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Oil Price Movements and Equity Returns: Evidence from the GCC Countries

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OIL PRICE MOVEMENTS AND EQUITY RETURNS

EVIDENCE FROM THE GCC COUNTRIES

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A Dissertation

Submitted in Partial Fulfillment of the Requirements for the

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ABSTRACT

This study examines to what extent how oil movements differently affect equity returns in general and sectoral levels of the GCC countries stock markets. Modeling the equity returns volatility requires using GARCH-type models. These models help to explore the pronounced differences of the conditional variance structures across sectors and markets. Chapter 1 compares the effects of changes in oil price return and its volatility on equity returns and volatility across sectors. The findings of this chapter show that despite the GCC states dependency on oil revenues, equity market performance at the sectoral level do not exactly associate with oil movements. Our results, in particular, show that the GCC stock markets do not always move hand-in-hand with oil market movements. In chapter 2, we explore the relationship within a specific sector, i.e. Banks sector in Saudi Arabia Stock market. We examine if oil price changes affect Islamic banks differently than conventional ones. The findings show a decrease in degree of co-movement between these two types of banking system and oil market, meaning that they are less integrated. Although the Islamic banks kept a higher degree of co-movement with oil, limitations of Shari'ah restrictions on Islamic banks have little impact on the relationship

between oil and those banks. Chapter 3 examines whether the level of corruption influences how oil changes affect the GCC stock markets. The findings of chapter 3 show that dissimilar levels of corruption between GCC countries have inconsiderable differences on the oil return effects on the GCC stock markets. Oil returns affect both low and high level of corruption groups. The oil return innovation affects the equity volatility for Saudi Arabia and Kuwait more than other four GCC countries.

DEDICATION

I would like to dedicate my work to my beloved parents: Mrs. Mubaraka and Mr. Masoud; and to my small family: my wife, Rajaa, and my little daughter, Amera. Without your patience, support, prayer, and most of all love, the completion of this work would not have been possible.

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CHAPTER 1

HETEROGENEITY OF SECTOR RESPONSES TO OIL PRICE CHANGES: EVIDENCE FROM THE GCC COUNTRIES

1. Introduction

Investigating the nature of the relationship between the energy market and stock market is still one of the challenging issues today. Important examples of the energy price impacts are on stock market returns. It is commonly believed that asset prices sensitively react to economic events. Oil as a global commodity plays a crucial role in economic news. The banking sector, for example, in a stock market might be influenced by these unanticipated events with more pervasive effect than are other sectors (see, Ratti and Hasan, 2013). Therefore, as the stock markets are scaled down to sector-level elements, the investigations of the equity index response to energy price instability have become more important elements for institutional and retail investors.

This study empirically examines the effects of oil changes on stock returns in oil-exporting countries where those changes allow for different effects in each sector in those equity markets. For example, the financial sector could differently respond to the changes from the industrial sector (see, Ratti and Hasan 2013). A large body of research has shown empirically that oil price changes can substantially influence equity prices either in oil-importing or oil-exporting countries. These studies have argued that oil-related volatility and investment decisions are connected (see, Hamilton, 1996, 2003; Barsky and Kilian, 2004; Hooker, 1996; Kilian, 2008\2009; Bjornland, 2000; Bernanke 1983; Kellogg 2010; Stein and Stone 2010).

This linkage to economies of oil-importing countries has been reported as negative (Wanga, Wua and Yang, 2013) while oil exporting economies are likely to benefit from oil price hikes (Arouri and Rault, 2012 and Degiannakis, Filis and Kizys, 2014). However, the attempts to investigate the dynamic relationship between oil price fluctuations and stock markets have been limited. An early paper conducted by Chen, Roll and Ross (1986), identifies the interaction between oil prices and stock prices. The authors use oil price risk to explain stock returns in the US. A pioneering paper of Jones and Kaul (1996) which utilitizes the standard cash-flow dividend valuation model shows that changes in oil prices have detrimental effects on output and real stock returns in four developed markets (Canada, Japan, the UK, and the US). Park and Ratti (2008) test the impact of oil price increases on monthly data of stock returns in the US and twelve European countries and they find negative effects except for Norway, the only studied oil-exporting country.

In the context of sectoral level returns, El-Sharif, Brown, Burton, Nixon and Russell (2005) test the relationship between crude oil prices and equity values of oil and gas sectors in the UK and their results show that a rise in oil prices raises the returns in the oil and gas sectors. Considering the volatility in the investigated model, Ratti and Hasan (2013) find that the general market index of returns responds negatively to oil returns increases while the volatility of this index falls as a response to an increase of volatility of oil price.

Most attention, nevertheless, paid to the developed economies and oil-importing countries, rather than those of oil-exporters. Indeed, the impact of oil changes on oil-exporting economies is certainly different from those of oil-importing countries. Oil price increases increase national income. Although the previous investigations primarily covered oil-importing countries, few studies investigate the interaction between oil prices and sectoral level equity prices in oil exporting countries.

Private investors in the Gulf region may hope that additional knowledge of analyzing the behavior of asset prices in sectoral level could help detect profitable trading opportunities and optimizing portfolio diversification. In other words, separating pure industry-specific returns from the market could help in robust risk management, performance attribution, and investment skill evaluation. Therefore, we focus on the sectoral level analyzing on the Gulf Cooperation Council (GCC) countries as oil-exporting countries.

Recently the U.S. Energy Information Administration (EIA) has ranked three states of the GCC countries as top world oil net exporters (EIA Report, 2012). The GCC countries are the major oil suppliers in world energy markets and the responses of equity returns in GCC stock markets to oil price movements are likely sensitive. In addition, GCC stock markets commonly react to regional political events that differs them from developed and other emerging markets. The recent global trend of increasing oil prices brings more money flows to the GCC region, which is positively affecting listed sectors in the stock markets. Therefore, understanding the impact of oil changes on the GCC stock market returns at the industrial level can help investors make necessary investment decisions and offer new information to policy-makers who regulate stock markets. Consequently, a study centered on the GCC countries should be of great interest.

Several works have tested the relationship between oil and stock markets in the GCC countries. For instance, Hammoudeh and Aleisa (2004) examine the link of oil prices to stock prices for five members (Bahrain, Kuwait, Oman, Saudi Arabia, and the United Arab Emirates) of the GCC. The results of this study show that a bi-directional relationship between oil prices and stock prices only exists for the Saudi Arabian stock market. Using a vector autoregression (VAR) approach to investigate the links between oil price changes and stock market returns in the GCC countries, Abu-Zarour (2006) finds evidence of predictive power between them only in

Saudi and Oman. Arouri, Lahiani and Nguyen (2011) use a VAR- autoregressive conditional heteroskedasticity (GARCH) model and investigate the return linkage and volatility transmission between oil and stock markets in the GCC countries. The results confirm the existence of substantial return and volatility spillovers between world oil prices and GCC stock markets.

The main purpose of this paper is to contribute to the stock market and energy price literature by investigating the influence of volatility and returns of oil prices on oil-exporting countries stock market returns at the sectoral level. In particular, this study examines the effect of oil changes and volatility on equity return in the sectors of the GCC countries. Unlike the majority of preceding studies, we employ higher frequency data to adequately capture the rapidity and intensity of the dynamic interactions between oil and stock prices in the GCC region. Since we are interested in investigating the effect of oil return unpredictability on the volatility of stock market returns, the exponential generalized autoregressive conditionally heteroskedastic (EGARCH) type model proposed by Nelson (1991) is employed in this study.

The remainder of this chapter is organized as follows: section 2 describes the background of the GCC stock markets. Section 3 provides the data set. The econometric model is presented in section 4. Section 5 represents empirical results of supersectoral and sectoral levels and the conclusion is provided in section 6.

2. A Brief Overview of the GCC Stock Markets

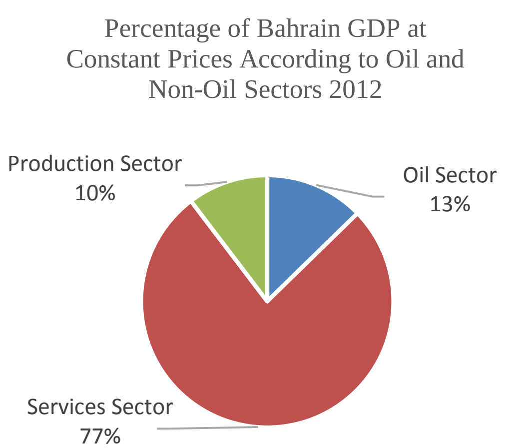
Table 1.1 presents summary of key financial indicators in each of six GCC countries in 2013. Two decades ago the listed companies on the GCC markets were less than 200 companies while it is shown that more than 659 companies are listed in the same markets in 2013.

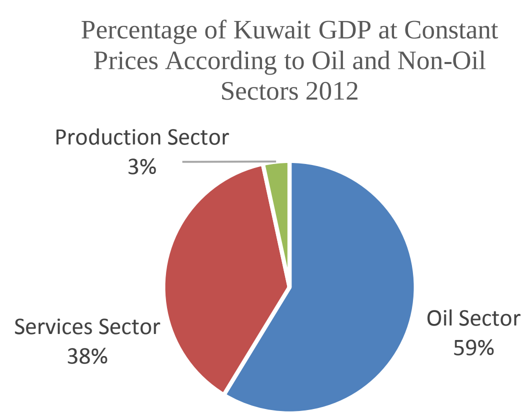
Table 1.1. *The Economies and Stock Markets of GCC Countries in 2013*

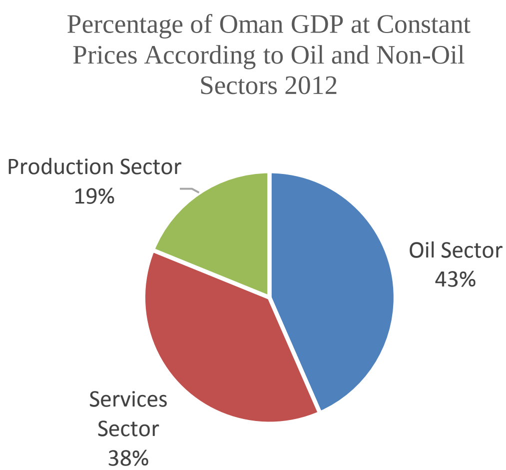
Market	Number of Sectors	Number of Companies	Market Capitalization ($ Million)	Market Capitalization (percent GDP)
Bahrain	6	47	17545	67
Kuwait	14*	210	113486	94
Oman	3	131	34950	59
Qatar	7	42	143923	154
Saudi Arabia	15	163	422849	57
UAE	8	66	99509	26

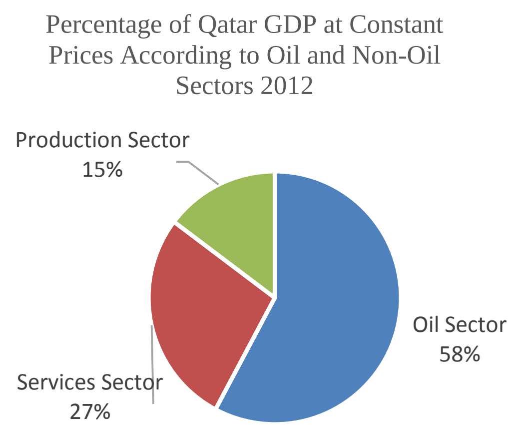
Sources: Arab Monetary Fund and Emerging Markets Database (Third quarter report, 2013);GCC Countries Central Banks 2013, GCC Stock Markets Reports 2013

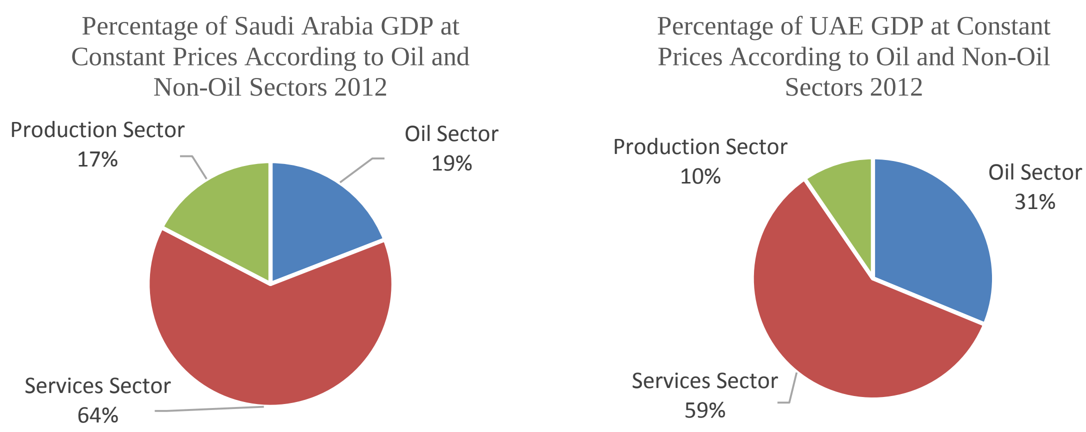
* These sectors represent the new classifications of Kuwait stock market (May 2012)











Sources: The GCC countries' Central Banks Annual Reports 2012/2013, Saudi Annual National Accounts report 2012 and National Bureau Of Statistics of UAE, National Accounts Estimates 2001-2013

Figure 1.1. Percentage of GCC countries GDP at Constant Prices According to Oil and Non-Oil Sectors in 2012

For the purpose of comparison, the sectors of economies in the GCC countries are regrouped into three major sectors: the oil sector, the production sector, and the services sector. The first sector includes the oil and gas sectors. The production sector includes manufacturing, mining and quarrying, agriculture, forestry and fishing, and non-petroleum industrial sectors. The services sector includes all other sectors such as: the construction, wholesale and retail, trade, restaurants and hotels, transport, storage and communication, finance, insurance, real estate and business services, community, social and personal services, imputed bank services charge, producers of government services, import duties sectors. Although the GCC countries income depend mainly on oil revenues, Figure 1.1 shows that non-oil sectors represent a bigger share of gross domestic product (GDP) in three GCC countries (i.e. Bahrain, Saudi Arabia, and UAE). The share of the oil sector in GDP ranges from 13 percent in Bahrain to 59 percent in Kuwait. Difference in relative size could a reason explains why oil changes differently affect sectors in stock markets across GCC countries.

On the other hand, external and internal oil changes can have different effects on financial series and pointing out the distinction between those changes is important to define the channels of direct and indirect oil effects on equity returns. Given their importance in the transportation and industrial end-use sectors, the International Energy Outlooks (2010\2011\2013) show that oil remain the world's largest energy. World use of oil and its production went from 86.1 million barrels per day in 2007 to 85.7 million barrels per day in 2008 to 87 million barrels per day in 2010. Therefore, decline in oil consumption in 2008 indicating a presence of reduction in external demand for oil. Because the GCC countries are members of the Organization of the Petroleum Exporting Countries (OPEC), quotas limit their oil productions. Changes in these quotas indicate internal supply shocks. Therefore, these types of changes could affect the relationship between oil movements and equity returns in different channels.

3. Data

Our return series are high frequency, i.e. daily data. The data set spans different periods for different sectors. Dates of inclusion are provided in the appendix A. Six GCC stock markets are used in this work as a sample of oil-exporting countries stock markets: Bahrain Stock Exchange (BSE), Kuwait Stock Exchange (KSE), Muscat Securities Market (MSM), Qatar Exchange (QE), Saudi Stock Exchange (Tadawul), and Abu Dhabi Securities Exchange (ADX). Daily stock market indices and closing equity prices are extracted from Bloomberg. Moreover, the historical daily data set of Kuwait stock exchange market index and sectors' indices is obtained from KSE. Since the Kuwait market data needs to be adjusted from Kuwaiti Dinar to US dollars, we use the exchange rate data, which also is obtained from Bloomberg, to convert them to US dollars. The ADX has been chosen to represent the stock market of United Arab Emirates. Daily data for the international Brent crude oil prices (US Dollars per barrel), which serves as a major benchmark price for purchases of oil worldwide, are obtained from the U.S. Department of Energy: Energy Information Administration (EIA). The daily returns are calculated from daily closing asset prices by taking the growth rate ratio of two successive prices as follows:

$$r_t = \left(\frac{Price_t - Price_{t-1}}{Price_{t-1}}\right) * 100; \quad t = 2,3,\ldots,T$$

where r_t is the daily asset returns and T is time period (days). Specifically, the term $\left(\frac{Price_t - Price_{t-1}}{Price_{t-1}}\right)$ is the capital gain/loss of $Price$ from period $t-1$ to t. All price data is denominated in the US dollars to avoid the impacts of exchange rates and to ease the comparison across markets[1]. To minimize the effects of cross-market differences in weekend and holiday market closures, we use daily returns, defined as growth rate of market indices for days running from Monday to Thursday[2]. The variation of timing and classifications of the data are shown with more detail in appendix A. A disadvantage of this data set is that the number of sectors provided differs across countries. For example, Saudi Arabia has fifteen sectors given whereas a stock market of Oman grouped the sectors into three categories (Supersectors). To make sectors comparable, we aggregate sectors into the three supersectors: Financial sector, Industrial sector and Services sector (excluding financial sector). The specific sectors in each supersector are included in the appendix A. A market capitalization weighting method is employed here to get the supersector categories for each country as follows:

$$supr_s = \sum_{i=1}^{n} w_{i,s} \times secr_{i,s}, \qquad s = 1,2,3;\ i = 1,2,\ldots,n$$

[1] Due to the pegging of the GCC currencies to the US dollars, all equity closing prices used in this work are presented in the USD also making the comparison between domestic indices and international crude oil prices easier.

[2] The global oil market closes on Saturday and Sunday while the GCC markets close on Friday and Saturday. Therefore, the combined weekly trading days in different markets are running from Monday to Thursday.

where $supr_s$ is supersector return for each set of supersectors s; $secr_{i,s}$ is the related sector return for each sector i under supsector s. $W_{i,s}$ is the coefficient of market capitalization weight for each sector. This coefficient is structured as[3]:

$$w_{i,s} = \frac{secmc_{i,s}}{secmc_{1.s} + secmc_{2.s} + \cdots + secmc_{n.s}}$$

where $secmc_{i,s}$ is the sector market capitalization of the sector i under the supersector s, and n is number of sectors in s supersectors.

3.1. Descriptive Statistics

The summary statistics of the supersectoral level data are given in Table 1.2. It is obvious that the average returns are small in comparison to the standard deviation of returns in each case. Furthermore, the standard deviation of returns in each sector is less than the standard deviation of oil price returns. Negative skewness is observed for general and most of supersectoral series, which indicates a long left fat tail, while a right fat tail is identified for the positive skewed Kuwaiti financial and industrial supersectors, Saudi financial supersectors, Emiratis industrial and services supersectors and oil series. High kurtosis in the data sample indicates that the distribution is more highly peaked than the curvature found in a normal distribution. Therefore, the empirical distribution has more weight in the tails. Financial literature (see, Wang and Fawson, 2001) argues that daily or higher frequency market returns typically have skewed and leptokurtic conditional and unconditional distributions instead of normal ones.

[3] Due to the data availability for Qatar Exchange Market, weights calculated in 2012 are used to group the sectors into supersectors for the time period of 2007-2012.

Table 1.2. *Description Statistics of Equity Supersectors and Oil Returns*

State	Indices	mean	sd	min	max	skewness	kurtosis	N
Bahrain	General Index	-0.0372	0.6988	-6.3919	2.7162	-1.4081	13.3497	1435
	Financial Supersector	-0.0145	1.0117	-7.7353	6.3976	-0.7126	13.5397	1435
	Industrial Supersector	-0.0334	1.1945	-10.1591	11.4538	-0.2521	32.3757	1435
	Services Supersector	-0.0186	0.782	-8.0869	6.1765	-1.0262	23.6663	1435
	Oil	0.0743	2.4408	-11.7236	27.9732	0.9209	17.3669	1435
Kuwait	General Index	0.0487	0.7804	-3.3515	3.0978	-0.0589	6.4748	323
	Financial Supersector	0.1367	1.7959	-6.1085	7.2661	0.413	5.5275	323
	Industrial Supersector	0.0459	0.7261	-2.8	3.1564	0.0187	6.0809	323
	Services Supersector	0.026	0.7635	-2.916	2.5562	-0.1689	4.4993	263
	Oil	0.0083	1.4577	-5.8925	4.8384	-0.211	4.3832	323
Oman	General Index	0.026	1.3819	-15.1105	10.8079	-1.0452	25.1801	1400
	Financial Supersector	0.0223	1.6271	-16.9809	11.7319	-0.7191	21.548	1400
	Industrial Supersector	0.078	1.6264	-15.4112	10.6028	-0.7475	17.0922	1400
	Services Supersector	0.0407	1.2458	-12.8518	9.2648	-1.0664	23.3348	1400
	Oil	0.0747	2.5091	-11.7236	34.192	1.7153	28.8709	1400
Qatar	General Index	0.0794	1.5488	-11.6121	11.3004	-0.7322	15.8064	1415
	Financial Supersector	0.0737	1.6832	-12.7805	10.7217	-0.904	15.4907	1415
	Industrial Supersector	0.105	1.8025	-11.8214	11.7486	-0.1539	12.0622	1415
	Services Supersector	0.082	1.441	-13.8476	9.761	-0.7192	19.7517	1415
	Oil	0.0777	2.4939	-11.7236	27.9732	0.9056	16.6513	1415
Saudi Arabia	General Index	0.0324	1.8553	-13.2935	11.7902	-0.6711	12.0307	1100
	Financial Supersector	0.0067	1.9054	-10.2582	14.073	0.2695	10.7846	1100
	Industrial Supersector	0.0654	2.1303	-15.3739	12.1995	-0.711	12.2619	1100
	Services Supersector	0.0672	1.8751	-16.4679	11.1302	-0.9157	15.9761	1100
	Oil	0.1058	2.8468	-17.0242	27.9732	1.1943	17.3478	1100
UAE	General Index	0.0222	1.3013	-10.0725	12.7389	-0.1671	17.8903	1500
	Financial Supersector	0.0327	1.4768	-11.8068	13.9022	-0.1482	15.291	1500
	Industrial Supersector	-0.0154	1.7152	-8.931	13.6788	0.2403	9.3798	1500
	Services Supersector	0.0238	1.4639	-9.3701	11.1974	0.0558	13.9554	1500
	Oil	0.0574	2.4474	-11.7236	27.9732	0.9071	16.5704	1500

Figure 1.2 shows how the returns series evolved during the samples' periods. Obviously, the three indices volatility in all countries is heightened during financial crisis of 2008- 2009. Negative returns are more pronounced than positive ones in this period. Furthermore, these indices tend to be associated with oil movements. Financial and industrial supersectors have

similar swings and they follow the same patterns while the services supersectors have less volatility during the sample period. The indices and oil returns look more stable after the financial crisis.

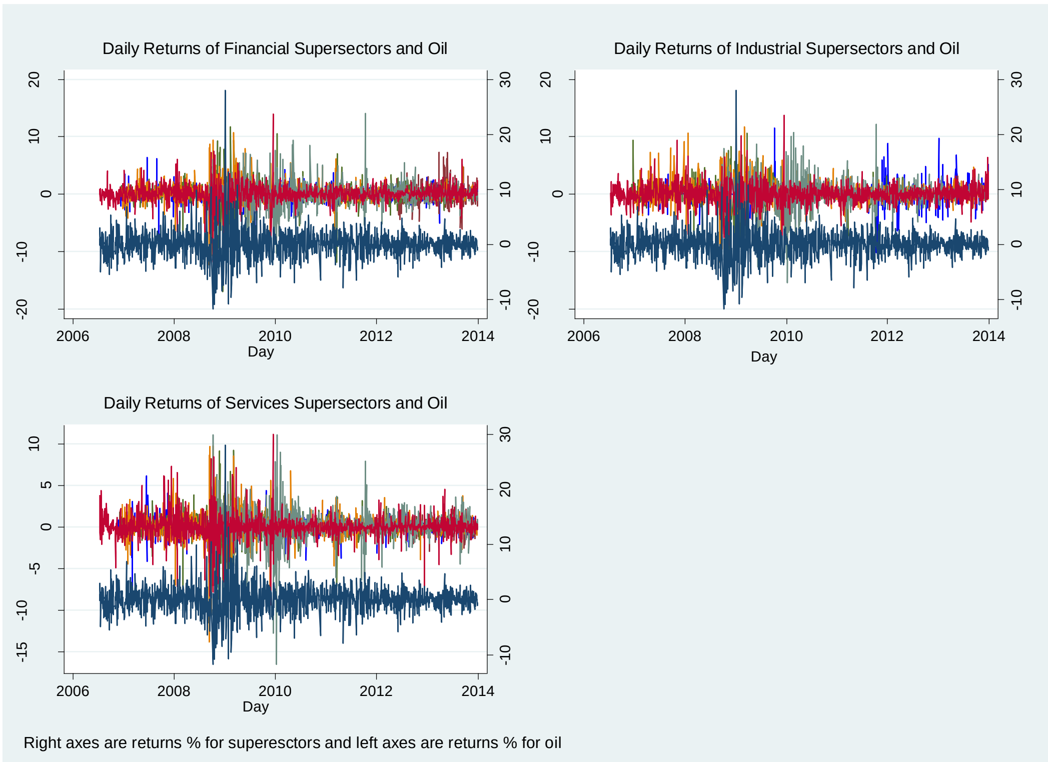


Figure 1.2. Daily Returns of Supersectors Indices (by countries) and Oil

As shown in Figure 1.3, most of supersector indices follow the oil price changes. However, it is clear that the magnitudes of those indices' changes are different from each other. In particular, Saudi supersectors, for example, have different responses to oil price declines during financial crisis. In addition, the industrial supersector of Bahrain is less responsive to oil changes until the beginning of 2012. This could be because of so many zero returns in most industrial equity sectors in Bahrain. On the other hand, while some indices are positively related to oil, other indices show negative relationships.

Figure 1.3. The Movements of (Log) Supersectoral Indices and Oil

As shown in Table 1.3, statistically significant positive correlations between general and supersectors and oil are revealed for Oman, Qatar, Saudi Arabia and UAE indicating that the Bahrain and Kuwait equity indices are less connected to oil changes. However, it is shown that the Oman and Saudi Arabia supersectors have higher positive correlations than the supersectors in Qatar and UAE.

Table 1.3. *Correlations of Oil Returns to Supersectors Returns*

Indices	General Index	Financial Supersector	Industrial Supersector	Services Supersector
Bahrain	0.0153	0.0006	0.0182	0.0311
Kuwait	0.0514	0.0697	0.0275	0.062
Oman	0.2167*	0.1948*	0.2035*	0.2050*
Qatar	0.1455*	0.1627*	0.1046*	0.1465*
Saudi Arabia	0.2553*	0.2058*	0.2863*	0.1796*
UAE	0.1816*	0.1797*	0.1579*	0.1032*

Note: * Statistically significant at both the 0.01, 0.05 significant level.

4. Econometric Model

Higher volatilities raise the risk of assets so that modeling the volatility is a crucial element to capture the impacts of oil price changes on the equity returns. A stylized fact in stock markets is that downward movements are followed by higher volatility than upward movements. A Leverage effect (Black, 1976) is another encountered phenomenon in equity markets, this effect occurs when equity price changes are negatively correlated with movements in volatility. Given the limitations of return series distributions, volatility clustering, and leptokurtosis that are observed in our financial time series, EGARCH by Nelson (1991) is an attractive vehicle for handling analysis. The analysis helps us to investigate the heterogeneity sector response to oil price changes and its volatility. We get advantages of EGARCH-in-mean (EGARCH-M) model to model the simultaneous effect of oil price return volatility on equity price returns and returns volatility over time. Two equations are involved in the EGARCH-M model: The mean equation and the conditional volatility equation. In this work, we follow Ratti and Hasan (2013) specifications. In general, the GARCH (p,q) type models have p lags on the conditional variance term and q on the squared error term. Our model is an EGARCH (1,1) which is documented as the most sufficient model for financial data. The mean equation allows the volatility to influence stock price return. An oil return and volatility betas can be calculated by estimating the following EGARCH-M model[4]:

$$r_{i,t} = \gamma_i + \beta_{i1} r_{i,t-1} + \beta_{i2} r_{m,t} + \beta_{i3} r_{o,t} + \beta_{i4} ln\sigma^2_{o,t-1} + \beta_{i5} lnh^2_{i,t} + \varepsilon_{i,t},$$

$$i = 1,2,\dots,N; \text{ where } \quad \varepsilon_{i,t}|\Omega_{t-1} \sim N\left(0, h^2_{i,t}\right) \qquad (1)$$

and the variance equation of EGARCH model is as follows:

$$lnh^2_{i,t} = \theta_{i0} + \theta_{i1} lnh^2_{i,t-1} + \delta_{i1}\left|z_{i,t-1}\right| + \delta_{i2} z_{i,t-1} + \rho_i ln\sigma^2_{o,t} \qquad (2)$$

In equation (1), $r_{i,t}$ is monthly return on the stock index of sector i at time t measured in percent while $r_{i,t-1}$ represents a single day lag of equity return. These equity returns represent share returns in sectors or supersectors in each stock market. Also, $r_{m,t}$ is the daily return on the market index at time t, $r_{o,t-1}$is the daily oil return at time at time $t-1$, $ln\sigma^2_{o,t}$ is the log squared conditional variance oil return, and N is the number of sectors. The error term $\varepsilon_{i,t}$ is a random variable with zero mean and conditional variance (GARCH term) $h^2_{i,t}$,and it is dependent on the information set Ω_{t-1}, which denotes all available information at time $t-1$. The parameters, β_{i2} and β_{i3} are, respectively, the stock market beta and oil beta while β_{i4} is the oil return volatility parameter and β_{i5} is the variance parameter of equity return. In equation (2), $z_{i,t} = \varepsilon_{i,t}/\sqrt{h^2_{i,t}}$ is the standardized change. The impact is asymmetric if $\delta_{i1} \neq 0$, and leverage is present if $\delta_{i1} < 0$. Further, the $\ln\left(h^2_{i,t}\right)$ is a logarithmic form of squared conditional variance that measures the volatility of equity returns of sector i at time t, and it appears in equation (1) that as is suggested

[4] Note: All six GCC countries' currencies used in this study are pegged to the US dollar.

by Engle and Granger (1987). The squared conditional variance is a function of the autoregressive term $h_{i,t-1}^2$ and a single day lag of the oil return conditional volatility $\sigma_{o,t}^2$.

In order to estimate the conditional variance which proxies for oil return volatility $\sigma_{o,t}^2$, we use an EGARCH (1, 1) model

$$r_{o,t} = \omega_0 + \omega_1 r_{o.t-1} + \epsilon_t,\ t = 1,2,\dots,T,\ where\ \epsilon_t | I_{t-1} \sim N\left(0, \sigma_{o,t}^2\right) \quad (3)$$

$$ln\sigma_{o,t}^2 = \vartheta_0 + \vartheta_1 s_{t-1} + |\vartheta_2 s_{t-1}| + \varphi\ ln\sigma_{o,t-1}^2 \quad (4)$$

where $ln\sigma_{o,t}^2$ is the log squared conditional volatility of oil price return at time t, which is a function of the squared values of a single day lag of the EARCH terms and the exponential conditional variance (EGARCH) term. $s_t = \epsilon_t / \sqrt{\sigma_t^2}$ is the standardized change. The ϑ_1 is the EARCH parameter, the ϑ_2 is the EARCH-A parameter, and the φ is the EGARCH parameter. The error term ϵ_t is a random variable with a zero mean and conditional variance $\sigma_{o,t}^2$ dependent on the information set I_{t-1}.

Oil changes can be assumed to have different effects on equity returns across sectors and across borders. This hypothesis is based on the findings of past studies that show sector returns differently respond to oil price movements. In other words, the international oil movement has diverse aggregate effects on equity returns. Therefore, our model estimates the coefficients of interest β_{i3} and β_{i4} that capture the effect of oil returns and volatilities on equity returns for each sector and each supersector in each country. Further, we are interested to look at behavior of volatility in both markets and how they interact. In the variance equation, we can answer all these questions. Next, we compare the coefficient estimates across sectors and supersectors within a country and between countries to see whether the oil price returns and their volatilities influence equity returns differently or not. If those coefficient estimates are not the same across sectors, so oil price changes differently affect the equity returns, this implies that sectors which are affected greatly should have more attention by private investors and decision makers. The same process is implied for the across country examination.

5. Empirical Results

To estimate the relationship between equity and oil returns in a simple empirical model, the OLS regressions are performed and their results are reported in Appendix B. The test of normality is considered and the Jarque-Bera statistics test suggests that the residuals for each return series are not normally distributed. The modified optimization technique in Stata is applied within the EGARCH model to achieve convergence in likelihood estimations. I first obtain results for the Financial, Industrial, and Services (Non-financial) supersectors. Then I employ the same model at the sector level for specific GCC countries.

5.1. Supersectoral Level

Since we are interested to measure responses of equity returns and volatility to oil return and volatility movements, Table 1.4 shows the exponential GARCH model results of those variables. The regression results for Kuwait are not reported due to the short time span of the financial data. In panel 1 of Table 1.4, Bahrain and Saudi Arabia financial supersectors coefficients show negative linkages to oil return changes while only Saudi Arabia and Qatar equity returns statistically significantly respond to oil changes with a positive sign for Qatar. Moreover, Oman, Saudi Arabia, and Qatar see higher absolute values of the impacts, indicating bigger oil price effects were transmitted into those supersectors. Saudi financial supersector returns are significantly reduced and Bahrain financial supersector returns are insignificantly reduced as oil returns increase. Whereas increases in oil returns significantly raise Qatari financial supersector returns and raise the rest of countries.

Obviously, results for financial supersector show that some countries are more responsive to oil return changes than others are. For instance, Qatar and Saudi Arabia have statistically significant coefficients but with opposite signs. These differences could be partially due to the economic structures of those countries. We show above (see, section 2) that oil sector for Qatar contributes about 58 percent to its GDP, while for Saudi Arabia it contributes about only 19 percent to its GDP. On the other hand, in terms of economic magnitude, Oman has the highest coefficient indicating heavy dependence of its economy on oil, approximately 59 percent. Another possible explanation could be due to differences in sample periods across countries. In order to confirm the effects of time factor, we use identical[5] sample time span for those countries and results become dissimilar (see, panel 2 of Table 1.4) indicating that differences in time span between series drive the differences in results. On the other hand, the results show that the Bahraini financial supersector negatively response to oil movements. This could be due to the instability condition of the Bahrain economy because of high deficit. For more discussion, see section 5.2.1.

From disaggregate level analysis (see, sections 5.2.2 and 5.2.3), comparing the response differences in financial supersectors between Qatar and Saudi Arabia; we could see that the distinction could be due to sub-sector level differences. Namely, we find the coefficients of oil return for Real Estate sectors in both states are statistically significant for Qatar and Saudi Arabia but with different signs, positive for Qatar and negative for Saudi Arabia. Certainly, having a positive linkage between the financial sector and the oil market is unsurprising because higher oil prices accelerate those countries' economic growth. Nevertheless, a negative response to oil prices changes as in Saudi Arabia is an interesting phenomenon and in turn raises concerns about

[5] Although the samples start and end in the same dates, they are not perfectly identical because of differences in holidays across countries. However, they are still comparable.

the reason behind this remarkable outcome. One feature of Tadawul is that big private-sector companies, which are backed by well-known local families, drives a large portion of great sectors in the market such as Real Estate. Another feature is that a lack of transparency and disclosure could reverse the relationship between equity returns and oil price returns. Inefficient investment decisions could be made due to a lack of institution quality so that increases in oil revenue could drive more inefficacies.

Thanks to oil price booms, the growth rate of the Saudi government spending has significantly increased by 31 percent from 2008 to 2013 (see, Saudi Arabia Statistics, 2013). Housing has received a valuable size of this spending. This economic distortion could lead the Real Estate sector behavior (which was the most active sector during the year 2013 that represents approximately 43 percent of the number of shares traded in the financial supersector) to ignore oil prices movements. Consequentially, the real estate sector appears to respond differently to oil shifts and this drives the overall Saudi financial supersector.

The industrial supersector estimates show that only the Saudi Arabia industrial supersector has a significant positive sign coefficient and is higher in absolute value indicting a sensitive behavior to oil return movements. This could be explained due to direct dependency of this sector on oil revenues and its production. That is, the Saudi industrial supersector directly benefits from oil price booms. Energy and petroleum sectors constitute approximately 64 percent of the total Saudi industrial supersector. Moreover, the rest of the Saudi industrial supersector is largely exposed to local row materials. On the other hand, the Bahrain and Oman industrial supersectors have negative coefficients indicating an opposite interaction between those sectors and oil return movements. Those supersectors are unresponsive to oil movements. Our investigations show that the Bahrain and Oman industrial supersectors still depend on foreign inputs and most of intermediate commodities are not directly affected by oil changes. This specifically could slow down the transmission of oil changes into the industrial sectors of Bahrain and Oman.

The estimates of the services supersectors of most the GCC countries are negative and statistically significant except for Bahrain, which is positive. The Omani Services supersector has a higher absolute value of estimated coefficient, though. These estimates indicate that the services supersectors for the GCC countries except Oman are more tied to oil returns changes than the other two supersectors. Consequently, the services supersector returns are most influenced by oil market changes. An increase in oil price return reduces the services supersector returns of Qatar, Saudi Arabia, and UAE while raise the services supersector returns of Bahrain. This is the first Bahrain supersector has a positive linkage to oil return movements. This could be due to a large share of transportation and hotels and tourism activities within the services sector that leads the Bahrain services index to increase as oil prices boom. The Oman services sector also benefits from oil increases because of the large share of public administration, defense, educational and health activities. The Omani government spending on these activities increase as oil revenues increase. Nevertheless, it appears that the major activities within the services supersectors for Qatar, Saudi Arabia, and UAE are not largely dependent of developments in oil prices. This could be due to the domination of non-oil related sectors on services supersectors. For instance, companies in the Saudi telecommunications sector, which constitutes approximately 74 percent of total services supersector market capitalization in 2013, appears to have overextended themselves. Whereas sectors that largely depends on oil prices changes, have a small share in market capitalization. For example, the Saudi transpositions sector represents only 5 percent of the total Saudi services supersector market capitalization in 2013.

Table 1.4. *EGARCH(1,1) Model Results –Supersectors*

Panel 1 (Different sample periods)

Mean Eq.					
Oil returns	BHN	OMN	QTR	SAU	UAE
Financial Supersector	-0.0062	0.0522	0.0194***	-0.0245***	0.0065
	(0.0055)	(0.0436)	(0.0058)	(0.0054)	(0.0046)
Industrial Supersector	-0.0295	-0.0059	0.0073	0.0406***	0.0196
	(0)	(0.0154)	(0.0072)	(0.006)	(0.0107)
Services Supersector	0.0245**	0.0337	-0.0186**	-0.0235*	-0.0244***
	(0.0092)	(0.0216)	(0.0066)	(0.0095)	(0.0074)
Oil return Volatility lag 1					
Financial Supersector	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)
Industrial Supersector	0	0	0	0	0
	(0.0028)	(0)	(0)	(0)	(0)
Services Supersector	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)

Panel 2 (Same sample periods, 1/22/2007- 12/31/2013)

Mean Eq.					
Oil returns	BHN	OMN	QTR	SAU	UAE
Financial Supersector	0.0107	0.0163*	-0.0133**	-0.0239***	0.0011
	(0.0253)	(0.0064)	(0.0046)	(0.0053)	(0.0063)
Industrial Supersector	0.0363***	0.0148*	-0.0241***	0.0333***	-0.0265*
	(0.0045)	(0.0068)	(0.0073)	(0.0051)	(0.0127)
Services Supersector	0.0046	-0.0067	-0.006	-0.0304	-0.0033
	(0)	(0.0056)	(0.0075)	(0.0039)	(0.0117)
Oil return volatility lag 1					
Financial Supersector	0.0000	0.0002	0	0	0.0000*
	(0)	(0.0002)	(0.0002)	(0)	(0)
Industrial Supersector	-0.0001	-0.0002	0.0006***	0	0
	(0)	(0.0001)	(0.0001)	(0)	(0)
Services Supersector	0.0000***	-0.0004	0.0005	0	0
	(0)	(0.0003)	(0.0005)	(0)	(0)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Zero coefficients shown above represent a very small value that is less than 0.00005

Panel 1 of Table 1.4 show that the oil return volatility coefficients for supersectors are very close to zero indicating a natural linkage between those supersectors and oil market movements. Therefore, when conditional oil price volatility increases due to greater error in anticipating oil returns, the GCC countries supersector returns rarely move in any direction. In other words, these supersector returns are unresponsive to oil price fluctuations. This result implies that a single day lag of oil price volatility has no effects on the equity returns through indirect channel.

In the variance equation, oil return volatility has no explicit effects on all GCC countries supersector equity returns volatility. Table 1.5 shows the GCC countries equity returns volatility responses to oil return volatility. That is oil price volatility increases do not influence the GCC countries supersectors movements. These results imply that oil price volatility has no effect on those returns because it does not influence their return volatility. Moreover, it implies that the GCC countries supersectors volatility are not sensitive to oil fluctuations.

Table 1.5. *EGARCH(1,1) Model Results-Supersectors*

Variance Eq.					
Oil Volatility	BHN	OMN	QTR	SAU	UAE
Financial Supersector	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)
Industrial Supersector	0.0005	0.0001	0	0	0
	(0)	(-0.0001)	(0)	(0)	(0)
Services Supersector	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Zero coefficients shown above represent a very small value that is less than 0.00005

Actually, differences in type of markets such as emerging stock markets that involve multiple sectors and the international market of one commodity play essential roles of reducing interactions between those markets. In other words, some sectors in the GCC stock markets have very low volatility for many days in a year such as industrial and hotels sectors in Bahrain, a financial market phenomenon like this can sever any link between lower volatility of the GCC stock markets and a volatility oil market.

For the better comparison across countries, we have used the same supersectors specifications; however, some countries have sector level data that could help us gain understanding to the equity return responses to oil prices movements. Let us look at some of these results.

5.2. Sectoral Level

It should be noted that Kuwait and Oman are excluded from our disaggregate analysis because of short time span for the Kuwait data set and the Mascot exchange has only three sectors which are already reported in supersector level section above.

5.2.1. Bahrain

Table 1.6 displays the results from estimating coefficients of interest in equations (1) and (2) for overall market index and sectors in the Bahrain Stock Exchange. The results in the mean equation show that the coefficients of oil price returns are negative and statistically significant at the 1, 0.01, and 5 percent level for the Banks, Insurance, and Hotels sectors, respectively, but statistically insignificant for the Investment and Industrial sectors. This indicates that an increase in oil price returns is associated with decreased returns. It is quite a surprise to have negative influence of oil on the Hotels sector. A possible explanation is that there is a sizable difference between growth rates of oil market, 81.2 percent, and the Hotels sector growth rate. The Bahrain hotels sector represents only 2.4 percent of overall market capitalizations in 2013. A plausible explanation for the sector behavior is that it specifically depends on other factors such as neighborhood tourists. The services sector is the only sector that is statistically insignificant and positively responds to oil returns changes. This sector constitutes 13.2 percent of total market capitalization in 2013. Indeed, the surprising results for some sectors such as financial sectors and the hotels sector become visible due to instable Bahrain economic growth. The main reason of this unstable condition is that Bahrain's government debt has doubled since 2009 and reached 43 percent of GDP at the end of 2014 (Saadi, 2015). Therefore, it is reasonable for these capital-intensive sectors to have negative response to oil price increases because governmental actions such as cutting energy subsidies will decline consumer savings. This leads to cuts in the lending and profitability of these sectors so that the demand for their shares decrease and then the equity prices fall.

Table 1.6. *EGARCH(1,1)Model Results-Sectors-BHN*

Variable	General	Banks	Investment	Insurance	Industrial	Hotels	Services
Mean eq.							
β_{i3}(Oil return)	0.0066	-0.0293**	-0.011	-0.0441***	-0.0517	-0.0051*	0.0155
	(0.0084)	(0.0106)	(0.0092)	(0.0064)	(0)	(0.0023)	(0.0085)
β_{i4}(Oil variance lag1)	-0.0001**	0.0004***	0.0039	0.0082***	0.0715	-0.0015	-0.0009
	(0)	(0.0001)	(0.003)	(0.0022)	(0)	(0.0011)	(0.0029)
Variance eq.							
ρ_i(Oil variance)	-0.0004***	-0.0005***	0.071	-0.0056***	-0.0090***	0.0663	0.0649***
	(0.0001)	(0.0001)	(0)	(0.0008)	(0)	(0)	(0.0069)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses
Complete EGARCH(1,1) model regression results are reported in Appendix B
Zero coefficients shown above represent a very small value that is less than 0.00005

At 0.1 percent levels of confidence, the coefficients of one day lag of oil volatility are statistically significant and positive for the Banks and Insurance sectors but statistically insignificant for the Investment and Industrial sectors. This implies that an increase in oil price volatility raises all four sectors returns. The coefficient of oil price volatility is statistically insignificant at the 1 percent level for general market index but statistically insignificant for the Hotels and Services sectors.

The oil returns volatility on equity return volatility parameters in the variance equation vary in magnitudes and signs. The coefficients are statistically significant at the 0.1 percent level of confidence with negative signs for the general market index and Banks, Insurance, and Industrial. This means that oil volatility reduces general and financial sectors volatility. The coefficient of oil price volatility is positive and statistically significant at the 0.1 percent level for Services but statistically insignificant for Investment and Hotels sectors, which indicates that increased oil price return volatility raises the volatility of those sectors. The results also imply that oil price volatility has an indirect effect on those returns through its influence on their return volatility. However, it is clear that Services and Hotel sectors have higher responses to oil volatility than others have, which explains high sensitivity of these sectors volatility to oil fluctuations.

5.2.2. Qatar

In Table 1.7, four of seven sectors are responsive to oil price returns. The coefficients of oil price return are statistically significant at the 0.1 percent level for Overall index and Consumer Goods and Services sectors and at 5 percent for Banks, Real Estate, Transportations sectors but statistically insignificant for Insurance, Industrial, and Telecommunications sectors. In overall index and sectors other than Insurance, an increase in oil return raises overall index and sector returns, which implies a positive linkage between oil and most sectors. It should be noted that the Insurance sector constitutes the smallest weight for total market capitalization (Qatar Exchange, 2012). The banks and real estate sectors, which represent about 96 percent for total market capitalization of the financial supersector, drive the overall financial sector positive and have significant linkage to the oil market. (See Table 1.4)

No considerable effects of oil return volatility on sectors returns and their volatility are found. Although most of sectoral indices volatility trends are associated with oil volatility trends, the fluctuations of these volatilities are dissimilar.

Table 1.7. *EGARCH(1,1) Model Results -Sectors-QTR*

Variable	General	Banks	Insurance	Real Estate	Consumer Goods & Ser.	Industrials	Telecommunications	Transportations
Mean eq.								
β_{i3}(Oil return)	0.0511***	0.0099*	-0.0242	0.0474*	0.0394***	0.0073	0.0176	0.0474*
	(0.0083)	(0.0048)	(0.0141)	(0.022)	(0.0103)	(0.0072)	(0.0176)	()
β_{i4}(Oil variance lag1)	0	0	0	0	0.0000***	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Variance eq.								
ρ_i(Oil variance)	-0.0000***	0	0	-0.0000*	0	0	0	-0.0000*
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Complete EGARCH(1,1) model regression results are reported in Appendix B

Zero coefficients shown above represent a very small value that is less than 0.00005

5.2.3. Saudi Arabia

The results of EGARCH(1,1) model-type regressions for the Saudi Arabia stock market are reported in Table 1.8. The coefficients of oil price return are negative and statistically significant at the 1 percent level for Real Estate, Agriculture, and Hotels sectors and at 0.1 percent for Telecommunications and Retail sectors but statistically insignificant for Multi-Investment, Energy, Cement, Building, and Transportations sectors. An increase in oil returns reduces these sectors returns. The oil return coefficients are positive and statistically significant at the 0.1 percent level for the Petroleum sector and at 5 percent level for the Industrial sector but statistically insignificant for overall index and Banks, Insurance, and Media sectors. Oil return increases raise those sectors returns and significantly for Petroleum and Industrial returns. As mentioned above, Saudi governmental spending on housing influences the Real Estate sector response to oil price movements.

Table 1.8. *EGARCH(1,1) Model Results -Sectors-SAU*

Variable	General	Banks	Insurance	Multi-Investment	Real Estate	Petroleum	Energy	Cement
Mean eq.								
β_{i3}(Oil return)	0.0927	0.0086	0.0023	-0.0112	-0.0343**	0.0751***	-0.0077	-0.0063
	(0)	(0.0075)	(0.0158)	(0.0141)	(0.0108)	(0.0075)	(0.0094)	(0.0073)
β_{i4}(Oil variance lag1)	0.1173***	0.4666***	0	0	0	0	0	0.0007**
	(0.0047)	(0.0093)	(0)	(0)	(0)	(0)	(0)	(0.0002)
Variance eq.								
ρ_i(Oil variance)	4.1179***	0.3289	0	0	0	0	0	0.014
	(0.002)	(0.894)	(0)	(0)	(0)	(0)	(0)	(0)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Complete EGARCH(1,1) model regression results are reported in Appendix B

Zero coefficients shown above represent a very small value that is less than 0.00005

The results also show that returns in the general index, Banks, and Cement sectors significantly increase with an increase in lagged oil price volatility but insignificantly for returns of Industrial sector. In contrast, increases of lagged oil price volatility significantly reduce returns of Agriculture sector but insignificantly for returns of Telecommunications sector. Other sector returns have no explicit connections to oil volatility. These results indicate that when sector returns are negatively related to oil returns, the sector returns are negatively related to oil return volatility, too; or they are not explicitly related but they are not positively related.

In the variance equation, three out of fifteen sectors conditional variances are responsive to oil return volatility. Sector volatility of returns are significantly influenced at the 0.1 percent level of confidence by oil return volatility for the general index and the Agriculture, Industrial, Telecommunications sectors but statistically insignificant for Banks and Cement sectors. The rest of sectors volatility are unresponsive to oil volatility movements.

Table 1.8. *Continued- EGARCH(1,1) Model Results -Sectors-SAU*

Variable	Agriculture	Industrial	Building	Telecommunications	Retail	Hotels	Media	Transportations
Mean eq.								
β_{i3}(Oil return)	-0.0471**	0.0327*	-0.0178	-0.0299***	-0.0451***	-0.0502**	0.0014	-0.0062
	(0.0165)	(0.0167)	(0.0107)	(0.002)	(0.0105)	(0.0171)	(0.0162)	(0.0127)
β_{i4}(Oil variance lag1)	-1.1948***	0.0995	0	-0.0086	0	0	0	0
	(0.0894)	(0.2735)	(0)	(0)	(0)	(0)	(0)	(0)
Variance eq.								
ρ_i(Oil variance)	-0.2910***	0.7593***	0	-0.0517***	0	0	0	0
	(0.0042)	(0.0453)	(0)	(0)	(0.0144)	(0)	(0)	(0)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Complete EGARCH(1,1) model regression results are reported in Appendix B

Zero coefficients shown above represent a very small value that is less than 0.00005

An increase in oil price return volatility significantly raises stock return volatility for general index and the industrial sector but insignificantly for Banks and Cement sectors. Furthermore, this increase significantly reduces stock return volatility of the Agriculture, and Telecommunications sectors. It should be noted that general index highly fluctuates for each shift of oil volatility indicating a large positive association between oil return volatility and volatility of returns in the overall index. Since Saudi Arabia is number one in the world for oil production, most of Saudi firms are functions of oil-related instruments. Moreover, we could see that the Agriculture sector is one of the sectors that is mostly influenced by oil price volatility. The large share of agricultural manufactures could explain the reaction of the Agriculture sector.

5.2.4. United Arab Emeries

Table 1.9 reports coefficient estimates of interest for UAE stock market, Abu Dhabi Securities Exchange. Three out of eight sector returns are responsive to oil returns. The parameters of oil returns are statistically significant at the 0.1 percent level of confidence for general index and at the 1 percent level for the Telecommunications sector and the 5 percent level for the Insurance sector but statistically insignificant for the Banks, Real Estate, Consumer Staple, Energy, and Industrial sectors. An increase in oil return raises significantly returns for overall index and Insurance sector but insignificantly for Real Estate, Consumer Staple, Energy, and Industrial sectors. While Banks, Telecommunications, and Services sectors returns are reduced by oil return raises. We could see that the Services sector returns have the highest absolute coefficient value among the market sectors. The Services sector constitutes approximately 3 percent of total market capitalization.

Table 1.9. *EGARCH(1,1) Model Results -Sectors-UAE*

Variable	General	Banks	Insurance	Real Estate	Consumer Staple	Energy	Industrial	Telecommunications	Services
Mean eq.									
β_{i3}(Oil return)	0.0726***	-0.005	0.0052*	0.0281	0.0275	0.0236	0.009	-0.0213**	-0.0509***
	(0.0071)	(0.0066)	(0.0021)	(0.0171)	(0.0214)	(0.014)	(0.0129)	(0.0079)	(0.0147)
β_{i4}(Oil variance lag1)	0	0	0	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Variance eq.									
ρ_i(Oil variance)	0	0	0	0	0	0	-0.0000***	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Complete EGARCH(1,1) model regression results are reported in Appendix B

Zero coefficients shown above represent a very small value that is less than 0.00005

The lag oil volatility has no explicit effects on overall and sectoral level returns and their volatility, which means that the UAE indices returns and their volatility are unresponsive to oil volatility. This could be due to power of other factors that play crucial role in equity fluctuations, such as political events within the region.

6. Conclusion

The objective of this study is to investigate to what extent oil returns and their volatility differently affect the equity returns and its conational variances in supersectoral and sectoral levels. The findings show that despite the dependency of the GCC states on oil revenues, the equity markets performance do not exactly associate with oil movements. In particular, our results conclude that the GCC stock markets do not always move hand-in-hand with oil market movements. This could be due to economic fundamentals such as news, changes in market sentiments and other factors that play a major role in influencing stock market returns. Shareholders and financial market participants can benefit from results obtained in this paper by understanding the behavior of asset prices that could help them to detect profitable trading opportunities and optimizing portfolio diversification. Based on the results of this paper, in the future, simulation works can be done to analyze specific sectors that have negative linkages to oil price changes. Furthermore, future studies could focus on investigating and distinguishing the direct and indirect impacts of short events on equity returns in this region. Moreover, using our analysis results to forecast trends of sectors in the GCC equity markets is possible.

CHAPTER 2

DISTINGUISHING THE EFFECTS OF OIL CHANGES ON ISLAMIC AND CONVENTIONAL BANKS: EVIDENCE FROM SAUDI ARABIA

1. Introduction

In recent decades, the interaction between oil and emerging markets has increased, especially the cases of Gulf Cooperation Council countries (GCC). More financial investors and economists are increasingly interested in this attractive region. It is documented that the financial crisis of 2008 was accompanied by high volatility of crude oil and stock markets. Even though many studies have found that oil changes differently affect equity performance across markets and sectors, no study investigates the linkages between oil changes and within specific sector (see, Ratti and M. Hasan, 2013; Abu-Zarour, 2006; Assaf, 2003; and J. Park and R. Rattia, 2008). Therefore, we distinctly focus on investigating the impact of oil price changes on Islamic and conventional banking system in the Saudi Arabian stock exchange (Tadawul).

The potential benefits of this type of analysis are numerous. For example, it can provide helpful evidence to both investors and decision makers when they make investment decisions and impose new policies. It could also carry on valuable information to financial analysts to be better understanding of these banking systems' equity indices behaviors. Besides, it contributes to both financial and oil market literature to encourage researchers to investigate differences within the financial sector. Finally, it can reveal hidden facts about both types of institutions to help Islamic banks to improve their efficiency levels, strategies and performances to effectively compete with their conventional counterparts and vice versa.

This study examines to what extent oil changes affect Islamic bank returns relative to conventional ones in the Saudi Arabian stock exchange. In the wake of the last financial crisis, a renewed debate has raised the role that Islamic finance can play in the stabilization of the current financial system, given its strong ethical principles and religion foundations (Islamic Finance in Europe, 2013). Particularly, Aggarwal and Yousef (2000) claim that Islamic banking is one of the fastest growing financial industries over the last decade. Moreover, the Islamic Financial Services Board (IFSB) reports that Islamic banking industry, as measured by Sharia compliant assets, charted a compound annual growth rate (CAGR) of 38.5 percent between 2004 and 2011. It has been shown that most Islamic banks are growing faster than their respective conventional banking peers (World Islamic Banking Competitiveness Report, 2012-2013\2013-2014). Even though the share of Islamic banking in the global financial market is low, the Gulf Cooperation Council (GCC) accounts for two-thirds of global Islamic Assets (Malaikah, 2012).

In context of economic and political clustering, it is obvious that the GCC countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and Arab Emirates) heavily rely on oil production for external revenues (i.e. the oil revenue percentage of the total GCC revenue in 2011 was 83.9 percent). Next to the oil and gas sector, the banking sector in the GCC states is the second highest contributor to a country's GDP. (The Global Investment House, 2005\2011). Moreover, many financial reports and studies highlight that Islamic banking as a part of the dual economy in the GCC countries, is growing very fast and becoming more attractive to consumers in GCC markets (Abu-Loghod, 2005).

The recent boom of oil prices increased the financial wealth at GCC countries. Through transferred channels (i.e. salaries, subsidies and direct transfers), the GCC population receives a substantial part of this prosperity. As a result, increases of people’s wealth certainly increase banking sector deposits. Solé (2007) finds that the majority of clients in the GCC countries patronize the use of Islamic credit instruments. Banking estimates show that between 60 to 70 percent of the population even in a mainly Muslim country base their choice of bank on non-religious factors such as ethical principles and fairness of consumer treating, which are better perceived by Islamic banks (Vizcaino, 2014). Other estimates reported by AL-Mashora reveal that 64 percent of banks clients in the GCC countries believe that Islamic banks are better than conventional ones while only 9 percent goes for the latter (Al-Yaum, 2014). One reason argued by those clients is that Islamic banks provide more ethical investment contracts to their clients. For instance, speculative contracts in Islamic banks are less risky for the bank's partner and more fair, that is, the bank only requires the collateral if the project loses because of the partner's (debtor) mismanagement or hostile actions. Moreover, Al-Omar and Iqbal (1999) point out that large amount of funds have been successfully mobilized by Islamic banking system.

For categories of the Saudi bank customers, Mahdi (2012) shows that about 46 percent of banks sector customers are Saudi clients and 54 percent is non-Saudi clients. In terms of income, about 86 percent are gaining a monthly income of 4000 U.S. dollars or less while 14 percent of banks clients had a monthly income more than 4000 U.S. dollars. The study shows that Saudis have slightly higher income than their counterpart have, the non-Saudis. Based on the finding of Solé (2007) we could infer, therefore, that most of those clients highly interact with Islamic banks rather than conventional ones.

The evidence above shows that the Islamic banking system gains a valuable size of customers' deposits. Surplus of cash inflows helps the Islamic bank to expand its investments and then generate considerable revenue. These investments are different from conventional bank's investments that they have higher capital adequacy ratios. The Islamic banks model does not allow investing in or financing the kind of instruments that have adversely affected their conventional competitors and triggered the global financial crisis. For example investing in toxic assets[6], derivatives, and conventional financial institution securities is not allowed. Islamic bank's investments are less affected by financial crises. Islamic banks become more stable during the recession (Hasan and Dridi, 2010; Nagaoka, 2012). Consquentlly, Willison (2009) and Yilmaz (2009) argue that the characteristic of Islamic banking should gain further success in confronting and overcoming the financial crisis and then stimulating considerable institutional growth. Regarding the advantage of stability during a recession, more demand for Islamic bank equities in the stock market could occur and that in turn pulls up these equity prices.

Some studies argue that Islamic banking solves problems of hoarding money by encouraging investors to make productive investments. Besides these claims, in the 2009 World Islamic Economic Forum, proponents including Muslim countries' leaders, view Islamic finance as a framework that leads to more stable global financial system (see, Hersh, 2008 and Aglionby 2009). The distinction between Islamic and conventional banking systems are provided with more detail in the next section.

This study compares how oil price movements differently affect equity prices in Islamic and conventional banking systems of banks sector in Tadawul. For both types of banks in Saudi Arabia, we create an equity index, which helps to compare how these two indices respond to oil price movements. The extent that they differ provides evidence that oil price changes affect these two types of financial institutions distinctly.

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[6] Hasan and Dridi (2010) define the toxic asset as a certain financial asset whose value has fallen significantly and for which there is no longer a functioning market, rendering the price unsatisfactory to the holder. This definition includes collateralized debt obligations and credit default swaps, considered to be non-Shari'ah compliant.

In co-movements in volatilities context, volatility changes are not only closely linked across markets, but also across assets within a market. For investigating the oil changes and Islamic and Conventional bank linkages, we employ a Dynamic Conditional Correlation (DCC) model, as introduced by Engle (2002) and its extended specifications. To examine this issue, Islamic and conventional equity indices and an oil prices are used.

The rest of the chapter is divided into five sections. Section 2: discusses Saudi banking system background. Section 3: describes the data set. Section 4: presents the econometric model. Section 5: includes the empirical results and the conclusion is presented in section 6.

2. Evolution of Saudi Islamic Banking System

First, let us define Islamic finances and determine their distinction from conventional banking systems. Ethical principles are the main base line of Islamic finances. These ground rules which are called Shari'ah, comply with Islamic religious law. Islamic banking can be defined as providing banking products and services based on Shari'ah that includes interest-free or the avoidance of usury, "Riba". It includes the avoidance of uncertainty or speculative risk, "Gharar" (Ibrahim, 2007). More specifically, Gharar relates to uncertainty in the basic elements of any agreement: subject matter, consideration, and liabilities. According to this aspect, it is an illegal transaction if the seller has no control of a good that is subject to sale, like selling a fish in the ocean, a bird flying in the air, or a contract in which the price has not been finalized or the future performance date is not known.

Islamic banks generally are set apart from conventional ones in four main principles, which are considered as the foundation of Islamic banking. First, it is prohibited to pay interest (i.e. any predetermined payment in excess of the principal). Consequently, a contract used by Islamic banks must create exposure to the productive sector and guarantee efficient risk management. The second principle deals with the concept of profit and loss sharing. That is their parties must share rewards and risks that are attached to a financial transaction. Hence, there are no extravagant profits and losses. The third one is related to prohibition of speculation or excessive uncertainty (Gharar). Transactions involving excessive uncertainty are forbidden, especially when they are associated with the prohibition of gambling. This includes some modern financial products such as options, future contracts and derivatives (see, Karasik, Wehrey and Strom, 2007). Nevertheless, risk-taking is allowed for the case of perfect information, such as all parties know the terms and conditions. The last principle requires the use of asset backing. Tangibility or/and identifiably of underlying assets must be connected to the financial transaction to ensure the association of Islamic banks to the productive economy (Di-Mauro, Caristi, Couderc, Di-Maria, Ho, Grewal, Masciantonio, Ongena and Zaher, 2013). In particular, Islamic bank does not permit the seller to sell what is not in the possession of the seller, it must be completely owned by the seller before any further transactions.

Islamic and conventional banks are competing in the same market segmentation in terms of offering complementary products and banking services. However, most Muslim customers have opportunity to invest in a bank that operates based on their religious beliefs while non-Muslims customers see benefits from such system. Other reasons make the Islamic institutions different from conventional ones are that no financial speculation is allowed and most investment decisions are made in productive sectors. The latter specifically makes their investments less risky. Al-Rajahi Bank is a large bank in Saudi Arabia and an Islamic bank and most of its investment decisions are made in Real Estate, Industrial, and Telecommunications sectors.

In the 1940s, Pakistani scholars began the discussion of introducing the modern theory of an Islamic financial system (Ibrahim, 2007). By the middle of the 1970's, the first Islamic finance institution entered Saudi Arabia through the establishment of the Islamic Development Bank. Later, some other GCC states followed with the establishment of other Islamic banks, for instance, the Dubai Islamic Bank in UAE and Faisal Islamic Bank of Bahrain in Bahrain. Recently, Saudi Arabia was ranked as one of the largest Islamic finance markets in the GCC countries (The Competitiveness Review, 2011). Figure 2.1 confirms that Saudi Arabia is the largest center of Islamic banking assets with half of banking assets owned by Islamic banks. Furthermore, Saudi Arabia alone holds about 16 percent of Global Islamic banking assets (World Islamic Banking Competitiveness Report, 2013-2014).

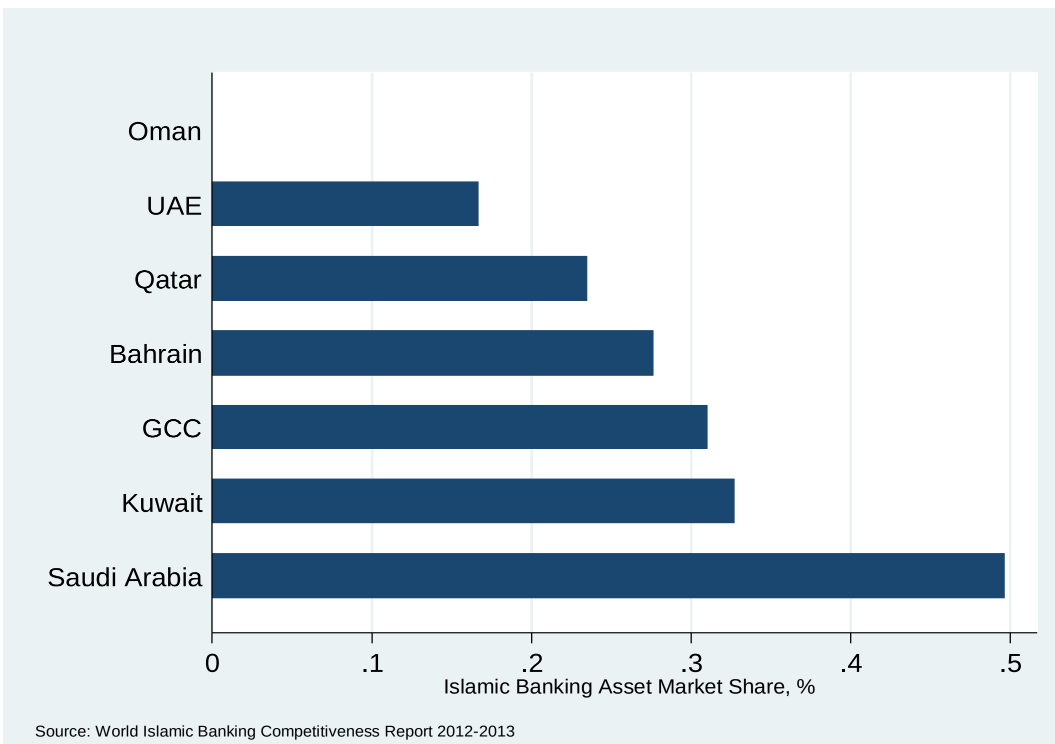


Figure 2.1. Islamic Banking Assets Percentage of Overall Banking Sector Total Assets (by Country)

In banks and financial services sector of the Saudi stock market, there are eleven listed banks, four of which represent Islamic banking. Table 2.1 reveals some important financial indicators of those banks as they appear in the Saudi stock market at the end of 2013.

Table 2.1. Financial Highlights of Listed Banks under Banks & Financial Services Sector in the Saudi Stock Market in 12/31/2013 (Currency in USD)

Banking System	Bank Name	Authorized Capital	Total Asset	Issued shares	Floated Issued shares	Deposits
Islamic	Al Rajhi Bank	5775150000	107753012	577515000	398524283	89164124
	Alinma Bank	5775150000	24256104	577515000	398985863	16464037
	Bank Albilad	1540040000	13984837	154004000	108306994	11206763
	Bank Aljazira	1155030000	23091517	115503000	104031574	18897263
Conventional	Arab National	3850100000	53106518	385010000	187047856	40954566
	Banque Saudi Fransi	3480559221	65473520	348055922	187124737	48110452
	Riyad Bank	5775150000	79021947	577515000	273975065	59366185
	Samba Fin. Group	4620120000	78941153	462012000	232262674	59737002
	Saudi Hollandi Bank	1833725628	30981085	183372563	50593223	23822667
	Saudi British Bank	3850100000	68263120	385010000	125092210	55535514
	Saudi Investment Bank	2310060000	30991539	231006000	123973514	21962452
	Ave. of Islamic type	3561342500	42271368	356134250	252462178	33933047
	Ave. of Conv. type	3674259264	58111269	367425926	168581325	44212691

Source: Saudi Stock Exchange (Tadawul) http://www.tadawul.com.sa/

Table 2.1 shows that Al-Rajahi bank leads the Saudi banking system with largest total assets at the end of 2013. Although the deposits obtained by Islamic banks represent 30 percent of overall deposits, Al-Raiahi Bank gains the biggest balance of consumer deposits that is 20 percent of overall consumer deposits. Moreover, with only four Islamic banks listed in Tadawul, the floated issued shares of those banks represent 60 percent of overall average floated issued shares. A study conducted by Argaam (2012) reveals that these four Saudi Islamic banks have gained a substantial growth in their total deposits, 65 percent from 2008 to 2011, while the seven conventional banks gained only 16 percent.

3. Data

Our daily data on international oil prices is obtained from the U.S. Department of Energy: Energy Information Administration (EIA). Increasing popularity of Islamic finance has led to the establishment of Shari'ah compliant stock indices in many stock markets across the world; however, Tadawul has no separate Islamic banking index. Therefore, we constructed the Islamic and conventional banks from Saudi individual Islamic banks data. The Islamic banks data represent listed “pure” Islamic banks in Tadawul while the conventional banks data reveal all other listed banks that do not completely comply with financial Islamic law (Shari’ah Complaints). The daily firm-level data set are obtained from Tadawul. The data covers the time period from June 3, 2008 to December 31, 2013. Due to data availability, individual banks data is used to aggregate the two indices. The classification is built as follows: the Islamic index involves four Islamic banks and the conventional index includes seven conventional banks. Each index is constructed using a float weighted method as follows:

$$P_s = \sum_{i=1}^{n} w_{i,s} \times \, p_{i,s}, \qquad s = 1,2;\; i = 1,2,\dots,n$$

where P_s is an equity index of either the Islamic index or conventional index, and $p_{i,s}$ is an asset close price of i^{th} bank on index s, $w_{i,s}$ is floated issued shares weight which is calculated as follows:

$$w_{i,s} = \frac{z_{i,s}}{z_{1s} + z_{2s} + \ \dots + z_{n,s}}$$

where $z_{i,s}$ is floated issued shares of i^{th}bank in Saudi stock market under index s, n is the number of banks in each group, and s is either the Islamic index or Conventional index. The data is transformed to return rates[7]. We measure all equity prices in the U.S. dollars because the international oil prices are represented in the U.S. dollars.

3.1. Descriptive Statistics

Summary statistics of the Islamic banks, conventional banks and oil data are given in Table 2.2.

Table 2.2. Summary Statistics of Saudi Banking System Daily Returns and Oil Returns

Variable	mean	sd	min	max	skewness	kurtosis	N
Islamic Banks	0.0028	1.9829	-14.1682	12.2411	0.1655	11.9543	857
Conventional Banks	-0.0212	1.9565	-8.6316	19.4846	1.5195	19.8439	857
Oil	0.0313	2.9697	-17.0242	27.9732	1.3139	18.0567	857

Daily prices and returns of the Islamic and conventional banks' indices and oil prices are plotted in the Figure 2.2. First, we could see that the performance of equity prices of two banking system in Saudi Arabia (right plot) do not perfectly follow the oil prices movements particularly after 2011. This indicates other factors effect power during that time. This could be due to new economic packages that were implemented by the Saudi government in 2011. These economic

[7] Daily asset (index)return rate = [(Current day close price - Close price day ago) / Close price day ago] x 100

reforms boost the economy as a whole and financial sectors as sectorial level. An example of those packages are new unemployment, social benefits, and an extension of the scholarship program. Furthermore, Islamic banks, on average, showed stronger resilience after the global financial crisis. This indicates that Islamic banks have performed better than conventional banks have done since the financial crisis of 2008 -2009. Consequentially, the returns graphs (left plot) show that Islamic bank returns fluctuate much more than conventional ones. In addition, the presence of volatility clustering are observed in these graphs.

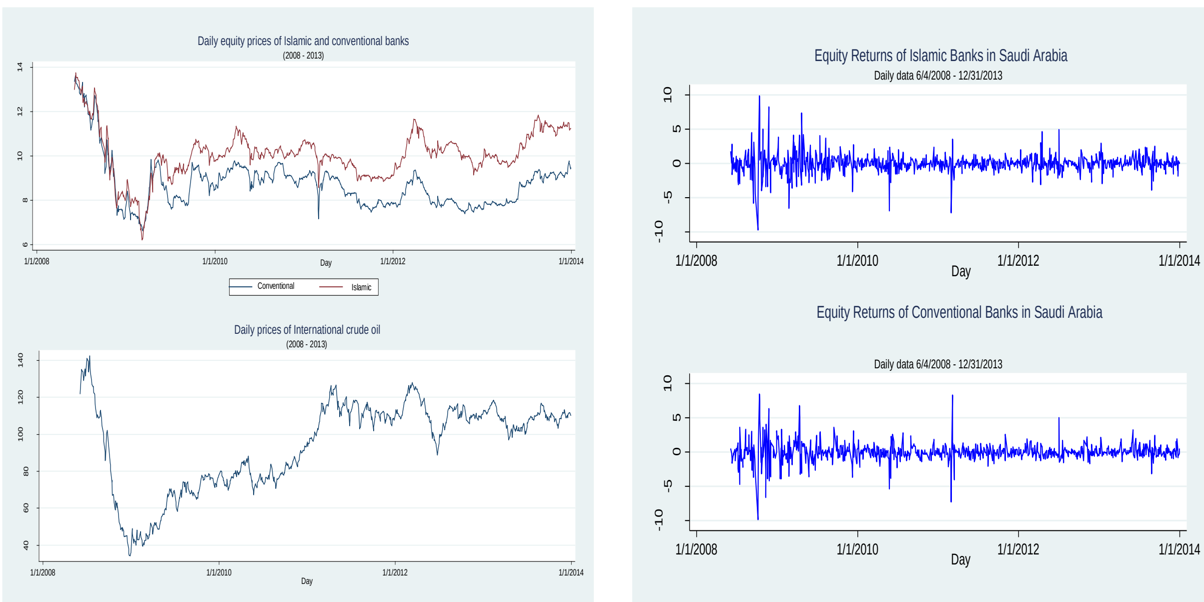


Figure 2.2. Daily Equity Prices and Returns for Saudi Islamic, Conventional Banks, and Oil

Table 2.3 shows the unconditional correlations between the banks indices’ returns and oil returns. Positive correlations are dominated herein. The Islamic banks have much higher correlation with oil market than conventional ones. This could be explained as a strong relationship between oil price increases and higher deposits in this type of banking system. Therefore, the Islamic banks equity prices slightly increase more than conventional ones.

Table 2.3. Unconditional Correlations for Islamic and Conventional Indices Returns to Oil Returns

	Islamic Banks	Conventional Banks
Oil	0.2846*	0.2203*

Note: * Statistically significant at both the 0.01, 0.05 significant level.

4. Econometric Model

For investigating the oil price changes and the Islamic and conventional banks linkages, we apply a multivariate extension of the GARCH framework that is the Dynamic Conditional Correlation (DCC). The main objectives of introducing the DCC model of Engle (2002) is to capture the observed dynamic contemporaneous correlations of asset returns which is not feasible in other multivariate GARCH model's extensions such as the constant conditional Correlation (CCC) model, the varying conditional correlation (VCC) model, and the diagonal VECH (DVECH) model. The concept volatility clustering, which refers to a condition of large or small changes in returns in one period tending to be followed by large or small changes in subsequent periods, respectively, mostly appears in increasing frequency of the data. In the presence of volatility clustering, a proven GARCH class model is the appropriate technique.

The above properties observed in asset returns volatility and correlations suggest a time varying conditional correlation model. In this study, we follow Engle's (2002) approach of the DCC-GARCH model. The representation can be given as follows. Denote by r_t the vector containing the equity market return series and oil return. All DCC class models of Bollerslev (1990) assume that a vector r_t is conditionally normal with mean (μ) equal, or very close, to zero and covariance matrix Σ_{t}. Thus, the general specification of this model is:

$$r_t | I_{t-1} \sim N(\mu, \Sigma_{\mathrm{t}}), \tag{1}$$

where I_{t-1} represents the past information set. We use the fact that Σ_{t} can be decomposed as follows:

$$\Sigma_t = D_t R_t D_t; \quad D_t = diag(\sqrt{h_{1t}}, \sqrt{h_{2t}}) \tag{2}$$

where D_t is the 2x2 diagonal matrix of time-varying standard deviations from univariate GARCH models with $\sqrt{h_{it}}$ on the diagonal, $h_{it} \equiv E_{t-1}(r_t^2)$ is the conditional variance, and R_t is a correlation matrix containing the conditional correlations as can directly be seen from rewriting this equation as: $E_{t-1}(\varepsilon_t \varepsilon_t') = D_t^{-1} \Sigma_t D_t^{-1} = R_t$[8], since the dynamics of the conditional variance of the standardized residuals $\varepsilon_t = D_t^{-1}(r_t - \mu)$. From equations (1) and (2), the marginal density of each element of r_t has a time-varying conditional variance, and can be modeled as a univariate GARCH process. The DCC model is designed to allow for two-stage estimation of the conditional variance-covariance matrix Σ_t. In the first stage, univariate volatility models are fitted for each of the assets and estimates of h_{it} are obtained. In the second stage, asset returns, which are transformed by their estimated standard deviations resulting from the first stage, are used to estimate the parameters of the conditional correlation. Once the univariate volatility models for markets are estimated the standardized residuals for each market $\varepsilon_{it} = r_{it}/\sqrt{h_{it}}$ are used to estimate the dynamics of correlation. In standard Engle (2002) DCC model, evolution of the correlation is given by:

$$Q_t = (1 - \alpha - \beta)\bar{Q} + \alpha \varepsilon_{t-1} \varepsilon_{t-1}' + \beta Q_{t-1} \tag{3}$$

$$R_t = Q_t^{*-1} Q_t Q_t^{*-1} \tag{4}$$

where $\bar{Q}$ is the unconditional correlation matrix of the ε's, that is $\bar{Q} = E[\varepsilon_t \varepsilon_t'] = \frac{1}{T} \sum \varepsilon_t \varepsilon_t'$. $Q_t^* = diag\{\sqrt{q_{ii,t}}\}$ is a diagonal matrix containing the square root of the i^{th} diagonal element of Q_t on

[8] R_t is equal to the standardized residuals.

its i^{th} diagonal position. Q_t is a positive matrix which guarantees that R_t is a correlation matrix with ones on the diagonal and every other element less than one in absolute value. The typical element ρ_{ijt} of R_t will be of the form $\rho_{ijt} = q_{ijt} / \sqrt{q_{iit} q_{jjt}}$. Scalar parameters α and β capture the effect of previous changes and previous dynamic correlations.

The DCC method first estimates volatilities for each asset and computes the standardized residuals. It then estimates the covariances between these using a maximum likelihood criterion and one of several models for the correlations. The correlation matrix is guaranteed to be positive definite.

Therefore, those procedures above are applied first to oil price returns and first financial series that reflect Islamic banks equity returns that to find the dynamic conditional correlations between these two series. Second, the same approach is utilized to oil price returns and conventional banks equity returns to capture the dynamic conditional correlations of the two series. Next, it is possible to compare the DCCs and examine to what extent returns of Islamic banks are differently associated with oil returns to returns of conventional banks. In other words, answering the question of how movement between Islamic banks compared to conventional ones can be attainable. One can also see from their dynamic correlations when similarities were most or least pronounced.

5. Empirical Results

We first apply a simple ordinary least squares (OLS) model on our data that to estimate the relationship between banking system and oil returns in a simple empirical model. In table 2.4, the OLS results show both banking systems have positive and significant relationships with oil movements; however, Islamic banks' returns changes are more associated with oil changes than conventional ones.

Table 2.4. *OLS Model Results*

	Islamic	Conventional
Oil	0.1900***	0.1451***

Notes: *** indicates a significant at the 0.1percent levels.

Than we run DCC-GARCH regression using the same OLS specification to understand the co-movements of oil and equity markets in dynamic conditions. The regression estimation results are showed in table 2.5. The empirical results of DCC- GRACH (1,1) indicate that the volatility coefficient estimate (DCC-beta) of Islamic banks is higher indicating greater sensitivity of Saudi Islamic banks equity returns to oil price movements than conventional ones.

Table 2.5. *DCC-GARCH Model Results*

Banks	Oil	DCC-alpha	DCC-beta
Islamic	0.1582***	0.1541***	0.8323***
Conventional	0.1478***	0.3774***	0.6001***

Notes: *** indicates a significant at the 5percent levels.

Using the DCC-GARCH- type model and the specifications in equations (1- 4), conditional correlation over time is plotted in figure 2.3. A first look to the graphs below shows that a downward slope of the average level of the conditional correlations in long run. This indicates that level of co-movement between the oil market and Islamic and conventional banks has decreased.

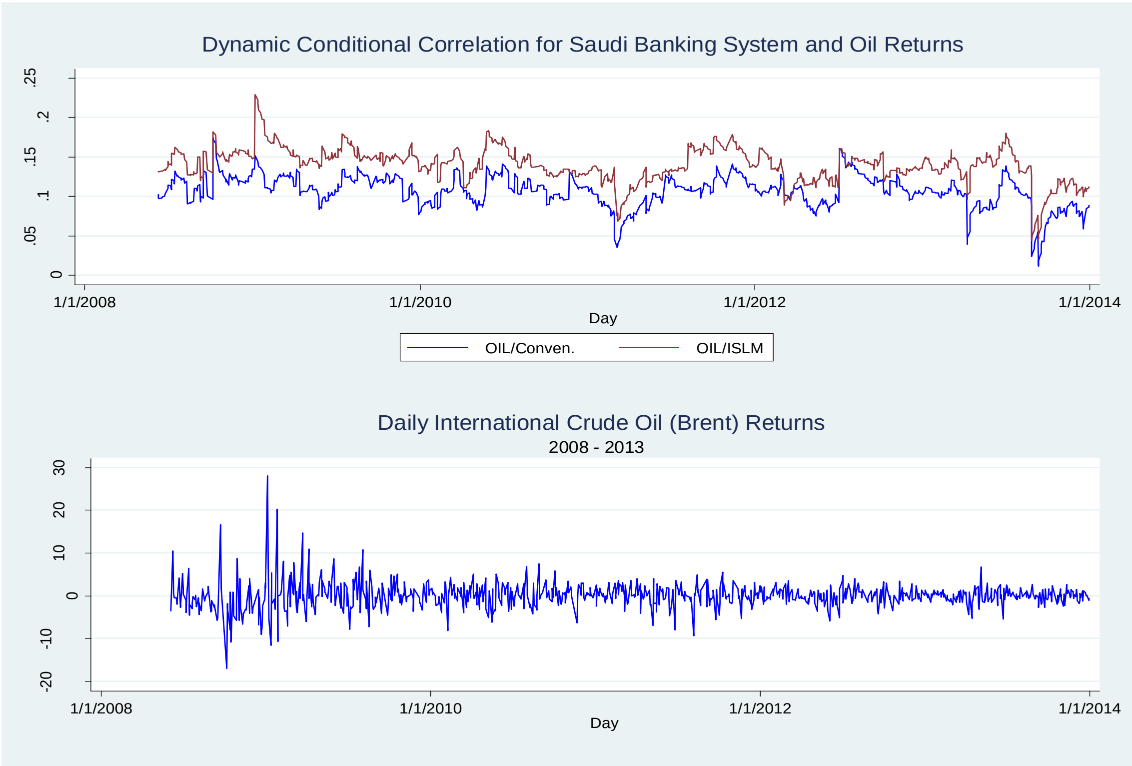


Figure 2.3. Dynamic Conditional Correlations for Saudi Banks and Oil, and Oil Returns

The plot above, which shows the DCC of Saudi banks and oil along with oil returns, attempts to find out the connections between the movements of oil returns and changes in correlations over time. The conditional correlations of the two banking systems and oil do not exceed 25 percent indicating weak relationship between Saudi banks sector and oil market. This conclusion is true for the banks sector, which indirectly depends on oil revenues. Our results of unconditional correlations between overall banks sector and oil is 13 percent. Figure 2.3 shows that the largest increase in oil returns is associated with higher correlations between bank equities and oil prices. Moreover, it shows that Islamic banks are more correlated to oil market, which could be due to similarities of Islamic banks index volatility and oil price volatility as it is displayed in Figure 2.2 (left plot).

In late 2008 and early 2009, the conditional correlations calculated above spike up more than the rest of sample period. However, an extreme fall of the dynamic correlations is not necessarily associated with a decrease in oil returns indicating a presence of other factors that could have powerful impacts on banks equity movements. One factor of these factors is the good news of bank announcement. For example, a bank announcement for distributing high dividends could drive more demand for the bank equity, which in turn increases the equity returns. Another factor that affects short-term movements could be hype. Negative financial market actions such as imposition of a penalty on the bank, press releases and news reports, and sometimes even social networks such Twitter, Facebook, Blogger can build low expectations for the performance of companies, which decrease the price of their stocks. This could be true in an emerging market such as Saudi Arabia market due to lack of transparency and efficiency.

In 2013, in order to reduce inefficiency and hype impacts, Tadawul installed a new transparency system which allows equity issuers to announce their financial information and statements and update them through the Stock Market webpage (Tadawul Annual Report, 2013). On the other hand, according to Tadawul Annual Report, 2013, most of the decline in correlations between oil and bank indices is associated with an extreme decline in the Tadawul All Share Index (TASI). This confirms the fact that internal market indices are more correlated (see Table 2.3).

The correlation between Islamic banks and oil decreased from 0.23 in 1/7/2009 to 0.18 in 5/21/2013, while the correlation between conventional banks and oil decreased from 0.17 in 10/7/2008 to 0.15 in 7/11/2012. This indicates that both Islamic and conventional banks still have positive conditional correlation to oil, but they become less correlated to oil as time passes. In the middle of March 2011 and September 2013, the correlation of two indices to oil reduced to the least point that are 0.04 and 0.01 for Islamic/oil and conventional/oil, respectively. A possible explanation for these transitions is due to differences in new development steps that each bank has been installed to improve its equity responses to oil movements.

Although Figure 2.3 shows some similarities in the dynamic conditional correlations between two types of banking system and oil but still there are several differences that can be discussed. From figure 2.3, we find that Islamic banks are more correlated to oil than conventional. This specifically could explain the argument raised by many studies that Islamic financial products are preferred by banking customers in the GCC over conventional ones (see, Al-Omar and Iqbal, 1999; Solé, 2007; Aloui, Hammoudeh, and Ben Hamida, 2015). The (weighted) Islamic banks' equity prices became higher than conventional ones right after end of the worse time of the financial crisis 2008-2009. At that time more customers redirected into Islamic banks instead which in turn increased demend for Islamic equity and then raised their prices.

Figure 2.4 shows several differences in correlation behaviors over time. The squares in the graph show the most pronounced differences of the time-varying conditional correlations between two banking systems and oil. This indicates presences of other factors than oil which in turn drive dissimilar DCC evolutions. Additionally, in Figure 2.1 we have showed evidence that Islamic banks fared better after the financial crisis than conventional ones. This could provide a valid explanation of the differences in Figure 2.4. There are couple of examples that show how market short-term events could significantly affect the correlations degrees: In 8/15/2010, the Capital Market Authority announced imposition of a penalty of one hundred thousand Saudi Riyals on the Arab National Bank (a conventional bank) due to its violation of the listing rules.

This action led to decrease the bank equity prices on coming days while at the same time the oil prices rose so that the correlations between conventional banks and oil were reduced.

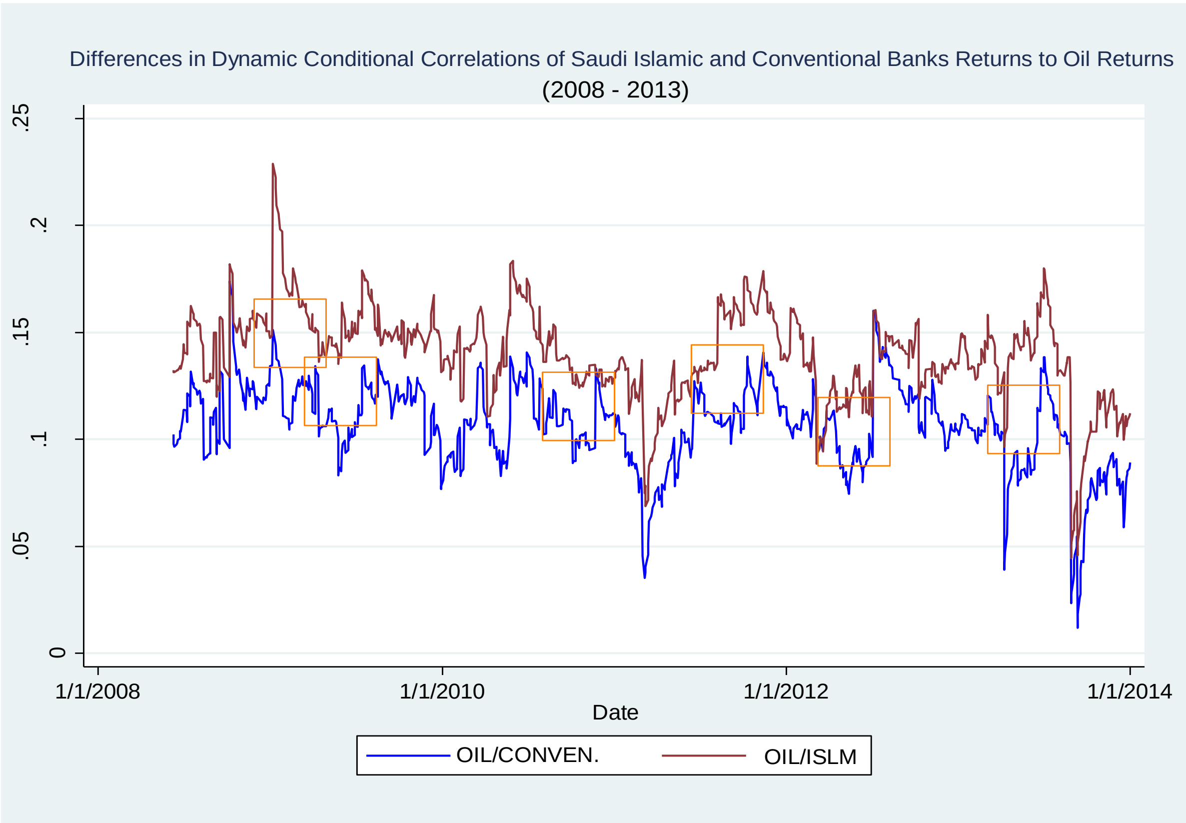


Figure 2.4. Differences in Dynamic Conditional Correlations of Islamic and Conventional Banks Returns to Oil Returns

Furthermore, in the first quarter of 2012, some conventional banks such as the Saudi British Bank (SABB), the Saudi Hollandi Bank, and Banque Saudi France increased their paid up capital, which stopped the falling of those banks equity prices. This action in turn reversed the status of correlation between the conventional banks and oil to be positive correlated instead. In 07/08/2013, The Alinma bank (an Islamic bank) received a penalty of one hundred thousand Saudi Riyals that due to its violation of the Capital Market Law. This market action led to lower bank equity prices in several days, which decreased the degree of the DCC of Islamic/oil since the oil prices were rising (Tadawul Market News, 2010\2012\2013).

6. Conclusion

The main objective of this chapter is to examine to what extent the Islamic and conventional banks equity returns in Saudi Stock Market show different co-movement with the international oil returns. Results show a decrease in degree of co-movement between these two types of banking system and the oil market. Although the conditional correlations between oil and Islamic and conventional banks equity returns decreased over time, at least after 2010, the Islamic banks kept a higher degree of co-movement with oil market. However, limitations of Islamic law on Islamic banks do not explicitly affect the relations between oil and banks. This implies that oil has a little more influence on Islamic banks returns than conventional ones. The implication for investors is that as the conditional correlations fall the optimal portfolios change. On the other hand, policy makers should pay more attention to the level of correlations between banks and oil despite overall deceasing co-movements between two markets. Profound investigation on economic factors backing the fall in the correlations is a possible extension of this study.

CHAPTER 3

DOES CORRUPTION MATTER IN THE LINKAGES BETWEEN OIL AND EQUITY RETURNS?

1. Introduction

Studies of oil importers find that oil price is negatively associated with equity returns (see, Jones and Kaul,1996), while a positive relationship is found between oil changes and equity returns for oil exporters (see, Arouri and Rault, 2012, and Degiannakis, Filis, and Kizys, 2014). In smaller emerging markets, such as the GCC stock markets where stock markets are newer, only few studies have concentrated on studying the effects of oil prices on equity returns (see, Hammoudeh and Aleisa, 2004 and Abu-Zarour, 2006).

In context of oil exporters' literature, the association between oil changes and equity returns might differ due to differences in the degree of corruption in oil exporting countries. Therefore, this study considers this relationship to explore the economic effects on this connection under different levels of corruption. Particularly, the aim of this study is to answer this question: how do the effects of oil changes upon equity returns differ in high-level corruption versus low-level corruption countries?

The GCC region is considered in this study because they share common features. For example, all GCC countries are located in the same region, use the same language, practice the same religion and are economically dependent upon oil revenues. Moreover, because they are largely segmented from the world equity markets and are overly sensitive to regional political events, the GCC markets differ from those of developed countries and from other emerging markets (Hammoudeh and Choi, 2006).

As will be shown in section 2, corruption levels differ across these countries. Thus, dissimilar levels of corruption between countries could have different effects on the connection between oil and stock markets. In the case of Gulf States, since those countries are mostly relying on hydrocarbon industries' revenues, any gained surplus in government budget from oil price increases would be beneficial to those countries' economies. In attempting to quench their public debts, the GCC governments buy their bonds from domestic banks since the GCC public debts are primarily internal debts. The extinguishing of public debts led the GCC governments to pump more money in their economies. The banks invest those surplus assets in the stock markets and then the expected actions are that equity returns increase. The reallocation of resources due to institutional and personal corruption could cause equity markets to react differently. Even if the qualitative effects are the same, which is a likely, magnitude could still differ. In particular, under a high-level of corruption the stock market would perform less efficiently than a country with a low-level of corruption because corrupted public and private institutions can play a crucial role in blocking the stock markets to react efficiently.

This paper will examine the issue empirically by using daily stock market indices of the GCC countries along with international oil price data that covers the time period from 2007 – 2013. In order to determine the degree of corruption, we use the annual data of corruption for the GCC countries. Degree of corruption in this study is measured by two international corruption indices: the Worldwide Governance Indicators (WGI) (The Control of Corruption indicator) and the Corruption Perceptions Index (CPI). The data sets of these two corruption measures cover the time from 2006-2012. On the other hand, we utilize the advantages of the diagonal VECH GARCH model to examine the relationship between oil market and the GCC stock markets under the corruption issue specifications. The coefficients of interest are the coefficients of oil return and its volatility variables. This approach, which was first proposed by Bollerslev, Engle and Wooldridge (1988), shows the linear form in which each element of the conditional correlation matrix is parameterized as a linear function of its own past and other past shocks. We apply the standard model to examine to what extent effects from oil changes upon equity prices differ between low corruption and high corruption GCC countries.

The paper is organized as follows: Section 2 introduces background on corruption in the GCC countries. Section 3 describes the data. Section 4 explains the econometric model. Section 5 shows the empirical results and finally the conclusion is given in section 6.

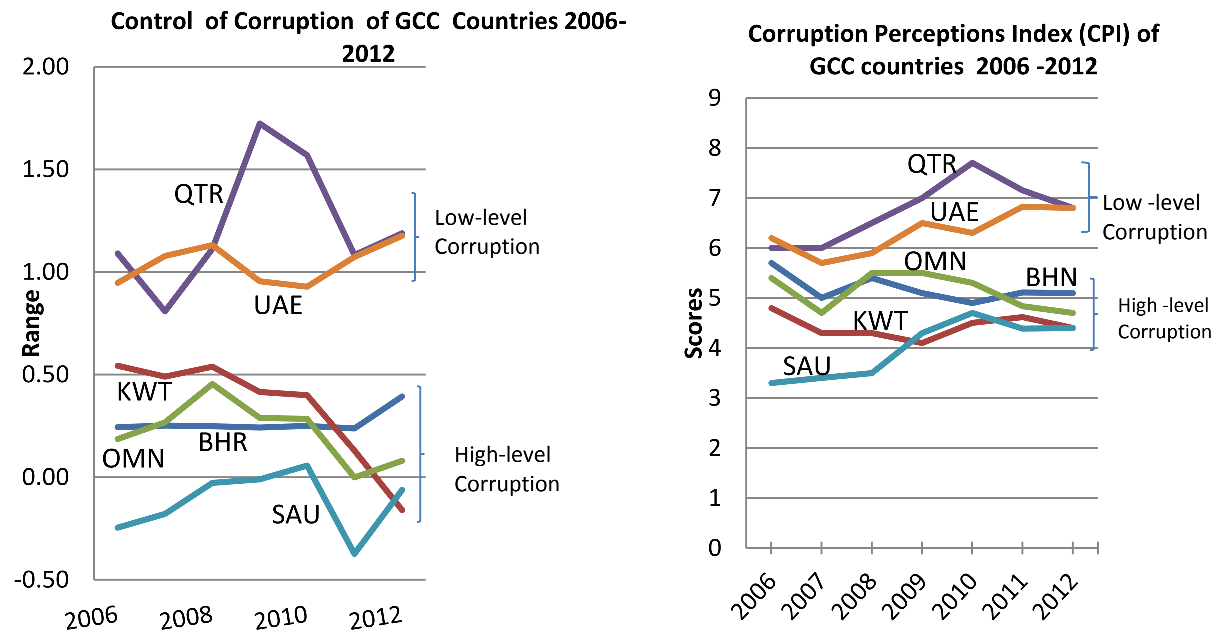
2. Corruption and the GCC Countries' Economies Features

Regarding the corruption context, corruption is now a popular topic in the economic sciences because it has been asserted that corruption influences economic activities in several channels (see, Robinson, Torvik and Verdier, 2006; Kolstad and Søreide 2009; Al-Kasim, Søreide, and Williams. 2013). Economic variables usually interact differently under high-corrupted institutions compared to low-corrupted ones. Lombardo and Pagano (2000) show that corruption has negative consequences on asset performance either in the stock market or in its relation to other economic variables. Concerning financial development, which involves stock market development, Pistor, Raiser, and Gelfer (2000) highlight that quality and effectiveness of institutions are the most important features of increasing the financial institutions' efficiency. For the financial sector development in the Middle East and North Africa (MENA) region, Creane, Goyal, Mobarak, and Sab (2004) argue that institutional quality is the most significant feature of gaining financial progress. On the other hand, Mayer and Sussman (2001) highlight that transparency of financial information is crucial in affecting financial development. Moreover, Robinson, Torvik and Verdier (2006) and Kolstad and Søreide (2009) see that corruption is one of the key factors affecting how institutions and countries deal with problems caused by the resource curse.

Asset prices could be very sensitive to the level of corruption in economic institutions. In August 2008, for example, stock market indices immediately and positively responded to an appropriate action taken by the United Arab Emirates (UAE) government to minimize the level of corruption in the UAE stock markets (see, Aleqt, 2008). In addition, weak institutions and high levels of corruption negatively influence the revenue management and the expenditure decisions of oil producing countries' economies. They also negatively affect possible investor benefits derived from oil, which in turn influences the adequate performance of equities in stock markets. Moreover, a listed firm in the stock market could be forced by the corrupted system to expand less rapidly and shift part of its savings toward an inefficient informal sector or even adopt ineffective policy for allocating its investments (Svensson, 2005).

The World Bank publications assert that approximately 12 percent of annual total world economic output (i.e. ranging between one trillion to four trillion US dollars) is lost because of corruption (Dunlop, 2013). The lack of transparency in the financial markets of high-level corruption countries leads to only a few investors having access to financial data so those markets preform inefficiently. Therefore, fewer investors are attracted to these markets, and then these markets become more isolated from global financial markets. On the other hand, economies might badly perform in the presence of corruption. Even though stock markets in the GCC countries should benefit from booming oil revenues, due to capital misallocation in those countries fewer advantages are gained (see, AL-Hussaini, AL-Mutairi and Thuwaini, 2013).

This study uses two international corruption indices, WGI and CPI, because each of them captures different aspects which it helps to reliably determine the GCC countries’ corruption levels. According to Rohwer (2009), each index is an aggregate indicator and it combines information from multiple sources. The WGI consists of six aggregate indicators while the CPI measures only corruption. Recently, eleven different organizations are involved to calculate the final CPI index. The Control of Corruption indicator, which is the sixth indictor of the WGI, uses the eleven CPI data sources, as well as fourteen others not used in the CPI. The main differences between the CPI and the WGI is that the CPI measures corruption only of the public sectors, as perceived by experts, while the WGI measures corruption in public and private sectors (with the help of some sources which provide data on corruption at the household level) as perceived by experts and opinion polls. Another distinction exists in the weighting scheme. The WGI weights available sources differently, in contrast to the equal weighting in the CPI of available sources for each country. Despite these differences, the two corruption indices group the GCC countries the same way.



Source: The Worldwide Governance Indicators 2013

Source: Corruption Perceptions Index 2013

Figure 3.1. Two Worldwide Corruption Measurements WGI And CPI of the GCC Countries

Figure 3.1 plots both the WGI and CPI scores for each of the GCC countries from 2006 to 2012. Both charts clearly divide the GCC countries into two groups, low (Qatar and UAE) and high level of corruption groups and both confirm that Qatar and UAE perform better than the rest of the GCC countries. However, is the magnitude of these differences between the two groups relevant? Consider the year 2012, the difference between the average WGI corruption score for low corruption group and the high corruption group is 1.90. How big is this difference? In 2012, the standard deviation in the WGI index across the entire world was 0.86. Therefore, a difference of 1.9 represents 221 percent of a standard deviation. The counterpart for the CPI index is 254 percent. We find these differences to be meaningful and sufficiently large to group our six countries into low and high categories. Ordinal rankings report a similar finding.

According to the Transparency International report in 2013, for example, only two GCC countries got a good rank, that is, UAE and Qatar ranked 26 and 28 out of 177 in the world, respectively. The rest of the GCC countries ranked 57 or worse.

3. Data

The data set of the GCC equity market indices (overall or general indices) are from Bloomberg covering the period 1/8/2007-12/31/2013. International oil prices is from the U.S. Department of Energy, Energy Information Administration (EIA) covering the same period. Excluding the weekends, holidays and differences of workdays between stock markets on one side and between stock markets and oil market on the other side; we end up with 1005 days. It should be noted that Friday is excluded from our data sample because the GCC markets are closed on Friday. The weekend in the GCC countries are Friday and Saturday.

3.1. Descriptive Statistics

The summary statistics of the data is given in Table 3.1. The average returns of both low and high levels of corruption countries are small in comparison to the standard deviation of returns in each series. Moreover, the standard deviation of oil price returns exceeds the standard deviation of returns in each series. Negative skewness indicates a long left fat tail. All the series are not normally distributed. High kurtosis indicates that the distribution is more highly peaked than the curvature found in a normal distribution. Therefore, the empirical distribution has more weight in the tails. Financial literature finds that daily or higher frequency market returns typically have skewed and leptokurtic conditional and unconditional distributions instead of normal ones.

Table 3.1. *Description Statistics of Market Equity and Oil Returns*

Corruption level	variable	mean	sd	min	max	skewness	kurtosis	N
Low	Qatar	0.061582	2.048395	-14.6122	11.38495	-0.88759	15.50252	1004
	UAE	0.047155	1.67229	-11.8351	14.35208	-0.15177	17.21605	1004
High	Bahrain	-0.05372	0.837678	-7.12178	2.852458	-1.59182	12.67969	1004
	Kuwait	-0.01837	1.26363	-12.2235	6.409251	-2.32075	20.29523	1004
	Oman	0.032552	1.720258	-17.1229	15.56241	-0.46544	24.54874	1004
	Saudi Arabia	0.029773	1.97787	-18.9287	11.79024	-1.24604	18.55811	1004
	Oil	0.116415	2.981045	-17.0242	33.06241	1.53761	23.16669	1004

Figure 3.2 shows how the low and high level of corruption countries and oil returns series evolved during the sample periods. During the financial crisis of 2008- 2009, higher volatility is observed in all indices and oil. The equity indices for low and high level of corruption countries tend to be more associated with oil movements. The volatility after the middle of 2009 becomes

more stable. Nevertheless, the equity returns volatility for high level of corruption seem to have larger swings even after the financial crisis.

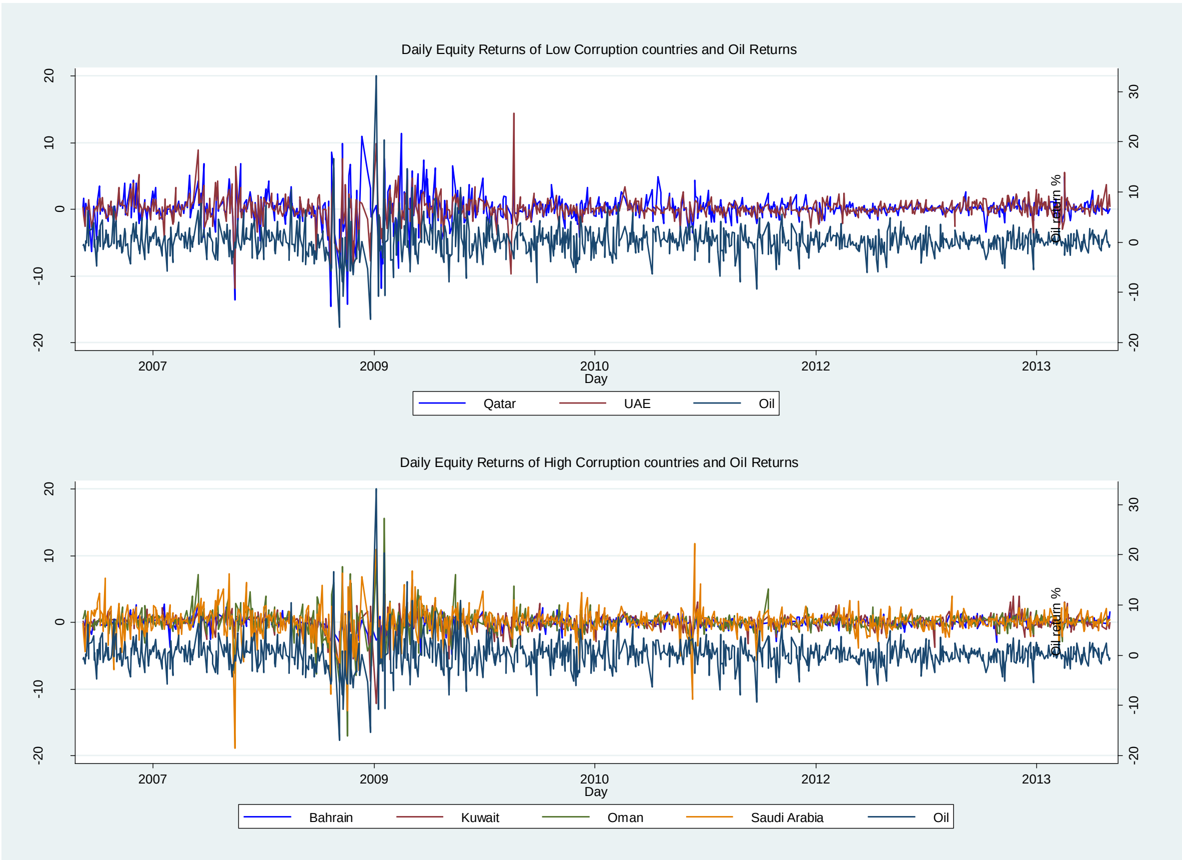


Figure 3.2. Daily Returns of Market Indices and Oil

Figure 3.3 shows how the daily (log) indices evolve during the sample period 2007 - 2013. The graph shows much of similarities than differences in trends between equity returns and oil returns. Associations of equity returns movements to oil price movements are dominated on most of time. The indices returns smoothly fluctuate after the financial crisis 2008 – 2009 indicating market stability but less money inflow. However, it appears that low-corrupted group countries' indices have been highly evolve compared to high-corrupted group.

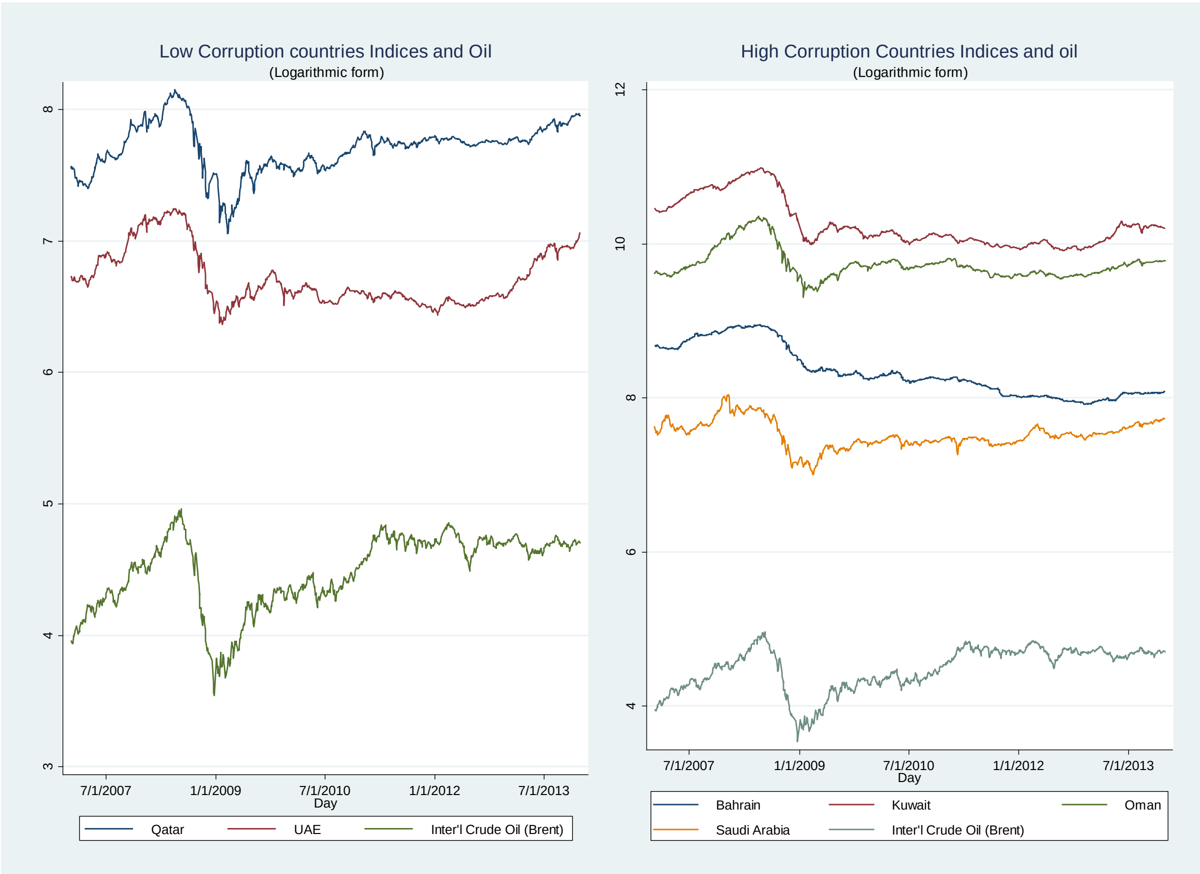


Figure 3.3. The Movements of (Log) Market Indices and Oil

Table 3.2 reveals significantly positive connections between the equity returns of the GCC markets indices and oil markets. The unconditional correlations test result show that the largest oil coefficient is for Oman whereas the smallest is for Kuwait.

Table 3.2. *Correlations of Market Equity Returns to Oil Returns for the Period 2007 -2013*

Corruption level	Low		High			
	Qatar	UAE	Bahrain	Kuwait	Oman	Saudi Arabia
Oil	0.2483*	0.2672*	0.1210*	0.1155*	0.3462*	0.2574*

Note: * Statistically significant at both the 0.01, 0.05 significant level.

4. Econometric Model

To estimate the dynamic relationship between oil movements and equity returns and their volatilities of the GCC countries on cross-section context, the VECH model of Bollerslev, Engle, and Wooldridge (1988) is used. The model helps to avoid the difficult estimation caused by exponential increase caused by using a multivariate generalized autoregressive conditional heteroskedasticity (MGARCH) models' variance-covariance matrix h_t size as the number of model variables increase (see, Grosvenor and Greenidge, 2013).

According to our two groups of corruption, the estimation is required to run multivariate GARCH systems along with diagonal VECH specification twice. One for low corruption group (Qatar and UAE) and another for high corruption group (four other GCC countries). These dynamic multivariate regression models are based on an autoregressive-moving-average structure to estimate the conditional variances and covariances of the errors. The diagonal VECH (DVECH) -MGARCH model allows for parameterizing each element of the current conditional covariance matrix as a linear function of its own past and other past shocks. The form of the DVECH- MGARCH (1,1) model can be written as follows:

$$r_t = Cx_t + \varepsilon_t, \tag{1}$$

where r_t is an $m \times 1$ vector of dependent variables, equity returns; C is an $m \times k$ matrix of parameters; x_t is a $k \times 1$ vector of independent variables including lags of r_t, such as current oil returns ($r_{o,t}$). While the error term is defined by this model as:

$$\varepsilon_t = h_t^{1/2} \nu_t \tag{2}$$

and DVECH (1,1) is:

$$h_t = a_0 + diag(\mathrm{a}_1)\ \mu_{t-1} + diag(\mathrm{a}_2)\ \ h_{t-1} \quad (3)$$

where $h_t^{1/2}$ is the Cholesky factor of the time-varying conditional covariance matrix $h_t = vech(\Sigma_t)$; v_t is an $m\ \times 1$ vector of independent and identically distributed innovations; $a_0 = vech(A_0)$ is an $m \times m$ symmetric parameter matrix; $\mathrm{a}_1 = vech(A_1)$ and $\mathrm{a}_2 = vech(A_2)$ each is an $m\ \times m$ symmetric parameter matrix. The matrices A_1 and A_2 are symmetric but not diagonal matrices. $\mu_{t-1} = vech\ (\varepsilon_{t-1}\varepsilon_{t-1}')$. These specifications clarify that each element in h_t depends on its past values and the past values of the corresponding ARCH terms and then derives a positive definite matrix for the conditional covariance matrices in the DVECH-MGARCH-model. Moreover, the proposition of restricting matrices a_1 and a_2 is wanted to be diagonal matrices because Bollerslev, Engle, and Nelson (1993) argue that without these restrictions the model is too flexible to fit to the data.

Papers such as Hsieh (1989), Taylor (1994), Brook and Burke (2003), and Frimpong and Oteng-Abayie (2006) show that higher order GARCH models may not be necessary in general, thus in our empirical application, the simple GARCH (1,1) is sufficient to capture volatility clustering in financial data. Therefore, this specification is used in this study. The DVECH-MGARCH estimates the parameters by maximum likelihood. The log-likelihood function based on the multivariate normal distribution for observation *t* is:

$$l_t = -\frac{1}{2}\ \log(2\pi) - \frac{1}{2}\log\{det(h_t)\} - \frac{1}{2}\ \varepsilon_t h_t^{-1}\varepsilon_t' \quad (4)$$

where $\varepsilon_t = r_t - Cx_t$. The log-likelihood function is $\sum_{t=1}^{T} l_t$

The Diagonal VECH-MGARCH model allows for varying ARCH and GARCH parameters between and within groups. In other words, Diagonal VECH GARCH models allow the conditional covariance matrix of the dependent variables to follow a flexible dynamic structure. The model will be applied on general market of both low corruption level group, which includes Qatar and UAE, and high corruption level group, which includes Bahrain, Kuwait, Oman, and Saudi Arabia. Coefficients of oil price return and oil volatilities components are the coefficients of interest. Those estimates of oil price return and its innovation show how this explanatory variable affects the equity returns and their volatility differently taking into account the corruption levels. Then we will compare the estimates between the high and low corruption one.

5. Empirical Results

Table 3.3 shows results of the DVECH- MGARCH (1,1) model for the coefficients of interest. The results show that there are insignificant differences in oil impacts on equity returns under the specifications of corruption. This could be due to reducing gap between low and high level of corruption groups. The market administrations of high level of corruption has implemented few new efficient policies that help increase the performance of their markets. The coefficients of oil returns are statistically significant for equity returns on both corrupted and non-corrupted countries. Both groups of countries equity returns are positively related to oil price movements. This infers that misuse of entrusted powers could raise the chance to have a tied relationship between equity returns and oil price returns instead of harming this relationship. Within the high-corrupted group, Bahrain and Kuwait have lower coefficients of oil returns compared to Oman and Saudi Arabia indicting a weaker connection to oil markets. Our results suggest that both efficient or inefficient institutions and different levels of corruption have no direct and explicit influence on this type of relationships. In other words, the finding of our approach fail to define patterns that help distinguishing equity returns responses of the low and high corrupted groups. This indicates that asset prices are insensitive to the level of corruption. Wald test against the null hypothesis that all the coefficients on the independent variables in each equation are zero. Non-reported results show that the null hypothesis is rejected at all conventional levels.

Table 3.3. *Diagonal VECH(1,1) Model Results*

Corruption level	Low		High			
Variable	Qatar	UAE	Bahrain	Kuwait	Oman	Saudi Arabia
Oil return	0.175 **	0.1501***	0.0331***	0.0454**	0.2036***	0.1696***
	(0)	(0)	(0)	(0.0144)	(0.0174)	(0.0212)
L.ARCH(oil return)	0.0018***	-0.0001***	0.0001	-0.0269**	-0.0012	-0.0354
	(0.0005)	(0)	(0.0007)	(0.0082)	(0.0181)	(0.0378)
L.GARCH(oil return)	-1.0031***	1.0115***	-1.0126***	-0.5546***	-0.6096***	0.6320***
	(0.0007)	(0.0002)	(0.0571)	(0.0532)	(0.0357)	(0.1169)

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Complete DVECH(1,1) model regression results are reported in Appendix C

Zero coefficients shown above represent a very small value that is less than 0.00005

As shown in Table 3.3, the ARCH and GARCH terms results are reported in the L.ARCH (where L is a single day lag) and L.GARCH equations, respectively. The ARCH term of oil return (innovation) are statistically significant for low-corrupted countries group (Qatar and UAE) and only for Kuwait from high-corrupted countries group. Nevertheless, insignificant for Bahrain, Oman, and Saudi Arabia (high corrupted countries group). The lagged equity indices returns volatility of Qatar and Bahrain responds positively to oil price return innovations while the four other of GCC countries volatility are negatively linked to oil price return innovations. It is obvious that the absolute magnitudes of the oil price innovation coefficients for Saudi Arabia and Kuwait are much larger than these of other GCC countries. Our results shows that the equity volatility of low-corrupted countries group are responsive to oil return invocations indicating stronger sensitivity to oil error terms.

The day lag of oil price return volatility coefficients are statistically significant for all countries equity return volatility indicating tied linkages between these variables. Although the equity returns volatility are responsive to oil volatility, it appears that different levels of corruptions have no important influences on the relationship between volatilities across oil and equity markets.

For the low corruption group, an increase in oil price volatility reduces the equity return volatility for Qatar but raises equity return volatility for UAE. For the high corruption group, when oil price volatility increases, the equity return volatility for Bahrain, Kuwait, and Oman was reduced but it increased for Saudi Arabia. Therefore, since our approach components have no patterns so that makes the level of corruption have no real effect on differences.

6. Conclusion

The objective of this study is to examine to what extent different levels of corruption affect the linkages between general equity indices returns of the GCC states and oil price returns and the volatilities. For this purpose, we utilize the advantages of two worldwide corruption measurements WGI and CPI that help us to divide the GCC countries into two groups: the low corruption group (Qatar and UAE) and the high corruption group (Bahrain, Kuwait, Oman, and Saudi Arabia). Our findings show that dissimilar levels of corruption between GCC countries have inconsiderable differences on the oil return effects on the GCC stock markets. Oil returns affect both low and high corruption groups with statistically significance levels. However, in terms of economic magnitudes, Qatar, UAE, Oman, and Saudi Arabia appear to be more affected by oil returns movements. Furthermore, the oil return innovation affects equity volatility for Saudi Arabia and Kuwait more than other GCC countries. This implies that investors in stock markets of those two countries could pay more attention to oil price innovations. The finding also reveals that the equity returns and their volatility of both groups are mostly responsive to oil price changes. This result implies that an absence or presence of corruption has no significant patterns on the relationship between oil and equity returns movements. Further investigation could be done to explore the linkages between oil and stock markets under different levels of corruption in other regions.

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APPENDICES

Appendix A

Country	# of sectors	Sector	Notation (Growth)*	Currency	Frequency Aggregation	Time Period	Obs
BHN (BSE)	1	Bank	GBBP	USD	Daily	9/28/2006 - 12/31/2013	1437
	2	Insurance	GBINSP				1437
	3	Hotels & Tourism	GBHTP				1436
	4	Investment	GBINVP				1437
	5	Industrial	GBINDP				1435
	6	Services	GBSP				1437
		All Share Index	GBGP	USD	Daily		1437

Source: Bloomberg

$* \, Growth\, of country Subsector = \left(\frac{Subsector\ close\ price_t - Subsector\ close\ price_{t-1}}{Subsector\ close\ price_{t-1}}\right) * 100$

Country	# of sectors	Sector	Notation (Growth)*	Currency	Frequency Aggregation	Time Period	Obs
KWT (KSE)	1	Banks	GKBP	KWD converted to USD using exchange rate	Daily	5/14/2012 - 12/31/2013	324
	2	Consumer Services	GKCSP			5/14/2012 - 12/31/2013	324
	3	Industry	GKINDP			5/14/2012 - 12/31/2013	324
	4	Insurance	GKINSP			5/14/2012 - 12/31/2013	324
	5	Real Estate	GKREP			5/14/2012 - 12/31/2013	324
	6	Consumer Goods	GKCGP			5/14/2012 - 12/31/2013	324
	7	Oil & Gas	GKOGP			5/14/2012 - 12/31/2013	324
	8	Basic Materials	GKBMP			5/14/2012 - 12/31/2013	324
	9	Telecommunications	GKTEP			5/14/2012 - 12/31/2013	324
	10	Health Care	GKHCP			5/14/2012 - 12/31/2013	264
	11	Technology	GKTEP			5/14/2012 - 12/31/2013	322
	12	Investment Instruments	GKIIP			5/14/2012 - 12/31/2013	324
	13	Financial Services	GKFSP			5/14/2012 - 12/31/2013	324
	14	Parallel	GKPAL			5/14/2012 - 12/31/2013	324
		All Share Index	GKGP	KWD to USD	Daily	5/14/2012 - 12/31/2013	324

Sources: Kuwait Stock Exchange and Bloomberg

*The new Kuwait Stock Exchange classification that is implemented on 5/13/2012 is used in this study

$** \, Growth\, of country Subsector = \left(\frac{Subsector\ close\ price_t - Subsector\ close\ price_{t-1}}{Subsector\ close\ price_{t-1}}\right) * 100$

Country	# of sectors	Sector	Notation (Growth)*	Currency	Frequency Aggregation	Time Period	Obs
OMN (MSM)	1	Banks & Financial	GOBP	USD	Daily	10/2/2006 - 12/31/2013	1424
	2	Industry	GOINDP				1424
	3	Services	GOSP				1424
		All Share Index	GOGP	USD	Daily	10/2/2006 - 12/31/2013	1424

Source: Bloomberg

$$* \, Growth\ of\, country Subsector = \left(\frac{Subsector\ close\ price_t - Subsector\ close\ price_{t-1}}{Subsector\ close\ price_{t-1}}\right) * 100$$

Country	# of sectors	Sector	Notation (Growth)*	Currency	Frequency Aggregation	Time Period	Obs
QTR (QE)	1	Bank	GQBP	USD	Daily	1/3/2007 - 12/31/2013	1414
	2	Industrial	GQINDP				1414
	3	Transport	GQTRP				1414
	4	Real Estate	GQREP				1414
	5	Insurance	GQINSP				1414
	6	Telecom	GQTP				1414
	7	Consume Goods & Services	GQCGSP				1414
		All Share Index	GQGP	USD	Daily	1/3/2007 - 12/31/2020	1414

Source: Bloomberg

$$* \, Growth\ of\, country Subsector = \left(\frac{Subsector\ close\ price_t - Subsector\ close\ price_{t-1}}{Subsector\ close\ price_{t-1}}\right) * 100$$

Country	# of sectors	Sector	Notation (Growth)*	Currency	Frequency Aggregation	Time Period	Obs
SAU (TASI)	1	Bank	GSBP	USD	Daily	12/31/2001 - 12/31/2013	2044
	2	Petroleum	GSPP			01/08/2007 - 12/31/2013	1074
	3	Cement	GSCP			12/31/2001 - 12/31/2013	2037
	4	Retail	GSRP			01/08/2007 - 12/31/2013	1074
	5	Energy	GSEP			01/08/2007 - 12/31/2013	1074
	6	Agriculture	GSAP			12/31/2001 - 12/31/2013	2044
	7	Telecommunication	GSTP			01/01/2003 - 12/31/2013	1823
	8	Insurance	GSINSP			01/17/2005 - 12/31/2013	1433
	9	Multi-Investment	GSIVP			01/08/2007 - 12/31/2013	1074
	10	Real Estate	GSREP			01/08/2007 - 12/31/2013	1074
	11	Transports	GSTRP			01/08/2007 - 12/31/2013	1074
	12	Media	GSMP			01/08/2007 - 12/31/2013	1074
	13	Hotel	GSHP			01/08/2007 - 12/31/2013	1074
	14	Building	GSBUP			01/08/2007 - 12/31/2013	1074

Country	# of sectors	Sector	Notation (Growth)*	Currency	Frequency Aggregation	Time Period	Obs
	15	Industry	GSINDP			12/31/2001 - 12/31/2013	2044
		All Share Index	GSGP	USD	Daily	12/31/2001 - 12/31/2013	2044

Source: Bloomberg

$* \; Growth\ of\ country Subsector = \left(\frac{Subsector\ close\ price_t - Subsector\ close\ price_{t-1}}{Subsector\ close\ price_{t-1}}\right) * 100$

Country	# of sectors	Sector	(Growth)**	Currenc y	F. A.	Time Period	Obs
UAE* (ADX)	1	Banks	GUBP	USD	Daily	7/3/2006 -12/31/2013	1505
	2	Energy	GUEP			7/10/2006 -12/31/2013	1502
	3	Real Estate	GUREP			7/3/2006 -12/31/2013	1505
	4	Industrial	GUINDP			7/4/2006 -12/31/2013	1505
	5	Telecommunication	GUTP			7/10/2006 -12/31/2013	1502
	6	Consumer Staples	GUCSP			7/3/2006 -12/31/2013	1505
	7	Services	GUSP			7/10/2006 -12/31/2013	1502
	8	Insurance	GUINSP			4/29/2002 -12/31/2013	2274
		All Share Index	GUGP	USD	Daily	4/29/2002 -12/31/2013	2274

Source: Bloomberg

* The Abu Dhabi Securities Market indices are used to present the UAE Market indices since most the literature uses this market

$** \; Growth\ of\ country Subsector = \left(\frac{Subsector\ close\ price_t - Subsector\ close\ price_{t-1}}{Subsector\ close\ price_{t-1}}\right) * 100$

VARIABLE	Notation	Currency	Frequency Aggregation	Time Period	Obs
Oil prices(Growth)*	GOP	USD	Daily	12/31/2001 - 12/31/2013	2044
Kuwaiti Dinar Exchange Rate to Dollar**	KER	USD		5/14/2012 - 12/31/2013	324

Source: Bloomberg

$*Growth = GOP = \left(\frac{Oil\ Spot\ price_t - Oil\ Spot\ price_{t-1}}{Oil\ Spot\ price_{t-1}}\right) * 100$

** Uses to convert data set in KWD units to USD units

The Supersectoral classification

Supersector	**Sectors**
Financial (6 sectors)	Banks
	Insurances
	Financial Investment
	Investment Instruments
	Financial Services
	Real Estate
Industrial (6 sectors)	Industry (Manufacturing)
	Petroleum
	Cement
	Agriculture and Food Industry
	Basic Materials
	Energy
Services (13 sectors)	Hotel &Tourism
	Services
	Telecommunications
	Consumer Staples
	Transportation
	Consumer Goods
	Utilities
	Media
	Retail
	Building
	Health Care
	Technology
	Parallel*

*Parallel: It is a sector (market) includes all companies that are not admitted in regular market.

Supersectors for the GCC Countries

Country	Period	Obs.
BHN	9/28/2006 - 12/31/2013	1435
KWT	5/14/2012 - 12/31/2013	323 (Services 263)
OMN	10/2/2006 - 12/31/2013	1400
QTR	1/3/2007 - 12/31/2013	1415
SAU	1/22/2007 - 12/31/2013	1100
UAE	7/10/2006 - 12/31/2013	1500

Appendix B

OLS-Sectors- BHN

Indices	General	Banks	Investment	Insurance	Industrial	Hotels	Services
Supersector own lag(1)		-0.0191	0.0046	0.0304	0.1665***	0.0062	-0.0265
		(0.0162)	(0.021)	(0.0264)	(0.0263)	(0.0264)	(0.0241)
General Index	0.0691**	1.4681***	0.7865***	0.0476	0.0928*	0.0436	0.5852***
	(0.0263)	(0.0302)	(0.027)	(0.0295)	(0.0447)	(0.0283)	(0.0343)
Oil	0.0242**	0.0048	-0.011	0.0068	0.0023	-0.0052	0.0155
	(0.0075)	(0.0087)	(0.0077)	(0.0085)	(0.0127)	(0.0081)	(0.0098)
Oil variance lag(1)	-0.0002*	0.0002*	-0.0018*	0.0001	0.0001	-0.0004	0.0009
	(0.0001)	(0.0001)	(0.0008)	(0.0009)	(0.0015)	(0.0007)	(0.0011)
Constant	-0.0349	0.0500*	-0.0155	-0.001	-0.0246	0.0401	-0.0238
	(0.0184)	(0.0211)	(0.0211)	(0.0232)	(0.0358)	(0.0215)	(0.0269)
Observations	1436	1436	1436	1436	1434	1435	1436
The Log Likelihood	-1500	-1700	-1500	-1700	-2300	-1600	-1900

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

EGARCH(1,1)-SECTORS-BHN

Indices	General	Banks	Investment	Insurance	Industrial	Hotels	Services
Mean eq.							
Sector lag(1)		0.0055	0.0046	0.6165***	-0.4041	0.0062	-0.0266
		(0.0139)	(0.0221)	(0.028)	(0.2506)	(0.0069)	(0.0226)
General lag(1)	0.1599***	1.3843***	0.7864***	0.5188***	-0.7307	0.0436***	0.5853***
	(0.0264)	(0.0283)	(0.0288)	(0.0555)	(0)	(0.008)	(0.0299)
Oil	0.0066	-0.0293**	-0.011	-0.0441***	-0.0517	-0.0051*	0.0155
	(0.0084)	(0.0106)	(0.0092)	(0.0064)	(0)	(0.0023)	(0.0085)
Oil variance lag(1)	-0.0001**	0.0004***	0.0039	0.0082***	0.0715	-0.0015	-0.0009
	(0)	(0.0001)	(0.003)	(0.0022)	(0)	(0.0011)	(0.0029)
Log Variance	0	0	-0.0000***	0	0	-0.0000***	0
	(0)	(0)	(0)	(0.1764)	(0)	(0)	(0)
Constant	-0.1286***	-0.0249	-0.0155	-0.5136	-1.9425	0.0401***	-0.0238
	(0.0239)	(0.0227)	(0.034)	(0)	(0)	(0.0117)	(0.034)
Variance eq.							
earch lag(1)	-0.0779**	0.1530***	0.0003	0.0323	-0.1106	-0.0032	0
	(0.0243)	(0.0263)	(0.0388)	(0)	(0)	(0.0062)	(0.0195)
earch-a lag(1)	-0.2725***	-0.1411***	0.001	-0.0657	-0.0059	0.007	0.0059
	(0.0261)	(0.0381)	(0.0532)	(0)	(0)	(0.0046)	(0.0203)
egarch lag(1)	0.39	0.3092	-0.0072	0.3562***	0.7165	-0.0244	-0.0063
	(0)	(0)	(0.0678)	(0.0055)	(0)	(0.0164)	(0)
Oil variance	-0.0004***	-0.0005***	0.071	-0.0056***	-0.0090***	0.0663	0.0649***

	(0.0001)	(0.0001)	(0)	(0.0008)	(0)	(0)	(0.0069)
Constant	-0.3415***	-0.3987***	-1.4372***	-1.1522	1.4715	-4.1930***	-1.3028
	(0.0301)	(0.0297)	(0.0595)	(0)	(0)	(0.0671)	(0)
Observations	1436	1436	1436	1436	1434	1435	1436
The Log Likelihood	-1600	-1800	-1600	-7800	-8800	-11000	-2000

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

OLS-sectors-OMN

Variable	General Index	Financial	Industrial	Services
Supersector own lag(1)		0.0061	0.0928***	0.0387**
		(0.0103)	(0.0139)	(0.0119)
General	0.1568***	1.0894***	0.9831***	0.7988***
	(0.0257)	(0.0123)	(0.0167)	(0.011)
Oil	0.1143***	-0.0042	0.0109	0.0065
	(0.0141)	(0.0067)	(0.0091)	(0.006)
Oil variance lag(1)	-0.000004	0	-0.000003	-0.000005
	(0.000009)	(0.000004)	(0.000006)	(0.000004)
Constant	0.0139	-0.0055	0.0453*	0.0178
	(0.0354)	(0.0165)	(0.0224)	(0.0147)
Observations	1423	1423	1423	1423
The Log Likelihood	-2400	-1300	-1800	-1200

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

EGARCH(1,1)-sectors-OMN

Variable	General Index	Financial	Industrial	Services
Mean eq.				
β_{i1}(Sector lag1)		0.0307**	0.0943	0.0261*
		(0.0119)	(0)	(0.011)
β_{i2}(General lag1)	0.6612	1.0899***	1.0106***	0.7804***
	(0)	(0.0134)	(0.0071)	(0.0097)
β_{i3}(Oil)	-0.0900**	-0.0102	0.01	-0.0045
	(0.0294)	(0.0073)	(0)	(0.0042)
β_{i4}(Oil variance lag1)	0.000004	-0.000002	0.000004	-0.000008
	(0.015881)	(0.000005)	(0.000016)	(0.000007)
β_{i5}(Log variance)	0	0.0475	-0.028	-0.013
	(0.0159)	(0.1708)	(0.0291)	(0.0676)
γ_i(Constant)	-0.0164	-0.0399	0.0336	0.0208
	(0.038)	(0.0754)	(0)	(0.0139)
Variance eq.				

δ_{i1}(earch lag1)	0.0174	-0.1630***	-0.0785	-0.0674**
	(0)	(0.0474)	(0)	(0.0236)
δ_{i2}(earch-a lag1)	0.5907***	0.3047***	0.4896	0.6045***
	(0.0433)	(0.0537)	(0)	(0.0462)
θ_{i1}(egarch lag1)	0.9233***	0.3745	0.3457	0.8156***
	(0.0151)	(0)	(0)	(0.007)
ρ_i(Oil variance)	0	0	0.0001	0
	(0)	(0)	(-0.0001)	(0)
θ_{i0}(Constant)	0.237	-0.4608***	-0.0131	-0.3453
	(0)	(0.0354)	(0.0643)	(0)
Observations	1423	1423	1423	1423
The Log Likelihood	-2200	-1300	-1700	-1100

Note: * p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

OLS-Sectors-QTR

Variable	General	Banks	Insurance	Real Estate	Consumer Goods & Services	Industrial	Telecommunications	Transportations
Supersector own lag(1)		-0.0075	0.0538**	0.0457*	-0.0139	0.0519***	0.0327	0.0457*
		(0.0093)	(0.0207)	(0.0177)	(0.0187)	(0.0111)	(0.0203)	(0.0177)
General Index	0.1675***	1.0314***	0.6958***	1.0632***	0.6479***	1.0525***	0.7502***	1.0632***
	(0.026)	(0.0103)	(0.0232)	(0.0258)	(0.0172)	(0.0131)	(0.0238)	(0.0258)
Oil	0.0887***	0.0105	-0.0037	0.0330*	0.0193	-0.0206*	-0.0059	0.0330*
	(0.0162)	(0.0064)	(0.0144)	(0.0159)	(0.0106)	(0.008)	(0.0147)	(0.0159)
Oil variance lag(1)	0	0	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Constant	0.0597	-0.0042	0.0144	-0.0207	0.0832**	0.0188	-0.0216	-0.0207
	(0.0403)	(0.0157)	(0.0354)	(0.0392)	(0.0263)	(0.0198)	(0.0362)	(0.0392)
Observations	1412	1412	1412	1412	1412	1412	1412	1412
The Log Likelihood	-2600	-1300	-2400	-2500	-2000	-1600	-2400	-2500

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

EGARCH(1,1)-Sectors-QTR

Variable	General	Banks	Insurance	Real Estate	Consumer Goods & Ser.	Industrials	Telecommunications	Transportations
Mean eq.								
β_{i1}(Sector lag1)		0.0225*	0.0586*	0.0099	0.0071	0.0059	-0.0038	0.0099
		(0.0105)	(0.029)	(0.0195)	(0.0277)	(0.0123)	(0.0331)	(0.0195)
β_{i2}(General lag1)	0.0888	1.0444***	0.6894***	1.0760***	0.5447***	1.0607***	0.7806***	1.0760***
	(0.0456)	(0.0111)	(0.0252)	(0.0392)	(0.0221)	(0.0143)	(0.0202)	(0.0392)
β_{i3}(Oil)	0.0511***	0.0099*	-0.0242	0.0474*	0.0394***	0.0073	0.0176	0.0474*
	(0.0083)	(0.0048)	(0.0141)	(0.022)	(0.0103)	(0.0072)	(0.0176)	()
β_{i4}(Oil variance lag1)	0	0	0	0	0.0000***	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
β_{i5}(Log variance)	0.0216***	0.1952***	0.0035	0.0006	-0.0549	0.1340**	0.0151	0.0006
	(0.0046)	(0.0461)	(0.0113)	(0.0023)	(0.0421)	(0.0436)	(0.016)	(0.0023)
γ_i(Constant)	0.0968***	0.0097	-0.0433	-0.1560**	0.0442	-0.0779**	-0.058	-0.1560**
	(0.0177)	(0.0172)	(0.0914)	(0.0508)	(0.0842)	(0.03)	(0)	(0.0508)
Variance eq.								
δ_{i1}(earch lag1)	0.1497**	0.1429***	-0.203	0.1032	-0.0463	-0.1362**	-0.1570*	0.1032
	(0.0495)	(0.036)	(0.2246)	(0.0966)	(0.1314)	(0.0505)	(0.0656)	(0.0966)
δ_{i2}(earch-a lag1)	1.072	0.8896	1.4279***	1.0850***	0.6135***	0.7955	1.0078***	1.0850***
	(0)	(0)	(0.2561)	(0.1975)	(0.0997)	(0)	(0.0912)	(0.1975)
θ_{i1}(egarch lag1)	0.9065***	0.7244***	0.1863**	0.3161***	0.6852	0.7823***	0.5289	0.3161***
	(0.0173)	(0.0453)	(0.0615)	(0.0655)	(0)	(0.0461)	(0)	(0.0655)
ρ_i(Oil variance)	-0.0000***	0	0	-0.0000*	0	0	0	-0.0000*
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
θ_{i0}(Constant)	0.1984***	-0.1814**	1.1939***	0.8174***	0.2475***	0.0501*	0.5157***	0.8174***
	(0.0186)	(0.0581)	(0.2366)	(0.1305)	(0.0606)	(0.0243)	(0.0519)	(0.1305)
Observations	1412	1412	1412	1412	1412	1412	1412	1412
The Log Likelihood	-2300	-1100	-2500	-2500	-1900	-1500	-2400	-2500

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

OLS-SECTORS- SAU

Variable	General	Banks	Insurance	Multi-Investment	Real Estate	Petroleum	Energy	Cement	Agriculture	Industrial	Building	Telecommunications	Retail	Hotels	Media	Transportations
Supersector own lag(1)		0.0521***	0.0764***	0.0564**	0.0226	-0.0188	-0.1282***	0.0126	0.0653***	-0.0153	0.0651***	-0.013	0.0579**	-0.0008	-0.0066	-0.0115
		(0.0109)	(0.0203)	(0.0205)	(0.019)	(0.0114)	(0.0252)	(0.0145)	(0.0174)	(0.0142)	(0.0171)	(0.0139)	(0.0201)	(0.0252)	(0.0247)	(0.0206)
General Index	0.0378	0.8230***	0.8964***	1.0733***	0.9644***	1.2471***	0.5547***	0.7805***	1.1028***	1.1252***	1.1109***	0.8731***	0.7974***	0.9491***	0.8609***	0.9897***
	(0.0219)	(0.0105)	(0.0291)	(0.0307)	(0.0238)	(0.0162)	(0.025)	(0.0151)	(0.0315)	(0.0214)	(0.0237)	(0.0151)	(0.0217)	(0.0425)	(0.0369)	(0.0282)
Oil	0.1160***	0.0017	0.0023	-0.0112	-0.0343*	0.0751***	-0.0077	-0.0063	-0.0890***	0.0732***	-0.0178	-0.0348**	-0.0451**	-0.0502	0.0014	-0.0062
	(0.0164)	(0.0079)	(0.0231)	(0.0201)	(0.0155)	(0.0105)	(0.0163)	(0.0113)	(0.0237)	(0.0161)	(0.0155)	(0.0117)	(0.0142)	(0.0277)	(0.024)	(0.0184)
Oil variance lag(1)	0.1044	0.5491	0	0	0	0	0	0.0008*	-1.2042	0.1495	0	-0.016	0	0	0	0
	(0.9746)	(0.461)	(0)	(0)	(0)	(0)	(0)	(0.0003)	(1.3874)	(0.9412)	(0)	(0.0192)	(0)	(0)	(0)	(0)
Constant	-0.6739	-3.8835	0.0323	-0.0142	-0.0032	0.0319	0.0096	-0.0074	8.6106	-1.0601	-0.0302	0.1179	0.0754	0.1199	-0.0396	0.0262
	(6.8725)	(3.2503)	(0.0551)	(0.0551)	(0.0427)	(0.0289)	(0.0447)	(0.0298)	(9.7829)	(6.6369)	(0.0425)	(0.1514)	(0.039)	(0.0763)	(0.066)	(0.0505)
Observations	2039	2039	1432	1073	1073	1073	1073	2036	2039	2039	1073	1822	1073	1073	1073	1073
The Log Likelihood	-4300	-2700	-3200	-2200	-1900	-1500	-1900	-3500	-5000	-4200	-1900	-3100	-1800	-2500	-2300	-2100

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

EGARCH(1,1)-SECTORS-SAU

Variable	General	Banks	Insurance	Multi-Investment	Real Estate	Petroleum	Energy	Cement	Agriculture	Industrial	Building	Telecommunications	Retail	Hotels	Media	Transportations
β_{i1}(Sector lag1)		0.0773***	0.0764***	0.0564***	0.0226	-0.0188*	-0.1282***	0.0126	0.0391*	0.0023	0.0651***	-0.0576***	0.0579***	-0.0008	-0.0066	-0.0115
		(0.0122)	(0.0138)	(0.0151)	(0.013)	(0.0085)	(0.0145)	(0.0096)	(0.0164)	(0.0157)	(0.0122)	(0.0174)	(0.0146)	(0.0162)	(0.0171)	(0.0138)
β_{i2}(General lag1)	-0.0418	0.8143***	0.8964***	1.0733***	0.9644***	1.2471***	0.5547***	0.7805***	1.1566***	1.2839***	1.1109***	0.7529	0.7974***	0.9491***	0.8609***	0.9897***
	(0)	(0.0105)	(0.02)	(0.0215)	(0.0163)	(0.0117)	(0.0146)	(0.0099)	(0.021)	(0.0212)	(0.0155)	(0)	(0.016)	(0.0252)	(0.0246)	(0.0188)
β_{i3}(Oil)	0.0927	0.0086	0.0023	-0.0112	-0.0343**	0.0751***	-0.0077	-0.0063	-0.0471**	0.0327*	-0.0178	-0.0299***	-0.0451***	-0.0502**	0.0014	-0.0062
	(0)	(0.0075)	(0.0158)	(0.0141)	(0.0108)	(0.0075)	(0.0094)	(0.0073)	(0.0165)	(0.0167)	(0.0107)	(0.002)	(0.0105)	(0.0171)	(0.0162)	(0.0127)
β_{i4}(variance lag1)	0.1173***	0.4666***	0	0	0	0	0	0.0007**	-1.1948***	0.0995	0	-0.0086	0	0	0	0
	(0.0047)	(0.0093)	(0)	(0)	(0)	(0)	(0)	(0.0002)	(0.0894)	(0.2735)	(0)	(0)	(0)	(0)	(0)	(0)
β_{i5}(Log variance)	0.0084***	0.0619	0	0	0	,	0	0.0000***	0.0323***	0.0067***	0	0.0113	0	0	0	0
	(0.0024)	(0.0747)	(0.018)	(0.0257)	(0)	(0)	(0)	(0)	(0.0035)	(0.0013)	(0)	(0)	(0)	(0.0244)	(0.0219)	(0.029)
γ_i(Constant)	-0.8172	-3.3374	0.0323	-0.0142	-0.0032	0.0319	0.0096	-0.0074	8.6093***	-0.7256	-0.0302	0.0093	0.0754*	0.1199	-0.0396	0.0262
Variance eq.	(0)	(0)	(0)	(0)	(0.0307)	(0.0222)	(0.0269)	(0.0199)	(0.6317)	(1.9219)	(0.0284)	(0)	(0.0293)	(0)	(0)	(0)
δ_{i1}(earch lag1)	-0.2804	0.1961***	0	0	0	0	0	0.0005	-0.279	-0.4623	0	0.3444***	0	0	0	0
	(0)	(0.0376)	(0.0166)	(0.0168)	(0.0158)	(0.0192)	(0.0108)	(0.0076)	(0)	(0)	(0.0112)	(0.0405)	(0.0181)	(0.0185)	(0.0117)	(0.0133)
δ_{i2}(earch-a lag1)	0.8777	0.2963***	0	0	0	0	0	0.0025	1.0371	0.0753	0	0.6735***	0	0	0	0
	(0)	(0.0453)	(0.0213)	(0.0223)	(0.0186)	(0.0285)	(0.0133)	(0.0088)	(0)	(0)	(0.0173)	(0.0508)	(0.0266)	(0.0207)	(0.0158)	(0.0144)
θ_{i1}(egarch lag1)	0.8163***	-0.0415	0	0	0	0	0	-0.0008	0.3237	-0.5552***	0	0.3883***	0	0	0	0
	(0.0138)	(0)	(0)	(0)	(0)	(0.034)	(0)	(0.0134)	()	(0)	(0.0377)	(0)	(0.0848)	(0)	(0)	(0)
ρ_i(Oil variance)	4.1179***	0.3289	0	0	0	0	0	0.014	-0.2910***	0.7593***	0	-0.0517***	0	0	0	0
	(0.002)	(0.894)	(0)	(0)	(0)	(0)	(0)	(0)	(0.0042)	(0.0453)	(0)	()	(0.0144)	(0)	(0)	(0)
θ_{i0}(Constant)	-28.7668	-2.447	0.9057***	0.4416***	-0.1033**	-0.8201	-0.3600***	-0.4631***	3.5329	-2.9497***	-0.2430***	0.7729***	-0.1638***	0.7650***	0.7253***	0.1856***
	(0)	(6.3041)	(0.0279)	(0.0404)	(0.0349)	(0)	(0.0335)	(0.0256)	(0)	(0.3552)	(0.0363)	(0.1256)	(0.0374)	(0.0333)	(0.0348)	(0.0328)
Observations	2039	2039	1432	1073	1073	1073	1073	2036	2039	2039	1073	1822	1073	1073	1073	1073
The Log l.	-4000	-2700	-3500	-2300	-2100	-1600	-2400	-4100	-4600	-4100	-2200	-3100	-1900	-2900	-2600	-2300

OLS-SECTORS- UAE

Variable	General	Banks	Insurance	Real Estate	Consumer Staple	Energy	Industrial	Telecommunications	Services
Supersector own lag(1)		0.0502***	-0.0074	0.0493**	-0.1089***	0.0234	0.1169***	-0.0023	-0.0570*
		(0.0113)	(0.0203)	(0.0167)	(0.0231)	(0.0176)	(0.0225)	(0.0165)	(0.0248)
General Index	0.1831***	1.0059***	0.1710***	1.7868***	0.7267***	1.3730***	0.6245***	0.9458***	0.4354***
	(0.0205)	(0.0129)	(0.0143)	(0.0399)	(0.0382)	(0.0334)	(0.0307)	(0.0205)	(0.0385)
Oil	0.0726***	0.0053	0.0052	0.0274	0.0162	0.0236	0.03	-0.0213*	-0.0509*
	(0.0115)	(0.0068)	(0.0081)	(0.0208)	(0.0203)	(0.0175)	(0.0162)	(0.0108)	(0.0205)
Oil variance lag(1)	0	-0.0000**	0	0.0000*	-0.0000*	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Constant	0.0429	0.0149	0.0201	-0.028	0.034	-0.0374	-0.0244	0.0016	0.0356
	(0.0282)	(0.0162)	(0.0196)	(0.05)	(0.0488)	(0.0421)	(0.0389)	(0.026)	(0.0493)
Observations	2273	1504	2273	1504	1504	1501	1504	1501	1501
The Log Likelihood	-3900	-1400	-3100	-3100	-3100	-2900	-2700	-2100	-3100

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

EGARCH(1,1)-SECTORS-UAE

Variable	General	Banks	Insurance	Real Estate	Consumer Staple	Energy	Industrial	Telecommunications	Services
Mean eq.									
β_{i1}(Sector lag1)		0.0482***	-0.0074	0.0568***	-0.1089	0.0234	-0.0154	-0.0023	-0.0570**
		(0.0123)	(0.0054)	(0.017)	(0.0569)	(0.0142)	(0.0262)	(0.0124)	(0.0177)
β_{i2}(General lag1)	0.1831***	1.0378***	0.1710***	1.7677***	0.5353***	1.3730***	0.6350***	0.9458***	0.4354***
	(0.013)	(0.0123)	(0.0038)	(0.0294)	(0.0426)	(0.0266)	(0.0269)	(0.015)	(0.0276)
β_{i3}(Oil)	0.0726***	-0.005	0.0052*	0.0281	0.0275	0.0236	0.009	-0.0213**	-0.0509***
	(0.0071)	(0.0066)	(0.0021)	(0.0171)	(0.0214)	(0.014)	(0.0129)	(0.0079)	(0.0147)
β_{i4}(Oil variance lag1)	0	0	0	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
β_{i5}(Log variance)	0	-0.1802***	0	-0.0122	0.0684***	0	0.007	0	0
	(0)	(0.0534)	(0)	(0.0122)	(0.0141)	(0.0204)	(0.0107)	(0)	(0.0199)
γ_i(Constant)	0.0429*	0.0443	0.0201***	0.0177	-0.2897	-0.0374	0.0283	0.0016	0.0356
	(0.0179)	(0.026)	(0.0059)	(0.0586)	(0.2457)	(0)	(0.0426)	(0.02)	(0)
Variance eq.									
δ_{i1}(earch lag1)	0	-0.0445	0	0.0748	-0.2201	0	0.2582**	0	0
	(0.0061)	(0.0461)	(0.0018)	(0.0549)	(0.1808)	(0.0186)	(0.0823)	(0.0154)	(0.0159)
δ_{i2}(earch-a lag1)	0	0.7346	0	0.9608***	1.1074	0	1.3068***	0	0
	(0.0086)	(0)	(0.0018)	(0.0821)	(0)	(0.0282)	(0.1641)	(0.0197)	(0.0219)
θ_{i1}(egarch lag1)	0	0.7633***	0	0.3796***	0.1988	0	0.4838***	0	0
	(0)	(0.0436)	(0.0029)	(0.0347)	(0.7846)	(0)	(0.0596)	(0)	(0)
ρ_i(Oil variance)	0	0	0	0	0	0	-0.0000***	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
θ_{i0}(Constant)	-0.3813***	-0.0777*	-1.5447	0.8948	1.6044	0.5117***	0.6886***	-0.6398***	0.6091***
	(0)	(0.0256)	(0)	(0)	(1.7096)	(0.0355)	(0.129)	(0.0311)	(0.0305)
Observations	2273	1504	2273	1504	1504	1501	1504	1501	1501
The Log Likelihood	-4600	-1400	-15000	-3100	-3200	-3000	-2700	-2300	-3300

Note: p<.05; ** p<.01; *** p<.001; Standard Errors in Parentheses

Appendix C

DVECH(1,1) Model results

Corruption level	Low		High			
Variable	Qatar	UAE	Bahrain	Kuwait	Oman	Saudi Arabia
Market Index lag 1	0.1574***	0.0554	0.0465	0.0723	0.1118**	0.066
	(0.0354)	(0)	(0)	(0.0379)	(0.0379)	(0.0435)
Oil return	0.175	0.1501	0.0331***	0.0454**	0.2036***	0.1696***
	(0)	(0)	(0)	(0.0144)	(0.0174)	(0.0212)
Sigma(oil return)	-0.5448	0.0000***	0	0.3504	-0.8054	0.0378
	(0)	(0)	(0)	(0)	(0)	(0)
L.ARCH(oil return)	0.0018***	-0.0001	0.0001	-0.0269**	-0.0012	-0.0354
	(0.0005)	(0)	(0.0007)	(0.0082)	(0.0181)	(0.0378)
L.GARCH(oil return)	-1.0031***	1.0115***	-1.0126	-0.5546***	-0.6096	0.6320***
	(0.0007)	(0.0002)	(0)	(0.0532)	(0)	(0.1169)
Constant	0.0428	0.0297	-0.055	-0.0226	0.0047	0.008
	(0.0394)	(0)	(0)	(0.0348)	(0.0395)	(0.0583)
Observations	1003		1003			
The Log Likelihood	-6000		-8600			

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