AMERICAN UNIVERSITY OF BEIRUT

IMPACT OF OIL PRICE SHOCKS ON THE GCC STOCK MARKET

by
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A project
submitted in partial fulfillment of the requirements
for the degree of Master of Arts in Financial Economics
to the Department of Economics
of the Faculty of Arts and Sciences
at the American University of Beirut

Beirut, Lebanon
February 2016

AMERICAN UNIVERSITY OF BEIRUT

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ACKNOWLEDGMENTS

First and foremost I would like to thank my advisor Professor Simon Neaime for his assistance and feedback. I would also like to thank Dr. Yassar Nasser.

Appreciations to my family and colleagues for their continuous support and opinions.

AN ABSTRACT OF THE PROJECT OF

Ghadi Said Stephan for Masters of Arts in Financial Economics
Major: Financial Economics

Title: Impact of Oil Price Shocks on the GCC Stock Market

The year 2016 started critically for the oil market. The WTI and Brent benchmark fell to their 13 year-low, breaking the $30 per barrel resistance level. This is mainly due to the slower than expected growth of the world's second largest economy, China. Nevertheless, the oil crisis started in September 2014. The oil prices have declined from over $100 per barrel to less than $50 per barrel in less than six months. This crisis had a severe impact on the GCC region. If the theory that oil prices have an impact on the stock market is precise, then looking at the beginning of 2016, the heavily oil-based GCC region is starting off on a worse year than 2015. This project studies the impact of oil price shocks on the GCC stock market indices over the period 12/31/2005 – 1/25/2016. After conducting all the necessary tests, the results reported by the Impulse Response Function and Variance Decomposition suggest that Brent crude price shocks have an impact on all the GCC stock market indices.

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CHAPTER I

INTRODUCTION

Emerging Markets came into being during the 1980's. The term was first coined by Antoine Van Agtmeal, an executive of the World Bank's International Finance Corporation (Zweig, 2013). The term is used to describe the developing economies, which have been a growing force of the World Economy. For example, China and India, which have the two largest populations by country, contribute to 23% of the World GDP (Quandl, 2015). As for emerging markets as a whole, their contribution to World GDP has increased from around 36% in the 1980's to around 57% in 2014 (International Monetary Fund, 2015).

Emerging Markets have been the hub for new investment decisions for portfolio and fund managers. They have been widely seen and recognized by experts as a promising area offering high returns. Moreover, the emerging market capitalization has grown rapidly from 4% in 1987 to 20% in 2000 (Arouri & Jawadi, 2010). This has shown the increased interest in the emerging stock markets. Globalization, coupled with economic stability and financial liberalization played a major role. Nevertheless, not all emerging markets have fully integrated the process of liberalization and some of these countries are still in the process of "Stock Market Liberalization". Foreigners are not welcomed into some of the emerging market countries and struggle when investing in their stock markets because of strict rules and regulations. For example, Saudi Arabia, part of the Golf Cooperation Council (GCC), just recently opened up its stock market to foreigners on June 15, 2015. Restrictions on foreigners still persist, and licenses are not easily given, where local traders are still the majority (Al Omran & Jones, 2015).

The Golf Cooperation Council (GCC) consists of 6 countries listed as emerging and frontier markets and encompasses Saudi Arabia, United Arab Emirates (UAE), Kuwait, Qatar, Oman and Bahrain. These countries have specific characteristics that set them apart from the other emerging markets. They are part of the World's largest producers and exporters of petroleum products. In 2013, Kuwait's as well as Saudi Arabia's oil exports consisted of above 80% of total exports and generated around 80% of total government revenues, followed by Qatar, which exported around 75% in crude materials and contributed around 65% of total revenues (Callen et al., 2014). As for the United Arab Emirates, around 40% of its total exports were in terms of Oil, but they generated more than 80% of its total revenues (Callen et al., 2014). Currently, Saudi Arabia is ranked as the world's largest oil exporter; it produces around 9.7 million barrel per day of crude oil and accounts to more than half of its total GDP (Organization of the Petroleum Exporting Countries, 2015). It also possesses around 18% of the world's total oil reserves (Organization of the Petroleum Exporting Countries, 2015). As for Kuwait, it produces around 2.867 million barrel per day of crude oil and contributes to 60% of the countries' GDP (Organization of the Petroleum Exporting Countries, 2015). As for the United Arab Emirates, its Oil & Gas sector contributes to 40% of total GDP. Moreover, the GCC countries are also members of OPEC and their influence in this organization is highly significant. In 2010, they contributed to around 50% of OPEC's oil production and 52% of OPEC's reserves and around 36% of the world's total oil production (Kabbani & Zughaibi, 2015).

Hence, from these figures one can conclude that the GCC region is oil-dependent, and hence oil price fluctuations might have a significant impact on its stock market indices. The theory that oil price movements can dictate the direction of the stock market arises from two strands of literature. The first one is based on the theory of future cash flows. The value of any stock is calculated as the discounted sum of expected future cash flows that are affected by exogenous macroeconomic events, such as oil price shocks, which in turn raises pressure on the stock prices and therefore on the market index (Basher, Haug & Sadorsky, 2010). The other theory is based on interest rates; oil price movements put inflationary pressure on the central bank to take action and adjust interest rates accordingly, which in turn affects the discount rate that is used in the calculation of the stock prices (Basher, Haug & Sadorsky, 2010).

This project tests whether oil price shocks have an impact on the GCC stock market indices using regression analysis. The study is divided as follows: Chapter 2 discusses the different related literature behind this theory. Chapter 3 gives an overview of the oil history. Chapter 4 presents the empirical data and methodology as well as the analysis of the reported results. Finally chapter 5 concludes the study with a brief summary of the whole project.

CHAPTER II

LITERATURE REVIEW

There exists a strand of literature that revolves around the impact of oil price shocks on the different stock markets. These papers date back to the 1970's and have focused on developed economies, specifically the United States followed by Europe. Papers focusing on emerging markets were scrace, but have substantially proliferated in recent years, focusing on GCC countries.

The impact that oil price volatility has on oil importing and exporting countries differs significantly.

A paper by Jones and Kaul in 1996, is based on the theory that an asset price is determined by its discounted cash flows, hence any factors affecting the latter, have a significant impact on that particular asset price (Fisher, 1930). Applying this theory on oil prices; costs of production increase hindering profits and to some extent the shareholders' value, leading to a decrease in stock prices. This particular paper studies the impact of oil price shocks on the stock markets of the United States, Canada, Japan and the United Kingdom, focusing on the United States (Jones & Kaul, 1996). They employ the standard cash-flow/dividend valuation model for quarterly data on these stock markets during the post –war period (Jones & Kaul, 1996). The results obtained for the US and Canada are in line with the future discounted cash flow theory, where the volatility in the stock market is completely accounted for by the effect of oil price shocks on current and future expected cash flows solely, whereas for Japan and the United Kingdom the findings are somewhat different (Jones & Kaul, 1996). They were able to prove as well that oil price shocks have a negative impact on the United Kingdom and Japanese stock market, however in excess of what can be explained by the rational discounted future cash flow model (Jones & Kaul, 1996).

Following that paper, in 1999, another paper studies the impact of oil price shocks on the United States stock market alone. Similarly, 3-month T-bill rates are used as a proxy for interest rates and industrial production variables are used (Sadorsky, 1999). The data collected is on a monthly basis, covering the 1947:1966 period (Sadorsky, 1999). A GARCH (1,1) model has been used in order to be able to account for the unexpected movements in oil prices (Sadorsky, 1999). As in any GARCH model, the order of the variables is very important. Following Ferderer's paper in 1996, the Cholesky factorization placed interest rates first, followed by oil price volatility then industrial production and finally stock market returns (Sadorsky, 1999). After constructing the model, Impulse Response Function and Variance Decomposition tests have been implemented. The results indicate that the oil price shocks have a negative impact on stock returns (Sadorsky, 1999), which is consistent with results obtained by Jones and Kaul in 1996. Nevertheless, the only difference here is that the impact is persistent over a 3-months period rather than just one month (Sadorsky, 1999). Moreover, the Variance Decomposition test generated the same results as the paper of Jones and Kaul, where 5 to 6% of stock price movements are explained by oil price fluctuations (Sadorsky, 1999).

In a more recent paper in 2014, non-linearity in oil prices is studied; in other words, the impact of oil prices on stock market returns in an environment where oil prices are fairly stable, compared to an environment where oil prices are more volatile

(Jiménez-Rodríguez, 2014). The sample used is over the period 1971:2 – 2012:8, with real stock returns (accounting for inflation), and the real oil price, which is defined as the ratio of UK crude oil, measured in US dollars, to the US Producer Price Index (Jiménez-Rodríguez, 2014). The countries tested are: United States, Canada, United Kingdom and Germany (Jiménez-Rodríguez, 2014). Evidence of non-linearity is reported after conducting the test suggested by Hamilton (2001) (Jiménez-Rodríguez, 2014). Hence, a bivariate VAR model with non-linearly transformed oil prices and real stock returns is used (Jiménez-Rodríguez, 2014). Looking at the linear case, Impulse Response Function reports evidence of a negative impact of oil price shocks on stock returns except for Canada, where the impact was not statistically significant (Jiménez-Rodríguez, 2014). The results indicate that a 10% oil price shock results in a negative impact with a magnitude of 0.5% in the United States, compared with a 1% for the European countries at the end of 1 year (Jiménez-Rodríguez, 2014). Taking into account the non-linear specifications, the results increase in magnitude, where a 10% shock in oil prices causes a 1% negative impact in stock returns for the United States compared to a 2% negative impact for the European countries after a period of 1 year (Jiménez-Rodríguez, 2014). These results are similar to the results obtained in previous papers, with a new finding that the environment in terms of oil price volatility is a very important determinant in assessing the impact of oil price fluctuations on price movements. An environment with stable oil prices almost doubles the impact of oil price shocks on the stock market compared to an environment where oil prices are volatile (Jiménez-Rodríguez, 2014).

In another paper, the impact of oil price shocks on the United States and 13 different European countries is studied. In this paper, a simple unrestricted VAR model is used; however, other variables have been included such as interest rates and the industrial production in addition to the oil prices and stock returns (Park & Ratti, 2008).

In this paper, monthly data for the period between 1986 and 2005 are employed (Park & Ratti, 2008). Even though cointergation is present, the unrestricted VAR model is used, since this paper focuses on the short-run relationship, and a VEC model gives similar results to a VAR when testing for short-run impacts (Park & Ratti, 2008). Using the impulse response function, oil price shocks have a significant impact on stock returns within the interval of 0 to 1 month after the shock has occurred (Park & Ratti, 2008). The results are also similar when including and omitting other variables, for example when including inflation to the standard model, the results remain similar, where oil price shocks have an impact on stock market returns for all the countries included in the study except for the United Kingdom (Park & Ratti, 2008). For the United States and 10 out of the 13 European countries, oil price shocks have a negative impact on the real stock returns with a time framework up to 1 month (Park & Ratti, 2008). For Finland, an oil-importing country, the effect is only persistent with a lag of 1 month, where during the same month no impact is reported (Park & Ratti, 2008). As for Norway, which is an oil exporting country, there is an immediate positive impact from oil price shocks on real stock market returns during the same month, and this effect disappears after 1month (Park & Ratti, 2008). Moreover, using the variance decomposition, oil price shocks explain 6% of the movements in the stock returns, which is a statistically significant amount given the different variables that affect stock market returns (Park & Ratti, 2008). These results are consistent with the notion that oil prices impact oil-importing and exporting countries differently.

A few papers have recently focused on the notion put forth by Kilian in 2004, in that not all oil price shocks are alike, one of which was written by Apergis and Miller in 2009. In this paper, the authors chose a sample of eight countries comprising Australia, France, Italy, United Kingdom, Germany, Canada, the United States and Japan (Apergis & Miller, 2009). In other words, the G7 countries plus Australia, which is a major player in the Pacific Rim, are the focus of this study. The data collected are monthly and cover the period 1981-2007 (Apergis & Miller, 2009). They employ vector autoregressive and vector error correction models in order to decompose the oil-price changes into idiosyncratic oil-demand shocks, global aggregate-demand shocks and oil-supply shocks (Apergis & Miller, 2009). Idiosyncratic shocks are related to precautionary demand shifts such as the uncertainty of available future oil supply (Apergis & Miller, 2009). Moreover the variables employed include monthly data for the Consumer Price Index (CPI), a proxy for goods prices, a global index of dry cargo single freight rate as a proxy for economic activity, in addition to crude oil spot prices, crude oil production per day and the eight countries' stock market indices returns (Apergis & Miller, 2009). This study is very important, in that it enables the identification of the exact effects of oil price changes on the stock market. By employing the variance decomposition and granger temporal causality tests on these segregated oil price shocks, mixed results are reported. The variance decomposition shows that global aggregate demand shocks have no effect on the variation in oil prices, whereas oil-supply and idiosyncratic-shocks explain around 3% of the variation in oil prices in the short-run and around 7% of the oil price variation in the long-run (Apergis & Miller, 2009). Hence, even though the effect is proven to be significant, the magnitude is relatively small. By employing the granger temporal causality test, oil supply and idiosyncratic demand shock do not lead to changes in stock market returns, whereas the global aggregate-demand shocks impacts stock market returns (Apergis & Miller, 2009). Hence even though this paper is in line with the other published studies, it disaggregates the effect of oil prices into its different components and shows that the impact is very minimal whereas there are other variables that might considerably affect the stock market returns.

On the other hand, other papers have been published that show no evidence of oil price shocks impacting the stock market. In a paper by Reboredo and Rivera-Castro, they used the wavelet multi-resolution analysis that allows the decomposition of time-series into two types of frequency components, high frequency time -series components, which occur over very short periods of time, and low frequency time-series components, which occur over longer periods of time (2013). The study is conducted on the United States and Europe on the aggregate as well as the sectorial level (Reboredo & Rivera-Castro, 2013). The data used are daily from the beginning of June 2000 till the end of July 2011, utilizing the Brent crude oil prices as a proxy, the S&P 500, the Dow Jones Stoxx Europe 600, and several other European and US industrial sectors including banks, oil and gas, utilities, technologies and many more (Reboredo & Rivera-Castro, 2013). The evidence suggest that in the pre crisis period from June till July 2008, oil prices had no impact on the stock market returns on the aggregate and sectorial level except for the oil and gas sector, where positive relationship is noticed and post July 2008, interdependence is recorded where oil prices lead stock prices and vice versa (Reboredo & Rivera-Castro, 2013). Nevertheless, the crisis of 2008 was an exception where other factors might have inflated the results suggesting that oil prices affect stock market returns.

In line with these results, other papers and studies have been published, the first of which was published in 1996. Applying the unrestricted VAR mode, the evidence suggests that oil price futures do not affect the United States stock market, particularly the S&P 500 (Huang et al., 1996).

As stated earlier, in the recent years published papers regarding the impact of oil prices on GCC countries have proliferated. Unlike the papers regarding Europe and the United States, mixed and different results are observed among the different papers as well as mixed results within the countries comprising the GCC region.

In 2010, Alkhathlan and Ravichandran investigated the impact of oil prices on the GCC stock markets. The data employed are daily covering the period between March 2008 and April 2010, for the variables that encompass the stock market indices of the 6 GCC countries and the NYMEX oil prices (Alkhathlan & Ravichandran, 2010). They employ the GARCH –M model in order to account for the impact of oil price uncertainty on the GCC stock market returns, where the error term includes the unobservable factors (Alkhathlan & Ravichandran, 2010). For the short run analysis they study the statistical significance of the coefficients that result from the model. The insignificance of the coefficients of Saudi Arabia and Bahrain, imply that the unobservable speculative factors, which are captured by the error term, are the driving force that determine the short term stock price returns, whereas for the other four markets, the coefficient are significant implying that in addition to the unobservable factors, oil price volatility plays an important role in determining stock price returns (Alkhathlan & Ravichandran, 2010).

Moreover by studying the signs of the coefficients for the latter four GCC countries, unobservable speculative factors and oil price uncertainty move in opposite directions when determining the impact on short-term stock price returns (Alkhathlan & Ravichandran, 2010). Moving on to the long run relationship, they use the cointergation results. In their view, the long term is achieved when oil prices transmit to macroeconomic indicators that in turn influence the profitability of firms (Alkhathlan & Ravichandran, 2010). One cointegrating vector exists when only stock prices are included, while it is three cointegrating vectors when turnover ratios are used instead (Alkhathlan & Ravichandran, 2010). So, oil prices impact liquidity more than they impact stock returns. Nevertheless, liquidity is proportional to the market size, and the bigger the economy (more oil based), the larger the liquidity (Alkhathlan & Ravichandran, 2010). Hence in the long run, the impact of oil prices on stock returns still prevails in the sense that oil prices transmit their effect to key macroeconomic indicators which in turn impact the stock price returns, with the exception of Kuwait and Bahrain (Alkhathlan & Ravichandran, 2010). Thus, oil prices affect the stock market returns in the long run.

Moreover, another paper published in 2010 also achieves the same results. The data used are weekly, covering the period 7 June 2001 to 21 October 2008 and encompassing the stock market indices of the 6 GCC members, the MSCI world market index as a proxy for the world stock market and the Brent spot price as a proxy for the crude oil price (Arouri, Bellalah & Lahiana, 2010). Linear and non-linear models are used and the results show that oil prices affect the stock markets non linearly and vary according to the oil price value, except for Bahrain and Kuwait where no relationship has been recorded (Arouri, Bellalah & Lahiana, 2010). For example, for Saudi Arabia, in the linear model, oil prices strongly impact the stock market negatively, whereas in the non-linear model, oil prices have a weak positive relationship with stock market returns (Arouri, Bellalah & Lahiana, 2010).

In another paper by Azar and Basmajian in 2013 testing the impact of oil prices on the Saudi and Kuwaiti stock market, also mixed results have been published. The data collected for the Saudi All Share Index, the Kuwait S.E, the Brent oil spot prices and the S&P 500 are daily and weekly (Azar & Basmajian, 2013). Because of non-linearity they employ the GARCH (1,1) model with four regressions (Azar & Basmajian, 2013). The first regression is the basic one where stock price returns are regressed on oil prices; the third model is an extension of the first model, in which two additional independent variables, the S&P 500 and a proxy for regional returns are added (Azar & Basmajian, 2013). The second model separates the oil prices into positive and negative changes, and the fourth model is an extension of the second model with the same two independent variables of model 3 added to the equation (Azar & Basmajian, 2013). The results obtained show that oil prices do not affect the Kuwaiti stock market linearly and non-linearly, whereas oil prices have a non-linear impact on the Saudi stock market (Azar & Basmajian, 2013). These results are in line with other papers, where Saudi stock market is affected by oil prices, in contrast to the Kuwaiti stock market index.

On the other hand, other papers have been published showing that volatility has a greater effect on stock indices compared to oil shocks. For example, in 2014, a paper has been published proving that shocks to volatility outweigh its effect on stock market returns than shocks to oil prices (Balli & Louis, 2014). The data extracted are daily, covering the WTI crude oil prices as a proxy for the oil prices, along with the prices of the stock market indices of all of the GCC countries as well as sectorial stock prices including banks, insurance, services and industry (Balli & Louis, 2014). The importance of this paper is that it measures the synchronicity between oil prices and stock market returns (Balli & Louis, 2014). Measuring synchronicity is a challenging task. In this paper they employ the Hodrick and Prescott nonparametric filter, in which the returns and volatilities are decomposed into a trend that is the long term return and a cycle that is the deviation of the actual return from its trend; and the difference between the two is calculated as the ratio of the cycle over the trend for the sectorial and aggregate stock market indices and the oil prices (Balli & Louis, 2014). In order to measure the synchronicity between the oil prices and stock markets, the bivariate and multivariate nonparametric synchronicity method are used (Balli & Louis, 2014). The results indicate a mild synchronization around 40 to 60% between cyclical fluctuations in oil prices and stock market returns and mild and strong synchronization of around 60% and above when it comes to the fluctuations of volatility (Balli & Louis, 2014). Moreover the researchers implement the dynamic factor models as developed by Geweke in 1977, in order to assess to what extent the oil prices and volatility can explain the dynamics of the common factor underlying the GCC stock markets (Balli & Louis, 2014). The results suggest that while oil price returns explain the dynamics of the common factor, the R-squared are very small ranging from 1 to 11 percent, which implies that oil prices are among many other variables underlying the dynamics of the common factor (Balli & Louis, 2014). On the other hand, when testing for volatility in oil prices, the R-squared range from 54 to 94% except for the model of Kuwait, the model of GCC national indices and the GCC-wide sector (Balli & Louis, 2014). These results show that changes in volatility are very important drivers behind the dynamics of each common factor in contrast to shocks in oil price returns (Balli & Louis, 2014).

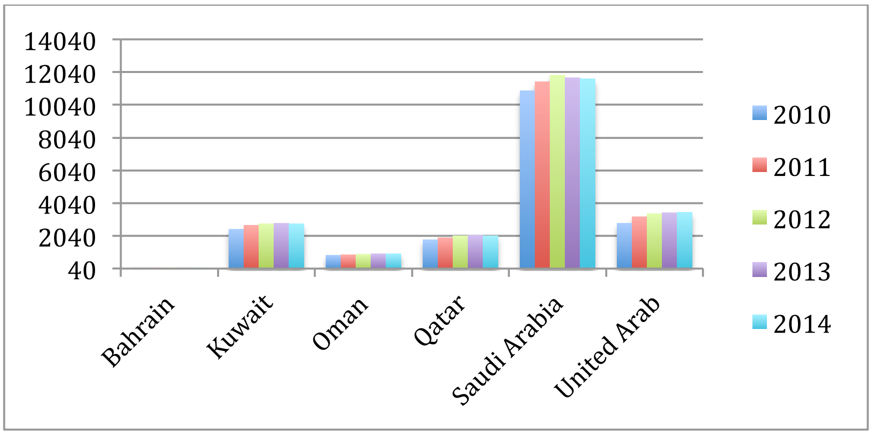
CHAPTER III

OIL PRICE CYCLE SINCE THE 1970's

Petroleum products play a crucial role in the economic state of a country, especially since a lot of our daily activities are dependent on them, and hence follows the price of oil.

Oil, like any other commodity, has its prices affected by changes in supply and demand; however, the main difference in the former, is that it has crucial impacts on the economy as well as the choices regarding monetary and fiscal policy. The leading supplier of oil is OPEC (Organization of Petroleum Exporting Countries). It has started first with six members including Saudi Arabia and Kuwait, and currently comprises 12 members to encompass 4 members of the GCC region except for Bahrain and Oman (Organization of the Petroleum Exporting Countries, 2015). This is not surprising, since looking at the statistics, we can see that between 2010 and 2014, Bahrain and Oman, produced around 5% of the total GCC production on average, constituting around 4.9 million barrels per day out of the total 102 million barrels per day GCC oil supply (U.S Energy Information Administration, 2015).

Figure 1: GCC Oil Production By Country 2010-2014 (Thousand Barrels per day)



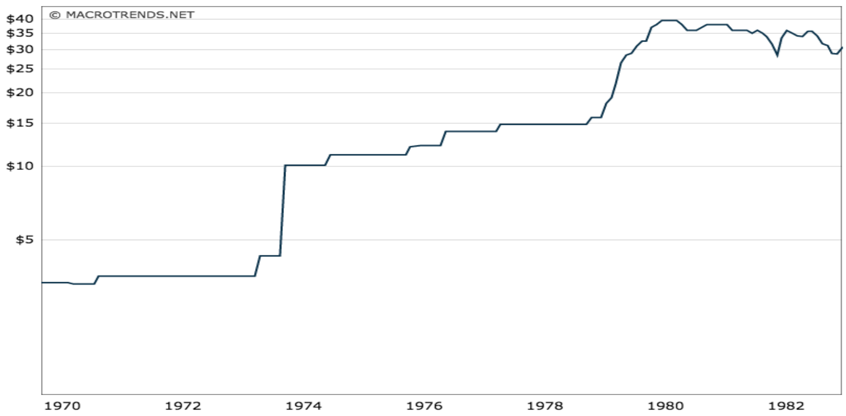
Source: US Energy Information Administration

Recently, the Brent oil prices have hit a "bottom to the market" at a little above 29.46$, in January 2016, after remaining within the $30 – $40 low range (BBC NEWS, 2016). Moreover, a survey conducted by The Wall Street Journal states that 13 investment banks showed bearish signs regarding the oil prices compared to previous estimates, where it was cut by $9/barrel (The Week, 2015). Nevertheless, a lot of other forecasts do not agree with the latter and these forecasts keep changing since the oil price volatility has drastically increased recently, which makes it even harder to predict its movements. Nevertheless, it has been established that the oil prices have decreased sharply in the late 2014, as of the start of the crisis in September, and they have been struggling ever since. Moreover, it is important to know how the oil price cycle works and its effects on the economies, because similar events have occurred in the past.

Looking at figure 2, in 1970, the oil price was around $3/barrel, and has been stable since 1958 (Williams, 2011). However, the oil prices rose sharply in 1974 to around $12/barrel, which is one of the main reasons for the recession that has occurred

(Macalister, 2011). This increase is substantial and unprecedented, since it represents a 150% increase in oil prices.

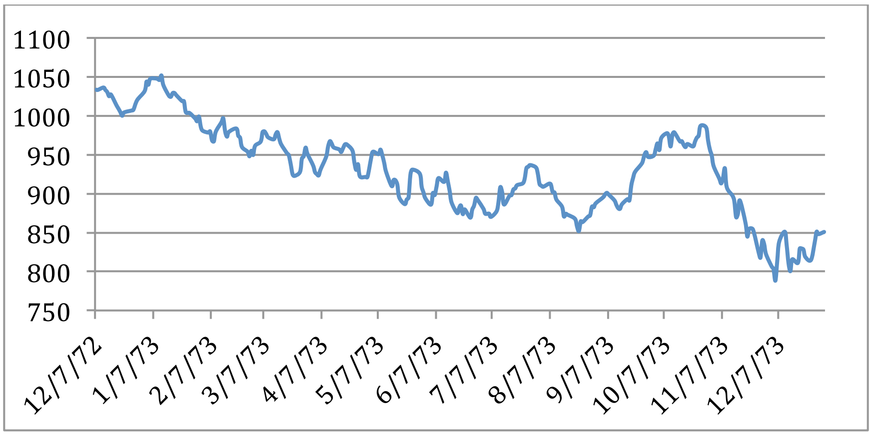
Figure 2: WTI Crude Oil Price (Jan 1970 – Feb 1983)



Source: MACROTRENDS

Several factors contributed to this price hike, the most definite one is the substantial cut in oil supply for strategic war reasons, which was led by OPEC when they enforced an embargo in order to boycott the United States (Macalsiter, 2012). This sudden increase in prices triggered fears of inflation, where workers try to protect themselves by demanding higher wages (Decressin, 2012). The wage rate jumped to 9.6%, compared to 6% before the recession (Wachter, 1974). This nonsensical increase in wages and fears of rising inflation was the base for a "wage-price" spiral set-off (Decressin, 2012), where wages and prices rise in tandem. The recession was also apparent when we look at how the United States' stock market reacted to this event. Regarding the Dow Jones, the first leg down came from January 1973, and continued till August of that year cumulating its seven-month loss of around 18% (Schwartz, 2008). During the following two months, the stocks rallied back due to some bullish investors believing that a new leg was occurring (Schwartz, 2008). Nevertheless, this was not enough to keep the stock market on the same path, hence the stock market dropped by 20% till December 1973 (Schwartz, 2008).

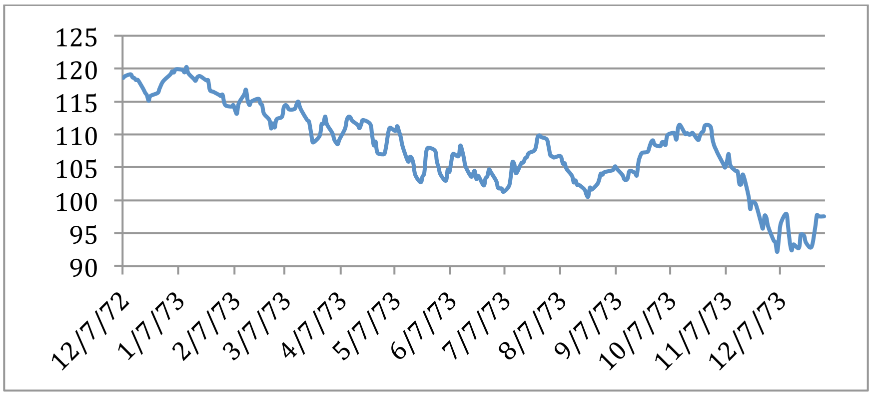
Figure 3: Dow Jones Industrial Average (Dec 1972 - Dec 1973)



Source: Bloomberg L.P

The S&P 500 reacted similarly, as observed in figure 4. The price, in USD, dropped from around 116 to around 97 during the end of 1973.

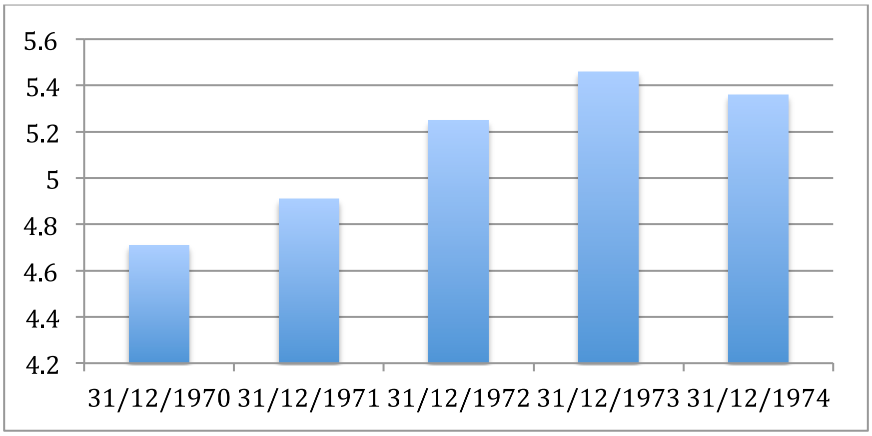
Figure 4: S&P 500 Index (Dec 1972 - Dec 1973)



Source: Bloomberg L.P

In addition to the recession and stock market drop, this oil price increase had major different impacts on oil-exporting and oil-importing countries. The oil-importing countries suffered stagnation, where United States allies such as Japan and European countries resided help from the former for energy supplies (U.S Department of State, 2013). Since the United States was highly dependent on oil imports, it had to negotiate and terminate the embargo, which in turn decreased its international leverage. This event, coupled with the decrease in the excess capacity of the East Texas oil fields as well as the devaluation of the US dollar for allowing it to float freely on the international exchange, resulted in periods of slow economic growth for most oil-importing countries (U.S Department of State, 2013). For example, the US GDP was increasing gradually during the 1970 – 1973 period, reaching $5.46 trillion, but decreased in 1974 to $5.36 trillion comprising a fall of 1.8% (US Bureau of Economic Analysis, 2015).

Figure 5: US Real GDP 1970-1974 (Billions of chained 2009 Dollars)

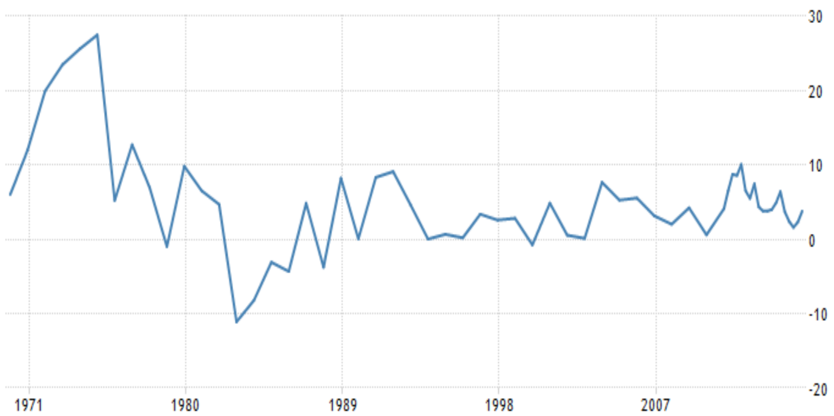


Source: US Bureau of Economic Analysis

Another example is Britain, which was a US ally during World War 2; It has recorded its highest GDP increase in 1973, with a growth rate of 7.4%, followed by a decline of 1.1% in 1974 (Office for National Statistics, 2013).

As for the GCC countries, the complete opposite has occurred. This increase in oil prices acted as the main engine to boost growth in the GCC region (Montasser & Osman, 2003), as the oil price quadrupled from exactly $2.7/barrel in September 1973 to $13/barrel in January 1974 (Baffes, Kose, Ohnsorgen & Stocker, 2015). This can be clearly seen from the GDP figures of Saudi Arabia; where the GDP growth rate reached an all time high of 27.49% in the 4th quarter of 1974 (Baffes, Kose, Ohnsorgen & Stocker, 2015).

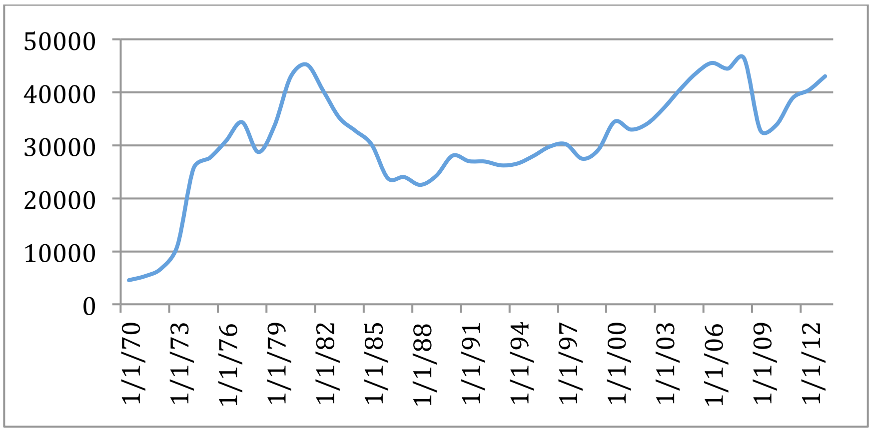
Figure 6: Saudi Arabia GDP Growth Rate (in %)



Source: Trading Economics

Another example is the United Arab Emirates, where the GDP has been gradually increasing from 1970 till 1973 to respectively reach $11 billion, and $25.7 billion, an abrupt increase of 133% (United Nations, 2015).

Figure 7: United Arab Emirates Annual GDP 1970 – 2012 (in USD)



Source: United Nations Statistics Division

As for Bahrain, which is a member of the GCC, but plays a small role in its share of oil exports, witnessed a gradual increase in GDP from 1970 till 1974, reaching $1.1 billion up from $0.82 billion in 1973 (IndexMundi, 2015). This contributes to an annual increase of 34%. Hence all of the GCC members were subject to an increase in GDP, some more than others and one of the main factors contributing to the GDP increase is the escalated price of oil, followed by an increase in government revenues. It has been stated that this surge in oil prices was the main source for the establishment of an oil-based Arab regional economy and order (Montasser & Osman, 2003).

From 1974 till the late 1978, the prices have been fairly stable, for example for the crude oil; the average change was 8% over the 4 consecutive years, whereas for the Brent prices the average change was around 12% (TradingEconomics, 2016).

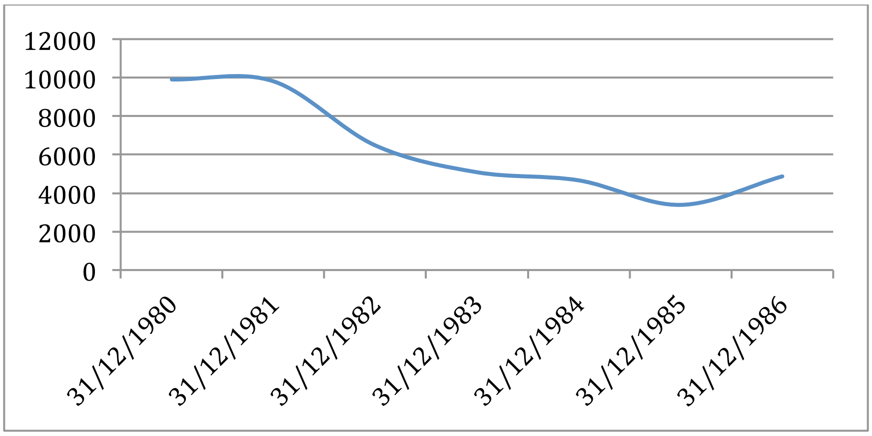
Figure 8: Brent crude Oil spot price (1970-2016)

Source: TradingEconomics

Nevertheless, in 1979 an oil crisis similar to its predecessor in 1974 emerged. This oil crisis also surfaced from events in the Middle East, in particular the Iranian revolution. It is important to note, that Iran is one of the OPEC non-GCC member countries, and their fair share of oil export is around 1,109,000b/d well above Qatar and United Arab Emirates who export around 595,000b/d and 760,000b/d respectively (OPEC, 2015). Moreover, its oil production per day is 3,117,000 b/d, which contributes significantly to OPEC's total output (OPEC, 2015). Nevertheless, its oil production in the 1970's was far more prominent than today. Its oil production reached its peak in 1978 to around 5.8 million b/day and became the second largest oil producer in OPEC (Verleger, 1979). During the Iranian revolution of 1979, Iran had reduced its oil production to around 445 thousand b/day a decline of around 5.3 million b/day (Verleger, 1979). The oil prices have increased from approximately $14/barrel to around $31/barrel, an increase of around 120% (ChartsBin, 2014). However, the oil supply reduction does not solely explain this increase, what caused the prices to soar was "investor sentiment", the fear of further oil disruptions following the cut, which in turn resulted in global speculative hoarding (Graefe, 2013). The booming global economy coupled with the increase in demand, resulted in a sharp increase in oil prices almost doubling the cost from April 1978 to April 1979 (Graefe, 2013). This oil crisis, hit the United States another time with a new recession, where interest rates increased to 20%, and new double-digit inflation figures emerged (Sawyers, 2013). Moving to European oil-importing countries, which were also hit, Britain suffered the most, since 40% of its oil supply came from Iran (Yeboah, 2014). This effect also spread to Japan, since it imported 20% of its oil from Iran, in addition to the contractual agreements between Britain and Japan, which stated that Britain is obliged to sell some its oil to Japan, were cancelled (Yeboah, 2014). Nevertheless, the impact of this oil price was less severe compared to 1973, since most policy responses focused on curbing inflation and wage adjustments, which prevented "wage-price" spirals (Bayoumi et al., 2000). As for the GCC countries, they were affected positively by this oil price hike. A $5 increase in oil prices per barrel, is expected to raise the net trade balance of OPEC member countries by $64 billion and increases between 4 to 9% of GDP in their current account balances ((Bayoumi et al., 2000). This can be clearly seen when the current account surplus as a percentage of GDP of Saudi Arabia increased from around 0% in 1978 to almost 10% in 1979 (Cappelen & Choudhury, 2007). Moreover, in 1980, oil prices remained in their upward trend due to the reduction in oil supply that resulted from the Iran-Iraq war. This event accumulated a combined loss of around 6% of world oil production (Hamilton, 2010). The 1978-1981 can be seen as one continuous event in the oil price history (Hamilton, 2010). Going forward, the 1986 oil glut has occurred.

This event was a combination of actions between 1981 and 1986 that were linked to the Iran-Iraq war. Between 1981 and 1986, the world oil consumption declined; the sharpest decline witnessed in 1981 contributing to around 3.2% (IndexMundi, 2015), and a decline of 1.6% from 1980 till 1986 (IndexMundi, 2015). In order to try and prevent oil prices from declining further, the world's largest oil producer and exporter, Saudi Arabia shut down more than half of its production between 1981 and 1985; nevertheless oil prices dropped further by 25% (Hamilton, 2010).

Figure 9: Saudi Arabia's Oil Production 1980-1986 (Thousand Barrels per day)

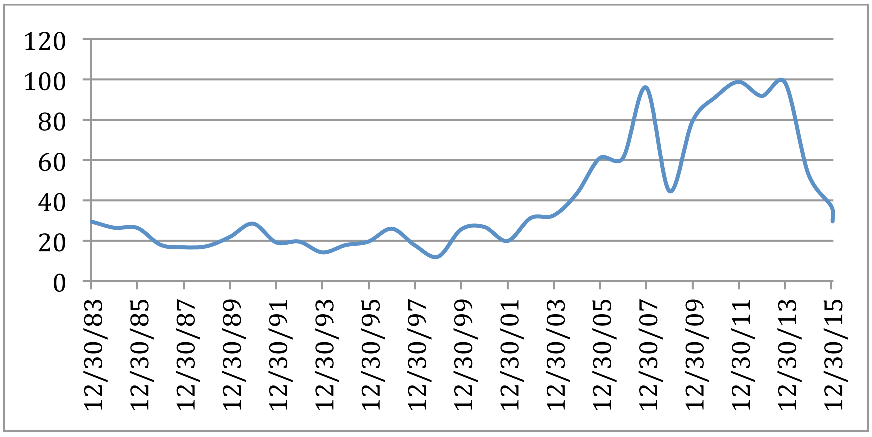


Source: IndexMundi

Which brings us to the oil glut of 1986. During that year Saud Arabia abandoned its efforts in reducing oil production, which triggered a 4-month dive of 67% in oil prices (Porter & Stets, 2014). WTI crude oil prices fell from their peak of $31.72/b in November 1985 to a $10.42/b low in March 1986 (Porter & Stets, 2014). During that time, Saudi Arabia regained its market share in oil production, however oil producers experienced their own oil shock. After OPEC, led by Saudi Arabia, decided to focus on market share rather than prices, oil output increased by around 4 million b/d (Gately, 1986). As mentioned above, Saudi Arabia contributed to more than half of this increase followed by Kuwait, United Arab Emirates, Nigeria and Iran (Gately, 1986). Even though Saudi Arabia revenues have slightly declined by around 6.5%, they were offset by the increase in its oil exports by around 70% (Alsaadi, 2014). But, OPEC as a whole has witnessed huge decreases in output (Alsaadi, 2014). It suffered in terms of oil revenues where they fell by $50 billion, which forced them to cut down on their investments, despite the total amount of $7 billion of accrued bank loans (Cunha, 1988). Moreover, the negative effect spread to less developed countries at that time, such as Mexico, who's GDP dropped by 3% in 1986 (Keohane, 2015). On the other hand, the decline in oil prices increased consumer spending in Europe as well as in the United States accompanied by a decrease in inflation (Keohane, 2015). The negative impact in the United States was only concentrated in the oil-dependent states such as Texas, where unemployment sharply increased and a severe recession occurred (Keohane, 2015).

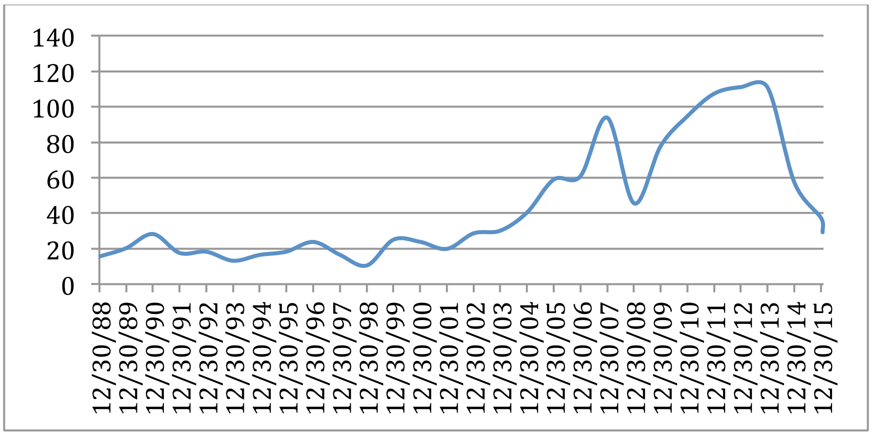
Another important event occurred between the years 1989 and 1991; however the political reason behind it is not within the scope of this paper. The important thing to note, is that when Iraq invaded Kuwait, the latter country's output decreased by around 35% and 84% in 1990 ands 1991 respectively (IndexMundi, 2015). This in turn caused crude oil prices to rise by around 30% and the Brent oil prices to rise by a little over 35% on average over the two consecutive years (Bloomberg L.P., 2016).

Figure 10: WTI Spot Price (1983 - 2016)



Source: Bloomberg L.P.

Figure 11: Brent Spot Prices (1988 - 2016)



Source: Bloomberg L.P.

The countries that have benefited from this surge were the OPEC members excluding Kuwait, most notably Saudi Arabia. For example, Saudi Aramco increased its production in July 1990 from 5.3 million b/d to 8.35 million b/d during a 5-months interval (Aarts & Renner, 1991).

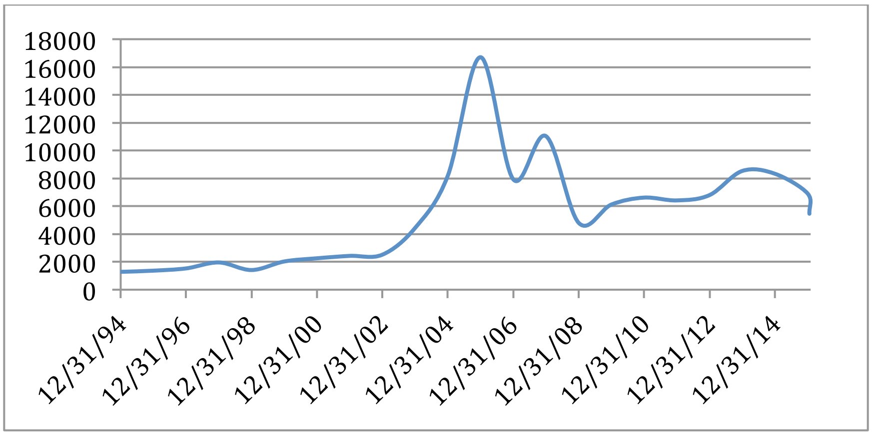
Another major event similar to the 1974 happening occurred in 1999. The prices of oil increased by more than 130% for both WTI and Brent prices (Bloomberg L.P., 2016). In order to understand the surge in oil prices during that year, we need to go back to the years 1997 and 1998, when the East Asian crisis of the "Asian Tigers" encompassing Hong Kong, Singapore, South Korea and Taiwan, had begun. The "Asian Tigers" economic prosperity started before 1997, which is commonly referred to as the "Asian Tigers" miracle. In short, this event was a combination of sustainable growth in investments in physical and human capital that lead to the increase in income per capita and a positive shift in productivity (Page, 1994). The contribution of these countries in terms of oil imports and consumption was fairly modest; nevertheless, the "Hotelling Principle" stated that these countries' continuing growth in oil consumption could boost the oil prices in the mid 1990's (Hamilton, 2010). Nevertheless in the midst of 1997, the "Asian Tigers" experienced a downturn. The currency crisis coupled with financial system distress raised major concerns by investors regarding the suggested continued growth of these Asian countries (Hamilton, 2010). Hence an OPEC meeting was held in Vienna in March of 1998, which resulted in an agreed oil production cut due to concerns of the reduced demand from the Asian Tigers (Mabro, 1998). The end result was a decline in oil prices due to the emerged contango (Mabro, 1998). The cut in production was not enough to meet the reduced demand, where oversupply was still present causing prices to go downhill (Mabro, 1998). During that time, oil prices declined by roughly 30% (Bloomberg L.P., 2016).

Which brings us to 1999, when oil prices surged; the Brent price surged by 139% and WTI price by approximately 200% (Bloomberg L.P., 2016). According to the OPEC annual report, the net income of the major oil companies has increased from \$16,965 million to \$26,748 million, an increase of 57% in 1999, compared to a decrease of roughly 86% in 1998 (OPEC, 1999). Moreover, OPEC revenues from oil exports in 1998 were around $108 billion, down from $160.7 billion in 1997, constituting a decrease of around 33% (US Energy Information Administration, 2015). In contrast, in 1999 OPEC realized revenues from net oil exports in the amount of $149 billion, contributing to an increase of around 37% from the previous year (US Energy Information Administration, 2015). Hence, the Asian tigers crisis negatively impacted OPEC member countries in 1997 and 1998, whereas outweighing this decrease by a surge in prices in 1999.

Which brings us to the 2000's era. From 2000 till 2012, several events that affected oil prices surfaced. The most significant were in 2002 and 2007 - 2009, where oil prices increased by 45% in 2002, and 24.2% between 2007 and 2009 on average (Bloomberg L.P., 2016).

In 2001, in order to stabilize the oil market, OPEC cut its production by 3.5 million b/d (OPEC, 2002). However, the aftermath of the unanticipated September 9/11 attack disrupted this trend. Raised concerns regarding the stability for Middle Eastern countries coupled with the attack, caused oil prices to decrease drastically, by around 18% in one month, and continued in this trend till the start of 2002 (Bloomberg L.P., 2016). According to OPEC, in the following month of the attack, the reference basket of oil decreased by $5/b from $25/b to below $17/b (OPEC, 2002). To counter this downward trend, OPEC held several meetings in 2002, after which they finally agreed to cut oil production further by 5 million b/d, with the compliance of non-OPEC producers to do the same, to the tune of 462,000 b/d (OPEC, 2002). Briefly, in 2005 and 2006, know as the years of growth and prosperity, oil prices rose by a significant percentage of around 45%, due to several factors, such as the growing demand from developing countries most notably China, as well as the unstable Middle Eastern geopolitical situation including the Iraqi war and the Lebanese-Israel war (Energy Information Administration, 2006). This increase in oil prices can be clearly translated into the GCC stock market, where the Tadawul Stock Exchange Index of Saudi Arabia reached an all time high in February 2006 of 20643.86 basis points (Bloomberg L.P., 2016). Moreover, this can be reinforced through all of the GCC stock market indices, where we can see that the returns of these indices have been moving in tandem with the oil prices[1].

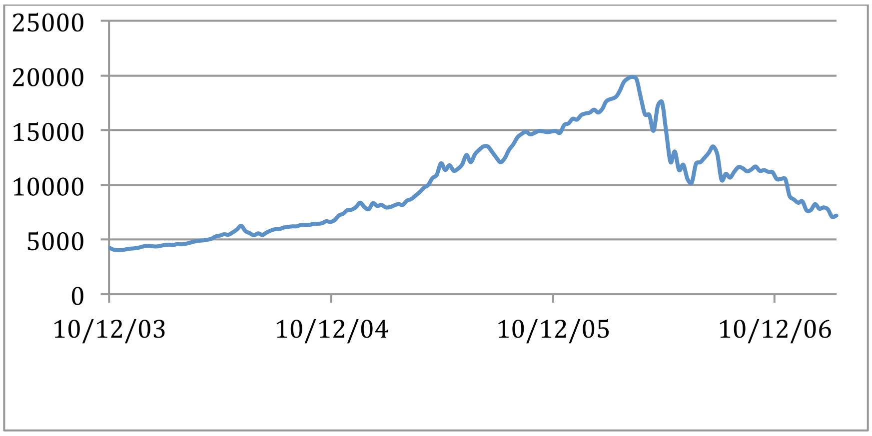
Figure 12: Tadawul Stock Exchange Index (1995 – 2016)



Source: Bloomberg L.P

[1] Figures of the Brent Price and GCC stock market indices in appendix 2

Figure 13: Tadawul Stock Exchange Index (2004-2007)

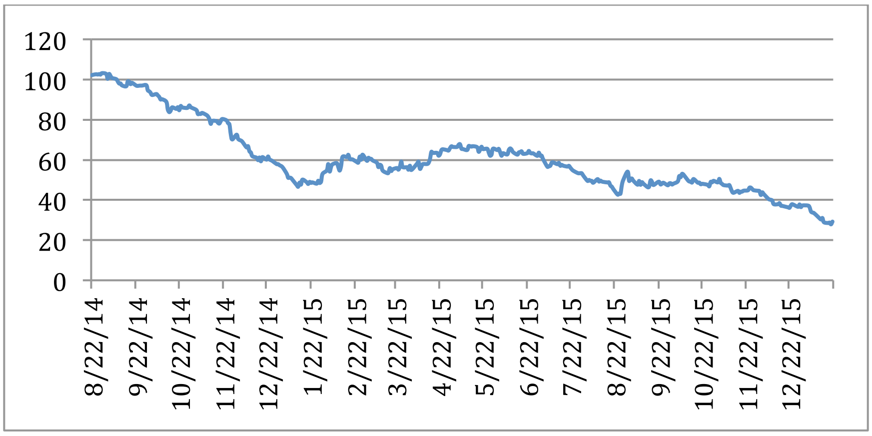


Source: Bloomberg L.P.

We move to the global financial crisis, which was considered the worst crisis after the 1930 depression. In 2007, the world economy was booming due to several factors, which caused oil prices to rise by 54% year on year (Bloomberg L.P., 2016). However, this surge in prices was outweighed by the bust in 2008, which resulted in a 52% decrease in oil prices (Bloomberg L.P., 2016). This was mainly a demand driven factor. In 2009, oil price surged by around 79% reaching records highs of around $78/b, the second highest after 2007 (Bloomberg L.P., 2016). The main reason behind this increase was a combination of recovery prospects, oil reserves reductions, predictions of oil price increases and hedging against weak dollar in the recession's aftermath (Fattouh, 2010). For example, on June 10th 2009, oil prices reached a peak of $71/b, when news broke out stating that the oil reserves had fallen, and predictions regarding the oil prices hit $250/b (Macalister, 2009).

Which brings us finally to the most recent oil crisis in 2014. Where the price of oil fell from above $100/b to below $50/b (Bloomberg L.P., 2016).

Figure 14: Brent Spot Price Since the start of the September 2014 Crisis



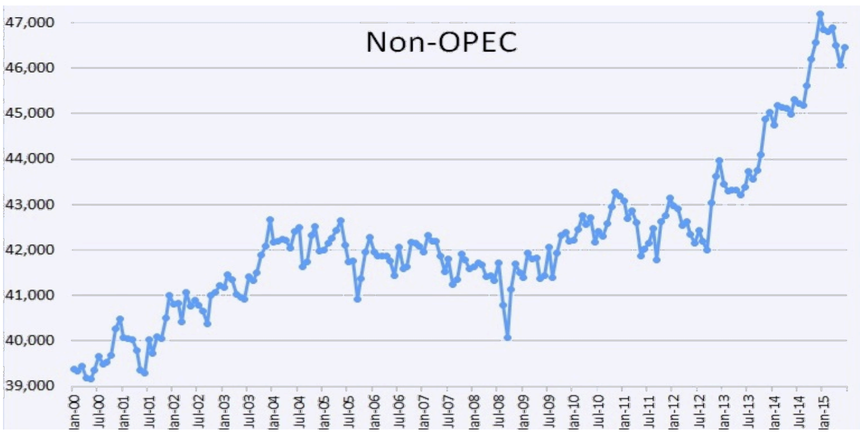
Source: Bloomberg L.P.

During the 1st half of 2014, oil prices have been increasing at a low rate, nevertheless starting June, oil prices started to decline slightly on a monthly basis, and the signs of crisis first emerged when prices broke the $100/b threshold on September 9 (Bloomberg L.P., 2016). The price of Brent fell from its peak of $112 in June 2014, to its trough of $48 in January 2015 (Bloomberg L.P., 2016). This is considered as the second worst oil crash after the 1986-oil glut, and its cause can be broken down into 3 distinct categories.

The most significant factor is the shift in OPEC's strategy. Saudi Arabia has been OPEC's swing producer, using its reserves to stabilize market prices the way it deemed fit. During that time, in order to stabilize prices and stop them from increasing further, production should have been cut down. However, after failing to reach an agreement at OPEC's meeting in November, supply remained high and production at 30 million b/d (WorldBank, 2015). This seems a little familiar, recalling the case of 1986, when Saudi Arabia switched its strategy to regain market share rather than oil price stabilization. The second factor, which has been the main drive in the previous oil crises, is the geopolitical instability that caused production to be cut. Nevertheless, this time, due to ISIS and other factors, the supply disruptions from the wars in the Middle Eastern countries such as Libya, did not materialize as expected (WorldBank, 2015).

The third factor is the supply and demand. On the supply side, OPEC members' production was not cut, subsequently production from other countries increased further. For example, the US lifted its four-decade ban on the exports of oil condensate (Hou, Keane, Kennan & Velde, 2015). US oil production alone in 2014 increased by 1.2 million b/d, the largest volume increase since 1900 (Hou, Keane, Kennan & Velde , 2015). The world supply increase can also be reflected through the global production, where OPEC's supply has declined slightly, despite the agreement of not reducing output. This decline was mainly due to the increase in production from non-OPEC producers.

Figure 15: Non-OPEC countries Oil Production (Thousand Barrels per day)



Source: International Energy Statistics

For example, the US share has increased to 15.3% up from 9.5% in 2008 (Hou, Keane, Kennan & Velde, 2015). Moving on to the demand side, the global oil demand has been revised downwards on several occasions. For example, between July and

December 2014 alone, the demand has been revised downwards by 0.8 million b/d (WorldBank, 2015). In fact, two-fifths of the decline in oil prices in the second half of 2014 resulted from the weak global demand especially from the Eurozone Area (Hou, Keane, Kennan & Velde, 2015). This can be attributable to U.S dollar appreciation, since an appreciation in U.S dollar can cause demand to decline in countries that experience erosion in the purchasing power of their currency (WorldBank, 2015). Hence, this can be clearly seen from the decline in the Eurozone demand from 13.61 million b/d to 13.4 million b/d a decline of 1.5%, as well as Asia Pacific with a decline of 2.12% (OPEC, 2015). Since then, the trend in the oil prices has been revised downwards (Bloomberg L.P., 2016)

Having looked at the oil history and its impact on the global economy, we will briefly address the question of whether oil prices are cyclical or countercyclical and their transmission mechanism. There is no clear answer, as we saw in the history above, oil prices are driven erratically, where their price volatility can hurt some economies and benefit others at the same time. It all depends on whether that particular economy is an oil importer, exporter and whether it is oil dependent or not. Another question that arises regarding the oil prices is whether they are cyclical or structural. This is beyond the scope of this paper since there is a whole strand of literature that revolves around that topic. Nevertheless, briefly some believe that prices are mainly driven by structural changes; while others believe that they are mainly cyclical. For example, in a recent conference by Fesharaki an energy expert, he states that oil prices are mainly driven by structural changes (Mandagolathur, 2015). He gives the example of the US, where it now produces an additional 4.5 million b/d compared to 3 years ago, surpassing Kuwait by approximately 3 million b/d (Mandagolathur, 2015). This is mainly due to the fact that the US has transformed itself discretely as an energy producer during the recent years without anyone noticing this shift (Mandagolathur, 2015). On the cyclical side, people believe that when oil prices rise, forecasts show further increases in oil prices and when oil prices fall, forecasts indicate further declines; predictions based on current prices or changes (Kemp, 2015). Looking back at the history, we can see that both structural as well as cyclical patterns emerge.

As for the transmission mechanism, several channels cause oil prices to impact the stock market, especially when it comes to the GCC region. As oil prices fluctuate, so do petrochemical companies as the latter two are positively correlated. For example, the profits of the S&P 500 companies are estimated to be down by 5.8% for 2015; however, by removing the energy companies, analysts predict that the profits of these companies are up by 5.7% (theguardian, 2016). The GCC region is oil-dependent, and so are the government revenues. Hence, a decrease in oil prices causes a decrease in public spending, ranging from government investments to spending on infrastructure, which in turn hurts the economic health of the region, hence the stock market index. According to Moody's, the regions' banking sector will not only be affected due to the high exposure to the oil sector, but also due to the reduced government related deposits and public spending (Global Credit Research, 2015). Another channel through which the stock markets are directly affected comes from the investors themselves. It is known as the "Investors Sentiment". For the GCC countries, oil prices play a huge role on the investors' choice of whether to enter the market. Since the economy is highly dependent on oil, the macroeconomic conditions can hence impact the global stockholders decisions regarding on whether to invest in these stock markets. For example, Saudi Arabia's average volume traded decreased by 7% on average in 2015, compared to 2014 (Bloomberg L.P, 2016). So, for the GCC region the macro level is linked to micro level, which in turn allows oil price shocks to impact the economy and hence the stock indices.

Having ended the history of oil from the 1970's till present, we will look at whether oil price shocks are translated into the stock markets. In the following section we will conduct regression analysis with the appropriate tests to determine whether this oil price shocks have an impact on the 6 GCC member countries' stock market indices.

CHAPTER IV

METHODOLOGY AND RESULTS

A. Data and methodology:

Data employed in this study are the daily oil prices and stock market indices for the period 12/31/2005 – 1/25/2016. The period used captures the 2007-2009 crisis and the most recent oil crisis that hit in September 2014. For the oil prices, the closing Brent spot price is used. Unlike the early years, the spread between Brent and WTI has recently widened, so it is vital to stress on the importance of using the right crude oil benchmark; in this case, the GCC region follows the Brent benchmark. As for the stock market indices, the most liquid markets for each country were employed: The Tadawul Stock Exchange for Saudi Arabia, the Bahrain Bourse All Share Index for Bahrain, the Qatar Exchange Index for Qatar, the Kuwait Stock Exchange Index for Kuwait, the Abu Dhabi Securities Market General Index for United Arab Emirates and the Muscat Securities MSM30 Index for Oman. The variables are transformed into their log form in order to capture the % change in values, in other words the indices returns.

The models used are bivariate, where the effect of oil price shocks on each stock market will be tested separately.

1. *Unit Root testing:*

In order to check for the order of integration of the variables before constructing the model, unit root testing using the Augmented Dickey-Fuller test as well as the Phillips Peron test:

Both tests are based on the following equation:

$Xt = \rho X_{t-1} + \varepsilon_t$

Where H_0: $\rho = 1$ (unit root/non-stationary series)

H_1 : $\rho \neq 1$(stationary series)

For the ADF test, the lag length is based on the AIC criterion, whereas for the PP test, the lag length is selected using the Newey-West bandwidth.

2. *Cointegration Testing:*

We need to test as well for the presence of a long run relationship between the variables in our models. If the variables in our model are integrated of order 1, then we expect the error term to also be integrated of order 1. However, if the error term is integrated of order 0, then the variables in our model are said to be cointegrated. If cointergation is present the simple unrestricted VAR model is transformed into a VEC model in order to account for that long-run relationship. The optimal lag length is based on the AIC criterion. The Johansen cointergation test is used on the non-stationary variables, to check for cointergation. Trace statistics and Max Eigenvalue statistics are viewed to interpret the results.

The test is based on the following equation and is divided into several steps:

$Z_t = Y_t + \gamma X_t$

For None:

H_0: $\gamma = 0$ (No cointergation)

H_1: $\gamma \geq 1$ (At least 1 cointegrating relationship)

If we fail to reject the null hypothesis, then we have no cointegrating relationship and conduct a simple unrestricted VAR model. If we reject the null hypothesis, then we have at least 1 cointegrating relationship and move to step 2.

At most 1:

H_0: $\gamma = 1$ (At most 1 cointegrating relationship)

H_1: $\gamma \geq 2$ (At least 2 cointegrating relationship)

We follow the same line of reasoning: Failing to reject H_0, indicates that at most one cointegrating relationship is present and a VEC model has to be used. The series is said to cointegrated of order 1, in other words, we have a weak form cointegrating relationship. Rejecting H_0, indicates that at least 2 cointegrating relationships exist, and we move to step 3. This test is repeated until we fail to reject H_0.

3. *VAR model:*

If the results of the Johansen cointergation test reported no cointegrating relationship, we proceed with a simple unrestricted VAR model. This model has been found useful in forecasting and describing the dynamic behavior of economic and financial time series (Sims, 1980). Its reduced form is described as follows:

$Y_t = c + \phi_1 Y_{t-1} + \phi_2 Y_{t-2} + \ldots + \phi_n Y_{t-n} + \varepsilon_t$

Where Y_t is an $_{(n \times 1)}$ vector of time series variables, ϕ_i are an $_{(n \times n)}$ coefficient matrices and ε_t is an unobservable 0 mean white noise vector process, in other words, the error term. The number of lags n, is determined by the Schwert's formula under the AIC:

$n_{max} = 12^* (T/100)^{0.25}$

4. *VEC model:*

If the Johansen cointergation test indicated a cointegrating relationship between the variables, then a VEC model is conducted. Its reduced form is described by the following equation:

$$\Delta Y_t = \Pi Y_{t-1} + \Gamma_1 \Delta Y_{t-1} + \ldots + \Gamma_{p-1} \Delta Y_{t-p+1} + u_t$$

Where Π is an $_{(n \times n)}$ matrix that represents the error correction adjustments towards the long-run equilibrium, in other words it represents all the cointegrating features in the system. The main idea behind the VEC model lies within the impact that the deviations from long-run equilibrium have on the cointegrated variables. The VEC model corrects for the disequilibrium of the previous period.

5. *Granger Causality Testing:*

By conducting this test, we would be analyzing the direction of causality between the variables. In other words, it tests the short-run relationship between the dependent and independent variable in the regression. It is very important in this type of study in order to understand which variables are causing movements in other variables. If granger causality is present, it could be unidirectional where one variable granger causes the other variable, or bidirectional, where both variables are granger causing each other. In this paper, we will perform a simple Wald test to determine the direction of causality. The test is based on the following equation:

$Y_t = a_0 + \sum \propto_i Y_{t-i} + \sum \beta_i X_{t-i} + \varepsilon_t$

H_0: $\beta_1 = \beta_2 = ... = \beta_n = 0$ (X_t does not granger cause Y_t)

H_1: $\beta_1 = \beta_2 = ... = \beta_n \neq 0$ (X_t granger causes Y_t).

Similarly, we conduct the same test in order to check whether Y_t granger causes X_t by regressing X_t on Y_t:

$X_t = b_0 + \sum \propto_i X_{t-i} + \sum \beta_i Y_{t-i} + \varepsilon_t$

6. *Impulse Response Function:*

In order to test for the consistency of the effect, the generalized Impulse Response Function is used to test for the significance of the shock of the variables. A one-time shock of the dependent variable on the independent variable is conducted in order to check whether oil price shocks are transmitted into the stock market indices.

7. *Variance Decomposition:*

Variance Decomposition is used in order to check for the relative importance of the variable in explaining its own variation as well as explaining the variations of the other variables used in the model. Hence, the variance of the forecast error is decomposed into two shocks; its own and that of the other endogenous variable employed.

B. Empirical Results:

1. Descriptive Statistics:

Table 1: Descriptive Statistics

	BRENT	BAHRAIN	ABUDHABI	OMAN	QATAR	KUWAIT	SAUDI
Mean	86.10523	1649.826	3507.136	6471.37	9000.474	8227.788	8022.787
Median	84.42	1448.135	3291.655	6259.95	8572.56	7335.32	7400.53
Maximum	146.08000	2902.680	5253.990	12109.1	14350.5	15654.8	20634.86
Minimum	27.88	1035.300	2136.64	4223.63	4230.19	4938.22	4130.01
Std. Dev.	24.59885	526.3081	914.9474	1364.152	2090.047	2555.679	2418.781
Skewness	-0.090074	0.960379	0.402046	2.106549	0.466447	1.227932	2.124798
Kurtosis	1.877880	2.667810	1.657883	7.889360	2.538519	3.458917	9.629592
Jarque-Bera	197.9387	582.2979	375.1319	63837.787	166.0088	956.5664	9503.118
Probability	0	0	0	0	0	0	0

By looking at the descriptive statistics, we can see non-normality in the distribution of all of our data. All of the data are concentrated to the left of the mean, with the exception of Brent. Compared to the mean, the standard deviations are low, which implies that there is small variation in the data coefficients, which is not surprising since we are looking at the daily data of stock prices and oil prices, where the prices do not usually vary a lot from day to day, even in cases of crisis, the sharp decline or increase can be seen on a monthly basis rather than daily. The Kurtosis falls well below 3 for most of the data with the exception of Saudi, Kuwait and Oman where it is substantially above 3, indicating non-normality for the distribution of all the Indices and the Brent oil price.

Also, the probabilities of the Jarque-Bera test for normality shown are in line with the Kurtosis values, showing that all the data follow a non-normal distribution.

2. *Unit Root Results:*

After employing the Dickey-Fuller and Phillips Perron tests, we find out that all the variables are integrated of order 1. Both tests showed that the variables are non-stationary at level. The following tables summarize the results:

Table 2: Unit Root Test at Level

Variables	**ADF**				**PP**			
	Trend & Intercept	**Intercept**	**None**	**Order**	**Trend & Intercept**	**Intercept**	**None**	**Order**
LBrent	-0.07 (0.995)	-0.36 (0.911)	-0.63 (0.441)	I(1)	-0.11 (0.995)	-0.42 (0.903)	-0.63 (0.441)	I(1)
LADSMI	-2.09 (0.551)	-1.78 (0.39)	-0.49 (0.504)	I(1)	-2.09 (0.55)	-1.79 (0.386)	-0.48 (0.507)	I(1)
LBHSEASI	-0.85 (0.960)	0.6 (0.868)	-2.04 (0.04)	I(1)	-0.96 (0.948)	-0.66 (0.856)	-1.84 (0.062)	I(1)
LKWSEIDX	-1.24 (0.901)	-0.62 (0.863)	-1.68 (0.088)	I(1)	-1.51 (0.827)	-0.84 (0.806)	-1.42 (0.146)	I(1)
LMSM30	-1.72 (0.743)	-1.71 (0.426)	-0.06 (0.663)	I(1)	-1.78 (0.714)	-1.78 (0.392)	-0.01 (0.68)	I(1)
LDSM	-2.72 (0.227)	-1.91 (0.328)	-0.32 (0.57)	I(1)	-2.75 (0.216)	-1.94 (0.316)	0.32 (0.571)	I(1)
LSASEIDX	-2.82 (0.192)	-2.91 (0.044)	-1.29 (0.182)	I(1)	-2.68 (0.244)	-2.77 (0.062)	-1.3 (0.178)	I(1)

Probability values are in parenthesis
AIC is used to select the lag length
Barlett Kernel is used as the spectral estimation method. Newey-West is used as the bandwidth selection method.
Data is estimated at the 99% confidence level

Table 3: Unit Root Test at 1st difference

Variables	ADF				PP			
	rend & ntercept	Intercept	None	Order	Trend & Intercept	Intercept	None	Order
ΔLBrent		-64.15 (0.000)		I(0)		-64.1 (0.000)		I(0)
ΔLADSMI		-54.02 (0.000)		I(0)		-54.16 (0.000)		I(0)
ΔLBHSEASI		-54.85 (0.000)		I(0)		-55.61 (0.000)		I(0)
ΔLKWSEIDX		-29.41 (0.000)		I(0)		-56.46 (0.000)		I(0)
ΔLMSM30		-24.71 (0.000)		I(0)		-49.88 (0.000)		I(0)
ΔLDSM		-53.97 (0.000)		I(0)		-53.97 (0.000)		I(0)
ΔLSASEIDX		-33.26 (0.000)		I(0)		-57.27 (0.000)		I(0)

Probability values are in parenthesis
AIC is used to select the lag length
Barlett Kernel is used as the spectral estimation method. Newey-West is used as the bandwidth selection method.
Data is estimated at the 99% confidence level

At level, all the probabilities of the coefficient are greater than 1%, so we fail to reject the null hypothesis of the presence of a unit root. At 1st difference, all the probabilities of the coefficients are less that 1%, we reject the null hypothesis of unit root; hence all the variables are stationary. The lag-lengths specified based on AIC and Newey-West are 29 and 8 respectively. These results indicate that the stock market indices and oil prices follow a random walk, which are in line with the papers that have been previously published. So, in the following sections we complete our analysis on the differenced variables, unless specified otherwise. In what follows, the regressions conducted are linear with the dependent variable being the Brent spot price and the independent variable a specified stock market index.

3. Cointegration Results:

In this section, the test should be conducted on the non-stationary variables; hence the models used are on the level variables. The model for Johansen cointergation test should be chosen carefully. Since models 1 and 5 are very rare to occur in practice, we will chose between models 1 and 4 (Juselius, 2005). Now, the choice relies on whether there is the presence of a trend in our data. By looking at the graphs and judging by the recent fluctuations in oil prices and stock market indices, there is no evidence of specific trend in the data, so we will be using case 2 in our analysis[2] (No deterministic trend restricted constant). Moreover, by choosing this assumption we are implying that the mean of the differenced variables is 0, in other words E (Δx) = 0 (Juselius, 2005). By looking at the data, this is clearly the case.

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[2] Cointegration Tables are reported in appendix 3

Table 4: Mean of the 1st differenced variables

	DLABUDHABI	DLBAHRAIN	DLBRENT	DLKUWAIT	DLOMAN	DLQATAR	DLSAUDI
Mean	-7.88E-05	-0.000174	0.000165	-0.000227	3.69E-06	6.05E-05	-0.000297

- Brent and Saudi Stock Market

Based on the AIC, the maximum number of lags is 15. By conducting the Johansen Cointergation test using 14 lags (n-1), both the trace and Max-eigenvalue showed no sign of long-run relationship between the two variables; hence we conduct a simple unrestricted VAR on the differenced variables in the following sections.

- Brent and Abu Dhabi Stock Market:

The maximum number of lags reported by AIC is 15. Hence we conduct the Johansen Cointegration test with 14 lags. The results showed no evidence of the presence of a long-run relationship between both variables, therefore a simple unrestricted VAR model on the differenced variables is estimated in what follows.

- Brent and Bahrain Stock Market:

Here, we conduct the Johansen cointergation with 16 lags (n-1) based on AIC. Both tests, Trace and Max-Eigenvalue show no evidence of a long run relationship; hence we conduct a VAR model.

• Brent and Kuwait Stock Market:

The AIC reported a maximum number of lags of 16, so we conduct the Johansen cointergation test with 15 lags. The results show no sign of a long run relationship between the parameters, so we proceed with VAR model in our estimations.

• Brent and Oman Stock Market:

The results of the Johansen cointergation test with 18 lags, after the AIC reported a maximum number of 17 lags, showed no sign of a long run relationship. So, we conduct a VAR model for the next step.

• Brent and Qatar Stock Market:

Based on the AIC, the maximum number of lags is 17. By conducting the Johansen Cointegration test on both variables with 16 lags, we find no long run relationship between both parameters; hence a VAR model is applied.

4. *Granger Causality:*

• Brent and Saudi Stock Market

Based on the cointergation results, we run an unrestricted VAR on the differenced variables with 14 lags. By looking at the output[3], we find out that there is mostly a positive relationship between the variables. For example, if the first lagged Brent variable increases by 1%, the Saudi stock market index increases by 0.05%. As the lag increases, this effect intensifies. By conducting the granger causality test, we find a

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[3] Estimation Outputs are in Appendix 4

bidirectional outcome, where the oil price granger causes the Saudi stock market index and the stock market index granger causes the oil prices.

Table 5: Granger Causality Test - Saudi

Granger Causality / Block exogeneity Wald test		
Dependent Variable	Independent Variable	Chi-Square
DLBRENT	DLSAUDI	31.86837 (0.0042)
DLSAUDI	DLBRENT	86.89680 (0.0000)

These results are in line with the results published in previous papers, where all of them have reported an effect from oil prices spilling over to the Saudi stock market. For example, a GARCH (1,1) model, reported that the oil prices impact the Saudi stock market non-linearly (Azar & Basmajian, 2013).

- Brent and Abu Dhabi Stock Market:

In this case, we also find a positive impact between the oil prices and the Abu Dhabi stock market index. For example, as the first lagged value of Brent increases by 1%, the Abu Dhabi stock market returns increase by 0.04%. The granger causality results are in line with the others papers, where Brent prices granger-cause the Abu Dhabi stock market returns (Alkhathlan & Ravichandran, 2010).

Table 6: Granger Causality Test - Abu Dhabi

Granger Causality / Block exogeneity Wald test		
Dependent Variable	Independent Variable	Chi-Square
DLBRENT	DLABUDHABI	11.97070 (0.6087)
DLABUDHABI	DLBRENT	50.32700 (0.0000)

- Brent and Bahrain Stock Market:

The estimation output for the VAR model with 16 lags, show a positive relationship between the oil prices and the stock market returns. As for the granger causality results, a short run relationship exists, coming from the oil prices towards the country's stock market index.

Table 7: Granger Causality Test - Bahrain

Granger Causality / Block exogeneity Wald test		
Dependent Variable	Independent Variable	Chi-Square
DLBRENT	DLBAHRAIN	19.31924 (0.2525)
DLBAHRAIN	DLBRENT	61.96616 (0.0000)

- Brent and Kuwait Stock Market:

By running a VAR on the differenced variables with 15 lags, we find out from the outputs that a positive relationship exists between the variables. Also, by running the granger-causality test, we find out that there is a bidirectional short run relationship.

Table 8: Granger Causality Test - Kuwait

Granger Causality / Block exogeneity Wald test		
Dependent Variable	Independent Variable	Chi-Square
DLBRENT	DLKUWAIT	35.39144 (0.0022)
DLKUWAIT	DLBRENT	58.69927 (0.0000)

Different papers published have reported contradicting results for the Kuwait stock market. For example, in a paper investigating Kuwait and Saudi, no effect in oil prices on the Kuwait Stock market returns was reported (Azar & Basmajian, 2013). Moreover, in another paper studying the impact of oil prices on the GCC region, no relationship was found (Balli & Louis, 2014).

- Brent and Oman Stock Market:

We run a VAR on the differenced variables with 17 lags. The estimation output results report small significant values in the coefficients of the lagged variables of both the Brent and Omani stock market prices. By conducting the granger causality test, we find a unidirectional short run relationship between the variables, where Brent prices granger-cause Omani's stock market index.

Table 9: Granger Causality Test - Oman

Granger Causality / Block exogeneity Wald test		
Dependent Variable	Independent Variable	Chi-Square
DLBRENT	DLOMAN	19.25330 (0.3142)
DLOMAN	DLBRENT	125.7345 (0.0000)

- Brent and Qatar Stock Market:

By running a VAR with 16 lags on the differenced variables, the estimation output results show a short-run relationship between oil prices and the Qatar stock market returns. Granger causality results reinforce this finding by reporting a bidirectional short-run relationship.

Table 10: Granger Causality Test - Qatar

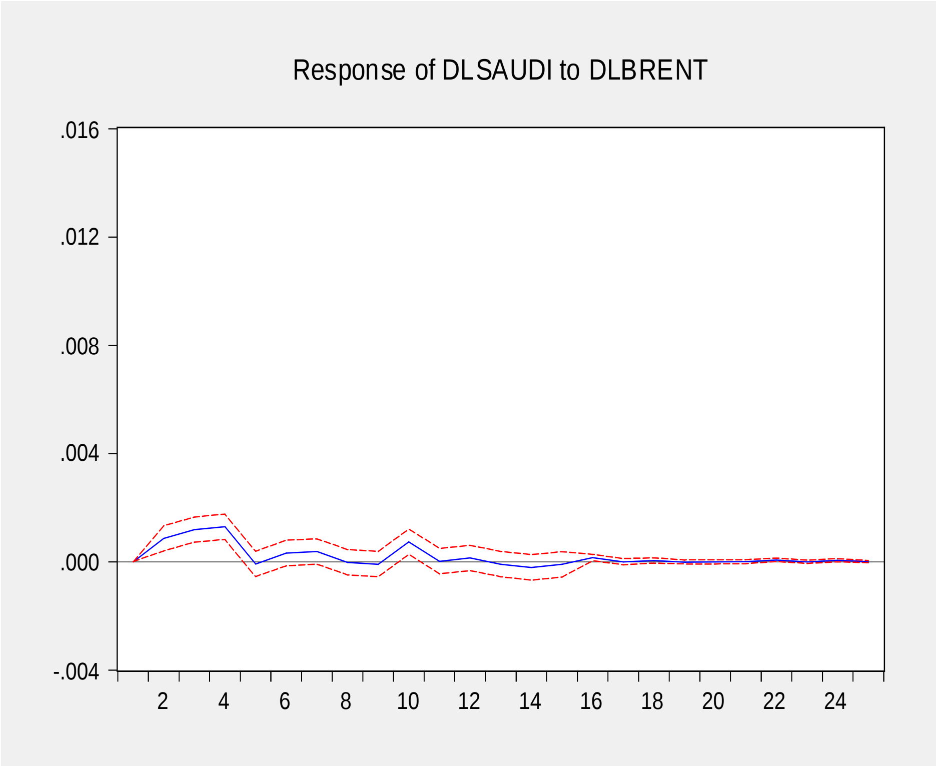
Granger Causality / Block exogeneity Wald test		
Dependent Variable	Independent Variable	Chi-Square
DLBRENT	DLQATAR	26.30154 (0.0499)
DLQATAR	DLBRENT	98.90923 (0.0000)

5. Impulse Response Function:

In the previous section, while conducting granger causality we looked at the short run relationship between both, the oil prices and the stock market indices. However, since this paper focuses solely on the effect of oil prices on the stock market, we will only analyze the results of the shocks coming from the oil price to the indices.

• Brent and Saudi Stock Market

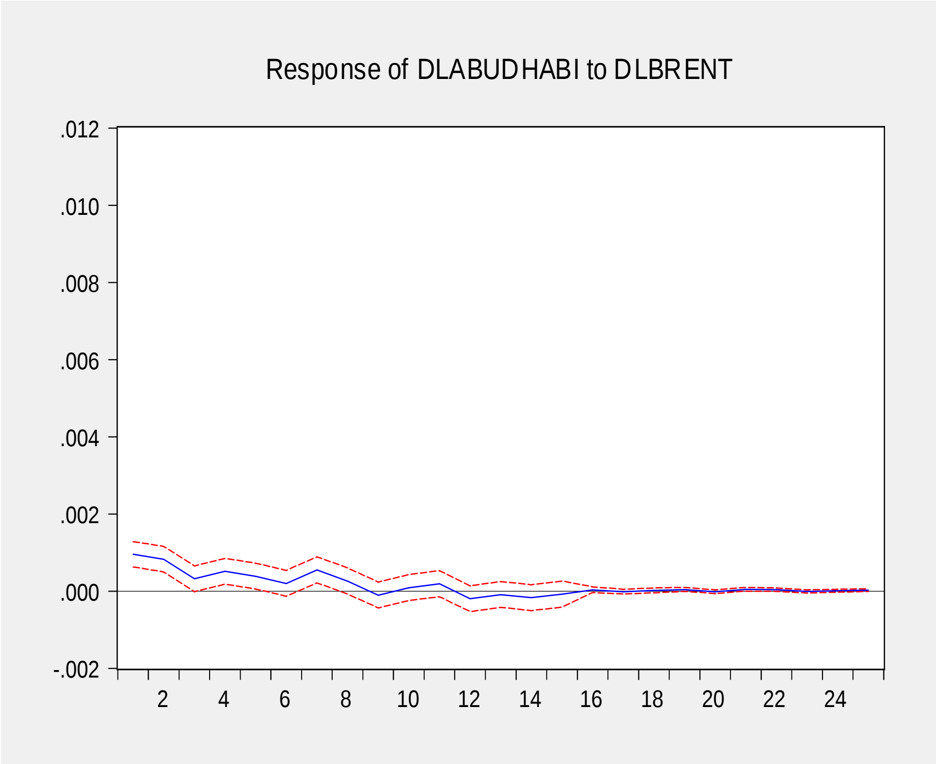
Figure 16: Orthogonalized Impulse Response Function of Brent Prices to the Saudi Stock Market



This graph translates into: a 10% shock in oil prices causes around 1.3% shock in the Saudi stock market returns, which decreases to 0% after 5 days and completely vanished after 17 days. This is very apparent, when we look at how the stock market reacted to the most recent crisis of September 2014: The Tadawul Stock Exchange dropped by around 50%.

• Brent and Abu Dhabi Stock Market:

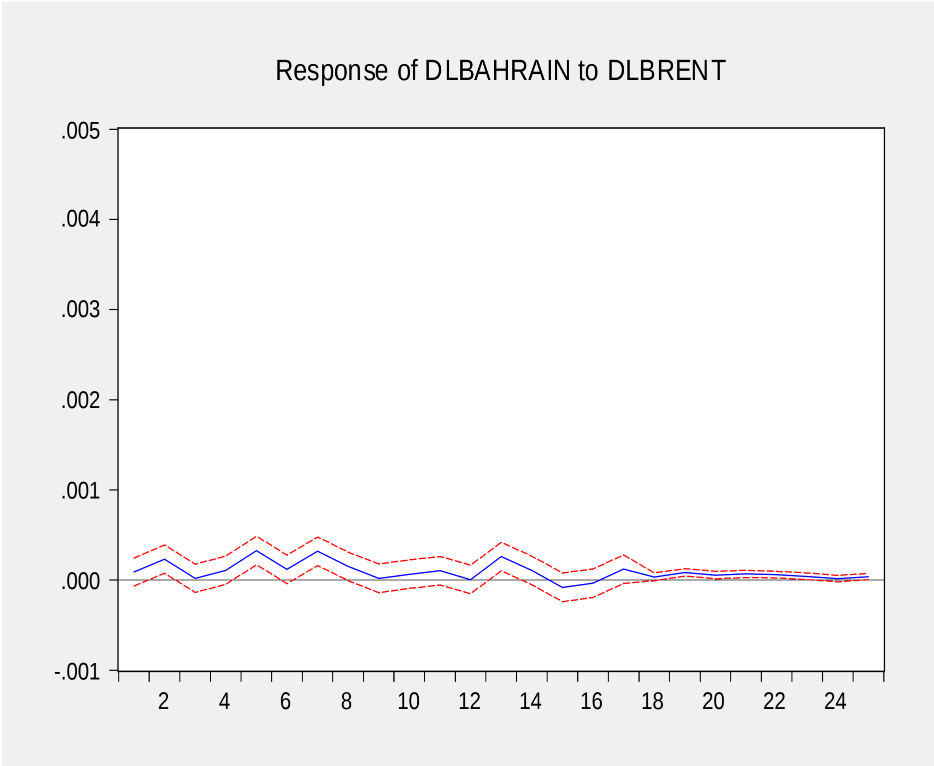
Figure 17: Orthogonalized Impulse Response Function of Brent prices to the Abu Dhabi Stock Market



Compared to Saudi Arabia, we can see a similar effect. A 10% shock in oil prices causes around 1.1% shock in the Abu Dhabi stock market index returns, and this effect completely vanishes after 17 days.

• Brent and Bahrain Stock Market:

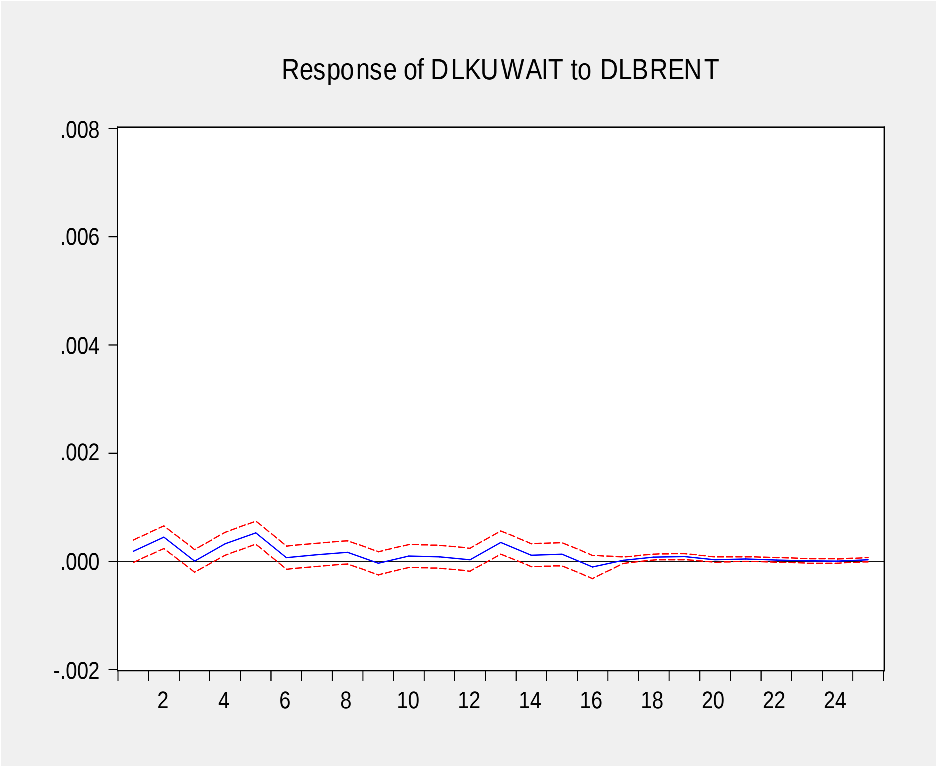
Figure 18: Orthogonalized Impulse Response Function of Brent prices to the Bahrain Stock Market



Even though the granger-causality results reported a short-run relationship between both variables, the impact of a 10% shock in oil prices on the stock market index returns is negligible where it reaches its peak after 5 periods to 0.03%.

- Brent and Kuwait Stock Market:

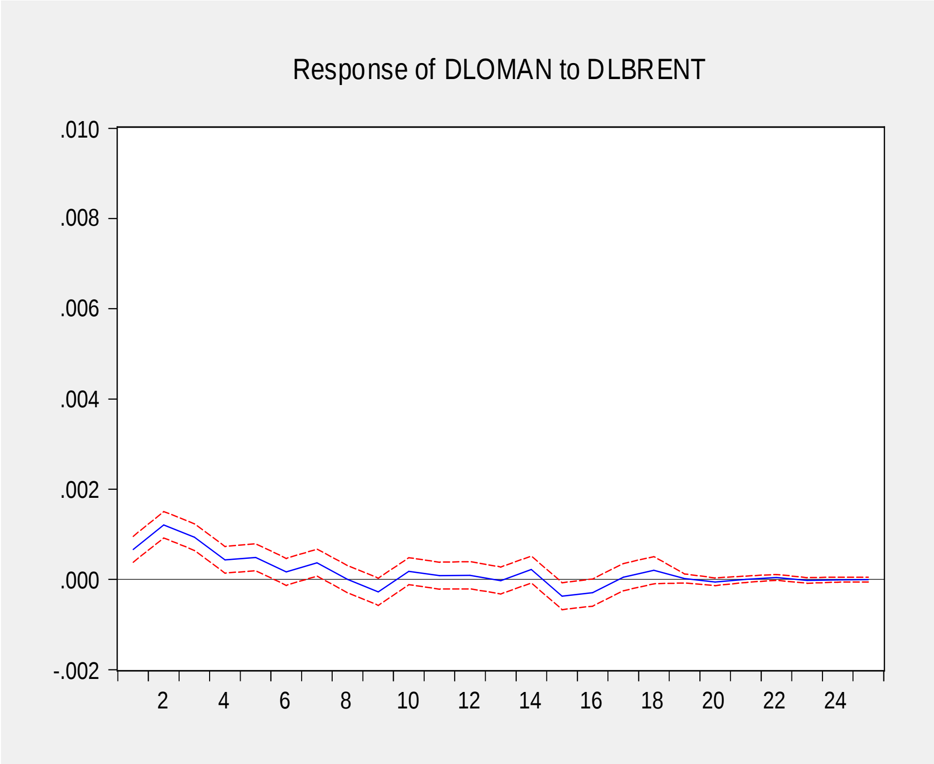
Figure 19: Orthogonalized Impulse Response Function of Brent prices to the Kuwait Stock Market



The same can be said about Kuwait: a 10% shock in oil prices translates into a 0.03% shock at its peak at period 5 in the Kuwaiti's stock market return and completely vanishes after 22 periods.

• Brent and Oman Stock Market:

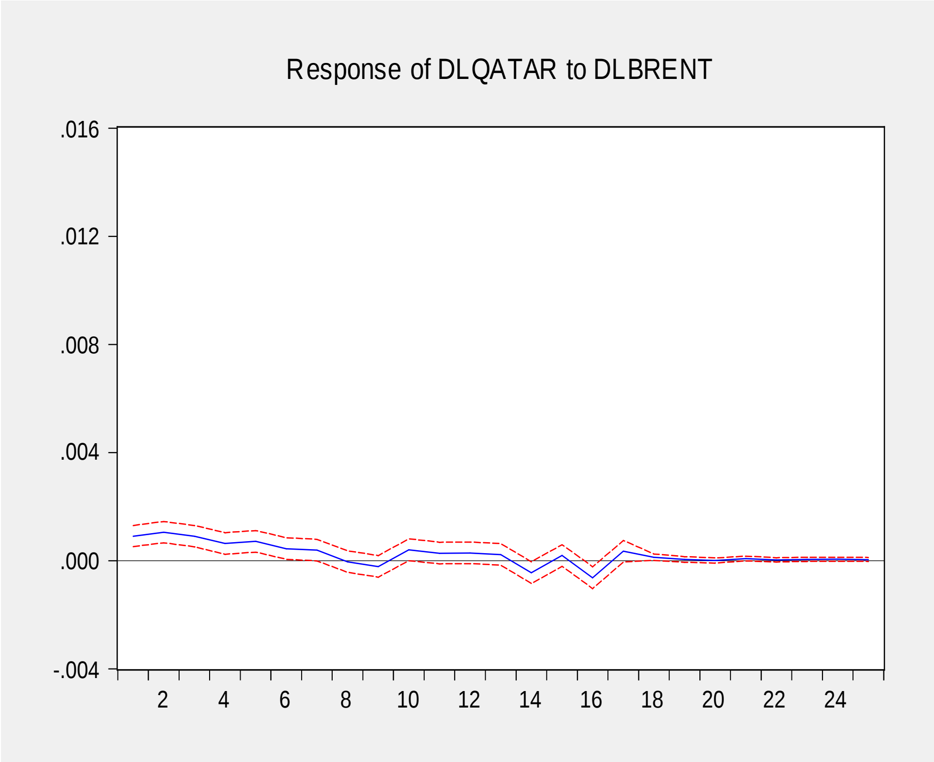
Figure 20: Orthogonalized Impulse Response Function of Brent prices to the Oman Stock Market



A 10% shock in Brent prices transmits to a 1.1% shock in the Oman stock market returns in 1 day, which then gradually decreases to a slightly negative value in period 8. It then fluctuates between near 0 positive and negative values to completely fade after 20 periods. Even though the graph shows a negative impact however, it is very minimal reaching a peak of -0.04%.

• Brent and Qatar Stock Market:

Figure 21: Orthogonalized Impulse Response Function of Brent prices to the Qatar Stock Market



A 10% shock in oil prices causes a 1.1% shock in Qatar's stock returns in day 1 days and gradually decreases to a negative value of -0.06% in day 17, to completely vanish after 20 days.

These results are consistent with previous papers published with the exception of Kuwait and Bahrain. For example in a paper studying all the GCC countries, the results reported an impact of oil prices on the stock market indices except for Kuwait and Bahrain (Arouri, Bellalah & Lahiana, 2010). However, as our results report, the impact on both countries' stock market indices returns is very minimal. The intuition behind these results is that the shocks in the indices returns are mostly driven by "Investor Sentiment". This can be clearly seen from the most impacted stock index; the Tadawul

Stock Exchange. In 2014, during the second half the volume traded dropped by 16% (Bloomberg L.P, 2016).

6. Variance Decomposition:

In this section we will analyze the proportion of the variation in the different stock indices that is due to its own shocks and the proportion that is due to the shocks transmitting from oil prices[4]. We will choose 50 periods and analyze the results using a 10 periods time interval.

- Brent and Saudi Stock Market

Table 11: Variance Decomposition of Saudi Stock Market

Variance Decomposition Results			
	Period	DLBRENT	DLSAUDI
Variance Decomposition of Saudi Stock Market	1	0	100
	10	2.288	94.96594
	20	2.333	97.713
	30	2.336	97.664
	40	2.336	97.664
	50	2.336	97.664

In period 1, 0% of the variation in the error of forecasting of the Saudi stock market return is explained by oil prices. The variation that is explained by oil prices increases reaching 2.336% after 20 periods and remains around this level throughout the whole 50 periods.

[4] Complete tables are Reported in Appendix 5

- Brent and Abu Dhabi Stock Market:

Table 12: Variance Decomposition of Abu Dhabi Stock Market

Variance Decomposition Results			
	Period	DLBRENT	DLABUDHABI
Variance Decomposition of Abu Dhabi Stock Market	1	0.913	99.087
	10	2.462	97.538
	20	2.574	97.426
	30	2.578	97.422
	40	2.578	97.422
	50	2.578	97.422

At first horizon, only 0.9% of the variation in the Abu Dhabi Stock market return is explained by Brent prices, whereas 99.1% is explained by its own variation. As the periods increase, so does the explanation of the variation in Abu Dhabi index coming from oil prices, reaching its peak 2.578% after 30 periods.

- Brent and Bahrain Stock Market:

Table 13: Variance Decomposition of Bahrain Stock Market

Variance Decomposition Results			
	Period	DLBRENT	DLBAHRAIN
Variance Decomposition of Bahrain Stock Market	1	0.035	99.965
	10	1.419	98.581
	20	1.922	98.078
	30	1.982	98.018
	40	1.989	98.012
	50	1.990	98.010

These results are in line with the previous section showing a weak variation in the error forecast of the Bahrain stock market return that is explained by the oil prices, reaching its maximum of 1.99% after 40 periods.

- Brent and Kuwait Stock Market:

Table 14: Variance Decomposition of Kuwait Stock Market

Variance Decomposition Results			
	Period	DLBRENT	DLKUWAIT
Variance Decomposition of Kuwait Stock Market	1	0.087	99.913
	10	1.616	98.384
	20	2.025	97.975
	30	2.040	97.960
	40	2.041	97.959
	50	2.042	97.958

As for Kuwait, oil prices explain only 0.08% of the variation in Kuwait stock market return at first horizon, however it jumps to 2.025% in period 20 reaching 2.041% in period 40 and remains around that range throughout the whole periods.

- Brent and Oman Stock Market:

Table 15: Variance Decomposition of Oman Stock Market

Variance Decomposition Results			
	Period	DLBRENT	DLOMAN
Variance Decomposition of Oman Stock Market	1	0.589	99.411
	10	4.270	95.730
	20	4.638	95.361
	30	4.648	95.352
	40	4.652	95.348
	50	4.653	95.347

In period 1, 99.4% of the forecast error of Oman stock market return is explained by its own variation, whereas only 0.5 % is explained by oil prices. However, it jumps to 4.27% in period 10 to gradually increase afterwards to 4.653% in period 50.

- Brent and Qatar Stock Market:

Table 16: Variance Decomposition of Qatar Stock Market

Variance Decomposition Results			
Variance Decomposition of Qatar Stock Market	Period	DLBRENT	DLQATAR
	1	0.587	99.413
	10	2.895	97.105
	20	3.538	96.462
	30	3.560	96.440
	40	3.561	96.438
	50	3.562	96.438

At first outlook, 0.587% of the forecast error in Qatar stock index return is explained by oil prices, whereas the largest portion is explained by its own variation. Nevertheless, the variation in the Qatar stock market that is explained by oil prices increases substantially in period 20 reaching 3.538% and then increases slightly to reach 3.562% in period 59.

Summarizing the test results, the coefficient estimates are somewhat small, however the insignificance of the t-stats allows us to reject these values and the small R^2 values show a low explanatory power for the models. However, the other test results revealed that all the GCC stock markets are affected by oil prices. As expected, and looking back at Saudi Arabia's role in the oil market, the greatest effect of a shock spillover is shown to be on the Saudi stock market index. However, as for the variance decomposition, Oman is ranked first among the GCC region with oil prices explaining around 4.7% of the variation in the stock index.

These results are consistent with previous papers published with the exception of Kuwait and Bahrain. For example in a paper studying all the GCC countries, the results reported an impact of oil prices on the stock market indices except for Kuwait and Bahrain (Arouri, Bellalah & Lahiana, 2010). Moreover, in another paper the authors studied the co-integrating vector results and found out that in the long run oil prices impact the GCC stock market indices with the exception of Bahrain and Kuwait (Alkhathlan & Ravichandran, 2010).

CHAPTER V

CONCLUSION

This paper studies the impact of oil price shocks on the GCC region's stock market indices. After studying the history of oil and exploring its cycles, it is found that several oil price turmoil events have occurred that affected not just the relevant country's economy, but also the worldwide economy. A dynamic model is employed to further explore these findings focusing on the impact of oil price shocks, specifically Brent prices on the GCC regions' different stock markets.

The empirical results revealed different results for each country at hand. By employing the VAR model, granger causality tests reported a short-run relationship between oil prices and the GCC stock market indices. These results were further reinforced through Impulse Response Functions and Variance Decompositions. The Saudi and Abu Dhabi stock markets proved to be impacted the most by the oil price shocks, with the spillover effect of a 10% shock in oil price causing around 1.3% shock in both countries stock market indices. This is not surprising, since Saudi Arabia and Abu Dhabi are heavily oil-based economies. For example, Saudi Arabia possesses 18% of World's proven petroleum reserves and its oil and gas sector accounts for around 85% of exports earnings and contributes to more than 50% of gross domestic product (OPEC, 2015). It is ranked as the largest exporter of oil with an amount of 7.2 million barrel per day (OPEC, 2015). As for Abu Dhabi, it has a lot of other productions, but also oil, plays a very important role in the country's prosperity contributing to 40% of its gross domestic product (OPEC, 2015). Moreover, the results also showed an impact of oil price shocks on the Qatari, Kuwaiti and Omani's stock market indices. However, the impact was not as significant compared to Saudi Arabia and Abu Dhabi. Moving on to the variance decomposition, the results reported the most significant values in Oman followed by Qatar with oil prices explaining 4.65% and 3.56% of their stock market indices respectively. Nevertheless, the other GCC countries also have some of the variations in their stock indices explained by oil price fluctuations, but with slightly a lower magnitude. These low magnitudes ranging between approximately 2% to 5% suggest that other exogenous factors might also have a significant role in explaining the variations in the stock market indices returns. These reported results are in line with the oil history, where we can see that the GCC region's stock market indices have been moving in tandem with the oil prices.

These results are partly in line with the findings published in previous papers; for example, in the long run oil prices transmit their effect to key macroeconomic indicators that impact stock price returns except for Bahrain and Kuwait (Alkhathlan & Ravichandran, 2010). As for the short run, an impact of oil prices is reported, except for Bahrain and Saudi Arabia (Alkhathlan & Ravichandran, 2010). In another paper, using different methodologies including linear and non-linear models, the evidence suggest that oil prices impact the GCC countries' stock markets except for Kuwait and Bahrain (Arouri, Bellalah & Lahiana, 2010). Similar results were obtained by another paper where by employing GARCH (1,1) model, empirical results suggest an impact of oil prices on the Saudi Stock Market but not the Kuwaiti Stock Market (Azar & Basmajian, 2013). So, based on these papers mentioned our results are in line except for Saudi Arabia's stock market index in the short-run, and the Kuwait and Bahrain stock market indices. On the other hand, other papers using different methodologies and time intervals have reported different results; such as Ballis and Louis, who proved that oil volatility has stronger impact on the stock market compared to oil price shocks (Balli & Louis, 2014). Not to mention the countless papers that have been published, reporting different results using different technics and methodology for the foreign countries' stock markets. This topic is very broad and has been the center stage for economic researchers for a decade, and will remain in this stage in the near future given the most recent oil crisis.

As for the oil price history, evidence suggests that no clear pattern exists, it is a combination of cyclical and structural factors that cause oil prices to move abruptly, and there is no clear conclusion of where oil prices are heading, whether they will fall further after breaking the $30 support level, reaching an all time low since 1998, or rebound back to the golden days in the $100 range.

Appendix 1 – LITERATURE REVIEW SUMMARY

Authors	Countries in Study	Data	Period	Methodology	Results
Jones & Kaul (1996)	US, Canada, UK and Japan	Quarterly Data for Oil prices and stock market returns	Post-War period	Standard Cash flow dividend model	US and Canada stock market indices completely accounted for by oil price shocks. UK and Japan somewhat accounted for by oil price shocks
Sadorsky (1999)	US	Monthly data for Oil prices, stock market returns, 3 M t-bills, Industrial Production	1947:1966	GARCH (1,1)	Oil prices have a negative impact on stock market returns
Jiménez-Rodríguez (2014)	US, Canada, UK and Germany	Monthly data for real stock returns, and the real oil price, which is defined as the ratio of UK crude oil to US PPI	1971:2-2012:8	Bivariate model with non linear transformation of oil prices and real stock returns	Impact of oil price shocks on all the stock market indices except for Canda

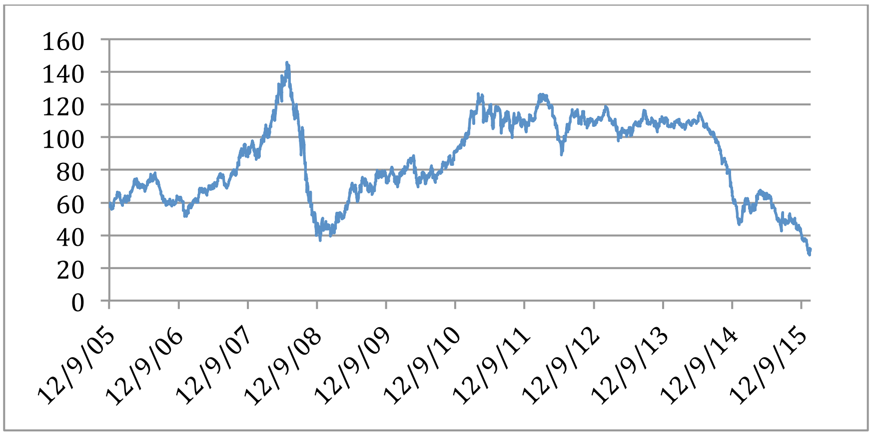
Park & Ratti (2008)	US and 13 European Countries	Monthly data for Oil prices, stock returns, industrial production and interest rates	1986-2005	Unrestricted VAR model	Indices of US and 10 European countries are negatively impacted by oil prices. Postive impact for oil exporting countries (Norway)
Apergis & Miller (2009)	Australia, France, Italy, UK, Germany, Canada, the United States and Japan (G7 and Australia)	Monthly data for crude oil spot prices, crude oil production per day, stock market indices returns, CPI, a proxy for goods prices, a global index of dry cargo single freight rate as a proxy for economic activity,	1981-2007	Vector autoregressive and VEC models	Only the global aggregate-demand shocks impacts stock market returns
Reboredo & Rivera-Castro (2013)	US and Europe	Daily data for Brent crude oil prices, the S&P 500,	2000:6-2011:7	Wavelet Multi-Resolution analysis	Oil prices do not impact stock market

		the Dow Jones Stoxx Europe 600 and European and US industrial sectors including banks, oil and gas etc…			returns
Alkhathlan & Ravichandran (2010)	GCC countries	Daily data for NYMEX oil prices and stock market indices	2008:3-2010:4	GARCH-M to account	In the long-run, oil prices impact the stock market indices. As for the short-run, KSA and bahrain are not affected
Arouri, Bellalah & Lahiana (2010)	GCC countries	Weekly data for the MSCI world market index as a proxy for the world stock market and the Brent spot price	2001:7-20010:8	Linear and non-linear models	All the stock market indices are affected by oil prices shocks except for Kuwait and Bahrain
Azar and Basmajian (2013)	KSA and Kuwait	Daily and weekly data for Saudi All Share Index, the	2008:1 - 2012:10	GARCH (1,1) with four different regression: 2 linear and 2 non-linear	Only the Saudi Stock market Index teturns are impacted by

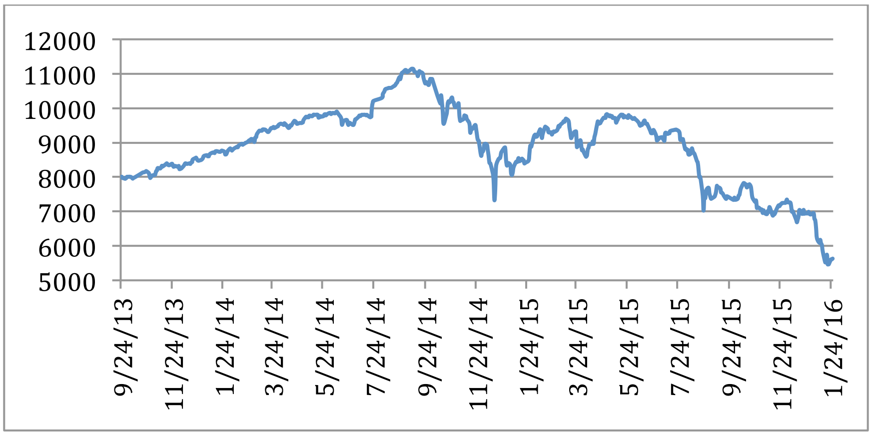
		Kuwait S.E, the Brent oil spot prices and the S&P 500		models	oil price shocks
Balli & Louis (2014)	GCC countries	Daily data for WTI crude oil prices, stock market indices returns, sectorial stock prices including 12 banks, insurance, services and industry	1999:1 - 2010:12	Hodrick and Prescott nonparametric filter and the dynamic factor models as developed by Geweke to in 1977	Oil price shocks have a small impact on the stock market indices, whereas volatility has a very significant impact on stock returns

Appendix 2 – GCC STOCK MARKET INDICES AND BRENT PRICES SINCE 2006

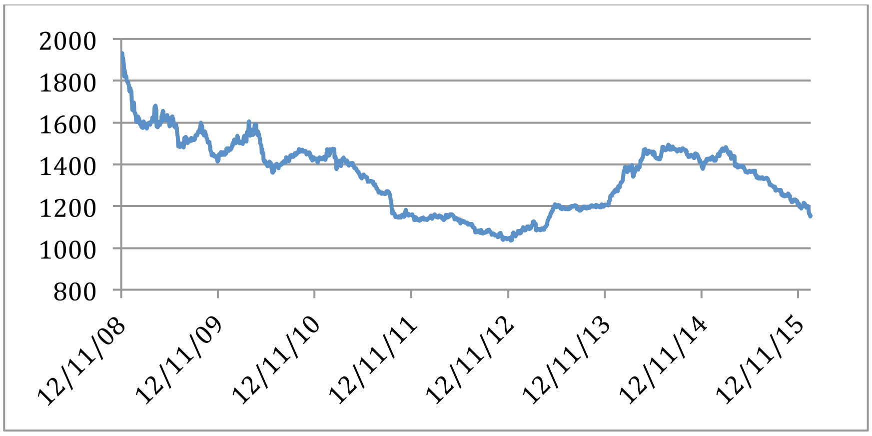
Brent Prices



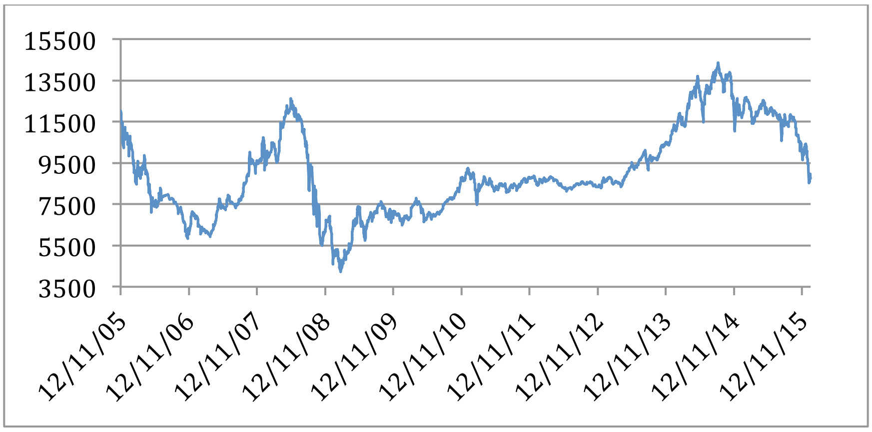
Saudi Stock Market Index



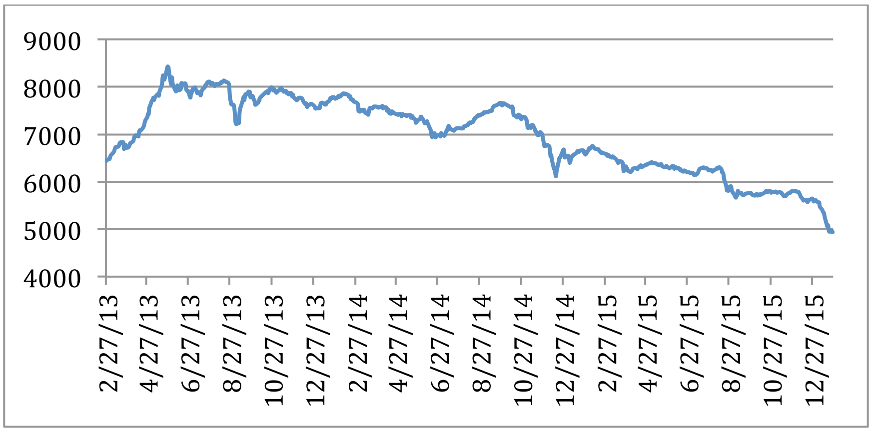
Bahrain Stock Market Index



Qatar Stock Market Index

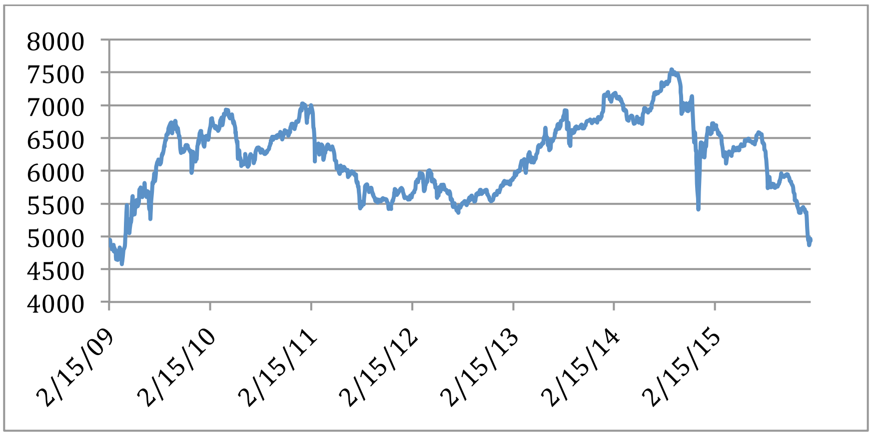


Kuwait Stock Market Index



Abu Dhabi Stock Market Index

Oman Stock Market Index



Appendix 3 – COINTEGRATION RESULTS

- **Saudi Arabia**

Trend assumption: No deterministic trend (restricted constant)
Series: LBRENT LSAUDI
Lags interval (in first differences): 1 to 14

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.003726	14.56617	20.26184	0.2523
At most 1	0.000243	0.890643	9.164546	0.9646

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.003726	13.67553	15.8921	0.1081
At most 1	0.000243	0.890643	9.164546	0.9646

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

- **Abu Dhabi**

Trend assumption: No deterministic trend (restricted constant)
Series: LBRENT LABU_DHABI
Lags interval (in first differences): 1 to 14

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.001802	9.722237	20.26184	0.6671
At most 1	0.00085	3.116426	9.164546	0.5592

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.001802	6.605811	15.8921	0.7173
At most 1	0.00085	3.116426	9.164546	0.5592

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

- **Bahrain**

Trend assumption: No deterministic trend (restricted constant)
Series: LBRENT LBAHRAIN
Lags interval (in first differences): 1 to 16

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.001158	4.926896	20.26184	0.983
At most 1	0.000187	0.683747	9.164546	0.984

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.001158	4.24315	15.8921	0.9439
At most 1	0.000187	0.683747	9.164546	0.984

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

- **Kuwait**

Trend assumption: No deterministic trend (restricted constant)
Series: LBRENT LKUWAIT
Lags interval (in first differences): 1 to 15

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.001366	5.695838	20.26184	0.9616
At most 1	0.000189	0.691115	9.164546	0.9834

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.001366	5.004723	15.8921	0.8879
At most 1	0.000189	0.691115	9.164546	0.9834

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

- **Oman**

Trend assumption: No deterministic trend (restricted constant)
Series: LBRENT LOMAN
Lags interval (in first differences): 1 to 17

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.001082	4.879828	20.26184	0.984
At most 1	0.000251	0.91841	9.164546	0.9614

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.001082	3.961418	15.8921	0.9592
At most 1	0.000251	0.91841	9.164546	0.9614

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

- **Qatar**

Trend assumption: No deterministic trend (restricted constant)
Series: LBRENT LQATAR
Lags interval (in first differences): 1 to 16

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.002572	11.69228	20.26184	0.4768

At most 1	0.000618	2.26413	9.164546	0.7248

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.002572	9.428146	15.8921	0.3893
At most 1	0.000618	2.26413	9.164546	0.7248

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix 4 – ESTIMATION OUTPUT RESULTS

- **Saudi Arabia**

	DLBRENT	DLSAUDI
DLBRENT(-1)	-0.048501	0.048566
	-0.01659	-0.01306
	[-2.92363]	[3.71868]
DLBRENT(-2)	0.008575	0.067551
	-0.01664	-0.0131
	[0.51539]	[5.15703]
DLBRENT(-3)	0.012273	0.075518
	-0.01667	-0.01313
	[0.73606]	[5.75326]
DLBRENT(-4)	-0.016825	-0.004215
	-0.0168	-0.01322
	[-1.00174]	[-0.31879]
DLBRENT(-5)	-0.002509	0.017407
	-0.01681	-0.01324
	[-0.14924]	[1.31515]
DLBRENT(-6)	0.047256	0.015042
	-0.01681	-0.01323
	[2.81127]	[1.13668]
DLBRENT(-7)	-0.03305	-0.005331
	-0.01683	-0.01325
	[-1.96407]	[-0.40242]
DLBRENT(-8)	0.016545	-0.009279
	-0.01683	-0.01325
	[0.98311]	[-0.70039]
DLBRENT(-9)	-0.013602	0.042397
	-0.01681	-0.01324
	[-0.80901]	[3.20307]

DLBRENT(-10)	-0.025353	0.009328
	-0.01683	-0.01325
	[-1.50678]	[0.70420]
DLBRENT(-11)	-0.025502	0.014497
	-0.01686	-0.01327
	[-1.51267]	[1.09233]
DLBRENT(-12)	0.027931	-0.002403
	-0.01686	-0.01327
	[1.65656]	[-0.18105]
DLBRENT(-13)	-0.023673	-0.009891
	-0.01687	-0.01328
	[-1.40361]	[-0.74497]
DLBRENT(-14)	0.068664	-0.008031
	-0.01683	-0.01325
	[4.07937]	[-0.60610]
DLSAUDI(-1)	0.003774	0.043519
	-0.02113	-0.01663
	[0.17861]	[2.61614]
DLSAUDI(-2)	-0.031716	-0.053854
	-0.02115	-0.01665
	[-1.49940]	[-3.23399]
DLSAUDI(-3)	0.02046	0.049273
	-0.02118	-0.01667
	[0.96619]	[2.95564]
DLSAUDI(-4)	-0.019803	0.014565
	-0.0212	-0.01669
	[-0.93409]	[0.87268]
DLSAUDI(-5)	0.030077	0.043983
	-0.0212	-0.01669
	[1.41852]	[2.63498]
DLSAUDI(-6)	-0.010754	0.002985

	-0.02123	-0.01671
	[-0.50660]	[0.17864]
DLSAUDI(-7)	-0.003843	-0.016788
	-0.02121	-0.0167
	[-0.18119]	[-1.00554]
DLSAUDI(-8)	0.00854	-0.06447
	-0.02121	-0.0167
	[0.40266]	[-3.86118]
DLSAUDI(-9)	0.033104	-0.019813
	-0.02129	-0.01676
	[1.55526]	[-1.18237]
DLSAUDI(-10)	0.004293	0.007152
	-0.02128	-0.01675
	[0.20176]	[0.42694]
DLSAUDI(-11)	-0.064737	-0.004489
	-0.02127	-0.01675
	[-3.04309]	[-0.26802]
DLSAUDI(-12)	0.059754	0.037518
	-0.02118	-0.01667
	[2.82147]	[2.25029]
DLSAUDI(-13)	0.006844	0.018882
	-0.02116	-0.01666
	[0.32344]	[1.13350]
DLSAUDI(-14)	0.053957	-0.027118
	-0.02107	-0.01659
	[2.56048]	[-1.63466]
C	-0.000165	-0.000256
	-0.00029	-0.00023
	[-0.56012]	[-1.10659]
R-squared	0.025453	0.038922
Adj. R-squared	0.017945	0.031516

Sum sq. resids	1.143503	0.708709
S.E. equation	0.017739	0.013965
F-statistic	3.38977	5.256037
Log likelihood	9586.188	10462.39
Akaike AIC	-5.21823	-5.696637
Schwarz SC	-5.169097	-5.647504
Mean dependent	-0.000187	-0.000313
S.D. dependent	0.0179	0.01419
Determinant resid covariance (dof adj.)		6.10E-08
Determinant resid covariance		6.00E-08
Log likelihood		20060.96
Akaike information criterion		-10.92163
Schwarz criterion		-10.82336

- **Abu Dhabi**

	DLBRENT	DLABUDHABI
DLBRENT(-1)	-0.050579	0.040793
	-0.01662	-0.00932
	[-3.04238]	[4.37580]
DLBRENT(-2)	0.005623	0.016368
	-0.01669	-0.00936
	[0.33688]	[1.74873]
DLBRENT(-3)	0.010213	0.026686
	-0.01669	-0.00936
	[0.61208]	[2.85198]
DLBRENT(-4)	-0.017773	0.01732
	-0.01676	-0.0094
	[-1.06042]	[1.84290]
DLBRENT(-5)	-0.003273	0.009964
	-0.01679	-0.00941

	[-0.19493]	[1.05838]
DLBRENT(-6)	0.045057	0.031314
	-0.01679	-0.00942
	[2.68308]	[3.32534]
DLBRENT(-7)	-0.035933	0.01209
	-0.01683	-0.00944
	[-2.13543]	[1.28128]
DLBRENT(-8)	0.014394	-0.006021
	-0.01684	-0.00944
	[0.85499]	[-0.63783]
DLBRENT(-9)	-0.012855	0.004759
	-0.01681	-0.00943
	[-0.76468]	[0.50480]
DLBRENT(-10)	-0.026751	0.011617
	-0.01681	-0.00943
	[-1.59124]	[1.23227]
DLBRENT(-11)	-0.030977	-0.011902
	-0.01685	-0.00945
	[-1.83838]	[-1.25959]
DLBRENT(-12)	0.029165	-0.002271
	-0.01685	-0.00945
	[1.73085]	[-0.24032]
DLBRENT(-13)	-0.023838	-0.00782
	-0.01686	-0.00945
	[-1.41404]	[-0.82720]
DLBRENT(-14)	0.070006	-0.002488
	-0.01683	-0.00944
	[4.15955]	[-0.26363]
DLABUDHABI(-1)	0.025491	0.104552
	-0.02972	-0.01667
	[0.85773]	[6.27366]

DLABUDHABI(-2)	4.66E-05	-0.023669
	-0.02991	-0.01677
	[0.00156]	[-1.41130]
DLABUDHABI(-3)	-0.009919	0.030974
	-0.0299	-0.01677
	[-0.33175]	[1.84734]
DLABUDHABI(-4)	0.016168	0.019853
	-0.0299	-0.01677
	[0.54068]	[1.18394]
DLABUDHABI(-5)	-0.01097	-0.01163
	-0.0299	-0.01677
	[-0.36688]	[-0.69363]
DLABUDHABI(-6)	0.053216	-0.028637
	-0.02993	-0.01678
	[1.77808]	[-1.70636]
DLABUDHABI(-7)	-0.013297	-0.005431
	-0.02998	-0.01681
	[-0.44357]	[-0.32308]
DLABUDHABI(-8)	0.02545	0.018751
	-0.02997	-0.01681
	[0.84919]	[1.11574]
DLABUDHABI(-9)	0.023126	-0.033017
	-0.03001	-0.01683
	[0.77065]	[-1.96207]
DLABUDHABI(-10)	-0.006613	0.009286
	-0.03003	-0.01684
	[-0.22025]	[0.55151]
DLABUDHABI(-11)	0.050266	0.030905
	-0.02998	-0.01681
	[1.67643]	[1.83807]

DLABUDHABI(-12)	-0.051242	-0.037862
	-0.02998	-0.01681
	[-1.70943]	[-2.25246]
DLABUDHABI(-13)	-0.001106	0.002749
	-0.02998	-0.01681
	[-0.03689]	[0.16353]
DLABUDHABI(-14)	0.030144	0.003746
	-0.02969	-0.01665
	[1.01545]	[0.22502]
C	-0.000183	-5.06E-05
	-0.00029	-0.00016
	[-0.62260]	[-0.30664]
R-squared	0.020135	0.033133
Adj. R-squared	0.012585	0.025683
Sum sq. resids	1.149744	0.361531
S.E. equation	0.017787	0.009974
F-statistic	2.666918	4.447512
Log likelihood	9576.22	11695.17
Akaike AIC	-5.212787	-6.369733
Schwarz SC	-5.163654	-6.3206
Mean dependent	-0.000187	-8.57E-05
S.D. dependent	0.0179	0.010105
Determinant resid covariance (dof adj.)		3.12E-08
Determinant resid covariance		3.07E-08
Log likelihood		21288.18
Akaike information criterion		-11.59169
Schwarz criterion		-11.49342

- **Bahrain**

	DLBRENT	DLBAHRAIN
DLBRENT(-1)	-0.049686	0.012648

	-0.0166	-0.0044
	[-2.99349]	[2.87518]
DLBRENT(-2)	0.006001	0.000525
	-0.01663	-0.00441
	[0.36081]	[0.11920]
DLBRENT(-3)	0.010549	0.005426
	-0.01659	-0.0044
	[0.63582]	[1.23397]
DLBRENT(-4)	-0.015608	0.018188
	-0.01665	-0.00441
	[-0.93726]	[4.12121]
DLBRENT(-5)	-0.000654	0.006329
	-0.01669	-0.00442
	[-0.03920]	[1.43048]
DLBRENT(-6)	0.047372	0.016809
	-0.0167	-0.00443
	[2.83672]	[3.79798]
DLBRENT(-7)	-0.034025	0.007221
	-0.01675	-0.00444
	[-2.03173]	[1.62688]
DLBRENT(-8)	0.014236	0.000924
	-0.01676	-0.00444
	[0.84943]	[0.20813]
DLBRENT(-9)	-0.009211	0.002383
	-0.01676	-0.00444
	[-0.54973]	[0.53663]
DLBRENT(-10)	-0.025096	0.00576
	-0.01675	-0.00444
	[-1.49855]	[1.29782]
DLBRENT(-11)	-0.026054	0.000234
	-0.01677	-0.00444

	[-1.55403]	[0.05258]
DLBRENT(-12)	0.030384	0.013191
	-0.01677	-0.00444
	[1.81203]	[2.96829]
DLBRENT(-13)	-0.02368	0.004958
	-0.01679	-0.00445
	[-1.41037]	[1.11416]
DLBRENT(-14)	0.070875	-0.005399
	-0.01679	-0.00445
	[4.22193]	[-1.21361]
DLBRENT(-15)	0.008309	-0.004435
	-0.01686	-0.00447
	[0.49289]	[-0.99253]
DLBRENT(-16)	0.023682	0.005745
	-0.01683	-0.00446
	[1.40710]	[1.28798]
R-squared	0.02264	0.042111
Adj. R-squared	0.014019	0.033662
Sum sq. resids	1.146689	0.080542
S.E. equation	0.017778	0.004712
F-statistic	2.626219	4.984245
Log likelihood	9574.862	14436.4
Akaike AIC	-5.212708	-7.868558
Schwarz SC	-5.156772	-7.812622
Mean dependent	-0.00019	-0.000179
S.D. dependent	0.017904	0.004793
Determinant resid covariance (dof adj.)		7.01E-09
Determinant resid covariance		6.89E-09
Log likelihood		24011.89
Akaike information criterion		-13.08161
Schwarz criterion		-12.96974

- **Kuwait**

	DLBRENT	DLKUWAIT
DLBRENT(-1)	-0.047541	0.023815
	-0.01659	-0.00588
	[-2.86619]	[4.04879]
DLBRENT(-2)	0.006606	-0.001405
	-0.0166	-0.00589
	[0.39790]	[-0.23872]
DLBRENT(-3)	0.005318	0.01738
	-0.0166	-0.00589
	[0.32039]	[2.95275]
DLBRENT(-4)	-0.01609	0.025408
	-0.01667	-0.00591
	[-0.96545]	[4.29893]
DLBRENT(-5)	-0.001345	0.001219
	-0.01673	-0.00593
	[-0.08042]	[0.20552]
DLBRENT(-6)	0.04016	0.004189
	-0.01673	-0.00593
	[2.40068]	[0.70606]
DLBRENT(-7)	-0.0317	0.003877
	-0.01673	-0.00593
	[-1.89443]	[0.65333]
DLBRENT(-8)	0.014131	-0.004199
	-0.01672	-0.00593
	[0.84529]	[-0.70825]
DLBRENT(-9)	-0.014688	0.002376
	-0.01671	-0.00593
	[-0.87883]	[0.40084]

DLBRENT(-10)	-0.02223	0.00232
	-0.01669	-0.00592
	[-1.33172]	[0.39184]
DLBRENT(-11)	-0.030021	-3.60E-06
	-0.01673	-0.00593
	[-1.79416]	[-0.00061]
DLBRENT(-12)	0.025593	0.017917
	-0.01674	-0.00594
	[1.52900]	[3.01837]
DLBRENT(-13)	-0.019745	0.004119
	-0.01675	-0.00594
	[-1.17867]	[0.69336]
DLBRENT(-14)	0.068977	0.005831
	-0.01676	-0.00594
	[4.11643]	[0.98126]
DLBRENT(-15)	0.006493	-0.012358
	-0.01679	-0.00595
	[0.38671]	[-2.07533]
DLKUWAIT(-1)	-0.026621	0.117777
	-0.04679	-0.01659
	[-0.56890]	[7.09726]
DLKUWAIT(-2)	0.089872	-0.01964
	-0.04708	-0.0167
	[1.90895]	[-1.17638]
DLKUWAIT(-3)	-0.010721	0.103216
	-0.04707	-0.01669
	[-0.22777]	[6.18362]
DLKUWAIT(-4)	0.06804	0.022413
	-0.04725	-0.01676
	[1.44003]	[1.33760]
DLKUWAIT(-5)	-0.009256	0.014123

	-0.04727	-0.01676
	[-0.19580]	[0.84248]
DLKUWAIT(-6)	0.033922	0.003099
	-0.04731	-0.01678
	[0.71698]	[0.18472]
DLKUWAIT(-7)	-0.030313	0.031984
	-0.04733	-0.01678
	[-0.64051]	[1.90577]
DLKUWAIT(-8)	0.17571	0.031354
	-0.04728	-0.01677
	[3.71632]	[1.86999]
DLKUWAIT(-9)	-0.060478	-0.019715
	-0.04748	-0.01684
	[-1.27386]	[-1.17100]
DLKUWAIT(-10)	0.012688	0.021764
	-0.0475	-0.01684
	[0.26712]	[1.29203]
DLKUWAIT(-11)	0.04408	0.009562
	-0.04751	-0.01685
	[0.92784]	[0.56755]
DLKUWAIT(-12)	-0.093251	-0.022118
	-0.04742	-0.01682
	[-1.96633]	[-1.31517]
DLKUWAIT(-13)	-0.039661	0.03841
	-0.0472	-0.01674
	[-0.84019]	[2.29448]
DLKUWAIT(-14)	0.072662	0.050644
	-0.04723	-0.01675
	[1.53844]	[3.02361]
DLKUWAIT(-15)	-0.127367	0.010144
	-0.04684	-0.01661

	[-2.71891]	[0.61063]
C	-0.000165	-0.000128
	-0.00029	-0.0001
	[-0.56048]	[-1.22428]
R-squared	0.02647	0.057847
Adj. R-squared	0.018427	0.050063
Sum sq. resids	1.14231	0.143659
S.E. equation	0.017737	0.00629
F-statistic	3.290908	7.431275
Log likelihood	9584.983	13381.32
Akaike AIC	-5.217904	-7.291272
Schwarz SC	-5.165371	-7.238738
Mean dependent	-0.000187	-0.000234
S.D. dependent	0.017903	0.006454
Determinant resid covariance (dof adj.)		1.24E-08
Determinant resid covariance		1.22E-08
Log likelihood		22967.9
Akaike information criterion		-12.51005
Schwarz criterion		-12.40498

- **Oman**

	DLBRENT	DLOMAN
DLBRENT(-1)	-0.047576	0.061586
	-0.01665	-0.00813
	[-2.85687]	[7.57877]
DLBRENT(-2)	0.007221	0.046662
	-0.01678	-0.00819
	[0.43024]	[5.69782]
DLBRENT(-3)	0.012253	0.020402
	-0.01686	-0.00823
	[0.72691]	[2.48035]
DLBRENT(-4)	-0.019108	0.023279

	-0.01688	-0.00824
	[-1.13173]	[2.82557]
DLBRENT(-5)	-0.004106	0.003676
	-0.01692	-0.00826
	[-0.24258]	[0.44515]
DLBRENT(-6)	0.046302	0.021389
	-0.01692	-0.00826
	[2.73625]	[2.59039]
DLBRENT(-7)	-0.031873	-0.001737
	-0.01695	-0.00827
	[-1.88069]	[-0.21004]
DLBRENT(-8)	0.017839	-0.009597
	-0.01695	-0.00827
	[1.05244]	[-1.16037]
DLBRENT(-9)	-0.006683	0.014388
	-0.01695	-0.00827
	[-0.39417]	[1.73908]
DLBRENT(-10)	-0.023272	0.005198
	-0.01696	-0.00828
	[-1.37220]	[0.62812]
DLBRENT(-11)	-0.023998	0.009555
	-0.01699	-0.00829
	[-1.41270]	[1.15269]
DLBRENT(-12)	0.033151	0.002204
	-0.01698	-0.00828
	[1.95260]	[0.26603]
DLBRENT(-13)	-0.023458	0.016194
	-0.01699	-0.00829
	[-1.38109]	[1.95391]
DLBRENT(-14)	0.072247	-0.021056
	-0.01699	-0.00829

	[4.25350]	[-2.54044]
DLBRENT(-15)	0.010165	-0.017289
	-0.01706	-0.00832
	[0.59598]	[-2.07727]
DLBRENT(-16)	0.023179	-0.00293
	-0.01707	-0.00833
	[1.35817]	[-0.35182]
DLBRENT(-17)	-0.006685	0.010128
	-0.01702	-0.00831
	[-0.39275]	[1.21945]
DLOMAN(-1)	-0.037246	0.17231
	-0.03409	-0.01663
	[-1.09256]	[10.3583]
DLOMAN(-2)	0.025893	-0.07537
	-0.03462	-0.01689
	[0.74797]	[-4.46192]
DLOMAN(-3)	-0.005914	0.046927
	-0.0347	-0.01693
	[-0.17044]	[2.77174]
DLOMAN(-4)	0.056402	0.016262
	-0.0347	-0.01693
	[1.62556]	[0.96049]
DLOMAN(-5)	-0.013148	0.020757
	-0.03466	-0.01691
	[-0.37939]	[1.22742]
DLOMAN(-6)	0.003813	-0.079361
	-0.03468	-0.01692
	[0.10996]	[-4.68974]
DLOMAN(-7)	-0.051321	-0.009712
	-0.03476	-0.01696
	[-1.47635]	[-0.57258]

DLOMAN(-8)	0.004773	-0.021502
	-0.03478	-0.01697
	[0.13724]	[-1.26713]
DLOMAN(-9)	0.003904	-0.013138
	-0.03483	-0.017
	[0.11210]	[-0.77301]
DLOMAN(-10)	-0.035836	0.020949
	-0.03481	-0.01698
	[-1.02959]	[1.23345]
DLOMAN(-11)	0.014674	-0.020687
	-0.03482	-0.01699
	[0.42147]	[-1.21763]
DLOMAN(-12)	-0.020252	0.001799
	-0.03471	-0.01694
	[-0.58339]	[0.10623]
DLOMAN(-13)	0.007237	-0.034789
	-0.03471	-0.01694
	[0.20848]	[-2.05383]
DLOMAN(-14)	-0.002429	0.028391
	-0.03468	-0.01692
	[-0.07003]	[1.67758]
DLOMAN(-15)	-0.062953	0.026069
	-0.03463	-0.0169
	[-1.81765]	[1.54253]
DLOMAN(-16)	0.102376	0.00327
	-0.0345	-0.01683
	[2.96781]	[0.19428]
DLOMAN(-17)	-0.0314	-0.049874
	-0.03366	-0.01643
	[-0.93283]	[-3.03645]

C	-0.000193	2.65E-05
	-0.00029	-0.00014
	[-0.65756]	[0.18460]
R-squared	0.022583	0.084984
Adj. R-squared	0.013416	0.076401
Sum sq. resids	1.145815	0.272826
S.E. equation	0.017779	0.008675
F-statistic	2.463418	9.902275
Log likelihood	9573.143	12199.26
Akaike AIC	-5.2121	-6.647137
Schwarz SC	-5.15276	-6.587798
Mean dependent	-0.000198	-1.06E-05
S.D. dependent	0.017899	0.009027
Determinant resid covariance (dof adj.)		2.36E-08
Determinant resid covariance		2.32E-08
Log likelihood		21783.21
Akaike information criterion		-11.86514
Schwarz criterion		-11.74646

- **Qatar**

	DLBRENT	DLQATAR
DLBRENT(-1)	-0.047689	0.054048
	-0.01664	-0.01105
	[-2.86643]	[4.88970]
DLBRENT(-2)	0.001331	0.049867
	-0.01672	-0.01111
	[0.07964]	[4.49038]
DLBRENT(-3)	0.011065	0.033171
	-0.01672	-0.01111
	[0.66180]	[2.98600]
DLBRENT(-4)	-0.019067	0.035018
	-0.0168	-0.01116

	[-1.13479]	[3.13695]
DLBRENT(-5)	-0.003302	0.019209
	-0.01684	-0.01119
	[-0.19604]	[1.71645]
DLBRENT(-6)	0.046351	0.019531
	-0.01684	-0.01119
	[2.75197]	[1.74537]
DLBRENT(-7)	-0.035324	-0.006347
	-0.01686	-0.0112
	[-2.09529]	[-0.56667]
DLBRENT(-8)	0.016033	-0.010579
	-0.01687	-0.01121
	[0.95060]	[-0.94410]
DLBRENT(-9)	-0.011047	0.02455
	-0.01687	-0.01121
	[-0.65491]	[2.19064]
DLBRENT(-10)	-0.027879	0.016217
	-0.01687	-0.01121
	[-1.65265]	[1.44697]
DLBRENT(-11)	-0.031399	0.019997
	-0.01689	-0.01122
	[-1.85870]	[1.78177]
DLBRENT(-12)	0.026587	0.014322
	-0.01691	-0.01124
	[1.57197]	[1.27458]
DLBRENT(-13)	-0.026136	-0.024608
	-0.01691	-0.01123
	[-1.54590]	[-2.19084]
DLBRENT(-14)	0.07049	0.011394
	-0.01689	-0.01122
	[4.17395]	[1.01548]

DLBRENT(-15)	0.008061	-0.043016
	-0.01694	-0.01126
	[0.47579]	[-3.82150]
DLBRENT(-16)	0.017954	0.017569
	-0.01694	-0.01125
	[1.06003]	[1.56121]
DLQATAR(-1)	0.012003	0.101788
	-0.02506	-0.01665
	[0.47903]	[6.11434]
DLQATAR(-2)	0.037953	-0.047803
	-0.02516	-0.01671
	[1.50867]	[-2.86013]
DLQATAR(-3)	-0.056994	0.041069
	-0.02519	-0.01673
	[-2.26297]	[2.45443]
DLQATAR(-4)	0.046178	0.04347
	-0.0252	-0.01674
	[1.83234]	[2.59623]
DLQATAR(-5)	-0.020105	0.010689
	-0.02522	-0.01676
	[-0.79716]	[0.63787]
DLQATAR(-6)	0.027736	-0.029132
	-0.02524	-0.01677
	[1.09878]	[-1.73707]
DLQATAR(-7)	-0.026101	-0.011458
	-0.02534	-0.01683
	[-1.03019]	[-0.68072]
DLQATAR(-8)	0.025295	-0.033525
	-0.02532	-0.01682
	[0.99885]	[-1.99261]

DLQATAR(-9)	0.024753	-0.016271
	-0.02544	-0.0169
	[0.97310]	[-0.96279]
DLQATAR(-10)	-0.019345	0.003578
	-0.02545	-0.01691
	[-0.76022]	[0.21165]
DLQATAR(-11)	0.056548	0.022999
	-0.02543	-0.0169
	[2.22326]	[1.36102]
DLQATAR(-12)	-0.023558	0.016142
	-0.02546	-0.01692
	[-0.92521]	[0.95420]
DLQATAR(-13)	0.007562	-0.020265
	-0.02539	-0.01687
	[0.29788]	[-1.20148]
DLQATAR(-14)	0.003831	0.029476
	-0.02533	-0.01683
	[0.15126]	[1.75172]
DLQATAR(-15)	-0.019232	-0.014082
	-0.02529	-0.0168
	[-0.76062]	[-0.83824]
DLQATAR(-16)	0.060755	0.020476
	-0.02504	-0.01663
	[2.42678]	[1.23106]
C	-0.000187	-4.02E-06
	-0.00029	-0.0002
	[-0.63690]	[-0.02058]
R-squared	0.024507	0.049645
Adj. R-squared	0.015903	0.041262
Sum sq. resids	1.144498	0.50519
S.E. equation	0.017761	0.0118
F-statistic	2.848288	5.922494

Log likelihood	9578.363	11075.32
Akaike AIC	-5.21462	-6.032408
Schwarz SC	-5.158685	-5.976472
Mean dependent	-0.00019	-5.50E-05
S.D. dependent	0.017904	0.012052
Determinant resid covariance (dof adj.)		4.37E-08
Determinant resid covariance		4.29E-08
Log likelihood		20664.46
Akaike information criterion		-11.25291
Schwarz criterion		-11.14104

Appendix 5 – VARIANCE DECOMPOSITION RESULTS

- **Saudi Arabia**

Variance Decomposition of DLSAUDI:

Period	S.E.	DLBRENT	DLSAUDI
1	0.017739	0.000000	100.0000
2	0.017760	0.375696	99.62430
3	0.017766	1.087322	98.91268
4	0.017769	1.909609	98.09039
5	0.017775	1.912231	98.08777
6	0.017779	1.959236	98.04076
7	0.017800	2.028117	97.97188
8	0.017814	2.027580	97.97242
9	0.017819	2.024026	97.97597
10	0.017827	2.286701	97.71330
11	0.017832	2.286378	97.71362
12	0.017859	2.295693	97.70431
13	0.017889	2.297599	97.70240
14	0.017899	2.318509	97.68149
15	0.017968	2.320945	97.67906
16	0.017968	2.331925	97.66808
17	0.017968	2.331524	97.66848
18	0.017969	2.332562	97.66744
19	0.017969	2.332604	97.66740

20	0.017969	2.332612	97.66739
21	0.017970	2.332547	97.66745
22	0.017970	2.334816	97.66518
23	0.017970	2.334799	97.66520
24	0.017970	2.336130	97.66387
25	0.017971	2.336145	97.66385
26	0.017971	2.336175	97.66383
27	0.017971	2.336161	97.66384
28	0.017972	2.336162	97.66384
29	0.017972	2.336218	97.66378
30	0.017972	2.336236	97.66376
31	0.017972	2.336261	97.66374
32	0.017972	2.336272	97.66373
33	0.017972	2.336272	97.66373
34	0.017972	2.336274	97.66373
35	0.017972	2.336275	97.66373
36	0.017972	2.336283	97.66372
37	0.017972	2.336289	97.66371
38	0.017972	2.336303	97.66370
39	0.017972	2.336303	97.66370
40	0.017972	2.336305	97.66370
41	0.017972	2.336305	97.66370
42	0.017972	2.336305	97.66370

43	0.017972	2.336306	97.66369
44	0.017972	2.336308	97.66369
45	0.017972	2.336308	97.66369
46	0.017972	2.336308	97.66369
47	0.017972	2.336308	97.66369
48	0.017972	2.336308	97.66369
49	0.017972	2.336308	97.66369
50	0.017972	2.336308	97.66369

- **Abu Dhabi**

Variance Decomposition of DLABUDHABI:

Period	S.E.	DLBRENT	DLABUDHABI
1	0.009974	0.912767	99.08723
2	0.010062	1.569530	98.43047
3	0.010068	1.668236	98.33176
4	0.010084	1.918918	98.08108
5	0.010095	2.059916	97.94008
6	0.010097	2.098168	97.90183
7	0.010117	2.382393	97.61761
8	0.010120	2.446818	97.55318
9	0.010123	2.456279	97.54372
10	0.010127	2.461550	97.53845

11	0.010129	2.495932	97.50407
12	0.010137	2.530602	97.46940
13	0.010141	2.536566	97.46343
14	0.010143	2.564578	97.43542
15	0.010144	2.570479	97.42952
16	0.010144	2.571504	97.42850
17	0.010144	2.571873	97.42813
18	0.010144	2.572137	97.42786
19	0.010144	2.573696	97.42630
20	0.010144	2.574002	97.42600
21	0.010144	2.575697	97.42430
22	0.010144	2.576863	97.42314
23	0.010144	2.576948	97.42305
24	0.010144	2.577006	97.42299
25	0.010144	2.577549	97.42245
26	0.010144	2.577848	97.42215
27	0.010144	2.577848	97.42215
28	0.010144	2.577942	97.42206
29	0.010144	2.578022	97.42198
30	0.010144	2.578026	97.42197
31	0.010144	2.578028	97.42197
32	0.010144	2.578034	97.42197
33	0.010144	2.578053	97.42195

34	0.010144	2.578061	97.42194
35	0.010144	2.578063	97.42194
36	0.010144	2.578074	97.42193
37	0.010144	2.578074	97.42193
38	0.010144	2.578074	97.42193
39	0.010144	2.578084	97.42192
40	0.010144	2.578087	97.42191
41	0.010144	2.578087	97.42191
42	0.010144	2.578087	97.42191
43	0.010144	2.578088	97.42191
44	0.010144	2.578088	97.42191
45	0.010144	2.578088	97.42191
46	0.010144	2.578088	97.42191
47	0.010144	2.578088	97.42191
48	0.010144	2.578088	97.42191
49	0.010144	2.578088	97.42191
50	0.010144	2.578089	97.42191

- **Bahrain**

Variance Decomposition of DLBAHRAIN:

Period	S.E.	DLBRENT	DLBAHRAIN
1	0.004712	0.034830	99.96517
2	0.004732	0.274370	99.72563

3	0.004735	0.275593	99.72441
4	0.004737	0.326170	99.67383
5	0.004750	0.796297	99.20370
6	0.004752	0.856541	99.14346
7	0.004763	1.302641	98.69736
8	0.004765	1.400417	98.59958
9	0.004766	1.401555	98.59845
10	0.004767	1.418670	98.58133
11	0.004768	1.465043	98.53496
12	0.004769	1.464641	98.53536
13	0.004776	1.754598	98.24540
14	0.004780	1.800202	98.19980
15	0.004786	1.825517	98.17448
16	0.004798	1.821805	98.17820
17	0.004810	1.875440	98.12456
18	0.004810	1.880048	98.11995
19	0.004811	1.909303	98.09070
20	0.004811	1.921651	98.07835
21	0.004812	1.940900	98.05910
22	0.004812	1.955365	98.04463
23	0.004812	1.962130	98.03787
24	0.004812	1.963076	98.03692
25	0.004813	1.968965	98.03104

26	0.004813	1.970573	98.02943
27	0.004813	1.976022	98.02398
28	0.004813	1.979829	98.02017
29	0.004813	1.981903	98.01810
30	0.004814	1.981637	98.01836
31	0.004814	1.981705	98.01830
32	0.004814	1.981722	98.01828
33	0.004814	1.984065	98.01593
34	0.004814	1.985173	98.01483
35	0.004814	1.986330	98.01367
36	0.004814	1.987095	98.01291
37	0.004814	1.987884	98.01212
38	0.004814	1.988049	98.01195
39	0.004814	1.988447	98.01155
40	0.004814	1.988627	98.01137
41	0.004814	1.988907	98.01109
42	0.004814	1.989080	98.01092
43	0.004814	1.989271	98.01073
44	0.004814	1.989298	98.01070
45	0.004814	1.989352	98.01065
46	0.004814	1.989355	98.01065
47	0.004814	1.989407	98.01059
48	0.004814	1.989464	98.01054

49	0.004814	1.989554	98.01045
50	0.004814	1.989598	98.01040

- **Kuwait**

Variance Decomposition of DLKUWAIT:

Period	S.E.	DLBRENT	DLKUWAIT
1	0.006290	0.087112	99.91289
2	0.006349	0.575160	99.42484
3	0.006349	0.575168	99.42483
4	0.006390	0.825238	99.17476
5	0.006418	1.491346	98.50865
6	0.006420	1.500545	98.49946
7	0.006422	1.533649	98.46635
8	0.006430	1.594105	98.40589
9	0.006436	1.594541	98.40546
10	0.006437	1.616141	98.38386
11	0.006440	1.630606	98.36939
12	0.006442	1.630972	98.36903
13	0.006452	1.912291	98.08771
14	0.006457	1.938680	98.06132
15	0.006473	1.968252	98.03175
16	0.006476	1.993693	98.00631
17	0.006476	1.994411	98.00559

18	0.006478	2.007242	97.99276
19	0.006479	2.023282	97.97672
20	0.006479	2.025180	97.97482
21	0.006479	2.028771	97.97123
22	0.006480	2.029787	97.97021
23	0.006480	2.029798	97.97020
24	0.006480	2.029792	97.97021
25	0.006480	2.031559	97.96844
26	0.006480	2.031976	97.96802
27	0.006480	2.038086	97.96191
28	0.006480	2.039619	97.96038
29	0.006481	2.040104	97.95990
30	0.006481	2.040351	97.95965
31	0.006481	2.040392	97.95961
32	0.006481	2.040590	97.95941
33	0.006481	2.041031	97.95897
34	0.006481	2.041091	97.95891
35	0.006481	2.041277	97.95872
36	0.006481	2.041293	97.95871
37	0.006481	2.041297	97.95870
38	0.006481	2.041296	97.95870
39	0.006481	2.041359	97.95864
40	0.006481	2.041370	97.95863

41	0.006481	2.041487	97.95851
42	0.006481	2.041509	97.95849
43	0.006481	2.041526	97.95847
44	0.006481	2.041527	97.95847
45	0.006481	2.041532	97.95847
46	0.006481	2.041533	97.95847
47	0.006481	2.041543	97.95846
48	0.006481	2.041545	97.95846
49	0.006481	2.041551	97.95845
50	0.006481	2.041551	97.95845

- **Oman**

Variance Decomposition of DLOMAN:

Period	S.E.	DLBRENT	DLOMAN
1	0.008675	0.588593	99.41141
2	0.008885	2.414491	97.58551
3	0.008944	3.474077	96.52592
4	0.008957	3.696427	96.30357
5	0.008975	3.975781	96.02422
6	0.008979	4.005782	95.99422
7	0.009008	4.149119	95.85088
8	0.009013	4.143980	95.85602
9	0.009019	4.233431	95.76657

10	0.009023	4.269405	95.73060
11	0.009024	4.276583	95.72342
12	0.009026	4.284514	95.71549
13	0.009027	4.285109	95.71489
14	0.009033	4.336782	95.66322
15	0.009042	4.498733	95.50127
16	0.009055	4.593947	95.40605
17	0.009055	4.596568	95.40343
18	0.009067	4.635453	95.36455
19	0.009068	4.635092	95.36491
20	0.009068	4.638394	95.36161
21	0.009068	4.638383	95.36162
22	0.009069	4.640261	95.35974
23	0.009069	4.640982	95.35902
24	0.009069	4.641002	95.35900
25	0.009069	4.641001	95.35900
26	0.009069	4.645318	95.35468
27	0.009069	4.645487	95.35451
28	0.009069	4.646483	95.35352
29	0.009069	4.647012	95.35299
30	0.009069	4.648049	95.35195
31	0.009069	4.649794	95.35021
32	0.009070	4.650902	95.34910

33	0.009070	4.651866	95.34813
34	0.009070	4.651878	95.34812
35	0.009070	4.652229	95.34777
36	0.009070	4.652271	95.34773
37	0.009070	4.652277	95.34772
38	0.009070	4.652280	95.34772
39	0.009070	4.652331	95.34767
40	0.009070	4.652401	95.34760
41	0.009070	4.652401	95.34760
42	0.009070	4.652415	95.34759
43	0.009070	4.652423	95.34758
44	0.009070	4.652424	95.34758
45	0.009070	4.652484	95.34752
46	0.009070	4.652485	95.34752
47	0.009070	4.652501	95.34750
48	0.009070	4.652524	95.34748
49	0.009070	4.652537	95.34746
50	0.009070	4.652539	95.34746

- **Qatar**

Variance Decomposition of DLQATAR:

Period	S.E.	DLBRENT	DLQATAR
1	0.011800	0.586855	99.41314
2	0.011907	1.356842	98.64316
3	0.011950	1.920072	98.07993
4	0.011973	2.191315	97.80869
5	0.012011	2.530831	97.46917
6	0.012021	2.661752	97.33825
7	0.012031	2.759312	97.24069
8	0.012032	2.759974	97.24003
9	0.012039	2.790070	97.20993
10	0.012049	2.895072	97.10493
11	0.012052	2.944770	97.05523
12	0.012058	2.996710	97.00329
13	0.012063	3.029828	96.97017
14	0.012073	3.162154	96.83785
15	0.012079	3.183010	96.81699
16	0.012095	3.448960	96.55104
17	0.012102	3.526675	96.47332
18	0.012103	3.536760	96.46324
19	0.012104	3.537648	96.46235
20	0.012104	3.537650	96.46235

21	0.012104	3.540767	96.45923
22	0.012104	3.541157	96.45884
23	0.012104	3.542439	96.45756
24	0.012104	3.544239	96.45576
25	0.012104	3.545047	96.45495
26	0.012104	3.545276	96.45472
27	0.012105	3.547618	96.45238
28	0.012105	3.551249	96.44875
29	0.012105	3.554691	96.44531
30	0.012105	3.559912	96.44009
31	0.012106	3.560656	96.43934
32	0.012106	3.560791	96.43921
33	0.012106	3.560988	96.43901
34	0.012106	3.561072	96.43893
35	0.012106	3.561246	96.43875
36	0.012106	3.561368	96.43863
37	0.012106	3.561462	96.43854
38	0.012106	3.561473	96.43853
39	0.012106	3.561512	96.43849
40	0.012106	3.561524	96.43848
41	0.012106	3.561559	96.43844
42	0.012106	3.561625	96.43837
43	0.012106	3.561715	96.43828

44	0.012106	3.561809	96.43819
45	0.012106	3.561870	96.43813
46	0.012106	3.561904	96.43810
47	0.012106	3.561930	96.43807
48	0.012106	3.561952	96.43805
49	0.012106	3.561965	96.43804
50	0.012106	3.561974	96.43803

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