

# Factors Influencing Capital Structure: An Empirical Evaluation of Major Oil and Gas Producing Companies Operating in Ghana

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## Abstract

A company's choice of capital structure determines how successfully it will operate. This choice heavily depends on the understanding and optimisation of the capital structure factors necessary to increase industry-specific profitability and, consequently, market value. Therefore, the goal of this study is to analyse the factors that determine the capital structure of six significant oil producing companies operating in Ghana, namely: Hess Corporation, Kosmos Energy, Tullow Oil and Ghana National Petroleum Company from 2010 to 2018. In the analysis of panel data for this study, random effect estimation is used. Size, liquidity, tangibility, crude oil price, and profitability are used in conjunction with pertinent literature to describe the factors that determine capital structure, which is proxied by the debt-to-capitalisation ratio (leverage). The findings demonstrated that profitability, firm size, crude oil price, and liquidity are major capital structure factors that have a markedly adverse connection with leverage. The main finding of this study implies that, in accordance with the pecking order theory, consideration of debt may ultimately be the last resort, whereas the management of these major oil and gas companies in Ghana must exercise discretion when considering funding based on debt and rely more on generated profits (retained earnings) and shareholder equity. Appropriate crude oil price hedging instruments are recommended to minimise the impact of commodity price volatility on decisions on capital structure strategies.

**Keywords:** Capital Structure, Random Effect Estimation, Pecking Order Theory, Debt-To-Capitalisation Ratio

**JEL CODES:** G30, G31, G32

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## 1. Introduction

Following the discovery of economically viable volumes of oil and gas in 2007, Ghana became one of the youngest oil-producing nations in the world in 2010. International oil and gas firms including Tullow Oil, Kosmos Energy, Hess Corporation (later merged with Aker

Energy), ENI Corporation, and Vitol were all drawn to Ghana's oil and gas industry subsequently. There was only one state-owned oil and gas operational firm among them-the Ghana National Petroleum Company.

Ghana is described as a net oil importer due to her lower crude oil export rate compared to higher rates of importation of very expensive finished petroleum products to augment her outstripping energy demands. These oil and gas firms are expected to produce more than their current levels of production in order to meet the growing oil and gas demands.

Investors, industry participants, and regulatory authorities may find it useful to have a precise and in-depth understanding of the factors that affect the composition of the capital structure of these firms and how they are strategically structured in order to meet the aforementioned increased demand. Although oil and gas operations need high capital outlay, the majority of oil and gas companies have very low debt loads as a share of overall financing. Even though higher debt to capitalisation ratios could be more manageable for large oil and gas businesses, greater debt to capitalisation ratios are generally worse than lower ones.

Rate of return on capital employed (ROC) in the oil and gas industries are a crucial factor when evaluating energy investments, especially amidst rising commodity prices. Oil and gas are commodities that are particularly prone to large price fluctuations. Oil and gas profit margins are therefore unstable. The sales from oil and gas are a major source of revenue for the oil and gas industry. By reinvesting their retained earnings into operations, oil and gas companies can have the flexibility of taking on less debts. Due to the industry's volatility, profit margins are more relevant as a guide to recent trends than as a justification for long-term investment of policy decisions.

Debt is one of the two main ways an oil and gas company can raise capital on the financial markets. Like all other firms, oil and gas companies benefit tremendously from debt due to its tax benefits. Tax deductions may be available for interest payments made because of borrowing money. Another benefit of using debt over equity is that an oil and gas firm can maintain control. In addition, debt is easily accessible and plentiful when interest rates are low. However, a business with a significant debt load has a riskier capital structure and is therefore not attractive to investors. Equity enables outside investors to acquire modest ownership stakes in the business. Equity and debt both have distinct risks and returns. Therefore, a balanced debt-to-equity ratio not only lowers the cost of financing, but also boosts the company's worth and the wealth of its owners (Hamzah and Marimuthu, 2019). It can be difficult to balance the proportion of debt and equity. However, a bad capital structure choice for a capital-intensive industry like the oil and gas has the propensity to lead to financial crisis, which increases the likelihood of bankruptcy (Ahmed Sheikh and Wang, 2011). Additionally, a big number of businesses are declared insolvent as a result of an excessive debt load or an unbalanced debt-to-equity ratio (Chadha and Sharma, 2015). Debt is more expensive than equity, particularly when interest rates decline. Equity, on the other hand, does not require repayment like debt does. This is advantageous to the business in the event of declining earnings. Equity nonetheless indicates a claim by the owner on the company's future profits.

The study aimed at uncovering the factors affecting capital structure decisions for major oil and gas producers in Ghana. Ghana was selected due to the huge productivity expectations

that welcomed the discovery of oil and gas in 2007 as well as the anticipated pressure on the major oil and gas producers. In the light of the high oil and a gas production expectations, what factors must these oil and gas firms in Ghana critically take into consideration when making capital structure decisions? Very few studies on the factors affecting capital structure in the context of the oil and gas industry have been carried out as compared to the other industries. The very few studies in this regard, have mostly focused on the endogenous variables that influence capital structure such as profitability, the tangible nature of assets, business scale, and development potential (De. Jong & Nguyen, 2008). Furthermore, Huong (2018) asserted that capital structure decisions are greatly influenced by a firm's own characteristics. However, this assertion provides inadequate literature as there are very scanty and inconclusive empirical findings on how commodity prices influence capital structure decisions against the revelation put forth by Cheung (2022) that commodity prices have been known to have the potential to favour or truncate profit margins of oil and gas companies. The study fills this research gap by incorporating crude oil price as an exogenous variable in order to determine its measure and direction of influence on capital structure of the major oil and gas companies in Ghana from 2010 to 2018 along with the other traditional endogenous variables.

The structure of this study is as follows: Section two provides an overview of the theories as well as extant empirical literature on capital structure. Section three elucidates on the methodology to be used to achieve the purpose of the study. The results are presented in section four, followed by section five and six, which outline the conclusion and recommendations from the outcome of the study respectively.

## 2. Literature Review

### 2.1. Theoretical Review

When discussing capital structure (leverage) and how specific elements known as determinants affect it, the Pecking order, trade-off, and Agency cost theories are essential. These theories are supported by a variety of possibilities. The results of these experiments are used to corroborate or refute these beliefs.

According to the trade-off theory, businesses choose their most advantageous financing strategy by weighing the gains and drawbacks of adding more debt. The ability to deduct loan interest from taxes is one of the perks associated with the acquisition of debt. Access to money that may be injected into a company's cash-generating operations is another benefit. The major components utilised in the assessment of the cost of borrowing/debt are costs of insolvency and the expenses realised from the competing interest between equity holders and creditors. Any marginal gain is offset by the cost of debt at a favourable leverage level. Leverage ratios such the debt-to-equity, debt-to-capitalisation, and debt-to-assets rise as a result of more debt. Additionally, debt results in a decline in net income, which acts as a tax shelter by reducing the amount of taxable income. When evaluating a company's capital structure, it is possible to enhance debt financing through two stages: the static trade-off stage and the dynamic trade-off stage. This will result in a desirable debt ratio in the capital structure. In the static trade-off stage, all of the trade-off theory's presumptions are upheld for a set amount of time in order to accomplish the intended debt ratio, but in the dynamic trade-

off stage, a corporation implements periodic readjustment measures in an effort to gradually reach her desired debt level.

The trade-off theory states that a company will borrow funds until the tax benefit of the debt's marginal value is offset by an increase in the present value of the costs of insolvency.

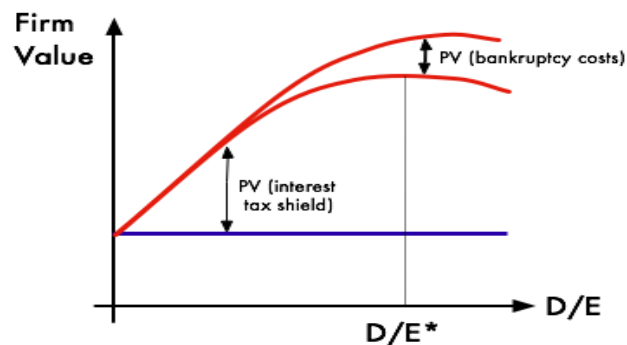


Figure 1: Trade-off theory of capital structure

Source: Brealey, Myers and Allen (2007)

Prior to this, the pecking order hypothesis was put forth with the notion that size should not take precedence over the hierarchy of available resources. Three types of funding are used to do this: internal cash, debts, and external finance through stock. Businesses tend to prioritize their sources of funding by first favouring internal funding. When internal funding runs out, businesses turn to debt. Firms turn to external financing (equity) as a last resort when taking on further debt becomes unjustifiably expensive, which dilutes the ownership of companies with external interest. A recent pecking order theory for industrialised nations has been created and is characterized by the following recapitulation of the finance preference: Internal finance using retained earnings, and outside funding through equity issues and finally, long-term debt (Mihaela *et al.*, 2015)



Figure 2: Hierarchy for Pecking Order Theory

Source: <https://efinancemanagement.com/financial-leverage/pecking-order-theory>

According to the agency theory, the most advantageous capital structure for a company can be achieved through agreements between different types of financing, including equity, debt, and securities, which allow conflicts of interest between managers and the capital suppliers (equity holders and creditors) to be resolved. Since they are the stockholders' agents,

managers are required to act in their best interests. Nevertheless, managers occasionally pursue personal gains such as higher wages, job stability, and asset acquisition rather than acting in the best interests of equity holders. Recent study has shown that, despite the fact that equity holders are able to stop these value transfers with the right supervision and control measures, it is still impossible to completely supervise management.

A generalised perspective of how extant literature captures the relationship between leverage and known determinants such as profitability, liquidity, firm size, tangibility, and crude oil price are highlighted in the foregoing discussion:

The relationship between leverage and a firm's profitability is one of the major theoretical debates. Profitability is a gauge of a company's financial strength. The primary concern of a company's shareholders is its ability to make money. The pecking order theory proposed by Myers clarified how profitability affects leverage (1984). This theory states that every firm has an ordered preference for financing. This hypothesis states that every business has an ordered preference for financing, demonstrating that businesses are favourably disposed to employing retained earnings as their primary source of money for investment, followed by debt. Therefore, obtaining external equity funding is a company's very last resort. The justification for this classification is because internal funds are regarded as being reasonably priced and impervious to outside meddling. External debt was placed next because it was thought to be less expensive and constrained than equity financing, with the issuing of external equity being the most expensive method. Therefore, a profitable corporation consistently decides to use less leverage when it has higher retained earnings. This explains why profitability and leverage are seen to have an antagonistic relationship. The static trade-off hypothesis, on the other hand, contends that high levels of profitability result in high borrowing capacities. The employment of the tax-shield is encouraged by this circumstance. Normally, businesses must pay taxes on their profits. They would rather take on more debt in their capital structure to avoid this since interest payments on debt are typically tax deductible. According to agency costs theories, profitable organisations will likely increase the amount of debt in their capital structures in order to constrain the actions of managers. Therefore, a company is more likely to take on debt as part of its capital structure the more profitable it is. The trade-off theory prognosticates a positive correlation between profitability and debt level as a result (Frank & Goyal, 2003).

According to Ehsan *et al.*, (2012), sectors that deal with liquidity have varying amounts of liquidity to satisfy their operational needs and control the company's rate of return. According to Majumdar and Chibber (1999), one of the most crucial factors in determining a company's capital structure is liquidity. There are differences between the theories of trade-off and pecking order on the relationship between liquidity and leverage. Firms with significant liquidity levels can take on new debt and easily fulfil their due obligations. The Pecking Order Theory's assertion that there is a negative correlation between liquidity and leverage can be explained by the fact that businesses prefer internal finance over external borrowing. Organisations with low levels of liquidity can initially finance their operations with internal resources, and only borrow money if these resources are insufficient (Butt *et al.*, 2013). According to Zhang and Mirza (2015), liquidity and leverage have a favourable relationship

both before and after the financial crisis. Lipson and Mortal's (2009) research of the effect of liquidity on firm capital structures demonstrated a negative interrelation between the two variables, similar to other empirical studies (liquidity and capital structure).

In terms of firm size, the Trade-off and Pecking Order Theories of Capital Structure are both in agreement with the prediction that firm size is positively connected to leverage. According to the trade-off theory's ideas, Large businesses are supposedly more varied and thus run the danger of going bankrupt (Chen & Hammes, 2003).

The key concepts advanced in the literature on tangibility as a factor in a company's capital structure are:

- Businesses with a large proportion of fixed assets also have increased borrowing power. Therefore, it is widely believed that leverage and asset tangibility have a positive relationship. Numerous research, including those by Titman and Wessels (1988), Rajan & Zingales (1995), and Booth *et al.*, (2001), have successfully confirmed this idea; there are proximal interconnections between long-term debt and tangibility (Wijst & Thurik, 1993);
- When working with financially strapped businesses that have limited access to outside resources, tangibility is especially crucial: Nevertheless, tangibility is less significant for a company with few resources (Almeida & Campello, 2007). However, research shows that asset tangibility is favourably connected with long-term debt and negatively correlated with leverage (and short-term debt) (Bas *et al.*, 2009)

Finally, the requirement for working capital is likely to increase if crude oil prices continue to fluctuate, as the cost of financing the same amount of imported or acquired crude oil would go up. On the other hand, a falling crude oil price could result in too much liquidity in the short market. A company may employ the extra working capital to expand its inventory, which would raise profitability. As an alternative, a company may utilise the excess cash leased from working capital to pay off a portion of the loan, lowering long-term financing costs. Due to the unknown future requirements, a changing oil product price may make it exceedingly difficult for financial managers to plan for an ideal capital structure and may even be more expensive in the long run.

## 2.2. Empirical Review

In a related study, Mihaela *et al.*, (2015) looked at the factors influencing the capital structure of extremely small businesses operating in Iasi, a county in Romania. Leverage, another dependent variable in the study, was used together with 5 other factors, including profitability, tangibility, liquidity, size, and growth potential. The capital structure's determining factors were represented by these 5 variables. Panel data with 1,155 observations for 385 companies were utilised to create the sample, which covered the years 2008 to 2010. The fixed effects estimator was used in the study, which found, among other things, that leverage had a significantly negative connection with tangibility, profitability, and liquidity. Leverage was slightly negatively impacted by firm size and growth prospects.

Mohammadi *et al.*, (2020) carried out a study that is connected to this study and used size, liquidity, tangibility, growth potential, and risk as the factors that determine the capital

structure. Nine listed tourism businesses in Oman from 2007 to 2016 made up the sample used in the study, yielding 90 observations. The study demonstrated that size, growth, and risk all affect the capital structure of Oman's tourist enterprises employing the fixed effects and a pooled regression model. The trade-off theory and pecking order theory helped to clarify the nature of the leverage decisions made by the tourism enterprises in Oman.

The factors influencing capital structure in Egyptian listed non-financial firms were also examined by Alber & Youssef (2020), as well as how capital structure decisions were made in three other countries (Argentina, Brazil, and Turkey), which are ahead in terms of economic development, from 2005 to 2015. The study concentrated primarily on the book leverage's sensitivity to predictor variables such profitability, business size, tangibility, volatility, GDP growth, inflation, and stock market development. The regressions for the 4 nations using the General Methods of Moments (GMM) showed that there was a constant and highly significant inverse link between leverage and profitability. Some inconsistencies were seen in the relationships with the other factors. According to the data, bank lending restrictions and consumer borrowing demand restraints prevent Egyptian businesses from being overly indebted.

The modified Fama-French industry classification was utilized by Orlovaa *et al.*, (2020) to assess factors responsible the complexity of capital structure. From CompStat, samples of the businesses were taken for the years 1985 to 2014. Firm-level clustering and industry- and year-fixed effects were also included in the models for all of the regressions. According to the study's findings, access to debt markets, the need for external capital, and the ability to take on extra debt were all related to how complex a company's capital structure was. Access to capital markets, however, acts as a mitigating factor for capital structure complexity for businesses with financial shortfalls. Each of these drivers had a distinctive impact on capital structure complexity.

Using a dataset of 8270 non-financial enterprises that were listed on the Malaysian Stock Exchange, Saif-Alyousfi *et al.*, (2020) looked into the factors that influence capital structure. The dataset had 8,270 observations covering the years 2008 to 2017. The results of the study demonstrated that profitability, growth potential, tax shield, liquidity, and cashflow volatility had a significantly negative impact on the measures of debt using static panel estimate approaches, two-step difference, and system dynamic GMM estimators. Collateral, non-obligatory debt tax, and profit volatility had a favourable impact on the metrics for debt, though. Additionally, it was shown that firm size, firm age, inflation rate, and interest rate were crucial factors in determining the present value of debt. The findings also showed a substantial inverse U-shaped association between the capital structure and the age of the companies. In general, the findings were consistent with the claims of the pecking order and trade-off theories.

Kahya *et al.*, (2020) examined the differences in capital structure across enterprises in industrialised and developing nations while taking firm- and country-level factors into account. The study divided the firms in the Dow Jones Islamic Market World Index (DJIM) into advanced and developing nation subsamples and used an unbalanced panel data setup to apply the Hausman-Taylor random effects regression with endogenous covariates to elaborate on the debt ratios of the enterprises. They found that the primary determinants of their capital

structure are firm-specific factors. The study also demonstrated that country-level features affected the debt-to-income ratio, with different types of creditors in industrialised and developing nations. Due in large part to the much lower leverage ratios of enterprises in Muslim-majority nations, debt ratios in developing-country firms were lower than those in advanced-country firms. The study further asserted that businesses in emerging nations were progressively getting less indebted globally prior to the all-pervasive financial crisis of 2008.

In order to review the various capital structure theories and develop empirical postulations about the factors influencing the capital structure of Pakistan's sugar industry, Khalid *et al.*, (2020) also conducted a study on the factors influencing the capital structure of the Sugar Industry listed on the Pakistan Stock Exchange for the years 2009 to 2018. The study's findings led to the conclusion that factors like firm size, financial flexibility, asset structure, profitability, liquidity, growth, and riskiness had an impact on all of the capital structure measures for Pakistani corporations using panel data econometric techniques like fixed effects and random effects. Short-term debt was discovered to be a significant source of funding for businesses in Pakistan. The ratios of leverage were negatively and significantly correlated with firm size and current ratio. Leverage ratios were positively and significantly correlated with long-term debt, working capital, asset structure, asset usage, effective tax rate, financial flexibility, growth opportunity, and risk volatility.

### 3. Research Method

#### 3.1 Variable Definition and Data Description

Information from the balance sheets and income statements of Hess Corporation, Kosmos Energy, Tullow Oil and Ghana National Petroleum Company were used to create the dataset for the study. The sample includes data that covers 9 years (2010-2018). The criteria for the selection of companies were the availability and quality of data from the year in which Ghana began oil and gas commercialisation (2010 to 2018).

The variables employed for the model of this study are defined as follows:

##### 3.1.1 Dependent variable: debt-to-capitalisation ratio (DCR)

The debt-to-capitalisation ratio provides the means to determine the proportion of a business' total capital utilised in comparison with the sum of its short and long-term obligations. In other words, it is a proportion of the total capital used by a company. A measure of the amount of debt a business uses to finance its ongoing operations in relation to capital is the debt-to-capitalisation ratio. Total debt and entire equity can be separated out of the total capital. The ratio provides an accurate reflection of a company's capital structure, level of leverage, and financial solvency at a given point in time. The DCR is stated mathematically as follows:

$$DCR = \frac{(Short - term\ debt + Long - term\ debt)}{(Short - term\ debt + Long - term\ debt + Equity)}$$

##### 3.1.2 Independent variables

### 3.1.2.1 return on capital employed (ROC)

A profitability statistic called return on capital employed (ROC) gauges how effectively a company uses its capital to generate profits. Investors frequently use the return on capital employed barometer as a realistic gauge in determining if it is feasible to invest in a firm. It is well-known in the financial world as an exceptional profitability-ratio.

Mathematically, ROC is expressed as:

$$ROC = \frac{\text{Profit Before Interest and Tax}}{\text{Capital Employed}}$$

### 3.1.2.2 liquidity ratio (LQR)

It is a ratio that indicates a firm's ability to pay off its debt as and when they fall due. In other words, this ratio expresses the ease with which a company is capable of transmogrifying its current assets into cash in order to honour their debt obligation in a timely manner. Generally, Liquidity and short-term solvency are used interchangeably. Liquidity ratio affects a firm's trust worthiness as well as creditworthiness. If there are frequent instances of non-remittance of a short-term liability by a firm, bankruptcy becomes the end result. This ratio therefore plays a pivotal role in the realisation of a firm's financial solidity and creditworthiness.

The quick ratio is used to proxy LQR in this study and is mathematically expressed as:

$$\text{Quick Ratio (QR)} = \frac{(\text{Current Assets} - \text{Inventory})}{\text{Current liabilities}}$$

### 3.1.2.3 the size of a firm (SZF)

The magnitude or volume of operations produced by a company is referred to as its size. A company's size has a big impact on its effectiveness and profitability. Realising a company's "size" and how it affects commercial enterprises' profitability is one of the most crucial entrepreneurial decisions in business organisation. SZF is theoretically estimated as follows in this study:

$$\text{Size of Firm (SZF)} = \text{Natural logarithm of Total Assets}$$

### 3.1.2.4 tangibility of firm assets (TGB)

Assets of a firm that are tangible refer to physical assets such as equipment, machinery, lands, real estates and ongoing construction projects that can be used over a long period time and are potentially capable of being offered as collateral to creditors in the event of insolvency. Tangibility is mathematically expressed as:

$$TGB = \frac{\text{Fixed Assets}}{\text{Total Assets}}$$

### 3.1.2.5 Crude Oil Price (COP)

The average spot price of Brent, Dubai, and West Texas Intermediate, equally weighted and adjusted for inflation, is used as a proxy for the price of crude oil. It is expressed in dollars (\$bbl) per barrel of oil. The World Bank's Commodity Price Data (Pink Sheet) was the source of the data.

### 3.2 Model Specification

According to related studies conducted by Fisseha, (2010), Mihaela *et al.*, (2015) and Mohammedi *et al.*, (2020), the following model specification was chosen for the study:

$$DCR_{it} = \sigma_1 ROC_{it} + \sigma_2 LQR_{it} + \sigma_3 COP_t + \sigma_4 SZF_{it} + \sigma_5 TGB_{it} + p_{it} + q_{it} \dots \dots \dots (1)$$

Where:

**$DCR_{it}$**  denotes the debt-to-capitalisation ratio of a firm *i* in year *t*

**$ROC_{it}$**  denotes the profitability of a firm *i* in year *t*

**$LQR_{it}$**  denotes the liquidity of a firm *i* in year *t*

**$COP_t$**  denotes the crude oil price in year *t*

**$SZF_{it}$**  denotes the size of a firm *i* in year *t*

**$TGB_{it}$**  denotes the Asset tangibility of a firm *i* in year *t*

**$p_{it}$**  denotes within-firm error in year *t*

**$q_{it}$**  denotes between -firm error in year *t*

**$\sigma_1, \sigma_2, \sigma_3, \sigma_4$  and  $\sigma_5$**  denote the estimated coefficients of the variables

### 3.3 Unit Root Tests

#### 3.3.1 Levin Lin and Chu Unit Root Test

The Levin -Lin and Chu (LLC) test is a unit root test in data analysis, which is best suited for balanced panel data. In order to compare the null hypothesis that no individual time series includes a unit root against the null hypothesis that every individual time series is stationary. This test involves pooling the estimator's T-statistic. This indicates that the LLC considers all individual time series to have homogeneous autoregressive coefficients.

Therefore,  $x_i = x$  for all *i*.

The following hypothesis is tested thus:

$$H_0: x = 0$$

$$H_1: x < 0$$

The LLC test is more effective for evaluating panel unit root testing than when running a separate unit root test for each individual because it puts a cross-equation limitation on the first order partial serial correlation coefficients under the null hypothesis (Barbieri, 2009).

The ratio of the number of panels ( $N$ ) to the time periods ( $T$ ) must asymptotically approach zero in order to pass this test (Levin, Lin, & Chu, 2002). This assumption means that both  $N$  and  $T$  tend to approach infinity, while  $T$  increases at a relatively faster rate than the  $N$ , so that  $\frac{N}{T} \rightarrow 0$ .

Due to this, the unit root test is inappropriate for usage in datasets where the number of panels is significantly greater than the number of time periods.

### 3.4 Random Effects Model

The research of the factors affecting capital structure (leverage) among the largest oil and gas businesses in Ghana from 2010 to 2018 using the random effects generalised least square regression. Ghana started commercializing oil and gas in 2010, and the financial statements of the companies under evaluation have all the necessary data for the study's variables up to 2018 to create a balanced dataset. Based on the results of the Hausman test, a selection is generally made between the random effects estimator and the fixed effects estimator.

Whether or not the unobserved individual effects are represented by components that are associated with the independent variables in the model, rather than whether or not these effects are stochastic, is the crucial distinction between fixed and random effects (Greene, 2008).

## 4. Findings and Discussions

### 4.1 Descriptive Statistics

Table 1. Summary Descriptive Statistics of Panel Data

| Variable | Mean    | Standard Deviation | Minimum | Maximum  |
|----------|---------|--------------------|---------|----------|
| DCR      | 0.3543  | 0.1908             | 0.0000  | 0.6926   |
| ROC      | 0.0828  | 0.2671             | -0.2794 | 1.3584   |
| LQR      | 2.1310  | 2.1343             | 0.5325  | 11.9919  |
| COP      | 78.1211 | 24.2088            | 42.8119 | 105.0096 |
| SZF      | 22.4833 | 1.3270             | 20.1049 | 24.4947  |
| TGB      | 0.7001  | 0.1899             | 0.1691  | 0.8898   |

Source: Author's computation based on data from financial statements from 2010 to 2018

An average crude oil price of US\$ 78.12 is obtained over the period of study. This means that all the major oil and gas companies throughout the period of the study, were exposed to same

measure of crude oil price volatility. An average of 35.43% represented the proportion of capital financed by debt. This means that these major oil and gas companies in Ghana generally use more equity (64.57%) than debt to sponsor their ongoing operations in relation to their capital structure. The average profitability (ROC) of the oil and gas companies was 8.28% over the 9-year duration of operations in Ghana. This means that on average considerations, US\$ 8.28 was earned as profit before interest and tax for every US\$ 100 invested as capital into these firms. This shows that the firms generally had low profitability partly due to the fact that the unrefined petroleum produced by these major oil companies in Ghana were associated with very high costs of production, but low revenues compared to the refined ones. In terms of liquidity, an average of 2.13 was achieved by the firms, indicating that the firms had US\$213 worth of current assets (less stocks) for every US\$100 worth of current liabilities.

The minimum and maximum value for DCR were 0.0000 and 0.6926, indicating that the firms at best generally acquired debt representing 0.0000% of their total capital and at worst acquired debt representing 69.26% of total capital. The minimum and maximum values of ROCE were -0.2794 and 1.3584. This is an indication that the oil and gas firms at worst generally made a loss of 27.94% before interest and tax and at best a profit of 135.84% before interest and tax.

The minimum and maximum values of LQR were 0.5325 and 11.9919. The indication is that the oil and gas firms generally had the least liquidity of 0.5325% and the highest liquidity of 11.9919. Generally, the oil and gas firms in Ghana did not seem to have liquidity challenges throughout the period under review.

#### 4.2 Correlation Analysis

**Table 2: Correlation Matrix**

|            | <b>DCR</b> | <b>ROC</b> | <b>LQR</b> | <b>COP</b> | <b>SZF</b> | <b>TGB</b> |
|------------|------------|------------|------------|------------|------------|------------|
| <b>DCR</b> | 1.0000     |            |            |            |            |            |
| <b>ROC</b> | -0.3215    | 1.0000     |            |            |            |            |
| <b>LQR</b> | -0.2825    | 0.1247     | 1.0000     |            |            |            |
| <b>COP</b> | -0.5034    | 0.3976     | 0.1172     | 1.0000     |            |            |
| <b>SZF</b> | -0.1044    | -0.4799    | -0.3595    | -0.0250    | 1.0000     |            |
| <b>TGB</b> | 0.1349     | -0.4513    | -0.4945    | -0.2227    | 0.5482     | 1.0000     |

*Source: Author's computation based on data from financial statements from 2010 to 2018*

The correlation findings for the study's variables are shown in Table 2. The dependent variable (DCR) and tangibility (TGB) had a meagerly positive connection. The profitability (ROC), liquidity (LQR), business size (SZF), and crude oil price (COP) all indicated a weak negative association with DCR. This clearly demonstrates that the examined indicators—profitability, liquidity, firm size, and crude oil price have a negative impact on leverage.

#### 4.3 Unit Root Test

Table 3 shows the outcome of the LLC test. The results indicate that COP, DCR and ROC are integrated of order 0, whiles LQR, SZF and TGB are integrated of order 1.

Table 3. Results of Levin-Lin-Chu Unit Root Test for Panel Data

| LEVEL                 |              |             |         | FIRST DIFFERENCE |             |         |                      |
|-----------------------|--------------|-------------|---------|------------------|-------------|---------|----------------------|
| Default lag length =1 |              |             |         |                  |             |         |                      |
| Variable              | Statistic    |             |         | Statistic        |             |         | Order of Integration |
|                       | Unadjusted t | Adjusted t* | P-Value | Unadjusted t     | Adjusted t* | P-Value |                      |
| COP                   | -4.821       | -3.5399     | 0.0002  | N/A              | N/A         | N/A     | I(0)                 |
| DCR                   | -4.2862      | -1.7535     | 0.0398  | N/A              | N/A         | N/A     | I(0)                 |
| ROC                   | -8.8905      | -8.0922     | 0.0000  | N/A              | N/A         | N/A     | I(0)                 |
| LQR                   | -2.6999      | -1.0724     | 0.1418  | -6.2572          | -2.9473     | 0.0016  | I(1)                 |
| SZF                   | -3.6065      | -1.3600     | 0.0869  | -4.6577          | -2.4608     | 0.0069  | I(1)                 |
| TGB                   | -2.6998      | -1.0204     | 0.1538  | -8.4161          | -5.7383     | 0.0000  | I(1)                 |

Source: Author's computation based on data from financial statements from 2010 to 2018

#### 4.4 Hausman Specification Test

The outcome of the Hausman specification test is presented in table 4.

Table 4: Hausman Test

| Coefficients |           |            |                  |                                         |
|--------------|-----------|------------|------------------|-----------------------------------------|
|              | (b) fixed | (B) random | (b-B) Difference | $\sqrt{diag(V_b - V_B)}$ Standard Error |
| <b>ROC</b>   | -0.0392   | -0.0470    | 0.0078           | 0.0389                                  |
| <b>LQR</b>   | -0.0188   | -0.0205    | 0.0017           | 0.0254                                  |
| <b>COP</b>   | -0.0179   | -0.0157    | -0.0022          | 0.0048                                  |
| <b>SZF</b>   | -0.0409   | -0.1739    | 0.1330           | 0.0551                                  |
| <b>TGB</b>   | -0.2071   | -0.1447    | -0.0624          | 0.0737                                  |

$$Prob > \chi^2 = 0.9814$$

Source: Author's computation based on data from financial statements from 2010 to 2018

The p-value of 0.9814 is a clear indication that the random effects estimator is more consistent (null hypothesis) than the fixed effect estimator, based on the failure to reject the null hypothesis. This formed the main justification for the preferential selection of the random effects model over the fixed effects model.

The random effects model indicates that 1% increase in **profitability** (ROC) was associated with a decline of 0.2513% in leverage (DCR) *ceteris paribus* at a significance level of 5%.

This outcome favours the pecking order theory, which supports that there is a negative relationship between profitability and leverage. Oil and gas companies that are very profitable have a strong preference for the use of retained earnings to finance their operations rather than debt and equity. The outcomes are generally consistent with studies conducted by Rajan and Zingales (1995), Booth *et al.*, (2001), de Jong *et al.*, (2006) and Chakraborty (2010).

#### 4.5 Random Effects Generalised Linear Regression Estimates

Table 5: Random Effects Generalised Linear Regression

Response variable: DCR

| Regressor         | Coefficient | Standard Error   | P -Value |
|-------------------|-------------|------------------|----------|
| <b>ROC</b>        | -0.2513     | 0.1305           | 0.0500   |
| <b>LQR</b>        | -0.0322     | 0.0147           | 0.0240   |
| <b>COP</b>        | -0.0027     | 0.0012           | 0.0270   |
| <b>SZF</b>        | -0.0533     | 0.0265           | 0.0440   |
| <b>TGB</b>        | -0.0822     | 0.1091           | 0.6660   |
| <b>C</b>          | 1.9156      | 0.5644           | 0.001    |
| <hr/>             |             |                  |          |
| Wald $\chi^2$ =   | 21.7800     | <b>R-squared</b> |          |
| Prob > $\chi^2$ = | 0.0006      | Within =         | 0.3823   |
|                   |             | between =        | 0.8083   |
|                   |             | Overall =        | 0.4206   |

Source: Author's computation based on data from financial statements from 2010 to 2018

1% appreciation in **liquidity** was found to be significantly associated with a decline of 0.0322% in leverage *ceteris paribus* at 5% level of significance. Most associated theoretical and empirical literature predicted that there would be a negative interrelation between capital structure and liquidity. Oil and gas companies which are highly liquid preferentially rely on shareholder's equity in their capital structure more than debts. The obtained results are in sync with the research work conducted by Lipson and Mortal (2009).

In terms of the **crude oil price** - leverage relationship, it was discovered that 1% increase in crude oil price was associated with 0.0027% decline in leverage *ceteris paribus* at a significant level of 5%. This negative association is primarily due to the difficulty associated with the acquisition of collateral-based loans to finance oil and gas operations. The value and nature of most primary oil and gas assets that can be used for collateral are more difficult to measure than typical equipment, stocks, and real estates. In addition, volatility of the value of oil and gas assets is significant depending on commodity prices, contract laws, regulations, and the financial competence of the oil and gas firm. Therefore, crude oil price is a pivotal factor in deciding whether to focus more on debt or equity in the capital structure. If crude oil prices go up, oil and gas companies make higher profit margins and are able to use some of their retained earnings to further finance their operations, resulting in a minimised reliance on debt financing. Conversely, lower crude oil prices reduce profit margins and force oil and gas companies to resort to the incorporation of debt financing.

It was also discovered that 1% increase in **firm size** was associated with 0.0533% decline in leverage *ceteris paribus* at a significant level of 5%. This outcome is not in support of both the Trade-off and Pecking order theories, which predict a positive relationship between firm size and capital structure (leverage). However, this finding is consistent with preceding research conducted by Rajan and Zingales (1995), Bas *et al.*, (2009) and Alves Pereira and Ferreira (2011).

**Tangibility** was found to have an insignificantly negative association with leverage. This could be as a result of the difficulty faced by most oil and gas firms in getting tangible oil and gas assets to be used as collateral for loans from financial institutions.

#### 4.6 Goodness of Fit ( $R^2$ ) and Overall Performance of the Model

The model was discovered to be generally a suitable fit for the panel data. This conclusion is based on the R-squared of 0.3823, 0.8083 and 0.4206, representing the extent to which variances within, between and overall the panel units (Oil and Gas companies) respectively, are accounted for by the random effects model. The collective statistical performance of the model showed a *Wald Chi<sup>2</sup>* of 21.78 with a corresponding probability value of 0.0006, indicating that the predictor variables are collective influential factors that impact on leverage as far as oil and gas companies in Ghana are concerned.

### 5. Conclusions

The purpose of the paper was to explore the factors that influence the capital structure of 4 major oil and gas companies operating in Ghana using panel data analysis from 2010 to 2018. A random effect generalised linear regression model was employed with debt-to-capitalisation (Leverage) ratio as the predicted variable and the 5 regressors (profitability, tangibility, liquidity, crude oil price, and size) as determinants of capital structure. The results of the estimation model showed that profitability had a significantly negative relationship with leverage. This finding was in agreement with research by Mihaela *et al.*, (2015), Rajan and Zingales (1995), Booth *et al.*, (2001), and Chakraborty (2010). Additionally, a negative and significant link between liquidity and leverage was discovered. The outcomes of the random effect regression analysis also revealed that firm size had a strikingly negative association with leverage. Finally, crude oil price, being the only exogenous variable also had a significantly negative relationship with leverage.

The study suggests managers of these oil companies exercise caution when contemplating debt as a source of financing since capital structure and its determining factors considered in this study have a negative association. The pecking order hypothesis suggests that they should endeavour to finance their activities using retained earnings and equity and turn to debt as a last resort. However, crude oil price volatility is an inevitable risk in the oil and gas sector, and has the potential to reduce the profitability of oil and gas firms. When profitability is reduced, potential equity providers are driven away due to loss of confidence, resulting in the ultimate resort to debt acquisition. Oil and gas risk and financial managers therefore need to monitor crude oil price trends regularly and select appropriate crude oil price hedging instruments that minimise any negative impact on decisions on capital structure strategies.

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