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The effect on capital structure during the 2014-2015 oil shock: An analysis of the Middle-East oil & gas industry.

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Abstract

Name : Mohammad Ali Ansari

Program of Study : Accounting and Finance

Title : The effect on capital structure during the 2014-2015 Oil Shock: An Analysis of the Middle-East Oil & Gas Industry

The 2014-2015 oil shock has affected a vast amount of industrial companies all around the world. Many believe this shock could lead to a full crisis if not handled correctly. The unique point about this crisis is that it was specifically engineered by the OPEC mainly to handle the recent rise of Shale Oil corporations. This suggests that the Middle-East may be better prepared to handle the oil shock since they caused it. This study seeks to assess the impact on leverage and capital structure during this oil shock for the oil & gas industry of the Middle-East. In particular, it hopes to conclude whether the Middle-East was able to mitigate the negative effects of the shock better than the rest of the world.

Quarterly panel data of Middle-East firms from 5 different countries were collected, with sampled data ranging from Q1 2011 – Q1 2015. The research applies various regression models with response variables including the gearing, book long-term debt, market short-term debt and book short-term debt ratios. The estimators applied include OLS, Fixed/Random models, GLM and NLM.

The results find a weak linear relationship between Middle-East capital structure and the oil price and similar weak support for a non-linear relationship suggesting that further drops in the oil price will have an appropriate effect to the leverage causing it to rise. Particularly in Q1 2015 the average leverage rises for Middle-East firms. This is similar to the global economy albeit to a lesser degree, although the leverage is expected to rise exponentially as the oil price continues to fall.

The Middle-East has been capable of mitigating some of the effects of the oil shock, although as the price falls further it becomes clear they are not prepared to handle all the negative effects. Further falls in the oil price may cause uncontrollable consequences to the economy as the results suggest that the currently falling price will cause a large rise in debt in the region. The results also find that the Middle-East economy behaves consistent with the predictions of the capital structure theories, similar to the global economy. Certain Middle-East countries have already started to have adverse effects on the economy, the recommendation is that these countries should treat this oil shock as a serious affair and not something they can simply mitigate with their large oil supply.

Keywords: *Middle-East, OPEC, Capital Structure, Leverage, Oil Shock.*

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1) Dr. Kai Sun, my main supervisor for this research project. I would like to thank him for bearing through my mistakes and constant questions throughout the project. His guidance has also significantly piqued my interest in the topic of research and econometrics.

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3) My family, for their constant reminders and updates on my progress ensuring I do not fall behind on my progress. My father also helped with providing some guidance of causality involved in this oil shock and was key to understanding some of the theories involved.

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List of abbreviations

Abbreviation	Meaning
GCC	Gulf Cooperation Council
GLM	Generalised Linear Model
MENA	Middle-East and North Africa
M-M	Modigliani-Miller
NLM	Non-Linear Model
OLS	Ordinary Least Squared
OPEC	Organisation of Petroleum-Exporting Countries
SMEs	Small or Medium Enterprise

Chapter 1: Introduction

1.1 Background of the study

The onset of the current 2014-2015 oil shock appears to have caused a fall in the price of crude oil to nearly a third of its peak price in 2014. Oil price shocks are usually never good for the economy and often prelude full financial crisis. The current oil price continues to fall and many call this an oil crisis, engineered by the OPEC cartel to deal with competition. One of the well-researched yet incomplete topics is the influence on capital structure during times of crisis. There is not much research of this topic for the Middle-East in particular, and almost none in relation to the oil price.

The unique point of this crisis is the reported fact that it is the result of the OPEC (in particular Saudi Arabia) increasing the supply of oil and hence causing the price to plummet. Saudi Arabia controls a third of the total OPEC oil supply and has the power to return the oil price to a reasonable value but chooses not to (The Economist, 2014). The main rationale behind this is to make American Shale Oil companies involved in 'fracturing' (or 'fracking') go bankrupt to remove them from competition, allowing current oil & gas companies to take them over. The second reason for the oil crisis is also to pressure other oil-producing economies such as Iran and Iraq and to deter investors from high-cost projects, for example in the Arctic and North Sea (The Economist, 2014).

Six months after the oil shock, The Economist (2015a) reports that 29 of 62 shale oil firms are financially distressed (having net debt more than eight times their net cash flow). However, The Economist (2015b) and Raval (2015) suggest that Shale Oil

companies have been successful in cost-cutting techniques and are not suffering as much as the OPEC had hoped. However, Saudi Arabia claims it can handle a far lower oil price because of its large reserve supply of oil (The Economist, 2015b). Generally this tactic has been successful, causing international companies to slash spending, jobs and investment (Financial Times, 2015), but not without damage to the Middle-East economy as well.

While the region's governments seem to be feigning confidence by claiming to financial markets that there will be little change in their investment behaviour despite the oil price drop, the evidence points to the contrary (Kerr, 2015). The Middle-East generally avoids borrowing debt and Saudi Arabia for instance has not issued bonds since 2007. The recent oil shock has not only caused debt to rise to more than 100% of GDP, but they will have to cut subsidies and public-sector jobs will be affected (The Economist, 2015c).

This unplanned increase in debt is one of the main rationales for this study. Is the effect on Middle-East capital structure similar to the rest of the economy, or is the Middle-East truly handling its leverage better than the rest of the world during this possible crisis as it claims?

1.2 Rationale and significance of the study

There are a number of reasons this study is deemed important. The study explores the large amount of relevant and established capital structure theories that seek to explain the way the debt and equity will behave during times of crisis. However it is unclear which of these is the most accurate, not to mention the fact that the body of knowledge exploring these theories in relation to the Middle-East is very small. In fact there appears to be no research at the moment exploring this current oil shock (likely because the oil price is still falling). As explained earlier, the Middle-East claims that it will be financially unaffected by the oil shock due to its large reserves of oil allowing it to detriment the negative effects of the falling price.

This study will contribute to the literature in two ways; by filling the current gap in knowledge of Middle-East capital structure, and by finding the general effects of capital structure during this current oil shock. What little literature that currently does exist about the Middle-East suggests that the leverage in these countries is far lower than the global economy. Whether this is true and remains to be the case during the oil shock will be clarified. Certain studies[1] explored in Chapter 2 also find that the Middle-East economy is unaffected by the oil price in a linear fashion, but do suggest that the economy is affected in a non-linear way. Essentially these studies suggest that only large falls in the oil price will cause a noticeable effect. This study will explore if this non-linear relationship can also be applied to capital structure.

[1] Note that these literature explore stock prices, not capital structure. See Maghyereh & Al-Kandari (2007) and Arouri & Rault (2012)

The capital structure acts as a good measure of the impact of the oil shock as there is already a large number of literature exploring the relationship of oil price and capital structure with other countries, which conclude that on average leverage will rise during times of crisis. This study will attempt to conclude if GCC firms leverage is also rising during this time which signals that the economy *is* in fact affected by the crisis similar to the global economy. If the leverage does not rise this can indicate two things. Firstly the question could be raised if the common capital structure theories are still relevant to economies such as the Middle-East if they turn out to be inaccurate in this study. Secondly if the Middle-East is truly somehow capable of mitigating the effects of the oil shock, how is it able to do this considering it is a major oil-exporter and its economy somewhat revolves around this resource?

1.3 Research objectives

1. Analyse the effects of the 2014-2015 oil shock on Middle-East capital structure.
2. Evaluate if Middle-East capital structure follows a similar pattern to the global capital structure during oil shocks.
3. Determine if Middle-East capital structure can provide a better understanding of how to handle leverage and equity during crisis.

1.4 Research questions

1. Is there an association between oil prices and Middle-East capital structure?
2. Does the amount of leverage during crisis increase as it does with the global economy?
3. Does the Middle-East economy handle oil crisis better than other economies?

Chapter 2: Literature review

2.1 Introduction

Chapter two of this dissertation aims to define capital structure from its roots as well as explain and critique some of the relevant theories used in literature to explain the dynamics of capital structure. Since there seems to be very little research on the effects of oil crisis or shocks on capital structure, this section will cover the effects of general financial crisis on capital structure and financial performance. Finally, the relationships between oil price and the global economy will outlined to provide a parallel between the Middle-East economy. Based on this, the expectation of capital structure for Middle-East oil & gas firms will be stated.

2.2 Capital structure theory

The cornerstone of modern capital structure theory originates from Modigliani and Miller's 1958 research paper which states that capital structure has no effect on the value of a firm. The two main propositions[2] that stem from the capital structure irrelevance principle state that the value of a firm is simply the sum of its debt and equity (Modigliani & Miller, 1958) and that increasing the debt-to-equity ratio (also known as "gearing") will increase the return on equity due to the higher risk associated with more debt (Modigliani & Miller, 1958).

[2] Their other propositions relate to the dividend policy which is not relevant to this this paper.

While the irrelevancy theory seems strange considering it is the focus of this paper, this is primarily due to the fact that the propositions assume perfect market conditions. This means the markets are absent of taxes, asymmetric information, agency conflicts, bankruptcy costs and are efficient markets (Gurieva & Kvasov, 2009). Even Modigliani and Miller released multiple revisions of their 1958 paper where the condition of taxes was relaxed for capital structure theory to take advantage of the tax shield gained from increasing debt (Modigliani & Miller, 1963). Much of modern capital structure research aims to relax some of these conditions to find a more realistic optimal ratio of debt and equity (Baker & Wurgler, 2002).

The three prevailing capital structure theories are the pecking order theory, the trade-off theory and the agency theory. None of these theories enable all the imperfect market conditions at once. As such, the following sections of this paper will focus on empirical research exploring the accuracy and predictive prowess of the three theories.

2.2.1 The pecking order theory

The pecking order theory was initially named by Myers in his 1984 paper, although evidence of the theory has existed since back in 1961 (Donaldson, 1961). The theory focuses on relaxing the asymmetric information perfect market condition (Myers, 1984).

The theory states that the best 'order' to finance capital is by using retained internal funds, followed by risky debt, and only using equity as a last resort. If there is a lack of investment opportunities, firms should prioritise retaining profits to build up a spare capacity of internal funds to avoid capital problems in the future (Baker and Wurgler, 2002). This order is established because of the expectation of asymmetric information – if a firm is using internal financing this may signal to external investors that the firm is in desperate need of finance if having to rely on its own investors (Klein Et Al, 2002). The interesting point about the pecking order theory is that there is no target optimal gearing ratio (Shyam-Sunders & Myers, 1999), instead the debt target is simply the end result of the pecking order.

The current literature generally finds evidence to support the pecking order theory [see for example Fama and French (2002), Adair & Adaskou (2015) and Serrasqueiro & Caetano (2015)], however it's lack of application to certain firms in modern markets is often it's largest criticism. Frank & Goval find a large amount of evidence for the theory in the 1970s but support for the theory declines in the following decades. They find that "Even when attention is restricted to the largest quartile of firms, support for the pecking order theory declines over time. Equity becomes more important" (2003). One reason for this decline is due to the rise of SMEs in recent times as they have less application with the pecking order theory than large firms.

Research by Holmes and Kent (1991) suggests that SMEs usually do not have the option available of issuing public equity and generally choose not to use it even if available, due to a strong aversion of diluting their ownership and control to external financers. Norton (1991a) also suggests that asymmetric information does not affect

the decisions made by SMEs, likely due to the large internal ownership. Similarly, Cosh & Hughes (1994) find that SMEs compared to larger firms tend to rely on internal equity more than anything else (even debt), which does not fit the pecking order. Bhaird & Lucey find that “the use of long term debt financing is positively related with the size of the firm” (2010) which suggests that larger firms will prioritise debt more than smaller firms.

However there is also evidence on the contrary that the pecking order theory is a better fit for SMEs due to the remaining perfect market assumptions. Norton (1991b) and Hall et al. (2000) both find that bankruptcy costs and agency costs have little influence on capital structure for SMEs and hence the pecking order theory is the most suitable. There is also the counter-argument presented by Huyghebaert & Van de Gucht (2007) and Mac an Bhaird (2010) suggesting that both debt and equity can result in a loss of control. The relevance of this is that SMEs form a 25% of the Middle-East sample in the study, and even large Middle-East firms surprisingly behave like SMEs which will be explored in the later sections.

Finally, research by Fama and French (2002) and Serrasqueiro & Caetano (2015) find that both the pecking order and trade-off theories have similar predictions and are not completely conflicting theories. Fama and French (2002) find both theories predict that firms which expect to invest largely in the future have less leverage to allow for spare debt capacity. One of the main points the two theories differ is that pecking order theory suggests profitable firms have less leverage while trade-off theory suggests the opposite – a result which Fama & French (2002) find to be incorrect in their study.

2.2.2 The trade-off theory

The trade-off theory was developed around the same time in Kraus and Litzenberger's (1973) paper which removed the perfect market conditions of taxes and bankruptcy costs from the original M-M irrelevancy model.

The main point of the trade-off theory seeks to oppose the idea that increasing debt will provide an unlimited associated tax shield. This makes sense as in the real world there are bankruptcy costs associated with having too much debt financing which ultimately starts to overshadow the tax shield (Baker & Wurgler, 2002). Different to the pecking order theory, this theory has a target ratio of debt and equity which seeks to find the perfect trade-off to balance the tax advantage of debt with the resulting costs of financial distress (Myers, 1984).

While research seems to suggest that the pecking order theory is more accurate in general, there are some studies which find trade-off theory correct in its prediction of the optimal ratio. Devereux et al (2015) finds that both large and small firms over time change their target leverage ratio to take advantage of the tax shield, and while the approach to the optimal debt ratio is delayed, it is eventually reached and consistent with the trade-off theory. Dierker et al (2015) find that trade-off theory is the most accurate in explaining the actions of firms facing risk, which tends to cause firms to issue equity due to an expected fall in equity valuation. Serrasqueiro & Caetano (2015) show that firms initially tend to aim towards the optimal target set by the trade-off theory, while older, more profitable firms start to turn away from debt.

The main criticism of the trade-off theory is due to its nature of avoiding too many factors associated with borrowing debt. For example Wald (1999) and Myers (2001) both find that profitable firms borrow less than other firms, primarily due to the debt tax shield not having any effect on shareholder value which is the opposite of what the trade-off theory suggests. Similarly, Graham (2000) finds that most firms "use debt too conservatively". Even though it accounts for about 10% of firm value, most firms tend not to take advantage of the tax shield. Myers (2001) cites these differences due to the different credit ratings that firms have, where larger, reputable firms can take advantage of a larger debt shield yet choose not to. Wald (1999) also suggests the issue of non-debt related tax shields not being included within the trade-off theory, for example R&D and asset depreciation. While Wald finds non-debt tax shields statistically insignificant to the impact of the capital structure in his study, they do raise the issue of other factors affecting the gearing ratio.

These other factors tend to be known as Agency costs, some researchers such as Wald (1999), Baker & Wurgler (2002) and Fama & French (2002) tend to include them as part of the trade-off theory. For the purpose of this study, they will be discussed within their own theory which will be discussed in the next section.

2.2.3 Agency cost theory

The idea of agency costs were explored in detail by Jensen & Meckling (1976) to explain how an entity which isn't maximising firm value through their debt and equity can still be considered perfectly efficient. The theory suggests that decision-making by the owner (the "principle") is divided between all the stakeholders (the "agent") both internal and external to the firm. They outline that the opportunity costs of these decisions cause agency costs (monitoring, bonding and residual costs) and the basic theory is to lower these agency costs as much as possible.

Examples of conflicts can be found at all levels of management. Baker and Wurgler (2002) suggest that too much equity can lead to conflicts of interest between shareholders and managers due to the free cash flow available, while Cvijanović (2014) also finds that financially constrained firms raise debt in an attempt to lower free cash flow and increase pay-out to shareholders to lower agency costs. Fama and Miller (1972) suggest too much debt can lead to conflict between managers and bondholders due to the asset substitution problem where managers invest in risky assets, shifting all the risk to debtors. Not only that, but because debt can act as a large signalling tool to investors and creditors, it is sometimes risky to use because it may incur agency costs in the future (DeAngelo et al, 2011).

Unfortunately the agency costs theory does not exactly provide an optimal or a suggested level of debt and equity, only to understand that there is a consequence in both. In this sense the current literature does not criticise the theory but finds way to apply it with the other theories. Ruah and Sufi (2012) find that agency costs are the largest contributor as to why the capital structure of firms in the same industry tend

to be similar. Bernanke and Gertler (1989) suggest that agency costs are tied quite closely with the asymmetric information that firms possess, and the more that asymmetry is alleviated, the lower the agency costs become. This suggests that agency costs can be tied in with both the pecking order theory and the trade-off theory.

While these three are not the only theories used to model capital structure, they will form the basis for the hypothesis on how Middle-Eastern firms' capital structure behave.

2.3 Capital structure in the Middle-East

While one of the main reasons for this dissertation is due to the lack of research of capital structure in the Middle-East, this section will attempt to summarise what current research *is* available. Note that most of the research explores either the entire MENA region, or explores a sample of Asia and Africa with the Middle-East as a small part of the sample. The Middle-East is a unique example for capital structure because of its economic ties to the demand and price of oil, and the price of the US dollar. Not only that, but much of the Middle-East is free of taxation and provides an opportunity where that perfect market condition is actually accurate.

Farooq (2015:100) explores capital structure influence through asymmetrical information and agency costs within the entire MENA region (which includes some countries not in the Middle East). Farooq & El Kacemi (2011) initially commented that the idea of asymmetrical information is one of the larger influencers of capital structure because "most firms in the MENA region are owned and controlled by insiders".

Farooq's (2015) findings suggest that the lower the level of information asymmetry, the higher the level of debt in the MENA region. He further finds that Middle-Eastern firms prefer debt over external equity to avoid diluting control, likened to SMEs in the pecking order theory.

Similar conclusions are found by Sbeiti (2010) who suggests that the gearing ratio in the GCC is significantly lower than developed countries and rises with insider agency problems. The research finds that "leverage liquidity, tangibility and profitability are negatively and significantly related to the leverage ratios" (Sbeiti, 2010). There is also evidence that the GCC markets dynamically try to reach a target leverage ratio similar to the trade-off theory, but at a lower level than the rest of the world because "tax considerations are of little importance" (Sbeiti, 2010). Finally, the research also finds that as equity markets in the region develop (particularly in Kuwait and Saudi Arabia), firms tend to issue more equity to reduce their reliance on debt.

Research by Booth et al. (2002) suggests that developing economies do share some factors with developed economies as well, although the sample of countries chosen in the research has only a small proportion of those in the MENA region and so there is some scepticism of these results. The article does touch on the idea that firms globally follow an aspect of the pecking order theory where more profitable firms have a lower debt ratio, regardless of how the debt-ratio is defined (2002). This conclusion is also consistent with Achy (2009) who finds a significant negative relationship between profitability and aggregate leverage in Morocco.

In summary, the current literature suggests that the Middle-Eastern firms generally have a high level of asymmetric information, due to a high concentration of insider shareholders which generally results in more equity than debt. Even though this is the case, these firms still prefer debt over external equity to avoid ownership dilution. Some concepts from the pecking order theory also seem to follow, such as more profitable firms having a larger proportion of equity.

2.4 Crisis effects on capital structure

This section will seek to explore the current literature on the change in capital structure caused by both financial and oil crisis in the global economy. Similar to the previous section, currently there is not much research on the Middle-Eastern oil & gas industry so this section will attempt to explain what the current research suggests happens to the rest of the world.

The majority of research exploring the relationship concludes that only temporary changes in capital structure take place during financial crises. Fosberg (2012) finds in his research that long-term measures of debt increased during the 2006-2008 crisis and returned to their original levels by 2010, concluding that “almost all of the debt accumulation that occurred was a consequence of the financial crisis” (Fosberg, 2012). His follow-up study on short-term debt values reached a similar conclusion, finding increases in both the book short-term debt ratio and market short-term debt ratio, and suggests that debt financing seems to be an undesired result which is why the values are reverted when the crisis ends (Fosberg, 2013). Korteweg & Strebulaev

(2010) reach a similar conclusion where average leverage ratios appear to be counter-cyclical to the economy[3].

Certain literature also finds accuracy with the three main capital structure theories and use them to predict the relationship in question. Harrison & Widjaja (2014) find that the pecking order theory is the most accurate in its ability to predict the capital structure during financial crisis (which reaches the above conclusion of increased debt). Bharath et al. (2009) suggest this is because information asymmetry faces a sudden increase during crisis times. Dimovski and Zarebski (2012) find debt increased during the crisis for the majority of firms due to a loss in profitability, however firms that reached negative profitability prompted a rise in equity to pay off debts – these conclusions are consistent with both the pecking order and trade-off theories respectively. Morri & Artegiani (2015) find debt increases for large firms taking advantage of the economies of scale of debt during crisis, a relationship again in accordance with the pecking order theory.

In terms of the oil shocks, both the current and past crisis usually result in negative effects for the oil and gas industry. Das (2015) finds that due to falling stock prices, equity is avoided and debt increases further (despite many bonds facing default). Relevant to the current crisis he suggests that American shale oil producers suffered the largest amount of debt increases (2015), which matches the goal OPEC was trying to reach initially. Davies (2014) suggests that the current oil crisis does not suffer from "extreme leverage" and "interconnectedness" that the subprime mortgage crisis did,

[3] This means that leverage is negatively correlated with the state of the economy, and so increases during crisis. Interestingly, Korteweg & Strebulaev also find profitability and leverage to be positively correlated (2010: 27) opposite of the conclusions of the capital structure theories.

Atkins (2015) reports that there is more debt in this current oil crisis for both developing and developed economies (minus the US) than in the 2007 financial crisis.

2.5 Oil price and The Middle-East economy

This section will seek to cover the literature on the effects of the oil price and other financial performance variables, such as stock price. While there isn't much literature exploring the Middle-East alone, there is some research where the Middle-East is a part of a greater sample. This section is relevant as changes to the Middle-East economy should be tied somewhat to the capital structure.

Maghyereh (2004) conducts a general analysis of 22 emerging economies (including the Middle-East) and finds no relationship between stock prices and crude oil prices. In particular, he finds that emerging economies are inefficient in the transmission of new information in the oil market. Rizvi & Masih (2014) find that there is a significant lag in the short-term influence of the Middle-East markets when oil shocks occur, with only the Qatari market holding any long-term effects.

The influence of external events are usually found to have more of an influence on Middle-East economies than oil shocks. Hammoudeh et al (2009) find that oil shocks have less influence on the risk of Middle East industries than the inherent risk of those industries. For example, "changes in the fundamentals of oil and natural gas, as well as for their products and energy-intensive goods, matter more when it comes to equity sector volatility than sector-specific shocks" (2009). Similarly, Hammoudeh & Li (2008) find that changes in the volatility of the GCC is influenced more by global factors, such

as the 1997-1998 crisis and the September 11th attacks[4], than internal changes such as OPEC engineered oil prices or regime changes.

There is a relatively large amount of research which suggests a strong relationship between oil price and stock price for developing economies. For example Basher & Sadorsky (2006) and Basher et al (2012) find there is a general relationship between stock and oil prices, while Lescaroux & Mignon (2008) suggest oil prices affect both GDP, unemployment rate and stock prices for oil-exporting countries. It is important to understand that the above articles focus on developing economies, with the GCC a small part of that sample so the data may not be a perfect representation.

There is also some specific GCC research into the above relationship. Maghyereh & Al-Kandari (2007) agree with previous studies that there is no *linear* relationship between the two. However he finds that there appears to be a non-linear relationship[5] and suggest more research on the issue. Arouri & Rault (2012) also conduct a co-integration analysis of the Middle-East and reach a similar conclusion of a non-linear relationship between oil and stock price. Mohanty et al. (2011) finds that oil prices changes have significant effects on the stock market and real economies of the GCC area, through shifts in costs of production and global consumer expenditure. Ilahi & Shendy (2008) find evidence that the oil shocks can cause pressures on the balance of payments of oil exporting countries, however the GCC is able to mitigate these effects quite well due to the cyclical nature of oil prices. Finally Hammoudeh & Aleisa

4 Although he does find that Saudi Arabia is influenced largely both by the oil price and external changes (Hammoudeh & Li, 2008)

[5] In particular, they apply a "nonlinear co-integration analysis" which has "potential superiority at detecting co-integration when the error-correction mechanism is nonlinear" (2007) . They find for example, that decreases in the oil price may also cause a shock to the inflation rate, resulting in an unnoticeable effect in the stock price. Also see Cochrane (2001) for more details.

(2004) find only Saudi Arabia bears a statistically significant relationship between stock markets and oil prices.

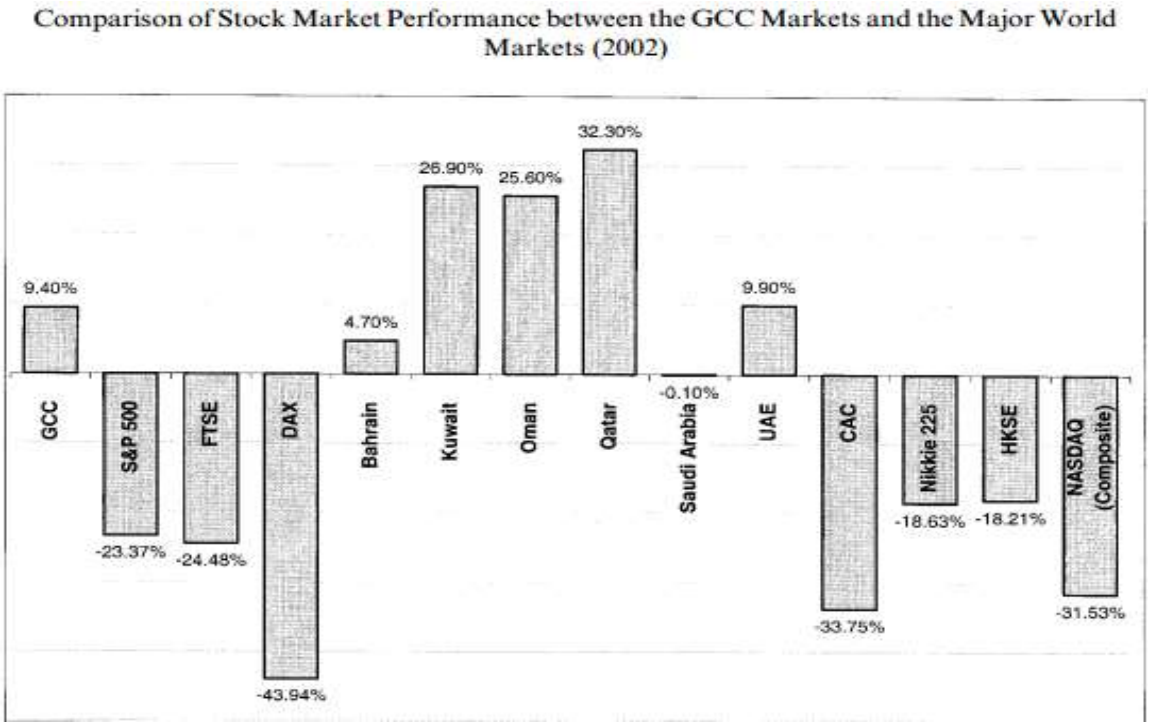

Figure 2.1 (Hammoudeh & Aleisa, 2004)

In general the conclusions of the literature seem to suggest a non-linear relationship between the oil price and the financial performance of emerging economies (including the Middle-East). Figure 2.1 above illustrates the opposite stock market relationship between the GCC and the rest of the world economy. While external political events play a big role in the economy of the GCC, it is not completely clear whether oil price shocks have a definite correlated relationship with the GCC economy. The next section will find that the rest of the world has a definite relationship between the oil price shocks and the economy.

2.6 Oil price and the global economy

The previous section explored the changes of oil price with the Middle-East and certain developing economies, while this section will deal with the rest of the world. The effect on the global economy is important to understand to see how the capital structure of the rest of the world will react based on the above models. The current literature generally seems to find a large difference in economic effects between the Middle-East and the rest of the world, and even large economic differences with other oil-exporting economies.

Various studies on the global economies including Europe and the US [see for example Sadorsky (1999), Papapetrou (2001) and Park & Ratti (2008)] find a strong link between oil price and economic activity (particularly stock prices). Elder & Serletis (2010) find oil price uncertainty has the largest effect on investment and durables consumption in the US. Asian economies like Korea have a strong link between oil prices and the stock market, with the banking sector and interest rates being affected as well (Masih et al., 2011). Even economies in China (Cong et al., 2008) have somewhat of a link between the two. Wang et al (2013) and Cashin et al. (2014) find a significant link between the economic performance and oil price of both oil-exporting and importing countries, they further suggest that oil price falls can sometimes even cause negative effects in oil importing countries.

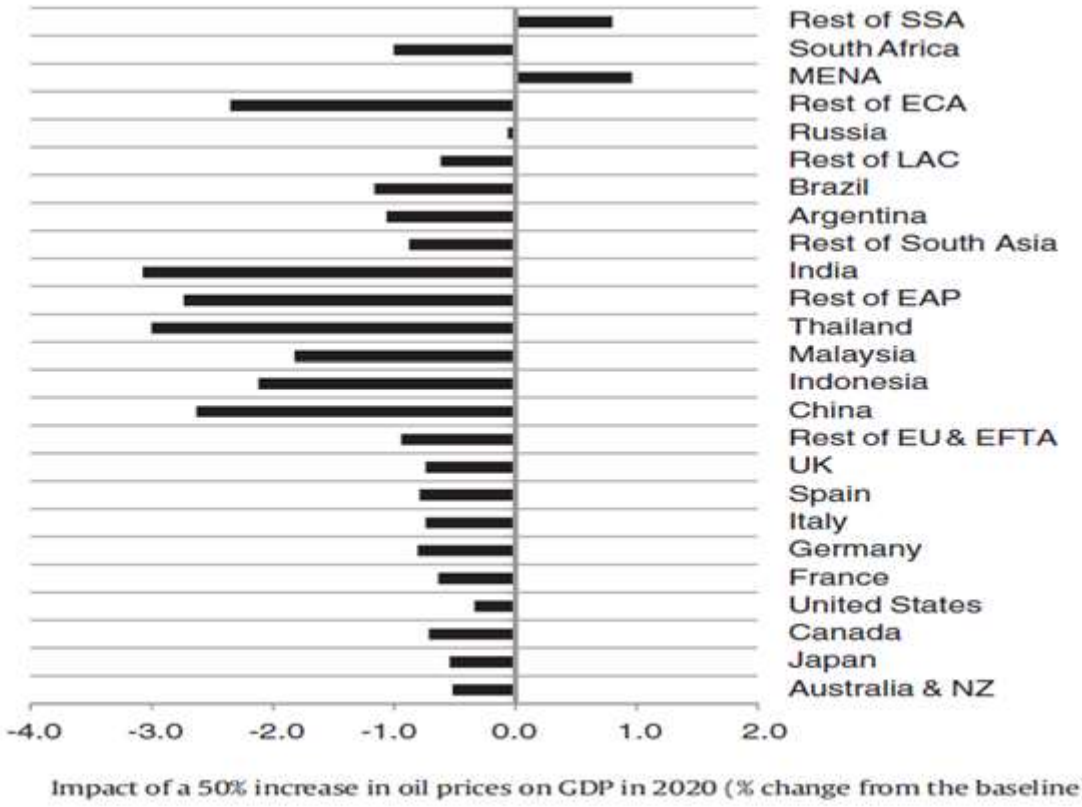

Figure 2.2 (Timilsina, 2015) examines the projected effects of an increase in the price of oil. The interesting point is that the MENA region reacts oppositely to the rest of the world, even other oil-exporting countries.

Further, Timilsina (2015) finds that Canada, Russia and Malaysia would suffer from an increased oil price, despite also being net exporters of oil. Kilian (2014), Fang & You (2014) and Morana (2012) suggest that oil crises do not occur ceteris parabus[6], and that supply-side shocks have far more of an effect on the economy than demand-side shocks. They find that for certain developing economies, positive effects from oil shocks in either direction rarely occur (Fang & You, 2014). They also suggest that OPEC is unable to effectively control the price of oil (Kilian, 2014), which is one theory of why this oil current crisis is different from others since it *was* directly engineered by

[6] They suggest that it's important to understand the underlying reason behind the oil price fall to see if it will have an effect. Barsky & Kilian (2004) for example suggest that oil price shocks may contribute to recessions without necessarily being pivotal. They also suggest the "oil shock hypothesis" is incorrect. See Barsky & Kilian (2004) and Tayebi & Yazdani (2014).

OPEC. This crisis also appears to be unique because commodity importers have suffered the least in terms of currency devaluation, where usually oil shocks negatively affect both importers and exporters (Johnson, 2015).

One interesting debate is the idea of the asymmetric relationship between oil price and the general economy. In particular, research seeks to question why a rise in oil price generally causes negative economic effects but a fall in oil price does not cause positive effects. Edelstein & Kilian (2009) find this effect to be prominent in the US, where a fall in energy prices have little effect on output and employment, while a rise is positively correlated. They cite these differences being tied primarily to consumer expectation, where rising energy prices decrease confidence in the economy and expected higher unemployment (2009). Herrera et al (2015) find a similar conclusion for the global economy, where "a decrease in the price of oil would not be associated with higher uncertainty about the future, this channel implies asymmetry" (2015). They also find oil price increases transfer wealth from oil exporting countries to oil importing countries (2015).

The Coincidence of Oil Dates and Recessions after 1972

Business cycle peak	*Events associated with subsequent major oil price increase*
November 1973	October War and Oil Embargo October 1973–early 1974
January 1980	Iranian Revolution October 1978–February 1979
July 1981	Outbreak of Iran-Iraq War September 1980
July 1990	Invasion of Kuwait August 1990
March 2001	OPEC Meeting March 1999

Figure 2.3 (Barsky and Kilian, 2004) suggests a strong coincidental relationship between certain oil price increase events, and subsequent periods of recessions.

To conclude, the research generally finds a strong relationship between oil shocks and the global economy, some research even suggesting oil crisis act as a precursor to financial crisis. There also seems to be researching suggesting that oil shocks in both directions can be negative for the economy, through the underlying cause of the shock is important. Finally, the asymmetric relationship between oil price and the economy suggests that a fall in oil price would be good for the economy of the Middle-East although that has yet to be seen.

2.7 Summary of chapter

Overall there are a number of theories and models used to explain the link between oil prices and capital structure. The three main theories are the pecking order, the trade-off and the agency costs theory. The research finds that each theory is correct in some regards, and in this oil shock the pecking order theory should be the most accurate in its prediction that debt will rise inversely to profitability. In relation to the research of this dissertation, these theories will be used to explain the changes in the capital structure based on changes in the oil price – it's very likely each theory will have some contribution to the explanation of the variables.

Middle-East firms like many developing nations seem to have a very low level of debt compared to developed nations, primarily because of the large number of insider shareholders favouring internal equity. The lack of tax in many MENA regions also removes the large advantage of debt tax shield in the area, furthering the low levels of debt of firms. As stock markets in the region develop and equity becomes more popular, owners still prioritise debt over external equity to avoid dilution of control.

The literature seems to suggest a debt increase for Middle-East firms both for short-term and long-term measures of leverage during crises. The sudden rise of information asymmetry during a crisis causes further agency costs and when internal equity is no longer an option they prioritise using debt to avoid dilution. Certain research does suggest that because the oil & gas industry is inelastic and less interconnected than other industries. the effects in capital structure may be less noticeable. As OPEC planned, American Shale Oil companies seem to be suffering the largest amount of increased debt.

There also appears to be a strong relationship between oil prices and the performance of both the global and the Middle-East economy. Many studies find both a linear and non-linear relation in the GCC where significant changes in the oil price affects stock prices, balance of payments and consumer expenditures. The middle-east economy in particular seems to have a very long lag where oil price change effects are not noticeable in the short-term and only carry long-term effects for the Qatar economy.

The global economy reacts similarly, albeit more harshly in most regards. There is much research which suggests that oil shocks herald financial crisis and both rises and falls in the oil price can be negative to the economy. The important point to understand is the underlying reason behind each oil or financial crisis. For example, oil shocks caused by the supply-side generally have more impact on the global economy than demand-side shocks. Similarly the research suggests that external political events affect the GCC economy more than internal ones. The current OPEC crisis is both supply-side and caused as a result of external competition and so should have a large effect on the global and GCC economy.

What effect will this have on the capital structure of firms? The next section will state the research and sample of Middle-East firms to find what impact the sudden fall in oil price will cause to capital structure.

Chapter 3 – Research methods

3.1 Introduction

The research methods chapter of this dissertation explains the design and framework of the research in line with the research objectives established in Chapter 1. Based on the research questions and supported by the literature review, two hypothesis will be developed and the methods to experiment them will be discussed. This section will also provide details on the sample of firms collected, ensuring the method is repeatable for any readers. Finally, the specific regression model including linear and non-linear methods will conclude this section.

3.2 Research design and philosophy

The research design is defined as the type of approach and the specific direction the research procedures will take, it provides a framework for data collection and analysis (Yin, 2013). This dissertation employs a quantitative research approach as the data is collected from an already existing secondary source and seeks to find a relationship between the data. Quantitative research also employs a deductive approach with an importance placed on the testing of theories and incorporating a natural scientific model (Bryman and Bell, 2012). However, this research could be said to be a mixed research in part as it employs some qualitative aspect as it also investigates the social causes of some variables (Biggam, 2015).

The research follows a positivist philosophy, as it seeks to demonstrate if there exists a causality relationship between two quantifiable variables through quantitative statistical means (Easterby-Smith et al., 2012). The idea of a random sample from a population, no social or human factor within the data, and the researcher being completely independent of the sample are also factors in this positivist research. This is important to understand as positivist research seeks to improve existing theory using varied empirical data. In particular, this research will investigate the impact on capital structure during the 2014-2015 oil crisis on a sample of Middle-East firms.

3.3 Research hypothesis

The idea of testing the correlation between two variables is to initially develop a null hypothesis, confirming first if there is no relationship between the two variables (Dougherty, 2007).

$H1_0$ – There is no association between capital structure and crude oil price.

If the null hypothesis is rejected, the following hypothesis investigates whether the relationship is positive or negative. In particular, the literature suggests that debt tends to rise during crisis and hence we can write the second hypothesis:

$H2_0$ – Leverage is inversely related to the oil price

We write this second hypothesis because the falling oil price is currently what caused the crisis, and hence a falling oil price should be related to debt negatively based on the capital structure theories. The literature also suggests that profitable firms have lower leverage, so we expect profitability to be lower during this oil crisis resulting in more debt. If this hypothesis is rejected, this may answer the research question that the Middle-East is in fact better capable of handling the effects of the falling oil price than the rest of the world.

3.4 Sample and data collection

The sample is chosen from a financial database of global firms, which includes capital structure data from the years Q1 2011 – Q1 2015 on a quarterly basis. The chosen sample of firms employ a 4-4-4 monthly calendar and hence the data is divided into 3 'quarters' instead of 4, but still contains data averaged for the whole year. The data collected is known as secondary data as it was initially collected for a purpose other than this research (Flowerdew & Martin, 2005). The data collected is historical data which is faster and less costly to obtain. Because of these limitations, secondary data is able to provide a larger sample and generally a more accurate result.

The main source of the data is the database OSIRIS, created and collected by BvD. The database contain a huge range of financial data for over 160 million firms over 190 different countries, both listed and unlisted from sources such as financial statements and regulatory sources (BvD, 2015). The data for the crude oil price was obtained from NASDAQ, one of the world's largest depositories of market and investor solutions.

The firms were chosen to provide the largest sample size possible, as the goal of this research is to investigate the change in capital structure for the entire Middle-East. Tables 3.1 – 3.3 provide various details about the chosen sample. Note that only 20 relevant firms were found in the Middle-East, as the large majority of Oil & Gas firms in that region do not publish their accounts publically. Not only that but it was important to have a complete set of data for each firm, so any companies with missing data

within the above years were also excluded. Also firms with extreme data[7] were also ignored and assumed to be a mistake in the collection or data entry. Firms no longer in operation were also excluded from the data as they may influence the sample irrelevant to the oil shock. Specifically, the data for Q1 2015 was very important for this research as that is when the impact of the oil crisis is expected to be most noticeable. Many firms did not have this data publically available as the current calendar period is just beginning Q3 2015.

A second sample of data was also collected comprised of over 1,000 global energy firms in over 40 different countries, including the same timeframe and filters. Note this data was only collected to provide as a comparison to the global economy, which will be relevant in the next chapter. Further details of this data can be found in Appendix A.

[7] For example some firms had ratio values of more than 100 or had negative ratio values for some measures, which would not make sense if they were negative.

Company Number	Company name
1.	RABIGH REFINING AND PETROCHEMICAL CO.
2.	QATAR FUEL QSC
3.	INDEPENDENT PETROLEUM GROUP COMPANY S.A.K.
4.	GULF INTERNATIONAL SERVICES Q.S.C.
5.	NATIONAL SHIPPING COMPANY OF SAUDI ARABIA (THE)
6.	AL MAHA PETROLEUM PRODUCTS MARKETING COMPANY S.A.O.G
7.	SHELL OMAN MARKETING COMPANY SAOG
8.	OMAN OIL MARKETING COMPANY SAOG
9.	QATAR GAS TRANSPORT COMPANY LIMITED Q.S.C. (NAKILAT)
10.	RENAISSANCE SERVICES SAOG
11.	ALDREES PETROLEUM & TRANSPORT SERVICES CO (SAUDI JOINT STOCK COMPANY)
12.	DANA GAS PJSC
13.	HEAVY ENGINEERING AND SHIPBUILDING COMPANY (K.S.C)
14.	NATIONAL GAS COMPANY SAOG
15.	BURGAN COMPANY FOR WELL DRILLING, TRADING & MAINTENANCE (K.S.C.C)
16.	NATIONAL PETROLEUM SERVICES COMPANY (K.S.C)
17.	GULF PETROLEUM INVESTMENT (S.A.K.C)
18.	ENERGY HOUSE HOLDING COMPANY (K.S.C)
19.	AL SAFAT ENERGY HOLDING COMPANY K.S.C.C
20.	SAUDI ARABIA REFINERIES COMPANY (SAUDI JOINT STOCK COMPANY)

Table 3.3 List of firms in Middle-East data sample

Country	% of firms
Kuwait	35%
Oman	25%
Saudi Arabia	20%
Qatar	15%
United Arab Emirates	5%

Table 3.2 Proportion of countries in Middle-East data sample

Type of Firm	% of Firms
Micro Firms	5.00%
Small Firms	0.00%
Medium-Sized Firms	20.00%
Non SMEs	75.00%

Table 3.3 Size of firms in Middle-East data sample

3.5 Ratio specification

The data collected include both measures of short-term capital structure and long-term capital structure. The short-term values include the market short-term debt (a ratio of the short-term debt divided by firm value) and the book short-term debt (a ratio of short-term debt divided by total assets). The long-term values include the gearing (a ratio of long-term debt divided total equity) and the book debt (a ratio of long-term debt divided by total assets)

Gearing is one of the most widely used measures of long-term capital structure as it provides a measure of how quickly a firm can repay its debt by selling assets, where equity is a measure of net assets. One criticism of this ratio is that it may be viewed as too conservative because it does not take into account the market value which may be forced when a firm is selling its assets (Neale & Pike, 2006). For this reason the book debt ratio was chosen to provide a possibly more accurate alternative measure, as the book debt ratio is found to not be significantly different from the market leverage value (De Jong et al., 2011) and essentially includes the total assets instead of net assets. Similar criticism is said about the book short-term debt ratio where the value of the total assets is considered inaccurate when compared to the market value of assets. For the same reason as above, the market short-term debt ratio is provided as an alternative measure.

Much of the research tends to combine short and long-term ratios to provide another measure called the market debt ratio (Flannery & Rangan, 2006). Especially for the Middle-East sample it was important to make the short and long-term separate as it is likely the influence on the capital structure caused by the oil crisis will have a larger effect on the former than the latter. Also the pivotal time period in the sample is Q1 2015, since there is only one quarter directly following the oil shock occurrence in Q4 2014 the expectation is that only the short-term ratios will be affected.

3.6 Framework for data analysis

The research data collected is panel data, which means the study includes a dataset of samples observed on both a time-series as well as the oil price and capital structure values. The primary advantages of panel data over other types is that it allows observation of other factors correlated with time to influence the model, as well as shows any repeated behaviour during the time period (Blossfield et al., 2009). The panel study includes 4 sets of 260 observations (20 companies over 4 years + 1 quarter)

3.6.1 Model specification

To apply a linear regression, certain models have been defined. These models have been chosen specifically for this paper, although similar models have been used by Maghyereh & Al-Kandari (2007), Farooq & El Kacemi (2011), Fosberg (2012), and Arouri & Rault (2012).

(1) $(\text{Market Short-Term Debt Ratio}_{it}) = \alpha_0 + \alpha_1(\text{Oil Price}_{it-1}) + \mu_{it}$

(2) $(\text{Book Short-Term Debt Ratio}_{it}) = \beta_0 + \beta_1(\text{Oil Price}_{it-1}) + \mu_{it}$

(3) $(\text{Gearing Ratio}_{it}) = \gamma_0 + \gamma_1(\text{Oil Price}_{it-1}) + \mu_{it}$

(4) $(\text{Book Debt Ratio}_{it}) = \delta_0 + \delta_1(\text{Oil Price}_{it-1}) + \mu_{it}$

(5) $(\text{Ratio}_{it}) = \varepsilon_0 + \varepsilon_1 \ln(\text{Oil Price}_{it-1}) + \mu_{it}$

(6) $(\text{Ratio}_{it}) = \dfrac{1}{1+\exp(\zeta_0 + \zeta_1(\text{Oil Price}_{it-1})) + \mu_{it}}$

It is important to note the subscript for the oil price features a period of *it-1*. This is because the panel data estimates the effects on the capital structure following a change in the price of oil in the previous quarter. This is to take into account that the capital structure (and most likely any financial variables) will have a delayed reaction to the changing oil price.

Equations (5) and (6) refer to the generalised linear model and logistic functions respectively. The left hand side of equations (5) and (6) are the same ratios as in equations (1) – (4).

3.6.2 Regression framework

For the main linear regression models, there are a number of possible methods of estimation. For this study, the model chosen is the Ordinary Least Squared estimator which will estimate the model by minimising the sum of the squared residuals, i.e. the difference between the dataset and the linear approximation of the data. Graphically, this is the observed distances between the regressor line and each point of data. These distances are known as residual values and will be discussed in the next chapter as a method of estimating how accurate the model fits. Note that OLS does not take into account the third variable of time. Because the data gathered is panel data, it is also possible to use estimators which include time as a variable.

The two main estimators used for the panel analysis are random and fixed estimators. Random effects includes the unobserved heterogeneity between the samples as part of the error term in the regression (Greene, 2008). The main difference between the two models is that the random estimator finds that the unobserved individual differences may be correlated with the regressor term (Baltagi, 2013). Hence the random effects estimator assumes that the variation across the different middle-east firms is random and uncorrelated with the oil price, and that the individual differences in the firms may affect their capital structure.

Fixed effects estimator on the other hand assume that the unobserved heterogeneity between observations is constant and controllable, it seeks to remove these time-variant characteristics to solely focus on the independent and dependent variables (Greene, 2008). For our model, fixed effects hence assumes that the differences in Middle-Eastern firms are unique to themselves and should not be a part of influencing either the oil price or their capital structure. Based on this logic the random effects model should be correct, however Chapter 4 will also run Hausman tests for each regression to confirm this statistically.

The research will also cover models (5) and (6) which seek to find if there is a non-linear relationship that was not visible in the OLS and panel estimators. The GLM equation (5) estimates a value for the variables by finding a suitable error distribution to match the data and the probability density function (R, 2015a). Note that for our gathered data the Gaussian distribution was found to be the most suitable, as other distributions gave either negative or very large and unrealistic values for the ratios. The logistic function on the other hand will be explored as an NLM starting with initial conditions of 1 and 0 for $\zeta 0$ and $\zeta 1$ respectively and using a Newton algorithm to calculate a true value of the estimators through iterations (R, 2015b). Both of these models will be explored only graphically in Chapter 4 to avoid repetition with previous sections.

Chapter 4 – Results and discussion

4.1 Introduction

Building on the previous section explaining the methodology for the research, this section will focus on exploring the experiment results, question their reliability and conclude if the hypothesis have been satisfied.

The section will start by explaining the summary statistics and correlations between the independent and dependent variables. Following will be the results of each individual GCC regression including OLS, random and fixed estimators. The collected data will then be graphically compared to the global capital structure data, and any relationship with the oil price will be discussed. Chapter 4 will then apply two other estimators to find further support of a relationship between the variables, these include a general linear model and a non-linear model and the solutions for all 4 ratios will be provided graphically. Finally, this section will cover whether the two hypothesis defined in Chapter 3 have been accepted.

4.2 Descriptive statistics and correlations

Table 4.1 below summarises the descriptive statistics for the capital structure ratios and the oil price. These descriptive statistics are useful to understand certain characteristics of the variables and provide an overall picture of the dependent variables. Although the sample size of the firms was reduced to 20, there are more than 1,000 observations concluding the mean, median, standard deviation, variance and range of the ratios and oil price.

Statistic	Market Short-Term Debt	Book Short-Term Debt	Gearing	Book Debt	Crude Oil Price
Mean	0.422431283	0.31641068	0.259746391	0.194137514	92.55
Median	0.280711053	0.300678129	0.152791525	0.093289127	96.36
Standard Deviation	0.538839162	0.207935718	0.270782513	0.231537739	15.10
Sample Variance	0.290347643	0.043237263	0.073323169	0.053609725	228.10
Range	5.305945238	0.79309363	0.960970482	0.918373385	58.47
Minimum	0.004754286	0.008335569	0.000448587	0.000435679	47.72
Maximum	5.310699524	0.801429199	0.961419069	0.918809064	106.19
Skewness	4.3855612	0.488176857	0.987796504	1.393592508	0.51

Table 4.1 – Summary statistics

The summary statistics of the ratios from left-to-right are already organised with the highest-to-lowest mean. Interestingly, the short-term ratios seem to be higher on average and also have larger middle values than the long-term ratios. All the ratios seem to have quite a low standard deviation, suggesting the values do not fluctuate very much over the 5 year period. The market short-term debt seems to be the most volatile, having both the largest range and the highest variance. This is likely due to the market value of assets depending heavily on the firm itself, and may be especially volatile due to the oil shock. Note that the maximum value in the market short-term debt is not an anomalous result as there are other values around that range in the sample which are also larger than the maximum of any of the other ratios.

The skew values for each of the ratios seem to be quite different to each other, although the market short-term debt and the long term measures both appear to be significantly rightly skewed. Only the book short-term debt has close to a symmetrical skew as the mean and median values are quite similar. This may be because the book short-term debt uses the book value of assets, which theoretically may have similar values since the sample is in the same region and industry (unlike the market value of

assets for example which we previously said was volatile and highly dependent on the situation). The remaining ratios all appear to have somewhat a right skew which means most of the values are concentrated to the left of the mean which suggests that extreme values may have some influence on the values. The skew of the oil price is relatively symmetrical, which makes sense as the only real 'extreme' value is from the current oil shock and probably does not affect the overall picture of the price yet.

Pearson Correlation	**Market Short-Term Debt**	**Book Short-Term Debt**	**Gearing**	**Book Debt**	**Crude Oil Price**
Market Short-Term Debt	1	*0.566*	-0.117	-0.208	-0.020
Book Short-Term Debt	*0.566*	1	*-0.296*	*-0.413*	0.004
Gearing	-0.117	*-0.296*	1	0.976	-0.016
Book Debt	-0.208	*-0.413*	0.976	1	-0.011
Crude Oil Price	-0.020	0.004	-0.016	-0.011	1

Table 4.2 – Pearson correlation coefficients

The correlation coefficients provide a first step in exploring the relationship between the dependent and independent variable which will be covered in more detail in the following sections. The first interesting point is that all of the capital structure ratios have very little correlation with the crude oil price. The signs for 3 of the 4 ratios are negative, suggesting an inverse relationship which will also be confirmed in the regression analysis. Generally the capital structure ratios seem to be quite independent of each other, the exception being the two long term measures gearing and book debt, which appear to be very strongly positively correlated. This is likely something only associated with the an economy such as the Middle-East, as both ratios have very small fluctuations over the period and the correlation likely corresponds to the lack of movement either way as opposed to an actual relationship between the gearing and book debt. The market and book short-term debt ratios also

have a slight positive relationship, likely because both measures involve the same short-term debt measure in the calculation. Similarly, the book short-term debt and the book debt ratios likely have a slight negative relationship because both measures involve the same measure of total assets in the calculations.

4.3 Short-term capital structure linear regressions

4.3.1 Market short-term debt ratio

$$(1)\ (\text{Market Short-Term Debt Ratio}_{it}) = \alpha_0 + \alpha_1(\text{Oil Price}_{it-1}) + \mu_{it}$$

The market short-term debt is known to be the more accurate of the two measures of short term capital structure as it relies on enterprise value instead of assets. The difference in measures usually results in a higher ratio, as enterprise value tends to be smaller than asset value as it represents the market value of assets as opposed to the book value.

Table 4.3 – Results of OLS on equation (1)

Coefficients	**Estimate**	**Standard Error**	**T value**	**Pr(>|t|)**
Intercept (α_0)	0.4886883	0.2082360	2.347	0.0197
Slope (α_1)	-0.0007159	0.0022207	-0.322	0.7474

R-squared: 0.0004027, Adjusted R-squared: -0.003472
F-statistic: 0.1039 on 1 and 258 DF, p-value: 0.7474

Table 4.4 – Results of random-effects estimator on equation (1)

Coefficients	**Estimate**	**Standard Error**	**T value**	**Pr(>|t|)**
Intercept (α_0)	0.4886883	0.1642971	2.9744	0.003214
Slope (α_1)	-0.0007159	0.0014365	-0.4984	0.618649

R-squared: 0.00096175, Adjusted R-squared: 0.00095435
F-statistic: 0.248371 on 1 and 258 DF, p-value: 0.61865
Hausman Test: p-value = 1 (Random-Effects estimator should be used)

The first important point is that for both estimators, the R-squared value is very small – closer to 0 than even 0.1. This suggests the two variables are not correlated at all. While considerations have to be made that R-squared is not a great estimator to test the relationship, a value this small certainly suggests a very low correlation. Similarly, both slope coefficients have a high p-value which provides some evidence that the

slope is not significantly different from 0. The standard error of both slope estimators is quite high and higher than the estimators themselves, again disproving any link between the data. Interestingly the slope estimators in both cases seem to be negative, suggesting that if there was a link between the two it would be an inverse relationship. While the fixed-effects estimator does not have an intercept coefficient, the intercept estimates for the other two estimators have a low p-value and are possibly the only 'good' estimates in the equation.

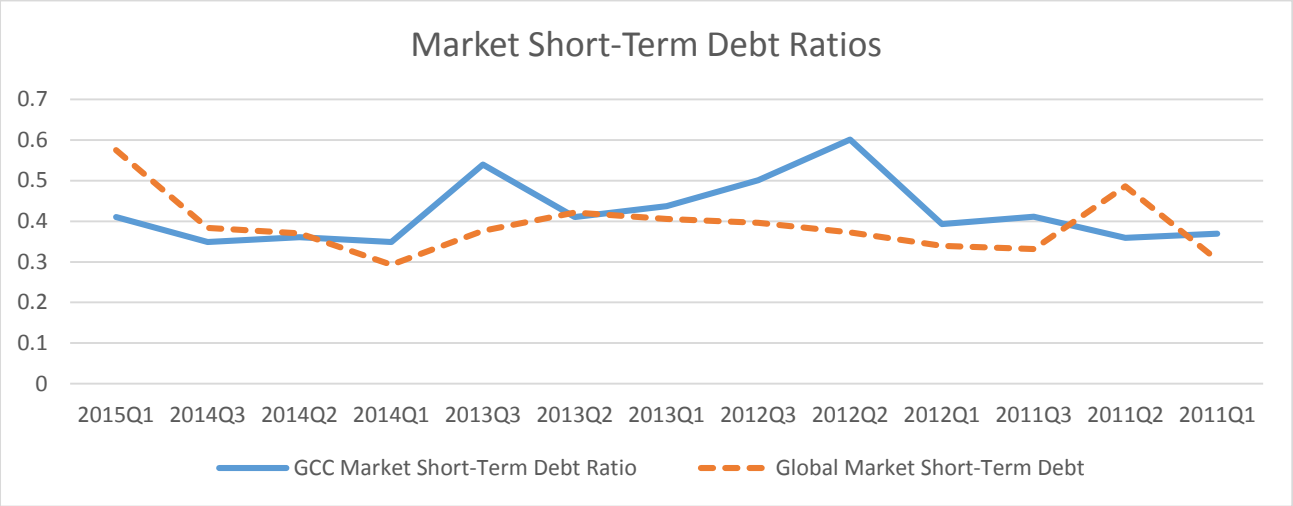

Figure 4.1 – A plot of the average global and GCC Market Short-Term Debt over the period 2011Q1 - 2015Q1

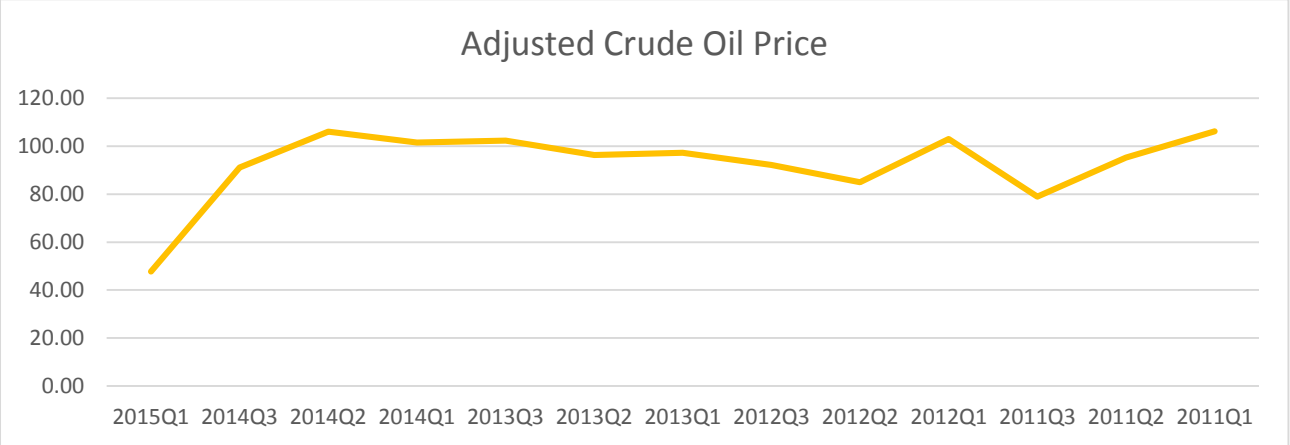

Figure 4.2 – A plot of the crude oil price over the period 2011Q1 – 2015Q1 (note the word "adjusted" refers to the periods being adjusted to 1 quarter ahead of their actual price)

By averaging the results of a second sample of the global economy, Figure 4.1 was created to see if there is any link that can be seen visually between the ratio and the oil price. The first point to note is that during the final period, both the global and GCC ratios have risen. This suggests that short-term debt was increased inversely to the oil price at the start of the oil shock which is consistent with some of the research. Interestingly, the global ratio rises far more than the GCC ratio which supports the theory that the GCC has a relatively inelastic relationship with the oil price. The GCC ratio also rose by 50% between 2012Q1 and 2012Q2, possibly a slightly delayed response to the oil price rising in 2012Q1. This is opposite to what the literature suggests as the relationship between the two should be inverse. The GCC ratio seems to fluctuate in 2013Q3 unrelated to the oil price as the price is stable for that period, suggesting something else influences this ratio. The global ratio reaches its lowest point in 2014Q1 during the stable period of oil price. Some of the previous literature would suggest that this may be due to increased profitability during stable times, resulting in a decrease in leverage. Surprisingly the Market Short-Term Debt is the only chosen ratio where the GCC is higher than the global ratio over a significant period of time during the period.

4.3.2 Book short-term debt ratio

$$(2)\ (\text{Book Short-Term Debt Ratio}_{it}) = \beta_0 + \beta_1(\text{Oil Price}_{it-1}) + \mu_{it}$$

The second ratio uses total assets instead of the value of the firm. This may have a different impact on the capital structure if firms expect to alter the value of their assets, possibly by switching between debt and equity while retaining the same enterprise value.

Table 4.5 – Results of OLS on equation (2)

Coefficients	Estimate	Standard Error	T value	Pr(>|t|)
Intercept (β_0)	0.3118	0.08037	3.879	0.000133
Slope (β_1)	0.00005034	0.0008571	0.059	0.953215

R-squared: 0.00001337, Adjusted R-squared: -0.003863
F-statistic: 0.003449 on 1 and 258 DF, p-value: 0.9532

Table 4.6 – Results of random-effects Estimator on equation (2)

Coefficients	Estimate	Standard Error	T value	Pr(>|t|)
Intercept (β_0)	0.3118	0.050224	6.2072	2.141e-09
Slope (β_1)	0.00005034	0.00021163	0.2379	0.8122

R-squared: 0.00021923, Adjusted R-squared: 0.00021754
F-statistic: 0.0565727 on 1 and 258 DF, p-value: 0.81219
Hausman Test: p-value = 1 (Random-Effects estimator should be used)

It seems both measures of short-term debt suffer from very low R-squared values, suggesting the model proposed is not a very good fit for the data. The book short-term debt ratio fares even worse than the market ratio with larger p-values and even low R-squared values. This may be due to the book value not being an accurate representation of the actual market price of assets, resulting in a less volatile and inaccurate asset value. The slope estimates do seem to be positive unlike the other short-term ratio, suggesting a very slight positive correlation between oil price and book short-term debt.

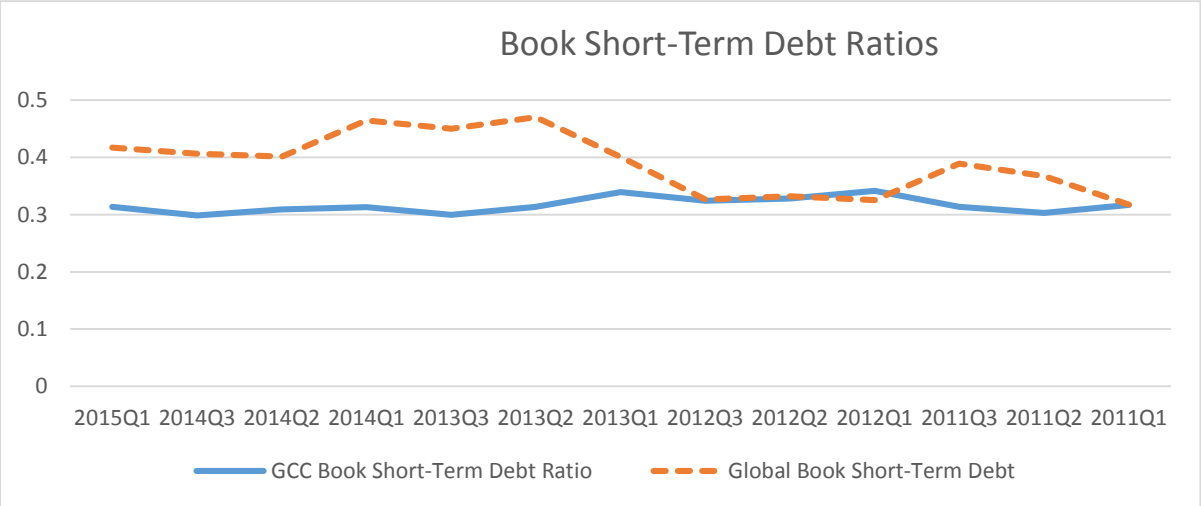

Figure 4.3 – A plot of the average global and GCC Book Short-Term Debt over the period 2011Q1 - 2015Q1

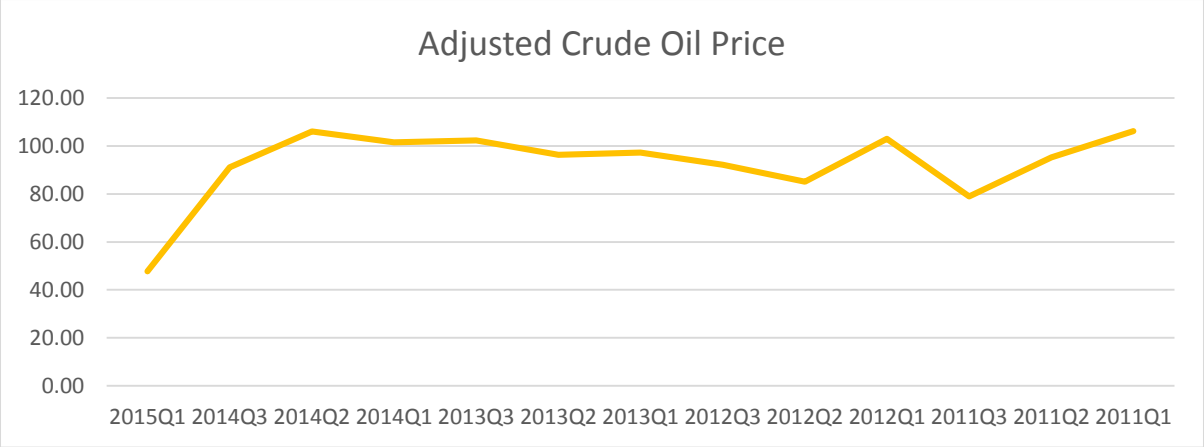

Figure 4.2 (repeated)

The comparison to the global capital structure is a little different compared to the previous short-term ratio. First of all, the GCC book ratio seems to be lower than the global book ratio almost throughout the period, only overlapping in 2012. This fits the previous literature which suggests the GCC has low leverage values than the rest of the world. The global book debt seems to fall in 2012Q1 at the same time the oil price rises, while the GCC ratio seems largely unaffected and in fact rises by around 2%. Finally, a similar observation seems to be that short-term debt is rising for both samples in 2015Q1, although the rise is so small that it is unclear whether this is just random variation or due to the oil price.

One can conclude from this that both measures of short-term debt appear to be quite unrelated linearly to the crude oil price. Book short-term debt appears to be quite unchanged throughout the period, while market short-term debt fluctuates almost randomly. The only significant point being in 2015Q1, where the debt appears to rise inversely with the oil price for the GCC and globally, although by a quite small amount in both ratios. This regression seems to suggest there is not enough statistical evidence supporting a relationship between the oil price and short-term capital structure.

4.4 Long-term capital structure linear regressions

4.4.1 Gearing ratio

$$(3)\ (\text{Gearing Ratio}_{it}) = \gamma_0 + \gamma_1(\text{Oil Price}_{it-1}) + \mu_{it}$$

The gearing ratio is the most common used estimator of capital structure, it relies on using direct measures of long-term debt and shareholder's equity. If the gearing shows strong evidence of no relationship with oil price, it is likely our first hypothesis will not be rejected.

Table 4.7 – Results of OLS on equation (3)

Coefficients	**Estimate**	**Standard Error**	**T value**	**Pr(>|t|)**
Intercept (γ_0)	0.2859536	0.1046527	2.732	0.00672
Slope (γ_1)	-0.0002832	0.0011161	-0.254	0.79991

R-squared: 0.0002495, Adjusted R-squared: -0.003626
F-statistic: 0.06437 on 1 and 258 DF, p-value: 0.7999

Table 4.8 – Results of random-effects Estimator on equation (3)

Coefficients	**Estimate**	**Standard Error**	**T value**	**Pr(>|t|)**
Intercept (γ_0)	0.28595364	0.06711040	4.2609	0.00002856
Slope (γ_1)	-0.00028317	0.00034019	-0.8324	0.406

R-squared: 0.0026783, Adjusted R-squared: 0.0026577
F-statistic: 0.692861 on 1 and 258 DF, p-value: 0.40596
Hausman Test: p-value = 1 (Random-Effects estimator should be used)

The results of the OLS estimator provide similar results to the short-term measures of debt, having high standard errors, very low R-squared values and a p-value of around 0.8 suggests the slope has a high chance of being quite similar to 0. The random-effects estimator on the other hand is the first estimation to not have an extremely high p-value. While the R-squared values are still very small, the p-value seems to provide some evidence that at least at the 5% significance level there is a small chance that there is an inverse relationship between oil prices and capital structure.

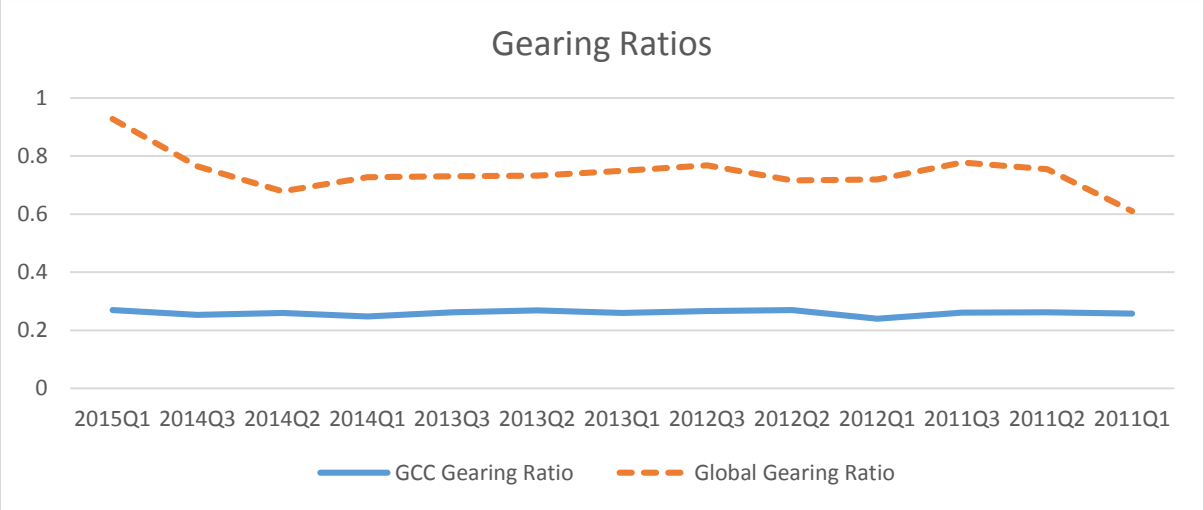

Figure 4.4 – A plot of the average Gearing over the period 2011Q1 - 2015Q1

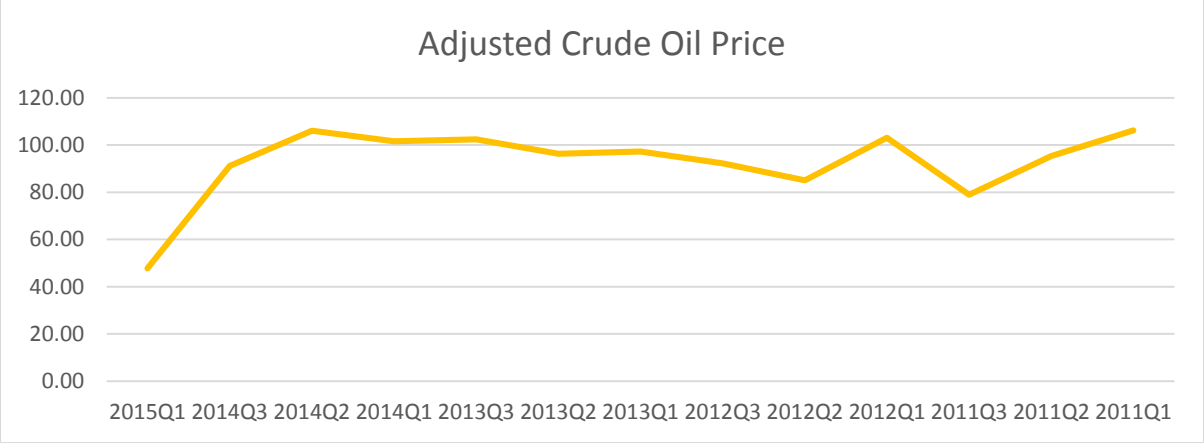

Figure 4.2 (repeated)

The gearing ratio trend over the period seems to be the strangest of all the capital structure ratios so far. The GCC ratio seems to be much lower than the global gearing ratio, and certainly seems to show complete inelasticity over the period. Comparing this to the global ratio, it seems debt rises inversely in relation to the current oil shock – a similarity shared by all the global capital structure ratios and is consistent with the literature. The only notable point is that the gearing ratio dips by around 2% at its lowest point in 2012Q1, the same time that the oil price seems to have a temporary rise. The stable gearing ratio over the period provides further evidence of no linear relationship between long-term capital structure and the oil price.

4.4.2 Book debt ratio

$$(4)\ (\text{Book Debt Ratio}_{it}) = \delta_0 + \delta_1(\text{Oil Price}_{it-1}) + \mu_{it}$$

The final ratio is often viewed as a more accurate representation of long-term debt compared to gearing as it is comprised of the market value of assets. In this sense we expect this ratio to be less in value and more volatile than gearing over the chosen period of time.

Table 4.9 – Results of OLS on equation (4)

Coefficients	**Estimate**	**Standard Error**	**T value**	**Pr(>|t|)**
Intercept (δ_0)	0.2101843	0.0894907	2.349	0.0196
Slope (δ_1)	-0.0001734	0.0009544	-0.182	0.8560

R-squared: 0.0001279, Adjusted R-squared: -0.003748
F-statistic: 0.03301 on 1 and 258 DF, p-value: 0.856

Table 4.10 – Results of random-effects estimator on equation (4)

Coefficients	**Estimate**	**Standard Error**	**T value**	**Pr(>|t|)**
Intercept (δ_0)	0.21018431	0.05644102	3.7240	0.0002409
Slope (δ_1)	-0.00017338	0.00025641	-0.6762	0.4995229

R-squared: 0.0017691, Adjusted R-squared: 0.0017555
F-statistic: 0.457239 on 1 and 258 DF, p-value: 0.49952
Hausman Test: p-value = 1 (Random-Effects estimator should be used)

The final book debt ratio contains the same issues as all the previous ratios: high standard errors, very low R-squared values and a high p-value in the OLS estimator. Similar to the gearing ratio, the random-effects estimator seems to suggest there is around a 50% chance that the slope coefficient is different from 0 at the 5% significance level.

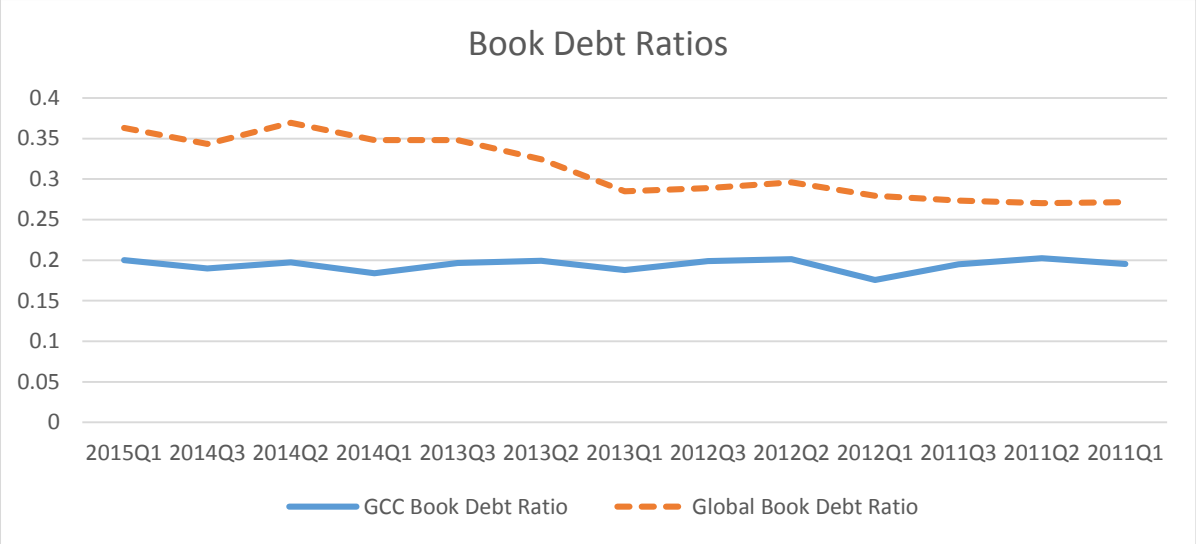

Figure 4.5 – A plot of the average Book Debt Ratio over the period 2011Q1 - 2015Q1

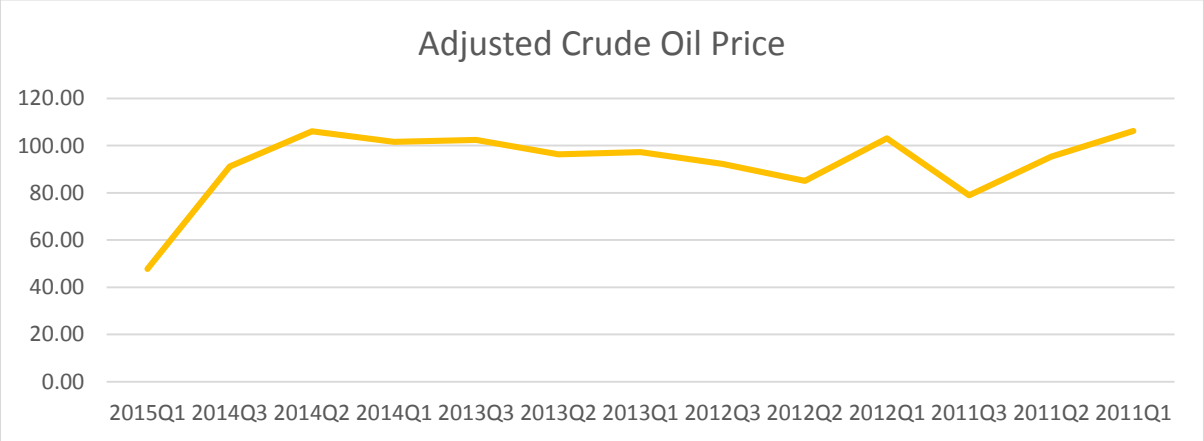

Figure 4.2 (repeated)

It seems both GCC long-term measures of capital structure remain relatively constant over the period, although the book debt ratio is a little more inconsistent (but still not as volatile as the short-term measures). The GCC Book Debt Ratio follows a similar trend to gearing of being very low compared to the global ratio, although both regions have a small rise in the ratio in the final 2015Q1 period. Similarly, the GCC faces a dip in the ratio of around 15% in 2012Q1 when the oil price rises in the same period. These two periods are the only points where there is some evidence of an inverse relationship between leverage and capital structure.

These regressions and graphical comparisons to the global capital structure seems to suggest there is not enough statistical evidence supporting a relationship between the oil price and long-term capital structure.

4.5 Non-linear regression results

The initial reason for testing a non-linear relationship was to conform the theories set by Maghyereh & Al-Kandari (2007) and Arouri & Rault (2012) who were unable to find a linear relationship between oil price and share price, but were able to find a non-linear relationship. The primary reason for this is to analyse the oil price on a wider range, for example extrapolating to extreme values to see if the linear relationship is still invalid. The results of this section will be provided graphically for all 4 ratios together to avoid repetition with the previous section.

4.5.1 The generalised linear model

The generalised linear model will be used to analyse the relationship of the natural log of the oil price and the capital structure ratios. This model shows a range where smaller fluctuations in the oil price and their impact on capital structure will be more noticeable graphically. The regression details of the GLM can be found in Appendix B.

$$(5)\ (\text{Ratio}_{it}) = \varepsilon_0 + \varepsilon_1 \ln(\text{Oil Price}_{it-1}) + \mu_{it}$$

Figure 4.6 appears to provide more evidence of a relationship between oil price and capital structure than the above linear models. The lines however still appear to be quite straight except when approaching zero where they begin to rise very sharply. The interesting point from this study is that while there appears to be little evidence of a linear relationship, there is some evidence of a non-linear relationship – similar to the conclusions of the literature mentioned above. One point that the previous linear models did get correct was the directions of the relationship between the oil price and the ratios.

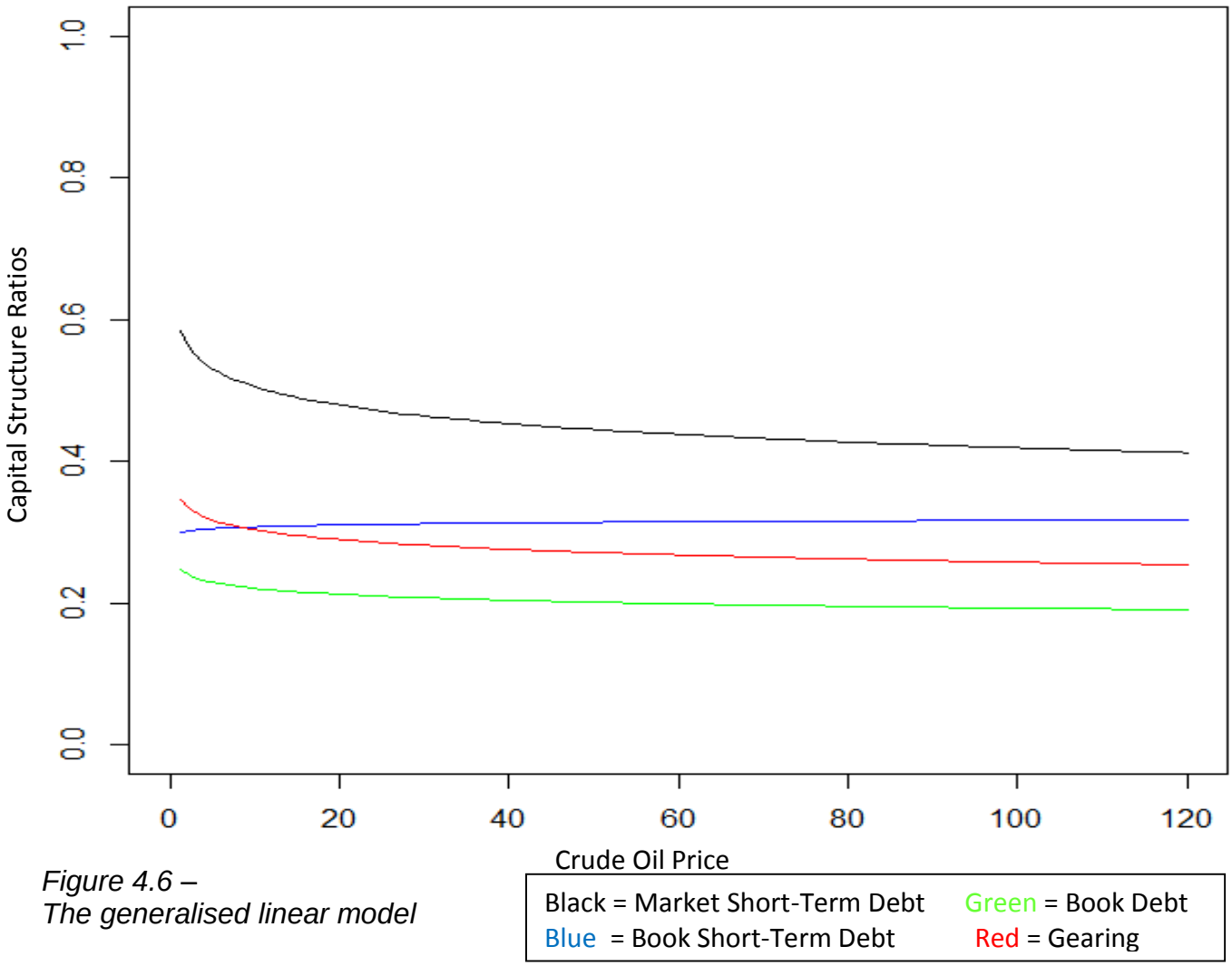

Figure 4.6 –
The generalised linear model

It seems 3 of the 4 ratios are negatively correlated with the oil price, with book short-term debt the only ratio positively correlated. This is likely due to the book measure not being very accurate, since the total assets values are usually taken to be the full value of those assets ignore emergency selling costs and depreciation values (which is particularly important since this is panel data). In this sense it's possible that the total assets value would be higher than the actual value, resulting in a lower book short-term ratio supporting a positive relationship with the oil price. Hence, for the remainder of this section we will assume the book short-term debt ratio is somewhat of an anomalous result. Either way – the generalised linear model supports that there is *some* relationship of capital structure and the oil price.

Figure 4.6 also supports some of the results from the above models as well as confirms the theories from the literature. The market short-term debt appears to have the highest gradient when compared to the long-term ratios. This was visible graphically in figures 4.1, 4.4 and 4.5 as well, where market short-term debt was appears to be more volatile than the other two ratios. This also makes sense from a logical perspective as short-term measures are more likely to fluctuate with changes in the oil price than long-term measures.

Finally if looking at the extreme values of oil price, figure 4.6 also makes sense. If the oil price was to reach 0 (a likely impossible scenario) then we would expect the capital structure ratios to significantly increase, which was not clear in the above linear models which simply suggested a relatively stable capital structure regardless of the oil price. The gradient of the curves should however be much higher. If the price of oil really did reach a value of 0 we would expect the debt of GCC firms to go far beyond the equity, resulting in ratios of values more than 1 which does not seem to be the case in figure 4.6. Looking at the relationship in the other direction it makes sense as well that if the oil price hypothetically continued to rise, the capital structure ratios would stabilise at a low ratio of debt to equity, as the literature suggests more profitable firms have lower leverage. In this sense, the curves may not have a perfectly accurate shape but at least they prove a non-linear relationship between oil price and capital structure.

4.4.1 The Logistic Function

The logistic function seeks to provide another look at the oil-capital structure relationship by testing an inverse exponential regression. The regression details of this NLM can be found in Appendix C.

$$(6)\ (\text{Ratio}_{it}) = \frac{1}{1+\exp(\zeta_0 + \zeta_1(\text{Oil Price}_{it-1})) + \mu_{it}}$$

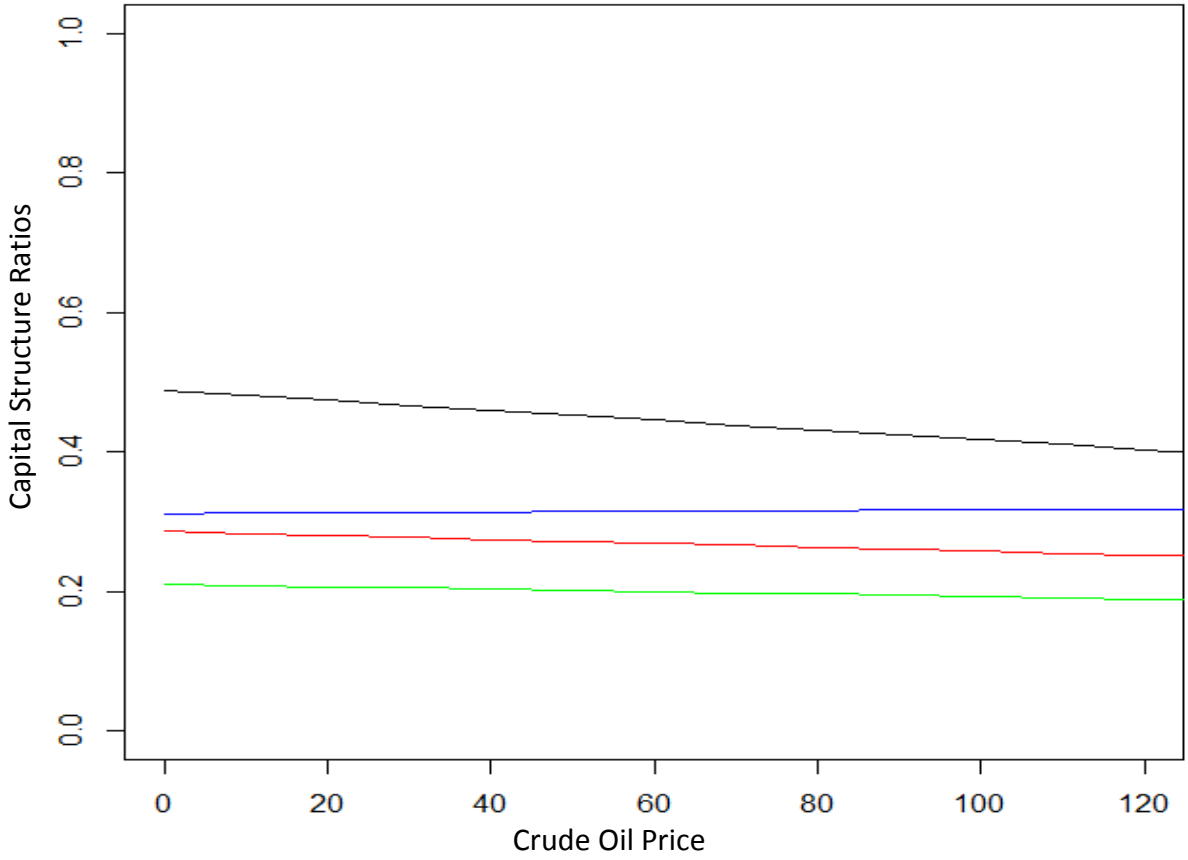

Figure 4.7 – The logistic function (no extrapolation)

The results in figure 4.7 show a very weak relationship between oil price and the capital structure ratios. Similar to the previous sections all the ratios have negative relationships with the oil price with the exception of the book short-term debt which has a very slight positive relationship, falling at the same time the oil price falls. The main reasoning behind this weak relationship dwells on the idea that our logistic function shows a better picture if the range of values in the independent variable were

larger. Because the oil price only has a relatively realistic range of 0 to 120, the lines appear to be linear. Figure 4.8 extrapolates the data to extreme values to illustrate this point.

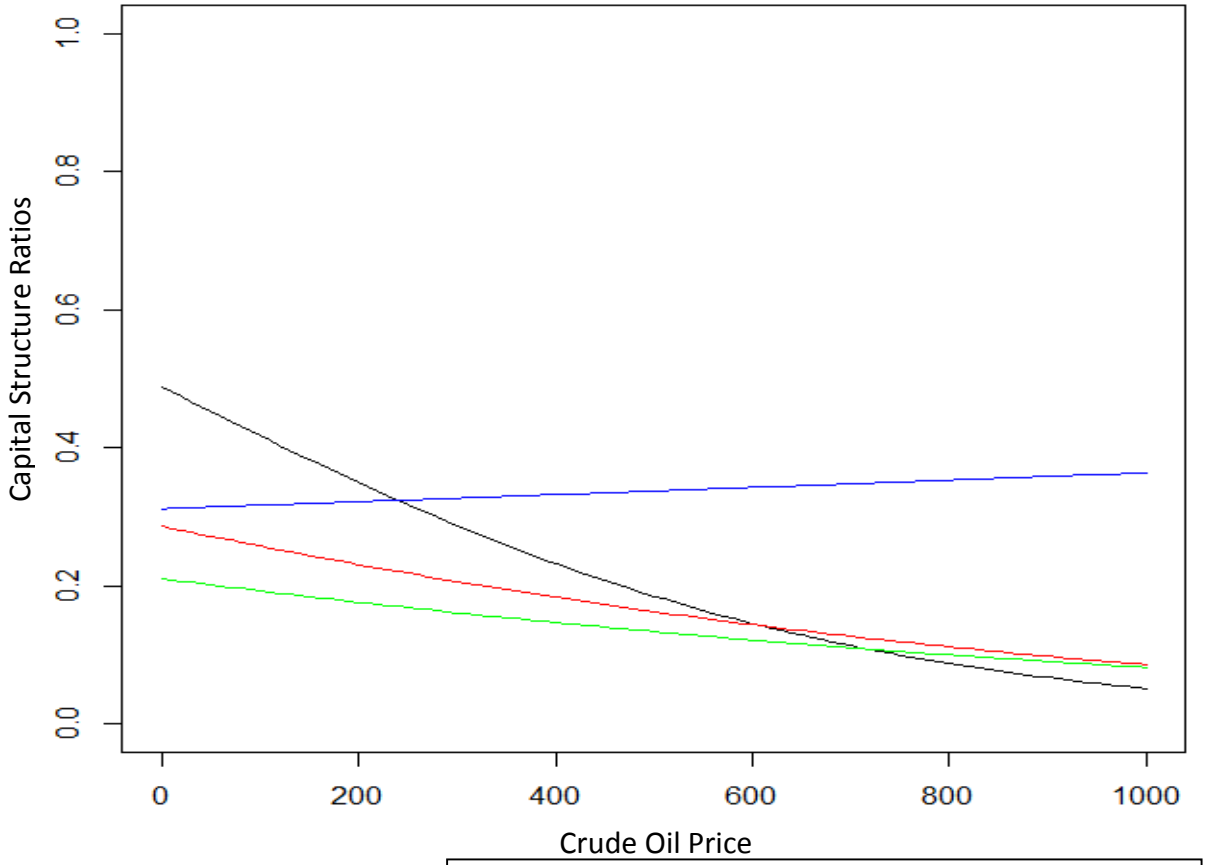

Figure 4.8 – The logistic function (with extrapolated oil prices)

The exaggerated oil price in figure 4.8 shows strong visual evidence of a non-linear relationship between the oil price and capital structure. Appendix C however does show that the p-values for the logistic functions are quite high, suggesting there is not much statistical evidence supporting the theory. Either way, figure 4.8 provides similar conclusions to the GLM model. As the oil price reaches 0 the capital structure ratios (with the exception of the book short-term debt again) sternly rise exponentially. The market short-term debt appears to have the highest slope which makes sense as the market values of assets fluctuate more in the short-term, raising leverage values. The main area where the logistic function differs from the GLM is that it suggests that the

market short-term debt ratio will eventually be lower than the long-term ratio, although this result is not important to understand as it occurs at a likely impossibly high oil price.

While figure 4.8 should not be used to provide any statistical conclusions, the shape of the curves provide useful inference of the relationship between the oil price and capital structure – results similar to the GLM figures.

4.6 Test of hypotheses

$H1_0$ – There is no association between capital structure and crude oil price.

The first hypothesis simply confirms whether there is any relationship between the independent and dependent variables, and it is safe to say we have enough evidence to reject this first null hypothesis.

The correlation coefficients suggest there is no relationship, however the regression results clarify this further and confirm a very weak relationship. In particular the random estimators for each linear regression finds some support for the confidence interval of the t-tests. In particular, the two long-term ratios and the market short-term debt ratio suggest there is some association between capital structure and the crude oil price. The graphical interpretations of the generalised linear model and the logistic function also support that there is a weak linear relationship, and when extrapolated suggest a quite strong non-linear relationship as the oil price falls further.

$H2_0$ – Leverage is inversely related to the oil price

The second hypothesis attempts to confirm after approving the association between the capital structure and oil price, that this relationship is negative. Unfortunately the results for this are rather mixed and the lack of statistical support for the estimated coefficients make it difficult to completely accept this hypothesis.

Firstly 3 of the 4 correlation coefficients relating the oil price and capital structure ratios support the hypothesis of a negative relationship, although the values are very close to 0. Similar conclusions can be made with all of the regression analysis, where estimates for all of the slope coefficient (with the exception of the book short-term debt ratio) are found to be negative. However the R-squared values for the linear estimators are very low suggesting the estimators may not be accurate. Not only that, but the p-values for both the random and OLS estimators are found to be quite high which implies that the estimators are not significantly different from 0. It's important to note that the book short-term debt (the only ratio opposing this hypothesis) has the highest p-values and the lowest R-squared values of the 4 ratios suggesting it may be the least accurate of the estimators, this may mean that even its sign is wrong. However, these results do support that the estimators are slightly different from 0 – which is the expected result.

Finally, the two graphical interpretations of the GLM and logistic functions provide further evidence that the relationship between capital structure and the oil price is different from 0 and that 3 of the 4 ratios are negatively correlated with the oil price. Both models show an exponential relationship as the oil price falls. In particular, they show that if the oil price were to reach the extreme value of 0 then leverage is expected

to rise significantly, which makes logical sense and supports this hypothesis. Appendix B and C however do suggest that these two non-linear estimators both suffer from the same issue of a very high p-value for the estimators, meaning that the sign is likely to be correct although the estimations of the coefficients is not.

In this sense we find that the relationship between oil price and capital structure is negative however the degree of influence found in this study is likely to be incorrect as it is plagued by "bad" estimations of statistical properties such as low R-squared values and high p-values for confidence interval. To conclude, we can accept the second hypothesis although suggest more research should be conducted on this topic.

Chapter 5 – Conclusions and limitations

5.1 Introduction

The main purpose of this thesis was to investigate the relationship between the oil price and Middle-East capital structure for the Oil & Gas industry. This was presented both graphically and statistically using a number of different summary statistics and regression techniques testing oil price changes on 4 capital structure variables including two short-term measures and two long-term measures. The final chapter of this dissertation seeks to conclude the results of the study and relate these conclusions to any past research and models. This chapter will also include limitations and possible complications from this study and will seek to provide an outline of how to improve the research for the future.

5.2. Conclusion

The main conclusion that can be drawn from the results is that there is a very weak relationship between the oil price and the capital structure ratios used in the study. In particular this conclusion is most evidence in the current oil shock as almost all of the ratios noticeably rose inversely with the oil price during the latest available quarter of Q1 2015.

The results generally seem to suggest that as the oil price falls, the capital structure ratios rise as leverage is expected to rise. Although the book short-term debt appears to be the exception as it appears to be positively correlated with the oil price, the fact remains that this ratio also proves that there *is* a relationship between the two variables. Finally, while the correlation coefficients between the independent variables are very close to zero, they do support that 3 of the 4 ratios are negatively correlated with the oil price.

Further, the results suggest that the Middle-East is not as affected by oil price changes as the rest of the world. The capital structure ratios for the Middle-East generally appear to be quite invariable throughout the period, especially the two long-term measures. Similarly 3 of the 4 Middle-East ratios are found to be consistently lower over the chosen period of 2011 – 2015 than the global ratios; these conclusions are similar to findings by Lescaroux & Mignon (2008) and Sbetei (2010) and are consistent with the pecking-order capital structure theory.

One of the main goals of this research was to investigate is if the Middle-East is somehow better at handling the oil shock than the global economy. Based on the findings it can be concluded that the Middle-East is a little better at handling fluctuations in the oil price than other economies. This can be heralded to the fact that they are a primary exporter of oil price, and will continue to do so because of their large supply of oil. However the research also points out that if the oil price falls even further (which is occurring, see figure 5.1 below) then the Middle-East leverage is expected to rise quite sharply, similar to the global economy. This suggests that the only reason the Middle-East is better at handling oil shocks is due to their large supply – their economy is still largely dependent on the price and it's likely if the price continues to fall, OPEC will interfere to avoid adverse effects to the economy of oil-exporting countries.

One point that needs to be made is that almost all of the regression results explored in chapter 4 suffer from very high p-values and low R-squared values where applicable. This suggests that while the data may be accurate in providing the direction of the relationship between the oil price and the capital structure variables, it is likely not accurate in the prediction of the slope estimators. In particular the research for some of the estimators based on a confidence interval suggests that the slope estimators may not be significantly different from 0, meaning the relationship between the oil price and capital structure is very weak. This lack of statistically significant data is likely due to limitations in the data sample, and improvements are suggested in the following section.

5.3 Limitations and suggestions for future study

Finally, there are a number of ways the study could have been improved and this section will seek to build upon these limitations to provide suggestions for future research.

The first problem with the regression model in particular lies in the fact that it is linear and only contains one independent variable at a time. Certain previous studies such as Cochrane (2002), Maghyereh & Al-Kandari (2007) and Arouri & Rault (2012) find there to be a non-linear relationship with other financial variables and the oil price. In particular, variables such as stock price and inflation could have been added as independent variables in the regression to exclude them from the error term as part of a separate regression. Figure 4.1 for example seems to find a random fluctuation of the market short-term debt ratio in 2013Q3 which appear to be independent of the oil price. These random fluctuations may have been identified if other independent variables were used.

Not only could that, but the degree of influence of the oil price on capital structure compared to other variables have been discovered. Also, while table 4.2 suggests there is no strong correlation between the dependent variables, it may have been useful to conduct a separate co-integration analysis to estimate how independent of each other the capital structure measures are. In relation to the capital structure theories, adding an independent variable of profitability could have also provided more stable evidence of the inverse relationship between profitability and debt. Considering there is no research currently on the influence of this oil shock on Middle-East capital

structure, this study is a first step and suggests a more detailed analysis for future research.

Another limitation is the rather small sample size of only 20 firms. The first improvement is that a larger sample would have provided more results and possibly a more accurate regression. Also, individual country analysis in the Middle-East was not possible as the sample size is very small for each of the 5 countries in the sample. This would have been an important point of analysis, as some of the previous research [such as Hammoudeh & Li (2008) and Rizvi & Masih (2014)] suggest that Qatar and Saudi Arabia have some differing reactions during the crisis than the other GCC countries. The main reason the sample size was small was due to the problem of many oil & gas firms in the region not publishing their accounts publically. Future research could attempt to gather this data through direct primary research means, allowing for a larger sample of firms not included in this study.

The current oil price also causes a potential problem with the data. When this research was planned, the oil price appeared to be rising again (see Figure 5.1) and it was assumed that this was the extent of the oil shock. However it seems the crisis is not yet over, as the oil price is continuing to fall further than the previous price and it is unclear when it will rise again. This may affect the results as the capital structure may be even more strongly affected in the remaining quarters of 2015. The suggestion here is that future studies could conduct a similar analysis for when this shock is definitely over and the oil price returns to a 'normal' value, possibly in 2016 when published accounts for all of 2015 will be available. This study extrapolates the data and finds a non-linear relationship, however future studies with a wider time period of data can confirm if the extrapolated conclusions are true.

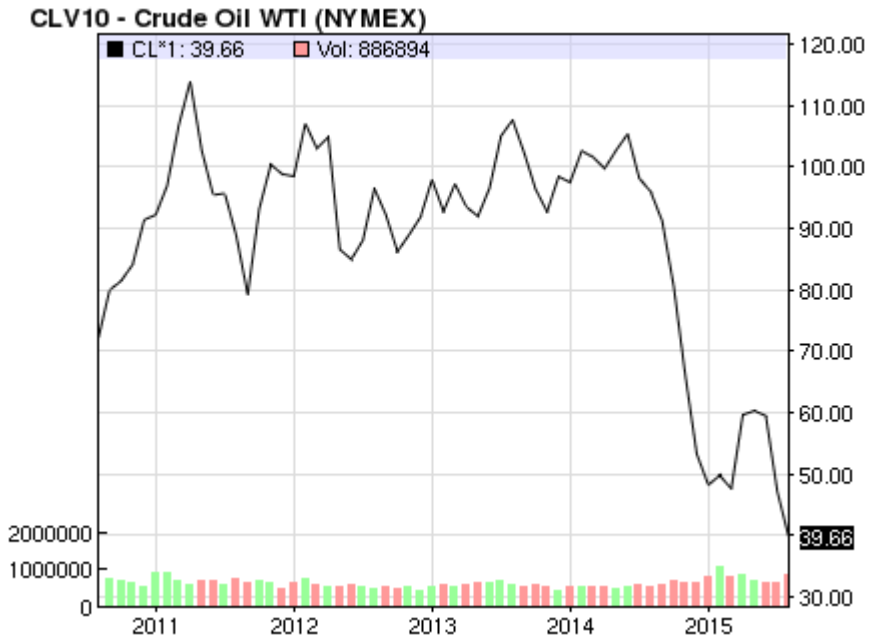

Figure 5.1 (NASDAQ, 2015) The price appears to rise at the end of Q1 2015, but falls again at the end of Q2 and continues through Q3 and has yet to hit a low-point.

Finally, a limitation of this study stems from the fact that the research is not an interpretive study. While the conclusions made by the research suggest for example that the Middle-East economy is not as affected by the oil price as the global economy it does not make much of an indication as to *why* this is the case, besides citing the large supply reserves of oil the GCC claims to have. Apart from news articles and literature, the data collected can only quantify the relationship between the variables without really explaining how they came to be. Especially considering the OPEC is the reason this oil shock occurred, the question of how they were able to handle the crisis well has not been completely answered. Although the results of this study suggest that the Middle-East was only able to mitigate the effects of the oil shock initially, it may be worth investigating how the capital structure ratios remain so inelastic even during small fluctuation in the oil price in earlier periods. In this sense future research could conduct primary research through questionnaires for example to find out how the GCC was able to mitigate the oil shocks effects on their economy, if other factors apart from the supply were the reason.

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Appendix A – Global oil & gas firms data sample information

Table A1 – Global sample firm sizes

Type of Firm	% of Firms
Micro	0.99%
Small	0.49%
Medium	1.60%
Non SME	96.91%

Table A2 – Global sample country proportions

Country	% of Firms	Country	% of Firms
Austria	0.37%	Netherlands	0.12%
Bangladesh	0.12%	Norway	2.96%
Bermuda	0.86%	Pakistan	0.86%
Canada	29.14%	Panama	0.12%
Cayman Islands	0.62%	Philippines	1.23%
China	5.43%	Poland	0.62%
Crotia	0.12%	Republic of Korea	3.33%
Curacao	0.12%	Romania	0.12%
Cyprus	0.37%	Russia	1.23%
Denmark	0.25%	Serbia	0.12%
Egypt	0.12%	Singapore	2.96%
Finland	0.12%	Slovakia	0.12%
Germany	0.37%	Spain	0.25%
Hungary	0.12%	Sri Lanka	0.25%
Indonesia	2.22%	Sweden	0.37%
Israel	0.86%	Switzerland	0.12%
Italy	0.12%	Taiwan	0.12%
Japan	2.72%	Thailand	1.85%
Kazakhstan	0.12%	Turkey	0.12%
Latvia	0.25%	United Kingdom	0.49%
Lithuania	0.12%	United States	32.72%
Malaysia	2.35%	Vietnam	2.59%
Marshall Islands	0.12%	Virgin Islands	0.25%

Appendix B – Generalised linear model regression results

Market short-term debt

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-0.4401	-0.2546	-0.1437	0.0070	4.8927

Coefficients:			
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.59076	0.74150	0.797	0.426
Log.Oil	-0.03732	0.16425	-0.227	0.820

Book short-term debt

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-0.30809	-0.16257	-0.01563	0.13497	0.48479

Coefficients:			
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.298351	0.286166	1.043	0.298
Log.Oil	0.004004	0.063387	0.063	0.950

Gearing

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-0.2716	-0.2279	-0.1064	0.2028	0.7019

Coefficients:			
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.34932	0.37262	0.937	0.349
Log.Oil	-0.01986	0.08254	-0.241	0.810

Book debt

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-0.2010	-0.1751	-0.1045	0.1673	0.7239

Coefficients:			
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.24865	0.31863	0.780	0.436
Log.Oil	-0.01209	0.07058	-0.171	0.864

Appendix C – Logistic function regression results

Market short-term debt

Parameters:			
	Estimate	Std. Error	t value Pr(>|t|)
a	0.047303	0.843675	0.056 0.955
b	0.002869	0.009012	0.318 0.750

Residual standard error: 0.5398 on 258 degrees of freedom

Book short-term debt

Parameters:			
	Estimate	Std. Error	t value Pr(>|t|)
a	0.7918586	0.3726398	2.125 0.0345
b	-0.0002327	0.0039726	-0.059 0.9533

Residual standard error: 0.2083 on 258 degrees of freedom

Gearing

Parameters:			
	Estimate	Std. Error	t value Pr(>|t|)
a	0.913112	0.532260	1.716 0.0874 .
b	0.001451	0.005692	0.255 0.7990

Residual standard error: 0.2713 on 258 degrees of freedom

Book debt

Parameters:			
	Estimate	Std. Error	t value Pr(>|t|)
a	1.322382	0.559738	2.363 0.0189
b	0.001092	0.005986	0.182 0.8554

Residual standard error: 0.232 on 258 degrees of freedom