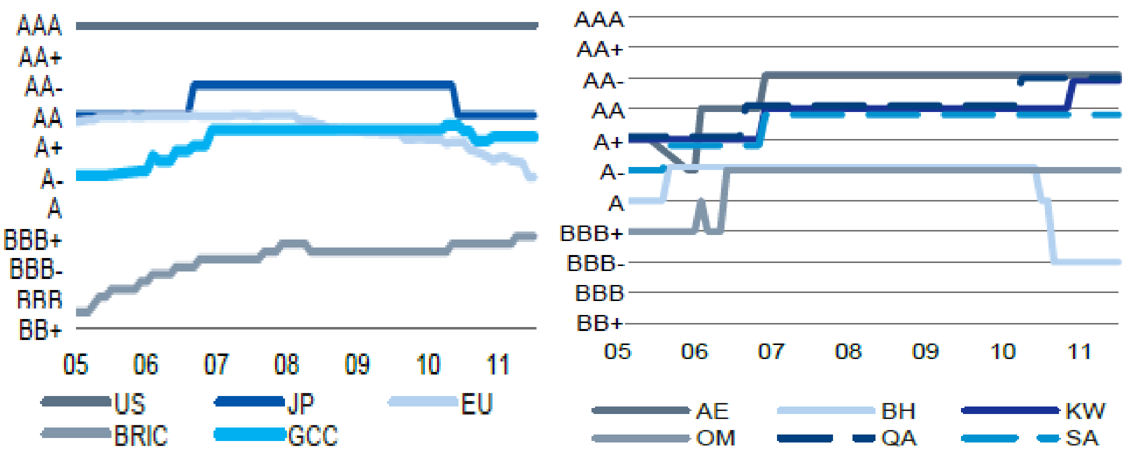
Note. The GCC stake in global Sovereign Wealth Funds.

Source: Deutsche Bank Research

The Kuwait investment authority is the oldest and dates back to the 1950s. In 2016, the GCC SWFs[15] global ranking is described as follows: Abu Dhabi investment authority assumes the 3rd position with $792 billion. SAMA foreign holdings (Saudi Arabia) ranks fourth with $582 billion. With $511 billion, Kuwait investment authority occupies the fifth position. Finally, Qatar investment authority is the eleventh globally with $335 billion.

[14] Kuwait used its SWF to fund the rebuilding projects after the war with Iraq.
[15] http://www.swfinstitute.org/fund-rankings/.

FIGURE 2. 11 CREDIT WORTHINESS OF THE GCC, BRIC AND DEVELOPED NATIONS



Note. Credit worthiness of the GCC compared with the US, Japan, the EU and the BRIC.

Source: Deutsche Bank Research and Standard and Poor's credit rating.

According to 2011 data, Figure 2.11 shows that the GCC bloc is comparable to the EU in terms of creditworthiness and significantly surpasses the emerging economic bloc of the BRIC (Brazil, Russia, India and China). Within the GCC region, the UAE tops the list.

2.2.5 Overview of the GCC financial markets

The GCC bloc is one of the fastest growing in the global economy and enjoys good macro fundamentals, significant capital holdings and a favourable creditworthiness rating. Nonetheless, the GCC financial markets are distinctive in the sense that they are segmented from the world equity markets (Yu and Hassan, 2008) and are remarkably influenced by oil and regional political events (Awartani and Maghyereh, 2013). Arouri and Rault (2012) state that GCC markets suffer from several structural and regulatory weaknesses such as a small number of listed firms, large institutional holdings and low sector diversification. In recent years, however, a broad range of legal, regulatory and supervisory changes has increased market transparency.

The 1990s saw steady efforts in the GCC countries to diversify their economies, enhance privatisation and improve trading technology (Kern, 2012). In essence, the recent economic developments and exceptional growth rates, besides capital requirements to fund budget deficits, has convinced the six GCC states to initiate capital market liberalisation, structural reforms and regulations, permitting foreign investors to access their financial markets (Al Janabi et al., 2010). Arouri and Rault (2012) report that GCC markets are beginning to improve their liquidity and open their operations to foreign investors. Likewise, Akoum et al. (2012) argue that financial liberalisation in the GCC region, including stock market reforms, has increased capital flows and improved the functioning of the markets.

TABLE 2. 1 GCC EQUITY MARKETS SUMMARY

Country	Start date	Number of companies 2018
KSA	1980	190
Kuwait	1983	175
Oman	1988	110
Bahrain	1989	42
Qatar	1997	46
Abu Dhabi	2000	65
Dubai	2000	75

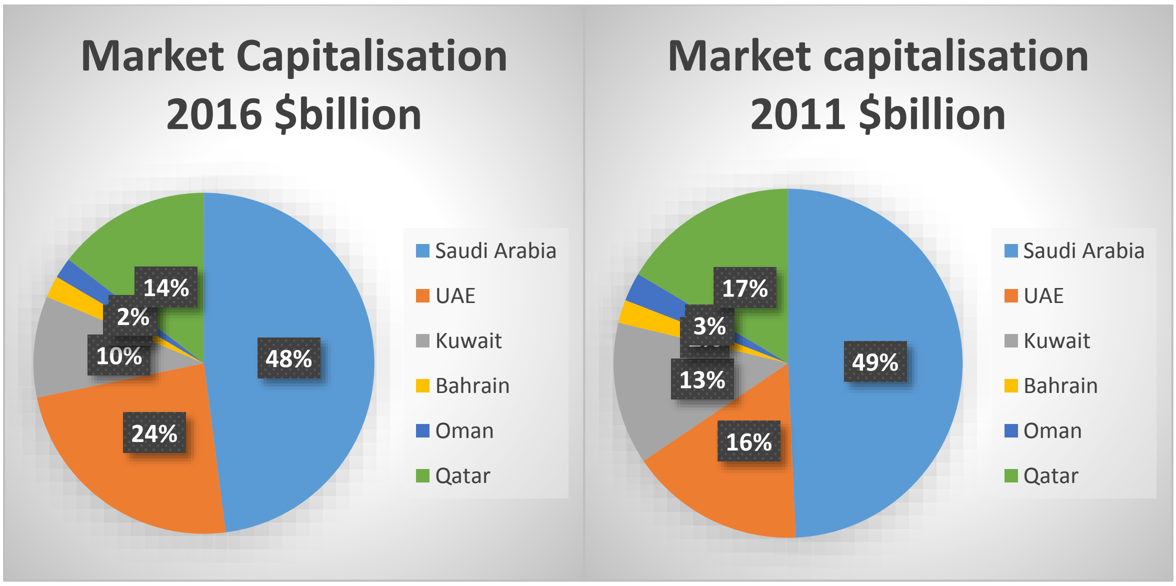
Note. GCC markets start up dates and the number of listed companies in each stock exchange as of 2018.

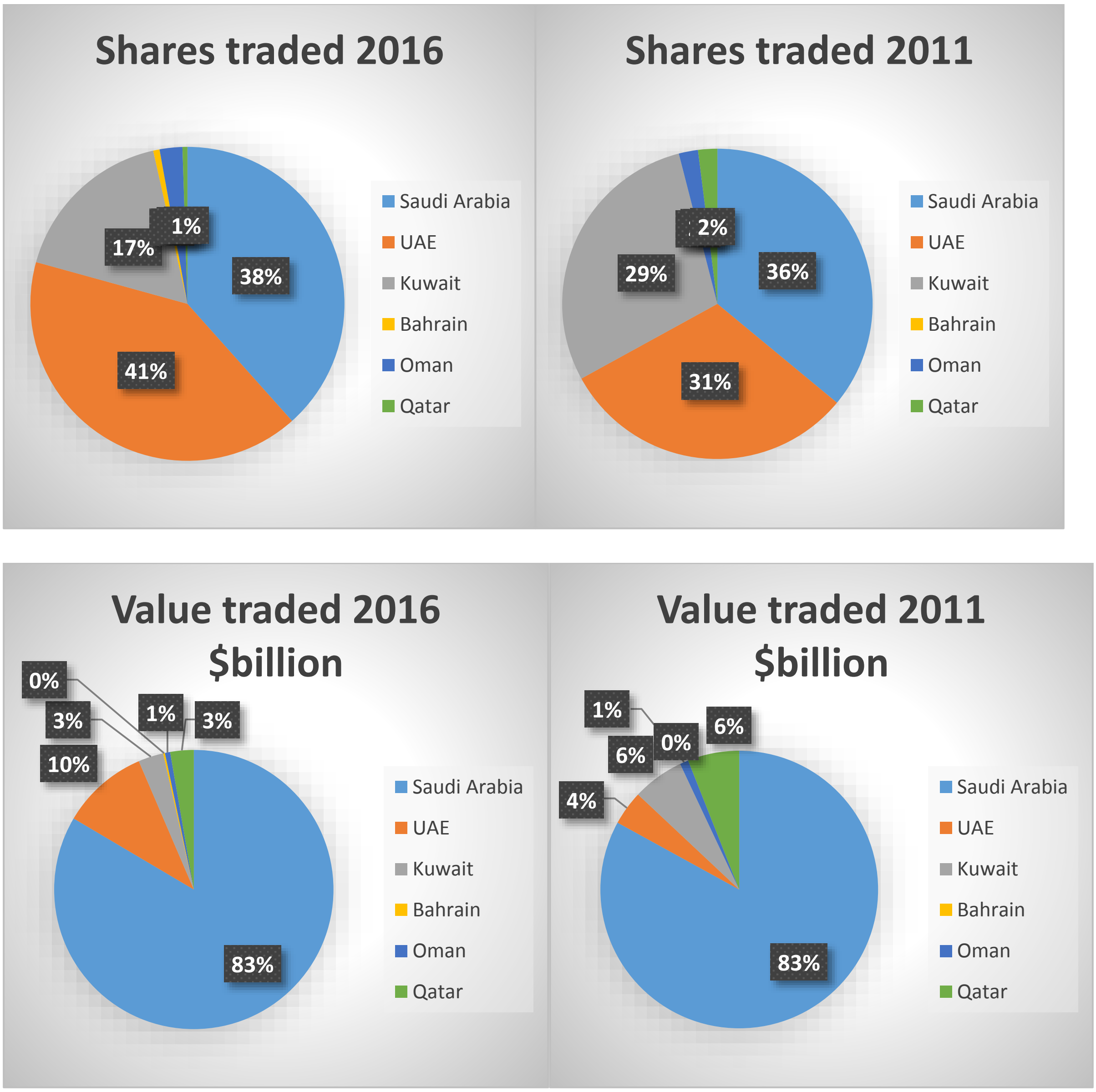
Source: Arab Monetary Fund Report

From Table 2.1, one can observe that while the financial markets are fairly new, the number of listed companies ranges from 190 in Saudi Arabia to 42 in Bahrain. Sedik and Williams (2011) state that the GCC financial markets vary considerably in the degree of foreign participation; the UAE has the highest degree of foreign participation and Saudi Arabia has the lowest. In fact, all GCC countries impose restrictions on foreign ownership in their stock markets. This policy is adopted in order to shield them from the harmful effects of regional and global risk spillovers (Balcilar et al., 2015). According to Ravichandran and Alkhathlan, (2010), restrictions on foreign ownership limit flows of ‘hot money’ into and out of GCC countries. Prior to 2014, foreign ownership restrictions alongside a number of other institutional issues prevented the majority of these markets from being classified as emerging markets (Balcilar et al., 2015). According to the MSCI Global Market Accessibility Review of 2019, despite considerable improvements, restrictions on foreign investors still exist and take the form of a 49% limit on shares owned by foreign nationals in Saudi Arabia, UAE, Kuwait and Bahrain; Qatar sets a cap at 25% while allowing companies themselves to raise it to 49%. Finally, Oman imposes the lowest restrictions in the GCC bloc where global investors are allowed to own up to 70% of listed Omani companies.

Thanks to their outstanding reforming efforts, the MSCI promoted Qatar and the UAE from frontier to emerging markets in 2014. Moreover, the MSCI 2015 report documents that Saudi Arabia launched the Qualified Investor Program which allows direct foreign ownership in Saudi stock exchange for the first time. Prior to that, investing in the Saudi market used to be restricted to buying shares in the country's portfolio, exchange-traded funds (ETF) and equity swaps. Saudi Arabia launched vision 2030, where the financial sector development program aims at the following: increasing the total size of financial assets to GDP ratio to reach 201% by 2020 from 192% registered in 2016; growing the share of capital markets assets from 41% in 2016 to 45% by 2020; increasing the share of SME financing at banks from 2% in 2016 to 5% by 2020. Finally, in 2019, the MSCI reclassified Saudi Arabia to emerging market status. These developments are expected to increase the level of international investments and funds directed towards the UAE, Qatar and Saudi Arabia.

FIGURE 2. 12 EQUITY MARKET STATISTICS 2016 VS 2011





Note. GCC markets breakdown in terms of capitalisation, number of shares traded and value traded in 2011 and 2016. While capitalisation reflects size and depth, number of shares traded and their values echo liquidity levels.

Source: Bloomberg

Although the GCC financial markets have only come to the global arena in the 1980s, Sedik and Williams (2011) state that their capitalisation to GDP is comparable with other emerging markets. Neaime (2016) documents that market capitalisation as a percentage of GDP ranges from a low of 4.6% in the UAE in 2014 to a high of 180% in Qatar in the same year. Figure 2.12 presents the GCC markets breakdown in terms of capitalisation, number of shares traded and value traded in 2011 and 2016. While capitalisation reflects size and depth, number of shares traded and their values echo liquidity levels. In 2016, Saudi Arabia had the lion's share of GCC equity market capitalisation as the level reached $400.6 billion, which constituted 48% of overall capitalisation of the GCC. The UAE recorded $198.9 billion signalling a notable increase from the 2012 figure of $125.1 billion. Therefore, the UAE increased its stake of the GCC capitalisation from 16% in 2012 to 24% in 2016; interestingly, this rise was mainly at the expense of Kuwait. The capitalisation in Oman and Bahrain remained marginal and sat at 2% in each nation. Again, these observations confirm the increasing importance of the UAE and Qatar alongside Saudi Arabia in terms of stock market capitalisation.

Neaime (2016) adds that, when compared with the figures of the last decade, turnover ratios increased in Saudi Arabia and the UAE indicating improved liquidity in these markets. Also, the number of listed companies increased in all GCC equity markets during the same period. Turning to Figure 2.12, in terms of the number of shares traded, the UAE ranks the highest with 41%, followed by Saudi and Kuwait. Interestingly, the Qatari equity market has a level of capitalisation that stands at a higher level than Kuwait, yet Qatar lags considerably in terms of the number of shares traded. This echoes minimal trading activity and may signal a sizeable presence of government and ownership by influential families. The value of traded shares is far higher in Saudi Arabia, as 83% of the traded value in the GCC takes place there. Indeed, 2018 figures[16] (see Figure A.1 in the appendix section) show that, while capitalisation proportions remain similar to 2016 figures, the volume of trading remains great in Saudi Arabia, with 83% of all GCC trading conducted there, while UAE and Qatar follow with 7% each. The latter demonstrates significant improvement in liquidity in Qatar. A plausible explanation to this can be the inclusion of Qatar in the MSCI emerging market list. To conclude, the MSCI upgrades of Saudi Arabia, Qatar and the UAE seem to mirror improvements in terms of capitalisation and liquidity.

2.2.6 Institutional investors

Influential families and government-owned entities assume a considerable stake in the GCC financial markets (Santos, 2015). In terms of ownership, Abdallah and Ismail (2017) document that 69.3% of majority shareholders in the GCC own at least 5% of majority shares, followed by 46.5% of majority shareholders who hold at least 10%, 28.8% own at

[16] Precise figures about the 2018 number of shares traded are not available.

least 20% and 22.1% own at least 25%. What is more, 42.8% of majority shareholders are local corporations, whereas 15.6% are individual investors and 14.4% are governments. Furthermore, Kern (2012) states that influential families are key players in the governance of listed entities; 76% of the supervisory boards of listed companies in the Qatari Exchange have two or more members of the same families. Kern (2012) documents that the GCC governments and sponsors own about 29% of the overall capitalisation, and that the level of government ownership is 20% in Oman, 13% in Kuwait, 35%, in Saudi Arabia and 45% in Bahrain.

The strong presence of government entities in the GCC financial markets is explained by the fact that they were the backbone of many companies before subsequent public offerings took place. This fact signals long-term interest in the progress and well-being of these companies as opposed to speculative interests. However, the downside of this is that much of the capitalisation in the GCC markets is not actively traded, and therefore trading in the GCC tends to be thin and unsophisticated. Hertog (2012) indicates the existence of a small number of institutional investors with technical investment knowledge. These institutional investors, alongside the liberalisation process and improved corporate governance, are collectively expected to improve trading in the GCC equity markets.

Free float shares are the ones readily available in the market, which excludes locked-in shares such as those held by insiders, promoters and governments. Sedik and Williams (2011) state that the level of free float constitutes less than 50% of the actively traded stocks. In the same IMF study, Sedik and Williams (2011) point out that the percentage of free float in the GCC is well below their ratios in the developed markets. As they represent 70% of shares in the EU and 90% in the US, at the same time, free float shares stand at 40% in Saudi Arabia and 56% in both Kuwait and the UAE.

The companies in the GCC are listed in a limited number of sectors, most notably, basic industries and financial services[17] and strong correlations exist between these sectors (Kern, 2012). Moreover, Hammoudeh et al. (2009) maintain that sector investing in the GCC stock markets lacks sophistication. However, recent privatisation and diversification efforts were implemented to improve the sectoral compositions in the GCC (Balcilar et al., 2015). Having that said, recent academic research focused on sectoral diversification benefit in the GCC; for example, Balli et al. (2013) classify GCC companies into 10 economic sectors.

[17] Banks and real estate mainly.

Focusing on eight out of ten sectors; namely finance, basic materials, industrial goods and services, energy, basic materials, telecom and utilities, they find that the finance sector is the largest in terms of trading volume across the GCC.

2.2.7 The GCC bloc in an international comparison

As a bloc, in 2014, the GCC stands at 50 million inhabitants and $1.6 trillion in GDP. This translates to $33,005[18] GDP per capita, which is slightly lower than the OECD[19] high-income average of $34,401. Nevertheless, this figure compares favourably to other emerging markets, as the Emerging Markets Equity Outlook estimates the average GDP per capita in BRICS to be less than $10,000.

TABLE 2. 2 GDP/MARKET CAPITALISATION GROWTH BETWEEN 2010 AND 2018 IN $ MILLION

GDP GCC	2010	2018
$US billion		
Saudi Arabia	375.77	782.48
UAE	230.25	414.18
Kuwait	148.02	141.68
Qatar	98.31	192.01
Oman	46.11	79.30
Bahrain	20.60	37.75
GCC	919.06	1647.39
World	63048.82	85791.00
GCC/World	1.46%	1.92%

Market cap	2010	2018
$US billion		
Saudi Arabia	353.3	494.8
UAE	130.8	232.2
Kuwait	128.4	95.8
Bahrain	16.6	21.1
Oman	18.9	12.6
Qatar	123.6	161.7
GCC	771.6	1018.2

Note. The difference in terms of GCC GDP growth and GCC market capitalisation growth between 2010 and 2018.

Source: World Bank and KAMKO Research

Table 2.2 reveals that the GCC's GDP increased from $919 billion in 2010 to more than $1,647.39 billion in 2018. This means that the GCC stake in the world's GDP grew from 1.46% to 1.92%. At the same time, Table 2.2 shows that the stock market capitalisation in the bloc progressed from US$ 771.1 billion in 2010 to US$ 1,018.2 billion in 2018. Interestingly, the 32% increase in market capitalisation is much lower than the impressive 51.7%

[18] Including citizens only instead of all population will increase this figure significantly.
[19]The Organisation for Economic Co-operation and Development.

augmentation in GDP. This indicates that the GCC financial markets are small by international standards, but they have the economic potential to grow significantly. Conversely, the GCC share in global official reserve assets[20] is more than 10%, which illustrates an extraordinary level of public-sector financial[21] wealth. In terms of other asset classes, Kern (2012) illustrates that the equity markets in the GCC are more advanced than the debt market. While the GCC markets accounted for 1.3% of the global equity market capitalisation, they only constituted 0.2% of outstanding worldwide debt securities.

2.2.8 Market integration

Since GCC equity markets are below their economic capacities, market integration is a viable path to achieve progress. Kim et al. (2013) argue that information may flow intra-regionally within the GCC through macroeconomic linkages, including monetary and fiscal policy arrangements and customs relationships. Forbes and Chin (2012) document the importance of trade and financial linkages as channels to enhance market integration globally. Therefore, the following segments discuss these factors in the GCC context.

2.2.8.1 Trade

Trade leads to large scale flows of funds, requires foreign exchange transactions, and is usually backed up by trade financing and hedging instruments. According to the World Trade Organisation (WTO), between 2005 and 2015, the value of merchandise exports in the GCC bloc grew from 397.6 to 649.6 US$ billion[22]. Moreover, imports increased from 188.3 to 490.6 US$ billion. These figures echo an upward trend in trade. This progress was accomplished due to the persistent efforts which GCC countries pursued to further integrate their economies globally. These policies include the ratification of the EU/GCC free trade agreement and the inclusion of all GCC countries in the World Trade Organisation (WTO).

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[20] Includes foreign currency deposits and bonds held by central banks and monetary authorities, gold and special drawing rights.

[21] Most of the reserves belong to Saudi Arabia according to the World Bank. https://data.worldbank.org/indicator/fi.res.totl.cd?view=chart&year_high_desc=true.

[22] https://www.wto.org/english/res_e/statis_e/wts2016_e/wts2016_e.pdf.

These global steps were matched regionally by the establishment of the Greater Arab Free Trade Agreement (GAFTA).

2.2.8.2 Foreign direct investment

Foreign Direct Investment (FDI) is an important means for financial flows and the development of financial services. Equally, FDI typically involves sophisticated financing and advisory arrangements. According to the World Bank, FDI net inflows are the value of inward direct investment made by non-resident investors in the domestic economy. FDI net outflows are the value of outward direct investment made by the residents of the reporting economy to external economies.

Inward Direct Investment includes all liabilities and assets relocated between resident direct investment enterprises and their direct investors. It also covers transfers of assets and liabilities between resident and non-resident associated enterprises, if the controlling party is non-resident. Outward direct investment incorporates assets and liabilities transferred between resident direct investors and their direct investment enterprises alongside transfers of assets and liabilities between resident and non-resident fellow enterprises, if the controlling party is resident.

Throughout the era of explosive oil prices from 2002 to 2008, there was a growing interest among foreign investors to access and invest in the larger GCC economies. According to the 2014 World Investment Report, in 2010, Saudi Arabia[23] occupied the 11th position among the top 20 FDI host economies. Kern (2012) states that the GCC inward FDI stock amounts to 23% of GDP. Even though it is less than the international average of 27%. It is significantly lower than the 39% in the EU, the world's most open economic zone.

[23] World Investment Report. 2014. Investing in the SDGs: An Action Plan. New York: UNCTAD. This could explain the Saudi stock market higher integration despite restrictions on foreign investment in Saudi stock markets.

TABLE 2. 3 FDI INFLOWS AND OUTFLOWS ($ MILLION)

FDI outflow	2011	2012	2013	2014	2015	2016
GCC	26,791	16,919	39,907	14,376	32,303	26,746
Saudi Arabia	3,430	4,402	4,943	5,369	5,390	8,359
UAE	2,178	2,536	8,828	11,736	16,692	15,711
Qatar	10,109	1,840	8,021	6,748	4,023	7,902
Kuwait	10,773	6,741	16,648	-10,468	5,407	-6,258
Oman	1,222	884	934	1,358	294	862
Bahrain	-920	516	532	-394	497	170

FDI inflow	2011	2012	2013	2014	2015	2016
GCC	29,384	27,189	24,290	23,854	14,811	17,911
Saudi Arabia	16,308	12,182	8,865	8,012	8,141	7,453
UAE	7,152	8,828	9,491	10,823	8,795	8,986
Qatar	939	396	-840	1,050	1,071	774
Kuwait	3,259	2,873	1,434	953	293	275
Oman	1,628	1,365	1,612	1,506	-2,692	142
Bahrain	98	1,545	3,729	1,519	-797	282

Note. The World Bank defines FDI net inflows are the worth of inward direct investment made by non-resident investors in the domestic economy. The World Bank defines FDI net outflows are the value of outward direct investment made by the residents of the reporting economy to external economies. The table illustrates the progression of the GCC FDI inflows and outflows between 2011 and 2016.

Source: UNCTAD world investment report, KAMCO research

As depicted in Table 2.3, FDI inflows to the GCC region displayed a regressive pattern in recent years where the inflows declined from $29,384 million in 2011 to $17,911 million in 2016. At the same time, albeit with heavy fluctuations, the FDI outflows from the

GCC remained around the same level and recorded $26,746 million. As a result, the GCC bloc has transformed into a net sender of FDI since 2015. With the exception of Saudi Arabia and the UAE, GCC nations are minimal net recipients of FDI. Also, in 2016, the UAE became the top exporter of FDI followed by Saudi Arabia and Qatar. These patterns could be ascribed to the steep fall of oil prices during the first half of the current decade. As depicted in Table 2.3, this is particularly evident in the case of prominent oil exporters; for example, FDI inflows in Saudi Arabia declined to a 12-year low level of $7,453 million in 2016. On the other hand, economic diversification efforts in countries like the UAE have resulted in higher levels of FDI inflows despite the deterioration in oil prices and the ramifications on the economy. Other factors contributing to the declining FDI may be the geopolitical uncertainty in the Middle East. The latter signals more regional risks that discourage international investors from pouring funds into the GCC. Of note, a decline in oil prices depresses both FDI inflows and outflows alike; since a portion of FDI goes towards oil and gas industries in the GCC, lower oil price dampens the expansion of business activities in the sector and halts planned investments. On the other hand, FDI outflows are equally impacted since the proceeds of oil are a major component of the funds channelled towards overseas investment.

2.2.8.3 Foreign portfolio investment

According to the World Bank, portfolio investment is defined as cross border transactions and positions involving debt or equity securities, other than those included in direct investment or reserve assets. In other words, foreign portfolio investment (FPI) consists of domestic financial assets passively held by foreign investors. It does not provide the investor with direct ownership of financial assets and is relatively liquid. This means that although FDI allows a company to maintain a better control over the firm held abroad, it may face more difficulty selling the firm at a premium price in the future. Table 2.4 shows that FPI figures have fluctuated extensively and do not display any particular pattern. However, Oman portfolio inflows are relatively high in the GCC standard, especially when I take into account the small size of the Omani stock market. This may lead to more integration of the Omani financial market globally, which could be plausibly linked to the fact that Oman has the lowest cap on foreign participation, as foreign investors are permitted to own up to 70% of Omani shares.

Again, the FPI is comprised of the sum of debt and equity security flows. In the GCC context, Balli et al. (2009) state that the majority of foreign portfolio inflows to the GCC market are in the form of debt securities; loans and bonds were prevailing targets for foreign investors in the UAE, Qatar and Saudi Arabia. This could be linked to the high creditworthiness of these countries (See Figure 2.11). In terms of the sources of FPI flows, Balli et al. (2015) document that between 2000 and 2011, 46% the FPI (US$ 380 billion) was directed towards the UAE; at the same time, Qatar and Saudi Arabia accounted for 19% and 16%, respectively. Also, the humble amount of foreign investment flows mirrors limitations in market access. This tendency is more pronounced in Bahrain and Kuwait as depicted in Figure 2.13. To conclude, it is evident that trade is the only factor with an increasing trend and is, therefore, expected to exert some influence on stock market integration in the GCC region.

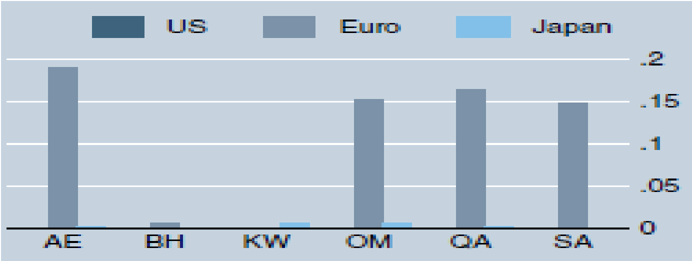
TABLE 2. 4 FPI INFLOWS TO THE GCC 2005-2015 ($ MILLION)

Nation/ year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Qatar	NA	NA	NA	NA	NA	NA	− 902	− 925	615	2,482	115
UAE	− 81	− 36	29	227	564	NA	NA	NA	NA	NA	NA
Kuwait	NA	44	676	3,954	500	− 25	832	638	65	585	42
Oman	573	1,180	1,629	-1,460	332	1,308	-400	1,771	1,280	798	1,938
Saudi Arabia	−0.35	11,951	5,489	1,630	20,140	15,151	16,511	3,180	NA	NA	NA
Bahrain	1,801	133	138	156	− 487	1,652	981	1,382	1,385	-7,688	NA

Note. According to the World Bank definition FPI is comprised of the sum of debt and equity security flows. Above are the FPI inflows to the GCC bloc between 2005 and 2015.

Source: World Development Indicators, World Bank

FIGURE 2. 13 FPI IN GCC FROM DEVELOPED COUNTRIES (PERCENT)



Note. The level of FPI inflows into the GCC countries from the US, the EU, and Japan.

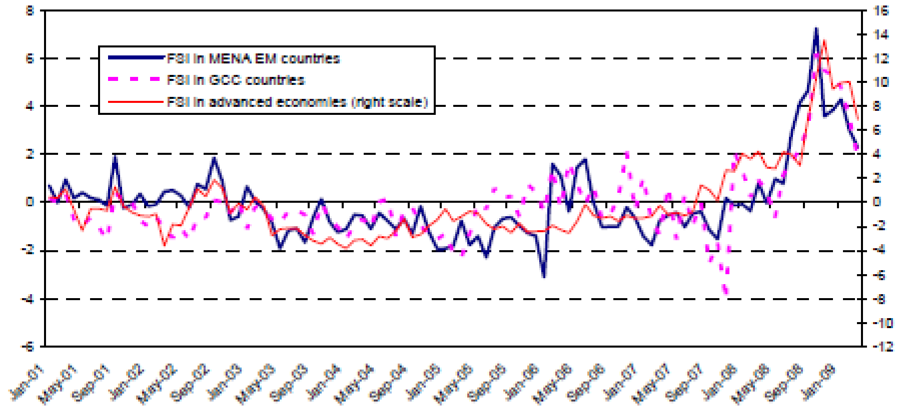
Source: Balli, F., Hajhoj, H.R., Basher, S.A. & Ghassan, H.B. 2015, "An analysis of returns and volatility spillovers and their determinants in emerging Asian and Middle Eastern countries. International Review of Economics & Finance, vol. 39, pp. 311-325.

2.2.9 Major crises

The GCC stock markets have gone through two major crises: the first was regional in nature and took place in 2006. It was the outcome of a speculative bubble that had built up in the first half of the millennium that eventually burst. Subsequently, valuations declined in Saudi Arabia and Dubai by 65% and 50%, respectively. In fact, the 2006 stock market crisis caused huge losses for hundreds of thousands of unsophisticated local retail investors who were lured by unrealistically high returns. Hertog (2012) maintains that the GCC stock market issued regulatory reforms and proceeded to police insider trading activities. The author argues that improvements have been recorded during recent years. Despite these reforms, Hertog (2012) states that stock markets did not recover their appeal as investment vehicles for GCC individual investors.

The second catastrophe occurred in the wake of the 2008 Subprime Crisis. Samarakoon (2010) points out that the decline in the US stock market began in late 2007, which was followed by deteriorations in both emerging and frontier markets. During the most turbulent episode from September 2008 to March 2009, the US stock market plummeted by 43%. Samarakoon (2010) adds that both emerging and frontier markets were affected further, and dropped by 50% and 60%, respectively.

FIGURE 2. 14 FINANCIAL STRESS INDEX DURING BOTH REGIONAL AND GLOBAL CRISES



The stress index in GCC compared with MENA and advanced markets.

Source: Moriyama, K. 2010, The Spillover Effects of the Global Crisis on Economic Activity in Mena Emerging Market Countries: An Analysis Using the Financial Stress Index, International Monetary Fund.

As illustrated in Figure 2.14, the 2006 regional crisis saw an increase in market stress in the MENA region as a whole, including the sub-region of the GCC; meanwhile, the 2008 global crisis produced an unprecedented stress escalation in the GCC and developed markets alike. Additionally, the 2008 financial crisis affected the GCC financial markets in two dimensions: first, markets reacted harshly to the banking crisis in the US and Europe from the second half of 2008 to the first quarter of 2009. As a result, a drastic drop in stock market indices took place. During the same period, GCC stock market indices plummeted by one-fifth in the case of Oman, around one-third in Bahrain, Kuwait and Abu Dhabi, by almost 50% in Saudi Arabia, and by as much as two-thirds in Dubai. Second, the GCC markets responded to the debt problems of individual state-owned enterprises in Dubai and Saudi Arabia, which ended in a US$ 10 billion bail-out of Dubai by neighbouring Abu Dhabi in December 2009.

The turmoil around these two events, together with other factors, had a profound impact on the GCC financial markets. Kern (2012) indicates that recovery levels from the subprime crisis varied across GCC markets but remained slower than other emerging stock markets.

The third crisis is regional and political in nature and culminated in the Qatari blockade by the nearby GCC nations in May 2017. This crisis had a severe influence on the Qatari stock market causing the index to drop by 18.3% during 2017 (see Figure 2.7).

Charfeddine and Al Refai (2019) report that the regional blockade on Qatar lowered the level of stock market dependence but did not totally cut the financial links between the GCC countries.

2.2.10 linkages among the GCC, the US, Japan and the UK in the Quantitative Easing era

This section examines the interrelationships between the GCC and global financial markets. The analysis uses the one-year rolling moving window correlations during the quantitative easing era. This policy increased the supply of funds in developed markets and consequently channelled more funds from developed to emerging markets. Sahay et al. (2014) states that between 2010 and 2013 emerging markets received half of the global flow of funds. The aims of the analysis are threefold: first, to assess the correlations between the GCC countries with the major global markets; second, to examine the intraregional correlations within the GCC bloc; third, to link shocks in correlations to specific market innovations.

2.2.10.1 Data

Weekly data, from 3/31/2010 to 9/21/2016, is used to maintain a high number of observations while avoiding some of the biases that can arise with daily data, including differences in trading hours, or national holidays that close one country's equity market that day, but leave others open. All returns are denominated in US dollars so as to be more comparable across countries. Official all share indices[24] are used for the following: Dubai, Saudi Arabia, Abu Dhabi, Qatar, Oman, Bahrain, and Kuwait. These indices are value-weighted free float. Also, the MSCI UAE is designed to capture the performance of the large and mid-cap segments in the Emirati financial markets of Dubai and Abu Dhabi. With nine constituents, the index covers approximately 85% of the UAE equity universe. The S&P 500 is employed as a proxy for the US; FTSE 100 and Nikkei 225 represent the UK and Japan, respectively. Returns are calculated as the percentage change of price series.

[24] S&P Saudi and MSCI UAE indexes were uniquely used in this chapter for comparability purposes.

Rolling analysis is the process of computing parameter estimates over a rolling window of a fixed size through the sample. This technique is commonly used due to its predictive accuracy and its capability to overcome outliers.

TABLE 2. 5 DESCRIPTIVE STATISTICS

	US	UK	UAE	SAUDI TADAWUL	ABU DHABI	QATAR
Mean	0.001	-2.1E-05	-0.00089	-0.00117	-0.0004	7.90E-05
Median	0.002027	0.002676	0.002272	0.003076	0.000505	0.001003
Maximum	0.113559	0.128984	0.192631	0.146677	0.110261	0.139605
Minimum	-0.20084	-0.14102	-0.25681	-0.18599	-0.18493	-0.24943
Std. Dev.	0.024847	0.030416	0.049751	0.038488	0.030134	0.037366
Skewness	-0.97674	-0.56708	-0.86014	-1.11177	-0.85088	-0.93334
Kurtosis	12.14894	6.177185	7.387338	7.207228	7.627451	10.51955
Jarque-Bera	2155.161	280.2525	546.8742	557.6303	598.6166	1478.193
Probability	0.00	0.00	0.00	0.00	0.00	0.00
Phillips-Perron unit root test	0.00	0.00	0.00	0.00	0.00	0.00

	OMAN	KUWAIT	JAPAN	DUBAI	BAHRAIN
Mean	0.000237	-0.00052	0.00077	-0.00061	-0.00107
Median	0.001064	0.000129	0.00288	0.001752	-0.00045
Maximum	0.139741	0.072067	0.14095	0.233998	0.047779
Minimum	-0.21055	-0.18096	-0.15244	-0.29114	-0.08511
Std. Dev.	0.027814	0.022582	0.026254	0.045549	0.014402
Skewness	-1.41965	-1.75546	-0.37327	-1.05072	-0.73217
Kurtosis	16.18649	14.10727	6.533271	11.29086	7.302329
Jarque-Bera	4480.398	3341.564	321.1426	1801.428	508.6125
Probability	0.00	0.00	0.00	0.00	0.00
Phillips-Perron unit root test	0.00	0.00	0.00	0.00	0.00

Note. Descriptive statistics of the logarithmic difference of weekly stock returns from 3/31/2010 to 9/21/2016 with 591 observations.

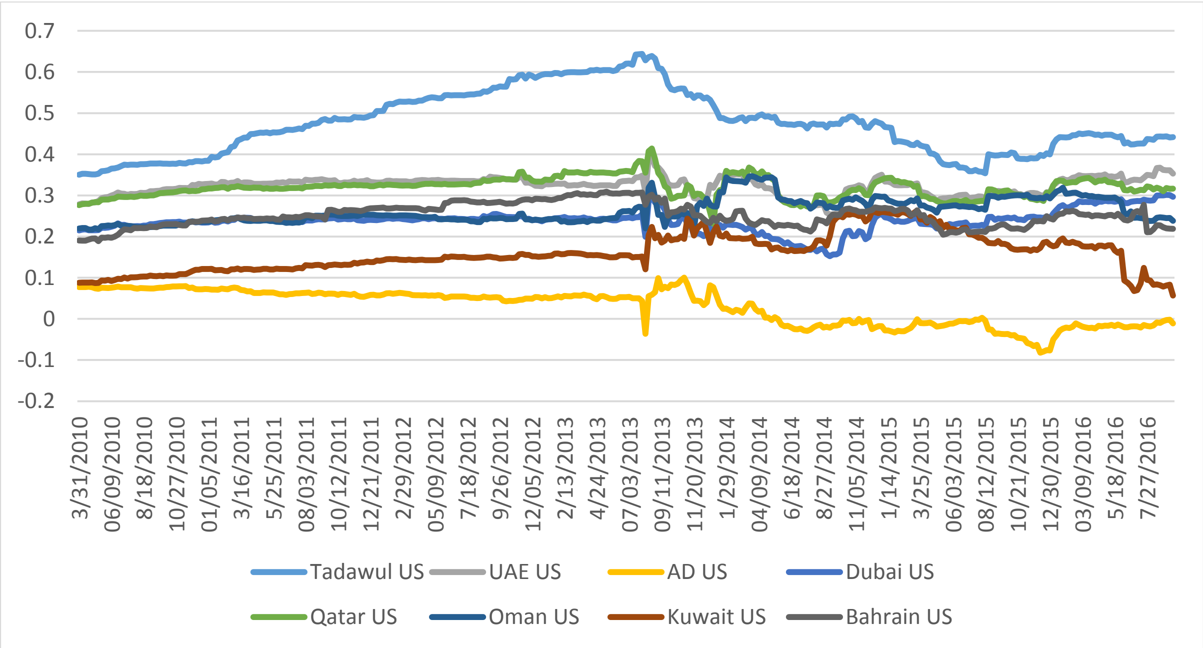
As is common in return series, Table 2.5 demonstrates departures from normality in all entries. In particular, negative skewness is observed in the sampled markets, therefore hinting recurrent small gains and a few large losses. Additionally, the distribution is leptokurtic; this means that the series display greater kurtosis than a mesokurtic distribution as a result of outliers. The Phillips-Perron unit-root test results point to the stationarity of all indices.

2.2.10.2 Empirical results

GCC correlations with developed markets

Figure 2.15 gives the correlations over a 1-year moving window for the US and all GCC countries between 3/31/2010 and 9/21/2016. The hallmark of this era is the Quantitative Easing policy implemented by central banks globally. Over the last six years, the rolling correlation coefficient dips and rises regularly and ranges between -0.08 and 0.65.

FIGURE 2. 15 US-GCC MOVING WINDOW CORRELATION



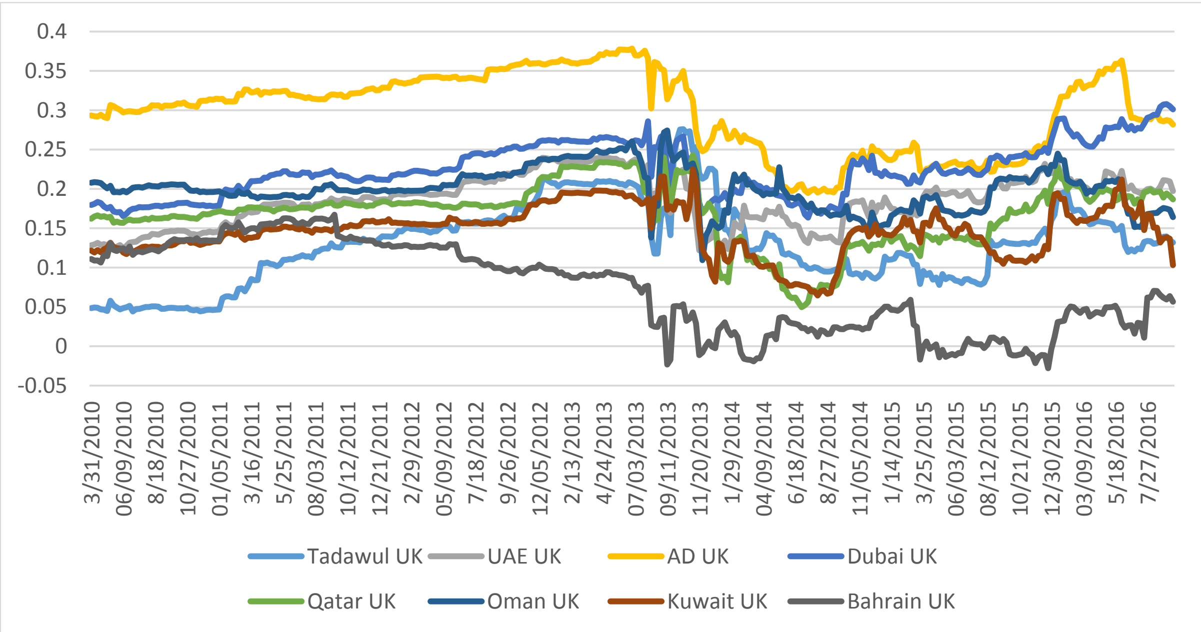
Note. One-year moving window correlation between the US and the six member states of the GCC. AD stands for Abu Dhabi.

From 03/2010 to 07/2013, with the exception of Abu Dhabi, there was an increasing pattern in US-GCC correlation. The recorded increase was 0.27-0.35 in Qatar, 0.22-0.25 in Oman and 0.08-0.15 in Kuwait. Bahrain correlation with the US ranged from 0.18 at the beginning of the subsample to 0.30 at the end of it. Finally, in addition to recording the highest correlation, Saudi-US recorded the steepest increase where it almost doubled (0.35-0.60). The fact that the MSCI UAE index is more interlinked with the US than both Dubai and Abu Dhabi may appear bizarre since the UAE index is constituted of both markets. However, this stems from the fact that the MSCI UAE Index is designed to measure the performance of the large and mid-cap segments of both markets.

The series of announcements from the US Federal Reserve (Fed) on halting the Quantitative Easing policy caused a shock to the upward correlation patterns and subsequent declines in correlations occurred starting around August 2013.

Figure 2.16 gives the correlations over a one-year moving window for the UK and all GCC countries. The variance of correlation between GCC countries and the UK is lower than its US counterpart, with observations ranging between -0.02 and 0.37. This result is primarily due to higher interdependence between the US and the Saudi Tadawul index.

FIGURE 2. 16 UK-GCC MOVING WINDOW CORRELATIONS



Note. One-year moving window correlation between the UK and the six member states of the GCC. AD stands for Abu Dhabi.

Contrary to the US case, Abu Dhabi has the highest correlation over the course of the sample. This may be due to the high influx of British[25] investors to Abu Dhabi. Bahrain

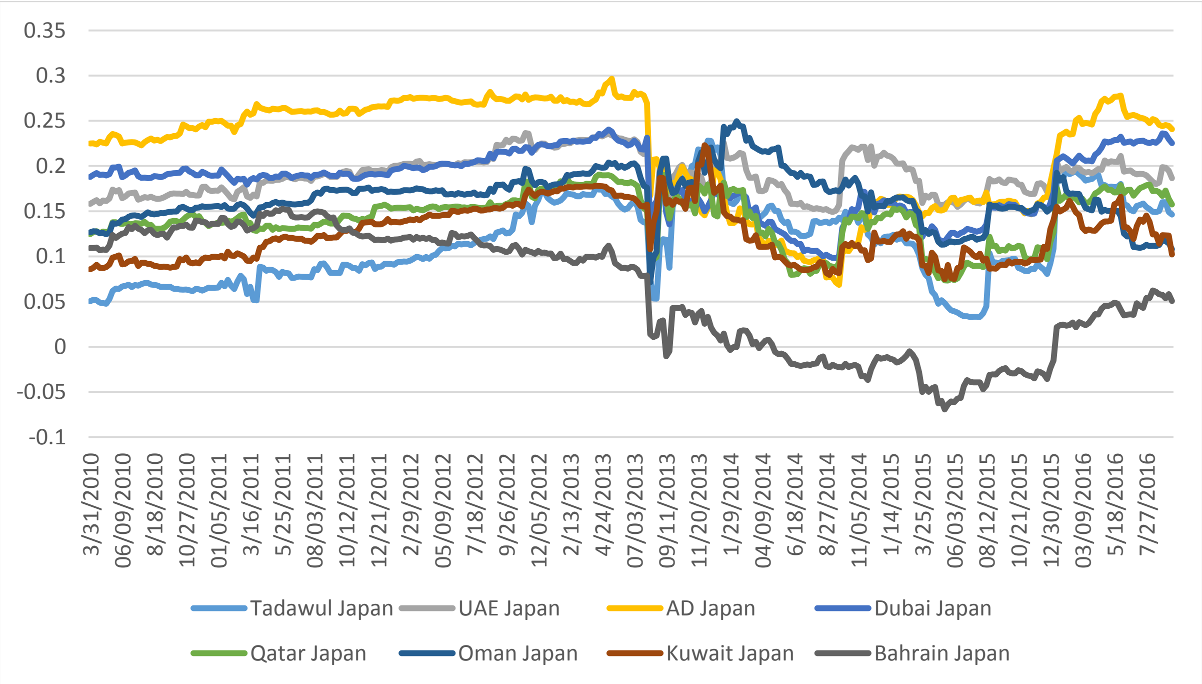
[25] See figures 2.8 and 2. 9.

exhibited a decreasing pattern during the sub-period prior to August 2013, and a volatile trend after it with approximate zero to -0.05 rate. It is worth mentioning that the distinctive behaviour of the Bahraini correlation before the Tapering Tantrum shock was reversed in the second sub sample and showed lagged comovements with the other GCC countries.

The rest of the GCC markets experienced increasing correlations that varied from 0.2 to 0.26 before August 2013. Finally, a global market shock in January 2016, related to lower than expected growth in China (one of the world's leading importers of metals and oil) precipitated a jump in the UK-GCC correlations.

Turning to Figure 2.17, similar to the UK case, the variance of correlation with Japan is lower than the US with a range between -0.05 and 0.03.

FIGURE 2. 17 JAPAN-GCC MOVING WINDOW CORRELATIONS



Note. One-year moving window correlation between Japan and the six member states of the GCC. AD stands for Abu Dhabi.

The GCC markets display a similar trend with a mild correlation increase from March 2010 to August 2013, with Abu Dhabi again on top. Additionally, Qatar and Oman were in the middle and Bahrain and Kuwait trailing. Similar to the UK case, all GCC linkages with Japan spiked in January 2016. This drift is persistent in correlations among the indices of the

GCC, the UK and Japan, but not with the US. Given the fact that the US federal funds rate[26] increased from 0.25 to 0.5 in January 2016, it is inevitable that GCC countries follow the US lead in (short term) interest rates and adjust accordingly, as their currencies are pegged to the US dollar. As a result, the GCC-US correlations did not experience the same spike. Moreover, both Japanese and European central banks did not follow the US Fed and maintained their expansionary monetary policies.

Finally, the Saudi Tadawul is strongly linked to the US while the UAE markets of Dubai and Abu Dhabi exhibit relatively high correlations with both the UK and Japan. In contrast, Bahrain and Kuwait to a lesser extent display relative isolation from global and regional markets.

The Tapering Tantrum[27] influence

In order to explain the shock in market correlations in August 2013, the following sheds light on the Tapering Tantrum event. Taper Tantrum is the term used to refer to the 2013 surge in US treasury yields, which resulted from the Federal Reserve's use of tapering to gradually reduce the amount of money it was feeding into the economy (Sahay et al., 2014). Tapering as a term attracted a great deal of attention on 22 May 2013 when US Federal Reserve Chairman Ben Bernanke stated, in testimony before Congress, that the Federal Reserve may decrease the size of the bond-buying program, known as Quantitative Easing. The program aimed at stimulating the economy and supporting financial market performance through the post-2008 crisis. On 19 June 2013, Ben Bernanke announced a tapering of some of the Quantitative Easing policies contingent upon continued positive economic data.[28] Specifically, he said that the Federal Reserve could scale back its bond purchases from $85 billion to $65 billion a month during the upcoming September 2013 policy meeting. To elaborate more on this matter, Mishra et al. (2014, p.4) state that “In the aftermath of the Global Financial Crisis, ultra-loose monetary policy in advanced economies prompted a global search for yield with investors flocking into emerging markets (EMs), loosening financial conditions, and contributing to a broader mispricing of domestic assets”.

[26] The effects of US interest rates on GCC is documented by an empirical investigation conducted by Hammoudeh and Choi (2006).
[27] For more information on the subject, please refer to Chen et al. (2012), Moore et al. (2013) and Lim et al. (2014).
[28] https://www.bloomberg.com/news/articles/2013-06-20/fed-seen-tapering-qe-to-65-billion-at-september-fomc-meeting.

In detail, Avdjiev and Takats (2014) document that the outstanding stock of cross-border bank claims on EMEs stood at more than $3.6 trillion at the end of 2013 which was as large as the stock of all portfolio investment in EMEs. This demonstrates the cross-border importance of securities market financing. Mishra et al. (2014) maintain that this trend was disrupted in May 2013 when the Federal Reserve signalled its intention to wind down its unconventional monetary policy.[29] Avdjiev and Takats (2014) report that during the taper tantrum, cross-border bank lending to EMEs slowed sharply. Its growth rate plunged to 2.5% in the second and third quarters of 2013 from around 10% over the previous two quarters. Mishra et al. (2014) indicate that the market pressure translated into global risk aversion with major corrections in emerging markets and reversal in capital flows. This radical change could explain the turbulence in the GCC stock market correlations in August 2013. Behar and Hadjian (2015) state that the movement of capital flows into the GCC and other emerging markets was interrupted by the tightening of monetary policy in the US. This trend distressed the availability and cost of financing in emerging countries. This fact resulted in two major volatility episodes in 2013 and early 2014. Behar and Hadjian (2015) document an outflow of capital from the GCC that took place from May to September 2013. Behar and Hadjian (2015) report that this propensity demonstrated the deterioration in investor sentiment and resulted in 4% outflow of assets under management in emerging markets and 3.6% in their GCC counterparts.

GCC pairwise correlations

Figure 2.18 depicts GCC intra-regional pairwise correlations. Predictably, the intra-regional correlation patterns are stronger than the inter-regional ones. The range of observations is by far the highest and some correlations record the uppermost values, particularly after 2015. This reflects heterogeneity in intra-regional linkages within the GCC bloc in the post-August 2013 shock. The highest observation recorded was 0.7 between the UAE and Qatar, while the Saudi and Kuwaiti linkages plummeted to reach near zero correlation during the latest observations.

The Tapering Tantrum shock in August 2013 was followed by a period of instability that lasted 4 months until December 2013. The outcome of the shock and the relocation of

[29]Referring to the US Department of the Treasury, the 10-year treasury bills rose from 1.5% in May, to 2.6% in July, to reach 3% in September 2013.

capital was translated into volatile correlations among the GCC markets. This is contrary to the collective pattern of comovements during the pre-August 2013 period.

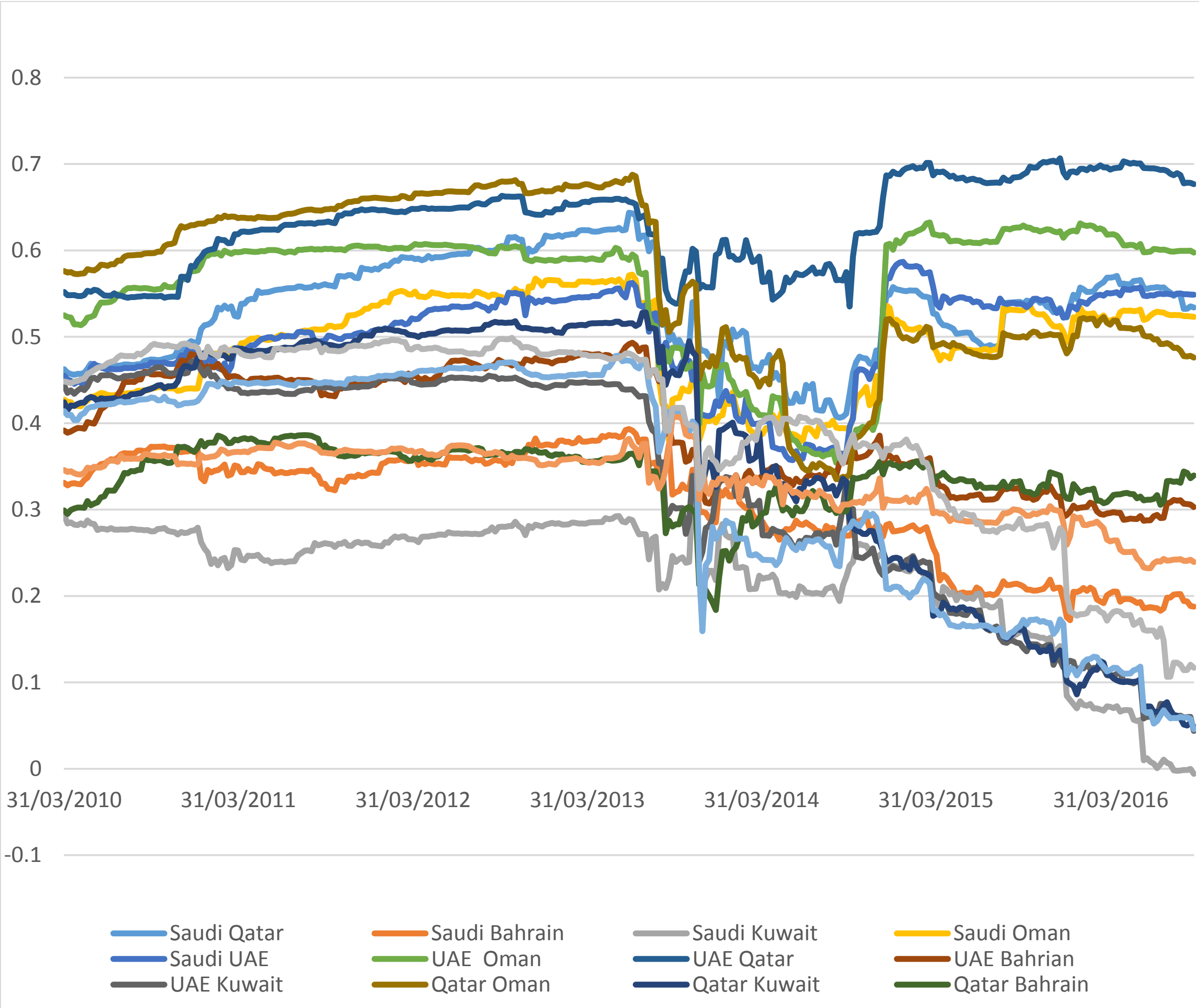
Behar and Hadjian (2015) stress that market turbulence calmed in September 2013 due to a delay in tapering; nevertheless, volatility hiked again in early 2014 over concerns on vulnerabilities in some emerging markets. However, according to Behar and Hadjian, (2015) the GCC financial markets experienced only 0.6% portfolio outflows compared with 1.2% in other emerging markets. This outcome can be attributed to better macro fundamentals in the GCC countries resulting from surpluses accumulated during the preceding high oil price era.

In essence, the aftermath of the Tapering Tantrum instigated decoupling in the GCC markets correlations; whereas Saudi, Oman, the UAE and Qatar correlations bounced back to their pre “Taper Tantrum” levels, Bahrain and Kuwait exhibited segregation that reached unprecedented near-zero values.

In fact, Saudi Arabia, Qatar, the UAE and Oman implemented policies towards more liberalisation and global integration. That being said, the 2016 MSCI report[30] indicates that Saudi Arabia launched the qualified investor program in 2015. This allowed direct foreign ownership in Saudi stock exchange after Saudi shares were only available through indirect means. Moreover, as of 2014, the UAE and Qatar are included in the emerging market index. Finally, Oman has the lowest cap on foreign investments. Indeed, the Musqat stock exchange allows global investors to own up to 70% of Omani companies’ shares. Consequently, Omani stock receives relatively high portfolio influx relative to its small market capitalisation. This could explain the higher integration in Oman when compared with Bahrain and Kuwait.

[30]https://www.msci.com/documents/1296102/1330218.

FIGURE 2. 18 MOVING WINDOW OF GCC PAIRWISE CORRELATIONS



Note. The GCC intra-regional one-year moving window correlations. The UAE index is used instead of the indexes of Dubai and Abu Dhabi to avoid overwhelming the graph.

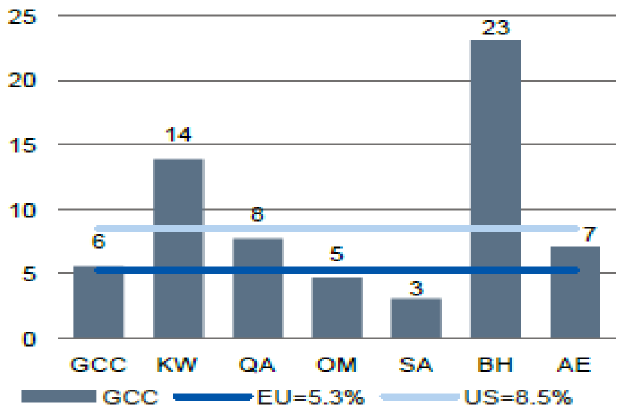
On an international level, Bahrain displays distinctive and decreasing correlations with Japan and the UK since the political unrest in 2011. The political instability affected Bahrain's image as a stable financial hub[31] of the Middle East, and consequently may have resulted in an outflow of international funds. The link with the US is perhaps due to monetary policy harmonisation.

The peculiar Kuwait index correlation could be explained by sluggish GDP growth. Indeed, between 2013 and 2016 an average of 1.5% was recorded[32], which is considerably

[31] See Assaf (2003).
[32] According to the World Bank, GDP average growth between 2013 and 2016 year was as follows: Saudi 2.85%, Qatar 6.5%, UAE 3.8%, Oman 3.8%, Bahrain 3.7% and Kuwait 1.5%.

lower than the 4.13% average in the rest of the GCC countries. This humble growth may indicate higher vulnerability to oil price fluctuations, thereby reducing the attractiveness of the country to global investors. Additionally, as illustrated in Figure 2.19, both Bahrain and Kuwait have a salient financial sector that contributes considerably to the national GDP. This fact might cause policymakers (in both countries) to take extra prudential measures to protect the financial markets from global turbulence. Finally, the lower segmentation in Kuwait when compared to Bahrain could be the result of a higher value of oil exports.

FIGURE 2. 19 FINANCE SHARE OF GDP IN 2009



Source: Deutsche Bank Research

2.2.10.3 Concluding remarks

Using weekly data from 3/31/2010 to 9/21/2016, and moving window correlations, the analysis has attempted to assess the correlations between the GCC countries and major global financial markets and within the region itself. The US is notably linked to Saudi Arabia while the UAE markets have the highest correlations with both Japan and the UK. Furthermore, results document heterogeneities in the nature of inter- and intra-regional correlations in the GCC bloc. On one side, higher global and regional integration is observed in the cases of Saudi Arabia, the UAE, Qatar and Oman, and on the other, Bahrain and Kuwait exhibit segregation from the GCC bloc and globally. The global isolation is less pronounced in the case of Kuwait perhaps due to its larger level of oil exports.

The examination has also introduced specific events that shaped the dynamics of the correlations; first, the January 2016 shock, which is a reflection of the global market crash and an increase in US Federal Reserve interest rates; second, the 2013 Tapering Tantrum, also related to monetary policy actions, yet, the turbulence was mainly caused by the consequent outflow of funds.

Concerning the implication of the analysis, GCC policymakers aiming to preserve financial stability should include US monetary policy changes in their strategies especially in the integrated GCC bloc of Saudi Arabia, the UAE, Qatar and Oman. Also, the heterogeneity in integration levels across the GCC markets carries important information for regional investors seeking intra-regional diversification benefits, for global investors seeking to improve their portfolios mean to variance ratios. Moreover, investors seeking to invest in the GCC ought to monitor US monetary policy innovations as they precipitate shocks to correlations.

To conclude, GCC nations jointly account for 40% and 23% of proven oil and gas reserves. Accordingly, GCC countries enjoy robust economies, good macroeconomic fundamentals, comparable GDP per capita to developed nations and high credit rating. Although backed by substantial hydrocarbon reserves, GCC markets are new to the global arena with considerable room to grow. The financial markets of the GCC are going through liberalisation. However, from the capitalisation levels, liquidity, MSCI classification and correlation results, it can be argued that much of the improvement in the GCC took place in the markets of Saudi Arabia, the UAE and Qatar. The GCC markets display sensitivity to oil innovations and to global crises. Finally, given the fluctuations in FDI and FPI, the economic integration of the GCC economies appears to stem from the trade channel.

Chapter 3

The inter- and intra-regional linkages in the GCC bloc

3.1 Introduction

Over the last two decades, economic and financial integration through trade and capital flows led to higher stock market integration. Rising international integration of financial markets has motivated empirical research to examine the mechanism through which stock market movements are transmitted globally. Building on the work of King and Wadhwani (1990), Hamao et al. (1990) and Eun and Shin (1989), this chapter is an effort to study the inter- and intra-regional stock market linkages in the GCC bloc. Understanding the nature and extent of linkages between different financial markets is important for portfolio managers, investors and domestic policymakers.

The motivation for the present study originates from the heat wave and meteor shower hypothesis of Engle et al. (1990) and its implications. The heat wave is consistent with the idea that most of the volatility sources are country-specific factors. The meteor shower hypothesis proposes that the present volatility of a stock market is a function of past volatility from other markets. It implies that shocks generated in one market, travel to other markets. In fact, potential linkages exist due to trade and cross country fund transfers (Ng, 2000; Forbes and Chinn, 2004; Wei et al., 1995). This is particularly important with the rapid expansion of the mutual fund industry and the growing number of investors seeking cross country diversification.

Traditionally, investors aiming to achieve cross-country diversification benefits have invested in emerging markets because of their low correlations with developed markets. However, the rise of globalisation and increased financial integration between developed and emerging markets have severely hindered these benefits (Kearney and Lucey, 2004). This leads to an interest in a subset of emerging markets known as frontier markets, sometimes referred to as “emerging emerging” markets, which are typically the smallest, least liquid, and, importantly, least integrated (Bley and Saad, 2012). Chen et al. (2014) state that frontier countries which are in the early stages of economic development, generally demonstrate long-run growth potential. They add that frontier markets today are often compared to emerging markets in the late 1990s. Despite the fact that the former sustain higher transaction costs, it does not eliminate the diversification benefits investors receive from allocating capital to these markets (Marshall et al., 2015). Although three of the GCC markets are classified[33] as frontier, the six member states of GCC jointly account for 40% and 23% of proven oil and gas reserves, respectively (Sedik and Williams, 2011). Accordingly, the GCC markets enjoy good macro fundamentals and are going through a liberalisation process (Al-Khazali et al, 2006; Bley and Chen, 2006; Al Janabi et al., 2010; Arouri and Rault, 2012).

The literature on the interrelationships among financial markets has evolved into different distinctive strands. The first segment focuses on stock market integration in the context of developed and emerging markets, examples include the work of Bekaert and Harvey (1995, 2000). Other researchers expand the scope of countries to include frontier markets in their analysis, such as Pukthuanthong and Roll (2009) and Samarakoon (2011). While financial integration covers different characteristics of complex linkages across financial markets, I focus on international equity prices convergence. Accordingly, I follow Kim et al. (2006) and use correlations across financial markets is a more specific concept of integration. The second strand of research involves the study of international financial spillovers.[34] Much of the earlier research in this particular field, such as the seminal work of Eun and Shin (1989), concentrates on linkages in the first moment, that is, the co-movement among returns. However, Kyle (1985) demonstrates that much of the information is revealed in the volatility of stock returns, hence, the focus turned toward volatility spillovers. Examples of this strand include the work of Baele (2005), Li and Giles, (2015) and Ng (2000).

Given the young age of the GCC financial markets, the academic research on equity markets linkages in the bloc remains thin. Motivated by the importance of oil to the GCC economies and the monetary policy harmonisation between the US and the GCC (resulting from the $US pegged GCC currencies), the majority of studies that examine the behaviour of the GCC in response to global factors limit their scope to examine the influence of the US and oil (Malik and Hammoudeh, 2007; Hammoudeh and Aleisa, 2004; Hammoudeh and

[33] In addition to Qatar and the UAE, Saudi Arabia has been included in the MSCI emerging market as of 2019.
[34] For a comprehensive review on financial spillovers, see Gagnon, L. & Karolyi, G.A. 2006, "*Price and volatility transmission across borders*". Financial Markets, Institutions & Instruments, vol. 15, no. 3, pp. 107-158.

Choi, 2006 and Khalifa et al, 2014) and largely neglect other global markets. Early research in intra-regional linkages in the GCC did not reach a consensus on which market drives the movements of equities in the bloc (Assaf, 2003; Abraham and Seyyed, 2006; Alkulaib et al., 2009; Hammoudeh and Alesia (2004). Yet, in response to the high liquidity and capitalisation of the Saudi stock market, more recent attempts assume that Saudi Arabia is the regional source of innovation for the rest of the GCC markets (Alotaibi and Mishra, 2015; Awartani et al., 2013).

To address these issues, this study takes an all-encompassing outlook on the GCC region and examines the linkages with the most prominent financial markets alongside analysing the intra-regional relationships. The modelling strategy targets correlations and spillovers and incorporates both moments of interaction, which are the mean and the variance.

The first objective of this research is to investigate the linkages among developed and GCC equity markets. Precisely, the examination incorporates the US, Japan, the EU, and the GCC to explore the new geography of financial information transmission in a time-varying framework. The second objective is to quantify the intensity and the direction of return and volatility spillovers intra-regionally in light of the recent contemporaneous innovations in the bloc. In fact, the Saudi market assumes almost half of the GCC overall capitalisation, on the other hand, the MCSI proceeded to reclassify Qatari and UAE markets to emerging status after being frontier markets prior to 2014.

In this context, this study empirically examines the inter- and intra-regional patterns of transmissions across GCC stock markets over the period stretching from 2004 to 2019. The empirical investigation uses weekly data and the Diebold and Yilmaz (2009, 2012) spillover index, as well as the Asymmetric Dynamic Conditional Correlation (ADCC GARCH) model of Cappiello et al. (2006).

The Dynamic Conditional Correlation model (DCC GARCH) specification of Engle (2002) significantly reduces the parameters to be estimated when compared with other multivariate GARCH models. The ADCC of Cappiello et al. (2006), an extension to the DCC model, treats positive and negative shocks differently, as it is commonly argued in the literature that negative shocks have more severe effects on markets and consequently on correlations. The spillover index of Diebold and Yilmaz (2009) is based on forecast error variance decompositions from a VAR model. This approach has advantages including the simplicity of estimation and the ability to incorporate many variables in one system without suffering from over-parameterisation. Diebold and Yilmaz (2012) use a generalised VAR framework in which forecast-error variance decompositions are invariant to variable ordering. The improved spillover index is also capable of measuring both total and directional volatility spillovers.

The main findings are as follows: The EU surpasses the US as a major originator of spillovers in most GCC nations, with the exception of Saudi Arabia. EU based events like the Brexit vote increased the EU-GCC correlation to 0.55, that is the highest recorded in all GCC correlations. On the intra-regional level, the UAE, represented by Dubai and Abu Dhabi, is the biggest recipient and sender of spillovers in the GCC region. On the contrary, Bahrain and Kuwait are quite segmented. This signifies the importance of financial market openness intra-regionally and trade as a determinant of the GCC market global linkages. From a dynamic point of view, events such US Monetary tightening policies, market crashes (2008, 2016, and 2018) and the Brexit vote amplified both correlations and volatility spillovers in the GCC. In effect, the results of this study are of importance to international investors, portfolio managers and policy-makers.

The rest of the chapter proceeds as follows: Section 3.2 reviews the relevant literature, Section 3.3 presents the methodology, Section 3.4 describes the data, Section 3.5 presents the empirical findings of the research and, finally, Section 3.6 concludes the chapter.

3.2 Literature review

Spearheaded by Eun and Shin (1989), many empirical studies concentrate on the analysis of interdependence in mean among different markets. Examination of volatility is made possible by the introduction of the conditional heteroscedasticity approach by Engle (1982) and Bollerslev (1986). Early examples of the incorporation of GARCH models include the work of Hamao et al. (1990), Lin et al. (1994), Theodossiou and Lee (1993) and Ng (2000).

Berben and Jansen (2005) investigate shifts in correlation patterns among developed equity returns using a GARCH model with a smoothly time-varying correlation. Similar to Arshanapalli and Doukas (1993), results indicate that correlations among the German, British and American stock markets have doubled between 1980 and 2000, while Japanese correlations have remained the same. Similar findings of increased linkages among developed markets in Europe and the US are reached by Baele (2005), Booth et al. (1997), Fratzscher (2002), and Tsai (2014).

Bekaert and Harvey (1997) find that stock market returns in emerging markets are high and foreseeable but lack strong correlation with major markets. The authors elaborate by stating that as emerging markets mature, they are likely to become gradually more sensitive to the volatility of stock markets elsewhere. Their increasing degree of integration with world markets will weaken their capability to enhance and diversify international portfolios and will make those stock markets more vulnerable to external shocks. Bekaert and Harvey (1997) find that capital market liberalisation often leads to a higher correlation between local and international markets. Ng (2000) elaborates that the relative importance of regional and world market factors is influenced by changes in foreign investment restrictions and volume of trade. Other attempts in this strand of research include the work of Li and Giles (2015) and Beirne et al. (2013). Yarovaya et al (2016) examine intra- and inter-regional transmission of information across 10 developed and 11 emerging markets. They state that markets are more prone to domestic and region-specific volatility shocks than to inter-regional contagion.

In the GCC region, based on a GARCH model and daily data from 1999 through to 2005, Yu and Hassan (2008) contend the segmentation of stock markets in the GCC bloc. They also find negative correlations between GCC and developed markets, implying that investors in GCC stocks stand a good chance to gain from international diversification. Sedik and Williams (2011) analyse the impact of global and regional spillovers on the GCC equity markets. They use monthly data from 2000 to 2010 and a trivariate GARCH model to identify the degree of spillovers, and their transmission mechanisms. Results indicate that regional volatility spillovers are highest in the UAE and Oman, and smallest in Kuwait. Meanwhile, the US (global) spillovers were highest in the UAE, lowest in Saudi Arabia and insignificant in Bahrain. The researchers stress that GCC stock markets are vulnerable to financial shocks from global and regional sources, especially during the 2008 subprime crisis. Alotaibi and Mishra (2015) examine spillover effects from the US and Saudi market on the remaining five GCC stock markets; namely Bahrain, Kuwait, Qatar, Oman, and the UAE. Weekly data and three bivariate GARCH models (BEKK, CCC, and DCC) are employed. The regional spillover effects from Saudi Arabia to each GCC market are found to be positive and significant in four GCC nations (Kuwait Oman, Qatar, UAE), while negative and significant in Bahrain. The US spillover effects are highly significant and positive for all five

GCC markets. Also, regional spillovers on Qatar and the UAE are greater in magnitude than global spillover effects. Both Sedik and Williams (2011) and Alotaibi and Mishra (2015) use the UAE index instead of Abu Dhabi and Dubai indices, additionally the authors state that Kuwait is the least affected by regional spillovers while Bahrain is the most segmented globally. Awartani et al. (2013) investigate return and volatility spillover effects from the US and Saudi Arabia to the GCC equities using the spillover index of Diebold and Yilmaz (2009, 2012). Similar to Alotaibi and Mishra (2015), they model the spillover transmission on the assumption of Saudi Arabia being the regional dominant player, and the US as the global force. They find that the US influence on GCC equities became substantial. In fact, the US market has changed from being a marginal sender of returns and volatilities, into a substantive factor in the spillover transmissions in the GCC. The net transmission of return and volatility from the US are 42% and 6%, respectively, compared to 67% and 12% of net spills from the Saudi market. Other examples on studies that research volatility spillovers in the GCC include the work of Malik and Hammoudeh (2007) and Khalifa et al. (2014).

In terms of the nature of the intra-regional interrelationships, Assaf (2003) examines the dynamic relationships among six GCC markets using weekly data, from 1/15/1997 to 4/26/2000. Using VEC models, he observes that Bahrain's more open market plays a dominant role in influencing the other GCC markets, while the segmented market of Saudi Arabia is slow to receive shocks from those markets. Abraham and Seyyed (2006) investigate the volatility spillovers across two stock markets in the GCC region, namely, the oil-based economy of Saudi Arabia and the trading-centred economy of Bahrain. The research uses daily data from 1998 to 2003 and a bivariate EGARCH model. Results from the bivariate conditional volatility model show that there is an asymmetric flow of information from the smaller Bahraini market to the larger Saudi market, where the conditional volatility in the Saudi market is significantly affected by innovations from the Bahraini market. Alkulaib et al. (2009) argue that the UAE stock market leads all the markets in the region due to the tremendous growth of the UAE's equity market, and the efforts in promoting itself as a prominent financial hub in the Middle East. Hammoudeh and Alesia (2004) find that the Saudi market has the highest linkages with other GCC countries, while Bahrain and the UAE follow the Saudi lead and Kuwait having the least casual linkages. In conformity with Hammoudeh and Alesia (2004), Awartani et al. (2013) and Alotaibi and Mishra (2015) claim Saudi market dominance in the GCC bloc due to its superior capitalisation and liquidity.

3.3 Methodology

3.3.1 Asymmetric dynamic conditional correlation model

The econometric technique is based on the Generalised Autoregressive Conditional Heteroscedasticity (GARCH) pioneered by Engle (1982) and Bollerslev (1986). The correlations models based on this methodology are superior to traditional correlation because they account for heteroscedasticity. This problem creates bias in correlations during high stress periods as argued by Forbes and Rigobon (2002). Multivariate GARCH family models have become popular, due to their ability to capture heavy-tailed distributions, excess kurtosis, and non-linearity. Regardless of the specification, the main problem common to multivariate GARCH models is the great number of parameters to be estimated, which limits the number of variables tested in a whole system. One answer to this issue is the Dynamic Conditional Correlation (DCC GARCH) model of Engle (2002). This specification significantly reduces the parameters to be estimated in a dynamic environment.

The DCC-GARCH model (Engle, 2002) models the time-varying correlation between each market pair. The conditional covariance matrix is expressed in terms of the following decomposition:

$$\Omega_t = D_t \Gamma_t D_t \tag{3.1}$$

Where D_t refers to the diagonal matrix of the conditional standard deviations and Γ_t is the matrix of conditional correlations. Bollerslev (1990) assumes the correlations are constant, i.e., $\Gamma_t = \Gamma$. To ensure positive variance-covariance matrix, account for the leverage effect and the volatility feedback, individual GJR-GARCH(1,1) (Glosten et al., 1993) processes are estimated for each series. I implement the GJR-GARCH model as it allows for an asymmetric effect within the conditional variance series as such:

$$h_t^2 = \omega + \sum_{i=1}^{p} \alpha \varepsilon_{t-i}^2 + \sum_{i=1}^{q} \gamma \varepsilon_{t-i}^2 I_{t-i} + \beta h_{t-1}^2 \tag{3.2}$$

Where $I_t[\cdot]$ is an indicator function which takes the value of one when the lagged shock is negative ($\varepsilon_{t-1} < 0$) and zero for positive shocks. Here, asymmetry is captured by γ, with negative news having a greater impact on volatility when $\gamma > 0$, i.e., the effect of a negative shock on conditional variance is given by $(\alpha+\gamma)$ and a positive shock by α. The standardised residuals (ξ_t) are then computed in the usual way:

$$\xi_t = D_t^{-1} \varepsilon_t \quad (3.3)$$

With the correlations given by:

$$\Gamma = \frac{1}{T}\sum_{t=1}^{T} \xi_t \xi_t' \quad (3.4)$$

While imposing a constant correlation may be a useful simplifying assumption in certain circumstances, it is not relevant in the analysis here. Hence, I implement Engle's extension whereby the conditional correlation is allowed to exhibit time-variation in a manner similar to the GARCH(1,1) model. Specifically, conditional correlations fluctuate around their constant (unconditional) values as such:

$$Q_t = (1-\alpha-\beta)\Gamma + \alpha\xi_{t-1}\xi'_{t-1} + \beta Q_{t-1} \quad (3.5)$$

where Q is the time-varying correlation matrix. The estimated correlations are standardised, $\rho_{ij,t} = \Gamma_{t,ij} = Q_{t,ij} / \sqrt{Q_{ii}}\sqrt{Q_{jj}}$, to ensure they lie between -1 and 1. This also ensures both a positive definite matrix as well as readily interpretable correlations.

Cappiello et al. (2006) introduce the ADCC model to allow for asymmetric effects in the correlation. Thus, equation (3.5) is extended as follows:

$$Q_{ij,t} = (1-\alpha-\beta)\Gamma + \alpha(\xi_{i,t-1}\xi'_{j,t-1}) + \beta(Q_{ij,t-1}) + g(\varsigma_{t-1}\varsigma_{t-1}{}') \quad (3.6)$$

Where $\varsigma_{it} = (I[\bar{\xi}_{it} < 0] o \bar{\xi}_{it}$ the latter being the element by element Hadamard product of the residuals if shocks are negative, and $\bar{\varsigma}_t = 0$ otherwise. The term g thus captures asymmetric periods where both markets experience bad news (negative shocks). This study uses the diagonal version of the ADCC equation model, which is a special case of the Generalized ADCC (AG-DCC) model as the parameter matrices therein are replaced by scalars.[35] This expression shows that conditional variances depend only on own lags and own lagged squared returns, and conditional covariances depend only on own lags and own lagged cross products of returns.

[35] The estimation of the vector of parameters (θ) is carried out using the quasi-maximum likelihood estimation (QMLE) method that is robust to departures from normality of return series under regular conditions (see Bollerslev and Wooldridge, 1992).

3.3.2 Spillover index

The simultaneous comovements reflect the impact common factors exert on equity returns jointly, on the other hand, spillovers measure how innovations in one market affect another; in other words, how the transmission of information from one market influences returns in another in a subsequent period. Gebka and Serwa (2006) argue that in contrast to equities contemporaneous interdependence measured by correlation coefficients, focusing on the time structure of spillovers, shed lights on the assimilation of shocks and time-varying patterns of cross country causality.

The framework provides separate measures of return and volatility spillovers based on forecast error variance decompositions from a vector autoregressive (VAR) model. Diebold and Yilmaz (2012) use Koop et al. (1996) and Pesaran and Shin (1998) (KPPS) variance decomposition, thus, retaining all the advantages of their general framework (Diebold and Yilmaz, 2009) and avoiding the Cholesky order variant identification.

The general k-variable and p-lagged VAR model is given by:

$$x_t = \sum_{i=1}^{p} \varphi_i \, x_{t-i} + \varepsilon_t \tag{3.7}$$

Where x_t represents the vector of k endogeneous variables (in this case, either stock returns or volatilities), while φ is a kxk matrix of parameters for each time lag, p, and $\varepsilon_t \sim (0,\Sigma)$ is a vector of disturbances that are assumed to be independently and identically distributed over time.

Assuming covariance stationarity, then equation (3.7) can be rewritten as an infinite moving average model, as such:

$$x_t = \sum_{i=0}^{\infty} A_i \, \varepsilon_{t-i} + \varepsilon_t \tag{3.8}$$

The parameter matrices, A_i, are recursively defined as follows: $A_1 = \varphi_1 A_{i-1} + \varphi_2 A_{i-2} +\ldots + \varphi_p A_{i-p}$ and with A_0 a kxk identity matrix. The variance decompositions allow the fraction of the H-step ahead error variance in forecasting x_i owing to shocks arising from x_j, where $i \neq j$ to be calculated.

The computation of variance decomposition requires orthogonal innovations. Some identification schemes, such as Cholesky factorization orthogonalize innovations, but the identified decompositions are then depending on the ordering of variables. Since the focus of this study lies in the direction of spillovers, a decomposition scheme that is invariant to ordering is preferred. A framework that satisfies these objectives is the generalized VAR that has been proposed by Koop et al. (1996), and Pesaran and Shin (1998) (the KPPS). Unlike other identification schemes, which try to orthogonalize innovations, the generalized VAR procedure accounts for contemporaneous innovations by using the observed historical distribution of errors. Hence, the framework can identify variance decompositions that are invariant to the order of markets and robust to simultaneously correlated innovations.

The H-step-ahead forecast error variance decomposition is given by:

$$\theta_{ij}(H) = \frac{\sigma_{ii}^{-1}\sum_{h=0}^{H-1}(e'_j A_h \Sigma e_i)^2}{\sum_{h=0}^{H-1}(e'_j A_h \Sigma A'_h e_j)} \tag{3.9}$$

where Σ is the (estimated) variance matrix of the error vector ε, σ_{ii} the (estimated) standard deviation of the error term for variable i, and e_i is the selection vector with one as the ith element and zero otherwise.

Each element of the variance decomposition matrix is then normalised by the sum of the elements of each row of the decomposition as such:

$$\tilde{\theta}_{ij}^{g}(H) = \frac{\theta_{ij}^{g}(H)}{\sum_{j=1}^{k}\theta_{ij}^{g}(H)} \tag{3.10}$$

This is to ensure that the own and cross-variable variance contribution sum to one under the generalised decomposition with $\sum_{j-1}^{k}\tilde{\theta}_{ij}^{g}(H) = 1$ and $\sum_{i,j-1}^{k}\tilde{\theta}_{ij}^{g}(H) = k$ by construction.

The total spillover index is then defined as:

$$TS^{g}(H) = \frac{\sum_{i,j=1,i\neq j}^{k}\tilde{\theta}_{ij}^{g}(H)}{\sum_{j=1}^{k}\tilde{\theta}_{ij}^{g}(H)} x100 \tag{3.11}$$

The directional spillover to variable i from all other variables j is given by:

$$DS_{j\to i}^{g}(H) = \frac{\sum_{j=1,i\neq j}^{k}\tilde{\theta}_{ij}^{g}(H)}{\sum_{j=1}^{k}\tilde{\theta}_{ij}^{g}(H)} x100 \tag{3.12}$$

With the reverse, i.e., from market i to all other markets j is given by:

$$DS^{g}_{i\to j}(H)=\frac{\sum_{j=1,i\neq j}^{k}\tilde{\theta}^{g}_{ji}(H)}{\sum_{j=1}^{k}\tilde{\theta}^{g}_{ji}(H)}x100 \tag{3.13}$$

From these last two measures I can then determine the net spillover from markets i to markets j as the difference between equation (3.7) and equation (3.6):

$$NS_{i}(H)=DS^{g}_{i\to j}(H)-DS^{g}_{j\to i} \tag{3.14}$$

The net spillover measure indicates whether a country is a net transmitter or a net receiver in the system. The total spillover index is applied to investigate the global and regional trends of spillover activity. Following the original methodology of Diebold and Yilmaz (2009), I apply a two-lag VAR and 10-week forecast horizon.

The total spillover index is applied to investigate the general connectedness level. The net spillover measure indicates whether a country is a net transmitter or a net receiver in the system. Following the original methodology of Diebold and Yilmaz (2009), I apply a two-lag VAR and 10-week forecast horizon.

3.4 Data

The first objective is to take a broader perspective on the linkages between GCC and developed markets, hence, the data set is based on geographical blocs. Similar to Beirne et al. (2013),[36] the US, Japan, and the EU are utilised as inferences of developed markets in this analysis. Following Balli et al (2015), this study uses MSCI based indices for the EU, the GCC and the BRIC. All MSCI indices represent the performance of large and mid-cap equities and cover approximately 85% of the free float-adjusted market capitalisation in each bloc. The MSCI GCC[37] includes 76 constituents from the six member states, the MSCI BRIC Index[38] is designed to measure the equity market performance across the following four emerging markets: Brazil, Russia, India and China. Also, the S&P 500 and the Nikkei 225

[36] Instead of the country index of Europe that Bernie et al. adopted, I rely on the MCSI Europe index.
[37] https://www.msci.com/documents/10199/6ea0316d-4067-4cc0-ab01-2b28ef407d2c.
[38] BRICS is the acronym for an association of five major emerging national economies: Brazil, Russia, India, China and South Africa. Originally the first four were grouped as "BRIC" before the introduction of South Africa in 2010. However, South African equities are not included in the MSCI BRIC index, thus, BRIC will be the term used in this study. Worth noting that ASEAN does not qualify because Singapore, one of the constituents, is classified as a developed market.

correspond to the US and Japanese markets, respectively. I consider including the BRIC in the analysis because economists believe BRIC nations display strong growth and will become dominant suppliers of manufactured goods, services and raw material. Accordingly, investors show interest in them as destinations of funds. That said, comparing the conduct of the GCC-developed linkages to the BRIC-developed will be pertinent to US/global investors. Official All Share indexes are used for the following: Dubai, Saudi Arabia, Abu Dhabi, Qatar, Oman, Bahrain, and Kuwait. The indices employed in this study are gathered from Datastream. The sample period is dictated by the availability of data of GCC markets.

Following Cappiello et al. (2006), Sedik and Williams (2011), Awartani et al. (2013) and Alotaibi and Mishra (2015), weekly data are used in order to maintain a high number of observations while avoiding some of the biases that can arise with daily data; including differences in trading hours and national holidays. Also, non-synchronous trading, associated with daily data, causes noise and consequently results in spurious spillover effects. The sample ranges from 14/1/2004 to 17/1/2019 and return series are denominated in US dollars so that they are more comparable across countries; moreover, such transformation implicitly captures how exchange rate movements impact returns, which makes it more relevant for global investors. Return series are generated by applying the natural logarithmic difference. Volatility is the degree of variation of a trading price series over time as measured by the standard deviation of logarithmic returns. In this chapter and in chapter 5, the conditional volatility, generated from GARCH models, is employed to calculate correlation series. In the spillover system, including a parametric measure of volatility, as the case in GARCH models, initiates an error-in-variable problem (Diebold and Yilmaz, 2015). For this reason, the historical volatility is calculated as the square of logarithmic differences in price series. The range volatility measure of Garman and Klass (1980) is not considered due to data unavailability on opening and closing market observations in the GCC.

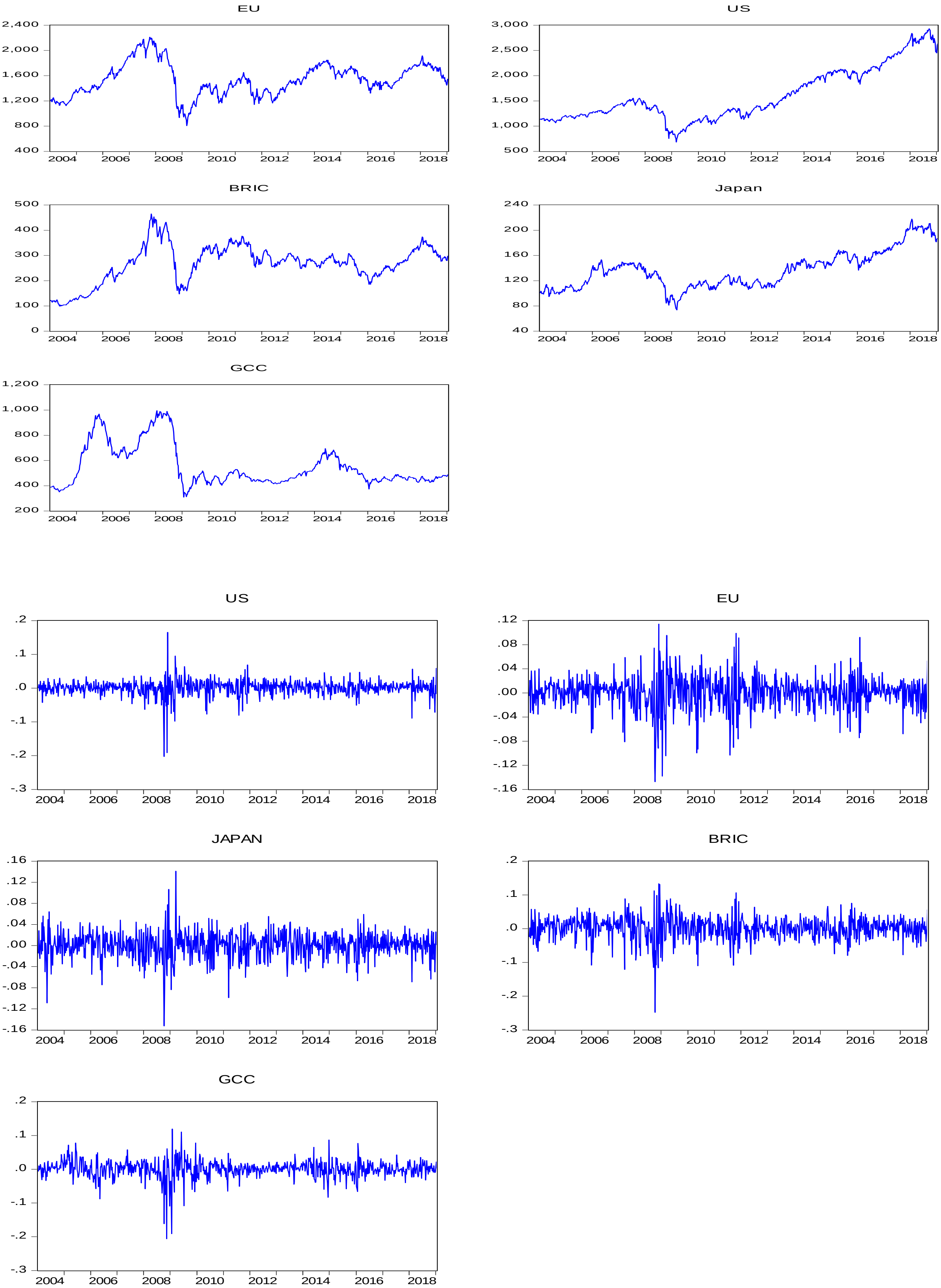
TABLE 3. 1 DESCRIPTIVE STATISTICS OF THE LOGARITHMIC DIFFERENCE OF WEEKLY STOCK RETURNS. THE SAMPLE SPANS FROM 14/1/2004 TO 17/1/2019 WITH 784 OBSERVATIONS

	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Arch test	Jarque-Bera	PP test
Abu Dhabi	0.0013	0.0020	0.4024	-0.3436	0.0342	0.1885	43.14	722*	52658*	0.0000
Bahrain	-0.00002	0.0002	0.0569	-0.0851	0.0141	-0.4724	7.233	778*	614.53*	0.0000
BRIC	0.0011	0.0045	0.1332	-0.2478	0.0347	-0.7377	7.397	756*	702.93*	0.0000
Dubai	0.0011	0.0021	0.1565	-0.284	0.0391	-1.0127	10.33	762*	1889.7*	0.0000
EU	0.0003	0.0027	0.1142	-0.1474	0.0278	-0.6468	6.636	734*	486.52*	0.0000
GCC	0.0003	0.0017	0.1191	-0.2061	0.0266	-1.4151	13.91	768*	4153.6*	0.0000
Japan	0.0008	0.0021	0.1410	-0.1524	0.0252	-0.4492	6.711	758*	476.40*	0.0000
Kuwait	-0.00001	2.E-05	0.1081	-0.1536	0.0200	-1.4457	15.55	776*	5423.8*	0.0000
Oman	0.0005	0.0003	0.1237	-0.1962	0.0243	-1.5172	16.06	768*	5878.8*	0.0000
Qatar	0.0012	0.0014	0.1501	-0.2296	0.0346	-0.559	9.254	741*	1318.7*	0.0000
Saudi	0.0008	0.0037	0.1141	-0.2531	0.0372	-1.7614	11.96	729*	3029.8*	0.0000
US	0.0011	0.0029	0.1653	-0.2026	0.0234	-1.5347	19.97	769*	9717.8*	0.0000

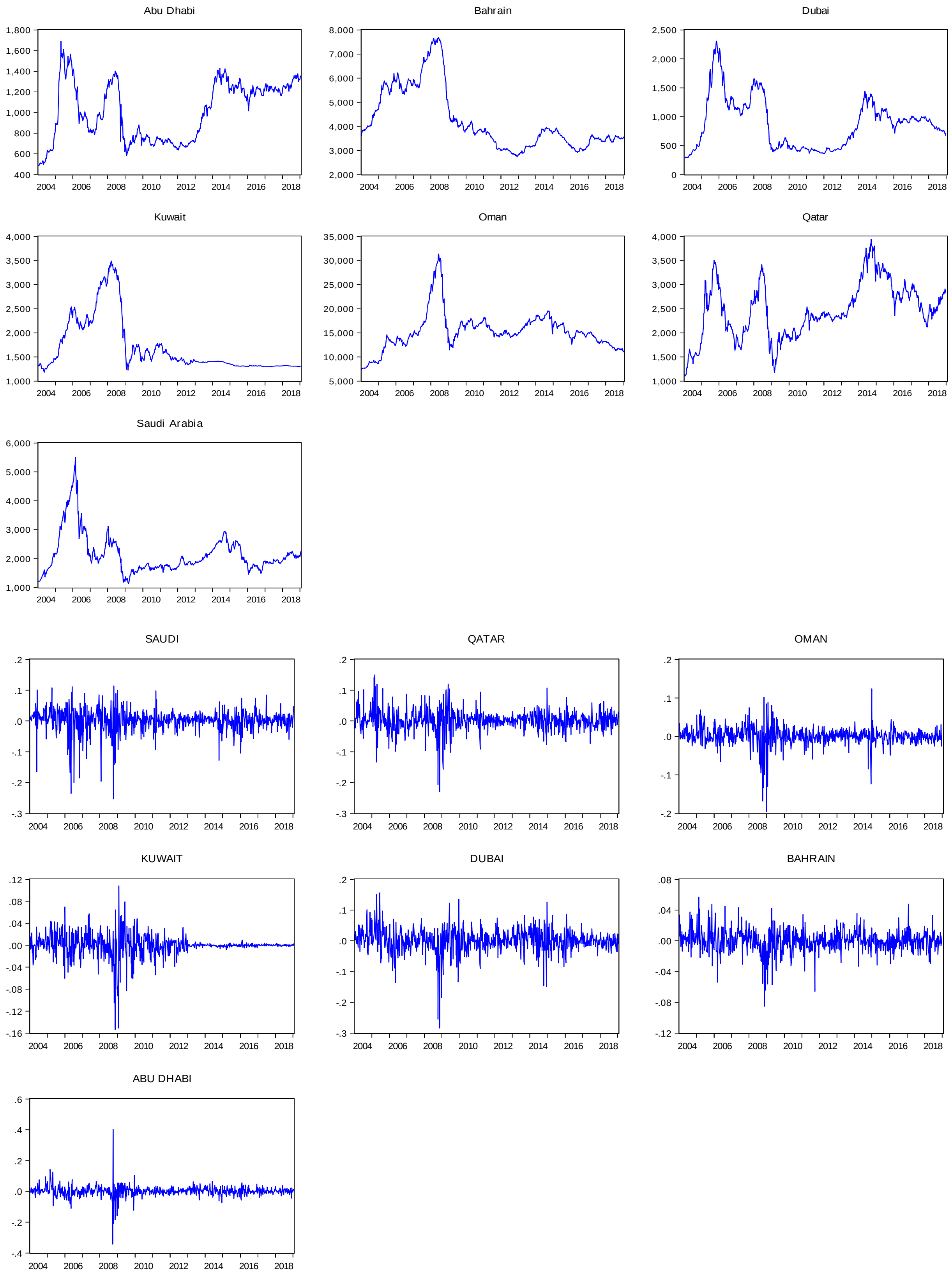
Notes. Std. Dev. Stands for the Standard Deviation and PP stands for the Phillips–Perron unit root test. In the Jarque-Bera test, * means that rejection of the null hypothesis of normality at 5% significance. Arch LM test for Arch effects where * indicates significance at 5%.

FIGURE 3. 1 STOCK MARKET PRICE AND RETURN SERIES

Panel A: stock market price and return series of the US, the EU, Japan, the BRIC and the GCC



Panel B: GCC country price and return series



Note. Stock market price and return series from 14/1/2004 to 17/1/2019.

As depicted in Table 3.1, all series demonstrate positive mean returns with the exception of Bahrain and Kuwait. The indices display negative skewness and high kurtosis which is a departure from a normal distribution. Moreover, these traits note the prevalence of small gains and scattered but large losses. The Philips-Perron unit root test shows that stationarity holds for all sampled markets. Figure 3.1 Panel A illustrates that, as opposed to the developed markets, the GCC bloc did not recover from the 2006 domestic crash and the 2008 crisis. Also, the GCC index uniquely reacted negatively to lower oil prices after 2014. Therefore, it is visually clear that GCC have unique patterns of movements when compared with common trends observed in the US, the EU, the BRIC and Japan. Figure 3.1 Panel B shows that price series in the UAE and Qatar display higher level of dynamism than the rest of the GCC. Also, the resemblance between the GCC and Saudi indices mirrors the high weight (60%) of Saudi equities in the MSCI index. Finally, volatility clustering is observed in all return series which means that the volatility changes over time and its degree shows a tendency to persist. The LM ARCH test confirm these observations and indicates significant ARCH effects.

3.5 Empirical results

3.5.1 GARCH parameter estimates

Table 3.2 presents summary of the estimation results of the GJR GARCH model wherein the parameters of the ARCH (a) and GARCH (b) and the asymmetry parameter (g) are reported. The parameter g shows that the US, the EU, Japan and the BRIC display significant leverage effects in the conditional variance equation. This implies that negative shocks tend to be followed by more volatility than positive ones of a similar magnitude. The evidence for asymmetry is not strong in the GCC markets, as the g parameter is not significant in their models. Tables 3.2 and 3.3 show lower values of the AIC information criteria of the GJR GARCH model when compared with the GARCH model in the US, the EU, Japan, the BRIC, the GCC, Oman, Dubai and Abu Dhabi. This means that the GJR GARCH provides better fit for the data in the aforementioned markets. All return series display strong persistence in volatility, as measured by (a+ b). This is indicative of the presence of volatility clustering, or market momentum, which is a common feature of financial returns series. The statistical significance of the parameters in both tables indicates strong presence of conditional heteroscedasticity in all stock return series. This weakens the accuracy of static measures of asset return correlations. The Durbin Watson test shows no serial correlation in most series, while the ARCH test highlights the ability of both GARCH and GJR GARCH in accounting for heteroscedasticity.

TABLE 3. 2 UNIVARIATE GJR GARCH MODEL

	GJR GARCH						
	w	a	g	b	DW test	ARCH test	AIC
US	**0.0001**	-0.0609	**0.3949**	**0.7222**	2.3124	0.0756	-5.1097
	(0.010)	(0.067)	(0.000)	(0.000)		(0.783)	
EU	0.0000	0.0494	**0.1830**	**0.7980**	2.1243	0.2247	-4.6359
	(0.003)	(0.268)	(0.001)	(0.000)		(0.636)	
Japan	**0.0001**	0.0270	**0.2021**	**0.7331**	2.0079	0.7170	-4.6495
	(0.027)	(0.471)	(0.021)	(0.000)		(0.397)	
BRIC	**0.0001**	0.0835	**0.1154**	**0.7682**	1.9246	0.1283	-4.1098
	(0.002)	(0.070)	(0.047)	(0.000)		(0.720)	
GCC	0.0000	**0.1221**	0.0782	**0.8075**	1.7773	0.0629	-4.8196
	(0.013)	(0.003)	(0.248)	(0.000)		(0.802)	

	w	a	g	b	DW test	ARCH test	AIC
Saudi Arabia	**0.0001**	0.2326	-0.0445	**0.7736**	2.0438	0.3649	-4.0945
	(0.045)	(0.066)	(0.730)	(0.000)		(0.546)	
Qatar	**0.0001**	**0.2130**	0.0390	**0.7292**	1.9051	1.0115	-4.2329
	(0.001)	(0.001)	(0.673)	(0.000)		(0.315)	
Oman	0.0000	**0.1171**	0.0724	**0.7899**	1.9208	0.0524	-5.0326
	(0.082)	(0.023)	(0.332)	(0.000)		(0.819)	
Kuwait	0.0000	**0.1722**	0.0196	**0.8374**	1.7586	1.5188	-6.7024
	(0.022)	(0.001)	(0.654)	(0.000)		(0.218)	
Dubai	0.0000	**0.1407**	0.0302	**0.8293**	1.6308	1.0296	-3.9192
	(0.188)	(0.000)	(0.721)	(0.000)		(0.310)	
Abu Dhabi	**0.0001**	**0.1892**	0.1497	**0.6739**	2.2770	1.1683	-4.5285
	(0.028)	(0.042)	(0.421)	(0.000)		(0.280)	
Bahrain	0.0000	**0.1363**	0.0109	**0.7763**	1.7948	0.1571	-5.7733
	(0.057)	(0.004)	(0.880)	(0.000)		(0.692)	

Note. The table shows the univariate GJR GARCH model and its parameter estimates for each index return series based on the AIC information criteria. P values are in parenthesis. Significant coefficients at 5% are emboldened. DW stands for the Durbin Watson test for autocorrelation in residuals. The ARCH test is a Lagrange multiplier test to assess the significance of ARCH effects or autocorrelation in the squared residuals. Stability condition is met as a+b<1.

TABLE 3. 3 UNIVARIATE GARCH MODEL

GARCH

	w	a	b	DW test	ARCH test	AIC
US	0.0000	**0.1740**	**0.7555**	2.3106	0.8863	-5.0467
	(0.056)	(0.032)	(0.000)		(0.347)	
EU	0.0000	**0.1730**	**0.7861**	2.1215	0.0870	-4.6216
	(0.006)	(0.000)	(0.000)		(0.768)	
Japan	0.0001	**0.1517**	**0.7500**	2.0058	0.0034	-4.6335
	(0.079)	(0.013)	(0.000)		(0.954)	
BRIC	**0.0001**	**0.1484**	**0.7787**	1.9235	0.1897	-4.1043
	(0.002)	(0.000)	(0.000)		(0.663)	
GCC	0.0000	**0.1644**	**0.8129**	1.7755	0.0148	-4.8157
	(0.016)	(0.000)	(0.000)		(0.903)	

	w	a	b	DW test	ARCH test	AIC
Saudi Arabia	**0.0001**	**0.2146**	**0.7646**	2.0447	0.5083	-4.0961
	(0.036)	(0.000)	(0.000)		(0.476)	
Qatar	**0.0001**	**0.2335**	**0.7305**	1.9050	0.7216	-4.2346
	(0.001)	(0.000)	(0.000)		(0.396)	
Oman	0.0000	**0.1524**	**0.7981**	1.9209	0.2094	-5.0297
	(0.087)	(0.001)	(0.000)		(0.647)	
Kuwait	0.0000	**0.1865**	**0.8339**	1.7586	1.1854	-6.7045
	(0.177)	(0.000)	(0.000)		(0.276)	
Dubai	0.0000	**0.1553**	**0.8299**	1.6311	0.9531	-3.9206
	(0.026)	(0.002)	(0.000)		(0.329)	
Abu Dhabi	**0.0001**	**0.2715**	**0.6751**	2.2769	1.2314	-4.5213
	(0.030)	(0.036)	(0.000)		(0.267)	
Bahrain	0.0000	**0.1428**	**0.7759**	1.7947	0.1927	-5.7758
	(0.058)	(0.001)	(0.000)		(0.661)	

Note. The table shows the univariate GARCH model and its parameter estimates for each return series based on the AIC information criteria. P values are in parenthesis. Significant coefficients at 5% are emboldened. DW stands for the Durbin Watson test for autocorrelation in residuals. The ARCH test is a Lagrange multiplier test to assess the significance of ARCH effects or autocorrelation in the squared residuals. Stability condition is met as a+b<1.

TABLE 3. 4 ADCC AND DCC GARCH ESTIMATE FROM AN INTER-REGIONAL PERSPECTIVE

GCC and BRIC bloc correlation

	ADCC				DCC		
	a	b	g	AIC	a	b	AIC
US-GCC	0.011613	**0.983366**	0.006059	-9.99179	0.017522	**0.976485**	-9.92161
	(0.145)	(0.000)	(0.096)		(0.057)	(0.000)	
EU-GCC	0.016609	**0.977785**	0.006603	-9.56087	**0.028443**	**0.966418**	-9.54666
	(0.094)	(0.000)	(0.082)		(0.008)	(0.000)	
Japan-GCC	0.017753	**0.951428**	0.006626	-9.51033	0.024079	**0.942865**	-9.49495
	(0.206)	(0.000)	(0.295)		(0.064)	(0.000)	
US-BRIC	**0.020695**	**0.945945**	0.006342	-9.78336	**0.029464**	**0.949684**	-9.72512
	(0.048)	(0.000)	(0.064)		(0.008)	(0.000)	
EU-BRIC	**0.035348**	**0.919878**	**0.006091**	-9.58239	**0.047022**	**0.920703**	-9.5827
	(0.013)	(0.000)	(0.038)		(0.000)	(0.000)	
Japan-BRIC	**0.032521**	**0.911688**	**0.011432**	-9.11844	**0.046452**	**0.914198**	-9.09928
	(0.041)	(0.000)	(0.025)		(0.003)	(0.000)	

Note. The table shows the multivariate ADCC GARCH and DCC GARCH models and their parameter estimates based on the AIC information criteria. P values are in parenthesis. Significant coefficients at 5% are emboldened. Stability condition is met as a+b<1 in all series.

Tables 3.4 and 3.5 illustrate the estimation results of the ADCC GJR GARCH and DCC GARCH models. The parameters measure the impact of past standardised shocks (a) and lagged dynamic conditional correlations (b), respectively, on the current dynamic conditional correlations. Similar to other studies (see for example the work of Lahrech and Sylwester (2011) on US-Latin American equity correlations and Dajčman and Festić (2012) on the Slovenian market correlation with the EU), the DCC parameter b is statistically significant in most cases, while a is significant in fewer circumstances. Also, given that the parameter b is larger than a, I can argue that the behaviour of current variances is more influenced by the magnitude of past variances when compared with past return innovations. The sum of parameters (a + b) is larger than zero, meaning that the conditional correlation among equity returns is not constant. The necessary condition of a + b <1 holds for all pairs, while the sum of the parameters is close to unity in most cases. This suggests mean reversion along a constant level, and a high degree of persistence in conditional volatility for all pairs. Lower values of AIC in the ADCC specification suggest that the ADCC model outperforms the DCC model in all equations with the exception of US-Bahrain and US-Dubai models.

TABLE 3. 5 ADCC AND DCC GARCH ESTIMATE FROM AN INTRA-REGIONAL PERSPECTIVE

US-GCC nations

	ADCC				DCC		
	a	b	g	AIC	a	b	AIC
US-Saudi Arabia	0.0126	**0.9469**	**0.0203**	-9.3036	**0.0400**	**0.9269**	-9.2448
	(0.308)	(0.000)	(0.001)		(0.010)	(0.000)	
US-Qatar	**0.0227**	**0.9641**	0.0097	-9.4025	**0.0255**	**0.9655**	-8.9249
	(0.044)	(0.000)	(0.183)		(0.016)	(0.000)	
US-Oman	**-0.0231**	0.0243	0.0143	-10.1633	**0.0077**	**0.9866**	-10.1020
	(0.000)	(0.984)	(0.216)		(0.000)	(0.000)	
US-Kuwait	0.1014	-0.2155	-0.1433	-11.8174	-0.0046	0.8069	-11.7517
	(0.091)	(0.111)	(0.125)		(0.821)	(0.056)	
US-Dubai	**-0.0207**	**0.7810**	**-0.0178**	-9.9346	**-0.0214**	**0.8313**	-9.4507
	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	
US-Bahrain	**0.0028**	**-0.3276**	**-0.0921**	-10.8133	**-0.0226**	-0.4625	-10.8350
	(0.000)	(0.000)	(0.000)		(0.000)	(0.173)	
US-Abu Dhabi	0.0092	**0.9881**	0.0050	-9.6596	**0.0139**	**0.9835**	-9.5877
	(0.132)	(0.000)	(0.160)		(0.039)	(0.000)	

EU-GCC nations

	ADCC				DCC		
	a	b	g	AIC	a	b	AIC
EU-Saudi Arabia	0.0349	**0.8939**	**0.0296**	-8.8042	**0.0613**	**0.8562**	-8.7908
	(0.058)	(0.000)	(0.005)		(0.004)	(0.000)	
EU-Qatar	**0.0176**	**0.9655**	0.0115	-8.9339	**0.0255**	**0.9655**	-8.9249
	(0.043)	(0.000)	(0.153)		(0.016)	(0.000)	
EU-Oman	0.0079	**0.9815**	0.0055	-9.6955	0.0107	**0.9824**	-9.6793
	(0.222)	(0.000)	(0.323)		(0.083)	(0.000)	
EU-Kuwait	0.0153	**0.9774**	0.0022	-11.3702	0.0199	**0.9675**	-11.3615
	(0.357)	(0.000)	(0.698)		(0.097)	(0.000)	
EU-Dubai	0.0063	**0.9942**	**0.0044**	-8.6618	**0.1449**	**0.9886**	-8.6519
	(0.278)	(0.000)	(0.004)		(0.000)	(0.000)	
EU-Bahrain	**-0.0297**	-0.3751	-0.0296	-10.4246	**-0.0297**	0.1485	-10.4149
	(0.000)	(0.432)	(0.383)		(0.000)	(0.881)	
EU-Abu Dhabi	**0.0100**	**0.9880**	**0.0053**	-9.2184	**0.0150**	**0.9843**	-9.1963
	(0.027)	(0.000)	(0.042)		(0.000)	(0.000)	

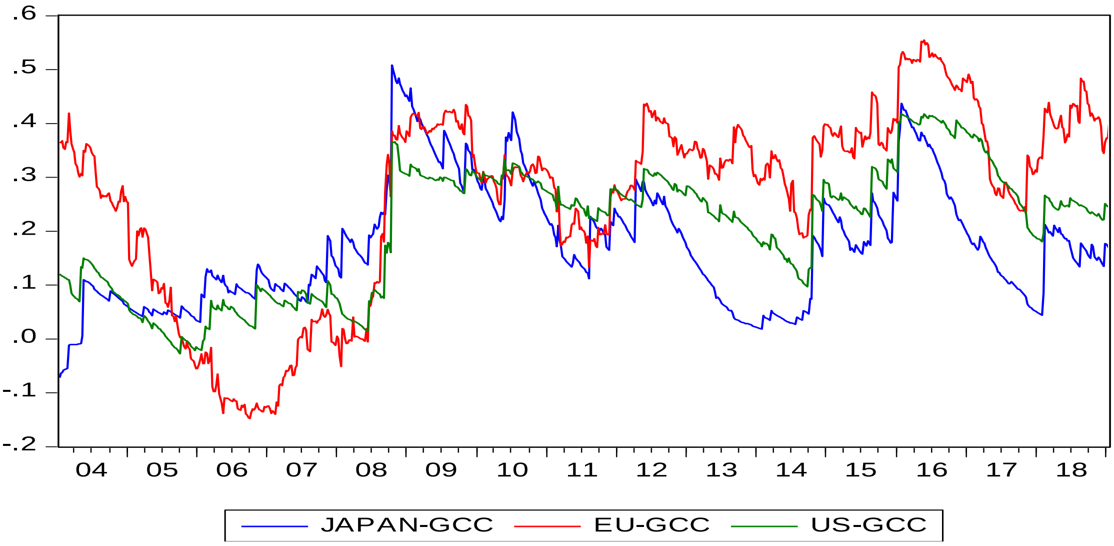
Note. The table shows the multivariate ADCC and DCC GARCH models and their parameter estimates based on the AIC information criteria. P values are below the coefficient and significant ones at 5% are emboldened. Stability condition is met as a+b<1 in all series.

3.5.2 Inter-regional linkages

Based on the ADCC model, Figure 3.2 depicts the time-varying correlation series between the US, the EU, Japan and the GCC. Figure 3.2 shows that the EU-GCC correlation is the highest, for most of the sample period, with an average value of 0.26 and a maximum of 0.55. The US correlation stands in the middle, with an average value of 0.21 and a highest value of 0.41, while the Japanese correlation trails with an average of 0.12 and a high point of 0.47. The GCC domestic market collapsed in 2006 and we can observe a noticeable drop in the correlations at this time, particularly in the EU-GCC pair. Figure 3.2 also points to a sharp break in equity market comovements, especially in the cases of US-GCC and Japan-GCC, with a large increase in correlations in 2008 and most likely linked to the onset of the financial crisis. A further increase in the correlations across all pairs arose from the 2009 Dubai Debt Standstill, where the Dubai request of debt deferment precipitated global markets to crash. High US-GCC, EU-GCC, and Japan-GCC correlations were recorded in January 2016. This observation can be associated with multiple factors, first, the stock market selloff in January 2016. Second, the oil price collapse to 25 dollars which is notably damaging for the GCC economies. Third, the US Federal Reserve increasing interest rates from 0.25 to 0.50 points in December 2015. While the Japan-GCC and US-GCC correlations declined shortly afterwards, the EU-GCC continue to rise and reached a peak of 0.54 following the Brexit vote in June 2016. As uncertainty in Europe increased flight to quality among European investors, some European funds might have been redirected from risky GCC markets to bonds therefore spreading panic to GCC markets. Following that, market turbulence in both blocs could have led to higher correlations. The fall in correlations throughout 2017 is linked with the sluggish growth in the GCC markets as a result of oil price declines. Falling GCC stock markets at this time were in contrast to US and the EU markets that enjoyed stronger performance. Global market falls in February 2018 saw the correlations rebound back to almost 0.5 in the EU-GCC and 0.3 in the US-GCC during March[39]2018.

[39] This is also linked to trade war concerns between the US and China with the Trump administration imposing tariffs on Chinese products (such as aerospace, information communication technology and machinery) on 22 March 2018.

FIGURE 3. 2 CORRELATIONS AMONG US, EU, JAPAN AND GCC STOCK MARKETS



Note. The correlation series in the graph are simulated from a GJR ADCC GARCH model.

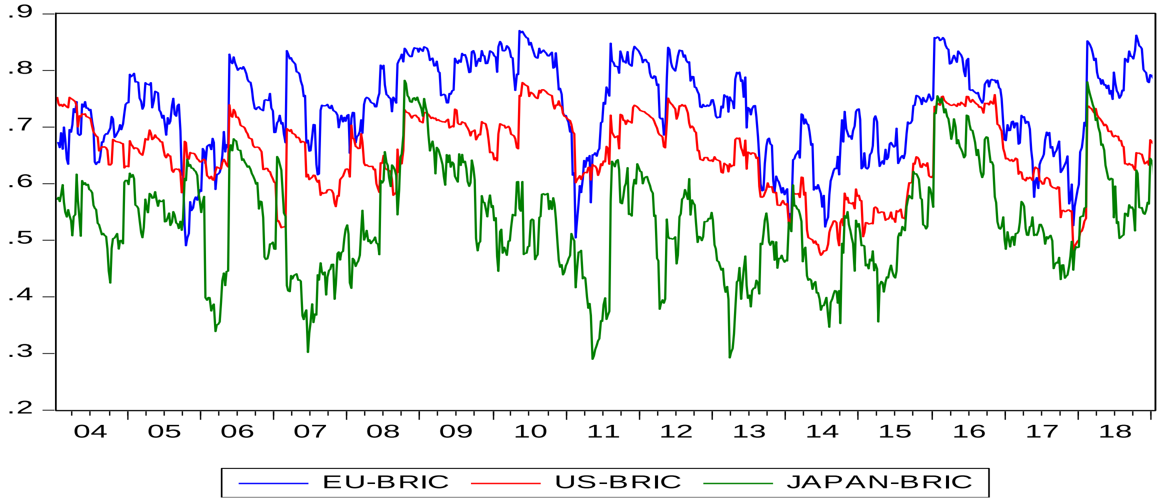
For comparability I consider the BRICS[40] as a benchmark for the correlations between developed and emerging markets. Similar to the GCC, the BRIC is an economic league constituted of emerging markets, with both blocs[41] contributing considerably to world GDP. Figure 3.3 shows that the EU-BRIC correlation is the highest with an average of 0.73 while the US-BRIC correlation revolves around 0.65. Indeed, the correlation values in these figures are triple those of the EU-GCC (0.26) and the US-GCC (0.20). Japan has the lowest correlations with 0.53 average over the sample. The Japanese market is evidently less correlated with both the GCC and BRIC. This finding echoes lower global integration of the Japanese markets as argued by Arshanapalli and Doukas (1993) and Morana and Beltratti (2008). These results demonstrate that the BRIC group is more globally interlinked throughout the period. This is perhaps because the BRIC markets are more mature than the GCC markets. The lower correlations observed in the GCC bloc could also signal higher segmentation, a result is in line with the findings of Yu and Hassan (2008). Further, the BRIC

[40] BRICS is the acronym for an association of five major emerging national economies: Brazil, Russia, India, China and South Africa. Originally the first four were grouped as "BRIC" before the induction of South Africa in 2010. However South African equities are not included in the MSCI BRIC index, thus BRIC will be the term used in this study.

[41] Worth noting that other economic blocs like ASEAN do not qualify because Singapore, one of the constituents, is classified as a developed market.

correlations also tend to be less erratic compared with the GCC. This may be due to their geographical dispersion across different continents.

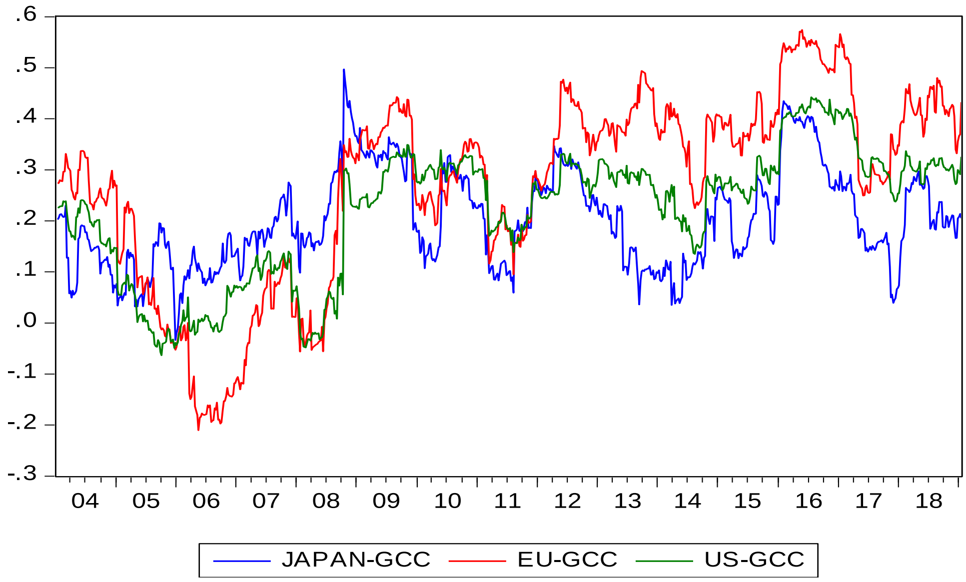
FIGURE 3. 3 CORRELATIONS AMONG US, EU, JAPAN AND BRIC STOCK MARKETS



Note. The correlation series in the graph are simulated from a GJR ADCC GARCH model.

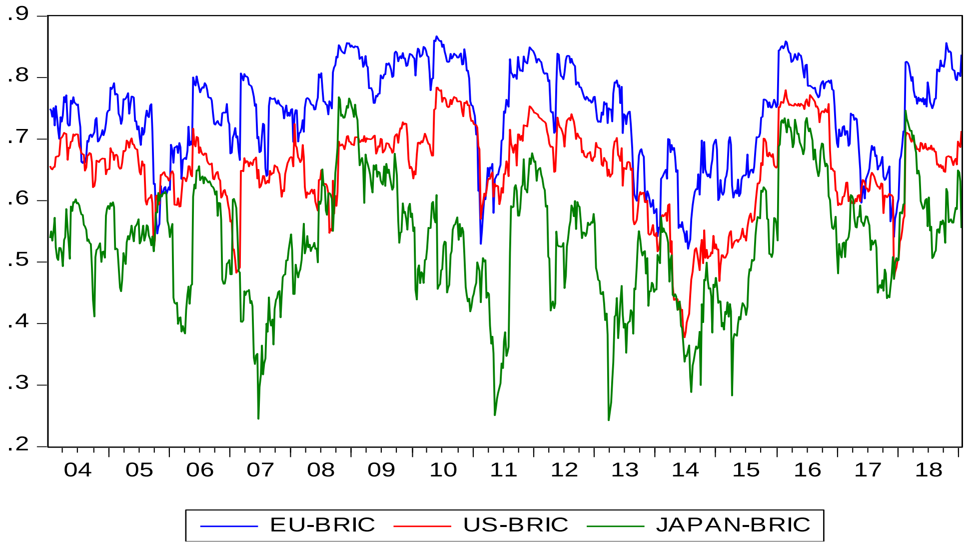
As noted, Europe has the highest correlations with both the GCC and BRIC blocs. This is perhaps not surprising for the BRICs case as it includes the geographically close Russia. However, this result is unexpected for the GCC bloc given the presumption that the US, as the world's largest economy, is likely to have the most influence on international stock markets. Moreover, given that GCC countries peg their currencies to the US dollar, this forces them to follow the US lead with respect to interest rate changes. Furthermore, oil, their main export commodity, is priced in US dollars.

FIGURE 3. 4 GCC CORRELATION SERIES GENERATED BY THE DCC GARCH



Note. GCC correlation series generated by the DCC GARCH model with the US, the EU and Japan

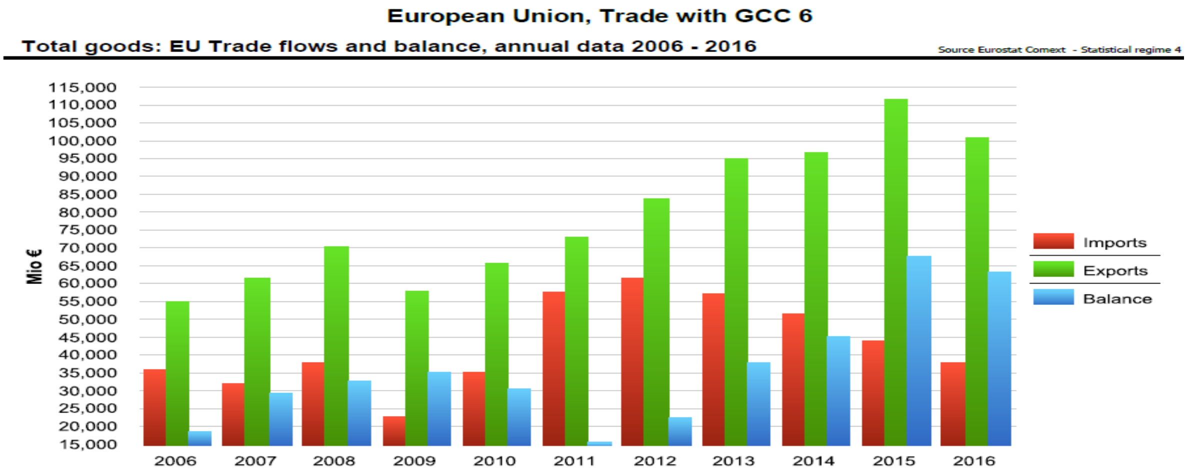
FIGURE 3. 5 BRIC CORRELATION SERIES GENERATED BY THE DCC GARCH



Note. BRIC correlation series generated by the DCC GARCH model with the US, the EU and Japan

Figures 3.4 and 3.5 show the bivariate conditional correlation graph of the GCC and BRIC with the US, the EU and Japan using the DCC GARCH. Similar to the ADCC model, the heterogeneity in the dynamics of correlations between the pairs shows the invalidity of static estimates of comovements. At the same time, the generated correlations display similar results to the ADCC as the EU displays the strongest links to both the GCC and the BRIC, but, with less pronounced jumps during market turbulence as observed in 2008.

FIGURE 3. 6 EU IMPORTS, EXPORTS AND BALANCE OF TRADE WITH THE GCC BLOC



Source: the European commission, Eurostat Comext

In order to explain the linkages among the EU and GCC equity markets, I follow the argument of Ng (2000) regarding the importance of trade to stock market linkages. Examining Figure 3.6, from the European Commission, there is an increasing trend in trade between the GCC and the EU with a 54% growth between 2006 and 2016. In addition, Figure 3.7 presents the GCC global trade pattern. The EU bloc is the biggest importer of GCC goods and ranks 4th in terms of export value. With 16.6 % of the overall global trading share, the EU is the main trading partner. Japan assumes 8.6 % and the US trails with 7.9%. The geographical location of the EU alongside increasing US oil self-sufficiency are plausible explanatory factors of our results.

According to Forbes and Chinn (2004), trade is the most important determinant of cross-country linkages. Thus, the extent of trade can explain the high EU-GCC correlation. This outcome is an indicator of the potential for significant spillovers from the EU to the GCC. As Karolyi and Stulz (2003) and Calvo and Reinhart (1996) note, since stock markets are correlated due to interdependence, it is plausible to expect shocks in one market to affect another. Given the above findings, it is pertinent to note that the previous literature overlooks the EU as an exporter of spillovers to the GCC. Instead, the focus is on the US and oil as main sources of spillovers in the literature, see Malik and Hammoudeh (2007), Sedik and Williams (2011) and Khalifa et al. (2014).

FIGURE 3. 7 GCC TRADE WITH THE WORLD 2018

	Imports				Exports				Total trade		
	Partner	Value Mio €	% World		Partner	Value Mio €	% World		Partner	Value Mio €	% World
	World	354,119	100.0		World	603,437	100.0		World	957,556	100.0
1	EU 28	86,110	24.3	1	China	81,252	13.5	1	EU 28	142,287	14.9
2	China	60,628	17.1	2	Japan	70,667	11.7	2	China	141,880	14.8
3	USA	42,442	12.0	3	India	62,951	10.4	3	India	92,129	9.6
4	India	29,178	8.2	4	EU 28	56,177	9.3	4	Japan	90,635	9.5
5	Japan	19,967	5.6	5	South Korea	54,163	9.0	5	USA	72,790	7.6
6	South Korea	10,251	2.9	6	USA	30,348	5.0	6	South Korea	64,414	6.7
7	Vietnam	8,687	2.5	7	Singapore	27,574	4.6	7	Singapore	30,222	3.2
8	Switzerland	7,350	2.1	8	Thailand	16,223	2.7	8	Thailand	21,829	2.3
9	Turkey	6,760	1.9	9	Pakistan	13,281	2.2	9	Switzerland	16,111	1.7
10	Thailand	5,605	1.6	10	Egypt	9,383	1.6	10	Pakistan	14,722	1.5
1	EU 28	86,110	24.3	4	EU 28	56,177	9.3	1	EU 28	142,287	14.9

Source: IMF, the European commission

Table 3.6 presents the return and volatility spillovers using the Diebold and Yilmaz (2012) methodology. Focusing on the US, EU, Japan, and the GCC return spillovers in Panel A. The GCC is, predictably, a net recipient of spillovers from other markets, accounting for 20.6% of the movement in GCC returns, while the GCC contributes 11.1% to the other markets. With 61.9% in the “To all” row, the EU is the highest net exporter of return spillovers (a net value of 9.5%, compared to 6.6% for the US and -6.6% for Japan). For the GCC, the EU spillovers rank first with a figure of 9.4%, while the US explains 7% and Japan only 4.2% of the variance decomposition of GCC returns. The results also demonstrate that the GCC receives the smallest amount of spillovers (20.6%) compared to the other markets within the system (i.e., the US receives 49.5%, the EU receives 52.4% and Japan receives 43.7% from the other markets). This supports the correlation results above, where the GCC appears relatively segmented from international stock markets.

TABLE 3. 6 THE RETURN AND VOLATILITY SPILLOVER INDEX IN A SYSTEM CONSISTING OF US, EU, JAPAN, BRIC AND THE GCC

Panel A: return spillover US, EU, Japan and GCC

	US	EU	Japan	GCC	From
US	50.5	30.8	15.1	3.60	49.5
EU	29.9	47.6	17.8	4.80	52.4
Japan	19.2	21.7	56.3	2.70	43.7
GCC	7.00	9.40	4.20	79.4	20.6
To all	56.1	61.9	37.1	11.1	16
All	107	110	93.4	90.5	41.5%

Return spillover US, EU, Japan, BRIC and GCC

	US	EU	Japan	BRIC	GCC	From
US	40.5	24.9	12.1	19.5	3.00	59.5
EU	23.1	36.4	13.6	23.3	3.70	63.6
Japan	16.0	18.0	46.7	16.8	2.40	53.3
BRIC	19.3	24.4	13.5	38.1	4.60	61.9
GCC	6.50	8.50	3.90	10.3	70.9	29.1
To all	64.9	75.8	43.1	69.9	13.7	267
All	105	112	89.8	108	84.6	53.5%

Panel B: volatility spillover US, EU, Japan and GCC

	US	EU	Japan	GCC	From
US	51.7	26.3	11.9	10.1	48.3
EU	23.1	60.8	12.6	3.60	39.2
Japan	16.8	20.5	58.8	4.00	41.2
GCC	2.20	12.7	6.80	78.4	21.6
To all	42.0	59.5	31.2	17.7	150
All	93.7	120	90.0	96.1	37.6%

Volatility spillover US, EU, Japan, BRIC and GCC

	US	EU	Japan	BRIC	GCC	From
US	39.8	20.7	22.2	9.30	8.10	60.2
EU	18.8	47.2	21.5	9.70	2.70	52.8
Japan	21.8	22.2	40.2	12.7	3.10	59.8
BRIC	14.0	16.5	18.6	47.7	3.10	52.3
GCC	2.10	11.6	8.20	6.40	71.7	28.3
To all	56.7	71.0	70.6	38.1	17.0	253

All	96.5	118	111	85.8	88.7	50.7%

Note: The variance decomposition is based on a weekly VAR system with two lags. The spillover value is the assessed influence on the variance of the 10 step ahead stock return/volatility forecast error of country i coming from innovations to stock return/volatility of country j. The decomposition is based on the KPPS method, and therefore it is robust to variable ordering. The spillover index is calculated as the summation of the off-diagonal elements of the table divided by the sum of all elements of the table.

When including the BRIC markets in the system, the GCC remains the most segmented with 70.9% of the return variance explained by its own innovations. This compares with 38.1% in the BRIC bloc. Of note, while the EU continues to exhibit the highest spillover effect of the developed markets to the GCC, the BRIC markets contribute more (10.3%), although the reverse is not true from the GCC to BRIC. This perhaps again highlights the relative segmentation of the GCC from international markets. Calculated as the summation of the off-diagonal elements of the table divided by the sum of all elements of the table, the total spillover index effectively summarizes spillovers in a single measure and indicates that 41.5% of the variance in returns is due to spillovers excluding the BRIC markets and increases to 53.5% when the BRIC markets are included. The table above illustrates that Japan has a lower impact on global markets than the BRIC bloc, where the BRIC influence in the system records 69.9% compared to 43.1% in Japan. This is in line with the 2016 IMF[42] world stability report, where it is argued that the spillovers from emerging markets are increasing.

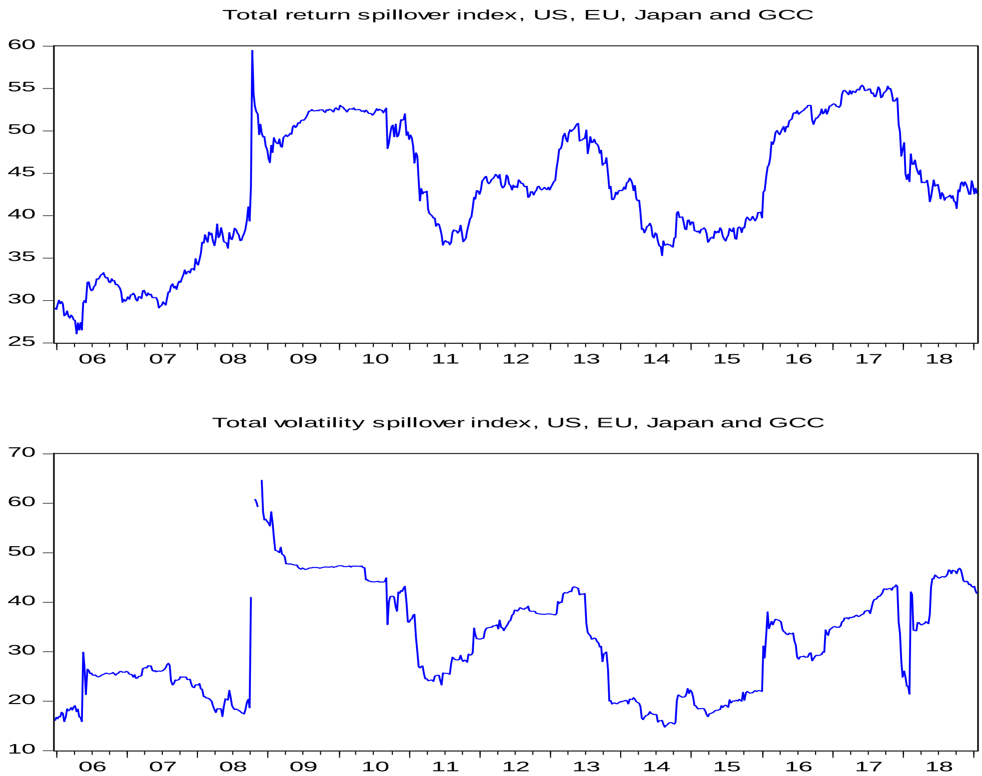
Table 3.6 Panel B depicts the spillovers in volatility. At 37.6%, the spillover index reveals moderate levels of connectedness among the US, EU, Japan and the GCC. This figure rises to 50% after the inclusion of BRIC countries. In common with previous results, we can observe that there is a higher level of spillovers among developed markets (Morana and Beltratti, 2008; Baele, 2005; Booth et al., 1997; Fratzscher, 2002). Within Panel B, for the US, EU, Japan, and GCC system, the latter is the most segregated with 21.6% contributions from other markets. This means that the GCC ranks the lowest in terms of exposure to volatility spillover from other indices. In accordance with the previous section, the EU is the main originator of volatility spillovers to the GCC region with 12.6%. Table 3.6 also illustrates that the US contributes marginally to the GCC volatility, with a small figure of

[42] https://www.imf.org/external/pubs/ft/gfsr/2016/01/pdf/text.pdf

2.3%, such that Japan (surprisingly) ranks second the level of spillover to the GCC sets at 6.8%.

Figure 3.8 plots the time-varying spillover[43] index. Similar to previous results, return spillovers exhibit a propensity to increase over time, reflecting amplified connectedness among international equity markets. In the GCC context, similar results are documented by Awartani et al. (2013). Volatility spillovers tend to boom and bust with market turbulence and tranquillity. Notably, Figure 3.8 shows a prominent hike in volatility spillovers that coincide with the subprime crisis and the Greek bailout from 2008 to 2010, the taper tantrum in 2013, the January 2016 market selloff and the Brexit vote in June 2016. The stock market crash of February 2018 alongside fears of higher expected inflation also contribute to higher spillovers.

FIGURE 3. 8 DYNAMIC TOTAL RETURN AND VOLATILITY SPILLOVER INDEX



Note: Both figures are generated from a sample including the US, the EU, Japan and the GCC based on a 100-week window and 10-step horizons. Also, the calculation is based on overlapping sub-samples and therefore would not be averaged to get the full sample spillover index. Finally, the gap recorded in 2008 volatility series is due to the extreme changes related to the 2008 Crisis; similar gaps can be found in the calculations of Diebold and Yilmaz (2009).

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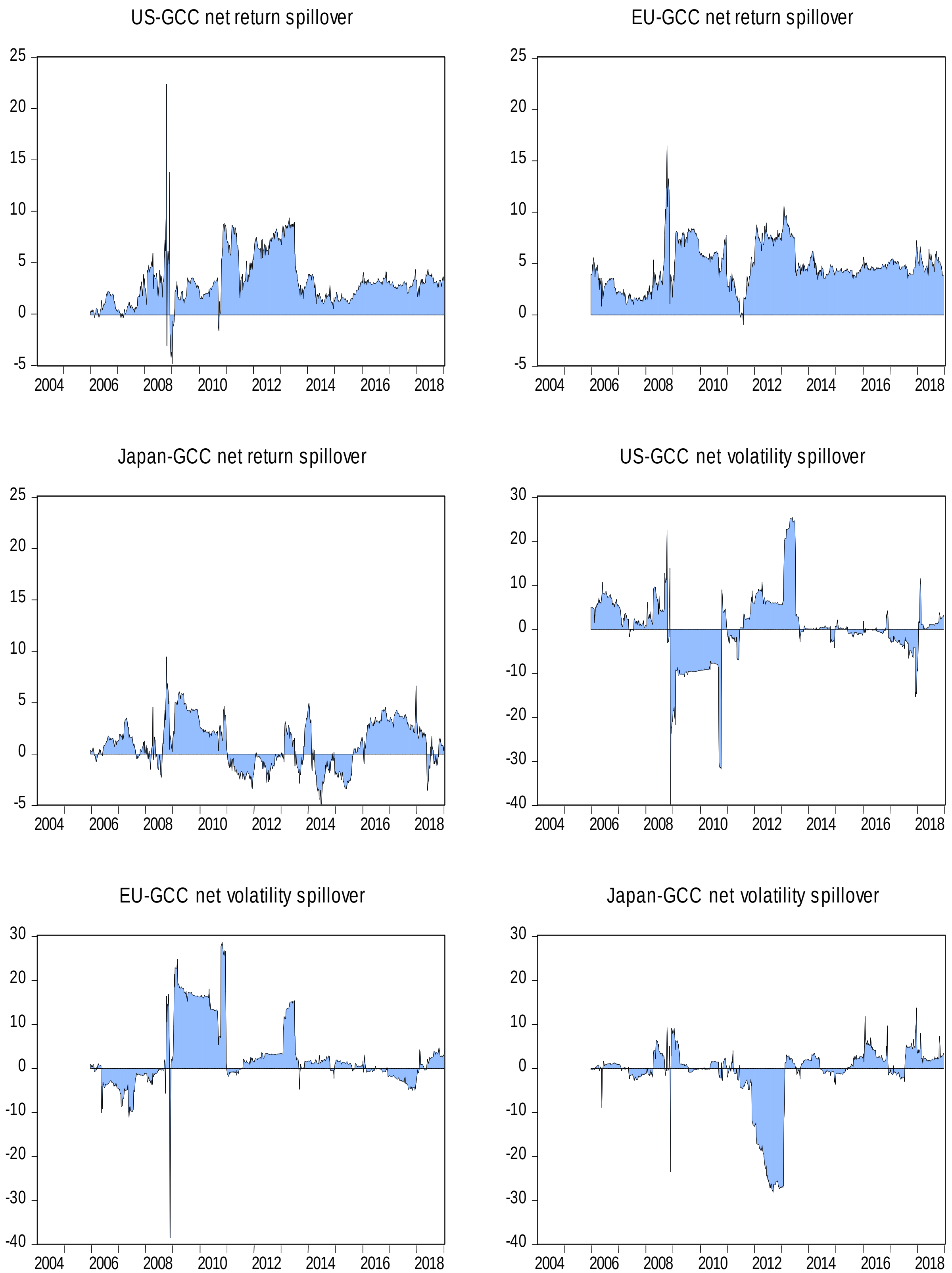
43 See Figure A.2 in the appendix for sensitivity analysis to different VAR lags, forecast horizons and rolling window length.

FIGURE 3. 9 NET PAIRWISE RETURN AND VOLATILITY



Note: the figures above are generated by subtracting the spills to the GCC from its exported shocks.

Figure 3.9 shows the net return and volatility spillovers using a 10-week-forecast-horizon and a 100-week-window. Net directional spillover corresponds to equation 3.14 and is the difference between the “Contribution from” column sum and the “Contribution to” row sum. In other words, the net spillover is the difference between spills to the GCC and spills to the GCC. When the value is positive, the net spillover runs from the US, the EU, Japan to the GCC. Figure 3.9 shows that the subprime crisis ignited a change in the dynamics of all sampled markets; this is demonstrated in higher intensity of return and volatility spillovers. As previously mentioned, the EU is the chief exporter of return spillovers to the GCC. However, the trend was severely impaired by the EU debt crisis during 2010/2011. The spillovers recovered their intensity until the taper tantrum, which caused them to deteriorate. That said, after the 2013 taper tantrum, the EU-GCC spillovers regained momentum and continued to be higher than the US spillovers to the GCC. This is perhaps because, unlike the US Federal Reserve, the ECB continued its policy of monetary expansion. The results for the Japanese return spillovers show only a limited degree of spillovers, which are not consistent in their direction over the sample.

Figure 3.9 points to the view that volatility spillover to the GCC mirror episodes of turbulence in the originator country; in 2006, volatility spilled uniquely from the US because the Fed policymakers raised federal funds rates to 5.25%, the highest since January 2001. Further, the EU debt crisis instigated spillovers from the EU to the GCC. Global events such as the 2008 financial crisis and the taper tantrum in 2013 result in a spike in spillovers from the US and the EU to the GCC. Again, spillovers from Japan are generally low and exhibit no consistent direction. Of note, the EU-GCC volatility spillovers were higher on average than those from the US particularly in 2009 and 2010 during the aftermath of the financial crisis and EU debt crisis. In contrast, the US-GCC volatility spillovers were more intense but short-lived, these patterns were demonstrated during the collapse of the Lehman Brothers in 2008, the 2013 taper tantrum, and the meltdown of February 2018. This explains the low 2.2% volatility spillover from the US to the GCC in the static view in Table 3.6 Panel B.

To summarise the results across both the correlations and spillovers, the EU-GCC correlations are the highest, while the EU is the main originator of both return and volatility spillovers to the GCC bloc. This overturns the presumption that the US would dominate the nature of the interrelationships. While US shocks appear to generate large shifts in correlations and spillovers, their effect tends to be short-lived, while the EU generates more consistent correlation and spillover behaviour over the full sample period.

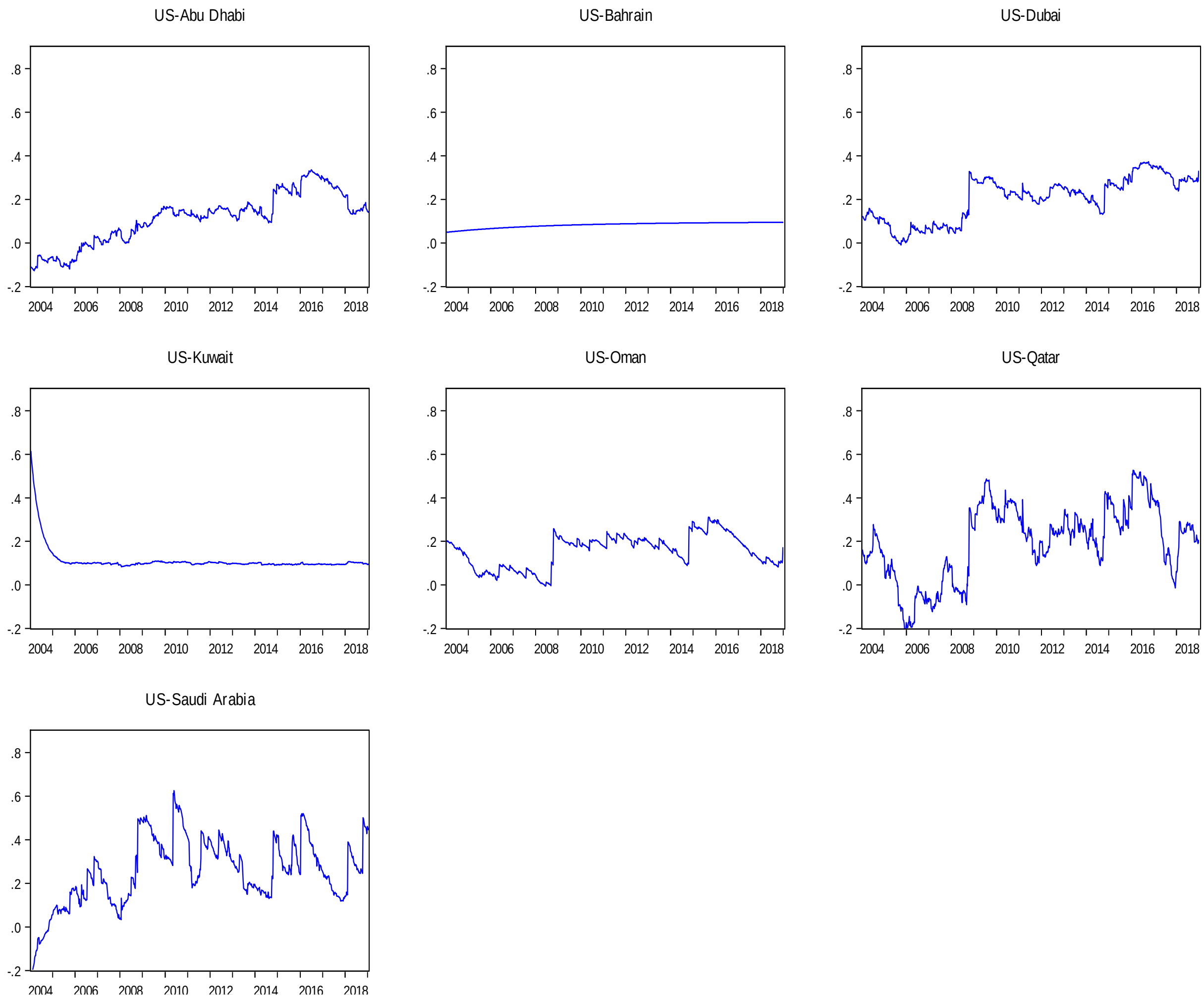
3.5.3 *A closer examination - inter and intra-regional linkages*

The above analysis considers the GCC as a bloc, however, as noted in the Introduction, there is some evidence of segmentation within the GCC bloc. Notably, both the Qatar and UAE markets have been reclassified as emerging, while the UAE has sought to become a regional financial hub. Thus, I now consider the correlations between the individual GCC markets and both the US and the EU.[44] Figure 3.10 plots the correlations of the US with the individual GCC markets using the ADCC GARCH model. Here, we can see that two broad camps appear to exist, on one side Saudi Arabia, Abu Dhabi, Dubai, Oman and Qatar collectively show signs of rising and volatile comovements with the US. On the other, Kuwait and Bahrain tend to be segregated with correlation levels as low as 0.1. Figure 3.11 depicts the equivalent correlations between the EU and the individual GCC markets and reveal a similar distinction, albeit that Kuwait shows greater integration with the EU compared to the US.

Using the DCC GARCH model, Figure 3.12 plots the correlations between the US and the seven GCC markets (Saudi Arabia, Qatar, Abu Dhabi, Dubai, Bahrain, Kuwait and Oman). While the generated series display similar traits to the ADCC GARCH model, the DCC GARCH model of US-Oman and US-Bahrain appears to vary more than its ADCC counterpart. Figure 3.12 also depicts the correlations between the EU and the GCC markets using the DCC GARCH model. In general, GCC market correlations with the EU exhibit analogous trends to the ADCC GARCH model, but, the 2008 Subprime crisis coincided with higher EU-Oman correlations. Also, the ADCC GARCH model produced higher correlations in EU-Kuwait model in 2004. Overall, the DCC GARCH model confirms the results of the GJR ADCC GARCH model and demonstrate segregation of Kuwaiti and Bahraini markets while higher level of integration is exhibited in the markets of Saudi Arabia, Qatar and the UAE.

[44] Equivalent graphs are available for Japan but add little to the results obtained for the GCC bloc as a whole.

FIGURE 3. 10 CORRELATIONS[45] AMONG US AND THE SEVEN GCC MARKETS GENERATED BY THE ADCC GARCH MODEL



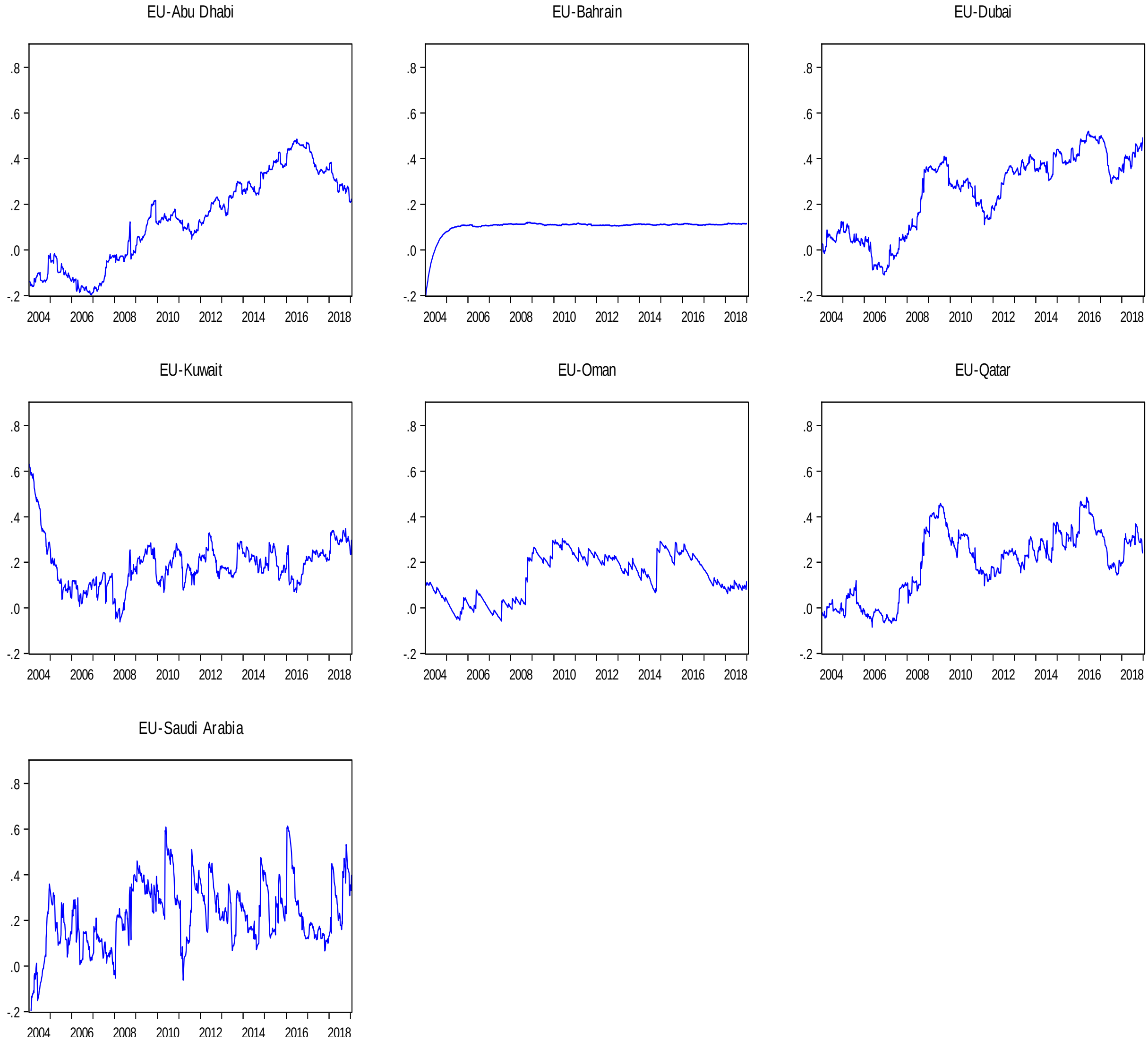
Note. The correlation series in the graph are simulated from a GJR ADCC GARCH model.

In explaining the segregation of Bahrain and Kuwait, for Bahrain it is potentially associated with the social unrest that occurred in 2011. Bahrain also lost the role of regional financial hub to Dubai. The Kuwaiti segregation might be associated with the country's heavy dependence on oil and the sluggish GDP growth during recent years. Moreover, while the Kuwaiti stock market capitalisation[46] in 2010 was $128 Billion, a similar figure to Qatari market capitalisation, the capitalisation dropped in Kuwait to reach $92 Billion in 2018. At the same time, the Qatari market capitalisation grew to reach $162

[45] Since Japan-GCC correlations are low, they are not presented to conserve space. The high correlations of Kuwait with both the US and the EU in early 2004 are perhaps linked to the war in nearby Iraq.
[46] http://www.kamconline.com/wp-content/uploads/reports/0de4cys6-rtbi-yr49-gfhv-uk1k4bx05yig.pdf.

Billion. Further, both Bahrain and Kuwait have recently fallen in the Transparency corruption index,[47] which may lead to international investors shunning such markets.

FIGURE 3. 11 CORRELATIONS AMONG THE EU AND THE SEVEN GCC MARKETS GENERATED BY THE ADCC GARCH MODEL



Note. The correlation series in the graph are simulated from a GJR ADCC GARCH model.

[47] https://www.transparency.org/

FIGURE 3. 12 GCC MARKETS CORRELATION SERIES WITH THE US AND THE EU, GENERATED BY THE DCC GARCH

Note. Correlation series of the US and the EU with Saudi Arabia, Kuwait Abu Dhabi, Dubai, Oman, Qatar and Bahrain. The series are generated by the DCC GARCH.

Two further markets worthy of note are Qatar and Oman. As with the majority of the GCC markets they exhibit an increasing trend in the equity market correlations with the EU and the US, however, this propensity was interrupted in Qatar and Oman during 2017 and 2018. The impact of the Qatari blockade from May 2017 results in a steep drop in the EU-Qatar correlation, while the decline in the US-Qatar correlation resulted in a negative observation for the first time in nine years. The diplomatic crisis behind the Qatar blockade, caused the Qatari stock market to crash and report -18% performance during 2017.[48] This decline was not the case in global markets, therefore, reducing the correlations. However, the Qatari market showed recovery in 2018 and consequently, the correlations have risen. Oman, on the other hand, suffers a downmarket of -11.8% and -15.2%[49] during 2017 and 2018 respectively. This mirrors low oil prices which led to unemployment and reduced profitability (Nasir et al., 2019). Therefore, the Omani integration that has occurred since the 2008 Crisis has now reverted to the level seen at the beginning of the millennium (and close to zero).

Table 3.7 depicts the return and volatility spillover results for the individual GCC countries. Considering the return spillovers, the following key points can be summarised: on the inter-regional level, the EU is a major exporter of return spillover, in particular, the EU surpasses the US as a major originator of spillovers in all GCC nations with the exception of Saudi Arabia and Bahrain. This finding contradicts those of Balli et al. (2015) who argue for the supremacy of US role across the GCC equity markets. Having that said, the return spillover from the US to Saudi Arabia has the highest intensity in the GCC region at 5.8%. This may explain the overestimation of Saudi role intra-regionally in previous studies such as Awartani et al. (2013) as the US was the only global factor included. Japan has a relatively low influence on the GCC nations, nevertheless, 3.3% of the variance of the Qatari returns is due to Japanese innovations. This result is in accordance with Balli et al. (2015). The total spillover index remains close to the previous finding at 53.1%.

In terms of volatility spillovers, Table 3.7 Panel B shows that the EU is an important originator of volatility in Kuwait with a relatively high figure of 6.1%. In addition, the EU is a salient source of volatility spillovers in the markets of Oman, Bahrain, and Qatar. In accordance with Balli et al. (2015), Yu and Hassan (2008) and Khalifa et al. (2014), the US is

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[48] The correlations among Qatar and the rest of the GCC did not display specific patterns during the diplomatic crisis. This is plausibly due to the unimpressive performance of the GCC markets in general during the year 2017.

[49] This could be the result of lower government spending on infrastructure projects and the increase in corporate tax rates.

an equally substantial source of volatility spillovers in the GCC region and records 7.3%, 4.9%, and 1.7% in Abu Dhabi, Saudi Arabia and Dubai respectively. In contrast to return spillovers, Japan plays a more notable role in volatility spillovers for Dubai, Oman and Qatar. This also highlights the view that the more integrated markets in terms of return spillovers do not necessarily demonstrate equivalent vulnerability to volatility spillovers. This is evident in the case of Dubai and Qatar. This perhaps mirrors the enhanced liquidity of these markets.

TABLE 3. 7 SPILLOVER AMONG THE US, THE EU, JAPAN AND THE GCC MARKETS.

Panel A: return spillovers

	US	EU	Japan	Saudi	Dubai	Abu Dhabi	Oman	Bahrain	Kuwait	Qatar	From
US	44.4	27.6	13.4	4.60	2.20	0.60	2.50	0.20	1.80	2.70	55.6
EU	27.0	42.2	15.6	2.70	3.50	0.30	2.60	0.50	2.20	3.40	57.8
Japan	17.4	19.5	51.2	2.70	2.30	0.70	2.00	0.40	1.00	2.70	48.8
Saudi	5.80	3.80	2.90	54.2	9.30	8.80	5.10	2.10	2.50	5.40	45.8
Dubai	2.80	3.70	1.70	7.30	38.8	17.3	10.1	4.30	5.10	8.90	61.2
Abu Dhabi	1.20	1.50	1.10	6.10	20.5	45.6	7.70	3.30	5.10	7.70	54.4
Oman	3.30	3.40	1.80	5.90	12.9	8.40	45.8	5.10	5.90	7.60	54.2
Bahrain	2.70	2.50	1.00	4.20	8.70	6.70	6.90	53.7	7.20	6.60	46.3
Kuwait	1.90	3.00	1.30	2.80	6.80	6.80	9.20	5.90	57.0	5.30	43.0
Qatar	3.50	5.10	3.30	5.00	10.9	8.70	7.60	3.90	5.70	46.2	53.8
To all	65.6	70.1	42.2	41.3	77.2	58.3	53.6	25.9	36.3	50.5	521
All	110	112	93.4	95.5	116	104	99.5	79.5	93.3	96.7	52.1%

Panel B: volatility spillovers

	US	EU	Japan	Saudi	Dubai	Abu Dhabi	Oman	Bahrain	Kuwait	Qatar	From
US	26.7	7.70	2.90	1.70	8.00	25.2	5.80	4.90	10.0	7.10	73.3
EU	9.30	49.3	5.50	0.40	2.80	18.7	3.20	2.30	4.50	3.90	50.7
Japan	4.60	8.20	50.3	1.40	3.90	17.9	3.20	2.70	2.30	5.40	49.7
Saudi	4.90	0.80	2.50	59.3	5.60	15.8	2.30	1.70	1.50	5.70	40.7
Dubai	1.70	0.70	2.00	3.40	37.2	7.00	14.1	9.40	9.60	15.1	62.8
Abu Dhabi	7.30	2.00	2.20	0.40	2.50	77.4	2.00	0.90	1.80	3.60	22.6
Oman	1.80	3.60	4.00	1.80	16.1	8.20	48.3	3.60	6.30	6.30	51.7
Bahrain	1.50	2.30	0.50	1.20	13.7	1.90	5.40	48.9	10.5	14.2	51.1
Kuwait	0.60	6.10	3.00	0.70	10.9	4.60	12.1	6.30	42.2	13.5	57.8
Qatar	0.70	2.20	2.40	3.40	16.0	5.90	7.30	9.60	11.9	40.7	59.3
To all	32.4	33.5	25.0	14.3	79.5	105	55.4	41.2	58.3	74.8	520
All	59.1	82.9	75.3	73.7	117	183	104	90.1	101	116	52.0%

Note: The variance decomposition is based on a weekly VAR system with two lags. The spillover value is the assessed influence on the variance of the 10-step ahead stock return/volatility forecast error of country i coming from innovations to stock return/volatility of country j. The decomposition is based on the KPPS method, and therefore it is robust to variable ordering. The spillover index is calculated as the summation of the off-diagonal elements of the table divided by the sum of all elements of the table.

3.5.4 Intra-regional linkages

On the intra-regional level, examining the return spillovers in Table 3.7 panel A, we can see that the UAE indices of Dubai and Abu Dhabi exhibit the highest intra-regional integration. Notably, Dubai is the greatest recipient and sender of spillovers with figures of 61.2 % and 77.2 % respectively and thus, a net sender of spillovers. The spillovers from other markets to the Saudi market are 48.8%, while the level of spillovers from Saudi to the other markets is 41.3%, hence, Saudi Arabia is a net recipient of spillovers. Furthermore, looking at "To all" row, the influence of the Saudi market in the system is noticeably lower than that of Dubai and Abu Dhabi and lower than Oman and Qatar. These tendencies oppose previous findings of transmission patterns in the GCC. For instance, it contradicts Awartani et al. (2013) and Hammoudeh and Aleisa (2004) who argue that the Saudi market plays the leading role. The discrepancy in these results could arise because, first, the recent liberalisation efforts in the UAE and the subsequent inclusion in the MSCI emerging market index in 2014, second, the inclusion of major developed markets adds important transmissions, which were overlooked by previous studies that exclusive focus on the US market.

Viewing Table 3.7 Panel B, Dubai is clearly the major instigator of volatility spillovers in the GCC region. Notably, Dubai exhibits larger spillovers in the "To" column towards all other GCC markets, with the exception of spillovers from Abu Dhabi to Saudi. Thus, Dubai contributes more volatility spillovers to other GCC markets than Saudi, which is commonly thought of as the dominant regional market. Moreover, the volatility spillovers from other GCC markets (Oman, Bahrain, Kuwait and Qatar) are greater than those of Saudi, again contrasting with the mainstream belief of Saudi's influence on the rest of the GCC. A final observation of interest within this table is that the volatility spillovers to the US, EU and Japan from the GCC markets is greatest from Abu Dhabi. This may reflect the small open nature of the Abu Dhabi market and simply reflects general international market movements.

The segregation in the case of Bahrain is perhaps associated with the social unrest that erupted in 2011. Someone could argue that the correlations remained stable during the sample period, but I believe that if the political situation had been stable, the ex-financial hub[50] of the GCC would have attracted more global funds and the integration level could have followed that of Dubai (the current financial hub of the GCC). The Kuwaiti segregation might be

[50] See Assaf (2003).

associated with the country's heavy dependence on oil and the sluggish GDP growth[51] during recent years. Moreover, while the Kuwaiti stock market capitalisation[52] in 2010 was $128 billion, a similar figure to the Qatari market capitalisation, the capitalisation dropped in Kuwait to reach $92 billion in 2018, at the same time, the Qatari market capitalisation grew to reach $162 billion (see Chapter 2). Finally, between 2004 and 2018, both Bahrain and Kuwait rank in the Corruption Perceptions Index[53] has deteriorated from 34 to 99 in the former and from 44 to 78 in the latter. These figures could plausibly preclude large flows of global capital to both countries resulting in segmentation. This is indeed relevant when the UAE, a fellow GCC member, ranked the 23rd internationally in 2018.

To summarise, in line with Sedik and Williams (2011) and Alotaibi and Mishra (2015), I argue that the UAE is the most integrated market inter-regionally. The GCC markets demonstrate more reflexivity towards region-specific innovations when compared with inter-regional ones. This result is not surprising and similar patterns are observed globally (Evans and McMillan, 2009; Yarovaya et al., 2016). The UAE, represented by Abu Dhabi and Dubai, is the main exporter and importer of spillovers in GCC; perhaps resulting from liberalisation policies and international capital flows, despite the higher market capitalisation and liquidity of Saudi Arabia, which (as of 2016) constitutes over 48% of the GCC market capitalisation and over 83% of the turnover (see Chapter 2).

3.6 Conclusions

This research aims to provide a vivid picture of the inter- and intra-regional linkages in the GCC region. The GCC bloc is a group of countries with strong economies which presents a set of markets that offers plausible diversification opportunities. The study incorporates both moments in the analysis of the GCC intra-regional linkages alongside its interactions with the US, the EU, and Japan. In practice, this is achieved using weekly data from 14/1/2004 to 17/1/2019, and two measures to assess the linkages; namely, the ADCC model of Cappiello et al. (2006) to generate the correlations series, return and volatility spillovers from the variance decomposition in the spillover index framework of Diebold and Yilmaz (2009, 2012).

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[51] According to the World Bank, GDP average growth between 2013 and 2016 year was as follows: Saudi 2.85%, Qatar 6.5%, UAE 3.8%, Oman 3.8%, Bahrain 3.7% and Kuwait 1.5%.
[52] http://www.kamconline.com/wp-content/uploads/reports/0de4cys6-rtbi-yr49-gfhv-uk1k4bx05yig.pdf.
[53] https://www.transparency.org/cpi2018, https://www.transparency.org/research/cpi/cpi_2004/0.

The findings reveal that the EU displays the highest correlation with the GCC bloc in general and during the Brexit vote in particular. Furthermore, the EU is an important originator of spillovers to the GCC region. This result is new to the literature as the focus on the US and oil is the norm (Malik and Hammoudeh, 2007; Sedik and Williams, 2011; Hammoudeh, and Choi, 2006; and Khalifa et al., 2014). Intra-regionally, contrary to the common belief of the Saudi market dominance (Awartani et al., 2013; and Hammoudeh and Aleisa, 2004; Alotaibi and Mishra, 2015), the UAE, represented by Dubai and Abu Dhabi, is the main transmitter of information in the GCC. Finally, the Qatari diplomatic crisis impacted the dynamics of the Qatari market correlations during 2017.

The existence of spillovers indicates that investors may extract information about domestic assets from foreign returns (King and Wadhwani, 1990). This is imperative because focusing on the time structure of spillover sheds light on the assimilation of shocks and time-varying patterns of cross country causality. Specifically, return spillover is essential in strategic portfolio asset allocation and market selection. As a measure of risk, volatility spillover is useful in the application of Value at Risk (VaR) and hedging strategies. Findings from this chapter have strong implications for the kind of risk premium that has to be paid to an investor holding an international portfolio.

The correlation results point out that, when compared with the BRIC bloc, the GCC enjoys lower correlations with major financial markets. While this is associated with lesser market integration (Bekaert and Harvey, 2000), it is a sign of higher diversification opportunities. However, GCC markets tend to be volatile, and consequently the diversification benefits could be severely impacted during turbulent periods. Moreover, there is a clear and consistent trend displaying disengagement between the GCC markets. Saudi Arabia, Qatar and the UAE are moving towards more integration while Bahrain and Kuwait demonstrate higher segmentation regionally and globally. This decoupling pattern between the GCC countries present essential information to global investors. As heterogeneity across countries means that markets within the region or bloc need to be treated individually according to their specific features. Therefore, this research's characterisation of individual markets improves investment choices and market portfolios for global investors.

From a domestic policy perspective, understanding the sources of spillovers is critical for providing important insight into the process of monetary and financial integration. The findings of this study can provide useful information for GCC policy-makers regarding monitoring stock market stability. As results show strong intra-regional linkages, policy-makers are bound to be aware of spillovers effects within the region, particularly in the UAE, Qatar, Saudi and Oman, as they have the highest linkages among them.

From the results presented in this study, policy-makers must consider the EU as a major source of spillovers alongside the US. In fact, the growing energy sufficiency in the US will shrink oil imports from the GCC, which in turn may decrease the stock market linkages with the GCC. This can further increase the importance of the EU in the information transmission dynamics of the GCC. In reality, spillovers could follow direct spillover from originating developed county, or indirect route from neighbouring countries that are subsequently affected by the originating country. Thus, GCC policy-makers may consider the UAE as a gateway of spillovers from international developed markets and a factor in forecasting returns in the rest of the GCC markets. The importance of the UAE is expected to increase following the UAE inclusion in MSCI emerging market index in 2014. The upgrade of Saudi Arabia to emerging market in 2019 encourages future research to examine if the UAE patterns will apply to Saudi Arabia.

Own-volatility innovations are considerably higher than volatility spillovers in the GCC markets. This would indicate that changes in volatility in the GCC markets from domestic conditions are relatively more salient than those found in their developed peers. Yet, the GCC policymakers ought to put procedures in place to react to macroeconomic changes in the US. Events including the Federal Interest Rate increase in 2006 and 2016, and the 2013 tapering tantrum, led to considerable volatility spillovers in the GCC and altered their correlations with developed markets.

Finally, investigating the influence of the exchange rate on financial spillover patterns in the GCC is another interesting extension to this study. However, since I take the perspective of the US investor and given that the GCC currencies are pegged to the $US, such adjustments are not considered in this chapter. Concerning the influence of oil on the linkages, the subject will be addressed in Chapter 5.

Chapter 4

Oil shocks and equity markets returns during bull and bear markets: the case of the GCC oil exporting and importing nations

4.1 Introduction

The literature review clearly shows that the GCC markets are not isolated from global shocks and reacted harshly to global crises. At the same time, results from Chapter 3 indicate that GCC markets exhibit low but increasing linkages with global markets. In fact, globalisation and high interdependence among international equity markets (Forbes and Rigobon, 2002; Kim et al. 2005) are echoing the growing importance of global factors influencing equity returns (Solnik et al, 1996). Thus, understanding the dynamic impact these factors exert on equity markets is essential for international investors, particularly in order to enhance the mean-variance ratio of their portfolios. Additionally, the financialization of oil markets is the phenomenon of the current decade as identified by Hamilton and Wu (2012), Maghyereh et al. (2016), Nadal et al. (2017) and Sadorsky (2014). This reflects a higher connection between oil and equity markets. This study is an attempt to detail the influence of oil shocks on global equity markets by factoring the type of oil shock, the nature of the energy profile of the country as an exporter/importer of oil, and market conditions from bullish to bearish.

Additionally, the landscape of oil-exporting countries has changed; for example, the UK has become a net oil importer after being an oil exporter in the past (Filis and Chatziantoniou, 2014). The US, on the other hand, thanks to the shale oil revolution, is moving in the opposite direction and emerging to become one of the biggest global oil producers. Such occurrences encourage a more in-depth examination of oil and equity market linkages, because understanding the nature of these linkages will provide policymakers with additional tools to absorb potential spillovers from oil markets, specifically in the light of the increasing activities of investors in both markets jointly.

The literature pioneered by Hamilton (1983) considers oil effects to be exogenous to the economy until Barsky and Kilian (2001, 2004) challenge the idea and suggest that the oil price might be endogenous to economic activity. Kilian (2009) proposes that a rise in oil price should be decomposed depending on its underlying source. Using a structural Vector Autoregressive (VAR) model, Kilian (2009) distinguishes among the following sources of oil price increase: supply-side shock attributable to the shortfalls in oil production, demand-side shock due to the rapid development of the world economy, and precautionary[54] demand for crude oil caused by expectations of future oil supply shortfalls. In addition to the importance of distinguishing between the different oil shocks, another advantage of adopting the Kilian (2009) methodology is raised by Scholtens and Yurtsever (2012); they argue that VAR models offer a direct way to model the dynamic relationships among economic variables without enforcing assumptions as may be the case in the CAPM and factor models.

As a result of this innovation in the literature, a specific strand of research, spearheaded by Kilian and Park (2009), emerged to study the impact of oil shocks on stock market returns. Early attempts concentrate on developed markets, for example Kilian and Park (2009) focus on the US market, Abhyankar et al. (2013) on Japan. Gupta and Modise (2013) examine the oil shocks impact on the oil importing nation of South Africa, while Basher et al. (2018) study the oil shocks influence over a group of oil exporters (Canada, Mexico, Norway, Russia the UK, Kuwait, Saudi Arabia, and the UAE).

In essence, policymakers and finance practitioners perceive oil differently; in oil-exporting nations, oil price increase is a source of wealth and optimism, while oil is associated with risk and higher production costs in oil importing nations. Bjørnland (2009) and Jimenez-Rodriguez and Sanchez (2005) argue that higher oil prices represent an immediate transfer of wealth from oil-importers to oil-exporters. Park and Ratti (2008) establish a negative association between oil price and stock returns for oil-importing nations while they argue for the opposite in oil exporting nations. Other notable studies in the same stream of research include the work of Wang et al. (2013), Guntner (2014) and Apergis and Miller (2009).

Given the complexity of the relationship between them, the asymmetry of oil influence on stock markets may extend to factor diverse market conditions. Baur (2013) argues that the quantile regression framework is capable of describing the changing nature of

[54] Oil-specific shock is another term referring to precautionary demand shock.

dependence during different market conditions from bullish to bearish. Also, Zhu et al., (2016) encourage the use of quantile regression as opposed to the OLS to account for sharp peaks and fat tail distribution in equity return series. From this perspective, Tchatoka et al. (2018), Sim and Zhou (2015), Lee and Zeng (2011), and You et al. (2017) investigate the oil and equity returns relationship by explicitly examining the dependence structure during bullish and bearish market conditions. This study contributes to the literature by combining the three aforementioned strands of research by examining the dependence structure between the three oil shocks and the conditional distribution of equity returns in oil exporting and importing nations.

The study examines the equity return series of the US, the UK, Germany, Italy, Spain, France, Japan, South Korea, China, and India to represent oil-importers. On the other hand, Russia, Norway, Canada and the Gulf Cooperation Council (GCC) nations exemplify oil exporters. The analysis involves two steps. First, a structural VAR is postulated, incorporating oil production, the Kilian proxy of economic activity and the Refiner's Acquisition Cost of crude oil (Kilian, 2009). The shocks are extracted from the system as supply, demand and precautionary demand variants. Second, a quantile regression framework is employed to distinguish between the effects of these shocks on stock returns in diverse market states.

Of note, Oil price shocks and uncertainties in markets can influence stock prices through affecting expected cash flows and discount rates. Likewise, oil price shocks can redistribute income and influence expectations about inflation and the real interest rate. Accordingly, oil price increases driven by increased global aggregate demand for commodities might be associated with reduced economic policy uncertainty and oil price increases caused by precautionary demand for crude oil in anticipation of oil shortages might be associated with increased economic policy uncertainty (Kang and Ratti, 2013). To account for such effects and ensure the accuracy of results, Global Economic Policy Uncertainty (GEPU) Index devised by Davis (2016). Given that VIX is a key measure of market expectations of a near-term volatility. This index is widely considered as a measure of fear and uncertainty in the market. Hence, VIX is included in the regressions to capture fluctuations of stock returns that are driven by stock market related variables which are unrelated to the oil innovations.

To be precise, in this chapter, three questions are investigated. First, the extent to which the different oil shocks are able to explain variations in equity returns. Second, how the energy profile is factored in the interlinkages among oil shocks and equity returns. Third, if asymmetry is observed in equity market reactions to oil innovations during different market conditions.

The findings point to the following: first, the markets of the US and oil-exporters (i.e., Saudi Arabia, Norway, Kuwait, Qatar, Oman, and Dubai) are positively stimulated by precautionary demand shocks during bear market conditions. The influence is stronger among GCC equity returns reflecting more reliance on oil. Second, among the US and many oil exporters (i.e. of Russia, Canada, Dubai, Kuwait, Qatar and Oman), the precautionary demand shocks have a dampening effect on stock market volatility during booming phases. Third, oil importers of Asia are robustly resilient to oil price shocks while the EU importers display similar behaviour to a lesser extent.

These results can provide a fresh outlook on the link between oil shocks and equity returns; instead of relying on impulse responses that test the magnitude and time span of oil shocks, this study will concentrate on the significance of oil shocks in different percentiles of the conditional distribution of return series, which echoes the different market conditions from booming to bearish.

The structure of the remaining chapter is organised as follows. Section 4.2 briefly reviews the literature. The methodology and data are presented in Section 4.3 and 4.4, followed by a discussion on the empirical results in Section 4.5. Section 4.6 presents the chapter’s conclusions.

4.2 Literature review

Subsequent to the seminal work of Hamilton (1983), the subject of oil-macroeconomy linkages became a vibrant research topic. For example, Hamilton (2003) and Jiménez-Rodríguez (2004) find evidence of a non-linear relationship between oil prices and the US economy. Mork (1989), Lee et al. (1995) and Hamilton (1996) introduced non-linear transformations of oil price. These transformations are commonly referred to as oil price shocks since they are designed to capture what is not anticipated by finance practitioners and equity markets.

In another strand of literature, Fama (1990) states that stock markets can anticipate economic activity. Having that said, the literature on the connection between oil price and equity returns[55] sparked the next wave of research. Prominent examples include the work of Jones and Kaul (1996) and Huang et al. (1996). Jones and Kaul (1996) depend on the cash flow hypothesis to establish a negative link between oil and US equity returns. The next wave of studies model the oil-stock relationship using VAR systems, two main studies stand out in this genre, namely, Sadorsky (1999) and Park and Ratti (2008).

Barsky and Kilian (2001) suggest that oil price might be endogenous to economic activity, since not all oil price movements are exogenous and could be influenced by economic factors. Given this, Kilian (2009) argues that the oil price should be decomposed to its source. Kilian (2009) distinguishes the following sources of oil price increase: supply-side shock due to shortfalls in oil production, demand-side shock due to a development of the world economy, precautionary demand for crude oil due to expectations regarding future oil supply disruptions.

Kilian and Park (2009) apply the Kilian (2009) decomposition to study the impact of oil price shocks on US equity returns. They use monthly series in a structural VAR from 1973 to 2006. Kilian and Park (2009) report that the response of US stock returns to oil price shocks is contingent on the underlying causes of the oil price increase. Precisely, they find that stock market returns are not influenced by supply-side shocks, on the demand side, a positive response is instigated by aggregate demand shocks, whereas the opposite is observed in the case of precautionary demand shocks. One criticism could emerge out of the fact that the data span in the original paper of Kilian (2009) finishes in 2006, therefore not accounting for the Subprime Crisis of 2008. Kim and Vera (2018) respond to this criticism and update the sample of Kilian (2009) to include the period around the 2008 crisis. Essentially, they provide evidence that the evolution of oil price in 2008 was mainly driven by demand side shocks which is the fundamental argument presented by Kilian (2009). Moreover, while in the original methodology of Kilian (2009) the data consist of oil production, the Kilian proxy of economic activity (dry cargo index) and oil prices, Kim and Vera (2018) provide robustness to the findings of Kilian (2009) by substituting the dry cargo index with the

[55] Smyth and Narayan (2018) identify multiple channels of the oil influence on equities. First, higher oil prices increase the cost of production therefore dampening future cash flows and dividends. Second, higher oil prices insinuates higher expected inflation and higher nominal interest rates. Since interest rates are integral to discount expected future cash flows, this will lower earnings. Third, oil price volatility can influence the effect of sensitivity of changes in oil prices on the risk premium of the discount rate.

industrial[56] production without altering the results. Fundamentally, despite some criticisms [57] concerning the construction of the Kilian economic activity index, the Kilian VAR proved to be very popular and paved the way for a considerable strand of research; that is the influence of oil price shocks on equity returns. This body of research associates a change in the price of oil to an unanticipated change in oil market fundamentals (i.e. global supply or demand of oil).

In accordance with Kilian and Park (2009), Basher et al. (2012) find that emerging stock markets do not seem to react to supply-side shocks, whereas a positive response is observed from both aggregate demand and precautionary demand shocks. The latter observation contradicts the findings of Kilian and Park (2009),[58] who maintain that the precautionary demand shocks lead to lower stock market returns, given the uncertainty that they are associated with. Abhyankar et al. (2013), using the same structural VAR model as Kilian and Park (2009), study the relationship between oil price shocks and the Japanese stock market. They report that when an oil price increase is driven by aggregate demand shocks, they are positively correlated to returns in the Japanese stock market. Conversely, oil-market specific shocks from an unexpected increase in precautionary demand for crude oil depress stock returns in Japan. Basher et al. (2018) study the relationship of oil price shocks with stock market returns in oil-exporting countries. They rely on a two-step approach. First, they identify structural oil-market shocks as in the Kilian and Murphy[59] (2014) VAR. The second step incorporates the distilled shocks together with equity returns in a Markov switching model. The results indicate that demand-side shocks dominate.

Some studies take a comprehensive approach and incorporate both oil importing and exporting nations. These studies aim to comprehend the asymmetric reactions among both blocs to oil price innovations. For example, Jiménez-Rodríguez (2015) deliver evidence of parallel conduct in both oil importing and exporting nations. In contrast, Park and Ratti (2008) and Ramos and Veiga (2013) argue that oil price hikes have a negative effect on the stock markets of oil-importing countries, while the impact is positive for the stock markets of oil-exporting countries.

[56] Industrial production of OECD countries and six major non-member economies Brazil, China, India, Indonesia, Russia, and South Africa.
[57] See Baumeister and Hamilton (2018) and Kilian and Zhou (2018).
[58] Basher et al. (2012) explain this by the fact that the index represents heavy oil importers, which demand large oil quantities, regardless of its price, in order to sustain economic activity. Hence, their stock markets might be more resilient to increases in oil prices even if they take place due to geopolitical uncertainty.
[59] Kilian and Murphy (2014) extend the Kilian (2009) framework and introduce speculative shocks.

Using the Kilian (2009) decomposition and studying both oil importers and exporters, Jung and Park (2011) and Wang et al. (2013) report heterogeneous responses of stock market returns to the different oil price shocks. Jung and Park (2011) find that aggregate demand shocks exercise a positive effect on both Norwegian and Korean equities, while precautionary demand shocks stimulate Norwegian stock markets and dampen their Korean peers. Using a wider range of countries, Wang et al. (2013) state that the oil price increase through precautionary demand shocks motivates stock market returns in some oil-exporting countries, while being insignificant in oil-importing countries.

Overall, the literature seems to agree on the following: first, the insignificance of oil supply[60] shocks in most markets. Second, oil aggregate demand shocks stimulate equity returns. Third, no consensus is reached over the effects of precautionary demand shocks.

Based on the intuition of negative oil price effects on economies (Sadorsky, 1999; Jones and Kaul, 1996), some studies attempt to establish a form of causation between oil prices increase and bear market state. In this strand, Angelidis et al. (2015) state that oil prices can be an indicator of a down market. Parallel to that, some studies study oil and equity returns relationship by explicitly examining the dependence structure during booming and depressed market conditions. Econometrically, this academic research field isolates bearish and bullish markets by employing the quantile regression. For example, Sim and Zhou (2015) examine the relationship between oil and US equities using a quantile to quantile approach and find that negative oil price impacts US equities positively when the US market is in good shape. Also, the influence of positive oil price shocks is weak, this advocates an asymmetric relationship between oil prices and US equities. Using quantile regression and monthly data from 1995 to 2016, You et al. (2017) investigate the impact of crude oil shocks and China's economic policy uncertainty on stock returns. Empirical results report that the effects of oil price shocks are asymmetric and highly related to stock market conditions. In accordance with Lee and Zeng (2011), You et al. (2017) explain these findings by linking them to optimistic or pessimistic investor sentiment.

[60] These findings might be ascribed to the fact that oil-suppliers decisions are anticipated and therefore they are not captured as shocks. As a side note, in recent years, OPEC lost its grip on oil prices due to Russian oil supply that compensates for OPEC supply shortages (Hamilton, 2014). This propensity is not expected to change much in light of the recent American shale oil revolution.

Basically, the studies in the first section do not systematically isolate bearish and bullish markets. While their counterparts in the second segment use oil prices which ignores the underlying factors behind the price innovations.

Ahmadi et al. (2016), Filis et al. (2011) and Apergis and Miller (2009) argue in favour of including additional control variables in the analysis of oil shocks and equity returns. They elaborate that the absence of these variables might lead to an overrated impact of oil price shocks on stock markets. Likewise, Bernanke et al. (2004) and Pieschacón (2012) maintain that oil shocks transmit to markets via monetary policy and fiscal actions. Baur and McDermott (2010) argue that commodities and equities fluctuate with the uncertainty of stock markets. Nazlioglu et al. (2015) state that the VIX and oil are intertwined. Kang and Ratti (2013) maintain that oil shocks and Economic Policy Uncertainty (EPU) are interrelated and influence stock returns. They argue that oil price shocks and economic policy uncertainty influence stock prices by disturbing expected cash flows and discount rates. Other examples of literature examining the VIX and the EPU interactions with oil and stock returns include the work of Kang et al. (2017), Basher et al (2018), Antonakakis et al. (2014),You et al. (2017) and Berger and Uddin (2016). Again, distilling accurate results of the influence of oil encourages the inclusion of risk measures that are associated with oil, such as policy uncertainty.

4.3 Methodology

4.3.1 The Kilian (2009) model

Given that since the 1970s oil has responded to some of the same economic forces that drive stock prices (see Barsky and Kilian, 2001), it is necessary to control for reverse causality. A second drawback of the literature is the presumption that it is possible to assess the impact of higher crude oil prices without knowing the underlying causes of the oil price increase. Thus, using a VAR system, this paper follows the methodology proposed by Kilian (2009) to decompose oil price into distinctive shocks; “oil supply shocks. “aggregate demand shocks” and “oil-specific demand shocks”. The data consist of the percentage change in world crude oil production, refiner’s acquisition cost oil price and the Kilian index of the global economy. It should be acknowledged that Apergis and Miller (2009) criticise the use of oil prices instead of oil returns in the original methodology of Kilian (2009), stating the existence of a mix of stationary and non-stationary variables in the VAR system. The practice of incorporating the non-stationary logged real price of oil alongside other stationary variables is common in prior literature (see Kilian and Park, 2009, Basher et al, 2018). That said, there is a wealth of literature including Sims et al. (1990), Inoue and Kilian (2002) and Inoue and Kilian (2019) that shows that the level specification under weak conditions is robust to the inclusion of I(1) or near I(1) variables. In contrast, working with differences is invalid when the data are not I(1). Thus, econometrically a strong case can be made for including the real price of oil in levels. Furthermore, differencing the oil price will result in removal of the slow-moving component therefore influencing the persistent effect of aggregate demand shocks (Abhyankar et al., 2013).

Following Basher et al. (2018) and Apergis and Miller (2009), I adopt a two-stage approach. In the first step, oil shocks are distilled from the Kilian (2009) structural VAR system. In the second stage, oil shocks, equity returns, the GEPU and the VIX are incorporated in a quantile regression. The two-stage procedure is advantageous as limiting the number of variables in the structural VAR framework reduces the computational difficulties associated with larger VARs and removes the need for additional identification restrictions. In a regression context, this means that oil supply shocks, aggregate demand shocks, and oil-specific demand shocks are supposed to be orthogonal variables. If orthogonality holds, these variables are uncorrelated with other included and omitted regression variables.

This section is based on the Kilian VAR (2009); the model is based on monthly data for $z_t = (\Delta\ prod_t, rea_t, rpo_t)'$, where $\Delta\ prod_t$ is the percentage change in global crude oil production, rea_t denotes the index of real economic activity and rpo_t is the real price of oil.

Unlike Apergis and Miller (2009), who include seven lags in their VAR model, I follow Hamilton and Herrera (2004) Kilian (2009) and rely on a 24-month lag length, this period is presumed adequate by Kilian (2009) as it allows for potential delays between structural oil demand and oil supply shocks and their effect on the economy. In addition, such a long number of lags removes serial correlation effects.

The structural VAR representation is:

$$A_0 z_t = \alpha + \sum_{i=1}^{24} A_i z_{t-1} + \varepsilon_t, \tag{4.1}$$

Where ε_t denotes the vector of serially and mutually uncorrelated structural innovations. A_0^{-1} has a recursive structure such that the reduced form errors e_t can be decomposed according to $e_t = A_0^{-1}\varepsilon_t$

$$e_t = \begin{pmatrix} e_t^{\Delta prod} \\ e_t^{rea} \\ e_t^{rpo} \end{pmatrix} = \begin{bmatrix} a_{11} & 0 & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & a_{33} \end{bmatrix} \begin{pmatrix} \varepsilon_t^{\text{oil supply shock}} \\ \varepsilon_t^{\text{aggreagate demand shock}} \\ \varepsilon_t^{\text{oil specific demand shock}} \end{pmatrix} \tag{4.2}$$

The identifying restrictions are based on Kilian's (2009) model. The crude oil supply does not respond to simultaneous changes in oil demand because of the high adjustment cost of oil production. The fluctuation in the real price of oil does not affect global real economic activity within the same month. An oil supply disruption and real aggregate demand shock will influence the real price of oil immediately, meaning that expectations about future oil supply shortfalls and/or global real economy downturns drive the precautionary demand for oil up within the same month. Another assumption is that while the global economic activity responds to oil supply shocks almost immediately, it takes more than a month for the global economy to react to other oil-specific shocks. This is rationalised by the fact that the disruption of crude oil supply has significant influence on global economic activity (Hamilton, 1983; Kilian, 2009), at the same time, the response of global economy to oil price change is lagging behind (Kilian, 2009). The reduced-form VAR model is estimated by the least squares method. Subsequently, the estimates are used to construct the structural representation of the VAR model. I follow Goncalves and Kilian (2004) and make inferences on a recursive-design bootstrap with 2,000 replications.

4.3.2 Quantile regression

The quantile regression, developed by Koenker and Bassett (1978), estimates the effects of the explanatory variables on the conditional quantile of the dependent variable. Compared to a traditional regression model, the quantile regression functions present more specific and accurate results of the impact of exogenous variables on the conditional variable of interest. Specifically, as the median quantile regression estimator minimises the symmetrically weighted sum of absolute errors to estimate the conditional median quantile function, other conditional quantile functions are estimated by minimizing an asymmetrically weighted sum of absolute errors, where the weights are functions of the quantile of interest. Moreover, the quantile regression gives information on the average dependence as well as the upper and lower tail dependence. Thus, quantile regression is robust to the presence of outliers and non-normality (Brooks, 2002).

A quantile regression models the quantiles (partitions or sub-sets) of the dependent variable given the set of potential explanatory variables (Koenker and Bassett, 1978; Koenker and Hallock, 2001). The quantile regression therefore extends the linear model in (X) by allowing a different coefficient for each specified quantile:

$$r_t = \alpha^{(q)} + \beta^{(q)} x_t + \varepsilon_t \qquad (4.3)$$

where $\alpha^{(q)}$ represents the constant term for each estimated quantile *(q)*, $\beta^{(q)}$ is the slope coefficient that reveals the relation between the correlation and the explanatory variable at each quantile, and ε_t is the error term.

Accordingly, different weights are given, conditional upon whether the points are above or beneath the line of best fit (Binder and Coad, 2011). In other words, the quantile regression model minimises the sum of residuals where positive residuals receive a weight of τ and negative residuals receive a weight of $1-\tau$.

4.4 Data

To extract the oil price shocks, global oil production, the Kilian (2009) index of global economy and the refiner's acquisition cost price are incorporated in a structural VAR. These monthly sampled variables are employed to account for oil supply, demand and price correspondingly. Kilian and Park (2009) argue that oil price shocks are intrinsically global, and this impact is better captured by a world price than country-specific prices. They explain this by the counteracting of currency exchange rates to the true dynamics. In this study, and for consistency with Kilian (2009), I use the refiner's acquisition cost price, deflated by the US CPI. Since this price is denominated in $US, I achieve consistency with Kilian (2009) without suffering from exchange rate fluctuation noise. The Kilian (2009) measure of economic activity is used as a proxy for global economic activity. This index is based on dry cargo single voyage ocean freight rates. The index is linearly de-trended and designed to capture shifts in industrial demand for commodities. Kilian (2009) argues that this index is more reflective of global economic activity than other measures like the OECD industrial production index because it incorporates emerging economies. This is imperative since

Hamilton (2011) states that these economies absorb two thirds of the oil production increase. Finally, the logarithmic difference of global oil production is applied to calculate the percentage change.

Baker et al. (2016) construct the economic policy uncertainty (EPU) index which is a weighted average for each country's uncertainty constituents: first, newspaper coverage of policy-related economic uncertainty. Second, the number of federal tax code provisions set to expire in future years. Third, a measure of disagreement among economic forecasters over future Federal government purchases and CPI inflation. Based on Baker et al. (2016), Davis (2016) construct a monthly index of Global Economic Policy Uncertainty (GEPU). The GEPU Index is a GDP-weighted average of national EPU indices for 16 countries that accounts for two-thirds of global output. The GEPU Index is an international EPU index that is constructed to echo economic policy uncertainty from a global view. Bloom et al. (2017) discuss how the EPU index had recently spiked in three waves and highlight how it was both a cause and effect of recessions. Hamilton (1983) argues that recessions are a product of higher oil prices. Thus, similar to Kang et al. (2013), it is plausible to expect the GEPU to be interlinked with oil and the economy.

The VIX Index is a measure of expected future volatility introduced by the Chicago Board Options Exchange (CBOE). The CBOE Volatility Index is the first benchmark index to measure the market's expectation of future volatility. The formulation of a volatility index, and financial instruments based on such an index, were developed by Brenner and Galai (1986). Starting from 1993, the CBOE commenced publishing the VIX based on a formula developed by Whaley[61] (1993); the current VIX index value quotes the expected annualized change in the S&P 500 index over the following 30 days, and it is computed from options-based theory and current options-market data. Despite both being uncertainty measures, Davis (2017) states that EPU and VIX do not necessarily co-move with each other. For example, the VIX fell swiftly after the Subprime Crisis, while this was not the case with the EPU. Essentially, Davis (2017) argues that VIX, as a measure of uncertainty about equity returns, provides the Wall Street perspective. Moreover, Davis (2017) maintains that the horizon of EPU fluctuates through time with a combination of economic and policy-related risks while the VIX has a 30-day fixed horizon.

[61] For more information, see Whaley (2008).

Stock returns, VIX and GEPU are sampled on a monthly basis. The data stretches from January 2002[62] to May 2018 and include the equity return series of the US (S&P 500), the UK (FTSE 100), Germany (DAX 30), Italy (FTSE MIB), Spain (IBEX 35), France (CAC 40), Japan (NIKKEI 225), South Korea (KOSPI), China[63] (SSE), India (BSE SENSEX 30), Russia (RTS), Norway (OSE) and Canada (S&P TSX), Saudi Arabia, Abu Dhabi, Dubai, Qatar, Oman, Kuwait and Bahrain. All indices are denominated in $US. The oil-importing nations are chosen based on their level of hydrocarbon imports and the capitalisation of their equity markets. For example, despite having the 9th highest stock market capitalisation globally in 2018, Switzerland was excluded due to its relatively low oil imports. Within oil exporters, Iraq and Iran, among the top ten oil exporters, were disqualified as a result of the lack of depth in their equity markets. The return series of all 20 indices are calculated by applying the natural logarithmic difference. Similarly, the explanatory variables represented by the GEPU and VIX are all stationary and in percentage change form in order to allow for a common[64] interpretation of the coefficients. The above variables are extracted from Thomson Reuters Datastream with two exceptions, first, the Kilian measure of global activity was downloaded from his personal[65] website. Second, the GEPU is downloaded from the policy uncertainty website. [66]

Finally, while studies like Antonakakis et al. (2013) among others, include a lagged dependent variable in their regression in order to address autocorrelation, Keele and Kelly (2006) argue that the lagged dependent variable specification is problematic. Explicitly, the lagged dependent variable causes the coefficients of explanatory variables to be biased downward. Also, given that the data is monthly, usually, return series are not correlated in that frequency. Finally, unlike the OLS, the quantile regression does not impose strong assumptions on the residuals against heteroscedasticity and serial correlation. For this reason, this study does not include lagged returns in the regressions.

[62] In Dubai and Bahrain, the sample starts in 2004 and 2003, respectively, due to data availability constraints.
[63] The Shanghai Stock Exchange index (SSE composite index) reflects all stocks that are traded at the Shanghai Stock Exchange including A and B shares.
[64] Some studies use the EPU without logarithmic differencing.
[65] http://www-personal.umich.edu/~lkilian/.
[66] http://www.policyuncertainty.com/.

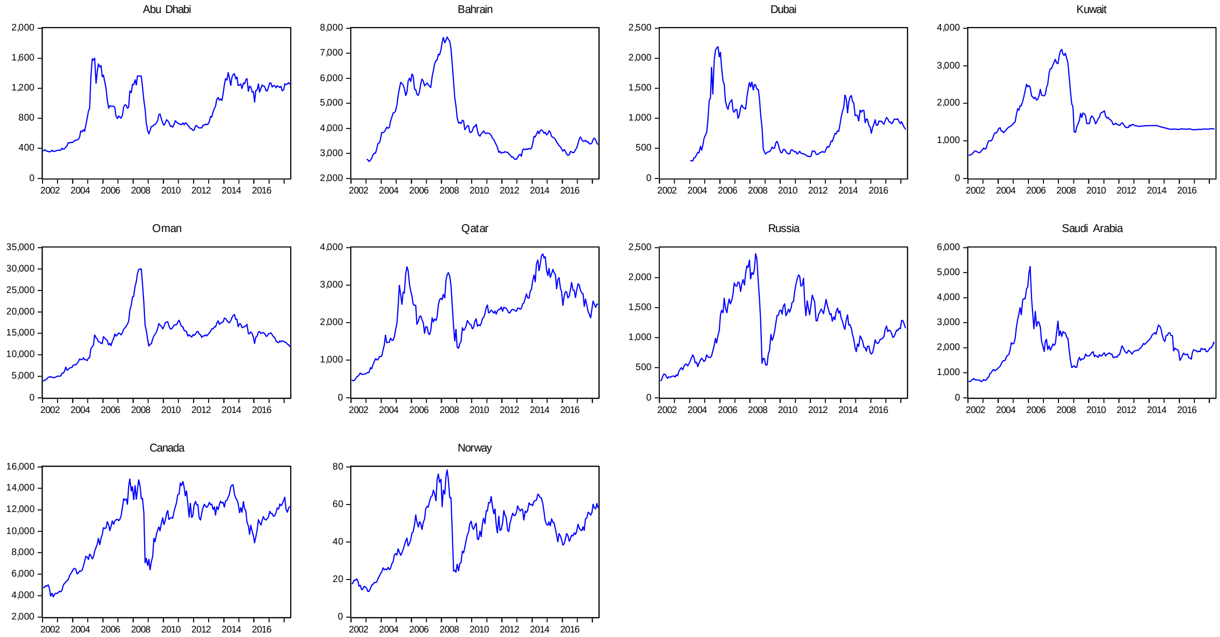
TABLE 4. 1 DESCRIPTIVE STATISTICS OF THE LOGARITHMIC DIFFERENCE OF THE VARIABLES. THE SAMPLE SPANS FROM JANUARY 2002 TO MAY 2018 WITH 197 OBSERVATIONS

	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	PP test	Jarque-Bera
Abu Dhabi	0.0055	0.0019	0.3573	-0.2339	0.0706	0.3147	7.1402	0.0000	125.69*
Bahrain	-0.0008	-0.0011	0.0846	-0.1214	0.0346	-0.4374	4.3293	0.0000	18.150*
Germany	0.0061	0.0119	0.1704	-0.3866	0.0692	-1.5416	9.3350	0.0000	355.75*
Dubai	0.0060	0.0000	0.3353	-0.536	0.1061	-0.465	7.1928	0.0000	132.19*
France	0.0018	0.0074	0.1528	-0.4479	0.0673	-2.0014	13.725	0.0000	939.24*
UK	0.0013	0.0083	0.1544	-0.4266	0.0574	-2.5916	19.939	0.0000	2248.9*
Italy	-0.0019	0.0076	0.1634	-0.5347	0.0828	-1.8734	12.112	0.0000	695.68*
Spain	0.0006	0.0121	0.1503	-0.5228	0.0784	-1.9854	13.423	0.0000	891.62*
Japan	0.0039	0.0083	0.1437	-0.3305	0.0555	-1.4001	9.8319	0.0000	390.70*
S. Korea	0.0066	0.0111	0.2877	-0.5927	0.0830	-2.0786	18.045	0.0000	1746.0*
Kuwait	-0.00009	0.00005	0.1168	-0.4321	0.0532	-3.2882	27.929	0.0000	4763.8*
Oman	0.0026	0.0055	0.1953	-0.2634	0.0547	-0.6815	7.6087	0.0000	165.53*
Norway	0.0051	0.0105	0.1916	-0.6442	0.0895	-2.4588	18.482	0.0000	1891.1*
Qatar	0.0047	0.0051	0.2249	-0.301	0.0813	-0.4073	5.0078	0.0000	33.645*
Russia	0.0038	0.0087	0.2957	-0.8034	0.1084	-2.3447	19.709	0.0000	2158.5*
India	0.0081	0.0140	0.3090	-0.3874	0.0808	-0.6469	6.5864	0.0000	104.18*
Canada	0.0038	0.0110	0.1984	-0.5049	0.0657	-2.6992	22.623	0.0000	2968.5*
Saudi	0.0034	0.0123	0.2237	-0.281	0.0855	-0.8359	4.8610	0.0000	44.854*
China	0.0054	0.0106	0.2351	-0.2995	0.0816	-0.5154	4.5443	0.0000	24.708*
Oil price	3.2317	3.2313	4.076	2.2313	0.4414	-0.0757	1.8572	0.7063	12.179*
Oil Prod	1.001	1.001	1.0292	0.9760	0.0078	0.0125	3.8586	0.0000	6.7637*
US	0.0051	0.0123	0.0986	-0.302	0.0444	-2.3261	15.765	0.0000	1322.8*
Kilian index	11.378	2.7496	187.66	-163.74	74.242	0.3957	2.473	0.0281	8.288*
VIX	-0.0004	-0.0169	0.8526	-0.486	0.2011	0.6302	4.6143	0.0000	30.062*
GEPU	0.0052	0.0028	0.6566	-0.5646	0.1944	0.3891	4.2157	0.0000	14.933*

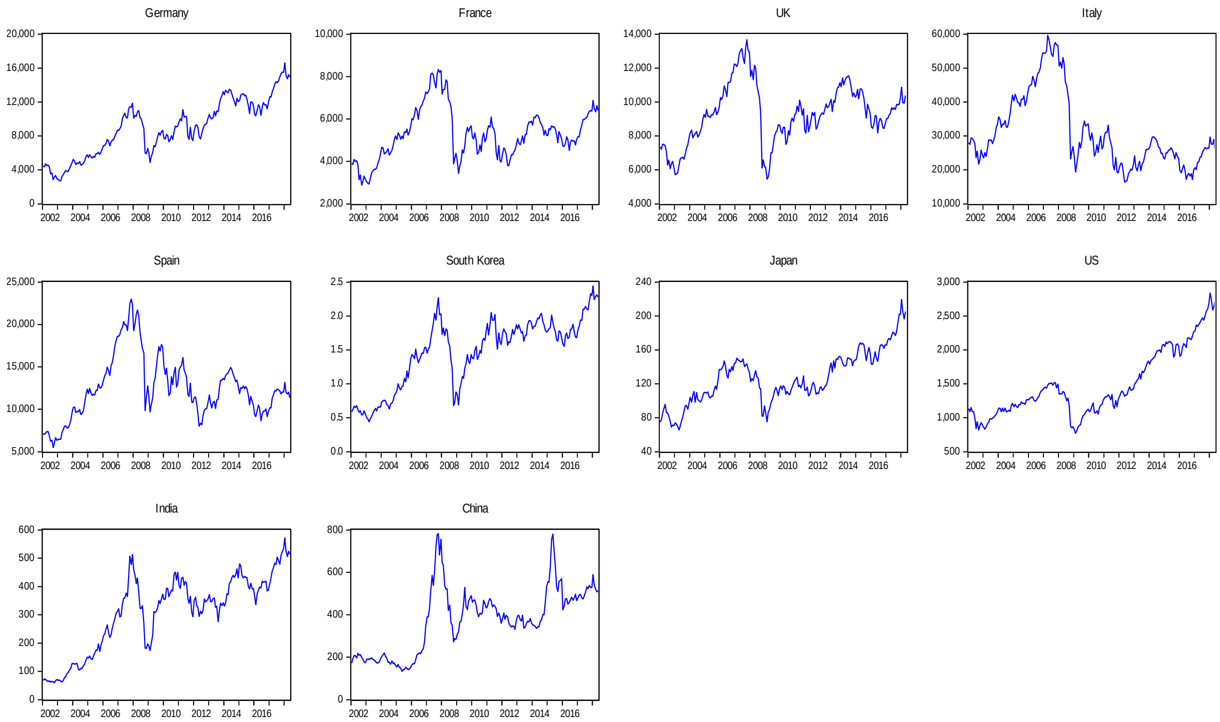
Notes. Phillips–Perron test (PP), Saudi Arabia (Saudi), South Korea (South Korea), oil production (Oil prod), Standard Deviation (Std. Dev.), Chicago Board Options Exchange Volatility Index (VIX), Global Economic Policy Uncertainty Index (GEPU), Kilian measure of economic activity (Kilian index). Statistics of oil price, oil production and Kilian index are based on 221 observation since they were used in a structural VAR with a two-year lag.

FIGURE 4. 1 STOCK MARKET PRICE INDICES

Panel A: oil exporters



Panel B: oil importers



Note. price series for the US, Canada, Norway, Russia, Saudi Arabia, the UAE, Qatar, Oman, Bahrain, Kuwait, Dubai, India, China, South Korea, Japan, Spain, the UK, Germany, Italy and Spain.

As seen in Table 4.1, typical stock return characteristics are observed; the series are not normally distributed with high kurtosis and negative skewness. Moreover, the equity markets of Italy, Kuwait and Bahrain illustrate negative mean returns. As expected, the standard deviation is higher in emerging markets when compared with their developed counterparts. Stationarity is the case in most entries[67] as reported by the Phillips–Perron unit root test.

Figure 4.1 shows that the oil price collapse and the economic slowdown in the second half of 2014 is manifested in a deterioration in equity returns of oil exporters. Conversely, oil importers experienced lower losses and rebounded in 2016.

4.5 Empirical results

4.5.1 Oil shocks timeline

From a historical perspective, Hamilton (2011) describes the periods 1973–1996 and 1997–2010 as "The age of OPEC" and "A new industrial age. respectively. Hamilton (2011) associates the age of OPEC with a shift in the emphasis of the global oil market from North America to the Persian Gulf, and with an imperative influence of the Organisation of Petroleum Exporting Countries (OPEC). OPEC is a permanent intergovernmental organisation of 15 oil-exporting developing nations that coordinates and unifies the petroleum policies of its member countries. According to Belcilar et al. (2015), although the inauguration of OPEC dates back to 1960, the organisation's strong grip over world crude oil prices commenced after its member countries nationalised their domestic oil industry. "A new industrial age" is linked with the remarkable economic growth in the emerging economies, particularly China and India.

[67] Refer to the methodology section for the reasons behind including the logged oil price despite being a non-stationary variable.

FIGURE 4. 2 STRUCTURAL OIL PRICE SHOCKS

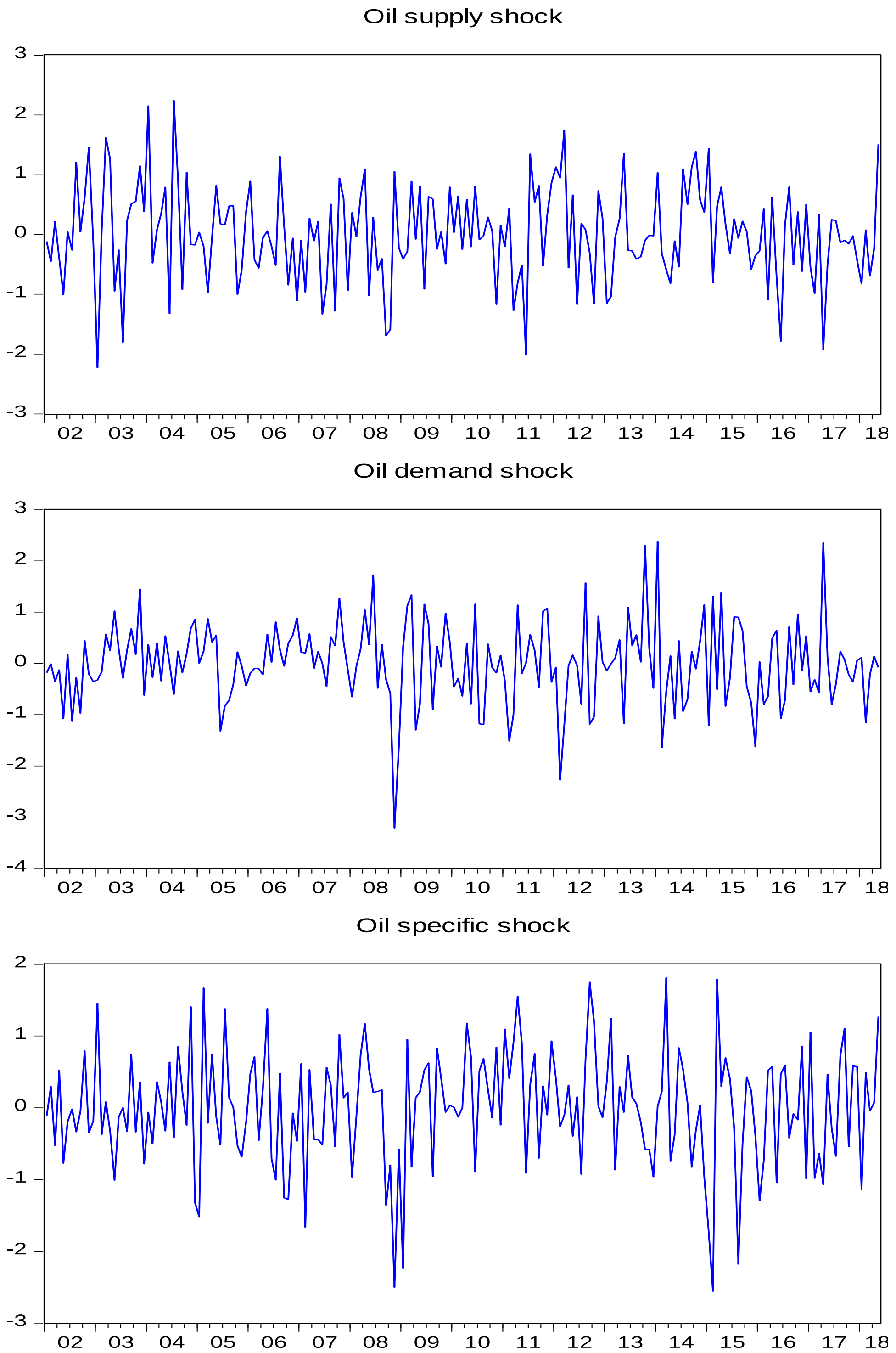


Figure 4.1 depicts the three oil price shocks. Focusing on 2002 to mid-2008, and similar to the findings of Hamilton (2011), the large increase in the real oil price was driven by a series of positive aggregate demand shocks associated with shifts in global real economic activity. Interestingly, during the same period, oil supply shocks played a

negligible role in oil price fluctuations. It is observable that at the end of 2008, the plunge in the price of oil reflected the fall in aggregate demand and oil market-specific demand, respectively. Turning to the period stretching from 2011 to mid-2014, the hallmark of this phase is the global economic recovery from the Subprime Crisis, and the presence of aggregate demand shocks is illustrated in Figure 4.1. Also, there are waves of positive oil market-specific demand shocks. Indeed, serious concerns about political instability have emerged with protests sweeping the Middle East. These events have created concerns about future oil shortages.

Concerning the astonishing oil price drop that took place from 2014 to 2016 (see Figure 4.2), it could be attributed to supply-side factors, precisely two main aspects. First, the shale oil revolution, second, OPEC policies; as the organisation was reluctant to stabilize the oil markets and decided against cutting production at a 2014 meeting in Vienna. Also, according to the Energy Information Administration (EIA), total oil production by year-end 2015 was expected to rise to over 9.35 million barrels per day, higher than the 9.3 million barrels per day forecast in February 2015. However, Baumeister and Kilian (2015) show that more than half of the observed cumulative decline, was actually predictable using only the information publicly available at the end of June 2014. They attribute the poor forecasts to the reliance on Brent futures prices as a measure of the market's oil price forecast.

FIGURE 4. 3 REFINER'S ACQUISITION COST OIL PRICE IN NOMINAL AND REAL TERMS FROM JANUARY 2002 TO MAY 2018

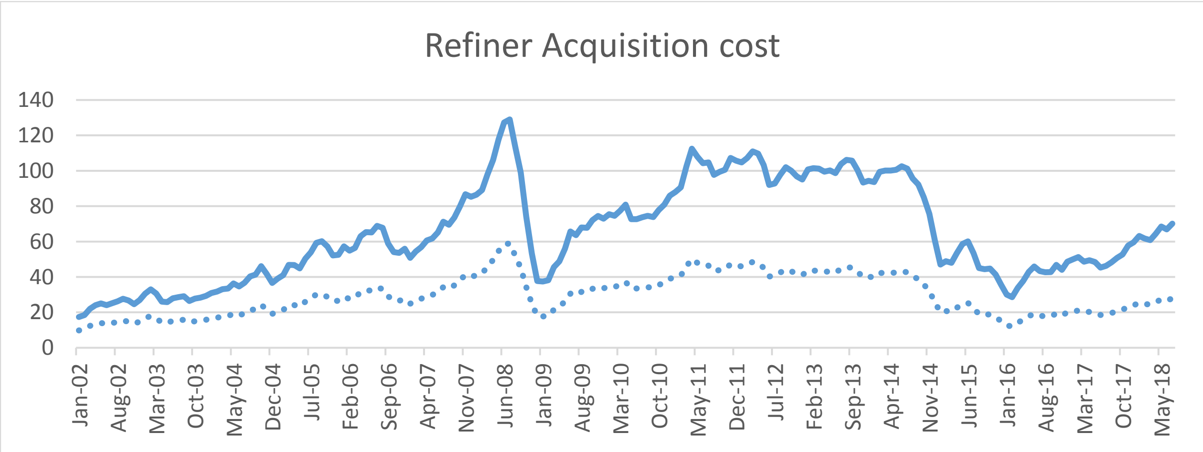
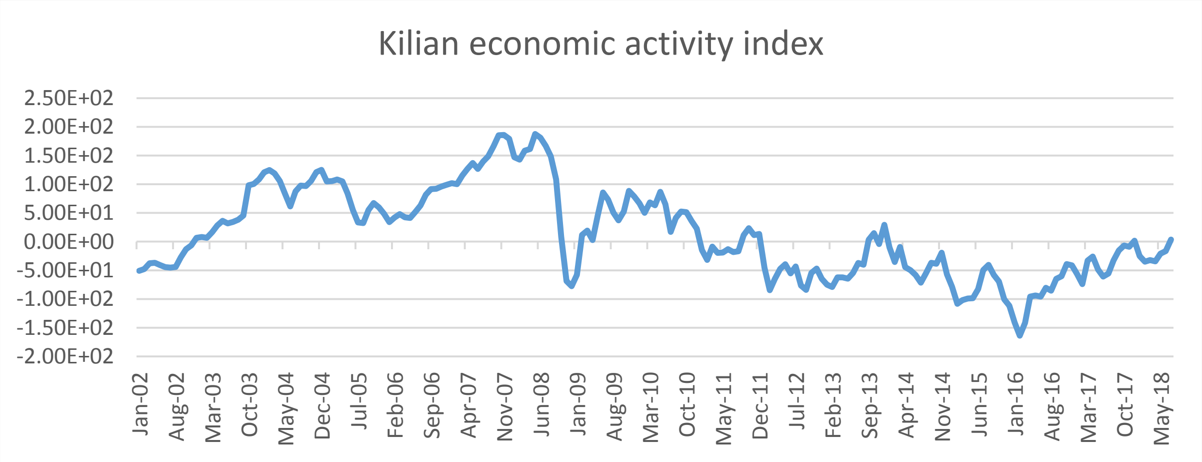


Figure 4.3 illustrates the Kilian economic activity index. Similar to the Baltic dry cargo index, it is a proxy for dry bulk shipping stocks. This index is used in the literature to mirror global economic activity. Clearly, a drop took place between 2014 and 2016.

Consequently, a negative shock to the demand for oil associated with an unexpected weakening in the global economy is apparent in the aggregate demand graph in Figure 4.2.

FIGURE 4. 4 KILIAN ECONOMIC ACTIVITY INDEX FROM JANUARY 2002 TO MAY 2018



Also, Figure 4.2 suggests that precautionary demand shocks had a major role in the oil price decline. This could be associated with the US nuclear deal with Iran which eased geopolitical stress and allowed more Iranian oil exports, therefore relieving concerns about the future supply of oil. In fact, according to the Institut Français des Relations Internationales (IFRI), the oil embargo introduced in June 2012 put Iran's oil production under strong pressure. Exports were reduced by around 1 million barrel per day (mb/d). After lifting of the sanctions in 2015, oil production increased to an average of 3.8 mb/d in 2017 and liquids exports increased by around 1 mb/d to 2.5 mb/d.

Davig et al. (2015) argue that the increase in Iranian oil exports coincided with stabilization of oil prices by the middle of 2015. The authors further argue that the nuclear deal suggested that another major oil producer may soon come online, so, oil would be oversupplied in what was already a low-price environment. To conclude, despite the occurrence of oil supply shocks in 2002 and 2011 as responses to the Iraq war and Arab uprising, respectively, in line with Kim and Vera (2018), there is a substantial role for demand-side shocks in the oil price rally between 2003 and early 2008 and the recent oil price collapse in 2014.

TABLE 4. 2 OIL SHOCKS IMPACT ON THE CONDITIONAL DISTRIBUTION OF EQUITY RETURNS

Panel A: Asian oil importers

		Japan		Korea		China		India	
Q		Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.
0.1	Supply	-0.001	0.881	0.004	0.678	-0.004	0.721	0.005	0.757
0.2		-8.00E-04	0.914	-0.006	0.481	-3.00E-04	0.980	0.004	0.679
0.3		0.001	0.865	0.006	0.521	-0.002	0.795	0.007	0.430
0.4		-0.003	0.749	0.007	0.493	0.002	0.792	0.005	0.572
0.5		-0.007	0.263	-0.002	0.860	4E-04	0.947	0.008	0.285
0.6		-0.001	0.805	0.003	0.720	-0.002	0.764	0.003	0.701
0.7		-0.001	0.781	0.007	0.401	0.001	0.883	0.006	0.497
0.8		-0.004	0.464	0.010	0.112	-0.001	0.893	0.005	0.529
0.9		0.003	0.664	0.002	0.782	0.008	0.532	0.013	0.149
0.1	Demand	-0.005	0.396	-0.003	0.825	-0.016	0.110	-0.011	0.314
0.2		-0.003	0.511	-0.009	0.150	-0.01	0.235	-0.002	0.831
0.3		-0.002	0.630	-0.005	0.379	-0.009	0.284	0.002	0.786
0.4		-9.00E-04	0.858	-0.006	0.291	-0.01	0.125	-0.005	0.506
0.5		-0.002	0.690	-0.001	0.834	-0.01	0.086	-0.002	0.787
0.6		8E-05	0.989	8E-04	0.918	-0.009	0.112	-9.00E-04	0.898
0.7		-5.00E-04	0.932	-0.001	0.886	-0.01	0.118	4E-04	0.958
0.8		-0.001	0.906	0.001	0.892	0.003	0.786	-0.009	0.333
0.9		-0.007	0.658	0.003	0.761	**0.025**	**0.010**	-0.014	0.180
0.1	Oil	0.007	0.291	0.008	0.500	0.010	0.323	0.001	0.887
0.2		**0.010**	**0.046**	-0.011	0.218	0.012	0.073	-0.001	0.877
0.3		0.005	0.309	-0.005	0.536	0.011	0.134	0.004	0.667
0.4		0.003	0.551	-0.003	0.669	0.009	0.247	-0.002	0.811
0.5		-1.00E-04	0.978	-0.002	0.783	-9.00E-04	0.892	-0.008	0.459
0.6		-0.001	0.784	-0.004	0.635	0.002	0.757	-0.012	0.210
0.7		-8.00E-04	0.885	0.005	0.490	0.009	0.292	-0.004	0.650
0.8		-0.002	0.785	0.008	0.286	0.004	0.633	-0.004	0.677
0.9		-0.004	0.617	0.011	0.191	0.004	0.647	-0.008	0.363
0.1	GEPU	-0.157	0.000	-0.101	0.011	-0.167	0.011	-0.067	0.010
0.2		-0.108	0.000	-0.098	0.001	-0.075	0.108	-0.032	0.369
0.3		-0.106	0.000	-0.079	0.004	-0.041	0.306	-0.044	0.239
0.4		-0.124	0.000	-0.079	0.008	-0.039	0.254	-0.027	0.512
0.5		-0.085	3E-04	-0.1	0.004	-0.029	0.258	0.008	0.849
0.6		-0.073	0.002	-0.063	0.132	-0.032	0.205	-0.018	0.705
0.7		-0.082	5E-04	-0.054	0.212	-0.018	0.590	0.013	0.794
0.8		-0.041	0.159	-0.034	0.395	-0.038	0.428	0.010	0.860
0.9		-0.07	0.145	-0.033	0.533	-0.055	0.234	-0.013	0.797
0.1	VIX	-0.061	0.075	-0.195	0.000	-0.094	0.029	-0.136	2E-04
0.2		-0.078	0.005	-0.134	2E-04	-0.08	0.006	-0.164	0.000
0.3		-0.062	0.018	-0.165	0.000	-0.103	3E-04	-0.139	1E-04
0.4		-0.047	0.026	-0.146	2E-04	-0.069	0.094	-0.177	0.000
0.5		-0.041	0.062	-0.155	1E-04	-0.045	0.187	-0.168	0.000
0.6		-0.032	0.205	-0.134	3E-04	-0.033	0.326	-0.142	1E-04
0.7		-0.035	0.183	-0.13	4E-04	0.009	0.833	-0.154	0.000
0.8		-0.062	0.074	-0.126	4E-04	0.044	0.270	-0.166	1E-04
0.9		-0.04	0.414	-0.098	0.004	0.034	0.422	-0.198	0.000

Panel B: European oil importers

		UK		Germany		France		Italy		Spain	
Q		Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.
0.1	Supply	0.003	0.527	0.002	0.808	0.005	0.624	0.017	0.185	0.016	0.221
0.2		0.005	0.348	0.004	0.626	0.006	0.478	0.010	0.275	0.002	0.862
0.3		**0.012**	**0.003**	0.002	0.723	0.011	0.246	0.008	0.405	0.001	0.866
0.4		**0.010**	**0.017**	0.005	0.482	0.007	0.214	0.004	0.603	0.002	0.759
0.5		**0.012**	**0.003**	0.006	0.367	0.006	0.256	0.011	0.122	0.003	0.618
0.6		**0.010**	**0.021**	0.008	0.265	0.007	0.127	0.013	0.060	0.006	0.289
0.7		**0.009**	**0.039**	0.010	0.104	**0.010**	**0.024**	0.011	0.124	0.005	0.410
0.8		0.009	0.103	0.007	0.235	**0.011**	**0.040**	0.012	0.110	0.007	0.294
0.9		0.013	0.103	**0.012**	**0.039**	0.010	0.165	0.014	0.145	0.012	0.062
0.1	Demand	0.006	0.472	0.013	0.200	0.006	0.583	-0.004	0.744	0.010	0.545
0.2		0.006	0.445	0.004	0.503	0.003	0.796	0.005	0.620	0.007	0.483
0.3		0.003	0.569	0.006	0.234	0.006	0.512	0.005	0.669	0.005	0.438
0.4		-6.00E-04	0.888	0.002	0.817	0.002	0.588	-0.004	0.617	0.009	0.205
0.5		-5.00E-04	0.895	0.003	0.617	4E-04	0.928	-8.00E-05	0.990	0.009	0.152
0.6		-4.00E-04	0.909	0.005	0.440	0.002	0.692	0.002	0.770	0.010	0.086
0.7		-5.00E-04	0.880	4E-04	0.955	4E-04	0.925	0.009	0.117	0.009	0.196
0.8		-0.002	0.590	0.003	0.662	0.003	0.505	0.008	0.132	-6.00E-04	0.940
0.9		0.005	0.453	0.006	0.459	0.003	0.754	0.003	0.757	-0.006	0.184
0.1	Oil	0.001	0.878	0.015	0.081	0.001	0.869	-0.011	0.250	-7.00E-05	0.994
0.2		5E-04	0.949	**0.014**	**0.034**	0.006	0.410	6E-04	0.959	0.008	0.394
0.3		-0.004	0.514	0.009	0.220	0.005	0.448	0.003	0.818	0.006	0.453
0.4		2E-04	0.960	0.005	0.521	-0.003	0.644	0.002	0.807	0.008	0.268
0.5		6E-04	0.891	-0.002	0.784	-0.003	0.627	0.002	0.759	0.012	0.088
0.6		-1.00E-04	0.981	-0.003	0.643	-0.002	0.640	0.002	0.734	0.008	0.266
0.7		4E-05	0.991	-0.005	0.397	-0.002	0.683	-5.00E-04	0.935	0.002	0.745
0.8		-8.00E-04	0.839	-0.004	0.579	-0.003	0.710	-0.006	0.349	-0.004	0.538
0.9		-0.004	0.524	-0.012	0.122	-0.009	0.295	-0.011	0.278	-0.003	0.513
0.1	GEPU	-0.105	0.000	-0.171	0.000	-0.139	0.000	-0.195	0.000	-0.161	0.000
0.2		-0.09	0.000	-0.141	1E-04	-0.097	1E-04	-0.127	0.000	-0.148	0.000
0.3		-0.068	6E-04	-0.093	3E-04	-0.083	1E-04	-0.144	0.000	-0.13	1E-04
0.4		-0.078	5E-04	-0.1	1E-04	-0.092	1E-04	-0.09	0.015	-0.099	0.009
0.5		-0.076	6E-04	-0.094	6E-04	-0.097	1E-04	-0.071	0.044	-0.085	0.015
0.6		-0.061	0.001	-0.074	0.017	-0.078	0.004	-0.085	0.018	-0.064	0.072
0.7		-0.054	0.003	-0.065	0.044	-0.093	5E-04	-0.064	0.098	-0.05	0.173
0.8		-0.046	0.044	-0.094	0.023	-0.057	0.086	-0.063	0.131	-0.04	0.276
0.9		-0.011	0.799	-0.059	0.132	-0.077	0.047	-0.082	0.135	-0.051	0.200
0.1	VIX	-0.115	0.000	-0.153	2E-04	-0.179	0.000	-0.21	0.000	-0.177	1E-04
0.2		-0.137	1E-04	-0.133	2E-04	-0.18	0.000	-0.164	4E-04	-0.16	0.000
0.3		-0.14	0.000	-0.123	7E-04	-0.153	0.000	-0.153	8E-04	-0.131	3E-04
0.4		-0.115	0.000	-0.131	1E-04	-0.137	0.000	-0.122	4E-04	-0.125	0.002
0.5		-0.104	0.000	-0.137	0.000	-0.122	0.000	-0.13	1E-04	-0.102	0.001
0.6		-0.095	0.000	-0.147	0.000	-0.126	0.000	-0.135	0.000	-0.112	0.000
0.7		-0.094	0.000	-0.128	0.000	-0.095	0.000	-0.116	0.000	-0.122	0.000
0.8		-0.106	0.000	-0.131	0.000	-0.106	3E-04	-0.13	0.000	-0.133	0.000
0.9		-0.102	0.001	-0.17	0.000	-0.127	1E-04	-0.109	0.006	-0.136	0.000

Panel C: US and non-OPEC oil exporters

		US		Russia		Canada		Norway	
Q		Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.
0.1	Supply	0.002	0.728	-0.005	0.569	0.010	0.394	-0.003	0.816
0.2		-7.00E-04	0.855	-0.005	0.564	0.006	0.463	0.011	0.215
0.3		0.004	0.277	0.002	0.837	0.004	0.393	0.004	0.600
0.4		0.005	0.193	0.010	0.373	0.003	0.497	0.010	0.177
0.5		0.005	0.150	0.005	0.663	0.003	0.508	0.009	0.286
0.6		0.005	0.125	0.004	0.687	0.002	0.692	0.007	0.441
0.7		**0.007**	**0.048**	0.004	0.745	-9.00E-04	0.857	0.011	0.203
0.8		**0.010**	**0.004**	0.010	0.421	0.005	0.395	0.006	0.540
0.9		**0.011**	**0.014**	**0.024**	**0.045**	0.011	0.064	0.004	0.730
0.1	Demand	0.005	0.297	-8.00E-04	0.939	0.011	0.304	0.008	0.490
0.2		0.002	0.743	9E-04	0.921	0.010	0.177	0.013	0.164
0.3		0.003	0.459	-5.00E-04	0.962	-3.00E-04	0.957	0.013	0.207
0.4		0.003	0.391	-0.007	0.475	-0.002	0.764	0.003	0.677
0.5		0.005	0.155	-0.004	0.638	4E-04	0.935	0.004	0.542
0.6		0.004	0.274	-0.006	0.521	5E-04	0.922	9E-04	0.922
0.7		0.002	0.648	-0.003	0.740	-0.001	0.789	0.009	0.298
0.8		-0.002	0.703	0.011	0.353	0.006	0.254	0.008	0.309
0.9		0.002	0.806	0.012	0.243	0.010	0.059	0.015	0.154
0.1	Oil	0.008	0.063	0.012	0.161	0.011	0.440	**0.023**	**0.025**
0.2		0.008	0.063	0.018	0.058	0.008	0.133	0.011	0.177
0.3		0.008	0.077	0.016	0.173	0.010	0.052	0.012	0.161
0.4		**0.008**	**0.037**	0.006	0.638	0.009	0.093	0.009	0.243
0.5		0.005	0.207	-0.007	0.488	0.003	0.570	0.008	0.370
0.6		0.005	0.195	-0.004	0.713	0.006	0.224	-0.001	0.905
0.7		0.007	0.101	-0.012	0.200	0.004	0.425	5E-04	0.954
0.8		0.004	0.354	-0.006	0.504	-0.001	0.842	-0.005	0.491
0.9		0.005	0.380	-0.003	0.755	-0.008	0.135	-0.018	0.082
0.1	GEPU	-0.089	0.000	-0.072	0.061	-0.094	0.026	-0.137	1E-04
0.2		-0.085	0.000	-0.08	0.045	-0.059	0.021	-0.144	0.000
0.3		-0.07	0.001	-0.103	0.026	-0.082	0.002	-0.117	7E-04
0.4		-0.048	0.007	-0.105	0.032	-0.083	0.001	-0.099	7E-04
0.5		-0.038	0.004	-0.091	0.045	-0.063	0.006	-0.083	0.007
0.6		-0.034	0.005	-0.06	0.181	-0.057	0.012	-0.094	0.008
0.7		-0.042	8E-04	-0.076	0.116	-0.073	0.001	-0.089	0.039
0.8		-0.048	5E-04	-0.069	0.211	-0.045	0.0.00	-0.102	0.060
0.9		-0.058	2E-04	-0.057	0.278	-0.02	0.572	-0.068	0.402
0.1	VIX	-0.144	0.000	-0.165	0.000	-0.127	0.003	-0.238	0.000
0.2		-0.118	0.000	-0.191	0.000	-0.142	0.000	-0.197	0.000
0.3		-0.105	0.000	-0.18	1E-04	-0.119	2E-04	-0.167	3E-04
0.4		-0.091	0.000	-0.128	0.018	-0.122	0.000	-0.164	1E-04
0.5		-0.101	0.000	-0.109	0.027	-0.109	0.000	-0.163	0.000
0.6		-0.094	0.000	-0.137	0.009	-0.106	0.000	-0.148	0.000
0.7		-0.092	0.000	-0.132	0.001	-0.11	0.000	-0.152	0.000
0.8		-0.08	0.000	-0.135	7E-04	-0.097	0.000	-0.168	0.000
0.9		-0.085	0.000	-0.136	1E-04	-0.107	1E-04	-0.194	0.000

Panel D: OPEC oil exporters

Q		Kuwait Coeff	Kuwait Prob.	Saudi Coeff	Saudi Prob.	Dubai Coeff	Dubai Prob.	Bahrain Coeff	Bahrain Prob.	Qatar Coeff	Qatar Prob.	Oman Coeff	Oman Prob.	Abu Dhabi Coeff	Abu Dhabi Prob.
0.1	Supply	0.003	0.619	0.005	0.761	0.017	0.457	0.005	0.461	0.015	0.206	0.007	0.333	0.015	0.393
0.2		0.004	0.350	0.013	0.242	-0.005	0.708	0.001	0.749	**0.017**	**0.018**	0.004	0.573	6E-04	0.940
0.3		3E-04	0.914	**0.021**	**0.015**	3E-05	0.998	0.002	0.594	0.011	0.132	0.005	0.466	-0.003	0.651
0.4		7E-04	0.833	0.014	0.082	-0.001	0.912	0.006	0.123	0.009	0.196	0.003	0.640	0.002	0.764
0.5		0.002	0.592	0.013	0.065	0.013	0.204	0.005	0.255	0.002	0.785	0.008	0.123	0.001	0.855
0.6		0.002	0.503	0.012	0.087	0.005	0.546	0.002	0.703	-3.00E-04	0.971	0.008	0.087	0.004	0.470
0.7		0.003	0.439	0.011	0.070	0.007	0.493	-3.00E-05	0.994	-0.002	0.807	0.008	0.106	-0.005	0.415
0.8		0.006	0.334	0.010	0.147	0.014	0.157	0.004	0.455	-3.00E-04	0.976	**0.011**	**0.026**	2E-04	0.977
0.9		-0.003	0.640	-3.00E-04	0.974	0.032	0.065	0.006	0.216	0.003	0.756	0.004	0.532	0.011	0.154
0.1	Demand	**0.011**	**0.032**	0.013	0.200	0.012	0.627	0.003	0.771	**0.027**	**0.008**	0.007	0.115	0.019	0.652
0.2		4E-04	0.916	0.006	0.697	0.025	0.082	-0.003	0.386	0.013	0.204	0.004	0.495	0.008	0.433
0.3		5E-04	0.865	0.002	0.824	0.010	0.464	-0.003	0.412	0.010	0.286	**0.010**	**0.024**	0.003	0.621
0.4		-4.00E-04	0.902	-9.00E-04	0.897	-9.00E-04	0.940	3E-04	0.944	-5.00E-04	0.942	0.006	0.309	2E-04	0.980
0.5		1E-04	0.968	0.002	0.795	0.002	0.861	0.001	0.713	-0.001	0.853	0.003	0.478	0.004	0.537
0.6		-0.001	0.655	0.003	0.574	-0.005	0.704	1E-04	0.980	-0.004	0.584	0.003	0.534	2E-04	0.975
0.7		0.001	0.832	-0.006	0.308	0.006	0.661	-0.001	0.801	0.004	0.592	0.008	0.178	0.003	0.692
0.8		-0.007	0.399	**-0.011**	**0.036**	0.005	0.718	-0.003	0.625	0.003	0.730	8E-04	0.915	0.010	0.274
0.9		2E-04	0.993	-0.007	0.428	-0.01	0.407	-7.00E-04	0.937	-0.002	0.865	9E-04	0.920	0.004	0.653
0.1	Oil	**0.025**	**0.000**	**0.040**	**0.001**	0.017	0.492	0.014	0.146	**0.023**	**0.026**	**0.010**	**0.006**	0.021	0.346
0.2		0.002	0.719	0.023	0.067	**0.032**	**0.009**	-4.00E-04	0.924	0.012	0.162	0.010	0.079	0.012	0.136
0.3		-0.002	0.576	0.013	0.132	0.015	0.266	-0.002	0.643	0.014	0.110	**0.014**	**0.028**	0.006	0.431
0.4		-0.001	0.671	0.010	0.193	0.013	0.272	2E-04	0.956	0.011	0.213	0.010	0.122	2E-04	0.978
0.5		-0.001	0.670	0.011	0.181	0.007	0.450	-0.001	0.771	0.002	0.816	0.006	0.301	0.006	0.350
0.6		-0.003	0.288	0.007	0.378	0.015	0.097	-0.003	0.482	-0.002	0.828	0.009	0.130	0.006	0.372
0.7		-0.006	0.183	0.005	0.515	0.012	0.257	-0.003	0.502	-0.004	0.704	0.004	0.582	-0.002	0.807
0.8		-0.009	0.148	0.006	0.546	0.016	0.233	-0.002	0.741	-0.005	0.691	-3.00E-04	0.964	0.006	0.606
0.9		-0.01	0.343	0.002	0.850	0.018	0.493	0.007	0.236	8E-04	0.962	-0.001	0.903	0.005	0.736
0.1	GEPU	0.007	0.737	-0.048	0.353	0.097	0.182	-0.002	0.949	-0.032	0.391	-0.019	0.364	0.018	0.745
0.2		-0.025	0.070	-0.104	0.010	-0.005	0.907	-0.002	0.933	-0.065	0.023	-0.029	0.265	0.004	0.888
0.3		-0.016	0.146	-0.079	0.060	-0.031	0.438	-0.018	0.270	-0.071	0.023	-0.028	0.198	-0.009	0.704
0.4		-0.011	0.347	-0.071	0.083	-0.037	0.330	-0.007	0.717	-0.085	0.006	-0.027	0.182	0.007	0.770
0.5		-0.004	0.750	-0.033	0.305	-0.041	0.278	0.005	0.759	-0.07	0.035	-0.02	0.270	-0.013	0.637
0.6		8E-04	0.949	-0.018	0.550	-0.046	0.250	-0.006	0.751	-0.091	0.006	-0.018	0.358	-0.013	0.652
0.7		-0.008	0.761	-0.036	0.259	-0.036	0.440	-0.014	0.522	-0.082	0.024	-0.032	0.171	-0.067	0.031
0.8		-0.018	0.532	-0.025	0.584	-0.05	0.321	-0.02	0.313	-0.091	0.099	-0.049	0.082	-0.059	0.129
0.9		0.008	0.834	0.037	0.486	-0.12	0.158	-0.027	0.280	-0.126	0.022	-0.079	0.001	-0.026	0.467
0.1	VIX	-0.06	0.002	-0.137	6E-04	-0.177	1E-04	-0.013	0.628	-0.1	0.092	-0.136	0.000	-0.064	0.215
0.2		-0.034	0.024	-0.093	0.018	-0.105	0.004	-0.016	0.267	-0.069	0.009	-0.091	1E-04	-0.079	4E-04
0.3		-0.013	0.288	-0.084	0.037	-0.075	0.112	-0.014	0.367	-0.065	0.026	-0.068	0.022	-0.054	0.016
0.4		-0.011	0.346	-0.092	0.025	-0.073	0.106	-0.017	0.322	-0.069	0.024	-0.038	0.112	-0.043	0.035
0.5		-0.01	0.404	-0.08	0.035	-0.064	0.133	-0.022	0.247	-0.055	0.160	-0.024	0.236	-0.038	0.095
0.6		-0.011	0.320	-0.078	0.037	-0.045	0.331	-0.002	0.952	-0.044	0.265	-0.023	0.235	-0.055	0.029
0.7		-0.035	0.064	-0.059	0.116	-0.05	0.388	5E-04	0.985	-0.027	0.491	-0.022	0.260	-0.035	0.262
0.8		-0.043	0.072	-0.027	0.512	-0.083	0.212	0.006	0.824	-0.021	0.614	-0.023	0.315	-0.01	0.834
0.9		-0.034	0.580	-0.069	0.161	-0.049	0.670	0.001	0.967	-0.122	0.069	-0.041	0.165	0.015	0.821

Notes. Demand stands for oil aggregate demand shocks, Supply refers to oil supply shocks, oil stands for oil-specific shocks, GEPU is an acronym for Global Economic Policy Uncertainty index, and VIX is the CBOE measure of implied volatility. Statistically significant oil shocks at 5% are emboldened. The constant results are not included in the table to conserve space.

4.5.2 Asian oil importing bloc

Table 4.2 presents the quantile regression model outcome. The dependent variable is the stock return and the regressors are oil shocks, VIX and GEPU. Table 4.2 shows the coefficient value next to the significance level of the regressors at different quantiles of the equity return's conditional distribution. Emboldened observations are significant at 5% level.

As depicted in Table 4.2 Panel A, the sampled Asian importing nations of India, Japan, China, and South Korea do not demonstrate any consistent tendencies in their reaction to oil price shocks. Precisely, they are communally resilient to all oil shocks.[68] This outcome is in accord with Fang and You (2014); they attribute the lack of significance in India to the segregation of the Indian market due to regulations and excessive capital controls. Nguyen and Batti (2012) argue that the rapid economic growth in China is able to offset the effects of oil shocks. This explanation could be expanded to include South Korea[69] and perhaps India. With figures of GDP growth close to 7% in China and India, the economic expansion can absorb the negative influence of oil shocks. South Korea's GDP growth is more robust than the EU and fluctuated between 3% and 6% in the last 10 years.

Although Japan is fully dependent on foreign crude oil imports, the country has a large number of strategic oil reserves (Mork et al., 1994), and a major portion of petroleum supply in Japan is covered by domestic production making it different from other oil-importing countries. Abhyankar et al. (2013) maintain that oil supply shocks due to unanticipated disruptions of crude oil production do not affect Japanese stock returns. This arises from the fact that the market anticipates that Japan has strategic oil reserves that include both state and privately held inventories. The immunity of Japan to oil shocks in general despite the sluggish GDP growth is noted by Jimenez-Rodriguez and Sanchez (2005). Likewise, Blanchard and Gali (2007) argue that Japan behaves differently from other countries since oil price shocks do not influence Japanese economic indicators.

Plausibly, due to government intervention,[70] Broadstock and Filis (2014) state that Chinese equity return responses[71] to oil shocks are less pronounced than their US

[68] Exceptions to this are positive reactions in Japan and China to oil-specific and aggregate demand shocks.
[69] See Basher et al. (2012).
[70] Broadstock and Filis (2014) link the discrepancy to differences in the regulations of financial markets in the US and China. Particularly, Chinese stock markets permit stock prices to vary only within 10% on any given day whereas the US does not impose such controls.
[71] The Chinese market distinctively demonstrates stimulus in stock returns as a result of an aggregate demand shock during market booms. This is in line with the mainstream literature (Kilian and Park, 2009). However, the

counterparts. Also, Cong et al. (2008) find that oil shocks do not provide any predictive information on the Chinese stock market. Jammazi and Aloui (2010) support the findings of Cong et al. (2008) for the Japanese market. From a methodological point of view, the aforementioned studies employ the BEKK GARCH, VAR and regime switching models respectively, and the results remain robust.

Fundamentally, recent trends demonstrated by stock market integration and the financialization of oil markets motivate the inclusion of control variables that are global in nature. Additionally, including the VIX and the GEPU aims at guaranteeing that the results are not obtained through an omitted variable bias.[72] Moreover, as uncertainty measures, both variables are expected to have a depressing influence on equity markets.

Both the VIX and the GEPU demonstrate reduced intensities in their influence over stock returns as we climb the quantiles. The reduced coefficients of both variables as market conditions improve is plausible; essentially, uncertainty, in general, is the flagship of bearish periods and both variables are constructed to capture uncertainty in markets and policy. The VIX index is significant and negative in the case of South Korea and India. While in Japan and China, the impact of the VIX is present during bear and normal market phases only. The GEPU is negative and significant in the first seven and five quantiles in Japan and South Korea, respectively. The more controlled markets of China and India do not report any effects with the exception of the first quantile. Similar results are recorded by Christou et al. (2017) using the EPU index.

To conclude, whether due to policy interventions, strong economic expansion, or huge crude oil reserves, Asian markets collectively display immunity to oil shocks.

4.5.3 EU oil importing bloc

Hamilton (2011) states that we are currently in the post-OPEC era, where a recent surge in non-OPEC oil production is flowing from Russia and the US. Kilian and Hicks

surprise is that the same shock causes negative feedback in Chinese returns during bear markets (at 10% significance). Albeit Wei and Guo (2017) and Broadstock and Filis (2014) report that China does not always display positive correlation to aggregate demand shocks from a time-varying perspective. This result shows that influence is conditional on the state of the market. Precisely, if oil price increases takes place during booming conditions, it will be subsequently absorbed positively by market growth. Conversely, oil price increases triggered by global demand shock depresses the Chinese market during sluggish phases.

[72] Regressions without including the VIX and the GEPU do not alter results qualitatively.

(2013) show that strong growth in emerging economies steered the rise in inflation-adjusted oil price from 2003 to 2008. As a result, the oil supply shocks generally have trivial effects on equity returns as documented by Kilian and Park (2009) and Kim and Vera (2018). Table 4.2 Panel B shows that supply shocks have a sporadic positive influence on EU oil importing nations. The results do not have a consistent pattern, instead, they vary across the quantiles, but, positive oil supply shocks are generally manifested during bull market conditions. One could argue that a bull market and the overconfidence of investors may justify such results, for example, Kollias et al. (2013) states that investors may link increasing oil prices with a booming economy.

Contrary to Kilian and Park (2009), Wang et al. (2013) and Guntner (2014), oil demand shocks are not significant in most sampled countries. This could be explained by the difference in econometric techniques applied; while the aforementioned studies generally rely on impulse responses from oil shocks to stock returns in a structural VAR, this study examines the dependence structure between oil shocks and the different quantiles of return series. The former methodology focuses on the magnitude and time span of oil shocks, whereas the latter emphasises the significance of oil shocks on equities amid different market conditions from booming to bearish. Finally, oil precautionary demand shocks are insignificant.

Both the VIX and the GEPU exert a negative influence on all EU oil-importers. The VIX is negative and significant in all market phases, while the GEPU is significant in bear, normal and moderate bull circumstances. The upper bullish market regime represented by the 8th and 9th percentiles displays resilience to the GEPU in Spain and Italy. The lack of significance of the GEPU is restricted to the 9th quantile in Germany and the UK. On the contrary, France is vulnerable to the GEPU influence regardless of the market phase.

Park and Ratti (2008) argue that the UK stock market, despite the country being an oil producer, demonstrates similar traits to those in oil importing nations. Nonetheless, I find that the UK equity market responds to oil supply shocks in a positive manner.

To summarise, the UK is the only EU oil-importer that displays consistent stimulus in stock returns prompted by oil supply shocks. The rest of the EU nations do not appear to react to oil shocks, but they exhibit higher vulnerability to VIX and GEPU when compared to Asian markets.

4.5.4 US and oil-exporting nations

As demonstrated in Table 4.2 Panel C and D, when compared with both Asian and EU importers, oil exporters appear to be more prone to precautionary demand shocks. Kilian (2009) and Alquest and Kilian (2010) link the precautionary demand shock to expected disruptions in future supplies of oil. In eight out of ten markets[73] (i.e. Saudi Arabia, Norway, Russia, Abu Dhabi, Qatar, Oman, Bahrain and Dubai) this shock is positive, and new to the literature, this particular shock is significant in bear market conditions

This result contradicts the findings of Filis et al. (2011), as they argue in favour of similar conduct of both oil importing and exporting nations in response to oil shocks. While conflicting results of precautionary demand shocks are reported[74] by Apergis and Miller (2009), Fong and You (2014) and Kang and Ratti (2013), Basher et al. (2018) find that the influence is positive in Norway, Russia, and Kuwait, while the coefficient is negative for Saudi Arabia and the UAE. It is worth noting that the discrepancy in results could be ascribed to their inclusion of a speculator shock in their model, or perhaps due to the different econometric approach; they use the Markov switching regression to account for oil shocks in high and low volatility regimes without explicitly accounting for different market conditions. Basher et al. (2018) state that the influence of oil shocks is asymmetric in high and low regimes, they showed that econometrically using the equality of coefficient test between the regime states. That could be considered a similarity to the results presented in this study. As the precautionary demand shocks are exclusively significant in bear market conditions, during which the uncertainty is high.

In general, the prominence of the precautionary demand shock is exclusive to oil exporters reflecting the importance of oil in explaining their stock return variations. This mirrors the positive impact oil has on both fundamentals and investor sentiment. Also, in line with the findings of Wang et al. (2013), the oil influence on stock returns is contingent on the level of importance of oil to the economy. This conclusion can be empirically drawn from the results in Table 4 Panel C and D, as the reaction of oil-dependent countries to precautionary demand shocks is 0.04 in the GCC market of Saudi Arabia which is considerably higher than

[73] The results in Canada and Russia are significant at 5.2% and 5.8% significance which is less than the standard 5%. Also, Abu Dhabi and Bahrain are the only oil exporters that do not respond to oil precautionary demand shocks.
[74] Although Apergis and Miller (2009) document negative reactions to precautionary demand shock in Canada and the US, Fong and You (2014) Kang and Ratti (2013) find the opposite to be true in Russia and Canada respectively.

its-non-GCC counterparts. These figures correlate positively with the percentage of oil revenue contribution to GDP; the percentage[75] in Saudi Arabia is 26.44% while Russia scores 7.01% and Canada trails the trinity with 0.25%.

Interestingly, the US stock market displays similar patterns to the oil-exporting nations. This is particularly evident with the oil precautionary demand shock. In common with Foroni et al. (2017), since this shock is associated with uncertainty about Middle Eastern oil supplies, US shale oil investment may increase therefore stimulating the US economy and consequently the US stock market.

In accordance with the literature, oil price increases, resulting from oil supply innovations, have limited influence on both oil importing and exporting nations. Instead, these effects[76] are consistently observed in the oil-importing nations with vibrant oil industries, as experienced in the UK and the US where the influence is significant and positive in normal and bullish phases, respectively. Concerning the positive impact of oil supply shocks, it could be argued that this shock incorporates the domestic oil supply shocks which is considered good news for local industries. It is pertinent to mention that Kang et al, (2017) and Kang and Wang (2018) decompose oil supply shocks into local and global and document significant differences in terms of their impact.

The GEPU is an important depressor of equity indices in Russia, Norway and Canada, that being said, the GCC markets are the most resilient to GEPU with the exception of Qatar. This could be a result of the blockade on Qatar by its neighbours due to the recent diplomatic tensions. Essentially, the regional barricade may cause Qatar to be more vulnerable to global uncertainty factors. The government restrictions and protective policies in the GCC equity markets in addition to their segmentation could explain such a finding. Similar to the GEPU, the VIX is imperative in explaining the variation of equity returns in Norway, Canada, and Russia. Bahrain uniquely does not demonstrate any reaction to VIX innovations. The result in Bahrain might be ascribed to the lack of activity in the Bahraini stock market and the unstable economic and political situation there since the 2011 uprising. Despite being the financial hub of the GCC in the last decade, the negative overall return in Bahrain mirrors the current situation. Qatar, Oman, Dubai, and Kuwait are affected during down markets, while the depressing effects of VIX reach the sixth quantile in Saudi Arabia and Abu Dhabi.

[75] https://www.theglobaleconomy.com/rankings/Oil_revenue.
[76] Kang et al. (2016) decompose the oil supply shock into US and non-US based and document heterogeneous results depending on the origin of the supply shock.

Additionally, in compliance with Antonanakakis et al. (2013), both the VIX and the GEPU dampen US stock returns.

To sum up, the coefficient of oil shocks is low regardless of the type of shock, market condition and country being an importer/exporter of oil. This outcome is in accordance with Apergis and Miller (2009). Also, my findings do not illustrate particular importance to aggregate demand shock. Furthermore, the level of dependence on oil is mirrored in higher reactions to oil shocks in the GCC markets when compared with non-GCC oil exporters.

As experienced in the UK, oil supply shocks have a positive influence on US stock returns. In fact, the industrial sector is not reliant on oil as a decisive source of wealth in both countries, yet, unlike other oil exporting nations, oil supply shocks are factored in the stock returns in both nations. This could be attributed to the higher cost of oil extraction of shale oil in the US and offshore drilling in the UK's North Sea. In other words, oil supply shocks do not affect equities in oil-exporting nations because the impact is absorbed in their high revenue margins in oil exports.

While researchers such as Bjornland (2009) and Park and Ratti (2008) offer support to the premise of a positive relationship between oil and equity returns in oil exporting nations, this study argues that oil price increases due to oil precautionary demand shocks and during bearish markets is the real factor under the umbrella of an oil price increase. Oil-specific demand shocks, that are orthogonal to aggregate demand shock by construction, cause an increase in the price of oil reflecting rising uncertainties about future oil shortages. This indicates that when market participants project a major oil shock due to geopolitical elevating risks in oil-exporting regions, they might be willing to pay a higher premium for the same quantity of oil to protect themselves from possible shortfalls in oil delivery in the future (Alquist and Kilian, 2010). Equally, this result can be justified by the term prudence from Kimball (1990). In particular, He argues that prudence is the sensitivity of the optimal choice of a decision variable to risk, where absolute prudence measure the strength of precautionary saving motive. That said, Kimball (1990) states that in the case of decreasing risk aversion (with more availability of oil), absolute prudence is more weighted than risk aversion and therefore is the main instigator of oil price increase.

4.5.5 US and oil exporting stock market volatility

Given the strong results of the impact of oil shocks on equity returns in oil-exporting nations, this section examines the relationship between oil shocks and stock market volatility in these nations. Again, Table 4.3 depicts a quantile regression model with stock market volatility as the dependent variable and oil shocks, VIX and GEPU as independent variables.

The academic research in the context of the linkages between oil price and stock market volatility includes the work of Awartani and Maghyereh (2013) and Ramos and Veiga (2013). Oil shocks and volatility of equity markets is investigated by Bastianin et al. (2016), Bastianin and Manera (2018), Eraslan and Ali (2018), and Degiannakis et al. (2014).

Based on the tradition of Merton (1980), and following Schwert (1989), the calculation of monthly volatilities is distilled from daily observations.

Looking at Table 4.3, the US alongside the oil exporters of Russia, and Canada demonstrate a negative response to precautionary demand shocks. This particular shock exerts a calming influence on stock return volatility which is in line with the findings of Bastianin and Manera (2018), Eraslan and Ali (2018), yet, new to the literature, the dampening influence on stock market volatility is manifested during booming periods

In the GCC bloc the picture is similar, where, during booming conditions, the precautionary demand shock reduces stock market volatility in Dubai, Kuwait, Qatar and Oman during bull markets. Inversely to non-GCC oil exporters, oil demand shock has a sedative impact on Dubai stock market volatility.[77] The prevalence of aggregate demand shocks influence on stock return volatilities is documented by Degiannakis et al. (2014).

[77] Despite the impact of precautionary demand shock present in other markets like Bahrain and Qatar, the coefficient is trivial. Additionally, Saudi equity volatility is influenced negatively at the 9th quantile.

TABLE 4. 3 OIL SHOCKS IMPACT ON THE CONDITIONAL DISTRIBUTION OF STOCK RETURN VOLATILITY IN OIL-EXPORTING NATIONS.

		US		Russia		Canada		Norway	
Q		Coeff	Prob	Coeff	Prob	Coeff	Prob	Coeff	Prob
0.1	Supply	7.00E-05	0.523	1.00E-04	0.656	2.00E-05	0.9	-0.003	0.816
0.2		2.00E-05	0.87	4.00E-04	0.319	2.00E-05	0.901	0.011	0.215
0.3		-7.00E-06	0.961	4.00E-04	0.291	-7.00E-05	0.616	0.004	0.6
0.4		-1.00E-04	0.451	6.00E-04	0.159	-4.00E-05	0.816	0.01	0.177
0.5		-1.00E-04	0.325	4.00E-04	0.352	8.00E-05	0.627	0.009	0.286
0.6		3.00E-06	0.988	-1.00E-04	0.847	7.00E-05	0.708	0.007	0.441
0.7		3.00E-04	0.36	2.00E-04	0.763	1.00E-04	0.623	0.011	0.203
0.8		4.00E-04	0.349	-0.001	0.327	7.00E-04	0.258	0.006	0.54
0.9		2.00E-05	0.981	**-0.005**	**0.046**	2.00E-04	0.928	0.004	0.73
0.1	Demand	-1.00E-05	0.894	-2.00E-05	0.952	-3.00E-05	0.817	0.008	0.49
0.2		3.00E-05	0.819	-4.00E-04	0.354	8.00E-06	0.954	0.013	0.164
0.3		6.00E-05	0.666	-4.00E-04	0.355	2.00E-05	0.908	0.013	0.207
0.4		3.00E-05	0.835	-4.00E-04	0.426	4.00E-05	0.852	0.003	0.677
0.5		-1.00E-04	0.462	-3.00E-04	0.499	-2.00E-04	0.515	0.004	0.542
0.6		-2.00E-04	0.388	-5.00E-04	0.406	-5.00E-06	0.986	9.00E-04	0.922
0.7		-1.00E-04	0.613	-9.00E-04	0.432	-2.00E-04	0.626	0.009	0.298
0.8		**-8.00E-04**	**0.048**	-0.002	0.27	-1.00E-04	0.866	0.008	0.309
0.9		-0.001	0.248	-5.00E-04	0.825	9.00E-05	0.941	0.015	0.154
0.1	Oil	2.00E-05	0.88	3.00E-05	0.932	-1.00E-04	0.464	**0.023**	**0.025**
0.2		7.00E-05	0.553	-2.00E-04	0.734	-3.00E-05	0.875	0.011	0.177
0.3		8.00E-06	0.95	-4.00E-04	0.387	-3.00E-05	0.874	0.012	0.161
0.4		-6.00E-05	0.625	-7.00E-04	0.182	-7.00E-05	0.689	0.009	0.243
0.5		-2.00E-04	0.325	-0.001	**0.077**	-2.00E-04	0.372	0.008	0.37
0.6		-2.00E-04	0.229	-0.001	0.085	-3.00E-04	0.226	-0.001	0.905
0.7		**-5.00E-04**	**0.03**	**-0.003**	**0**	-3.00E-04	0.284	5.00E-04	0.954
0.8		-7.00E-04	0.179	**-0.004**	**0**	-0.001	0.138	-0.005	0.491
0.9		**-0.002**	**0.002**	-0.004	0.383	**-0.003**	**0.036**	-0.018	0.082
0.1	GEPU	8.00E-04	0.108	-1.00E-04	0.935	7.00E-04	0.207	-0.137	1.00E-04
0.2		6.00E-04	0.247	7.00E-04	0.686	0.001	0.129	-0.144	0
0.3		6.00E-04	0.313	0.002	0.358	8.00E-04	0.258	-0.117	7.00E-04
0.4		0.001	0.07	0.001	0.547	0.002	0.059	-0.099	7.00E-04
0.5		0.002	0.012	0.002	0.464	0.002	0.048	-0.083	0.007
0.6		0.002	0.006	0.003	0.257	0.001	0.194	-0.094	0.008
0.7		0.003	0.004	0.002	0.563	0.003	0.026	-0.089	0.039
0.8		0.003	0.144	0.006	0.298	0.003	0.116	-0.102	0.06
0.9		0.01	0.008	0.014	0.49	0.006	0.254	-0.068	0.402
0.1	VIX	3.00E-04	0.644	3.00E-04	0.885	-3.00E-05	0.968	-0.238	0
0.2		9.00E-04	0.183	0.001	0.531	2.00E-04	0.772	-0.197	0
0.3		0.001	0.058	3.00E-04	0.887	2.00E-04	0.808	-0.167	3.00E-04
0.4		0.001	0.101	6.00E-04	0.794	8.00E-04	0.389	-0.164	1.00E-04
0.5		0.001	0.113	6.00E-04	0.806	0.002	0.04	-0.163	0
0.6		0.002	0.081	0.001	0.708	0.002	0.054	-0.148	0
0.7		0.002	0.008	-1.00E-04	0.964	7.00E-04	0.459	-0.152	0
0.8		0.002	0.063	0.002	0.743	0.002	0.502	-0.168	0
0.9		0.002	0.509	0.011	0.506	0.003	0.42	-0.194	0

	Kuwait		Saudi		Dubai		Bahrian		Qatar		Oman		Abu Dhabi	
Q	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.	Coeff	Prob.
0.1 Supply	6.00E-07	0.994	-2.00E-05	0.916	2.00E-05	0.933	2.00E-05	0.621	-7.00E-05	0.544	-1.00E-05	0.79	-9.00E-05	0.356
0.2	6.00E-06	0.958	-2.00E-05	0.938	-9.00E-06	0.977	-2.00E-05	0.57	-2.00E-04	0.183	2.00E-05	0.753	4.00E-05	0.761
0.3	2.00E-05	0.874	2.00E-05	0.912	2.00E-04	0.583	-1.00E-05	0.722	-6.00E-05	0.734	-1.00E-05	0.862	-3.00E-05	0.796
0.4	5.00E-05	0.636	7.00E-05	0.763	4.00E-04	0.399	-1.00E-05	0.775	-2.00E-05	0.929	4.00E-05	0.611	5.00E-05	0.697
0.5	2.00E-05	0.846	-8.00E-05	0.789	**0.001**	**0.049**	-2.00E-05	0.716	-4.00E-05	0.866	9.00E-05	0.284	5.00E-05	0.764
0.6	-8.00E-05	0.571	-6.00E-04	0.127	6.00E-04	0.374	9.00E-06	0.883	2.00E-04	0.563	1.00E-04	0.214	1.00E-04	0.556
0.7	1.00E-04	0.472	-8.00E-04	0.095	7.00E-04	0.339	3.00E-05	0.73	-4.00E-05	0.931	-4.00E-05	0.817	6.00E-05	0.798
0.8	2.00E-04	0.615	-4.00E-04	0.788	1.00E-04	0.918	8.00E-05	0.353	-4.00E-05	0.964	2.00E-04	0.451	-5.00E-04	0.343
0.9	-5.00E-04	0.428	-5.00E-04	0.582	-2.00E-04	0.916	7.00E-06	0.953	-2.00E-04	0.892	-7.00E-04	0.41	-0.003	0.112
0.1 Demand	2.00E-06	0.976	1.00E-05	0.948	-3.00E-05	0.93	3.00E-07	0.993	-2.00E-05	0.889	4.00E-06	0.936	1.00E-05	0.913
0.2	4.00E-06	0.973	-1.00E-05	0.948	-5.00E-05	0.913	-8.00E-06	0.826	-5.00E-05	0.792	-3.00E-05	0.66	-3.00E-05	0.859
0.3	9.00E-06	0.94	9.00E-05	0.709	-3.00E-04	0.524	-7.00E-06	0.858	-9.00E-05	0.659	-4.00E-05	0.645	-1.00E-04	0.396
0.4	2.00E-05	0.89	2.00E-04	0.515	-2.00E-04	0.622	-2.00E-05	0.589	-4.00E-04	0.147	-4.00E-06	0.967	-1.00E-04	0.363
0.5	1.00E-05	0.928	2.00E-04	0.455	-5.00E-04	0.273	-2.00E-05	0.604	**-6.00E-04**	**0.025**	4.00E-05	0.684	-1.00E-04	0.383
0.6	-4.00E-05	0.82	2.00E-04	0.611	-8.00E-04	0.122	-3.00E-05	0.539	**-7.00E-04**	**0.007**	5.00E-05	0.688	-7.00E-05	0.708
0.7	-3.00E-04	0.137	4.00E-04	0.46	**-0.001**	**0.031**	-5.00E-05	0.489	-5.00E-04	0.249	-6.00E-05	0.782	-2.00E-04	0.505
0.8	-2.00E-04	0.626	-1.00E-04	0.916	**-0.002**	**0.005**	-2.00E-04	0.096	-2.00E-04	0.725	-4.00E-04	0.211	-8.00E-05	0.884
0.9	-6.00E-04	0.13	**-0.004**	**0.011**	**-0.004**	**0.003**	**-4.00E-04**	**0.017**	3.00E-04	0.843	-5.00E-04	0.457	-2.00E-04	0.849
0.1 Oil	-4.00E-06	0.955	-5.00E-05	0.815	4.00E-05	0.91	-1.00E-06	0.966	-4.00E-05	0.82	-2.00E-05	0.717	-3.00E-05	0.825
0.2	-3.00E-07	0.998	-1.00E-04	0.55	-1.00E-04	0.81	1.00E-05	0.734	-5.00E-06	0.981	-4.00E-05	0.632	-1.00E-04	0.447
0.3	9.00E-06	0.94	-3.00E-04	0.288	-3.00E-04	0.575	2.00E-05	0.606	-1.00E-04	0.628	-8.00E-05	0.371	-8.00E-05	0.627
0.4	1.00E-04	0.253	-4.00E-04	0.171	-4.00E-04	0.434	-4.00E-06	0.92	-5.00E-04	0.05	-8.00E-05	0.373	-1.00E-04	0.47
0.5	1.00E-04	0.327	-6.00E-04	0.055	-8.00E-04	0.156	4.00E-05	0.471	-2.00E-04	0.357	-1.00E-04	0.153	-1.00E-04	0.441
0.6	6.00E-05	0.7	-8.00E-04	0.071	**-0.001**	**0.034**	7.00E-05	0.247	-5.00E-04	0.116	-2.00E-04	0.104	-2.00E-04	0.259
0.7	9.00E-05	0.603	-7.00E-04	0.284	**-0.002**	**0.02**	-9.00E-06	0.905	-7.00E-04	0.082	-6.00E-05	0.598	-2.00E-04	0.284
0.8	-5.00E-04	0.41	-0.001	0.07	-0.001	0.164	-1.00E-04	0.301	**-0.002**	**0.044**	**-6.00E-04**	**0.047**	-7.00E-04	0.215
0.9	**-0.002**	**0**	-0.001	0.145	-0.002	0.262	-2.00E-04	0.118	**-0.004**	**0.003**	**-0.003**	**7.00E-04**	-0.002	0.179
0.1 GEPU	2.00E-05	0.945	4.00E-04	0.644	2.00E-04	0.816	-1.00E-05	0.938	-2.00E-04	0.795	-1.00E-05	0.963	-5.00E-05	0.93
0.2	3.00E-05	0.949	5.00E-04	0.638	9.00E-05	0.942	1.00E-04	0.489	-7.00E-05	0.926	1.00E-04	0.601	1.00E-04	0.856
0.3	3.00E-05	0.951	4.00E-04	0.695	3.00E-04	0.862	-5.00E-06	0.972	1.00E-04	0.905	8.00E-05	0.801	4.00E-04	0.49
0.4	5.00E-04	0.34	0.001	0.354	5.00E-04	0.757	1.00E-04	0.58	2.00E-04	0.8	-3.00E-05	0.944	4.00E-04	0.576
0.5	5.00E-04	0.394	0.002	0.286	2.00E-04	0.915	2.00E-04	0.321	-5.00E-04	0.67	2.00E-05	0.958	5.00E-04	0.502
0.6	0.001	0.07	0.002	0.197	6.00E-04	0.791	3.00E-04	0.139	5.00E-04	0.714	-4.00E-05	0.936	0.001	0.217
0.7	0.001	0.141	0.003	0.156	0.006	0.213	6.00E-04	0.037	0.002	0.217	3.00E-04	0.759	0.002	0.124
0.8	4.00E-04	0.877	0.007	0.303	0.007	0.366	6.00E-04	0.131	0.002	0.625	-3.00E-04	0.748	0.006	0.001
0.9	-5.00E-04	0.84	0.011	0.012	0.002	0.819	1.00E-04	0.879	2.00E-04	0.959	-0.002	0.48	-0.003	0.475
0.1 VIX	-3.00E-06	0.993	3.00E-04	0.708	-1.00E-04	0.915	-4.00E-05	0.691	3.00E-04	0.635	-5.00E-06	0.98	-2.00E-05	0.972
0.2	3.00E-06	0.994	4.00E-04	0.667	1.00E-04	0.915	-7.00E-05	0.579	4.00E-04	0.61	2.00E-05	0.934	-1.00E-04	0.835
0.3	9.00E-06	0.985	9.00E-04	0.462	2.00E-05	0.992	7.00E-05	0.653	3.00E-04	0.726	9.00E-05	0.787	4.00E-04	0.534
0.4	6.00E-04	0.236	0.001	0.369	0.001	0.55	-5.00E-05	0.769	0.001	0.17	2.00E-04	0.539	0.001	0.12
0.5	5.00E-04	0.32	0.003	0.044	0.003	0.176	-2.00E-05	0.907	0.002	0.072	7.00E-04	0.098	0.002	0.062
0.6	3.00E-04	0.707	0.003	0.125	0.006	0.016	-3.00E-05	0.901	0.003	0.035	0.001	0.004	0.002	0.034
0.7	-2.00E-04	0.756	0.004	0.159	0.005	0.065	1.00E-04	0.716	0.004	0.024	0.002	6.00E-04	0.003	0.002
0.8	4.00E-04	0.859	0.009	0.008	0.01	0.045	5.00E-04	0.263	0.007	0.022	0.002	0.06	9.00E-04	0.631
0.9	0.002	0.461	0.013	0.105	0.022	0.027	0.001	0.368	0.018	1.00E-04	0.006	0.037	0.018	0.044

Notes. Demand stands for oil aggregate demand shocks, Supply refers to oil supply shocks, oil stands for oil-specific shock, GEPU is an acronym for Global Economic Policy Uncertainty index, and VIX is the CBOE measure of implied volatility. Statistically significant oil shocks at 5% are emboldened.

4.5.6 Simulations with Brent oil price

As a robustness exercise for the results presented earlier in the chapter, I re-simulate the structural VAR model with the Brent oil price instead of the refiner's acquisition cost price. Again, the system is comprised of oil production and the Kilian index of economic activity in addition to oil price. Table 4.4 confirms the findings of the chapter and illustrates the importance of precautionary demand shocks to oil exporters. On the other hand, equities among oil-importers do not exhibit specific patterns in response to oil shocks. Similar to the previous section, the influence in the GCC is contingent on the market condition as the significance of oil shocks prevails during bear markets.

TABLE 4.4 BRENT OIL SHOCKS IMPACT ON THE CONDITIONAL DISTRIBUTION OF EQUITY RETURNS (VOLATILITY)

Panel A: Asian oil importers

		Japan		S.Korea		China		India	
Q		Coeff	Prob	Coeff	Prob	Coeff	Prob	Coeff	Prob
0.1	Supply	0.0038	0.632	0.0039	0.554	-0.0033	0.750	-0.0008	0.955
0.2		0.0114	0.109	0.0062	0.383	0.0055	0.630	0.0053	0.636
0.3		0.0043	0.527	-0.0009	0.924	0.0052	0.524	-0.0047	0.573
0.4		0.0053	0.419	0.0005	0.959	0.0013	0.881	-0.0039	0.630
0.5		**0.0131**	**0.041**	-0.0075	0.391	-0.0024	0.795	0.0006	0.948
0.6		0.0110	0.079	-0.0126	0.118	0.0007	0.943	-0.0006	0.942
0.7		0.0098	0.093	-0.0126	0.114	0.0045	0.643	-0.0017	0.820
0.8		0.0115	0.073	-0.0115	0.159	-0.0014	0.891	-0.0028	0.747
0.9		0.0083	0.213	-0.0142	0.134	-0.0151	0.227	0.0016	0.911
0.1	Demand	0.0045	0.685	0.0024	0.877	**0.0185**	**0.047**	0.0105	0.556
0.2		-0.0050	0.495	-0.0109	0.261	0.0064	0.609	0.0024	0.852
0.3		-0.0034	0.664	-0.0040	0.671	0.0056	0.559	0.0112	0.224
0.4		-0.0022	0.756	-0.0027	0.776	0.0021	0.808	0.0057	0.503
0.5		-0.0030	0.599	0.0003	0.974	-0.0021	0.796	-0.0018	0.839
0.6		-0.0017	0.740	-0.0027	0.741	-0.0022	0.787	0.0020	0.831
0.7		0.0003	0.947	-0.0025	0.734	0.0003	0.974	0.0005	0.955
0.8		-0.0033	0.618	-0.0011	0.874	-0.0043	0.597	-0.0029	0.772
0.9		0.0013	0.899	-0.0038	0.570	-0.0008	0.934	0.0119	0.370
0.1	Oil	0.0161	0.111	0.0139	0.245	**0.0198**	**0.038**	0.0055	0.706
0.2		0.0137	0.139	0.0071	0.507	0.0107	0.316	0.0114	0.383
0.3		0.0030	0.629	0.0065	0.552	0.0015	0.864	-0.0036	0.757
0.4		0.0047	0.444	0.0054	0.625	-0.0060	0.476	-0.0054	0.588
0.5		0.0019	0.747	0.0067	0.509	0.0048	0.653	-0.0026	0.788
0.6		0.0019	0.742	0.0126	0.161	0.0058	0.619	-0.0017	0.845
0.7		-0.0021	0.693	0.0106	0.206	0.0127	0.206	0.0005	0.945
0.8		0.0001	0.986	0.0092	0.271	0.0085	0.373	-0.0030	0.734
0.9		-0.0072	0.379	-0.0046	0.629	-0.0019	0.898	-0.0130	0.160

Panel B: EU oil-importers

		France		Italy		Spain		Germany		UK	
Q		Coeff	Prob	Coeff	Prob	Coeff	Prob	Coeff	Prob	Coeff	Prob
0.1	Supply	-0.0057	0.586	-0.0078	0.500	-0.0083	0.507	-0.0042	0.785	-0.0069	0.541
0.2		-0.0002	0.983	-0.0105	0.472	-0.0011	0.910	-0.0121	0.270	0.0029	0.632
0.3		-0.0095	0.246	0.0011	0.900	0.0010	0.901	-0.0084	0.420	0.0016	0.789
0.4		-0.0037	0.520	-0.0036	0.635	-0.0036	0.595	0.0003	0.968	0.0002	0.970
0.5		-0.0019	0.722	-0.0063	0.384	-0.0010	0.885	-0.0015	0.823	-0.0019	0.655
0.6		0.0005	0.916	-0.0043	0.527	-0.0039	0.547	0.0014	0.816	0.0036	0.347
0.7		0.0027	0.595	-0.0016	0.810	-0.0043	0.489	0.0003	0.954	0.0031	0.428
0.8		-0.0003	0.955	-0.0065	0.346	**-0.0132**	**0.047**	-0.0010	0.869	-0.0010	0.815
0.9		0.0003	0.973	-0.0077	0.302	-0.0077	0.360	-0.0004	0.941	0.0092	0.124
0.1	Demand	0.0003	0.981	0.0007	0.965	0.0082	0.631	0.0087	0.580	0.0015	0.893
0.2		-0.0039	0.732	0.0058	0.745	0.0096	0.459	0.0036	0.747	-0.0042	0.576
0.3		-0.0028	0.782	0.0009	0.944	-0.0001	0.989	0.0045	0.662	0.0017	0.829
0.4		0.0006	0.943	0.0014	0.897	0.0052	0.581	-0.0003	0.975	0.0028	0.616
0.5		0.0005	0.944	-0.0013	0.890	0.0038	0.654	0.0027	0.737	0.0061	0.219
0.6		0.0051	0.457	-0.0024	0.781	0.0066	0.413	0.0094	0.180	0.0061	0.168
0.7		0.0105	0.075	-0.0017	0.825	0.0040	0.584	0.0092	0.140	0.0046	0.261
0.8		0.0047	0.400	-0.0007	0.928	0.0062	0.331	0.0062	0.277	0.0039	0.313
0.9		0.0045	0.353	0.0012	0.839	-0.0052	0.509	0.0049	0.381	0.0045	0.353
0.1	Oil	0.0079	0.235	0.0113	0.167	0.0068	0.417	0.0049	0.618	0.0114	0.089
0.2		0.0024	0.763	0.0122	0.224	0.0003	0.966	0.0060	0.516	**0.0218**	**0.000**
0.3		0.0000	1.000	-0.0006	0.941	0.0005	0.943	-0.0008	0.929	0.0159	0.061
0.4		0.0005	0.934	0.0035	0.649	0.0024	0.761	0.0003	0.974	0.0065	0.255
0.5		0.0041	0.488	0.0071	0.323	0.0047	0.566	0.0000	0.995	0.0079	0.149
0.6		0.0044	0.434	0.0094	0.186	0.0067	0.397	0.0000	0.998	0.0047	0.334
0.7		**0.0109**	**0.038**	0.0089	0.218	0.0022	0.809	0.0045	0.512	0.0050	0.292
0.8		0.0101	0.056	0.0085	0.265	0.0041	0.606	0.0084	0.137	0.0053	0.285
0.9		0.0121	0.085	0.0149	0.061	0.0004	0.954	0.0073	0.166	0.0067	0.192

Panel C: US and non-GCC oil-exporters

		US		Canada		Russia		Norway	
Q		Coeff	Prob	Coeff	Prob	Coeff	Prob	Coeff	Prob
0.1	Supply	-0.0070	0.146	-0.0068	0.674	0.0058	0.600	-0.0053	0.754
0.2		-0.0018	0.767	0.0020	0.769	0.0117	0.247	-0.0016	0.883
0.3		-0.0043	0.389	-0.0001	0.992	0.0156	0.111	-0.0068	0.448
0.4		0.0019	0.641	0.0005	0.926	-0.0043	0.682	-0.0058	0.470
0.5		0.0040	0.284	0.0026	0.565	-0.0016	0.865	0.0000	0.995
0.6		0.0052	0.136	0.0086	0.055	-0.0005	0.961	-0.0005	0.938
0.7		0.0059	0.055	0.0062	0.178	0.0009	0.926	0.0031	0.660
0.8		**0.0094**	**0.003**	-0.0012	0.823	-0.0022	0.830	0.0052	0.462
0.9		**0.0085**	**0.005**	-0.0004	0.952	-0.0129	0.320	0.0027	0.771
0.1	Demand	0.0068	0.320	0.0063	0.751	-0.0075	0.673	0.0084	0.735
0.2		-0.0046	0.356	0.0088	0.335	0.0006	0.959	-0.0027	0.812
0.3		-0.0028	0.516	0.0043	0.551	0.0042	0.724	0.0031	0.721
0.4		-0.0046	0.161	-0.0008	0.915	0.0100	0.319	0.0062	0.437
0.5		-0.0057	0.093	0.0027	0.644	0.0114	0.262	0.0046	0.521
0.6		-0.0046	0.166	0.0001	0.992	0.0096	0.341	0.0072	0.315
0.7		-0.0034	0.332	0.0018	0.701	0.0097	0.292	0.0062	0.404
0.8		0.0011	0.782	0.0023	0.666	-0.0001	0.993	0.0146	0.084
0.9		0.0012	0.774	0.0047	0.446	-0.0013	0.895	0.0154	0.079
0.1	Oil	-0.0012	0.799	**0.0304**	**0.038**	**0.0331**	**0.033**	**0.0281**	**0.009**
0.2		0.0001	0.981	**0.0265**	**0.018**	**0.0447**	**0.000**	**0.0304**	**0.003**
0.3		0.0018	0.731	**0.0178**	**0.005**	**0.0409**	**0.000**	**0.0333**	**0.002**
0.4		-0.0024	0.580	**0.0162**	**0.009**	**0.0399**	**0.000**	**0.0255**	**0.012**
0.5		-0.0034	0.386	**0.0143**	**0.021**	**0.0382**	**0.000**	**0.0286**	**0.004**
0.6		-0.0006	0.873	**0.0141**	**0.016**	**0.0400**	**0.000**	**0.0253**	**0.008**
0.7		-0.0036	0.314	**0.0130**	**0.036**	**0.0332**	**0.001**	**0.0250**	**0.004**
0.8		-0.0018	0.645	**0.0131**	**0.044**	**0.0376**	**0.002**	**0.0268**	**0.000**
0.9		0.0030	0.446	**0.0187**	**0.005**	0.0206	0.274	**0.0371**	**0.000**

Panel D: GCC oil-exporters

		Oman		Qatar		Dubai		Bahrain	
Q		Coeff	Prob	Coeff	Prob	Coeff	Prob	Coeff	Prob
0.1	Supply	0.0065	0.311	-0.0026	0.766	0.0025	0.832	-0.0039	0.357
0.2		0.0047	0.411	0.0051	0.482	0.0105	0.374	-0.0022	0.626
0.3		0.0018	0.776	0.0044	0.485	0.0038	0.810	-0.0064	0.168
0.4		0.0037	0.544	0.0026	0.691	0.0091	0.534	**-0.0084**	**0.049**
0.5		0.0032	0.573	-0.0026	0.714	0.0112	0.446	**-0.0085**	**0.020**
0.6		0.0007	0.901	-0.0032	0.668	0.0120	0.401	-0.0073	0.070
0.7		-0.0007	0.899	-0.0094	0.214	0.0096	0.473	-0.0055	0.222
0.8		-0.0050	0.258	-0.0184	0.061	0.0201	0.112	-0.0045	0.397
0.9		-0.0058	0.299	**-0.0287**	**0.003**	0.0349	0.103	-0.0059	0.392
0.1	Demand	0.0056	0.362	**0.0202**	**0.001**	0.0117	0.289	0.0080	0.068
0.2		0.0083	0.119	**0.0140**	**0.033**	**0.0252**	**0.008**	0.0049	0.295
0.3		0.0092	0.119	**0.0155**	**0.042**	0.0077	0.536	0.0037	0.366
0.4		0.0080	0.189	0.0033	0.699	0.0076	0.467	0.0055	0.125
0.5		0.0045	0.429	0.0046	0.601	0.0080	0.453	0.0043	0.228
0.6		0.0078	0.146	0.0006	0.945	0.0086	0.426	0.0024	0.551
0.7		0.0033	0.580	0.0007	0.934	0.0074	0.529	0.0014	0.732
0.8		0.0075	0.320	-0.0040	0.763	0.0048	0.782	0.0018	0.687
0.9		0.0013	0.925	0.0129	0.501	-0.0117	0.567	**0.0129**	**0.040**
0.1	Oil	**0.0145**	**0.043**	**0.0252**	**0.007**	**0.0245**	**0.007**	**0.0146**	**0.002**
0.2		**0.0119**	**0.045**	**0.0241**	**0.007**	0.0197	0.073	0.0067	0.171
0.3		0.0133	0.060	**0.0203**	**0.007**	0.0111	0.410	0.0049	0.310
0.4		0.0061	0.435	**0.0166**	**0.027**	0.0143	0.288	0.0052	0.240
0.5		0.0091	0.259	**0.0203**	**0.010**	0.0214	0.136	0.0045	0.225
0.6		0.0058	0.436	**0.0171**	**0.030**	0.0138	0.254	0.0036	0.353
0.7		0.0038	0.594	**0.0211**	**0.014**	0.0113	0.336	0.0038	0.316
0.8		-0.0007	0.903	0.0062	0.588	0.0123	0.364	0.0030	0.433
0.9		0.0029	0.668	0.0029	0.828	-0.0088	0.703	-0.0044	0.477

		Kuwait		Abu Dhabi		Saudi	
Q		Coeff	Prob	Coeff	Prob	Coeff	Prob
0.1	Supply	0.0040	0.326	0.0117	0.286	-0.0106	0.503
0.2		0.0064	0.124	0.0019	0.759	-0.0087	0.362
0.3		-0.0013	0.709	0.0016	0.763	-0.0023	0.751
0.4		-0.0002	0.951	-0.0010	0.862	-0.0030	0.652
0.5		-0.0012	0.746	-0.0017	0.786	-0.0027	0.681
0.6		0.0009	0.808	-0.0019	0.763	-0.0046	0.481
0.7		0.0005	0.901	0.0015	0.852	-0.0038	0.585
0.8		-0.0064	0.298	-0.0013	0.881	-0.0042	0.588
0.9		-0.0040	0.678	0.0014	0.928	0.0083	0.400
0.1	Demand	**0.0218**	**0.000**	0.0092	0.449	0.0047	0.716
0.2		0.0038	0.332	0.0045	0.373	0.0022	0.818
0.3		0.0000	0.990	0.0015	0.778	0.0015	0.831
0.4		0.0015	0.568	0.0008	0.889	-0.0020	0.762
0.5		0.0007	0.797	0.0013	0.840	0.0015	0.834
0.6		0.0015	0.626	0.0026	0.703	0.0025	0.768
0.7		0.0008	0.836	0.0016	0.880	-0.0014	0.881
0.8		0.0072	0.350	-0.0102	0.329	0.0120	0.194
0.9		-0.0033	0.729	0.0061	0.713	0.0169	0.091
0.1	Oil	0.0041	0.335	0.0156	0.205	**0.0299**	**0.036**
0.2		-0.0009	0.810	**0.0155**	**0.044**	**0.0261**	**0.027**
0.3		0.0007	0.776	0.0117	0.141	0.0150	0.051
0.4		0.0011	0.701	0.0074	0.261	**0.0170**	**0.018**
0.5		0.0024	0.403	0.0067	0.293	**0.0169**	**0.010**
0.6		0.0046	0.173	0.0046	0.448	**0.0150**	**0.019**
0.7		0.0043	0.314	0.0136	0.059	0.0096	0.154
0.8		0.0043	0.661	0.0051	0.594	0.0107	0.179
0.9		0.0061	0.539	-0.0040	0.818	0.0007	0.937

Panel E: US and oil exporters' volatility

Q		US Coeff	Prob	Canada Coeff	Prob	Russia Coeff	Prob	Norway Coeff	Prob	Oman Coeff	Prob	Saudi Coeff	Prob
0.1	Supply	0.0000	0.613	0.0000	0.987	0.0001	0.836	-0.0002	0.430	0.0000	0.941	0.0000	0.973
0.2		0.0000	0.930	0.0000	0.774	-0.0001	0.802	0.0000	0.876	0.0000	0.531	0.0000	0.882
0.3		0.0000	0.812	-0.0001	0.672	-0.0001	0.684	-0.0002	0.425	-0.0001	0.480	-0.0001	0.540
0.4		0.0001	0.410	0.0000	0.822	0.0000	0.935	-0.0002	0.577	-0.0001	0.224	-0.0002	0.352
0.5		0.0002	0.345	-0.0001	0.539	0.0003	0.549	0.0000	0.963	-0.0001	0.257	-0.0001	0.657
0.6		0.0000	0.859	0.0002	0.369	0.0004	0.532	0.0003	0.496	-0.0001	0.584	0.0000	0.897
0.7		0.0003	0.435	0.0002	0.478	0.0001	0.940	-0.0001	0.876	0.0000	0.908	-0.0001	0.782
0.8		0.0005	0.313	0.0003	0.474	0.0015	0.164	-0.0005	0.691	0.0000	0.899	0.0003	0.707
0.9		0.0010	0.307	0.0008	0.427	0.0011	0.640	0.0014	0.737	0.0000	0.988	0.0003	0.933
0.1	Demand	0.0000	0.952	0.0000	0.874	-0.0001	0.815	0.0000	0.949	0.0000	0.976	0.0001	0.685
0.2		0.0000	0.811	-0.0002	0.137	0.0002	0.721	0.0000	0.905	0.0000	0.623	0.0001	0.796
0.3		-0.0001	0.482	-0.0002	0.340	0.0000	0.934	-0.0001	0.779	0.0000	0.613	0.0002	0.539
0.4		0.0001	0.620	-0.0002	0.330	-0.0003	0.556	-0.0001	0.761	0.0000	0.692	0.0003	0.416
0.5		0.0000	0.877	-0.0001	0.502	-0.0005	0.364	-0.0002	0.650	0.0001	0.314	0.0000	0.920
0.6		0.0001	0.685	-0.0002	0.431	-0.0008	0.223	0.0001	0.828	0.0000	0.772	0.0001	0.885
0.7		-0.0004	0.327	0.0000	0.998	-0.0002	0.850	0.0003	0.639	-0.0001	0.803	0.0002	0.719
0.8		-0.0003	0.552	0.0001	0.927	-0.0007	0.647	-0.0008	0.684	-0.0002	0.411	-0.0005	0.510
0.9		-0.0009	0.494	-0.0009	0.525	-0.0009	0.857	-0.0017	0.585	-0.0015	0.100	-0.0027	0.281
0.1	Oil	0.0001	0.469	0.0000	0.771	0.0000	0.978	-0.0001	0.819	0.0000	0.808	-0.0002	0.532
0.2		0.0001	0.627	-0.0002	0.274	-0.0003	0.538	0.0000	0.940	0.0000	0.909	-0.0001	0.677
0.3		0.0000	0.854	-0.0001	0.488	-0.0009	0.075	0.0000	0.913	0.0000	0.849	-0.0004	0.276
0.4		0.0000	0.944	-0.0001	0.668	-0.0010	0.082	0.0000	0.933	0.0000	0.912	**-0.0008**	**0.019**
0.5		-0.0001	0.395	-0.0001	0.551	-0.0011	0.066	-0.0004	0.368	-0.0001	0.287	**-0.0011**	**0.004**
0.6		-0.0002	0.347	-0.0001	**0.548**	**-0.0018**	0.018	-0.0002	0.704	-0.0002	0.143	**-0.0012**	**0.002**
0.7		-0.0003	0.370	-0.0005	**0.124**	**-0.0034**	0.002	-0.0008	0.229	-0.0002	0.244	**-0.0015**	**0.002**
0.8		**-0.0009**	**0.041**	-0.0008	**0.075**	**-0.0041**	0.000	-0.0003	0.850	-0.0007	0.080	**-0.0019**	**0.007**
0.9		-0.0015	0.220	-0.0009	**0.324**	**-0.0047**	0.027	-0.0036	0.429	**-0.0018**	**0.034**	-0.0017	0.336

Q		Qatar Coeff	Prob	Dubai Coeff	Prob	Bahrain Coeff	Prob	Kuwait Coeff	Prob	Abu Dhabi Coeff	Prob
0.1	Supply	0.0000	0.848	-0.0001	0.830	0.0000	0.217	0.0000	0.993	-0.0001	0.649
0.2		0.0001	0.617	0.0001	0.743	0.0000	0.178	0.0000	0.989	-0.0001	0.417
0.3		0.0000	0.799	0.0001	0.776	0.0000	0.492	0.0000	0.888	-0.0001	0.289
0.4		0.0000	0.890	0.0001	0.874	-0.0001	0.069	-0.0001	0.381	-0.0001	0.545
0.5		-0.0001	0.568	0.0000	0.953	-0.0001	0.086	-0.0001	0.470	0.0000	0.854
0.6		-0.0001	0.750	0.0004	0.506	**-0.0001**	**0.024**	-0.0002	0.138	-0.0001	0.694
0.7		-0.0003	0.596	0.0002	0.740	-0.0001	0.052	-0.0002	0.218	-0.0001	0.568
0.8		0.0000	0.962	0.0018	0.073	**-0.0002**	**0.001**	-0.0005	0.170	0.0004	0.412
0.9		-0.0003	0.785	**0.0050**	**0.011**	-0.0001	0.619	-0.0008	0.343	0.0001	0.946
0.1	Demand	-0.0001	0.661	0.0000	0.906	0.0000	0.394	0.0000	0.992	0.0000	0.803
0.2		0.0000	0.828	-0.0002	0.687	0.0000	0.526	0.0000	0.971	0.0001	0.766
0.3		0.0000	0.905	-0.0002	0.636	0.0000	0.372	0.0000	0.940	0.0001	0.574
0.4		0.0001	0.839	-0.0003	0.599	0.0000	0.705	-0.0001	0.540	0.0001	0.551
0.5		0.0002	0.508	-0.0007	0.184	0.0000	0.711	0.0000	0.863	0.0000	0.751
0.6		0.0003	0.375	-0.0006	0.364	0.0000	0.501	-0.0001	0.655	0.0000	0.835
0.7		0.0000	0.933	-0.0012	0.206	-0.0001	0.376	-0.0003	0.375	-0.0001	0.629
0.8		-0.0011	0.522	-0.0020	0.054	0.0000	0.508	0.0000	0.973	-0.0008	0.126
0.9		**-0.0022**	**0.020**	-0.0039	0.058	-0.0003	0.172	-0.0004	0.535	**-0.0026**	**0.011**
0.1	Oil	-0.0001	0.618	-0.0001	0.728	0.0000	0.883	0.0000	0.995	0.0001	0.633
0.2		-0.0001	0.530	-0.0004	0.461	0.0000	0.645	0.0000	0.976	-0.0001	0.715
0.3		-0.0001	0.798	-0.0005	0.427	0.0000	0.994	0.0000	0.836	-0.0001	0.421
0.4		-0.0001	0.720	-0.0007	0.286	0.0000	0.593	0.0001	0.666	-0.0002	0.249
0.5		-0.0002	0.414	-0.0010	0.134	0.0000	0.851	0.0000	0.929	-0.0003	0.128
0.6		-0.0001	0.809	-0.0009	0.160	0.0000	0.654	0.0001	0.695	-0.0005	0.071
0.7		-0.0002	0.563	**-0.0014**	**0.028**	0.0000	0.939	0.0000	0.938	-0.0005	0.148
0.8		-0.0006	0.509	-0.0012	0.081	0.0001	0.397	-0.0003	0.670	-0.0006	0.168
0.9		-0.0011	0.305	-0.0029	0.123	-0.0002	0.144	**-0.0012**	**0.037**	**-0.0020**	**0.040**

Note. Demand stands for oil aggregate demand shocks, Supply refers for oil supply shocks and oil stands for oil-specific shock. GEPU and VIX coefficients are not presented because the focus is on the significance of oil shocks. Statistically significant oil shocks at 5% are emboldened.

Remarkably, using Brent instead of the refiner's acquisition cost price produces stronger results in the non-GCC oil exporters of Norway, Canada and Russia. This could stem from the higher level of fluctuation in Brent price when compared with the more stable refiner's acquisition cost price. In terms of volatility, similar to the baseline model, oil precautionary demand shocks dampen stock return volatility in oil exporting nations. The importance of volatility is more pronounced in the upper tale of the distribution. Finally, this model illustrates the particular importance of oil precautionary demand shocks to stock return volatility in Saudi Arabia and Russia, the biggest exporters of oil in the world.

4.6 Conclusions

The study is a continuation of the literature that focuses on the interlinkages between oil prices and equity returns, as in the case of the pivotal work of Jones and Kaul (1996). Specifically, based on the Kilian (2009) methodology, the impact of different oil price shocks (i.e. supply, demand, and oil-specific demand shocks) is conducted for both oil importing and exporting nations. This is motivated by the fact that oil can be an agent of a stimulus or a burden on the economy depending on the abundance/dependence. Additionally, the study distinguishes the market feedback to oil shocks during bull, normal and bear phases. From an economic point of view, the aim of the study is to provide a richer characterisation of the linkages between oil price shocks and equity markets.

The analysis postulates a structural VAR and incorporates monthly data representing oil production, the Kilian proxy of economic activity and the Refiner's Acquisition Cost of crude oil. The shocks, distilled from the Kilian (2009) structural VAR system, are included alongside equity returns, the GEPU, and the VIX in a quantile regression framework. The sample stretches from January 2002 to May 2018. The results are in partial accordance with Basher et al. (2018), Wang et al. (2013) and point to the following. First, oil-exporters are generally stimulated by precautionary demand shocks during bear market conditions. Also, among oil-exporters, the GCC markets display stronger responses to oil shocks, therefore reflecting a positive correlation between dependence on oil as a source of wealth and the reaction domestic stock markets display to oil shocks. Moreover, precautionary demand shocks have a dampening influence on stock market volatility in the US and the oil-exporters of Canada, Russia, Kuwait, Dubai, Qatar and Oman during bullish phases. Third, oil importers in Asia and Europe are numb to oil shocks. Fourth, oil supply shocks stimulate stock markets in oil-importing nations with strong oil industrial sectors, as in the case in the US and the UK.

In a Markov regime switching framework, Reboredo (2010), Balcilar et al (2015) find that there is no relationship between oil price shocks and stock returns in low volatility regimes, which supports the results of Huang et al. (1996), while they report a negative connection for high-volatility regime, which is in line with the findings of Jones and Kaul (1996). Following the logic of Balcilar et al (2015), I could justify the contradiction in results between this study and the previous literature. Actually, the high volatility echoes uncertainty and the latter is the norm during bear markets.

Essentially, considering the heterogeneous responses of stock returns to oil supply and demand shocks, it is imperative for policymakers and investors to treat the sources of oil price shocks differently. In light of the stock market integration and the financialization of energy markets, attention to the impact of oil shocks on equity returns will provide a broader perception for decision-making activities.

In practice, it is imperative to understand how stock returns respond to oil supply and demand shocks, and whether the impact is contingent on market conditions. To be more explicit, policymakers and investors should be cautious when formulating macroeconomic policies and investment strategies in relatively normal periods, because oil price shocks in bull/bear conditions could undermine the outcomes of these policies and strategies.

The results note that Asian markets are the most resilient to oil innovations; this could signal hedging opportunities for investors in oil and Asian equities. Also, oil price increase due to supply-side shocks is persistently good news for the UK and the US during normal and bullish market phases, respectively. This result could carry diversification opportunities in portfolios comprised of these markets, alongside other markets that do not enjoy the same effects, mainly in oil importing nations.

In oil exporting nations, oil precautionary demand shocks have a positive impact on both equity returns and equity return volatility. The influence is manifested during bearish conditions in the former and bullish phases in the latter. In fact, the stimulus of stock returns during bearish market conditions may open a window of diversification during high-stress periods, when diversification is needed most. Equally, oil precautionary demand shocks have a dampening influence on stock market volatility. This result opens a window of opportunity for short term traders and speculators to benefit. Also, this result indicates that less insurance arbitrage is needed for portfolio and risk managers.

Of note, Chapter 2 documents varying degrees of oil dependence among individual GCC nations; for example, the level is notoriously high in Kuwait when compared with the UAE. Nonetheless, the results do not point to these intra-regional differences. Contrary to that, in the case of market liberalisation, the reclassification of Qatar and the UAE into emerging markets, documented in Chapter 2, coincided with increasing role of both nations in the GCC information transmissions, as seen in Chapter 3.

The GEPU and the VIX exert negative effects on equity returns in many nations, yet, the consequences of both factors in India, China and the GCC markets are quite limited. These results point to diversification prospects associated with including stocks from these countries in global investment strategies.

Chapter 5

Macroeconomic determinants of the stock markets interdependence in oil importing and exporting blocs: the case of US and GCC

5.1 Introduction

International financial markets have grown rapidly over the last few decades and much of the recent expansion took place in emerging stock markets. In many cases, stock market development goes hand in hand with stock market integration, particularly with rapid technological advancements in trading (Issing, 2001). Market integration echoes higher interdependence, the latter is hazardous to the benefits of international diversification, and possibly increases the transmission of shocks among financial markets (Karolyi and Stulz, 1996). This study tries to establish oil price as one of the macroeconomic determinants of the interdependence of equity markets. In essence, studying stock market interdependence and establishing what may influence it is crucial for risk management, assets allocation and the activities of policymakers.

This research topic is timely and relevant, as the financialization of oil (Hamilton and Wu, 2012; Sadorsky, 2014; and Nadal et al., 2017) means that crude oil has become an important asset class within investment portfolios of financial practitioners resulting in stock markets and oil prices becoming increasingly interrelated. Equally, Sadorsky (1999) maintains that oil shocks have significant effects on economic activity, and Lescaroux and Mignon (2008) states that oil Granger-causes stock returns.

The factors that impact equity return interdependence are an issue of ongoing research (Pretorius, 2002; Longin and Solnik, 1995; Forbes and Chinn, 2004 and Kiviaho et al., 2014). A number of studies explore oil impact on equity markets (Sadorsky, 1999; Papapetrou, 2001; Park and Ratti, 2008; Le and Chang, 2015; Bjørnland, 2009), the findings illustrate that equity returns are significantly impacted by oil innovations. Likewise, the literature stresses an asymmetric effect of oil on financial markets (Wang et al., 2013; Bjørnland, 2009); commonly the criteria is constructed on the basis of the country being an oil exporting/importing nation (see Chapter 4). Accordingly, Park and Ratti (2008) and Wang et al. (2013) document a positive relationship between oil and equity returns in oil-exporting countries while the opposite is the case in oil-importing ones. While some studies focus on the comovements of oil and equity returns (Filis et. al, 2011; Broadstock and Filis, 2014), others consider oil price influence on the correlations of economic and financial variables (Nadal et al., 2017; Antonakakis et al., 2013), yet, the role of oil in stock market comovements remains largely absent.

To address this gap in the literature, this study aims to establish that oil price is one of the macroeconomic factors influencing the interdependence among stock markets. Essentially, this research contributes to the literature by combining three research aspects; first, the interdependence among international stock markets; second, the analysis of the determinants of equity market comovements; third, oil prices impact on financial markets.

This study tests the influence of oil prices on the correlations of the US S&P 500 and the MSCI GCC index. The latter is designed to capture the performance of GCC stock markets. The six member states of the GCC jointly account for 40% and 23% of proven oil and gas reserves respectively (Sedik and Williams, 2011). Accordingly, the GCC markets enjoy good macro fundamentals and are going through a liberalisation process (Al-Khazali et al, 2006; Bley and Chen, 2006). The choice of the sampled countries is based on the view that the GCC nations are collectively the largest exporters of oil around the globe. The US, thanks to the shale oil revolution, is becoming a conspicuous producer of oil, yet the US remains the 2nd largest importer of oil[78] and, by far, the largest consumer of oil in the world. To the best of my knowledge, this is the first study to establish the role of oil prices[79] in explaining stock market interdependence. Furthermore, this is the first attempt to decompose the comovements of the GCC financial markets into macroeconomic innovations.

This research aims to achieve the following: first, to measure interdependence in the US-GCC pair. Second, to assess the ability of oil prices, among other factors, to explain the US-GCC stock market[80] interdependence. Third, to examine the time evolution of these factors. Fourth, to test the dependence structure of the US-GCC correlation on oil innovations.

[78] http://www.worldstopexports.com/crude-oil-imports-by-country/.
[79] In a close study to mine, Kocaarslan et al. (2018) examine stock market, oil, and gold uncertainties influence on US-BRIC correlations.
[80] The words comovements, correlations, and interdependence are used interchangeably.

Fundamentally, the link between oil and equity returns, whether the relation is linear (Wang et al., 2013) or non-linear (Jiménez-Rodríguez, 2015), many studies document heterogeneous reactions to oil innovations and explain these differences by the dependence versus the abundance of oil in the respective countries; for example, Sadorsky (1999) and Park and Ratti (2008) report a negative relationship between oil and the EU and the US, respectively. On the contrary, Mohanty et al. (2011) and Jouini (2013) document a positive link between oil and GCC markets. Having said that, I hypothesise that oil price increases will have a negative impact on the US-GCC correlations reflecting the heterogeneous impact oil innovations exercise on equities among oil importers and exporters. In addition to oil innovations, the decomposition of the US-GCC correlation controls for global factors and local macroeconomic variables (VIX, business cycle fluctuations, the inflation environment, and monetary policy stance).

Acknowledging the importance of allowing for asymmetric reactions in conditional variances, this research uses the Asymmetric Dynamic Conditional Correlation (ADCC) model of Cappiello al. (2006) to generate the correlation series. Under this method, the dynamics of the correlation, which are time-dependent, are modelled together with those of the volatility of returns. Subsequently, the Markov regime switching model is employed to capture the structural breaks in the correlations. Finally, the quantile regression model is used to explain the impact of oil on the correlation under different international market conditions.

The findings of the chapter note the following: first, oil price changes and the VIX index are the main drivers of equity market interdependence in the US–GCC pair. Second, a subsample analysis reveals that the impact of oil prices on interdependence is increasing over time. Third, oil and financial shocks coincided with structural breaks in the US-GCC correlations. Finally, oil price changes and volatility display an asymmetric tail dependence with the US-GCC correlations where the oil impact prevails in the upper tail of the correlations’ conditional distribution.

From a practical perspective, determining the factors that impact the interdependence carries essential information for international investors, and helps their portfolio balancing efforts. Also, understanding what drives stock market interdependence will enable policymakers to analyse different scenarios during both high and low equity-return comovements.

The rest of the chapter is organised as follow. The next section contains a summary of the literature on the oil influence on equity markets. Section 5.3 outlines the methodology used to decompose the interdependence process. Section 5.4 describes the data and Section 5.5 reports the empirical results. The conclusion is included in the last section.

5.2 Literature review

The seminal work of Hamilton (1983) laid the foundation for a distinctive strand of academic research that examines oil effects on macroeconomic variables (Hamilton, 1996, 2003). As mirrors of the economy, financial market share natural candidates to attract the subsequent wave of research. This constituent of research introduced prominent papers by Jones and Kaul (1996) and Huang et al. (1996). Interestingly, both papers provide conflicting results; Jones and Kaul (1996) report that oil price changes exert a negative impact on US stock returns, whereas Huang et al. (1996) do not offer support to these findings, claiming that the effects of oil on stock markets are non-existent. Chen et al. (1986) use economic factors to explain the pricing of stock market equities. In accordance with Huang et al. (1996), Chen et al. (1986) state that returns generated by oil futures have no significant impact on stock market returns, and there is no clear advantage in considering the risk caused by the volatility of oil prices on stock markets.

The subsequent wave of research studies the effects of oil price and volatility changes on equity returns in Vector Autoregressive models (VAR). The academic research in this field usually involves the control of additional macroeconomic variables. For example, Sadorsky (1999) focuses on the US market and incorporates a set of economic variables: industrial production, interest rates, real oil prices, and real stock returns. Results show that positive volatility shocks explain a large proportion of forecasting error variance of stock returns as compared to negative ones. Both oil return and volatility shocks have significant effects on economic activity, while the opposite does not hold true, which he interprets by the exogenous nature of oil prices. Papapetrou (2001) presents evidence that oil prices are important in explaining Greek stock price movements. In accordance with Sadorsky (1999), Papapetrou (2001) concludes that a positive oil price shock tends to depress real stock returns. Bjornland (2009) investigates the effect of oil price changes on the Norwegian equity market. The monthly sample period represented by the span of time from 1993 to 2005 is applied alongside controls for interest rates, inflation and unemployment. The author concludes that oil price increases have a positive effect on the Norwegian equity market.

Lescaroux and Mignon (2008) investigate the linkages between oil prices and macroeconomic and financial variables. Their results highlight the existence of an important link between oil and equity prices in the short run. Specifically, Granger-causality generally runs from oil to stock returns. In the same vein, Park and Ratti (2008) examine the effects of oil on equities in the US and the EU. The study includes additional explanatory macroeconomic variables in a sample stretches over the period from January 1986 to December 2005. Park and Ratti (2008) find that oil price shocks have a negative impact on stock markets in the US and many European countries, while in Norway, an oil-exporter, stock markets exhibit a positive response to the rise in oil price. Focusing on Asian markets, Le and Chang (2015) postulate a VAR model including oil price, interest rate, and industrial production alongside stock returns using monthly data from Japan, Malaysia and Singapore over the period 1997 to 2013. Using subsample analysis, they report an increasing role of oil in influencing stock returns. In a recent study, Diaz et al. (2016) examine the relationship between oil price volatility and stock returns in the G7 economies.[81] Similar to Park and Ratti (2008), Diaz et al. (2016) report the negative effects of oil price volatility on stock returns. Diaz et al. (2016) attribute the negative effects of oil volatility on stock prices to their efficiency in reflecting the economic reaction to the risk associated with this vital factor.

Bjornland (2009) and Jimenez-Rodriguez and Sanchez (2005) argue that higher oil prices represent an immediate transfer of wealth from oil importers to exporters. They maintain that if the governments of oil producing countries use the funds to purchase goods and services domestically, higher oil prices will increase the level of activity which, in turn, creates greater productivity, including in stock markets. Thus, a positive association is anticipated between oil and stock returns for an oil-exporting country. Filis et al. (2011) include both oil importing and exporting countries in their analysis. The authors use monthly data from 1987 to 2009 and a GJR DCC correlation framework. Following oil shock decomposition by Kilian (2009), the study provides evidence that the time-varying correlation of oil and stock returns do not differ for oil-importing and oil-exporting economies. Conversely, using monthly data, Jung and Park (2011) focus on Norway and Korea and document heterogeneous responses of stock market returns and volatility to

[81] Canada, France, Germany, Italy, Japan, the UK, and the US.

different oil price shocks. The authors explicitly attribute that to the fact that Norway is an oil exporter, whereas Korea is an oil-importing country. Wang et al. (2013) maintain that the energy profile of the country (oil exporting/importing) influences the magnitude, duration, and even direction of responses displayed by stock returns in reaction to oil shocks.

A number of studies consider oil price influence on the correlations of economic and financial variables. In this perspective, Nadal et al. (2017) examine oil shocks impact on oil and equity return correlations. Antonakakis et al. (2013) establish oil price shocks as factors to explain the change in correlations between US equity returns, policy uncertainty and the VIX index. Wang et al. (2013) touch briefly on the subject of oil influence on equity return comovements; they achieve this by testing the impact of oil shocks on the degree of market dispersion as a measure of stock market interdependence.

All in all, three distinctive strands of literature were briefly reviewed. First, the oil price and volatility influence on equity returns. Second, the asymmetric effects of oil on oil importing /exporting economies. Third, oil impact on financial/economic variables comovements. These streams of research are combined to establish oil as one of the macroeconomic determinants of equity market correlations in the context of oil exporting and importing nations.

5.3 Methodology

5.3.1 Asymmetric dynamic conditional correlation model

Building on the work of Engle (1982) and Bollerslev (1986), the dynamics of the correlation are modelled together with those of the volatility of returns. This constitutes a remedy of the heteroscedasticity-induced correlation coefficient bias discussed by Forbes and Rigobon (2002). To examine the level of interdependence between US and GCC equity returns, the research uses the Asymmetric Dynamic Conditional Correlation (ADCC GARCH) model devised by Cappiello et al. (2006) as an extension to the Dynamic Conditional Correlation (DCC) model of Engle (2002). The choice is based on the intuition that negative shocks have more pronounced effects than positive ones, especially since the period of study endured major crisis phases.

The DCC-GARCH model (Engle, 2002) models the time-varying correlation between each market pair. The conditional covariance matrix is expressed in terms of the following decomposition:

$$\Omega_t = D_t \Gamma_t D_t \tag{5.1}$$

Where D_t refer to the diagonal matrix of the conditional standard deviations and Γ_t is the matrix of conditional correlations. Bollerslev (1990) assumes that the correlations were constant, i.e., $\Gamma_t = \Gamma$. To account for the leverage effect and the volatility feedback, individual GJR-GARCH(1,1) (Glosten et al., 1993) processes are estimated for each series. I implement the GJR-GARCH model as it allows for an asymmetric effect within the conditional variance series as such:

$$h_t^2 = \omega + \sum_{i=1}^{p} \alpha\varepsilon_{t-i}^2 + \sum_{i=1}^{q} \gamma\varepsilon_{t-i}^2 I_{t-i} + \beta h_{t-1}^2 \tag{5.2}$$

Where $I_t[\cdot]$ is and indicator function which takes the value of one when the lagged shock is negative ($\varepsilon_{t-1} <0$) and zero for positive shocks. Here, asymmetry is captured by γ, with negative news having a greater impact on volatility when γ >0, i.e., the effect of a negative shock on conditional variance is given by ($\alpha+\gamma$) and positive shock by α. The standardised residuals (ξ_t) are then computed in the usual way:

$$\xi_t = D_t^{-1} \varepsilon_t . \tag{5.3}$$

With the correlations given by:

$$\Gamma = \frac{1}{T}\sum_{t=1}^{T} \xi_t \xi_t' . \tag{5.4}$$

While imposing a constant correlation may be useful simplifying assumption in certain circumstances, in the analysis here it is not relevant. Hence, I implement Engle's extension whereby the conditional correlation is allowed to exhibit time-variation in a manner similar to the GARCH(1,1) model. Specifically, conditional correlations fluctuate around their constant (unconditional) values as such:

$$Q_t = (1 - \alpha - \beta)\Gamma + \alpha\xi_{t-1}\xi_{t-1}' + \beta Q_{t-1} \tag{5.5}$$

where Q is the time-varying correlation matrix. The estimated correlations are standardised, $\rho_{ij,t} = \Gamma_{t,ij} = Q_{t,ij} / \sqrt{Q_{ii}}\sqrt{Q_{jj}}$, to ensure they lie between -1 and 1. This also ensures both a positive definite matrix as well as readily interpretable correlations.

Cappiello et al. (2006) introduce the ADCC model to allow for asymmetric effects in the correlation. Thus, the equation (5.5) is extended as follows:

$$Q_{ij,t} = (1 - \alpha - \beta)\Gamma + \alpha(\xi_{i,t-1}\xi'_{j,t-1}) + \beta(Q_{ij,t-1}) + g(\varsigma_{t-1}\varsigma_{t-1}{}') \tag{5.6}$$

Where $\varsigma_{it} = (I[\bar{\xi}_{it} < 0]o\bar{\xi}_{it}$ the latter being the element by element Hadamard product of the residuals if shocks are negative, and $\bar{\varsigma}_t = 0$ otherwise. The term g thus captures asymmetric periods where both markets experience bad news (negative shocks). This study uses the diagonal version of the ADCC equation model, which is a special case of the Generalized ADCC (AG-DCC) model as the parameter matrices therein are replaced by scalars.

5.3.2 Markov switching model

To consider break points in the data, I implement the Markov switching approach original introduced by Hamilton (1989), which allows for switching in the regression intercept. The Markov switching can be described as follows:

$$r_t = \mu_{s,t} + x`\beta + \sigma_{s,t}\,\varepsilon_t \tag{5.7}$$

where r_t is the correlation series, $\mu_{s,t}$ refers to the state dependent intercept and captures the average correlation in each regime (which can be referred to as high and low correlation periods), $x`$ is the vector of explanatory variables (interest rates, inflation, industrial production, MSCI world index and VIX), $\sigma_{s,t}$ is the regime-dependent volatility series and ε_t is the random error term, which is *iid* and normally distributed with a mean of zero and variance of one. The regime variable, s_t is assumed to follow a first-order Markov chain where the probability of being in one regime depends upon the previous state, with transition probabilities given by: $P_{(mn)} = P(s_t = m|s_{t-1} = n) = p_{mn}$. These probabilities can be collected in a transition matrix, which, allowing for two regimes, is given by:

$$\boldsymbol{P} = \begin{pmatrix} p_{00} & p_{10} \\ p_{01} & p_{11} \end{pmatrix} \tag{5.8}$$

where the *mn*-th element represents the probability of transitioning from regime n in period $t-1$ to regime m in period t.

5.3.3 Quantile regression

A quantile regression models the quantiles (partitions or sub-sets) of the dependent variable given the set of potential explanatory variables (Koenker and Bassett, 1978; Koenker and Hallock, 2001). The quantile regression therefore extends the linear model in (X) by allowing a different coefficient for each specified quantile:

$$r_t = \alpha^{(q)} + \beta^{(q)} x_t + \varepsilon_t \tag{5.9}$$

where $\alpha^{(q)}$ represents the constant term for each estimated quantile (q), $\beta^{(q)}$ is the slope coefficient that reveals the relation between the correlation and the explanatory variable at each quantile, and ε_t is the error term.

5.4 Data

This study follows the literature that investigates the relationship between economic fundamentals and equities using the Arbitrage Pricing Theory (APT)[82] of Ross (1976). In the financial theory, the Capital Asset Pricing Model (CAPM) and APT remain the prominent theoretical models used to evaluate the relationship between stock markets returns and shocks of other financial assets. The CAPM assumes that investors respect the Markowitz mean-variance criterion in choosing their portfolios which is supposedly normally distributed. However, it is mostly documented in the literature that the distribution of financial assets or portfolios is not normally distributed. Also, The APT uses fewer assumptions and may be harder to implement than the CAPM. Ross (1976) establishes the APT on the basis that equity prices are driven by multiple factors, which could be grouped into macroeconomic or intrinsic firm factors. Unlike the CAPM, the APT does not characterise the factors or specify their numbers. Finally, while the CAPM formula requires the input of the expected market return, which is cumbersome to calculate given that the market index is not accepted in this framework, the APT formula uses an asset's expected rate of return and the risk premium of multiple macroeconomic factors.

[82] Chen and Jordan (1993) test two alternative specifications of the APT, the conventional factor model, and another where the factors are specified as macroeconomic variables. The researchers conclude that a model with macroeconomic variables specified as factors performs similarly to the one where the factors are unspecified. That said, the former has an advantage over the latter, as the results are easier to interpret economically.

In particular, the procedure followed in this chapter comprises regressing the correlations on oil prices, oil volatility, the consumer price[83] index, the three-month-average interbank[84] interest rates[85] and industrial[86] production. These variables are chosen following the work of Sadorsky (1999), Kiviaho et al. (2014) and Park and Ratti (2008). The rationale behind using these variables in the examination is to account for business cycle fluctuations, the inflation environment, and monetary policy stance. Unlike some of the abovementioned studies, the dependent variable is the correlation of stock market indices and not the return of a single market, thereby, this study incorporates a set of global factors including the MSCI world index and the VIX index. The necessity of controlling for common[87] variables while studying stock return comovements is stressed by Dickinson (2000). He argues that global stock markets are affected by a number of macroeconomic variables; since these macroeconomic risks will not be diversified away, market indices will be affected in a similar fashion.

The variables are denoted as follows: oil price (WTI), oil volatility (WTI^2), Industrial Production Index[88] (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD) and the Chicago Board Options Exchange (CBOE) stress index (VIX). Moreover, the return series of the S&P 500 and MSCI GCC are used to construct the US-GCC correlation, which is the dependent variable in this study. The MSCI GCC[89] Countries Index captures large and mid-cap representation across the six member states of the GCC (Saudi Arabia, Kuwait, the UAE, Bahrain, Oman, and Qatar). The index includes 76 constituents, covering about 85% of the free float-adjusted market capitalisation in each country.

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[83] The choice of variables is based on Fama (1981). Spiro (1990) notes that interest rates and national income are fundamental factors in stock market movements. Also, Gerske and Roll (1983) use a reduced form model consisting of stock returns, real activity, inflation and interest rates.
[84] The interest rate that impacts markets is the federal funds rate. This is the cost that depository institutions are charged for borrowing money from Federal Reserve banks.
[85] Chen et al. (1986), among others, state that high interest lowers the estimated amount of future cash flows in companies. The effects, however, depend heavily on the sector as it appreciates the banks for example. Connolly et al. (2005) add that interest rates may co-move positively with stock markets following inflationary expectations or due to the flight to quality activities as risk-averse investors pull out from stock markets and channel their funds to long-term bonds during high-stress periods.
[86] Industrial production is used instead of GDP due to its availability on a monthly frequency.
[87] For example, Forbes and Chinn (2004) include the world interest rate as a global variable.
[88] The GCC industrial production and GCC-CPI are in reality the Saudi ones due to the absence of such data. Additionally, Saudi Arabia has the lion share of the MSCI GCC index with 61.99% of the country weights and more than 50% of the total market capitalisation. The GCC-IR is represented by the Kuwait interbank interest rate because the Saudi data start in 2006.
[89] The dependence on this portfolio instead of individual GCC indexes is advantageous since it overcomes the investment restrictions in these nations.

The study uses the West Texas Intermediate (WTI) oil price. The reliance on this global measure of oil as opposed to local ones is because stock market behaviour is more sensitive to the information given by indicators of oil prices, rather than its expected impact in local currency (Diaz et al., 2016). Likewise, Hamilton (2008) states that in most oil shocks, the change in nominal oil prices is larger than the overall change in general prices.

Data are collected from Thomson Reuters Datastream. All macroeconomics are at a monthly level and range from December 2002 to December 2016. Stock market indices are denominated in $US and the natural logarithmic difference [ln (pt / pt − 1)] is applied for all series with the exception of the EU harmonised CPI and the correlations, where the first difference of the variables is used for the empirical analysis. The volatility[90] of oil is the square of the return series. Finally, the stock indices are sampled on a weekly basis, where the last week of the month is used to avoid smoothing effects.

Table 5.1 reports the descriptive statistics for the logarithmic difference of both equity returns and macroeconomic variables. Both mean and median values are close to zero. For each series, the standard deviation is larger than the mean value, and the Jarque-Bera test rejects the hypothesis of normality in most series. Also, the Phillips-Perron unit root test results indicate that all series are stationary.

[90] The use of the squared return as a proxy of volatility is common practice in the academic literature (Pagan and Schwert 1990; West and Cho, 1995; So, 2000).

TABLE 5. 1 DESCRIPTIVE STATISTICS OF THE DIFFERENCED STOCK RETURNS AND MACROECONOMIC VARIABLES. THE SAMPLE SPANS FROM DECEMBER 2002 TO DECEMBER 2016 WITH 169 OBSERVATIONS.

	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	PP test
US-IP	0.0006	0.0015	0.0149	-0.044	0.0071	-2.2498	13.367	899.41*	0.0000
US-IR	-0.0023	0.0000	0.3860	-0.5772	0.1126	-1.1824	9.2386	313.44*	0.0000
US-CPI	0.0017	0.0019	0.0137	-0.0179	0.0032	-1.3669	11.846	603.67*	0.0000
GCC-IP	0.0021	0.0000	0.1618	-0.1188	0.0515	0.1887	3.3179	1.7146	0.0000
GCC-IR	-0.0032	0.0000	1.0770	-0.6336	0.1540	1.9339	19.495	2021.3*	0.0000
GCC-CPI	0.0028	0.0023	0.0215	-0.0055	0.0038	1.8711	8.7826	334.08*	0.0000
EU-IP	0.0005	0.0000	0.0192	-0.0405	0.0097	-1.0008	5.9685	90.262*	0.0000
EU-IR	-0.0165	0.0040	0.4912	-1.7557	0.1949	-4.4053	40.190	10286*	0.0000
EU-CPI	0.0036	0.0000	1.8000	-1.2	0.5107	0.2499	3.5378	3.7957	0.0001
VIX	-0.0044	-0.0156	0.9638	-0.6939	0.2285	1.0302	6.4790	115.12*	0.0000
WORLD	0.0047	0.0122	0.1795	-0.3329	0.0524	-1.8318	13.488	869.08*	0.0000
WTI	0.0042	0.0127	0.2715	-0.3873	0.1092	-0.649	4.0673	19.885*	0.0000
GCC	0.0009	0.0028	0.1191	-0.205	0.0268	-1.4553	13.724	3914.9*	0.0000
EU	0.0004	0.0031	0.1387	-0.2658	0.0301	-1.3663	13.293	3596.3*	0.0000
US	0.001	0.0020	0.1136	-0.2008	0.0240	-0.8937	11.471	2376.5*	0.0000
WTI^2	0.0118	0.0052	0.1499	0.0000	0.0204	3.7973	21.119	2717.9*	0.0000

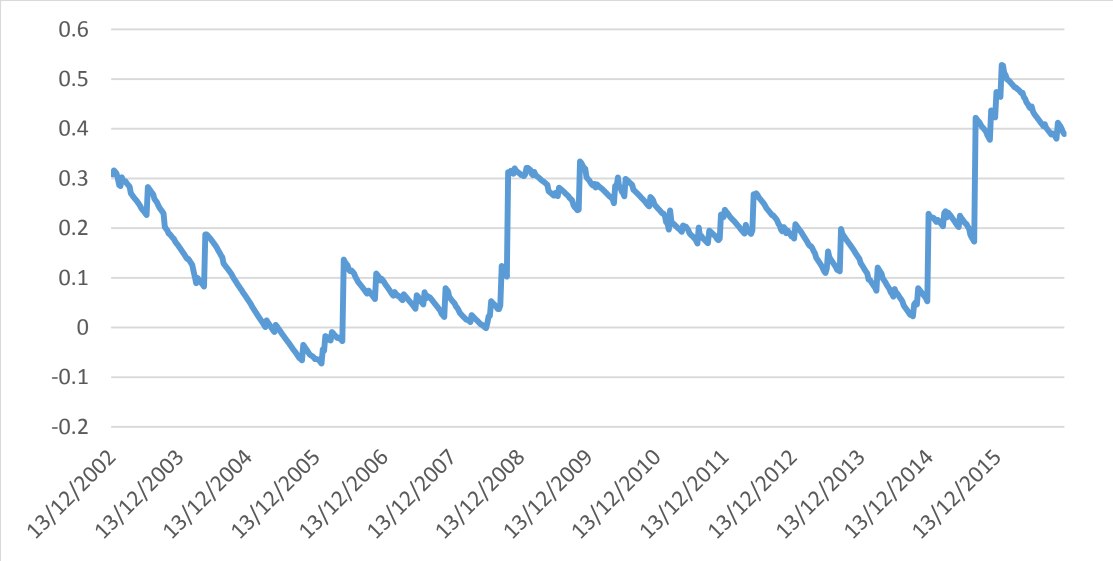
Notes. The notation is as follows: oil prices (WTI), oil volatility (WTI^2), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the Chicago Board Options Exchange stress index (VIX), Standard Deviation (Std. Dev.), and the Phillips–Perron unit root test (PP). The first difference is sufficient to make the EU CPI stationary. The logarithmic difference is applied to the rest of the series. This difference only is used in correlations because the natural logarithmic difference is applied to the individual return series.

5.5 Empirical results

5.5.1 Correlation decomposition

The correlation series from estimating the GJR-ADCC-GARCH model is presented in Figure 5.1 and indicates time-variation in the correlation pattern. An overall upward trend is observed, with the exception of the first two years, while exceptional spikes coincide with the Iraq war, the 2008 Subprime Crisis and the January 2016 market selloff. The observed increase in correlations during turbulent periods is consistent with Forbes and Rigobon (2002) and Solnik et al. (1996).

FIGURE 5. 1 US-GCC CORRELATION FROM DECEMBER 2002 TO DECEMBER 2016



Note. The correlation series in the graph are simulated from a GJR ADCC GARCH model.

Table 5.2 presents the estimated results of regressing the correlations (from the ADCC-GJR-GARCH[91] model) on oil price, oil volatility, world portfolio, VIX and domestic macroeconomic variables (interest rates, industrial production and inflation). Given that residuals suffer from heteroscedasticity, the White coefficient covariance matrix is applied. Notably, Table 5.2 Panel A shows that an oil price increase leads to a statistically significant fall (with a coefficient value of -0.068) in the US-GCC correlation. This is consistent with our view that an oil price rise tends to favour the stock market returns in oil-exporting economies, while hurting the returns in an oil-importing market (Wang et al., 2013; Park and Ratti, 2008).

In addition to the oil return variable, Table 5.2 Panel A reports the VIX index and US interest rates exhibit a positive and statistically significant effect on the stock return correlation. This suggests that both these variables have the same impact on both the US and GCC stock returns. The positive sign on the US interest rates perhaps arises from the harmonisation of interest rates between the US and the GCC. This is likely to arise from the pegging of the $US and GCC currencies. Solnik et al. (1996) state that US interest rates exhibit a global sphere of influence and this further explains its positive coefficient sign. The

[91] See Table A.1 in the appendix section for alternative correlation specification.

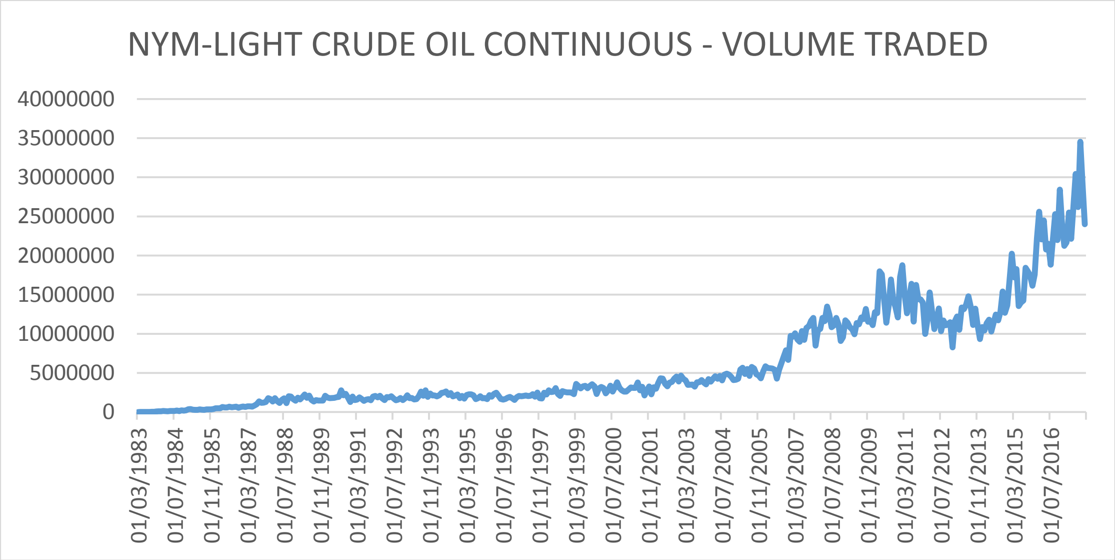
positive VIX relation implies that an increase in risk in the US market also has a similar effect on international markets.

Considering the sub-sample[92] analysis, Table 5.2 Panel B reveals that oil price change is only statistically significant in the second sub-sample (2009-2016), although it is negative in both periods, the coefficient notably increases, from -0.03 to -0.12, across the two samples. Of note, the world equity index exhibits a significant effect on the correlation dynamics in the second sub-sample, perhaps as a result of the financial crisis, and a signal of globalisation in equity markets (Issing, 2001). Both the VIX index and US interest rates still continue to exhibit a positive coefficient sign but are not statistically significant in the sub-samples. These positive relations are consistent with the argument of Pindyck and Rotemberg (1993), who argue that stocks move jointly in response to the common effects of changes in macroeconomic variables.

In short, the results reveal the key role of oil price change, US interest rates and the VIX[93] index in determining the stock market correlation between the US and the GCC. Furthermore, in line with the results of Le and Chang (2015), the sub-sample analysis demonstrates an increasing role for oil in explaining the variations of US-GCC interdependence. The increasing effect of oil on equity markets can be attributed to two reasons. First, the aftermath of the financial crisis affects the dynamics of financial markets and their interaction with oil (Tsai, 2015). Second, and more importantly, oil and stock markets are becoming increasingly interlinked due to the financialization of oil markets. This effect is the result of the increased participation and speculation of hedge funds and investors in the oil market (Hamilton and Wu, 2012; Sadorsky, 2014; Nadal et al., 2017; Maghyereh et al., 2016). Despite the fact that the introduction of oil futures dates back to 1983 (Huang et al, 1996), Figure 5.2 illustrates that the most notable increase in the volume of oil future trading (at the New York metal exchange) began around the time of the financial crisis but in an even more pronounced manner after 2013.

[92] The choice of sub-sample dates is largely determined by dividing the sample into half and thus, (approximately) a similar number of observations in each sub-sample. This also splits the sample into pre- and post-financial crisis periods.
[93] Tsai (2014) documents the importance of VIX on equities.

FIGURE 5. 2 WTI CRUDE OIL FUTURES VOLUME IN NEW YORK METAL EXCHANGE



Source: Thomson Reuters DataStream.

TABLE 5. 2 US-GCC CORRELATION ANALYSIS

	C	WTI	WTI^2	WORLD	VIX	US-CPI	US-IR	US-IP	GCC-CPI	GCC-IP	GCC-IR	Adj. R^2	AIC
Panel A: Full sample analysis 2003M1 2016M12													
COEF	-0.0029	**-0.0681**	0.2801	0.0204	**0.0583**	-0.5138	**0.0543**	-0.3843	0.6025	-0.0276	-0.0223	0.2982	-4.043
SE	(0.0044)	(0.0288)	(0.1827)	(0.0703)	(0.0228)	(0.8549)	(0.0228)	(0.2647)	(0.7379)	(0.0341)	(0.0193)		
Prob.	0.5115	0.0194	0.1273	0.7724	0.0116	0.5487	0.0184	0.1486	0.4154	0.4199	0.2488		
Panel B: Subsample analysis: 2003M1 2009M12													
COEF	-0.0033	-0.0341	0.1847	-0.0583	0.0662	-0.5641	0.0535	-0.3523	1.1853	-0.1027	-0.0239	0.2673	-4.018
SE	(0.0065)	(0.0433)	(0.1887)	(0.0617)	(0.0334)	(0.7581)	(0.0326)	(0.2423)	(0.9870)	(0.0559)	(0.0203)		
Prob.	0.6178	0.4334	0.3309	0.3484	0.0514	0.4592	0.1058	0.1502	0.2336	0.0700	0.2444		
Subsample analysis: 2009M12 2016M12													
COEF	0.0012	**-0.1192**	0.4286	**0.2528**	0.0525	-2.3903	0.0330	-0.5287	-0.9707	-0.0141	0.0204	0.3732	-4.023
SE	(0.0073)	(0.0379)	(0.2604)	(0.1033)	(0.0292)	(2.1512)	(0.0296)	(0.7882)	(1.0320)	(0.0452)	(0.1029)		
Prob.	0.8714	0.0024	0.1040	0.0167	0.0760	0.2701	0.2671	0.5045	0.3500	0.7562	0.8433		

Notes. The notation is as follows: oil price (WTI), oil volatility (WTI^2), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the Chicago Board Options Exchange stress index (VIX), the constant (C) and the dependent variable is the US-GCC correlation. The entries are the coefficients with Huber-White standard errors (SE) in parentheses. AIC stands for Akaike information criterion. Concerning the fact that the correlation is a bound variable, between −1 and 1, applying the Fisher transformation of the correlation series does not affect the results. The US interest rate is not significant in both subsamples due to the bigger standard error resulting from a smaller sample. The first difference is applied to the correlation series, therefore the sample starts from January 2003. I emboldened coefficients with p-values less than 5%.

5.5.2 The role of oil and financial shocks

The existence of structural breaks is a common issue in macroeconomic series; they are usually affected by exogenous shocks under economic or financial events. While Hamilton (1988) argues that abrupt government policy changes may induce such breaks, Hamilton (2005) states that these dramatic breaks in financial series correspond to financial crises. In essence, the subprime crisis is not the only extreme incident that took place during the last decade; other major events include: the domestic GCC bubble burst in 2006, the 2010-2011 EU Debt Crisis, and the collapse in oil prices between 2014 and 2016. To account for these events, a non-linear approach is put in place, that is, the Markov regime switching method. The Markov switching model of Hamilton (1989) involves multiple equations[94] that describe the correlation's behaviour in different regimes. The switching mechanism between regimes is governed by a latent state variable that follows a first-order Markov chain. The usefulness of this method lies in the fact that it captures breakpoints in time series without the need for predetermined dates. In essence, the Hamilton (1989) filter is capable of providing useful information about the nature of the correlations and the persistence of each state.

It is well established in the literature (see for example Solnik et al., 1996) that stock market comovements increase during high-stress periods, thereby an abrupt increase in a correlation series may signal a turbulent period. Similar to the Bai and Perron (2003) method, the applied regime switching here is in the mean of the equation. The constant in the equation (C) is the average change in the correlation based on the information of the preceding period. While Hamilton (1989) states that the switching model could be used as an independent algorithm to define business cycles, the regime switching methodology here is used to verify the dates of shocks, simply by relating the high regime to specific events. This is based on the following intuition: when large shocks in world factors take place, they affect global financial markets simultaneously causing correlations to increase precipitously. To sum up, the dates of crises and their durations are determined endogenously when a jump in correlations occur. The modelling strategy maintains the view that the behaviour of correlations varies drastically during calm and turbulent phases and can be characterised by shifts between crisis and calm periods.

[94] The subjective definition of two regimes instead of multiple is consistent with the criterion of parsimony.

TABLE 5. 3 US-GCC MARKOV SWITCHING MODEL WITH TWO STATE VARIABLE

Variable	COEF	SE	Prob.
	Regime 1		
C	-0.006909	0.002638	0.0088
	Regime 2		
C	0.121652	0.009250	0.0000
	Non-switching variables		
WTI	-0.034300	0.017135	0.0453
WTI^2	0.112551	0.089217	0.2071
WORLD	0.019826	0.032599	0.5431
VIX	0.035786	0.007731	0.0000
US-CPI	-0.273347	0.624990	0.6618
US-IR	0.035933	0.015132	0.0176
US-IP	-0.636158	0.219571	0.0038
GCC-CPI	0.642060	0.416992	0.1236
GCC-IP	-0.034529	0.029421	0.2405
GCC-IR	0.005787	0.010287	0.5737
AIC	-4.645136	SIC	-4.366210

Constant Markov transition probabilities

		1	2
All periods	1	0.955736	0.044264
	2	1.000000	2.18E-09

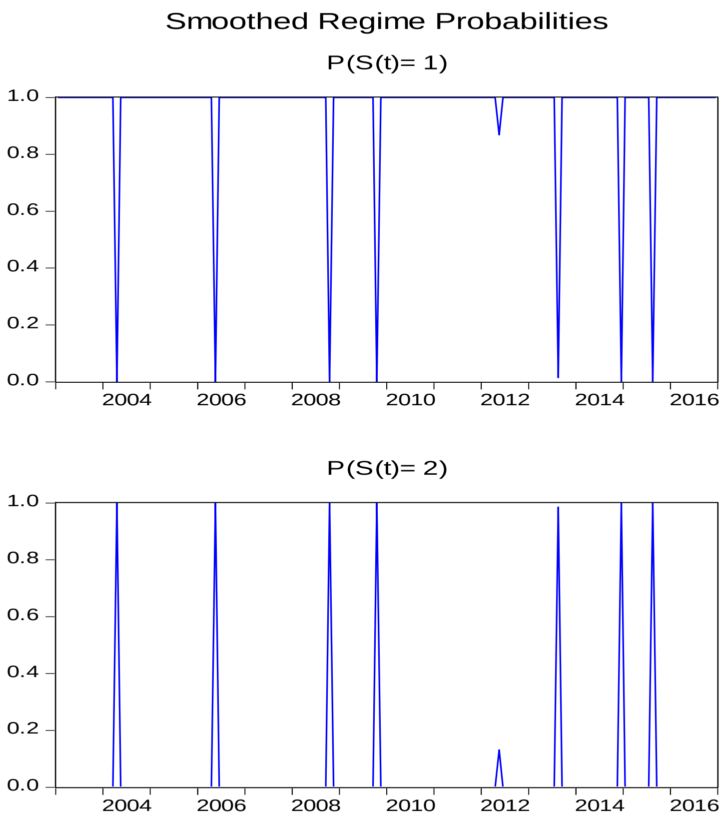
Expected duration based on constant Markov transition probabilities

	1	2
All periods	22.59174	1.000000

Notes. The notation is as follows: oil prices (WTI), oil volatility (WTI^2), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the constant (C) and the VIX index (VIX). Due to the non-linear nature of the model, white robust standard errors are not applied in the regime-switching regression. AIC and SIC stand for Akaike information criterion and Schwarz information criterion, respectively. Concerning the fact that the correlation is a bound variable, between −1 and 1, applying the Fisher transformation of the correlation series does not affect the results.

Table 5.3 depicts the outcome of the Markov switching model. I can point out the following: first, two significant regimes exist, a low one records almost zero change in correlations, and the high regime yields a 0.12 jump in the US-GCC correlation. Second, the expected duration of the low regime is around 23 months while the high regime stands at a single month. Third, the low regime is fairly stable with a 95.6% probability of remaining in the same regime. Finally, the high regime is not stable, as the probability of remaining in the same regime is null. In essence, the results above indicate relative stability with sporadic hikes in correlations that do not exceed one month. This mirrors both turbulence and tranquillity in financial markets, where market turbulence lasts for shorter periods.

FIGURE 5. 3 US-GCC SMOOTH TRANSITION CHART



Notes. Based on the Kim (1994) filter, Figure 5.3 illustrates the smooth probabilities of each regime. This technique involves the estimation of probabilities[95] using the entire sample. The high regime reflects jumps in correlation coefficients while the low regime corresponds with stable correlations.

From Figure 5.3, it is observable that switches to the high correlation regime took place during April 2004, May 2006, between 2008 and 2009, August 2013, December 2014 and

[95] Another approach is the filtered probabilities which follows a recursive approach based on the information available at each time period (see Brooks, 2002).

August 2015. The first break[96] is perhaps linked to the geopolitical tensions in Iraq. The May 2006 break coincided with the US Federal Reserve interest rate increase and the GCC market bubble burst (2006). The subsequent breaks reflect the aftermath of the financial crisis (2008-2009) and the Tapering Tantrum[97] (2013) respectively. Additionally, other events throughout 2014 and 2015 precipitated a switch; the high regime in 2014 is perhaps associated with the historical oil price drop in 2014 that coincided with the end of the US Quantitative Easing phase. Finally, the last break is the product of the "Black Monday"[98] of August 2015.

To summarise, as with Hamilton (1988, 2005), market turbulences (2006, 2008, and 2015), and monetary policy actions precipitated breaks in the US-GCC co-movement pattern. For example, the historical oil price drop in late 2014 had serious ramifications for the GCC markets, at the same time, an end to a quantitative easing phase on 24/10/2014 sparked uncertainty in the US market. Hence, the confluence of these factors dampened both the US and the GCC equity returns, consequently instigating a jump in the correlation.

5.5.3 Oil influence during different levels of market interdependence

This section uses the quantile regression to examine the behaviour of oil prices and volatility during various intensities of stock market linkages. Essentially, the quantile regression, developed by Koenker and Bassett (1978), estimates the effects of the explanatory variables on the conditional quantile of the dependent variable.

Figure 5.4 plots the quantile coefficient estimates for each variable across the different deciles together with the 95% confidence intervals. This figure shows that the oil price return and volatility have a greater effect at higher correlation values. Notably, for the oil price, the coefficient is marginally significant for below median quantiles but becomes increasingly significant, and negative in value, above that. For volatility, again, below median coefficients are borderline significant (at best) but become significant at the highest quantiles. The coefficient sign is positive throughout but becomes increasingly so at the highest quantiles. Of note, elsewhere, the VIX becomes increasingly positive and significant and

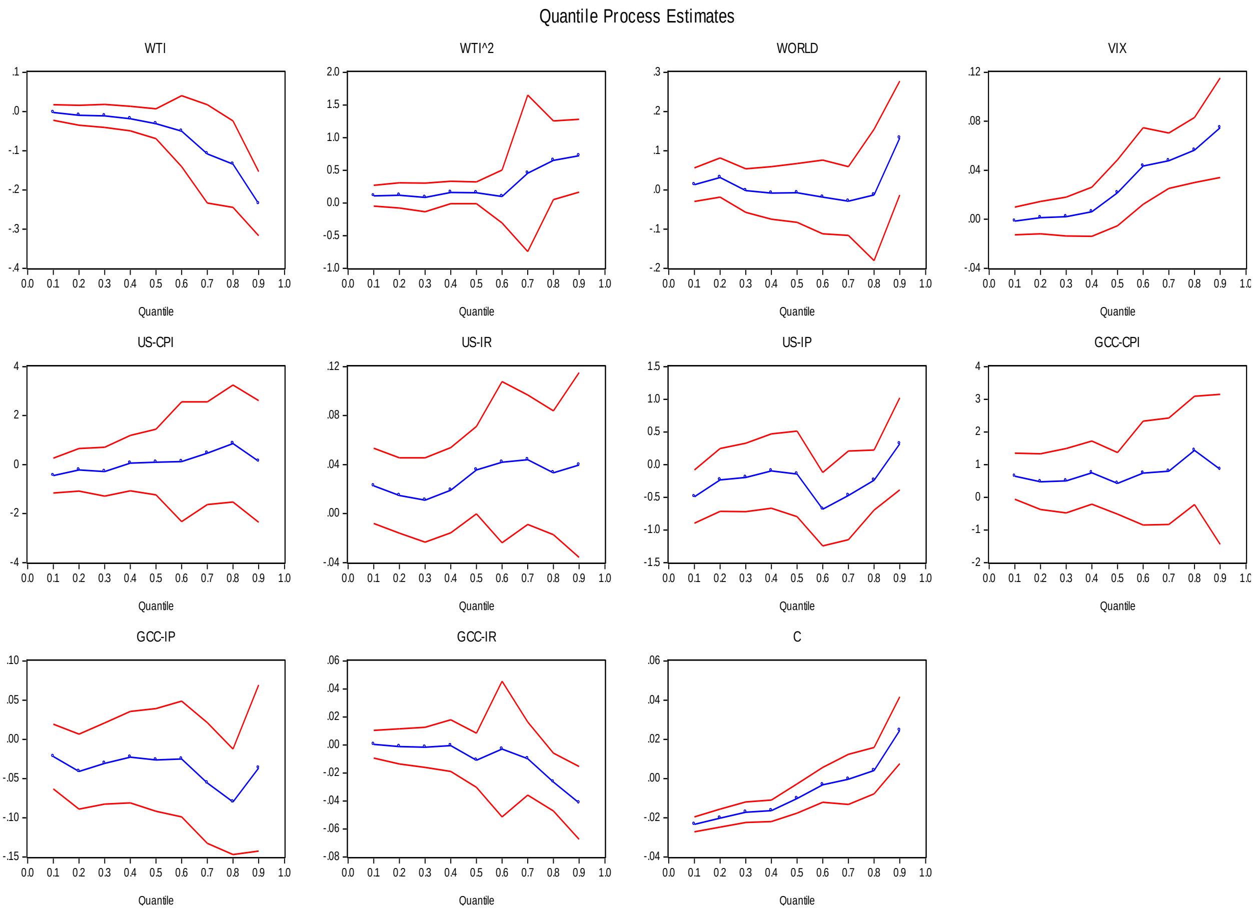
[96] https://www.imf.org/External/Pubs/FT/fmu/eng/2004/0604.pdf.

[97] Tapering tantrum is the term used for the 2013 increase in US Treasury yields, which was caused by Federal Reserve's use of tapering to gradually reduce the amount of money injected into the economy.

[98] Black Monday is the name given to the stock market crash that occurred on August 24, 2015. The incident was associated with concerns about the Chinese economy and uncertainty over the Yuan devaluation.

GCC interest rates increasingly negative and significant at higher quantiles. Solnik et al. (1996) argue that local country factors are more likely to dominate when correlations are low, while global factors assume more influence during high correlation phases. Where oil can be regarded as a global factor, then this appears to hold, although there is less evidence of local factors dominating at low correlation levels.

FIGURE 5. 4 US-GCC QUANTILE COEFFICIENT CHART



Notes. Quantile regression coefficients: vertical axes show coefficient estimates of variables over the stock returns distribution; horizontal axes depict the quantiles of the dependent variable; quantile regression error bars correspond to 95% confidence intervals. The notation is as follows: oil prices (WTI), oil volatility (WTI^2), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the Chicago Board Options Exchange stress index (VIX), the constant (C) and the dependent variable is the US-GCC correlation. Concerning the fact that the correlation is a bound variable, between −1 and 1, applying the Fisher transformation of the correlation series does not affect the results.

Overall, the results in Figure 5.4 indicate a positive influence of both oil price declines and oil volatility hikes on the US-GCC correlations. In particular, the dependence structure is seen to be asymmetric, where it exhibits upper tail dependence and lower tail independence.

This could be rationalised by the importance of global factors during intense co-movement epochs (Solnik et al., 1996). Another possible reason for this behaviour can be given by Longin and Solnik (1995), who argue that turbulent periods concur with high correlations. Within this scenario, an oil price drop means the absence of a safety cushion that may shield GCC markets from the ramifications of globally turbulent periods. This, in turn, could push GCC markets down and so increase the US-GCC correlation.

5.5.4 Alternative oil price/volatility specifications

Some academic studies investigate the existence of non-linear links between oil and stock returns; examples include Jiménez-Rodríguez (2015) and Ciner (2001) among others. The literature pins down two major non-linear transformations of oil prices, the general idea behind these transformations is to account for shocks that are not explained by the market and macroeconomic innovations.

TABLE 5. 4 US-GCC CORRELATION ANALYSIS WITH ALTERNATIVE OIL PRICE SPECIFICATIONS

	C	NOPI	SOP	OIL-VIX	WTI^2	WORLD	VIX	US-CPI	US-IR	US-IP	GCC-CPI	GCC-IP	GCC-IR	Adj. R^2	AIC
Panel A: Full sample analysis 2003M1 2016M12															
COEF	-0.001	-0.101			0.3630	0.0187	**0.0648**	-1.070	**0.0557**	-0.464	0.7295	-0.015	-0.024	0.2803	-4.001
SE	(0.0045)	(0.0583)			(0.1977)	(0.0737)	(0.0241)	(0.7984)	(0.0226)	(0.2765)	(0.7300)	(0.0394)	(0.0207)		
Prob.	0.7608	0.0857			0.0682	0.7998	0.0080	0.1823	0.0150	0.0951	0.3192	0.7009	0.2444		
COEF	0.0021		-0.004			0.0144	**0.0690**	**-1.951**	**0.0530**	-0.542	0.7698	-0.023	-0.022	0.2668	-3.983
SE	(0.0037)		(0.0031)			(0.0795)	(0.0249)	(0.9115)	(0.0210)	(0.2594)	(0.7134)	(0.0370)	(0.0199)		
Prob.	0.5541		0.1474			0.8561	0.0062	0.0339	0.0124	0.0384	0.2822	0.5361	0.2602		
Panel B: Subsample analysis: 2003M1 2009M12															
COEF	-0.003	-0.040			0.2437	-0.056	**0.0692**	-0.748	0.0534	-0.382	1.2072	-0.104	-0.024	0.2545	-3.964
SE	0.0072	0.0736			0.1776	0.0632	0.0346	0.6834	0.0338	0.2487	1.0022	0.0601	0.0214		
Prob.	0.7015	0.5895			0.1744	0.3778	0.0495	0.2778	0.1176	0.1290	0.2325	0.0889	0.2665		
COEF	0.0014		-0.001			-0.069	**0.0744**	-1.529	0.0473	-0.392	1.1068	-0.106	-0.022	0.2507	-3.959
SE	(0.0052)		(0.0042)			(0.0687)	(0.0348)	(0.8392)	(0.0341)	(0.2384)	(1.0633)	(0.0611)	(0.0204)		
Prob.	0.7849		0.8810			0.3202	0.0359	0.0729	0.1693	0.1049	0.3015	0.0880	0.2790		

Panel C. Subsample analysis: 2009M1 2009M12

COEF	0.0031	-0.146			0.4679	0.2010	**0.0670**	-3.974	0.042233	-0.539	-0.340	0.0372	0.0090	0.3187	-3.940
SE	(0.0069)	(0.0830)			(0.2826)	(0.1063)	(0.0319)	(2.4962)	(0.0300)	(0.8371)	(0.8533)	(0.0490)	(0.1113)		
Prob.	0.6504	0.0825			0.1019	0.0625	0.0392	0.1156	0.1630	0.5218	0.6914	0.4496	0.9353		
COEF	0.0037		**-0.011**			**0.2458**	0.0661	-3.947	0.0537	-0.909	-0.088	-0.010	0.0095	0.3187	-3.950
SE	(0.0075)		(0.0047)			(0.1061)	(0.0338)	(2.5241)	(0.0293)	(0.8485)	(0.6240)	(0.0470)	(0.1173)		
Prob.	0.6131		0.0247			0.0232	0.0542	0.1221	0.0701	0.2877	0.8881	0.8259	0.9354		
COEF	0.005445			0.0345		**0.2398**	0.0558	-2.350	0.0472	-0.690	-0.813	-0.030	0.0129	0.3548	-3.994
SE	(0.0075)			(0.0216)		(0.1055)	(0.0285)	(2.0254)	(0.0264)	(0.8031)	(0.8316)	(0.0497)	(0.1153)		
Prob.	0.4678			0.1141		0.0259	0.0538	0.2496	0.0783	0.3927	0.3312	0.5446	0.9111		

Notes. The notation is as follows: oil prices (WTI), oil volatility (WTI^2), Net Oil Price Increase (NOPI), Scaled Oil Price (SOP), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the constant (C), the VIX index (VIX), the implied oil price volatility (OIL VIX) and the dependent variable is the US-GCC correlation. The entries are the coefficients with Huber-White standard errors (SE) in parentheses. AIC stands for Akaike information criterion. Concerning the fact that the correlation is a bound variable, between −1 and 1, applying the Fisher transformation of the correlation series does not affect the results. In the last equation in Panel C, the oil price variable WTI is significant with -.0135 coefficient. I emboldened coefficients with p-values less than 5%.

Net oil price increase

Proposed by Hamilton (1996), the Net Oil Price Increase (NOPI) is the first non-linear specification. NOPI compares the price of oil in each period with the maximum value observed during the preceding year. If the value of the current price exceeds the previous twelve months maximum, the percentage change over the previous twelve months maximum is plotted. However, if the price of oil is lower than what it had been at some point during the previous year, the series is defined to be zero. In short, NOPI is specified as the difference between the current price and the maximum recorded price during the last twelve months if positive, and zero otherwise. Hamilton (2003) expands the time horizon for the NOPI specification from one year to three years, however, since the data span is short and following Park and Ratti (2008), the calculations in this chapter define the comparative time horizon at six months instead of one year.

The results of this analysis are presented in Table 5.4, with Panel A for the full sample and the sub-samples in Panels B and C. In Panel A, we can see that the coefficient on NOPI is negative and statistically significant at the 10% level. Similar to the WTI oil price, the NOPI coefficient increases from 0.04 in the first sub-sample to 0.14 in the second sub-sample and is again statistically significant at the 10% level in the latter period. Of the remaining variables, they exhibit the expected signs, i.e., negative for the factors with asymmetric effects such as US CPI (and NPOI), while the opposite holds true for the VIX, oil volatility and the US interest rates.[99] Notably, our results are consistent with Pretorius (2002), who finds that an increase in industrial production growth differential decreases interdependence. The (marginal) significance of the US industrial production in this model and its absence of significance as a variable in the benchmark regression is consistent with the conclusions of Chen et al. (1986) who state that the inclusion of the oil price into models using economic factors to explain the pricing of stock market equities induces a fall in the statistical significance of factors such as industrial production.

The full sample provides weak evidence of a non-linear oil influence in the overall sample. Yet, in the same vein as the benchmark[100] regression, the subsample analysis results show increasing linkages between the NOPI and the US-GCC stock market comovements.

[99] As previously mentioned, the harmonisation of interest rates between the US and the GCC countries causes the US interest rate effect to be positive.
[100] See Table 5.2.

Scaled oil price

The Scaled Oil Price (SOP) devised by Lee et al. (1995) is the second non-linear transformation applied in this study. The idea behind this specification is that oil price shocks depend on the stability of the oil price environment. In other words, a shock in a stable environment is more likely to have a profound impact on the economy than in a volatile environment. Jiménez-Rodríguez (2015) argues in favour of the superiority of this specification in capturing non-linear oil effects. Empirically, Lee et al. (1995), using quarterly data, extract the standardised residual of an AR(4) -GARCH(1,1) process. Since data in this chapter are sampled on a monthly basis, and for the sake of consistency, the calculations employ the standardised residuals of an AR(6)-GARCH (1, 1) model. Also, Since the SOP specification incorporates the conditional volatility of oil, the historical volatility variable (WTI^2) is dropped from the model.

The results in Table 5.4 Panel B show that the coefficient value of SOP is still negative but considerably lower than for NOPI, nevertheless it is statistically significant at 5% in the second sub-sample. The results also show that the VIX remains broadly significant across the different samples, while US macroeconomic variables are significant over the full sample, with inflation significant in the first sub-sample and interest rates significant in the second sub-sample. The world index is also significant in the second sub-sample.

Overall, both non-linear specifications reinforce the idea of the influence of the oil price over stock market comovements. However, unlike the conventional oil price variable, which is significant in the full sample, here both are exclusively significant in the second subsample. Nonetheless, both NOPI and SOP demonstrate an increasing influencing on the US-GCC correlation and reflect a robust impact of oil on the US-GCC correlation.

Implied oil volatility

Sadorsky (1999) states that a positive change in oil volatility is an indicator of oil price uncertainty. The same author maintains that oil volatility increases the option value linked to the waiting time to invest. He goes further in arguing that the high uncertainty may overshadow the change in oil price. This study uses the oil VIX index as a measure of oil price uncertainty.

The Chicago Board Options Exchange (CBOE) introduced the oil implied volatility (Oil VIX) in 2007 as a forward-looking measure of oil volatility. Empirically, it is calculated from both call and put options, therefore reflecting the market's expectations of future volatility. When fear is high, a risk premium follows, and options are priced with higher volatilities than the volatilities used when fear is low. In that sense, the implied volatility analysis tracks investor sentiment (Maghyereh et al., 2016).

The analysis incorporates the lagged implied volatility to replace the historical volatility. The lagged value is considered because the oil-VIX index is forward-looking. This is particularly important for the sake of comparability with the historical volatility employed in the benchmark model. Since the introduction of the oil-VIX index is recent and dates back to 2007, it is employed exclusively in the second subsample from 2009 to 2016. Viewing Table 5.4 Panel C, similar to historical volatility, oil VIX lacks significance in the US-GCC model.

5.5.5 Comparison with the EU

To assess the US-GCC correlation decomposition results, the EU[101] is introduced since it is one of the biggest economic blocs and among the largest importers of oil, yet, unlike the US, production is limited to the North Sea,[102] which is considerably lower than that of the US.

Turning to Table 5.5 Panel A, the EU-GCC correlation is significantly explained by oil price changes with a -0.07 coefficient that is almost identical to the US-GCC figure. From Table 5.5 Panel B, the first subsample outlines the absence of oil prices as a key factor for the EU-GCC correlation. Instead, the GCC industrial production has a predictable negative effect as a local factor. This result is in line with Pretorius (2002), who finds that the increase in industrial production growth differential decreases the interdependence. The VIX index also explains the variations in the EU-GCC interdependence. As illustrated in Table 5.5 Panel B, the recent subsample from 2009 to 2016 presents two major novelties; first, while trivial in the first subsample, the oil price coefficient records -0.14 in the second subsample. Second,

[101] I acknowledge that Norway is not part of the EU, but it is part of the MSCI EU index used

[102] Despite the Brexit vote, the UK still has the lion's share in the MSCI EU index with 28% of the capitalisation as of 2018.

with a coefficient of 0.5, oil volatility affects the interdependence significantly. The coefficient values in the overall sample are comparable to those of the US-GCC model. Nevertheless, this trend overshadows the US-GCC regression because both oil return and oil volatility are significant at 5%. This result is perhaps related to the US shale[103] oil revolution.

[103] Albeit evolving towards energy efficiency, the US has a more diversified economy when compared with the GCC.

TABLE 5. 5 EU-GCC CORRELATIONS ANALYSIS

	C	WTI	WTI^2	WORLD	VIX	EU-CPI	EU-IP	EU-IR	GCC-CPI	GCC-IP	GCC-IR	Adj. R^2	AIC
Panel A: Full sample analysis 2003M1 2016M12													
COEF	-0.0040	**-0.0711**	0.334438	-0.0322	**0.0502**	0.0077	-0.2371	0.0104	0.5906	-0.0125	0.0048	0.2020	-3.722
SE	(0.0044)	(0.0295)	(0.2446)	(0.0981)	(0.0187)	(0.0057)	(0.3416)	(0.0111)	(0.6923)	(0.0482)	(0.0221)		
Prob.	0.3687	0.0170	0.1735	0.7435	0.0080	0.1751	0.4887	0.3444	0.3948	0.7964	0.8283		
Panel B: Subsample analysis: 2003M1 2009M12													
COEF	-0.00199	-0.04054	0.191251	-0.1438	**0.0752**	0.0051	-0.3116	0.0357	1.0402	-0.1346	-0.0005	0.3226	-3.820
SE	(0.0057)	(0.0344)	(0.2893)	(0.0765)	(0.0296)	(0.0103)	(0.3575)	(0.0664)	(0.9237)	(0.0726)	(0.0223)		
Prob.	0.7298	0.2430	0.5107	0.0641	0.0132	0.6203	0.3863	0.5921	0.2638	0.0677	0.9801		
Subsample analysis: 2009M12 2016M12													
COEF	-0.004	**-0.1357**	**0.5727**	**0.3205**	0.0334	0.0060	-0.3764	0.0144	-1.433	0.0210	0.0322	0.2102	-3.657
SE	(0.0054)	(0.0488)	(0.2343)	(0.1171)	(0.0195)	(0.0073)	(0.5534)	(0.0107)	(0.9753)	(0.0566)	(0.1017)		
Prob.	0.4242	0.0069	0.0169	0.0078	0.0908	0.4118	0.4985	0.1796	0.1457	0.7106	0.7519		

Notes. The EU-GCC correlation is regressed on the following: oil prices (WTI), oil volatility (WTI^2), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the constant (C) and the VIX index (VIX). The entries are the coefficients with Huber-White standard errors (SE) in parentheses. AIC stands for Akaike information criterion. Concerning the fact that the correlation is a bound variable, between −1 and 1, applying the Fisher transformation of the correlation series does not affect the results. I emboldened coefficients with p-values less than 5%.

TABLE 5. 6 US-GCC CORRELATION ANALYSIS WITH ALTERNATIVE OIL PRICE SPECIFICATIONS

	C	NOPI	SOP	OIL-VIX	WTI^2	WORLD	VIX	EU-CPI	EU-IP	EU-IR	GCC-CPI	GCC-IP	GCC-IR	Adj. R^2	AIC
Panel A: Full sample analysis 2003M1 2016M12															
COEF	-0.0035	-0.1007			0.4582	-0.0401	**0.0553**	0.0035	-0.3288	0.0142	0.571	-0.0044	0.0035	0.1816	-3.680
SE	(0.0047)	(0.0628)			(0.2660)	(0.1025)	(0.0196)	(0.0055)	(0.3334)	(0.0110)	(0.7107)	(0.0526)	(0.0249)		
Prob.	0.4618	0.1110			0.0869	0.6956	0.0054	0.5217	0.3256	0.1968	0.4229	0.9328	0.8873		
COEF	-0.0010		**-0.0076**			-0.0481	**0.0584**	0.0064	-0.4432	0.0094	0.6857	-0.0068	0.0006	0.1621	-3.656
SE	(0.0038)		(0.0038)			(0.1160)	(0.0205)	(0.0059)	(0.3186)	(0.0109)	(0.7410)	(0.0511)	(0.0228)		
Prob.	0.8012		0.0479			0.6790	0.0049	0.2756	0.1661	0.3846	0.3562	0.8939	0.9758		
Panel B: Subsample analysis: 2003M1 2009M12															
COEF	-0.0026	-0.0087			0.2447	-0.1550	**0.0766**	0.0009	-0.3733	0.0379	1.0147	-0.1521	0.0009	0.3047	-3.759
SE	(0.0063)	(0.0710)			(0.3035)	(0.0816)	(0.0315)	(0.0108)	(0.3383)	(0.0678)	(0.9832)	(0.0811)	(0.0242)		
Prob.	0.6760	0.9029			0.4226	0.0619	0.0175	0.9326	0.2737	0.5779	0.3057	0.0649	0.9676		
COEF	0.000673		-0.0025			-0.1626	**0.0804**	0.0002	-0.522	0.0350	0.9019	-0.1428	-0.0012	0.3026	-3.754
SE	(0.0051)		(0.0038)			(0.0903)	(0.0330)	(0.0115)	(0.3840)	(0.0678)	(0.9873)	(0.0858)	(0.0233)		
Prob.	0.8959		0.5198			0.0762	0.0175	0.9819	0.1784	0.6070	0.3641	0.1005	0.9584		

Subsample analysis: 2009M12 2016M12

COEF	-0.0030	**-0.2439**			**0.7114**	**0.2539**	**0.0478**	0.0005	-0.4638	0.0201	0.6958	0.0726	0.0177	0.1585	-3.593
SE	(0.0058)	(0.1206)			(0.3080)	(0.1243)	(0.0219)	(0.0072)	(0.5715)	(0.0111)	(0.8592)	(0.0591)	(0.1175)		
Prob.	0.6040	0.0467			0.0237	0.0445	0.0316	0.9400	0.4197	0.0736	0.1776	0.2234	0.8801		
COEF	-0.0045		**-0.0172**			**0.2967**	0.0435	0.0092	-0.1083	0.01341	-0.4816	0.0186	0.0097	0.1435	-3.586
SE	(0.0048)		(0.0070)			(0.1351)	(0.0239)	(0.0081)	(0.6255)	(0.0118)	(1.0414)	(0.0574)	(0.1233)		
Prob.	0.3523		0.0162			0.0311	0.0726	0.2542	0.8630	0.2595	0.6451	0.7461	0.9369		
COEF	0.0012			**0.0553**		**0.2831**	0.0358	0.0077	-0.0694	0.0122	-1.3412	0.0026	0.0296	0.1968	-3.640
SE	(0.0054)			(0.0225)		(0.1207)	(0.0196)	(0.0080)	(0.5489)	(0.0137)	(0.9530)	(0.0610)	(0.1214)		
Prob.	0.8264			0.0162		0.0216	0.0712	0.3351	0.8998	0.3747	0.1635	0.9652	0.8074		

Notes. The notation is as follows: oil prices (WTI), oil volatility (WTI^2), Net Oil Price Increase (NOPI), Scaled Oil Price (SOP), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the constant (C), the VIX index (VIX) and the implied oil price volatility (OIL VIX). The entries are the coefficients with Huber-White standard errors (SE) in parentheses. AIC stands for Akaike information criterion. Concerning the fact that the correlation is a bound variable, between −1 and 1, applying the Fisher transformation of the correlation series does not affect the results. In the last equation in Panel C the oil price (WTI) is significant with -16.3 coefficient. I emboldened coefficients with p-values less than 5%.

Looking to Table 5.6 Panel A, resembling the standard oil price, the SOP confirms the significance of the oil price in the EU-GCC correlation. In line with the US-GCC model, Table 5.6 Panel B demonstrates the significance of both SOP and NOPI in the late sample from 2009 to 2016. In other words, the subsample analysis shows that both specifications demonstrate an upward impact on correlations.

TABLE 5.7 THE QUANTILE REGRESSION WITH FIVE PROCESS QUANTILES

US-GCC quantile regression with five process quantiles

	Quantile	COEF	SE	Prob.
WTI	0.20	-0.0098	0.0131	0.4543
	0.40	-0.0185	0.0159	0.2470
	0.50	-0.0314	0.0194	0.1078
	0.60	-0.0505	0.0460	0.2748
	0.80	**-0.1344**	0.0562	0.0180
WTI^2	0.20	0.1149	0.0974	0.2406
	0.40	0.1587	0.0882	0.0739
	0.50	0.1534	0.0853	0.0742
	0.60	0.0974	0.2071	0.6389
	0.80	**0.6515**	0.3078	0.0359

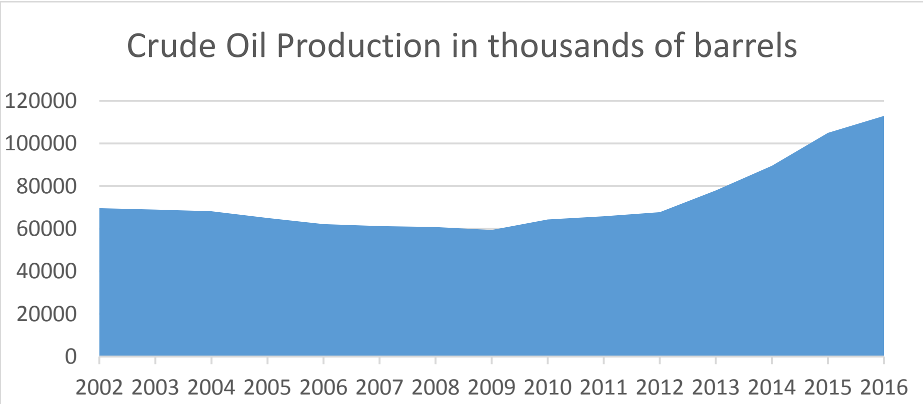
EU-GCC quantile regression with five process quantiles

	Quantile	COEF	SE	Prob.
WTI	0.20	-0.0139	0.0291	0.6350
	0.40	0.0103	0.0260	0.6942
	0.50	-0.0430	0.0394	0.2770
	0.60	-0.0662	0.0372	0.0779
	0.80	**-0.1798**	0.0475	0.0002
WTI^2	0.20	0.2529	0.2259	0.2647
	0.40	0.1370	0.2310	0.5541
	0.50	0.2248	0.1960	0.2534
	0.60	0.2043	0.1954	0.2977
	0.80	**0.7279**	0.2458	0.0035

Note. The quantile coefficients are simulated from a quantile regression that incorporates the GCC correlations with the US and the EU, oil innovations alongside the rest of global and local variables. Significant coefficients at 5% are emboldened. Please see appendix for the EU quantile process graph.

To sum up, full-sample regressions from 2003 to 2016 designate oil price changes as a strong factor influencing correlations in the US-GCC and EU-GCC pairs. The NOPI is weakly significant in the US-GCC regression, and the SOP is imperative in the EU-GCC model. While strengthening the argument for a strong oil impact on correlations, these results stress the relative dominance of linear effects. Subsample regressions document an increasing importance of oil in the interdependence process in all models. As depicted in Table 5.7, oil influence on the interdependence displays an upper tail dependence where the oil impact is magnified and significant in the upper tail of the correlations' conditional distribution. The lagged oil-VIX has a similar effect to historical volatility, where significance is manifested in the EU-GCC correlation. This supports the idea of an important role for oil volatility in the oil importing/exporting equity market comovements. The significance is exclusively observed in the EU-GCC; fundamentally, oil volatility, whether affecting a vital source of income as in the GCC, or a heavy burden on investments in the EU, is considered a substantial risk in both blocs due to the high exposure to oil. Contrary to that, as depicted in Figure 5.5, the US is marching towards oil sufficiency. Thanks to fracking technology, US oil production has almost doubled during the last seven years. Additionally, as of 2017, the US[104] is the biggest producer and consumer of oil globally. That being said, oil volatility as a source of risk has less overall impact on the US therefore limiting its impact on the US-GCC correlations.

FIGURE 5. 5 US CRUDE YEARLY OIL PRODUCTION



Notes. Thanks to fracking technology, US oil production has almost doubled during the last seven years. It is important to note that the US ban on exporting crude oil was lifted as of 2014 (Kilian, 2016).

Source: Thomson Reuters Datastream

5.6 Conclusions

The literature establishes a link between oil and stock returns (Sadorsky, 1999). The impact of oil on equities is argued to be asymmetric and depends on whether the country is an

[104] https://www.eia.gov/tools/faqs/faq.php?id=709&t=6.

oil importing or exporting nation (Bjørnland, 2009; Wang et al., 2013). This study contributes to the literature by establishing oil as one of the factors behind the comovements of stocks among oil importers and exporters. The study uses the US and the GCC to proxy for oil importers and exporters, respectively. Also, global and domestic factors are controlled for in a monthly sample from December 2002 to December 2016.

The study disentangles the drivers of stock market interdependence and establishes oil price changes and the VIX index as key influencers in the US-GCC interdependence process. A subsample analysis unveils an increasing propensity of oil impact on the US-GCC correlations. Also, oil and financial shocks coincided with breaks in the US-GCC equity-comovements. Finally, oil price innovations display an asymmetric tail dependence with the US-GCC correlations where the oil impact is more pronounced in the upper tail of the correlation's conditional distribution. To back up the significance of the results, different specifications of oil price and volatility are introduced. The NOPI and SOP confirm the significance of oil prices in explaining interdependence in the US-GCC pair. Furthermore, the EU, one of the largest oil-importing blocs, is employed for robustness. The outcome illustrates that oil returns and volatility are significant explanatory variables in the EU-GCC model.

While Hamilton (1983) stresses the importance of oil in explaining recessions, Cologni and Manera (2008) report a decreasing role of oil price shocks in explaining economic recessions. This means that the relationship between oil and economic downturns has lapsed. Cologni and Manera (2008) interpret that by the actions of monetary and fiscal authorities, in addition to progress in energy efficiency. In fact, the success of policy-makers should be expanded to counter risks associated with stock markets in the GCC bloc; oil price changes display an increasing role in influencing stock market interdependence; therefore, neglecting oil when forming policies may exacerbate the potential side effects of this high interdependence, such as financial spillovers (Karolyi and Stulz, 1996). Essentially, oil price ability to explain interdependence can provide the GCC policymakers with additional tools to mitigate the adverse impact of risk spillovers.

The significance of oil innovations and the VIX index in explaining the comovements of equity returns can provide investors with handy information for forecasting equity market comovements and therefore directly enhance portfolio management and asset allocation.

From the adjusted R^2 value in table 5.2, the US-GCC full sample model explains around 28% of the variation in US-GCC correlation. Given the complexity of asset pricing and comovements, this level is reasonable and consistent with previous studies like Pretorius, (2002). Although 72% could be attributed to other excluded variables or contagion, a substantial proportion of the interdependence can be explained by oil price movements and other macroeconomic fundamentals. This implies that there is still a possibility of diversification among oil importers and exporters, and international investors can simulate and predict where their best possibilities lie.

The time-varying analysis reveals that turbulent periods coincided with high correlations; this observation leads to Murphy's law of diversification "diversification opportunities are least available when they are most needed”. Likewise, Karolyi and Stulz (1996) argue that large shocks deter global diversification efforts. In other words, from a global portfolio management perspective, diversification will be less effective if asset returns are more correlated. The outcome shows that oil prices have a significant effect in the upper tail of the correlations’ conditional distribution. Given these findings, it is imperative to include oil as a factor in devising dynamic portfolios strategies in these markets.

Chapter 6
Conclusion

Motivated by increased stock market integration, the shale oil revolution and the financialization of oil markets, this dissertation examined the behaviour of GCC stock markets against instabilities in international financial markets and oil prices. In order to provide a vivid image of GCC markets, the dissertation inspected the topic from three different perspectives: first, the correlation and spillover dynamics in the GCC region, second, the impact of oil shocks on the GCC markets, and third, the role of oil, among other macroeconomic factors, in the GCC stock market interdependence process.

The key results of the thesis highlight the relative segregation of the GCC markets and the importance of the EU and the UAE in determining the inter- and intra-regional equity linkages, respectively. In terms of their reactions to oil shocks, similar to the financial markets of oil-exporting nations, the GCC markets are stimulated by oil precautionary demand shocks during bearish phases, yet, the intensity of the impact is significantly more pronounced. Also, oil price change is a key factor of the US-GCC and EU-GCC stock market interdependence. Finally, oil innovations display upper tail dependence with US-GCC and EU-GCC correlations.

While Chapter 2 presented a literature review and background information about the GCC markets and their particularities, Chapter 3, the first empirical chapter, examined the inter and intra-regional linkages in the GCC. In detail, the chapter studied the patterns of information transmission across the US, the EU, Japan and seven GCC countries over the period from 2004 to 2019. Using weekly data, correlations and spillovers were modelled through asymmetric dynamic conditional correlation and the spillover index. Findings reveal that while GCC markets exhibit increasing correlations primarily with the EU and, to a lesser extent, the US compared with the BRIC bloc, the GCC remains relatively less interlinked globally. Notably, findings support significant return and volatility spillovers from the EU and the US to the GCC markets, with the EU being stronger. Further, EU-related events, such as the Brexit vote, increased the EU-GCC correlations. Intra-regionally, the UAE is the main exporter and importer of spillovers between the GCC and world markets. Further, linkages within the GCC countries display a decoupling pattern, with pronounced segmentation in Bahrain and Kuwait.

Chapter 4 examined the oil influence on the GCC markets in contrast to their counterparts in oil-exporting and importing economies. Notably, Chapter 4 enriched the energy finance literature by detailing the oil-equity relation depending on the type of the oil shock, the energy profile of the country and the state of the financial market. Empirically, I relied on the Kilian (2009) structural VAR to distil the oil shocks in the first step. Subsequently, stock returns were regressed on oil price shocks in a quantile regression framework. The examination was carried whilst controlling for both Global Economic Policy Uncertainty (GEPU) and the VIX index and the span of data stretched from January 2002 to April 2018. The results reveal that while equities among oil-importers, in general, do not exhibit specific patterns in response to oil shocks, in oil-exporting nations, oil precautionary demand shocks have a favourable impact on equity returns and volatility. Among oil exporters, the link to oil price shocks is stronger within the GCC nations and the impact is more pronounced during bear market conditions.

Chapter 5, the final empirical section, focused on oil as one of the macroeconomic determinants of stock market interdependence in the context of oil importing and exporting countries. The analysis used monthly data from the period 2002 to 2016 and the US and GCC indices. The chapter reveals the joint importance of oil price innovations and the VIX index in the US-GCC correlation. Both oil and financial shocks caused structural breaks in the correlations. A subsample analysis disclosed an upward trend in the importance of oil price changes in the interdependence process. Also, oil price innovations display an asymmetric tail dependence with the US-GCC correlations, where the oil impact is more pronounced in the upper tail of the correlation's conditional distribution. Finally, the results remain robust when the sample is expanded to use the EU-GCC correlation.

This dissertation contributes to the literature by remapping the information transmission flow in the GCC. Characterizing the GCC markets behaviour in response to oil shocks is another contribution made possible using the Kilian (2009) method. Finally, for the first time in energy finance literature, oil price is presented as a macroeconomic determinant of GCC market comovements with the US and the EU. The core contribution of the dissertation is in the field of emerging markets finance; nonetheless, the dissertation also makes a number of contributions to several strands of literature including international finance, energy finance, stock market interdependence, and macroeconomic literature. Therefore, the overall contribution of the dissertation is in merging these several strands of literature to provide a vivid image of the GCC stock markets as an understudied subdivision of emerging markets.

In detail, Chapter 3 enriches the literature on the interrelationships between developed and emerging equities by focusing on the stock markets in the GCC bloc, which represent an increasingly attractive investment destination, yet still a marginally investigated subdivision of emerging markets. Principally, the chapter contributes to the literature by taking a broader outlook on the GCC bloc inter- and intra-regionally where linkages in mean and variance are modelled using both correlation and spillover analysis. The chapter contributes to the literature by expanding the scope of interactions as the examination includes major global developed markets (i.e. the US, the EU, and Japan). Therefore, Chapter 3 deviates from the classical GCC literature, wherein the focus is exclusively on the US and oil, hence the chapter sheds lights on the geography of information transformation mechanisms in the GCC bloc.

Chapter 4 contributes to academic efforts in understanding the interrelations between energy and equity markets. In particular, for the first time in the literature, the influence of oil on GCC equity markets is conducted using the Kilian (2009) decomposition wherein oil price innovations depend on their underlying sources as supply, demand and precautionary demand. Additionally, Chapter 4 contributes to the literature by comparing the GCC markets reactions to oil shocks with other oil-exporters. This highlights the relation between the dependence on oil in the economy and domestic equity markets reactions to oil shocks. Econometrically, Chapter 4 enriches the literature by combining the Kilian (2009) methodology with the quantile regression framework to test the influence of oil price shocks on global equity markets in oil importing and exporting nations. In essence, while the original methodology of Kilian (2009) and Kilian and Park (2009) relies on impulse responses from oil shocks to stock returns in a structural VAR, this study examines the impact of oil shocks on the conditional quantiles of return series. The former methodology focuses on the magnitude and time span of the shocks, while the latter emphasises the significance of oil shocks in different market conditions from boom to bearish.

Chapter 5 contributes to both the energy finance and the macroeconomic literature by establishing oil price as a key macroeconomic determinant of equity market comovements.

This is accomplished by combining three research aspects; first, the interdependence among international stock markets; second, the analysis of the determinants of equity markets comovements; third, the oil impact on financial markets. Moreover, to the best of my knowledge, this is the first attempt to analyse the macroeconomic influences on the GCC stock market interdependence wherein both mean and tail dependence are examined. Furthermore, this chapter adds to stock market interdependence literature by applying the Markov switching model to assess the stability of correlations. This method does not oblige predetermined dates of breaks like the Chow test (1960). Also, unlike the Bai and Perron (2003) method, this technique does not need trimming of observations to determine breaking points, thus, detecting breaks requires less observations. Finally, while the literature applies NOPI and SOP to test oil influence on stock returns, this is the first attempt to apply these specifications to establish a link between oil and stock market interdependence.

The above-mentioned results are of significance to domestic policymakers in the GCC attempting to formulate macroeconomic policies. Equally, the results can provide policymakers with extra tools in order to enhance their efforts at preserving financial market stability against potential spillover effects from oil and global equity markets. In parallel, the outcomes contribute to academic efforts in understanding the interrelations among financial markets in the context of frontier markets. Also, the thesis adds to academic efforts in understanding the link between energy and equity markets. From an investor's point of view, the thesis provides a fresh destination to achieve global equity diversification. Similarly, the outcome conveys implications for the kind of risk premium that has to be paid to an investor holding an international portfolio. Given the heterogeneity across GCC countries, this study's characterisation of individual markets improves investment choices and market portfolios for global investors. Furthermore, the thesis presents oil as a predictive tool to forecast equity market returns during different market conditions. Finally, this study concludes that oil is a key driver of the US-GCC interdependence, thus, constituting an important factor upon which to construct and balance portfolios.

From a theoretical standpoint, Chapter 3 contributes to the financial integration literature in the context of frontier markets and shows that the MCSI upgrades mirror a higher level of integration and information transmission in the case of Qatar and the UAE. Also, the varying degrees of volatility spillovers and correlation during stable and turbulent periods enrich the literature on financial contagion theory in the context of GCC financial markets. Chapter 4 contributes to the portfolio diversification theory by establishing oil prices as a barometer of diversification among oil-importing and exporting nations, which encourages more research attempts to target the diversification benefits from including equities from oil-exporting and importing nations in global portfolios. Chapter 5 adds to the financial contagion theory. Given that the influence of oil prices prevails in the upper tail of the correlation conditional distribution, and the latter is commonly associated with market turbulence, this chapter presents oil prices as a mean of financial contagion. The rationale stems from the fact that oil price drop is associated with deteriorated fundamentals in the GCC, thereby increasing their vulnerability to shocks originated elsewhere.

Concerning the weaknesses of the thesis, data availability is a major issue. For example, opening and closing prices are not available in the GCC. This prevented the calculation of range-based volatility as described by Garman and Klass (1980). Consequently, I had to rely on the squared returns which is a noisy historical volatility measure. Furthermore, the data in some GCC markets starts after the year 2000 which limits our understanding of relevant historical events such as the market crises in 1997, 1998 and 2001. Comparing the GCC reaction (net volatility spills and correlations) to previous crises to the ones observed in the study would have offered a perspective on evolvements in GCC market integration, GCC financial market depth and policymakers conduct. Another area for concern is the period of study; oil prices conduct has been abnormal, experiencing phases of explosive growth (2004-2008) and others of extreme decline (2014-2016). Thus, drawing conclusions from the thesis might be tricky during periods characterised with stability. Finally, the Kilian (2009) decomposition is only applicable to monthly data which limits the relevance of results to investors, especially short-term traders.

Finally, using a spillover index with time-varying parameters is a plausible avenue of future research to expand on in Chapter 3. In particular, a TVP-VAR[105] connectedness approach, proposed by Antonakakis and Gabauer (2017), is an extension to the Diebold and Yilmaz (2009, 2012) spillover index to overcome issues with specifying window length. Also, within the same chapter, a sectoral extension to the analysis would be another interesting avenue of research. Regarding the analysis in Chapter 4, future research could exploit the new method of Ready (2018); this technique offers an oil price decomposition by taking advantage of the forward-looking nature of traded financial asset prices. In doing so, this method allows empirical analysis to be conducted on higher frequency data. Future

[105] Time varying parameter.

research expanding[106] on Chapter 5 may introduce structural oil shocks instead of oil price changes. The methodology of Kilian and Murphy (2014)[107] is among the most popular in the field. The aforementioned decomposition proposes a speculative oil shock in addition to the supply and demand side shocks introduced in the original Kilian (2009) VAR.

[106] The decomposition of US-GCC and EU-GCC total spillover index or the net spillover from the Diebold and Yilmaz (2009, 2012) model into different macroeconomic variables did not provide meaningful results.
[107] I used structural oil shocks following the Kilian (2009) decomposition in the regressions, but the results were not telling. Also, expanding the sample of oil exporters to include Russia did not provide strong results.

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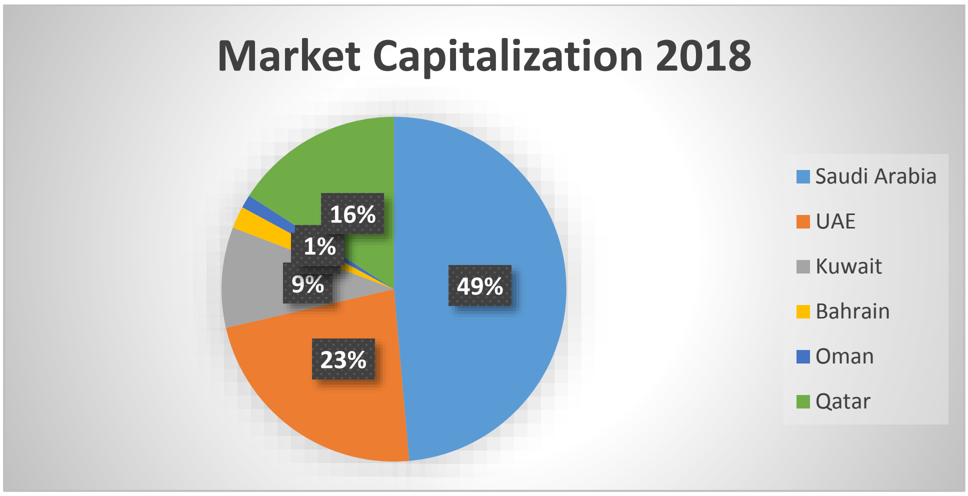
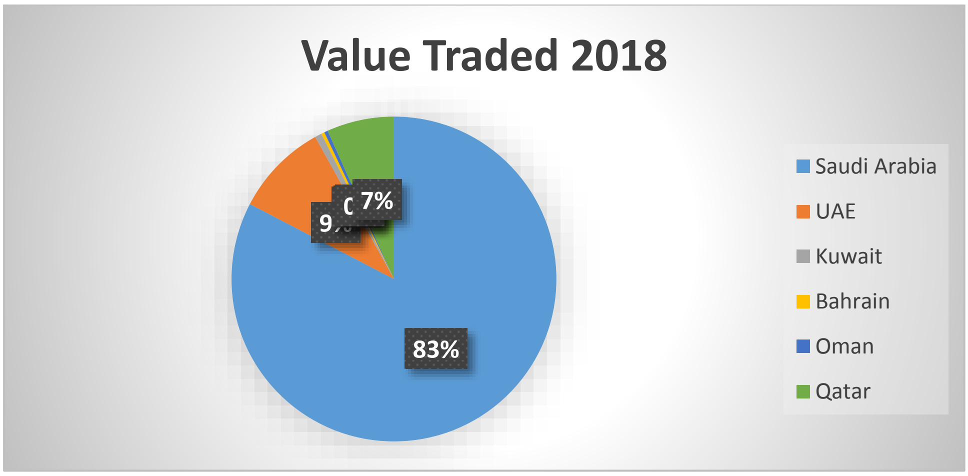
Appendix

Figure A.1 GCC markets stats 2018





Note. GCC markets breakdown in terms of capitalisation and value traded in 2011 and 2018.

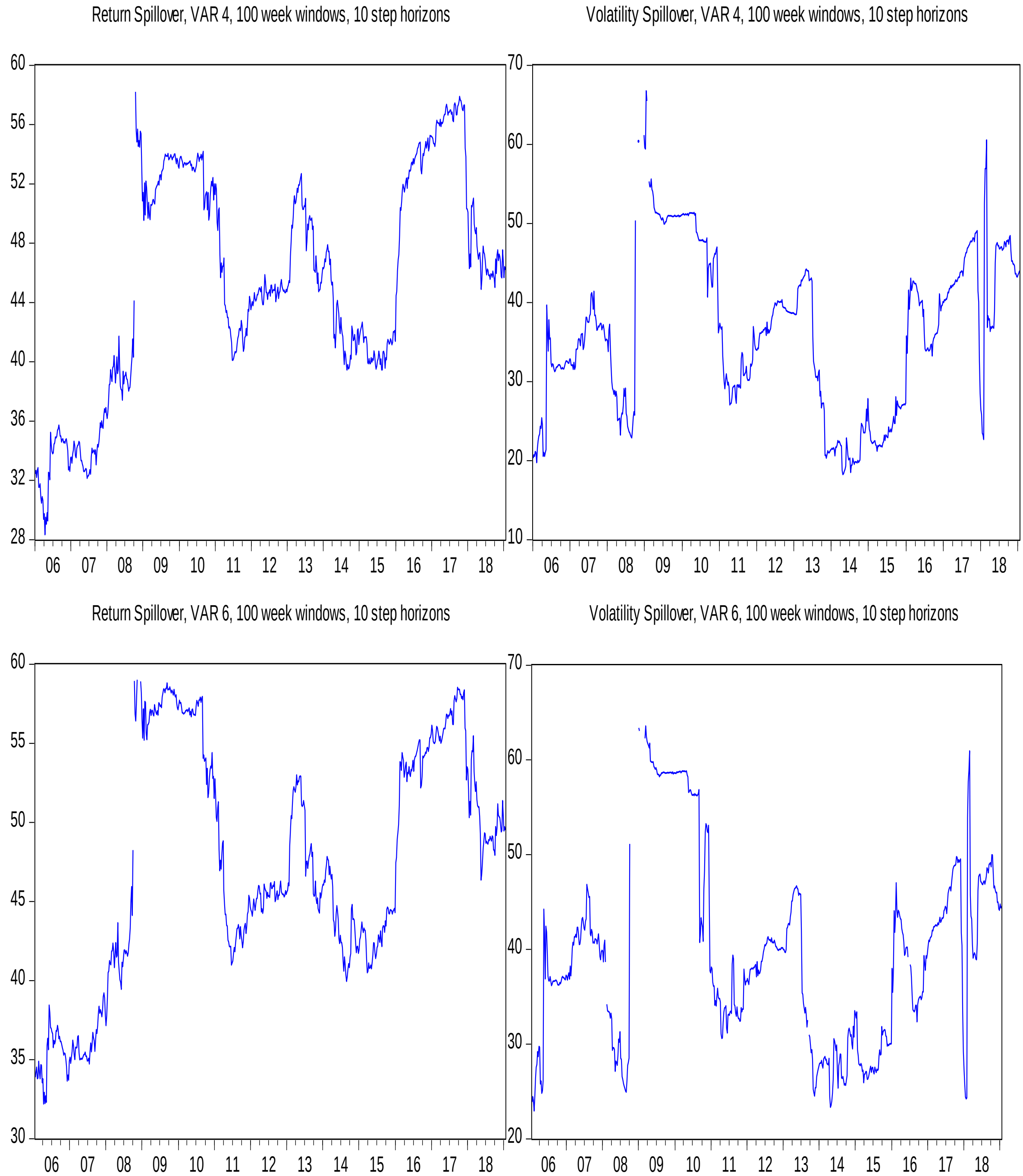
Source: Bloomberg

Figure A.2 Return and volatility spillover index using different VAR lags, forecast horizon and rolling window length.

Panel A: Return Spillover Index

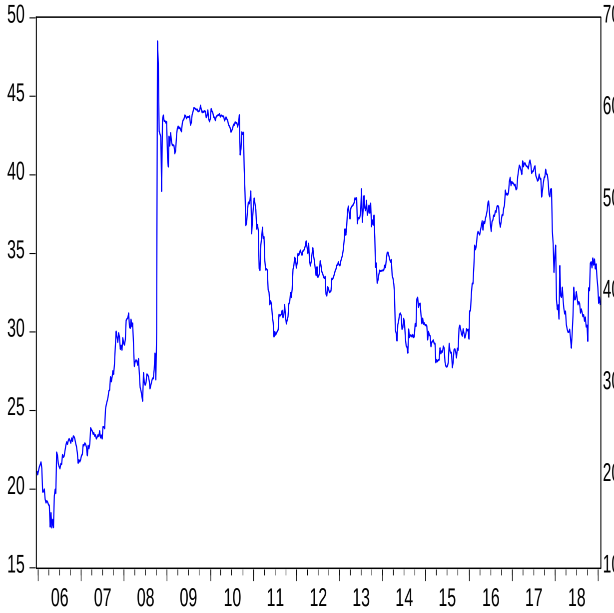
Panel B: Volatility Spillover Index

(I) VAR lag

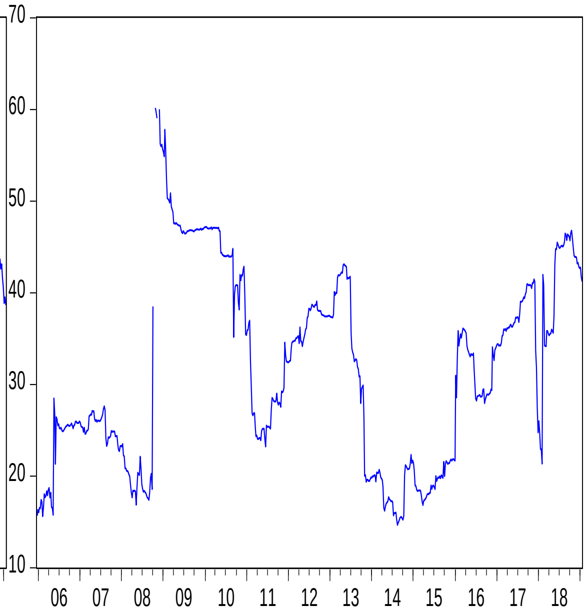


(II) Forecast Horizon

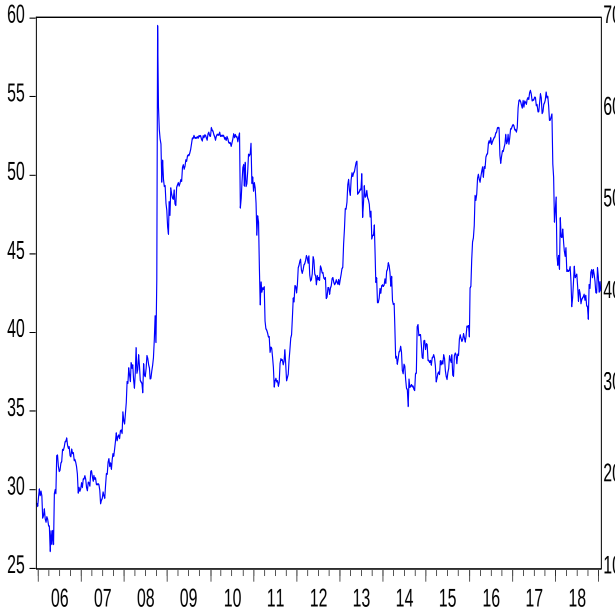
Return Spillover, VAR 2, 100 week windows, 4 step horizons



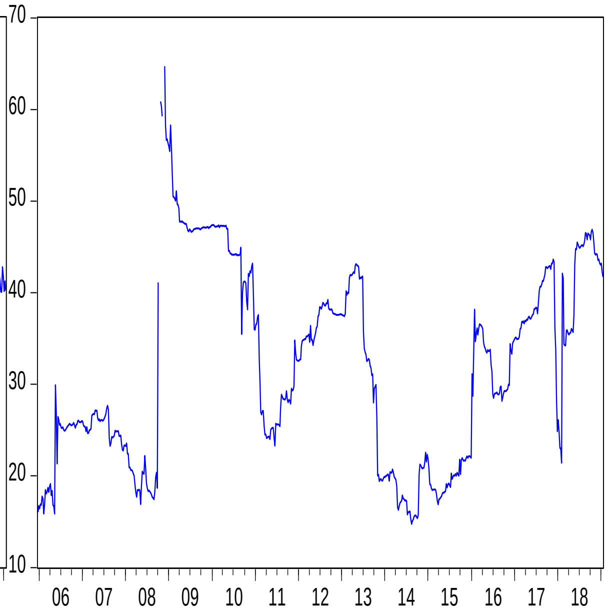
Volatility Spillove, VAR 2, 100 week windows, 4 step horizons



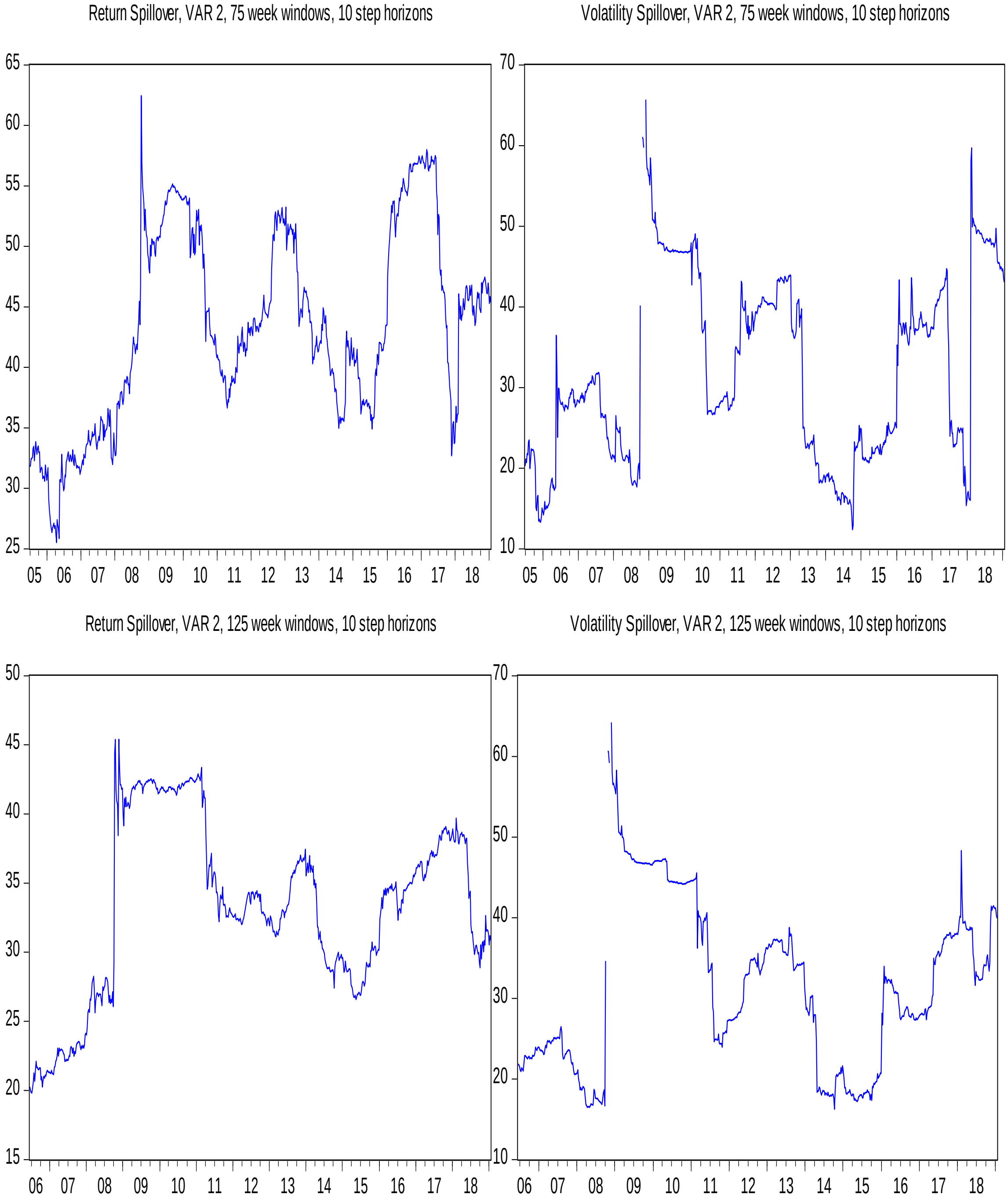
Retun Spillover, VAR 2, 100 week windows, 12 step horizons



Volatility Spillover, VAR 2, 100 week windows, 12 step horizons



(III) Rolling Window Length



Note. Panel A illustrates return and volatility spillover index for the US, the EU, Japan and the GCC using 4 and 6 VAR lags. Panel B depicts return and volatility spillover index for the US, the EU, Japan and the GCC using 4 and 12 week forecast horizon. Panel C illustrates return and volatility spillover index for the US, the EU, Japan and the GCC using 75 and 125 rolling window length.

Following Diebold and Yilmaz (2009; 2012), I carry out robustness tests on the spillover index of the baseline model of Chapter 3 (the US, the EU, Japan and the GCC). Figure A.2 shows the sensitivity of the spillover index to VAR lags, forecast horizon and rolling window length. While the standard model uses VAR 2, longer VAR lags of 4 and 6 do not change the results qualitatively. Diebold and Yilmaz (2015) report risk management and asset allocation considerations to determine the forecast horizon. That said, altering the forecast horizon from the standard 10-week to 4 and 12 does not change the spillover index significantly. Finally, I choose a 100-week rolling window length following Diebold and Yilmaz (2011) who, similar to this study, use weekly data. Diebold and Yilmaz (2015) report that the aim is not to over-smooth or under-smooth the series while setting the rolling window length. Accordingly, 75 and 125-week window lengths produce similar spillover indexes. Thus, the general conclusion is that the spillover index is robust to the choice of VAR lag, forecast horizon and window length.

Within Chapter 5, I examined the oil significance by using different price specifications such as the NOPI and SOP. Here, I provide robustness to the results of Chapter 5 by applying different modelling techniques to generate the correlations (dependent variable). In this section, correlations are modelled via the ADCC GJR GARCH, ADCC GARCH, DCC GJR GARCH and DCC GARCH. Again, the ADCC models account for asymmetry in covariance while the GJR models consider asymmetry in variance. Table A.1 depicts the results from regressing oil prices, oil volatility, the MSCI world index, the VIX index and local macroeconomic variables (Industrial production, interest rates and CPI) on US-GCC and EU-GCC correlations. The US-GCC model shows significance of oil price in all four specifications. Oil volatility is important in all models with the exception of the standard ADCC GJR GARCH. In the EU-GCC regression, Table A.1 shows that oil price is exclusively important in ADCC specifications. This means that EU-GCC correlations are explained by oil when asymmetry in covariance is accounted for. Interestingly, despite producing similar coefficients to the ADCC GJR GARCH, the ADCC GARCH yields the best R2 and AIC values (highest in the former and lowest in the latter). However, as seen in in Chapter 3, asymmetry in variance is important in the US and EU models and yields superior fit to the data.

Table A.1 Correlation decomposition of the US-GCC and EU-GCC

US-GCC correlations

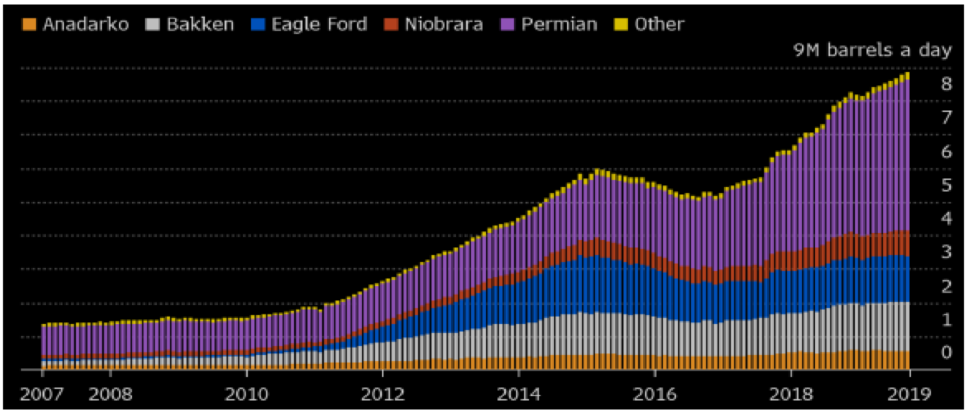
ADCC-GJR GARCH			ADCC GARCH			DCC GJR			DCC GARCH		
Variable	COEF	Prob.	Variable	COEF	Prob.	Variable	COEF	Prob.	Variable	COEF	Prob.
WTI	**-0.0681**	**0.0194**	WTI	**-0.0710**	**0.0058**	WTI	**-0.0375**	**0.0498**	WTI	**-0.0359**	**0.0395**
WTI^2	0.2801	0.1273	WTI^2	**0.6565**	**0.0005**	WTI^2	**0.3738**	**0.0001**	WTI^2	**0.3827**	**0.0001**
WORLD	0.0204	0.7724	WORLD	-0.0298	0.6608	WORLD	0.0212	0.68	WORLD	0.0283	0.5332
VIX	**0.0583**	**0.0116**	VIX	0.0175	0.4449	VIX	0.0128	0.4402	VIX	0.0126	0.3872
US-CPI	-0.5138	0.5487	US-CPI	-0.7742	0.3027	US-CPI	-0.8434	0.2161	US-CPI	-0.8864	0.1379
US-IR	**0.0543**	**0.0184**	US-IR	-0.0396	0.1449	US-IR	-0.0156	0.4149	US-IR	-0.0216	0.2519
US-IP	-0.3843	0.1486	US-IP	0.2845	0.2451	US-IP	0.0154	0.9453	US-IP	0.0508	0.7946
GCC-IP	-0.0276	0.4199	GCC-IP	0.0161	0.5926	GCC-IP	0.0003	0.9931	GCC-IP	-0.0024	0.9385
GCC-IR	-0.0223	0.2488	GCC-IR	0.0069	0.3893	GCC-IR	-0.0015	0.9234	GCC-IR	0.0030	0.7993
GCC-CPI	0.6025	0.4154	GCC-CPI	-0.7677	0.1969	GCC-CPI	-0.7723	0.0664	GCC-CPI	-0.7369	0.0531
C	-0.0029	0.5115	C	-0.0038	0.3033	C	-0.0010	0.7461	C	-0.0013	0.6076
Adj. R2	0.2982		Adj. R2	0.3383		Adj. R2	0.1444		Adj. R2	0.2032	
AIC	-4.0431		AIC	-4.3093		AIC	-4.4442		AIC	-4.7507	

EU-GCC correlations

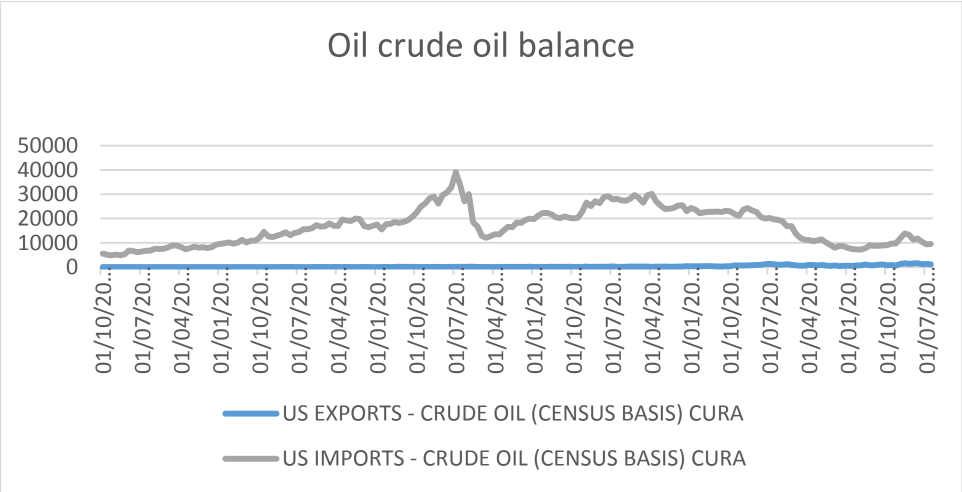
ADCC-GJR GARCH			ADCC GARCH			DCC GJR GARCH			DCC GARCH		
Variable	COEF	Prob.	Variable	COEF	Prob.	Variable	COEF	Prob.	Variable	COEF	Prob.
WTI	**-0.0711**	**0.0170**	WTI	**-0.0621**	**0.0193**	WTI	-0.0657	0.1033	WTI	-0.0538	0.1392
WTI^2	0.3344	0.1735	WTI^2	0.3650	0.1431	WTI^2	0.4904	0.1316	WTI^2	0.4867	0.1258
WORLD	-0.0322	0.7435	WORLD	-0.0661	0.5305	WORLD	0.0028	0.9814	WORLD	-0.0313	0.8022
VIX	**0.0502**	**0.0080**	VIX	**0.0505**	**0.0062**	VIX	0.0105	0.6695	VIX	0.0175	0.4519
EU-CPI	0.0077	0.1751	EU-CPI	0.0062	0.2079	EU-CPI	0.0072	0.3876	EU-CPI	0.0049	0.4938
EU-IP	-0.2371	0.4887	EU-IP	-0.1893	0.5401	EU-IP	-0.2262	0.6345	EU-IP	-0.2145	0.5986
EU-IR	0.0105	0.3444	EU-IR	0.0106	0.3212	EU-IR	0.0264	0.1480	EU-IR	0.0242	0.1668
GCC-IR	0.0048	0.8283	GCC-IR	0.0060	0.7626	GCC-IR	0.0106	0.8032	GCC-IR	0.0111	0.7647
GCC-IP	-0.0125	0.7964	GCC-IP	-0.0121	0.7634	GCC-IP	-0.0541	0.4558	GCC-IP	-0.0579	0.3720
GCC-CPI	0.5907	0.3948	GCC-CPI	0.7369	0.2703	GCC-CPI	-0.2324	0.8220	GCC-CPI	-0.1241	0.8987
C	-0.0040	0.3687	C	-0.0048	0.2304	C	-0.0035	0.5316	C	-0.0038	0.4571
Adj. R2	0.2020		Adj. R2	0.2721		Adj. R2	0.0477		Adj. R2	0.0762	
AIC	-3.7220		AIC	-3.9618		AIC	-3.0664		AIC	-3.2936	

Notes. The notation is as follows: oil price (WTI), oil volatility (WTI^2), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the Chicago Board Options Exchange stress index (VIX), the constant (C) and the dependent variables are US-GCC and EU-GCC correlations. Both variables are measured using ADCC GJR GARCH, GARCH, ADCC GARCH, DCC GJR GARCH and DCC GARCH. The entries are the coefficients with Huber-White standard errors (SE) in parentheses. AIC stands for Akaike information criterion. The first difference is applied to the correlation series, therefore the sample starts from January 2003. I emboldened coefficients with p-values less than 5%.

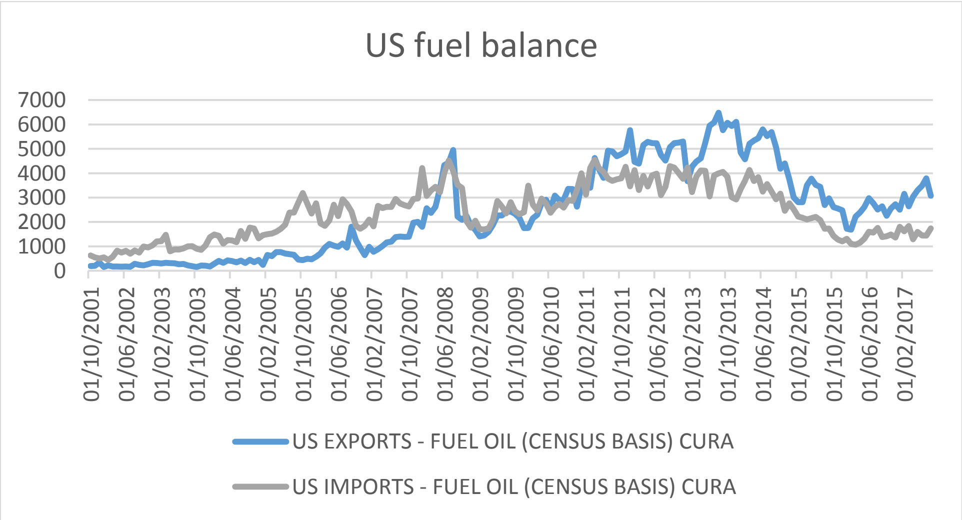
Figure A.3 facts about US oil production



Source. EIA drilling report



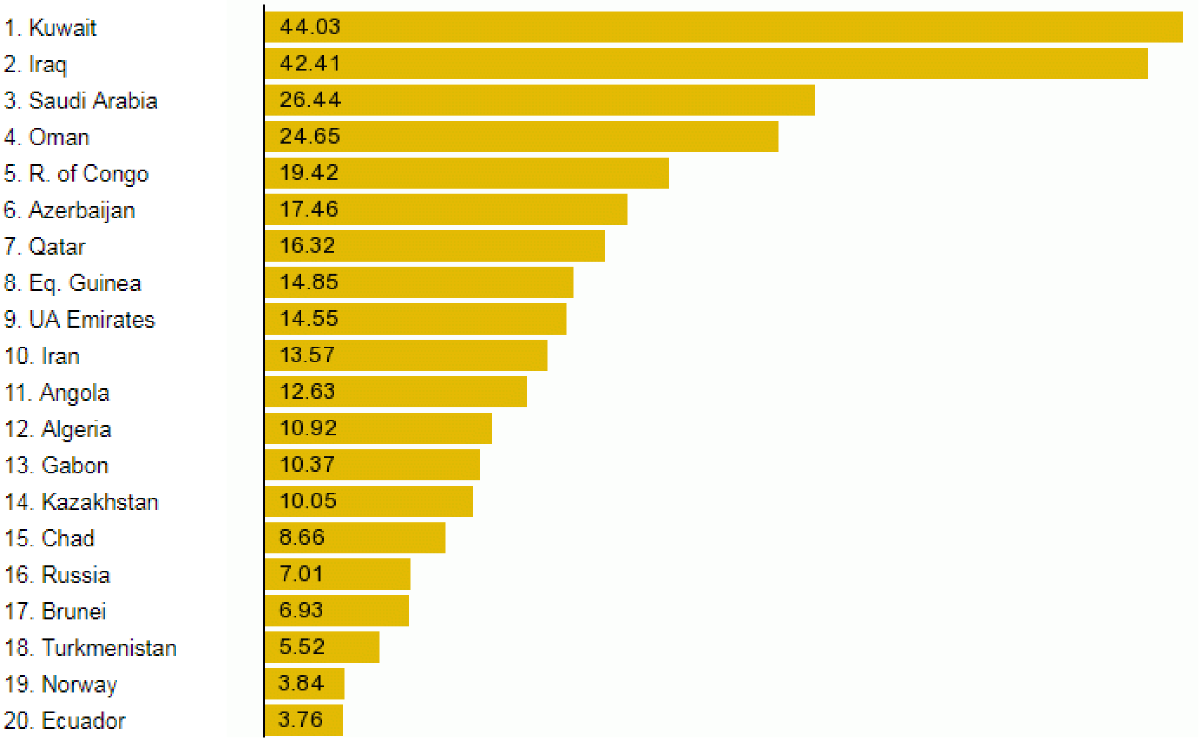
Source: Thompson Reuters DataStream



Note. The evolution of US crude oil and fuel trade balance.

Source: Thompson Reuters DataStream

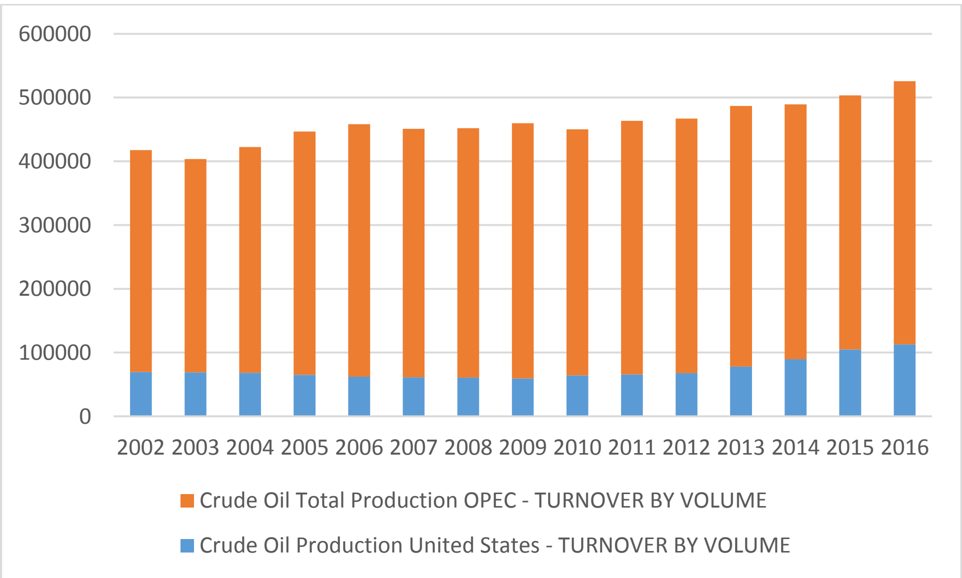
Figure A.4 Revenue minus oil production cost of oil as a percentage of the GDP in 2016



Note. Revenue minus oil production cost of oil as a percentage of the GDP in 2016 in oil exporting nations.

Source: The World Bank, TheGlobalEconomy.com

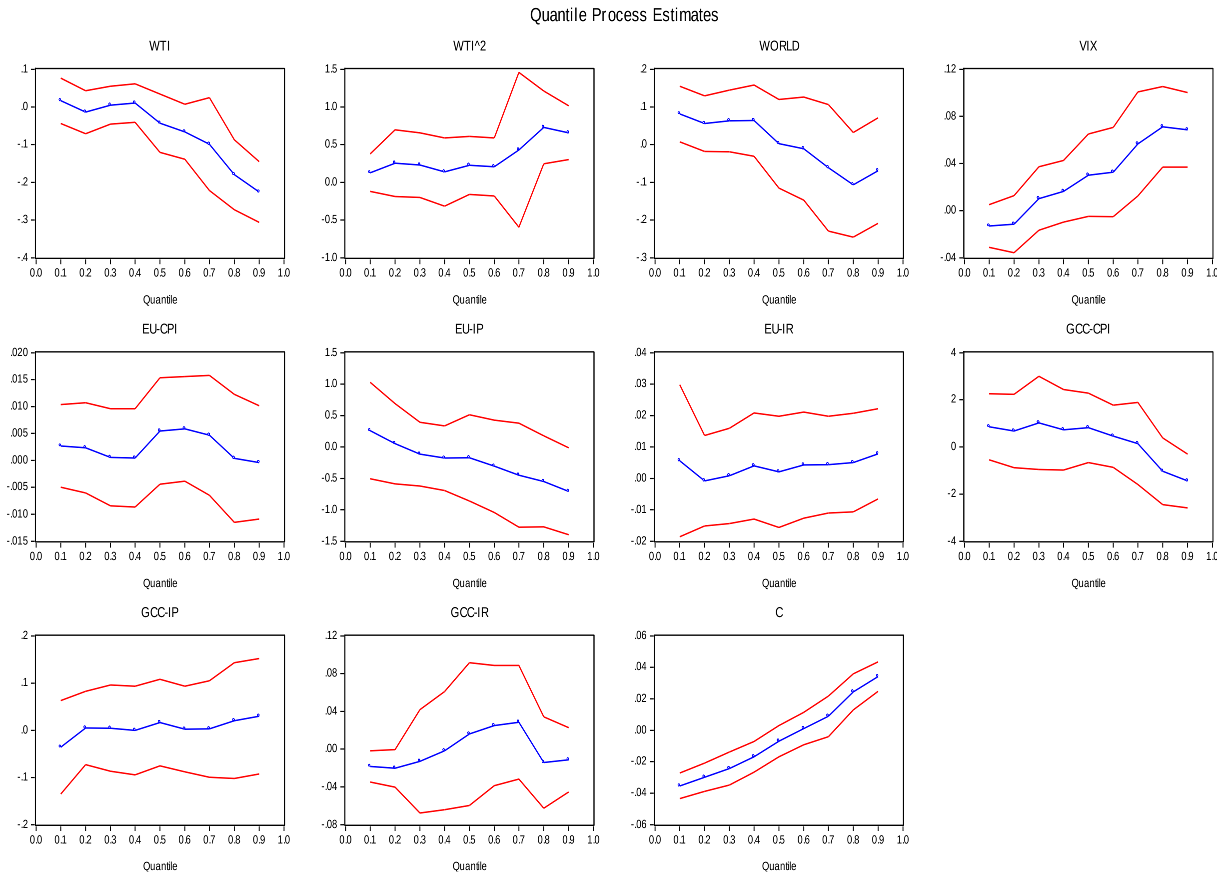
Figure A.5 OPEC vs US oil production in thousands of barrels



Note. The evolution of US total crude oil production the US and OPEC nations.

Source: Thomson Reuters DataStream

Figure A.6 EU-GCC quantile coefficient process



Notes. Quantile regression coefficients: vertical axes show coefficient estimates of variables over the stock returns distribution; horizontal axes depict the quantiles of the dependent variable; quantile regression error bars correspond to 95% confidence intervals. The notation is as follows: oil prices (WTI), oil volatility (WTI^2), Industrial Production Index (IP), Consumer Price Index (CPI), three-month-average interbank interest rates (IR), the MSCI world index (WORLD), the Chicago Board Options Exchange stress index (VIX), the constant (C) and the dependent variable is the US-GCC correlation. Concerning the fact that the correlation is a bound variable, between −1 and 1, applying the Fisher transformation of the correlation series does not affect the results.