University of Nottingham

IMPACT OF RESERVE AND DECOMMISSIONING DISCLOSURES ON VALUE AND PERFORMANCE OF LISTED OIL COMPANIES IN THE UK

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DEDICATION

To My Wife Fatma Darrat
Thank you very much for all your Sacrifice, Patience, love and Support

To the Memory of My Father Salem, may Allah bless his soul and To My Mother Majida
To my dear sons, Salem and Abdulmalik, I see myself in both of you, and I wish you a bright future.

DECLARATION

I hereby affirm that this thesis was written by yours truly, and the report detailed in it has not been formerly acquiesced in any previous application for a degree. The creation of this thesis is the author's own research. It should not be cited in any published material without written consent from the stated author; intelligence extracted from the document should be alongside a fair acknowledgement.

Suliman Salem Alshahmy

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ABSTRACT

Owing to risk and uncertainties, and the significant capital investments required for oil and gas investments, companies operating in the oil and gas industry are unique in comparison with companies in other industries. Oil and gas reserves and decommissioning of oil and gas assets represent the most significant cash flow in the oil and gas industry. Thus, with uncertainty of reserves and decommissioning, investors have to rely on the disclosures of oil and gas firms to determine an estimated value that would translate into future cash inflows to the company. The aim of this study is to examine the impact of oil and gas reserve disclosures and disclosures of decommissioning costs of oil and gas assets on the financial performance and value of oil and gas companies listed in the UK. This study uses qualitative and quantitative approaches to address the main research objective. The total sample included 52 companies under upstream exploration and production of oil and gas. Both descriptive statistics and inferential statistics were used to test the hypotheses developed. The findings revealed that mandatory and voluntary decommissioning and reserve disclosures influence the value and performance of oil and gas companies listed in the UK. In addition, firm-specific characteristics impact on the relationship between disclosure level and the firm's value and performance. The results were verified by interviews with experts from the oil and gas industries. The interview outcomes supported the study's statistical results and provided even deeper and logical explanation for reserves and decommissioning disclosures influencing oil and gas firms' performance and value. The findings contribute to the bridging of gaps in the literature and provide ways potentially to increase the level of disclosure among oil and gas companies. In addition, the findings enable better valuation of companies and increase investors' support to oil and gas firms leading to long-term sustainable performance.

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LIST OF ABBREVIATIONS

AAF	Attributes of Analysts' Forecasts
AIMR	Association for Investment Management and Research
ANOVA	Analysis of Variance
CIC	Corporate Information Committee
DisMDQ	Mandatory Decommissioning Disclosure
DisMRQ	Mandatory Reserve Disclosure
DisVDQ	Voluntary Decommissioning Disclosure
DisVRQ	Voluntary Reserve Disclosure
EBITDA	Earnings before Interest Tax Depreciation and Amortization
FAF	Financial Analystes Fédération
FIBV	Fédération Internationale des Bourses de Valeurs
GRI	Global Reporting Initiative
IAS	International Accounting Standards
IASB	International Accounting Standards Board
IFRS	International Financial Reporting Standards
LSE	London Stock Exchange
MV	Market Value
OCF	Operational Cash Flow
OFR	Operating and Financial Review
P/E	Price to Equity Ratio
ROA	Return on Assets
ROE	Return on Equity
ROCE	Return on Capital Employed
RRA	Reserve Recognition Accounting
SORP	Statement of Recommended Practice
CSR	Corporate Social Responsibility
UK	United Kingdom
OIACOil	Industry Accounting Committee
WFE	Word Federation of Exchanges

SEC	Securities and Exchange Commission
NVivo	Software using for content analysis
SPE	Society of Petroleum Engineers
SALES	Sales (also referred to as Turnover)
EBITDA	Earnings before Interest Tax, Depreciation and Amortization
PROFITS	Net Income, also known as After-Tax Profits
OPROF	Operating Profits (Earnings before Interest and Tax)
MCAP	Market Capitalization is the value of the firm in capital markets.
ASSETS	Asset denotes the Total Assets at the end of the period.
PRICE	Stock price
TOBQ	Market Value over the Replacement Value assets
UKCS	United Kingdom Continental Shelf
PRMS	Petroleum Resources Management System
RBL	Reserve Based Lending
R&DDI	Reserve and Decommissioning Disclosure Index

CHAPTER ONE: INTRODUCTION

1.1. Background

In many industries, disclosures play a significant role in the oil and gas industry. Stakeholders such as investors and governments constantly require disclosures for decision-making purposes (Byard and Shaw, 2003; De Abreu et al., 2016). Owing to their significant cash flow effects, oil and gas reserves and decommissioning of oil and gas structures represent significant events for oil and gas companies. Thus, disclosures relating to reserves and decommissioning are important information required by investors. However, companies may not provide sufficient information about these two items (Arnott, 2004; Standard and Poor, 2007).

Previous research around accounting disclosures by oil and gas companies has focused on reserves linked with either the firm's performance or value (Spear, 1994; Aboody, 1996; Bryant, 2003; McChlery et al. 2015; Ani et al. 2015; Misund and Osmundsen, 2015; Patatoukas et al. 2015; Misund, 2017; Misund, 2018), with very limited research having tackled decommissioning-related disclosures and without any study measuring the impact of decommissioning disclosures on a firm's performance or value. Furthermore, no study so far has focused on the effect of reserve and decommissioning disclosures in one piece of work; therefore, the purpose of this study is to investigate the impact of reserves and decommissioning disclosures on both the value and performance of oil and gas companies listed in the UK.

1.2. Concept of disclosure in oil and gas companies

Disclosure is defined by Salehi et al. (2017, p 35) as the communication aspects of corporate governance and financial performance of firms by the management to other stakeholders outside of the firm. However, there are two categories of disclosure: mandatory and voluntary. Stoner and Sangster (2013) confirm that, in the UK, the adoption of International Financial Reporting Standards (IFRS) was made as a mandatory requirement from 2005, and so disclosure requirements of IFRSs are binding for oil and gas companies listed on European stock exchanges, as well as in the UK. Moreover, the Statement of Recommended Practice (SORP)[1] provides guidance on a

[1] SORP is formulated by the Oil Industry Accounting Committee (OIAC) in the UK. The document was updated last in 2001 and gives guidance on various additional voluntary disclosures for the oil and gas industry. The SORP is, however, no longer mandatory.

range of additional voluntary disclosures in the UK's oil and gas industry (McChlery et al. 2015).

It is argued that the most important disclosures in the oil and gas sector are related to oil and gas reserves and decommissioning of oil and gas installations. This is because these two items have the most significant impact on cash flows. However, the uncertainty that surrounds the estimation of reserves and decommissioning of oil and gas as well as the costs associated with data collection on reserve and decommissioning disclosure is sufficient for investors. Disclosure of oil and gas reserves is linked to a number of factors such as leverage, cash flow risk, corporate governance, firm size, and identity of auditors (McChlery et al., 2015). Ani et al. (2015, p. 99) found that "a number of firm characteristics, such as size, size of audit firm, debt capital and listing status is significantly affect the extent of disclosure of oil and gas reserves information in the UK". Thus, these characteristics play an important role in determining the quality of oil and gas reserve disclosure; therefore, a relatively high level of estimation and subjectivity is involved.

Owing to their cash inflow effects, disclosures of reserves have the potential for impacting on the value and performance of oil and gas companies. On the other hand, decommissioning is the process that comprises the removal of relevant structures and industrial installations the productive life of which has ended and the consequent restoration of the site to an appropriate standard (Rogers and Atkins, 2015; Abdo et al., 2018). Decommissioning represents a significant part of the financial risk of oil and gas companies because significant cash outflow is required to decommission oil and gas assets (Standard and Poor, 2007). As opposed to the US, where companies are required to set up a decommissioning fund, Aldersey-Williams and McKenna (2016) highlight that in the UK there is no regulation requiring oil and gas firms to have sinking funds or cash set aside to meet decommissioning obligations. This means that, after cessation of production, oil and gas companies are expected to fund decommissioning from their current cash. Moreover, based on the fact that decommissioning liabilities are included in the provisions sections of balance sheets, however the amount of provision is far much less than the actual costs incurred by companies in decommissioning their assets (Odo et al. 2016).

1.3. Motivation for the study

Few studies have tackled decommissioning obligations and disclosures of decommissioning costs via oil and gas firms. In this context, Russell et al. (1998) reviewed the present situation at that time of accounting for the abandonment of the oil and gas structures in the UK North Sea and established that companies only disclose as far as is required by the Statement of Recommended Practice (SORP) but few, if any, voluntary disclosures are made. Also, Standard and Poor (2007) highlighted that when it comes to reporting on decommissioning obligations, very little additional information is provided.

In a study to examine empirically the determinants of voluntary disclosures of oil and gas companies, McChlery et al. (2015) argue that, within an environment of complete voluntary disclosure, there was no compliance with the requirements of the SORP or Operating and Financial Review (OFR) by most of their sampled companies. This lack of compliance was attributed to increasing political and propriety costs in comparison to agency benefits.

Rogers and Atkins (2015) evaluated oil and gas decommissioning liabilities within the framework of an environmental disclosure report card which are five financial reporting objectives. This study was conducted in the USA between 2003 and 2014 for oil and gas companies registered with the US Securities and Exchange Commissions (SEC). The results indicated that actual performance of oil and gas companies, based on five financial decommissioning reporting objectives, which were the comparability across companies and reporting periods, accuracy of estimates, funding and forecasting constituted extremely poor reporting.

Despite the numerous studies related to the effect of disclosure level on value and performance of companies, none has examined the concept of disclosure quality pertaining to both reserves and decommissioning costs of oil and gas companies listed in the UK. Although there seems to be agreement with regard to the impact of disclosure on value and performance, this appears only to hold true in certain circumstances. The oil and gas industry appears to be more sensitive to news; therefore, disclosures of good news may lead to enhancing valuation of firms, while disclosure of bad news may lead to negative impacts on either, or both, a company’s value and performance. In this regard, disclosures related to reserves and decommissioning offer different types of news as reserves disclosures are expected to be treated as good news and decommissioning related disclosures are expected to be considered as bad news. Oil and gas reserve disclosure mainly provide evidences about the value of a company's oil and gas properties and how those properties contributed to the current financial period performance, as such good news is useful and important in making rational investment, credit by sending good signal to the investors which reflect on predictive firm's value (Mirza and Zimmer, 1999; Wright and Skousen, 2010; Tamimi and Sebastianelli, 2017). Berry and Wright (2001) argue that oil and gas reserve disclosure provide positive future cash flow information to the shareholder which is used by them as good news affecting the share price and market value.

On the other hand, decommissioning disclosure can be seen as negative news of cash outflow which might affect share price and firm's value in the market in an opposite way of reserve disclosure. Therefore, decommissioning disclosure may be received by investors as bad news that might lead to loss of competitive advantage for the oil and gas companies (Abdo et al., 2017; Abdo et al., 2018). As such, investors may not be as interested in the extent of disclosure but rather its content. Bad news disclosure can impact companies abilities to raise funds for further investments, and this will impact their cost of capital Therefore, such news impacts companies' cash flow and accounting profit negatively (Linsley and Shrives, 2006; Abdullah et al., 2015; Rogers and Atkins, 2015). Rogers and Atkins (2015) confirm that decommissioning disclosure is bad news reflected on company's performance in the period following the standardisation of reporting of decommissioning as asset retirement obligations. This could be explained as the difference between impact on performance or value of oil and gas firm.

There are many studies on disclosures' impact on companies' value or performance (see Appendix 1). However, no study has combined consideration of both reserve and decommissioning disclosures and their impacts on the value and performance of oil and gas companies listed in the UK. Hence this is where this study makes its contribution. Disclosure has been shown potentially to cause differential impacts on company value and performance. This study, therefore, attempt to investigate the impact of disclosures on the value and performance of oil and gas companies listed in the UK. The reason for investigating the impact of reserve disclosure and decommissioning disclosure in this study together is that they are the most significant in and out cash flows in the oil and gas companies' life. The estimation of the decommissioning activities in the UK for the period from 2019 to 2028 account for 28% from 85 billion dollars of total global decommissioning experience (Oil & Gas UK 2019a). Decommissioning oil and gas assets in the UK is relatively new business, and actual decommissioning costs far exceed estimates of decommissioning provisions (Abdo et al., 2017); therefore, disclosures of decommissioning obligations are met with caution by stakeholders.

Specifically, this study examined the impact of reserve and decommissioning disclosures on the value and performance of exploration and production oil and gas companies listed in the UK. This is to establish whether there is a significant difference in value and performance resulting from each of these two disclosures individually and collectively. Moreover, the study examined the effect of underlying firm characteristics on the level of disclosure and investigated the reception of stockholders of the study's empirical results.

1.4. Research problem

Oil and gas companies have high asset values, and the bulk of their assets consist of structures and machines used for exploration and production activities. This means that in the case of decommissioning, the asset value is lost to some extent in addition to the fact that it depreciated during the field's life. Also, the biggest asset of such firms is the oil and/or gas reserve, as it determines the period within which the field remains productive and is the main source of revenue for the company. Reserves and decommissioning represent the biggest cash elements in the oil and gas industry, with an estimated amount of remaining recoverable reserves at about 20 billion barrels for next 20 years (Oil and Gas Authority, 2018b) and an estimated decommissioning cost of £15 billion for the next decade, and neither of them is presented in financial statements (Oil and Gas UK 2019a). Thus, with uncertainty of reserve quantities, values and decommissioning costs, investors have to rely on the disclosures of oil and gas firms to determine an estimated future cash flow that would translate into the value of the reporting entity.

Disclosures can be classified as voluntary or mandatory, and they offer bad and good news. Discovering oil and gas reserves in commercial quantities promises cash inflow to the company, but decommissioning oil and gas assets implies cash outflow. Therefore, disclosures related to reserves and decommissioning offer different types of news, as reserve disclosures are expected to be treated as good news and decommissioning-related disclosures are expected to be considered as bad news. Given the lack of studies on the combined impact of these two different disclosures, there is no clear idea of the importance of disclosing decommissioning-related information. Therefore, stakeholders may not have a clear view on the impact of these disclosures on companies' performance and/or value. However, does disclosing decommissioning-related information always have a negative impact on companies' value and performance? Also does disclosing reserves-related information always have a positive impact on performance and value of reporting companies? How does the combination of voluntary and mandatory information related to reserves and decommissioning impact on the value and performance of oil and gas companies? These questions have never been tackled before in relation to oil and gas companies listed in the UK. This study is going to answer these questions and sets them out clearly in section 1.6 of this chapter.

1.5. Research aims and objectives

This study aims to examine the impact of mandatory and voluntary disclosures of oil and gas reserves and decommissioning obligations of exploration and production oil and gas companies listed in the UK on these companies' value and performance. More specifically, the objectives of this research are:

i. To determine the level of mandatory and voluntary disclosures of reserves and decommissioning costs of exploration and production oil and gas companies listed in the UK;
ii. To determine the impact of listing status on the market and accounting methods on the level of reserve and decommissioning disclosure among exploration and production oil and gas companies listed in the UK;
iii. To examine the impact of reserve and decommissioning disclosure levels on the performance and value of the exploration and production oil and gas companies listed in the UK;
iv. To determine the impact of firm-specific characteristics on the relationship between disclosure and firm performance and value of exploration and production oil and gas companies listed in the UK;
v. To verify the empirical results of the impact of reserves and decommissioning disclosure on firm performance and value; and

vi. To gather perceptions of key stakeholders of the impact of reserves and decommissioning-related disclosures on exploration and production oil and gas companies' value and performance.

1.6. Research questions

i. To what extent do exploration and production oil and gas companies listed in the UK comply with reserves and decommissioning disclosure requirements?
ii. To what extent do the listing status in the market and accounting method influence the level of reserve and decommissioning disclosures of exploration and production oil and gas companies listed in the UK?
iii. To what extent do voluntary and mandatory disclosures of reserves and decommissioning costs impact on the financial performance of exploration and production oil and gas companies listed in the UK?
iv. To what extent do voluntary and mandatory disclosures of reserves and decommissioning costs impact on the value of exploration and production oil and gas companies listed in the UK?
v. What firm characteristics influence the relationship between disclosure and performance/value of exploration and production oil and gas companies listed in the UK?
vi. What are the perceptions of key stakeholders about the impact of mandatory and voluntary reserves and decommissioning disclosures on exploration and production oil and gas firms' performance and value?

1.7. Overview of research methodology

In this study, the researcher utilised various data collection methods to test empirically the impact of reserve and decommissioning disclosures on a company's value and performance. The study adopted quantitative-based methods, using content analysis in a quantitative manner by scoring the disclosure quality through the reserve and decommissioning disclosure index (see section 2.6.3 for more details). Performance and value were calculated alongside other variables, and the researcher estimated a cross-sectional regression on the sampled companies to determine the effect of disclosures on performance and value. In addition, this study used interviews with oil and gas stakeholders as a qualitative method, after revealing the empirical results, and investigated the perception of stockholders about them as one of the study's objectives was to verify and understand better the results obtained.

The target population included all the 111 exploration and production oil and gas companies listed on the London Stock Market (80 in the Alternative Investment Market (AIM) and 31 in the Main Market) as of October 2018, as shown in Appendix 3 (oil and gas producer firms listed in the London Stock Market as of October 2018).

The study reviewed the annual reports of all 111 exploration and production oil and gas listed companies on the LSE. The final list of companies studied that met the sampling/inclusion criteria and were in upstream oil and gas and in production stage included only 52 companies, as shown in Appendix 4. In this regard, the study eliminated firms that were not in production stage, or those that were not upstream oil and gas companies as well as firms with missing data for the study period.

Data were collected from annual reports and accounts of the sampled 52 companies (52 × 8 years = 416 observations) in accordance with Bowen (2009). The annual reports for the period 2010 to 2017 were published on the 52 companies' websites. Content analysis was used to evaluate the level of reserve and decommissioning disclosures and to determine the accounting methods used. This approach is adapted from Beattie et al. (2004, p. 25), who measured disclosure quality by examining the narratives in the annual reports of firms against an established index for mandatory and voluntary disclosures.

This eight-year period has been selected starting from 2010. This was to avoid the impact of the 2007/08 international market crises which may have caused irregular disclosure practices, and unusual changes in companies' performance and value due to factors linked to the financial crisis. The justification for the use of the 2010–2017 period is that oil and gas companies were made aware of an International Accounting Standards Board (IASB) discussion paper back in 2010 (IASB, 2010a), and they may have started to prepare their disclosures in according with it.[2] However, since the project started by the IASB in 2010, these requirements may have changed. Therefore, the 2010–2017 period is ideal for this study.

[2] The IASB, in 2010 published a discussion paper under the title: 'Extractive Activities'. More details can be found in this link: https://www.ifrs.org/-/media/project/extractive-activities/dp-extractive-activities-april-2010.pdf.

Moreover, decommissioning activity in the UK has been confirmed to be growing in recent years, with the total decommissioning expenditure in 2014 at £1.6 billion, and in 2015 at £2.1 billion. Furthermore, the total amount forecast to be spent on decommissioning between 2016 and 2025 is £17.6 billion (Antonas and Hammerson, 2016). This means more decommissioning disclosure will (or should) be presented in the annual reports.

The data on the disclosure scores were collected manually and the automated disclosure scores gathered using NVivo software. Data were collected directly from the annual report of the sampled companies. This qualitative data was converted by allocating values of a numeric value of 1 for disclosure of a given item and 0 for non-disclosure and a total disclosure index developed. This enabled the calculation of the developed index totals and percentages for the voluntary and mandatory disclosure quality variables.

The data for the calculation of the value and performance of the companies were derived directly from the Bloomberg database. The choice of this database was informed by the availability of the information sought on the research variables. Following the computation of value and performance, SPSS software was used to produce quantitative analyses. Further independent t-tests were conducted as required by the researcher to help in further quantifying relationships and more accurately answering the research questions.

Interviews as a qualitative method have been used in this research to help in verifying the study's statistical results. The interviews with certain stockholders in the oil and gas industry afforded a deeper understanding of the managers' attitude to the reserves and decommissioning (as agents) and also how the investors evaluated the signalling of reserve and decommissioning disclosures.

1.8. Summary of research contribution

The findings contribute to the bridging of gaps in the literature and provide ways potentially to increase the level of disclosure among oil and gas companies. In addition, the findings enable better valuation of companies and may help increase investor support to oil and gas firms, leading to long-term sustainable performance. As far as the literature review is concerned, most of the empirical studies focused on measuring disclosure through identifying variables that might have a relationship with level of disclosure. This study focuses on, and is directed by, three related literature themes: reserve disclosures, decommissioning disclosures, and a firm's performance and value. The literature demonstrates that there is a strong relationship between mandatory and voluntary disclosures and a firm's value and performance. Furthermore, the firm's disclosure (level or quality) is motivated by the firm's specific characteristics.

The theoretical perspective that this study is based on are that signalling and agency theories seem to be relevant to disclosure of oil and gas reserves as being good news, and decommissioning costs and obligations as being bad news. This study, therefore, employs both of these theories in explaining firm behaviour as they pertainsto mandatory and voluntary disclosures related to reserve and decommissioning and how that behaviour impacts on the value and performance of the firms.

Also, an important contribution, especially through the qualitative analysis, is that there is an urgent need for harmonising of both mandatory and voluntary requirements on an international level for upstream oil and gas companies, and that these should be adhered to, to estimate the reserves and decommissioning costs. The oil and gas industry can improve decommissioning disclosures by introducing specific regimes about what companies need to do, and how they need to do it, during the decommissioning process. This will enhance transparency and consistency, and help iron out some of the persistent uncertainties, especially for the investors, which will ensure fairness in how information is analysed.

1.9. Thesis structure

This thesis has seven major chapters to enable a clear and coherent flow.

Chapter one provides the background to the study, where the concept of disclosure in oil and gas companies is introduced. Motivations for the study and the problem statement for the study are also outlined. A major section of chapter one includes the research aim and objectives on which this thesis is based. Furthermore, this chapter includes the overview of research methodology and summary of research contributions.

Chapters two and three comprise the theoretical framework and empirical literature review, where past studies are discussed with the aim of highlighting the research gaps . The importance of corporate disclosure, disclosure level, types of corporate disclosures and relevant theories are discussed. The literature review is divided into two chapters detailing the research hypotheses and explains the conceptual theoretical framework for the study.

Chapter four reviews the reserves and decommissioning of the oil and gas industry in the UK. This chapter is designed to explore the oil and gas sector contribution to the UK economy, its history and the background of the oil and gas sector in the UK, then provide information on oil and gas reserves, production, exploration and decommissioning.

Chapter five is concerned with research methodology, where research design and paradigms followed are explained. Data collection is explained in chapter five including validity and reliability, data collection instruments and analysis used in the study. The various variables of interest are also discussed in this chapter.

Chapter six presents the results, findings and discussion in line with the study objectives and research questions. In essence, findings on the level of Mandatory Reserve Disclosure by accounting method, impact of disclosure levels on firm performance, and impact of disclosure levels on firm value are outlined.

Chapter seven presents the research discussions. This chapter also reveals the results of interviews regarding stockholder perception to support the empirical results of this study.

Chapter eight provides the conclusion of the study including the summary of findings and the implications of the study. The chapter ends with the limitations and contribution to future research.

CHAPTER TWO: TYPS AND MEASUREMENTS OF ACCOUNTING DISCLOSURE

2.1. Introduction

This chapter is anxious with the literature review on corporate disclosures, types, methods, measurements and disclosure index, where previous studies are discussed with a view to developing the research aim. The purpose of financial reporting is to arrange financial information regarding the particular firm which is useful for existing and potential investors, lenders and other creditors in order to take decisions for providing resources to the firm (International Accounting Standards Board, 2015; Sovbetov, 2015). This takes the form of formal and informal means of disclosure by firms. Most of the formal means of disclosure are mandated by law, while the informal ways of disclosure are voluntary practices by the reporting companies. These disclosures vary in terms of quality of reporting, and as such, their impacts also vary. Researchers have argued that high-quality disclosures may result in an increased value and performance of listed firms, although counter arguments also exist (Bushman and Smith, 2003; Salehi et al., 2017). Disclosure is therefore important for ensuring the efficiency of the market. However, the disclosure index as a tool for measuring the level or quality of mandatory and voluntary disclosures has been adopted by this research to evaluate the oil and gas reserve and decommissioning disclosures levels.

This chapter deals with the following topic: the importance of corporate disclosures, the quality and types of corporate disclosures, methods of disclosure measurements, disclosure index construction and reliability and validity of a disclosure index.

2.2. Importance of corporate disclosures

The emergence of companies that are owned through many different shareholders and the separation between management and ownership has increased the importance of corporate disclosure (Donnelly and Mulcahy, 2008). Moreover, the broader acknowledgement of business’s social responsibility in the last few decades has notable implications for the practices of corporate disclosure (Gelb and Strawser, 2001). This has placed emphasis on the efficiency of the allocation of the wealth and resources belonging to a society by obliging organisations to operate responsibly and to disclose the extent of their social responsibility. The purpose is to create congruence between organisations' activities and the values and ethics of the society that owns the resources. The idea of social responsibility is now wider and includes the control of pollution, the generation of employment and civic amenities leading to increased interests among groups such as local communities, employees, the general public and social groups. These groups continue to have critical influences on reporting and accounting disclosures (Raufflet et al., 2014).

Companies usually disclose information through the financial statements and their notes, analysis and management discussions and other channels of reporting, such as press releases and websites (Shiri et al., 2016). Some companies also disclose information through forecasts by management and dissemination through the press, in addition to press releases (Byard and Shaw, 2003; Arnott, 2004; Shiri et al., 2016).

Corporate disclosures aim to lead to the provision of relevant and reliable information to the interested stakeholders for the purpose of their decision making. Disclosure requirements lead to the classification and proper recording of the business's economic transactions. As such, corporate disclosures are expected to make available the true outcomes of business operations as well as a fair picture over a specific period. This further increases the capability of estimating the future trends of the business with increased accuracy. This can only be possible in a situation where the financial statements are prepared according to disclosure rules and regulations. Therefore, there is a need for the inclusion of all the material information that is of relevance to the various stakeholders for their decision making.

The importance of corporate disclosures that provide significant financial information and transparency is that such disclosures lead to an increase in the ability of corporate disclosure users, such as investors, to evaluate the performance and value of the company.

2.3. Disclosure quality

The quality of disclosure can be regarded as reflecting the accuracy of suspicious investors' beliefs concerning the value of exchange following their reception of disclosed information (Salehi et al., 2017). Forker (1992) defines disclosure quality as the distributional attribute of an event that is uncertain. Quality is characterised by full disclosure, compliance, comparability and transparency (Hla et al., 2013). Moreover, Kai and Matsunaga (2015) describe disclosure quality as the general effectiveness of the communication that takes place between the management and the investment community. This definition nevertheless does not take into account that disclosures target a wider stakeholder group than just investors. Salehi et al. (2017) also define the quality of disclosure as its relevance, correctness and reliability that are enhanced through the independence of financial audit. According to Chiu and Wang (2015), high quality in corporate social disclosure occurs when annual reports are developed in line with the Global Reporting Initiative (GRI) standards[3].

When these definitions are combined, disclosure quality is regarded as encompassing informative content that adheres to certain standards, is correct, relevant and reliable, timely and eliminates any suspicions, leading to more informed decision making by relevant stakeholders. As it pertains to standards, disclosure quality of information reported by companies listed in the UK is therefore measured by the level of compliance with the UK national Generally Accepted Accounting Principles (GAAP) and the International Financial Reporting Standards (IFRS). The correctness, relevance and reliability may be attributed to the independence of the audit although investor confidence is influenced by the disclosure levels.

Firm transparency is further regarded by Bushman and Smith (2003) as the accessibility of a broad scale of reliable and relevant information concerning the firm's financial position, periodic performance, value, governance, investment opportunities and risk. This means that transparency concerns availability and relevance while quality relates to compliance with IFRS. Transparency and compliance are regarded by Khiari (2013) as a significant part, and among the major indicators, of the effectiveness of the structures of corporate governance. This makes the terms 'quality' and 'transparency' more common and of importance in the disclosure literature.

Salehi et al. (2017) define transparency as the standards through which events, judgements and occurrences, as well as estimates, are revealed in financial statements. Moreover, transparency in disclosure is a mix of conservatism and timeliness. While conservatism is the allowing reflection of bad economic news faster than reflect of the good economic news within the financial statements, punctuality is the level at which current events are recorded within financial statements (Salehi et al., 2017). Shaw (2003) indicates that there is a negative relationship between disclosure quality and the timeliness with which bad news is captured by accounting earnings. This implies that

[3] The GRI is an organisation that has afforded guidance on sustainability reporting since 1997. This guidance has become a key guiding principle for pest practices in sustainability reporting and is widely used across many industries.

quality disclosure adheres to acceptable standards for transparency, compliance and comparability and is comprised of both good and bad news, with the disclosure carried out in a timely way for purposes of transparency.

2.3.1. *Determinants of disclosure quality*

In determining disclosure quality, firms are influenced at three levels which are driven by the closeness of accountability to specific stakeholder groups (Cormier et al., 2005). The first level for determining quality is considered to be immediate: the firm has a direct accountability to its debt holders and shareholders, providing the incentive for the disclosure of value relevant information for the minimisation of the cost of capital of the firm. Nevertheless, the mix of quality disclosure is determined by trading off the underlying cost of information and the financial condition of the firm. In the second level of determining quality, the firm evolves within a wider societal context: its activities have an impact on other stakeholders such as governments, suppliers, customers, employees and the public at large (Cormier et al., 2005). The firm infers these concerns through the degree of media exposure it faces. Therefore, the quality of disclosure is based on the pressure from these groups. At the third level of determining determining, the institutional environment, encompassing what other firms do, what the company has been doing and the relevant laws and regulations that govern disclosures play a significant role (Cormier et al., 2005).

Disclosure reduces cost of capital and fluctuation in share price, whereas lack of disclosure can affect company capital negatively since shareholders may be misled and their confidence may diminish. The accounting system and disclosure quality has an association with the success of a firm in the market since it leads to trust and reliance of investors on annual financial reports without which it is impossible for market growth to occur. This study is tasked with measuring level of compliance with disclosure requirements by exploration and production oil and gas companies that are listed in the UK.

2.3.2. *Disclosure quantity and quality*

Disclosure quantity refers to the amount of disclosed information, and the clear measurement of disclosure quantity is through content analysis which involves counting the number of words, sentences, and statements that relate to a specific aria of disclosure (Milne and Adler, 1999; Unerman, 2000). However, Marston and Shrives

(1991) provided a review of studies using a disclosure index to measure disclosure quantity, and they argue that measuring the extent of disclosure can be done by index disclosure score but does not essentially indicate the quality of disclosure. Also, Hassan and Marston (2010) clarify that most of the prior studies could not clearly differentiate between the disclosures' quantity and quality.

It seems that there is a difficulty in measuring disclosure quality because of the absence of a general model. Also, there are no reliable and relevant techniques (Eng and Mak, 2003) and none with a sufficient degree of accuracy (Beattie et al., 2004) to measure the quality of disclosure. However, Botosan (1997) assumed that disclosure quality and disclosure quantity seem to be correlated positively. On the other end, Beretta and Bozzolan (2008) arranged empirical evidence that disclosure quantity is not appropriate proxy for disclosure quality. However, a number of studies used statements' quantity as a proxy for disclosure quality (Amir and Lev, 1996; Hussainey et al., 2003; Cerbioni and Parbonetti, 2007; Schleicher et al., 2007; Hussainey and Walker, 2009; Grassa, et al., 2018).

In addition, one of the latest studies, conducted by Alotaibi and Hussainey (2016), explored the influence of CSR disclosure quantity and quality on companies' value. They complete and expand the efforts of Hasseldine et al. (2005, p 2) by "measuring the quality and quantity of CSR disclosure impact on the firm value". They followed Beest et al.'s (2009) approach of capturing all qualitative attributes of information quality and they constructed a disclosure index to measure the disclosure's quantity. Alotaibi and Hussainey (2016) found that CSR disclosure quality and quantity and market capitalisation have been positively associated and both quality and disclosure quantity have the same impact on the firm value.

Finally, it seems that there is still an open debate in the disclosure literature about the measurement of disclosure quality and whether the quantity of disclosure is the proper proxy for disclosure quality. However, following Amir and Lev (1996), Botosan (1997), Beest et al. (1999), Hussainey et al. (2003), Schleicher et al. (2007), Cerbioni and Parbonetti (2007), Hussainey and Walker (2009), Chakroun and Hussainey (2013) and Alotaibi and Hussainey (2016), this study uses the quantity of disclosure as proxy of quality of disclosure by using a disclosure index to measure the level of reserves' and decommissioning costs' disclosure in the annual reports of exploration and production companies in the oil and gas industry.

2.4. Types of corporate disclosures

Disclosures can be classified as mandatory and voluntary. These categories are discussed next in some detail.

2.4.1. Mandatory disclosure

In common law countries, such as the UK, the stock market is the major source of capital, and firms are mandated to disclose information with a high ranking of accuracy and transparency to the shareholders and the investors (Mio and Venturelli, 2013). These disclosures are in accordance with the IFRS requirements. IFRS are regarded as comprising a set of accounting principles and were introduced for the first time by the IASB in 2001 (Sovbetov, 2015). Among the objectives of this mandatory adoption of IFRS is the enhancement of financial reporting, as well as voluntary and mandatory disclosures through the need to set a high-quality standard (Białek-Jaworskaa and Matusiewicza, 2015).

In 2005, the EU made it mandatory for publicly traded companies on EU stock markets to adopt IFRS, and this led to a notable change in consolidated financial reporting as well as disclosure practices (Białek-Jaworskaa and Matusiewicza, 2015). Stoner and Sangster (2013) confirm that, in the UK, the adoption of IFRS was made a requirement for the consolidated financial statements for the publicly listed and traded companies from 1 January 2005.

Choi et al. (2013) state that some researchers consider IFRS as leading to the generation of increased transparency and quality of accounting numbers. On the other hand, the national GAAP is also argued to have come about as a result of evolutionary processes and that they are more adapted to the particular circumstances of their countries. There is a notion that mandatory adoption of IFRS in different countries can produce negative impacts on companies because applying IFRS increases company expenses, particularly when audit fees are very high (Choi et al. 2013).

More particularly, the authors argue that a possible negative impact could arise in the case that IFRS are less useful compared to the national GAAP in valuation and prediction of performance. However, Choi et al. (2013) regard the UK market as having national GAAP that is of the same quality as IFRS and therefore companies listed in the UK may not have experienced material differences in reporting requirements from IFRS mandatory adoption.

Comparability is among the attributes that underlie IFRS, and it is of significance for investors to be able to analyse annual reports of various companies within the same sector with the confidence that the results can be comparable (Hla et al., 2013; Marra and Mazzola, 2014). Castillo-Merino et al. (2014) further argue that, with regard to the impact of IFRS on the cost of equity, the adoption of uniform accounting standards has the potential to enhance firms' financial information comparability across countries and markets. This leads to a decrease in the cost of information and ultimately decreases the asymmetry of information and capital costs (Castillo-Merino et al., 2014). In a nutshell, adoption of IFRS by companies listed in the UK should have impacted on the quantity and quality of disclosures made by these companies, which in turn reduces information asymmetry and thus reduces cost of capital for these companies. Reducing cost of capital should enhance the performance of these companies. This study addressed research objectives that are directed at understanding the impact of oil and gas reserve and decommissioning cost disclosures on the value and performance of exploration and production oil and gas companies listed in the UK. This implies that companies that have a higher level of compliance with the IFRS requirements can be regarded as having higher-quality disclosures. On the contrary, those that have lower levels of compliance can be regarded as having lower-quality disclosures. The implication can, however, be argued based on studies that examine the impact of IFRS adoption on the quality of disclosures. For instance, the study of Aksu and Espahbodi (2016) showed an improvement in the scores of transparency and disclosure for a sample of firms drawn from Borsa Istanbul (BIST) with the firms which had previously adopted IFRS between 2003 and 2004, exhibiting scores that were significantly higher than their counterparts. The authors also realised that "following the mandatory adoption of IFRS in 2005, there was no significant difference between transparency and disclosure scores of voluntary and mandatory adopters of IFRS" (Aksu and Espahbodi, 2016, p 1013). This study therefore attests that, irrespective of whether IFRS is adopted voluntarily or mandatorily, adoption improves disclosure quality. Avwokeni (2016) gathered data on qualitative non-financial and financial disclosures on the basis of core indicators created by the UN Conference on Trade, Aid and Development. The disclosures were before and after the adoption of IFRS. The findings from the analyses of the disclosures reveal that there is an enhancement of disclosures on health and safety, employment creation, environment, welfare and labour practices during the regime of IFRS (Avwokeni, 2016). The enhancement is linked with the size of the firm but not with other characteristics, for instance, ownership, audit identity or the firm's capital structure. This means that the use of IFRS by large companies, such as those in the oil and gas industry, should in effect enhance disclosure quality.

2.4.2. Voluntary disclosure

Voluntary disclosure is described as entailing the choice to disclose non-obligatory information or not (Júnior et al., 2014). According to the voluntary disclosure theory, firms will disclose favourable information to investors and fail to disclose unfavourable information (Júnior et al., 2014). Furthermore, Omran and El-Galfy, (2014) argue that voluntary disclosures is one of signalling means and effected on the firm value.

Voluntary disclosures are divided into five categories: strategic and corporate information, capital and financial market data, information about senior management and directors, information that is forward looking and CSR (Uyar et al., 2013). Strategic and corporate information concerns firm background, competition and market information, also the competitiveness of the firm in the industry, political and economic circumstances that may have an impact on the operational performance of the firm.

Capital and financial data comprise the historical information that is presented in the firm's financial reports and include the key financial ratios, details about wealth creation, review of performance and trends such as share prices, volumes traded and market capitalisation (Ho and Taylor, 2013). These items are considered as the voluntary disclosure elements. Literature on voluntary disclosure theory considers disclosure as a communication tool to stakeholders (Guidry and Patten, 2012). This is based on the assumption that, even in the capital markets that are considered to be efficient, the information about the forthcoming performance of the firm as held by the management is superior in comparison with that of investors. Furthermore, because of the imperfections of the accounting and auditing regulations, there is an incentive by the management towards managing the reporting of financial performance for various reasons, including political, contracting and corporate governance (Guidry and Patten, 2012). Additionally, because of the proprietary costs linked with the information disclosure, non-disclosure is interpreted by the oil investors as bad news. This therefore means that non-disclosure leads to uncertainty with regard to the information held by management. However, the firm's performance determined by the level of disclosures. For instance, considering adverse selection of information, firms that exceed a certain minimum level of performance will disclose additional financial information such as financial ratios and projections of future performance, while those below the minimum will not. In this case, the failure to disclose as a result of being below-minimum average performance may lead investors to consider the firm as averagely, or poorly, performing (Guidry and Patten, 2012).

The focus of voluntary disclosure theory is based on the judgement of companies' management regarding what ought to be disclosed. Disclosure decisions are dependent on organisational characteristics, for instance, performance, practices and the size of the organisation (Uyar et al., 2013). Larger firms may be more inclined to disclose more because of greater scrutiny by stakeholders. In the same way, firms that have strong corporate governance principles are more likely to have developed a practice of increased disclosure. Firms also disclose information based on certain interests, for instance, the need to raise capital and to enhance their legitimacy (Malone et al., 1993).

Not every company chooses voluntarily to disclose information, and the disclosures that occur are of varied quality. This results from the costs of disclosure, which are divided into the costs of measurement, verification, collation and publishing disclosed information. Moreover, costs also include those associated with the loss of strategic discretion as regards the making of public commitments to do with performance or actions that can be verified in the future (Brammer and Pavelin, 2008). The costs of voluntary disclosure include litigation, propriety and opportunity costs, such as those of possible damage to the firm's relationship with their financiers. Proprietory costs may lead companies to disclose as little as possible on both a voluntary and mandatory basis (Abdo et al., 2018).

Voluntary disclosure is related to the cost of litigation that may come with allegations of insufficient disclosure (Elliott and Jacobson, 1994). Elliott and Jacobson (1994) further explain that this has happened in situations where the disclosure of forward-looking information that was followed by declines in share prices resulted in an allegation of companies being engaged in deceptive and misleading disclosure. In this case, fuller disclosure is preferred because of its ability to enable the formation of realistic expectations.

Along the same line, Dhaliwal et al. (2011) discover that voluntary disclosure of CSR information leads to a lower cost of equity capital. Utilising a sample of 34 countries, Francis et al. (2005) further find that expanded policies of disclosure lead to decreased equity and debt capital. Nikolaev and Van Lent (2005), however, state that there is a possibility of endogeneity bias in the studies that estimate the impact of disclosure on the cost of capital. Although the bias may exist, the overwhelming number of studies that support the relationship is a pointer that voluntary disclosure is necessitated by certain motivations.

The disclosure of environmental information has two important components: it indicates the level of companies' awareness of the impact of their activities on the environment and represents the criterion on which stakeholders can judge the magnitude and the degree of the environmental impact, the efforts made by the firm towards its minimisation and its financial implications (Aldrugi and Abdo, 2016). This is relevant to the current study as the decommissioning process involves a great many environment-related issues. Disclosing such environmental obligations as part of decommissioning oil and gas assets may drive the cost of capital of reporting entities down, and thus enhance their financial performance.

2.5. Disclosure measurement

A number of studies has reviewed the literature that relates to measures of disclosure by focusing on individual measures, for instance, the disclosure index and content analysis method (Marston and Shrives, 1991; Jones and Shoemaker, 1994; Abdo et al., 2018). Marston and Shrives (1991) argue that measuring the information disclosed would require counting all the data items, that is, the number of words and numbers, shown in the annual report and accounts. This method is suggested by Copeland and Fredericks (1968) to evaluate disclosure of changes in common stock (Marston and Shrives, 1991).

Beattie et al. (2004) summarised different five approaches to analysis of narratives in annual reports. Figure 2.1 shows these approaches, which are mainly divided between two major approaches: subjective analysts' ratings and semi-objective approaches. The subjective analysts' approach assesses disclosure by using surveys to investigating perceptions of financial analysts. The other main approach is the semi-objective includes disclosure index as a partial type of content analysis, also including textual analysis, and which is divided into three approaches: thematic content analysis, readability studies and linguistic analysis.

Hassan and Marston (2010) also reviewed studies that presented measures of disclosure, and they classified them into two approaches. The authors also added that the first approach involved proxies for disclosure without recourse to the original disclosure medium. This approach included American Depository Receipts (ADR) and the attributes of analysts' forecasts (AAF). The second one provided measures of disclosure obtained by inspecting the original disclosure media(s), which included content analysis, disclosure index, management forecasts, disclosure of good (bad) news and disclosure frequency (Hassan and Marston, 2010).

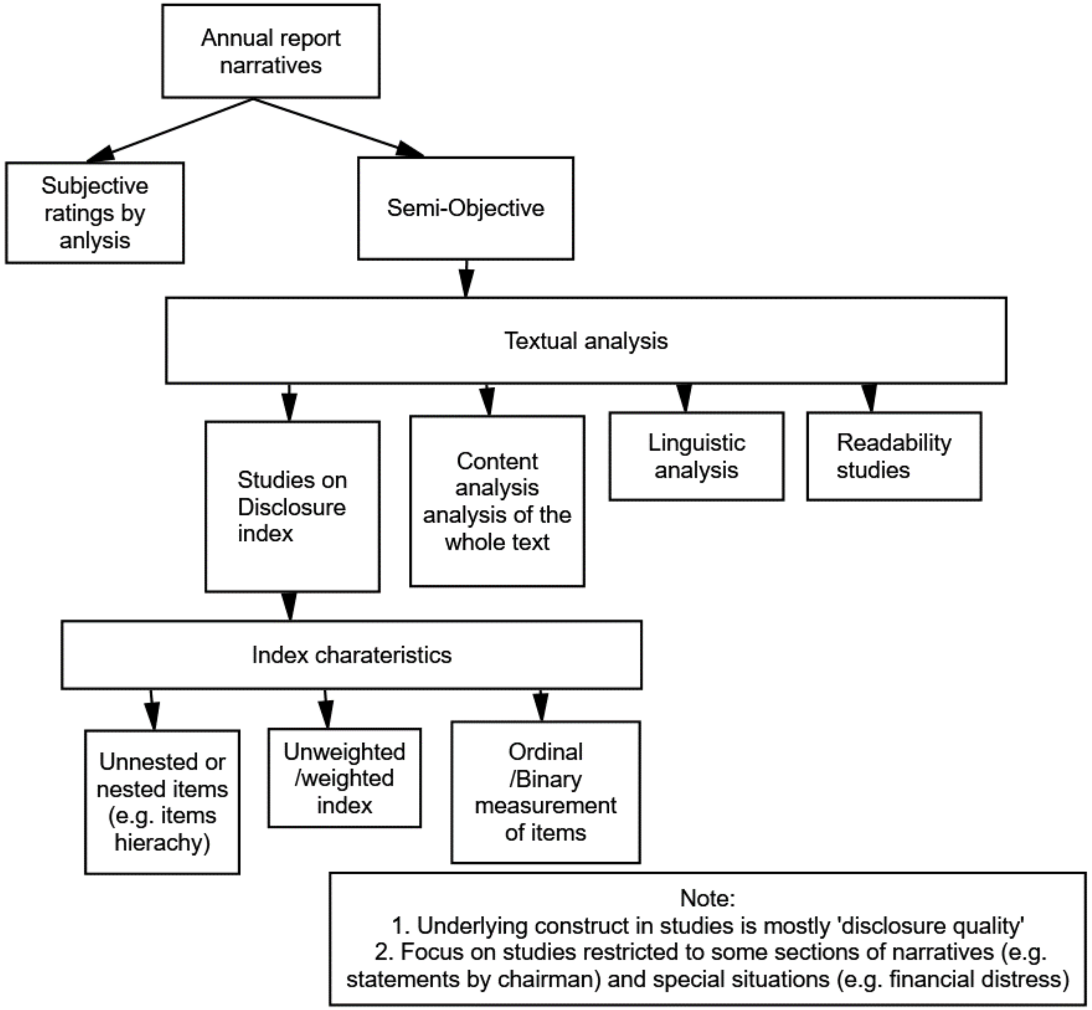

Figure 2. 1: Approaches to the analysis of narratives in annual reports. Adapted from Beattie et al. (2004, 205–236).

The disclosure measurement used in Hassan and Marston's (2010) study includes a self-constructed disclosure index. The rationale for this disclosure measurement was that it has been adopted in past studies (Healey and Palepu, 2000). In addition, constructing the index enables precise measurement to be achieved since the process involves identifying relevant information, exploring the level of mandatory and voluntary disclosures of reserve and decommissioning in annual reports of exploration and production oil and gas firms, modifying the checklist, reviewing the initial checklist and constructing the final checklist.

Healy and Palepu (2001) reviewed the literature that focused on measuring the extent of voluntary disclosure based on the motivation for voluntary disclosure, and the credibility of voluntary disclosure. They divided the prior studies in measuring the extent of voluntary disclosure into three categories: management forecasts, AIMR (Association for Investment Management and Research) survey score which is provides a general measure of voluntary disclosures and self-constructed measures (disclosure indices). The study concentrated on three approaches to measure the disclosure: survey approach, content analysis approach and indices approach. These are discussed next in some detail.

The AIMR data provides a more general measure of voluntary disclosure

2.6. Methods of disclosure measurements

Academic researchers in disclosures developed a number of methods to quantify the parts of quantitative and qualitative disclosures in corporate disclosure.

2.6.1. Survey disclosure approach

This approach examines disclosure level and quality by using survey tools such as questionnaires and interviews which were developed by various organisations. Hassan and Marston (2010) argue that using disclosure surveys is the most common example, which is shown in the results of two surveys performed by the Financial Analysts Federation (FAF) and the AIMR. The actively to encourage improved reporting and disclosure by public firms is the objective of the AIMR's Corporate Information Committee (CIC). The CIC constructed a checklist of criteria that its sub-committees used to evaluate companies' disclosures, and the overall score was generated by the final disclosure ratings (Healy et al., 1999).

As per Hassan and Marston (2010), the FAF and AIMR reports provide an inclusive determine of corporate disclosure and reflect the ratings of a number that reflects the analysts' view of firms overall mandatory and voluntary disclosures. In the FAF report, the complete range of a firm's disclosures evaluated by analysts, summarising their evaluations by a score in each of three categories: a) annual reports; b) quarterly and monthly reports; and c) investors and relevant relations (Lang and Lundholm, 1996; Hassan and Marston, 2010).

Lang and Lundholm (1996) investigate the effect of corporate policies on the analysts' earnings forecasts, the study apply a sample of 751 American companies' results between 1985 and 1989. They used an FAF survey to measure the quality of disclosure. The authors illustrate that firms often voluntarily disclose information beyond that required as mandatory disclosure, which increases information available tousers, such as investors and analysts, and that the increase of disclosure might have an announcement effect on investors' demand from analysts for information and recommendations.

Lang and Lundholm (1996) clarify that the FAF rating assessment factors include both the content of a firm's disclosure and its timeliness. In the "Annual Report" category, analysts assess the informativeness and clarity of the financial focuses and president's letter, the details about the corporate managers, the corporation's targets and product and geographic fragments, and the general level of detail in the financial statements and footnotes (Lang and Lundholm, 1996). Same argument employed by Sengupta (1998) about the association between corporate disclosure and the cost of debt, the same data source as Lang and Lundholm (1996) which is the Report of the Financial Analysts Federation Corporate Information Committee from 311 US firms, from 1987 to 1991. The study provides evidence that companies with high disclosure quality ratings from financial analysts benefit from a lower effective cost of issuing debt. The study used the FAF checklist of criteria for scoring the firms and guidelines for the weights of different disclosure categories. In addition, the findings showed that disclosure quality competed an essential role under uncertain market conditions regarding the cost of debt.

Another study, conducted by Frost et al. (2006), used a survey to measure disclosures. This study examined the associations between market development for 50 of the member stock exchanges of the World Federation of Exchanges (WFE) and the stock exchange disclosure characteristics (rules, monitoring and enforcement). The researchers used the 1998 FIBV disclosure survey and press releases, and exchange website, and other public information suppliers. The goal of the 1998 FIBV disclosure survey was to arrange reasonable information to the FIBV member exchanges on their disclosure practices (Frost, 1999). The survey's questions consisted of three parts. In essence, Frost et al. (2006) reported in their results that there was significant evidence that market development was associated positively with disclosure quality (enforcement, monitoring and disclosure rules)

Hussainey et al. (2003) provided an automated process for scoring a large sample of corporate narrative in the annual report, similar to AIMR-FAF ratings, but this was applied to UK firms. This method of scoring was unlike AIMR-FAF ratings in that it was adaptable to the particular requirements of the research project. The authors provided software to emphasise voluntary narrative disclosure in the annual report and identified keywords that were normally correlated with forward-looking disclosures in the annual report.

In conclusion, the survey approach used interviews and/or questionnaires to reflect the perceptions of users of firms' disclosure practice. However, this approach did not extend to evaluating disclosure policies. The advantage of using ratings such as AIMR is that they provide inclusive evaluate of disclosure influences the quality of formal disclosure in annual reports and informal disclosures made by managers (Lang, 1999; Healy et al., 1999). However, there are some disadvantages in using this approach. For example, the quality of design of the research tool will affect the quality of the results obtained. For example, a poor questionnaire design might result in misleading deduction about disclosures (Hassan and Marston, 2010). Healy and Palepu (2001) also criticise this approach for its lack of clarity from three angles: whether the analysts on this disclosure ranking take the ratings critically, how the firms are selected to be included in the ratings, and the biases that they bring to ratings based on the performance.

2.6.2. Content analysis approach

Content analysis is a research method for composing replicable and authentic deductions from texts to the contexts of their use (Krippendorff, 2004). Morris (1994, p 903) stated that "content analysis is a research technique used to objectively and systematically make inferences about the intentions, attitudes, and values of individual by identifying specified characteristics in textual messages". Krippendorff (2004) clarifies that in order to identify patterns in demonstration and reporting of data, content analysis involves categorising qualitative and quantitative information in predefined classifications, through a systematic, objective and reliable analysis.

According to Unerman (2000), a key assumption underlying the use of content analysis is that quantity of information indicates the importance of the item being disclosed. Thus, determination of the unit of measurement is a critical decision in any content analysis study. Content analysis is to be used in this study to develop themes (from qualitative data) on disclosure levels built on the information provided in annual reports and allow for quantification of the data (e.g., reserve quantum and decommissioning cost).

2.6.3. Self-constructed disclosure index approach

Disclosure indices are one of the instruments being used to measure the range of information reported in specific disclosure media(s) by specific entity(ies) based on an extensive list of selected items. Urquiza, et al., (2010) argue that Self-constructed indices are the most commonly used method to measures and capture different information attributes such as quantity, quality or coverage on most empirical disclosure studies. However, a disclosure index includes mandatory disclosures and/or voluntary disclosures (Marston and Shrives, 1991; Hassan and Marston, 2010). The disclosure index has been broadly used to analyse the narrative information and/or search for specific type of disclosure in the annual report. However, the first study that used the disclosure index was conducted by Cerf (1961). A review of the many studies that used the disclosure index shows that indices were used to explain, assess and compare information disclosed by firms in annual reports (Hassan and Marston, 2010; Marston and Shrives, 1991). Researchers who applied index disclosure tended to use the amount of disclosure as proxies for disclosure quality (Beattie et al. 2004). In addition, according to Botosan (1997), disclosure index studies link the quantity and quality of corporate disclosure positively.

Disclosure indices can be classified in three groups. The first group was described by Beattie et al. (2004), who categorised the self-constructed disclosure index in terms of partial content analysis and holistic content analysis. In the partial content analysis, investigators identified a list of disclosure focusses, then searched in annual reports to find whether these topics existed or not. In the holistic content analysis, investigators examined entire annual reports for constructing their index. The second group was identified by Hassan and Marston (2010). They classified the prior studies in three categories:

- The degree of involvement by the researcher in constructing index from full involvement to no involvement. However, no involvement means that the researcher used the indices available from previous studies or published from professional organisations such as FAF and AIMR.
- The type of disclosure index, for example, mandatory disclosure, voluntary disclosure or both mandatory and voluntary disclosures.

Despite wide use of disclosure indices, there are some limitations to applying this tool to measure the quality of disclosure.

- The number of disclosure items included in a self-constructed disclosure index depends on the researcher's judgement. Thus, in general, studies employing a self-constructed disclosure index select a small sample because of the labour-intensive data collection process. Furthermore, the results of measuring the level of disclosure are appropriate only to the scope of index used (Hassan and Marston, 2010). Healy and Palepu (2001) argue that the limitation of the disclosure studies is the difficulty in measuring the extent of voluntary disclosure. Considering this limitation, researchers who use disclosure indices undertake that the amount of information provided on certain arias is considered a proxy for the disclosure quality (Beattie et al., 2004).

The choice of approach in this study was the use of a disclosure index that includes both mandatory and voluntary disclosures. The holistic content analysis focused on evaluating the annual report to develop a disclosure index to manage and compare the information enclosed by companies. The steps involved in the disclosure index construction are detailed in the section below.

2.7. Disclosure index construction

The construction of a disclosure index involves a number of steps. Hussainey (2004) acknowledged that there are three main stages to implementing the disclosure index: selecting the preliminary list of disclosure subjects, selecting the final list of disclosure subjects and measuring the quality of disclosures. Ahmed (2015) provided five steps for the construction of a disclosure index. These are identifying related information, exploring R&D voluntary disclosure in annual reports, modifying the checklist, reviewing the initial checklist and constructing the final checklist. Furthermore, Hooks et al. (2002) suggested a generic method for public disclosure index. This involved four discrete steps:

- Establishment of a stakeholder panel such as auditor, lender, regulator and academic, to identify the items to be included in the index and their relative importance;
- Construction of the index;
- Application of the index to the annual reports; and
- Feedback of the results to the panel and report preparers to validate the findings.

However, all of these studies are quite similar in their proposal of the disclosure index construction. In this study, one of the main objectives is constructing a disclosure index for mandatory and voluntary disclosure of oil and gas reserve and decommissioning costs of exploration and production oil and gas companies listed in the UK. The construction of the disclosure index involves the following steps:

1] Identify and select the list of disclosure topics

The first step is to identify and select the type and items of information by clarifying the mandatory and the voluntary disclosures. Given that there is no commonly known theory that specifies which specific items should be selected when assessing disclosure level, studies often consider their area of focus when selecting the items (Wallace and Nasser, 1995).

Studies adopting the self-constructing disclosure index tend to include a large number of disclosure topics in order to arrive at the most relevant issues. Moreover, the potential bias and subjectivity during the process is minimised through considering these large numbers of disclosure topics (Hooks et al., 2000, cited in Hussainey, 2004).

Marston and Shrives (1991) acknowledged that subjective judgment associated with the constructed of a disclosure, and the researchers should aim to minimise the subjectivity of the disclosure index. In this study, the list of disclosure topics was identified and selected from the annual reports of the sampled oil and gas companies based on their relevance to decommissioning and reserve disclosure in line with the accounting standards and based on the review of previous studies.

2] Review the list of the disclosure index

After selecting the items in the disclosure index (e.g., information about proved developed reserves, oil and gas reserves' quantity in total or by geographical region, provision of decommissioning cost and the decommissioning cost at the time of establishing the decommissioning asset), the second step is to review the list, using a panel as Hooks et al. (2002) suggested. There are several ways to review this pre-index, including sending it to professionals working in the field (i.e., oil and gas) such as analysts, experts and regulators focusing on the oil and gas field. Conducting interviews with experts could be also another way to review the draft of the disclosure index.

In this study, the researcher sent the index for this study for review to academics who are experts in oil and gas. In essence, dichotomous scores were considered by awarding one (1) for disclosure, otherwise a zero (0) in case of non-disclosure. Different authors have suggested various steps in building a disclosure index. For example,Ahmed (2015) identifies five steps in index construction: identifying the relevant information, exploring R&D voluntary disclosure in annual reports, modifying the checklist, reviewing the initial checklist and constructing the final checklist.

All of the above suggested steps seem to follow a broadly similar process. This study uses all suggestions to build a comprehensive reserve and decommissioning disclosure index.

3] Modifying the list of the disclosure index

In order to expand the validity of the research disclosure index, all suggestions are deliberated and reflected to ensure the capability and applicability of the final list of the index, in terms of capturing all the related information in annual reports. Then the final disclosure index is constructed. To modify the list of items in a disclosure index for this current study, the existing index was first adopted for each type of disclosure (e.g., mandatory disclosure items in the index were based on International Accounting Standards (IAS) and IFRS requirements while voluntary disclosure was based on [Securities and Exchange Commission (SEC) requirements, OFR and SORP recommendations] and then modification was based on the feedback from academic reviewers of the index.

4] Measuring the quality of disclosure

Measuring extent of disclosure using a disclosure index is done normally by applying the scoring method. In some studies (e.g., Firth, 1980; Botosan, 1997; Hooks et al. 2012), disclosure topics were weighted for their relative importance. However, other studies used an unweighted index (e.g., Cooke, 1989; Hossain et al., 1994; Owusu-Ansah, 1998; Haniffa and Cooke 2005; Abdo, 2016; Abdo et al., 2017; Abdo et al., 2018). The unweighted index method assumes that all items selected in the index are equally important, allocating a score of 1 if the company presents a disclosure item or score 0 if not. This method of scoring is known as the 'dichotomous' method: the total score is the total number obtained by the company in sample of study to the maximum number of items applicable for that company. The weighted index method assumes that each item in the index has different categories of importance and is weighted accordingly (Abdo et al., 2018). The crucial point is that the choice between these different weighted and unweighted methods frequently does not significantly change the research results (Cooke, 1989).

This study applied the un-weighted method for index items, allocating a score of 1 for items in the index if the company presented it in their annual report or 0 if not.

2.8. Reliability and validity of a disclosure index

Previous studies that used a disclosure index to measure the quality (level) of disclosure acknowledged that the disclosure index is one of the most useful research instruments to measure corporate disclosure (e.g., Cooke, 1989; Botosan, 1997; Hassan and Marston, 2010). However, Botosan (1997) saw that the application of a disclosure index required using a subjective assessment technique by the researcher. Yet, Hassan and Marston (2010) argued that the measures of disclosure are subject to judgement in the researcher's construction, and that must be subject to reliability tests in order to obtain useful deductions from applying the index in the research. Also, Healy and Palepu (2001) advocated that self-construction measurement of disclosure increases the confidence, in that that the tool truly captures what it is designed for; hence there is necessarily judgement involved and that finding may be difficult to replicate.

It is important, therefore, to consider the reliability and validity of the resulst of using a disclosure index in this research to measure mandatory and voluntary disclosure. In addition, data reliability tests for disclosure constructs were conducted by generating Cronbach’s alpha involving the measurement items for each construct. In addition, an inter-coder reliability test was performed by comparing correlations between automated-disclosure and manual-disclosure constructs. Convergent validity tests were conducted for the disclosure index constructed for this study by using Pearson correlation tests.

To elaborate, Hussainey et al. (2003) compared the disclosure scores generated by automated content analysis of firms’ annual reports with those obtained from manual content analysis and found a high level of correlation (0.96). Accordingly, this study used automated disclosure scores obtained using NVivo software analysis and compared them with the results of manual index disclosure to assist the reliability.

There are three common applications of reliability according to Hassan and Marston (2010). The first one is a test-retest: this method is to measure the stability of the result that is obtained by using the disclosure index or content analysis although the test-retest normally can be used with an automated study vehicle to measure the extent of corporate disclosure. The second application of reliability is inter-coder: this method uses the same text coded by more than one coder, and then finds the correlation between them. The higher the correlation coefficient acquired, the higher the reliability of the measurement vehicle. Hussainey et al. (2003) found a high and significant correlation between the automated disclosure score method from using automated content analysis and disclosure score achieved from using manually sample annual reports.

The third form of reliability is internal consistency, and the most popular test that can be used is Cronbach’s alpha, which is an estimate of the assumed correlation between one test and a suppositional alternative form including the same number of items. This approach is used by many studies’ instruments (Botosan, 1997; Hail, 2002; Kelton and Yang, 2008; Hassan et al., 2009;) and is considered as the best technique for assessing the reliability of a disclosure measurement instrument (Hassan and Marston, 2010).

Validity, on the other hand, is the strength of the conclusions of a study that uses the disclosure index. It explains whether the scores mean what the researcher intended them to, and whether the index scores have any other meanings as measures (Marston and Shrives, 1991). There are three common ways to measure the validity of index disclosure. These are criterion validity, content validity and construct validity (Hassan and Marston, 2010).

Content validity (face validity) is seen as insufficient to test the validity of a disclosure index because of the subjective judgment from non-experts and/or professionals on the face validity of the researcher's measurements of disclosure (Hassan and Marston, 2010). The concurrent validity and the predictive validity are the two types of criterion validity, the difference between them being that concurrent validity concerns the correlation between a measure and the criterion at the same time, while the predictive validity concerns the correlation between a future criterion and a relevant measure (Hassan and Marston, 2010).

The third way to measure the validity is construct, which measures the performance in accordance with theory and is empirically used by different researchers. For instance, it is used in measuring the validity of disclosure scores through a significantly positive correlation between disclosure quality or quantity and a number of company characteristics such as size, listing, profitability and others. Most disclosure index studies used the construct method to measure the validity of the disclosure index, because, if the hypothesis of the study that uses a disclosure index is proved wrong, the theory might be wrong or there might be a problem with the create validity of the disclosure index or the proxies that were used for the instructive variables of the study (Hassan and Marston, 2010).

Construct validity is related to support the validity of measuring the disclosure scores by confirming a significantly positive correlation between disclosure scores and firm characteristics acknowledged in the previous literature review to be associated with the levels of corporate disclosures.

Finally, there is an alternative method that might be used to construct a disclosure index and evaluate the reliability and validity together by using principle component analysis (PCA), which is based on multivariate statistical technique that investigate the level of correlations among disclosure variables represented in a bidimensional matrix (Burgas, et al., 2014; Al Asbahi, et al.,2019). No any study so far has used this method (PCA) to construct index disclosure in oil and gas, because this method (PCA) is a dimensionality-reduction method that is often used to reduce the dimensionality of large data sets, by transforming a large set of variables into a smaller one that still contains most of the information in the large set of disclosure items, which is not the case of this research.

2.9. Summary

In this chapter, there was a discussion of the measurement of disclosure by using different ways that have been developed in the empirical disclosure literature, and how to assess the readability and validity of a measure of disclosure. However, it is not an easy task to develop a measurement of disclosure, because there is no general theory of disclosure. Most of the empirical studies examined disclosure through identifying variables that might have a relationship with level of disclosure.

This study focuses on measuring the mandatory and voluntary disclosure of oil and gas reserves and decommissioning costs of exploration and production oil and gas firms listed in the UK. Therefore, identifying the variables that have a relationship with voluntary disclosure and identifying what are the mandatory requirements of the disclosure would be the significant issues when developing a disclosure index for this study. Detailed information is provided in chapter five in the section 'Constructing the disclosure index'.

In addition, data reliability tests for disclosure constructs were conducted by generating Cronbach's alpha involving the measurement items for each construct. In addition, an inter-coder reliability test was performed by comparing correlations between automated-disclosure and manual-disclosure constructs. Convergent validity tests were conducted for the disclosure index constructed for this study by using Pearson correlation tests.

CHAPTER THREE: EMPIRICAL LITERATURE REVIEW

3.1. Introduction

This chapter deals with the research hypotheses and explains the conceptual framework related to the study. It has been argued that the most important disclosures in oil and gas are related to reserves and the cost of decommissioning because they are considered as the most significant cash flow indicators in the oil and gas industry (Odo et al., 2016). The oil and gas reserves are not presented in financial statements per se but the financial information related to them is included in the annual reports. However, decommissioning costs are not presented totally in the financial statements because they are estimations and are only represented on a company's balance sheets as part of the provisions and added to the asset value for depreciation purposes.

3.2. Disclosures by oil and gas companies

Disclosure of oil and gas reserves is linked to a number of factors such as leverage, cash flow risk, separation between ownership and control (agency problem), firm size and identity of auditors (McChlery et al., 2015). Also, Ani et al. (2015) found that the characteristics of company included firm size, size of audit firm, debt capital and listing status significantly affected the extent of disclosure of oil and gas reserves' information in the UK. Thus, these characteristics play an important role in determining the quality of oil and gas reserve disclosure; therefore, this involves a relatively high level of estimation and subjectivity.

Disclosures by oil and gas companies are of great importance because of the heavy capital investments that are involved, and because of the adverse impacts that exploration, drilling and production cause to the environment. De Abreu et al. (2016) posit that in the oil and gas industry, stakeholders continually demand the disclosure of issues that affect climate change, and carbon emissions. This makes environmental disclosures in the oil and gas industries critical. Moreover, other critical aspects of disclosure include social disclosures as well as the disclosure of past and future performance of the firm. While past performance is disclosed through annual reports and financial statements, prediction of future performance is determined by the disclosure of possible decommissioning costs and the disclosure of the oil and gas reserves in place.

Although companies often disclose their information through financial reporting, this is considered as insufficient. Boone (1998) explains that the financial reports that are based on historical cost accounting have serious deficiencies because of a lack of any relationship between historical cost accounting and the quantified values of oil and gas reserves. Investors cannot easily recognise the future cash flows through historical performance, because of the significant role of reserves in determining future production. Supporting this proposition, McChlery et al. (2015) explain that the market value for a specific oil and gas firm comes from the company's physical reserve quantum, which comprises assets that are normally not indicated as part of the company's financial position. Even though oil and gas companies disclose accounting information about such reserves and decommissioning in one way or another, their disclosures are not in line with the Statements of Recommended Practice (SORP), with great variability of the quality of disclosure since the SORPs are not mandatory anymore (McChlery et al., 2015).

The study of Alciatore and Callaway Dee (2006) established that among US oil and gas firms, although most firms stated that they had accrued costs for environmental exit and remediation liabilities, less than half disclosed the quantity of accruals although the disclosure ought to be made in situations wherethe amount is material. Moreover, Dong and Burritt (2010) established that the oil and gas companies sampled in their study did not provide details regarding their target achievements for environmental reporting practice and did not quantify their environmental and social participation targets and the degree to which their employees were expected to participate in environmental and social practices.

Given this lack of sufficient disclosures made by oil and gas companies, stakeholders, and particularly investors, may not find it easy to understand the impact of newly discovered oil and gas reserves, expiry of existing oil and gas reserves and decommissioning obligations on the value and performance of oil and gas companies. Thus, this means they are unable to make sound investment decisions and are required to use sophisticated financial analysis and stock market brokers' services which may come at high costs to them. Therefore, this study comes to bridge this gap in knowledge and uncover the impact of disclosures of oil and gas reserves and decommissioning costs of oil and gas structures on value and performance of oil and gas companies listed in the UK.

3.2.1. *Disclosure of oil and gas reserves*

The annual changes in the proven oil reserves[4] comprise discoveries and extensions, improved recovery, revisions of the previous quantity estimates, production, sales and purchases of reserves in place to meet their immediate production obligations (Spear, 1994). These changes ought to be communicated to stakeholders by means of reserve disclosures. This is because of the significant role of reserves in determining the future cash flow of the oil and gas companies. Therefore, the failure to communicate the reserves would lead to misjudgement of the company's present value and future performance. Also, investors may not understand the content of disclosure that contain risk factors and that plays a huge role in firm evaluation (Santos and Coelho, 2018). However, Odo et al. (2016) posit that the uncertainty that surrounds the estimation of reserves of oil and gas, as well as the costs associated with the collection of data on reserves, discourages sufficient disclosure of data that satisfies the requirements of SORP.

In the first place, when risk is the driving force behind reserve disclosure, firms engaged in production of oil and gas have a higher likelihood of disclosing the balance of their reserve quantum with significant increases in disclosure quality rather than developer firms (McChlery et al. 2015). Such risk factors include oil spills or reputation damage that force firms to make disclosures as a means of restoring the trust and goodwill of investors and other stakeholders. Also, disclosures of oil and gas reserves indicate the financial position and future cash flows of the reporting company, thus its financial performance and market value.

In many cases, the disclosed information regarding the reserve quantity may not be considered as accurate or even reliable, but it will contain information that is relevant for decision making by investors (Wright and Brock, 1999). This usually manifests itself when the oil and gas firm is in need of financing, either through the capital market or through financial institutions. The level of disclosure and its quality therefore become primary factors in the subjective decisions of the investors to provide the additional capital required. Higher reserves in this situation mean that the company,

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[4] Proven reserves are defined by Society of Petroleum Engineers (SPE) as the quantities of petroleum which can be approximated with a reasonable level of certainty through the analyses of engineering and geological data, to be recoverable commercially from a specific date from reservoirs that are known and under current operating techniques, government regulations and economic conditions (http://www.spe.org/industry/petroleum-reserves-definitions.php).

through production, will be able to pay the principal debt and the interest accrued and will qualify for financing.

3.2.2. Disclosure of decommissioning costs of oil and gas installations

Decommissioning is the process that comprises the removal of relevant structures and industrial installations the productive lives of which have ended and the consequent restoration of the site to an appropriate standard (Standard and Poor, 2007). An entity is required to acknowledge liability following the creation of the decommissioning obligation, which usually occurs at the time of the construction of a facility and damage requiring restoration has been done. Due to its nature and cash outflow effects, one can argue that the disclosure of decommissioning has the potential for decreasing firm value and reducing performance. There are significant future cash outflows that come with decommissioning. The results will lead to the withdrawal of funds by investors. This can occur especially where a company has no alternative field under production and has not shown any signs of acquisitions in the medium term.

The provisions for decommissioning costs are representative of a notable part of the companies' financial risk because most of the cash outflows take place at the end of the life of the project (Standard and Poor, 2007). As opposed to the USA, which require companies to set up a decommissioning fund (PWC, 2011), Aldersey- Williams and McKenna (2016) highlight that in the UK there is no regulation requiring oil and gas firms to have sinking funds or cash set aside for decommissioning. This means that following the end of production, the oil and gas companies are expected to fund decommissioning from their cash flow (Aldersey-Williams and McKenna, 2016; Abdo et al., 2018). This implies that, towards the end of production, a firm is expected to utilise significant cash outflow from other producing fields which may increase its risk of insolvency and especially in a situation where oil prices are low.

Aside from the loss of revenues owing to taxes, notable costs associated with decommissioning include the restoration of the site to a suitable standard, as indicated. Also, while some structures can be recycled, and some may be used for other purposes, for instance in reefing (verting decommissioned oil and gas platforms into artificial reefs), other structures are usually abandoned. In all three cases, the costs involved in decommissioning costs of the UK oil and gas installations are forecasts that annual decommissioning expenditure significantly large and stood at £1.8 billion in 2017, and will peak in 2030, at almost £2.5 billion per year (Oil & Gas UK, 2020). These costs have to be estimated by production oil and gas company before the approval of the decommissioning programme. Moreover, in compliance with the legal requirements in the UK, decommissioning programmes are implemented case by case, in accordance with the guidance notes which provide for cost estimates of the measures to be implemented, timelines and maintenance in the case that structures are to be left (Antonas and Hammerson, 2016).

Finally, decommissioning stakeholders including communities, environmental, representatives, fishing organisations, etc. are required to ensure the decommissioning project meet their expectations as well, therefore, decommissioning disclosures is vehicle to provide that information expected by decommissioning stakeholder (Jackson, et al., 2020). Decommissioning related studies such as Schroeder and Love, (2004); Fowler, et al., (2014); Gordon et al., (2019) argues that decommissioning stakeholders require that decommissioning project should be provided disclosures that follows a transparent and consistent process based on scrutiny, best practices, and results which meet their expectation from decommissioning project.

3.2. Previous similar studies on reserves and decommissioning disclosures

A number of studies has been conducted that provide the state of disclosure by the oil and gas industry and their impact on companies' values and performance. These studies can be broadly grouped into decommissioning-related studies and reserve-related studies as detailed in the sections below.

3.2.1. Decommissioning-related studies

Russell et al. (1998) reviewed the present state of the accounting for the abandonment of the oil and gas structures in the UK North Sea. The authors used questionnaires administered to finance directors of major oil and gas companies and representatives of accountancy firms. Moreover, data on the disclosure of abandonment was obtained from the analyses of this study surveyed companies' accounts between 1987 and 1993 to investigative the annual reporting practices about provisions for decommissioning costs of oil and gas companies. The companies were found to be in compliance with the recommendations of SORP 3, although the disclosures were established as lacking details. The results of the study clearly show that companies only disclose as far as SORP 3 requires and the voluntary aspect appears to be missing.

Ekins et al.’s (2006) study in the UK (North Sea) conducted an energy and material flow analysis together with consideration of financial flows for various elements of decommissioning of offshore oil and gas structures. Comparative environmental evaluations were made of scenarios, including leaving all structures in situ, leaving structures on the seabed and removing structures for disposal and recycling. The findings revealed a variation in the priorities, preferences and perceptions associated with decommissioning and that the variations make assigning of money values to the outcomes and impacts of decommissioning unsatisfactory. Moreover, the researchers found that there is no decommissioning scenario that is environmentally superior. This study is different from that of Russell et al. (1998) in that instead of focusing on compliance, it audits the environmental influences of decommissioning. However, despite their importance in the literature on the decommissioning costs, neither of these two studies examined the link between disclosures of decommissioning obligations and companies’ value and performance.

Rogers and Atkins (2015) evaluated oil and gas decommissioning liabilities in the USA within the framework of an environmental disclosure report card objectives. The results indicate that the actual performance of oil and gas companies in terms of the comparability across companies and reporting periods, accuracy of estimates, funding and forecasting was extremely poor. This performance was established in the period following the standardisation of reporting of decommissioning as asset retirement obligations. These studies indicate variations in compliance with the set standards, and that decommissioning results in significant environmental degradation, significant cash outflows and uncertainty in estimation of related costs and impacts.

Furthermore, study of O’Hanlon and Taylor (2007) examine the impact of liabilities disclosures on the UK firms’ value. which focused on the concept of cash outflow disclosure (mandatory disclosure of equity liabilities) and established that it has a negative relationship with value relevance coefficients. This result suggests that from the accounting regulator perspective, the labilities mandatory requirements disclosures such as the UK's Accounting Standards Board (ASB) of FRS 9 are seen as negative signals, harmonic with concerns about off accounting statements that motivated such disclosures.

The study by Abdo et al. (2018) examined how compliance with requirements for accounting disclosure was associated with decommissioning cost provisions by oil and gas companies. In addition, the authors also assessed the perception of stakeholders about the companies' reporting practices. According to the results, there was a high compliance level but with fewer of the disclosure requirements. In addition, the study reported that decisions about disclosure were determined by information credibility concerns because of the complexities in regulatory requirements, accounting processes, propriety costs and lack of demand for information. Abdo et al. (2018) also reported that the oil and gas companies only provided numerical disclosure in most cases on the decommissioning cost provisions without providing detailed explanations.

Abdo et al. (2017) conducted a study about provisions for decommissioning costs of oil and gas companies' disclosure practices in the UK compliance. This was the first study in the UK to discover the effectiveness and accomplishment of International Accounting Standards (IAS) and the Statement of Recommended Practices (SORPs) in providing a principle for accounting for decommissioning costs and the level of compliance of oil and gas firms listed in the UK. This study found that, in the UK, there were different levels of compliance with the decommissioning disclosure requirements. Most companies apply SORP disclosure requirements, although the attention paid to and compliance with IAS requirements seem to vary between different oil and gas companies listed in the UK market. Surprisingly, oil and gas companies provided minimum required information about decommissioning, including decommissioning obligations, provisions and expenditure. Abdo et al. (2017) highlighted the information that should be disclosed by oil and gas companies related to decommissioning, which are about timing, amount, changes to decommissioning estimates, the reasons underpinning such changes, timing of cash outflows and discount rate used. Furthermore, the decommissioning obligations needs to be breakdown into geographical regions and separate fields.

Despite the numerous studies (e.g., Taylor;s, et al., 2012; Oluwagbemiga, 2014; Ani et al., 2015; McChlery, et al., 2015; Odo et al., 2016) related to the effect of reserve disclosure level on value and performance of companies, none has examined the concept of disclosure quality pertaining to both reserves and decommissioning of oil and gas companies listed in the UK. Although there seems to be agreement with regard to the impact of disclosure on value and performance, this appears only to hold true in certain circumstances. The oil and gas industry appears to be more sensitive to news media disclosures. Therefore, disclosures of good news may lead to enhanced valuation of firms, while disclosure of bad news type may lead to negative impacts on either, or both, company value and performance. Investors may not be keen on the extent of disclosure, as much as on its content.

To the best of the researcher’s knowledge, there is no study that has combined consideration of both reserve and decommissioning disclosures and their impacts on value and performance of exploration and production oil and gas companies listed in the UK. Therefore, this is where this study makes a contribution. Disclosure has been shown potentially to cause differential impacts on company value and performance. This study, therefore, seeks to investigate the impact of disclosures on oil and gas companies listed in the UK. The reason for investigating the impact of reserve disclosure and decommissioning disclosure in this study together is that they are the most significant influences on cash inflows and outflows in the oil and gas companies’ life. Also, the UK oil and gas industry is maturing, and more fields are being decommissioned. Decommissioning oil and gas assets in the UK is a relatively new business, and actual decommissioning costs far exceed estimates of decommissioning provisions (Abdo et al., 2017). Therefore, disclosures of decommissioning obligations are met with caution by stakeholders.

3.2.2. Reserve-related studies

Salomone and Galluccio’s (2001) study focusing on reserves involved a survey of the trends of environmental issues and financial reporting among the chemical and oil industries. The sample comprised 82 companies with 26 from the USA and Canada, 26 from Southern Europe, 26 from Northern Europe and four from other countries. The authors used 156 annual reports from between 1993 and 1998 with environmental information coded as follows: 0 for missing information, 1 for the presence of qualitative information and 2 for quantitative information. The results indicated a high level of environmental disclosure and the production of separate sections dedicated to environmental issues within the companies’ annual reports. While the USA and Canada had the highest disclosures, companies in Northern Europe had the least levels of disclosure, and companies in Southern Europe did not disclose environmental information in their annual reports at all.

The study of McChlery et al. (2015) was aimed at empirically examining what determined voluntary disclosures of oil and gas reserves. The authors established that within an environment of complete voluntary disclosure, there was no compliance with the requirements of SORP as well as with an operating and financial review (OFR) by most of the companies. They attributed the lack of compliance to increased political and propriety costs in comparison with agency benefits resulting in non-disclosure or a lower level of disclosure. Similarly, the study of Taylor, et al., (2012) examines the determinants of reserves disclosure (RD) in the Australian extractive industries, they used index disclosure to determine and evaluate the level of reserve disclosure. This study heighted that reserve disclosure is positively associated with corporate governance, foreign listing, leverage, and external (Big 4) auditor.

The impact of reserve disclosure on market value, as established in the case of mandatory disclosure, is explained by McChlery et al. (2015) as resulting from the valuation of a firm's market value by reference to the firm's reserve quantum. Oil and gas reserves are the sources of revenue for oil and gas companies and are the most important tangible asset. Therefore, reporting reserve quantities signals to the market that revenues are occurring, therefore enhancing the market value of reporting entities. This means that the higher the reserves, the higher the market value, and the clearer the disclosure, the better the quality of information for stakeholders.

However, Banghøj and Plenborg (2008) established that voluntary disclosures do not provide the kind of information that can be easily interpreted by investors as enabling the prediction of future earnings. Moreover, Abdo et al. (2017) indicate that these disclosures are difficult to understand by investors who lack a finance background. Additionally, Aboody (1996) differentiates between recognised value and disclosed value, thus agreeing that disclosure by itself may not necessarily provide information that leads to increased value, if investors fail to understand and recognise the financial flows from the disclosed information. Taking this finding into account, it can therefore be argued that, although the information provided as voluntary disclosures may be positively biased, some of the information may be confusing to investors, and may not be useful in predicting the future value of the company. The confusing information in this case concerns the value of the current reserves, which should be predictive of future cash flows and as such impact on the valuation of the firm by the investment community.

Therefore, this study comes to bridge this gap in knowledge and uncover the impact of disclosures of oil and gas reserves and decommissioning costs of oil and gas structures on the value and performance of exploration and production oil and gas companies listed in the UK.

3.3. The impact of disclosures on a firm's value

3.3.1. Disclosure and value

Abdel-Azim and Abdelmoniem (2015) investigated the effect of voluntary disclosure and risk management on the value of a firm, using a sample of firms drawn from the Egyptian stock exchange in the year ending 2012. Voluntary disclosure was found to be related positively to the value of a firm. The relationship was explained by the argument that increased disclosure leads to increased reduction of risk exposure by management, and in the end impacts positively on firm value. This therefore accords with the argument that increased disclosure positively affects managerial decision making.

There are also studies that do not base their findings on any theoretical argument. For instance, Gordon et al. (2010) used a cross-section pooled model based on assumption that coefficients are constant across years for each company, in which 19,266 non-disclosing and 1,641 disclosing firms in the. The findings show that the voluntary disclosure of information security items had a positive relationship on a firm's market value. The authors, however, did not explain their findings but posited that the result could vary by industry. However, based on the previous arguments, the positive relationship can be attributed to the disclosure of good news. However, disclosure of bad news also enhances the legitimacy of the reporting companies. In the other side, Abdullah et al. (2015) addressees the relationship between voluntary risk disclosures and firm value. They clearly indicate that the voluntary disclosure of damaging information was found to have no significant relationship with firm value.

Lys (1986) investigated the relationship between oil and gas reserves' values and firm values of oil and gas companies. The annual change in the value of the firm was regressed against the annual change in the value of oil and gas reserves. The results indicated a significant variation from zero, but considerable deviation from theoretical values. This supports the relationship between the implicit disclosures (recognition accounting) and the perception of investors on firm value (market value).

Dharan (1984) found that the disclosure of oil and gas reserves through Reserve Recognition Accounting (RRA) may not impact greatly on security prices observed among oil and gas companies. According to Cooper et al. (1979), the RRA is an accounting framework that was introduced in the USA by the Securities and Exchange Commission (SEC) for the extractive industries where the expenses of such industries comprise all their current cost of exploration and development of proven properties and all the non-productive costs during the period. RRA in this sense is a way in which the financial results reflect the situation of the proven reserves in place and their value.

Aside from the RRA, the study of Clinch and Magliolo (1992) was aimed at examining the perception of the market on the disclosure of reserves. The authors established that when disclosures were based on reserves that had been proved or which had been proved and developed,[5] their impact on market value remained unknown. This implies that the relationship between the disclosure of such reserves and firm value was not then established. However, following the partitioning of the sample analysed, the authors reported that the proved reserve estimates appeared to be informative for the firm the projections of which were perceived to be more accurate. This aspect of accuracy was regarded by the authors as referring to the quality of disclosure. Thus, although mere reserve disclosure may not impact on value, increased quality of oil and gas reserve disclosures significantly impact on investor perceptions of the firm's value. The finding is further supported by Bryant (2003), who posits that past studies have found reserve estimates as having greater usefulness in the valuation of oil and gas firms. These estimates may either be in terms of reserve quantities or reserve values as they both provide similar information (Berry et al., 2004).

As it pertains to oil and gas companies, Patatoukas et al. (2015) reported that there is value relevance in the mandatory disclosure of the discounted cash flow of reserves. Companies that disclose their reserve balances are perceived by investors as of either a higher or lower value depending on whether the specific disclosure leads to a positive or negative investor perception of the firm. This means that the relationship between disclosure and value can be explained by more than the agency theory, since such disclosures appear to impact on investor perceptions by offering signals to the cash flow and/or revenues.

[5] Society of Petroleum Engineers (SPE) defines proved and developed reserves as those expected to be recovered from wells that are already in existence including the reserves behind pipe (http://www.spe.org/industry/petroleum-reserves-definitions.php).

3.3.2. Disclosures and stock prices

According to Jiao (2011), disclosures of higher-quality information have the capability of facilitating the communication between the management of a firm and the equity market. This results in the reduction of managerial myopia and misevaluation which arise as a result of the asymmetry of information and market pressures that are short-term oriented. This means that managers having private and valuable information regarding the future earnings of a firm have stronger incentives towards the enhancement of the quality of disclosure in order to communicate the information to investors (Jiao, 2011). As such, higher-quality disclosure leads to less under-valuation of stocks. Markets with low quality disclosures and asymmetry of information considered by investors as ‘a lemon’ market (Akerlof, 1970). Therefore, it represents an opportunity for arbitrage as part of a strategy in which stocks with higher-quality disclosures are purchased while stocks with lower quality disclosures are short sold (Jiao, 2011). This is, however, limited to the disclosure of non-strategic information.

One of the techniques used to measure the impact of disclosure on value is to correlate it with share price changes of oil and gas firms (Teall, 1992). Stock prices also have a crucial role in resource allocation through the reflection of managerial inefficiencies and the signalling of profitable opportunities for the potential acquirers. Jiao (2011) found disclosure rankings to have a high correlation with firm value and recommended the use of disclosure for the reduction of misevaluation of stocks and short-term pressures in the market.

In the oil and gas industry, Aboody (1996) found that disclosure significantly impacted on the value of oil and gas firms. More specifically, the author found that there was a negative reaction on stock prices of the oil and gas firms that disclose losses. The negative reaction can be attributed to perception of decreased firm value and inability to distribute dividends due to loss making.

Although the study of Aboody (1996) has similarities with the current research, it differs in the sense that it sought to establish the differential impact of disclosure and Reserve Recognition Accounting (RRA) on the oil and gas industry. On the other hand, the current study differentiates between voluntary and mandatory disclosures and good news and bad news disclosures and establishes whether they have a differential impact on the value and performance of exploration and production oil and gas companies listed in the UK.

Furthermore, Boone (1998) measured the relationship between the disclosure of discounted present values of reserves of oil and gas companies and bid–ask spreads in the common stock of the disclosing firms. A bid–ask spread is the amount by which the asking price exceeds the bid price for an asset in the market. The results indicated that increased disclosure led to a decrease in the bid–ask spreads. Lower bid–ask spreads mean that larger volumes are traded for the given security, implying an increase in the market value of the stocks of the disclosing firm.

Berry and Wright (2001) found that the disclosure of efforts as well as abilities to discover reserves was significantly related to the market value of oil and gas firms. This means that even though a company may not have a net increase in its reserves, anything that signals capabilities and efforts towards discovery, such as the acquisition of new technology, may signal future enhancement of firm value. The increased value is therefore reflected in the pricing of oil and gas securities and in the volume of purchases of the given company's shares.

Based on the studies presented, it is evident that there is a positive relationship between quality disclosures and a firm's value. The increased value is presented as generated by positive signals that emanate from increased disclosure of positive information. Although the magnitude of the relationship may vary among the studies presented, they ultimately indicate that the relationship between disclosure (explicit or implicit) and firm value established among listed companies holds true for the oil and gas companies. First of all, the impact of disclosure on the value of oil and gas companies is dependent on the content of disclosure. Disclosures that portray positive information, or which provide the hope for future cash inflows, lead to increased value, while the disclosures that send negative signals lead to decreased firm value.

3.4. Impact of disclosure on a firm's performance

The impact of corporate disclosure on companies' financial performance has been explained mainly using agency theory, explicitly or implicitly. The explanations are centred on the role of disclosure in the decrease of estimation risk and reduced information asymmetry, and consequently reduced costs associated with adverse selection (i.e., where asymmetric information is exploited by one party). The estimation risk is regarded as the rise in capital costs because of the uncertainty of the investors with regard to the true parameters of the payoff distribution of a security (Castillo-

Merino et al., 2014). Signalling and agency theories seem to be relevant to disclosure of oil and gas reserves as being good news, and decommissioning costs and obligations as being bad news. Signalling theory considers disclosure as a signal to investors and thus affects their perception of firm value and consequently share price. The authors based the finding on the argument that corporate disclosure signals the genuine efforts of managers to provide favourable information regarding the company's future earnings to its investors. Basing the explanation on signalling theory, one can argue that net purchases of oil and gas reserves signal a major move by the management towards value-added projects, hence, investors will react with support of available resources that in the end contribute to the firm's performance.

When private information is made available to investors, they perceive the security as less risky, and the availability of such information lowers prices more than in the case of non-disclosure. The implication is that, with better information, there is a reduction of the estimated risk of investors with regard to the parameters of the future return of securities' stocks (Castillo-Merino et al., 2014).

The increase in disclosure in this regard allows investors to have greater confidence in their forecasts and is therefore beneficial in that it leads to the reduction of the estimation risk part of capital costs. This type of disclosure according to Jankensgård et al. (2014) also concerns the disclosures pertaining to the firm risks. The assumption made is that investors place greater systematic risk on assets about which there is less information in comparison with the assets with more information. Supporting this argument, Easley and O'Hara (2004) found that private information stimulates some form of systematic risk and that investors need compensation for bearing the systematic risk.

The costs associated with information asymmetry are considered by Boone (1998) as adverse selection costs. According to the author, market makers widen their bid–ask spreads in order to cover for the possible losses associated with trading with informed traders. As such, the bid–ask spreads are expected to reduce with increased disclosure given that they reduce the incentive for investors to discover information that is undisclosed for any given security.

The increase in the level of disclosure decreases the asymmetry of information between investors who are more informed and those who that are less informed. The investors who have less information will demand increased returns for holding stocks with unevenly spread private information, leading to a decrease in the volume of trade of the specific securities (Jankensgård et al. 2014).

Moreover, according to Elshandidy and Neri (2015), the increase in accounting information disclosed to the public makes it difficult to obtain private information which arise the agency conflict between insiders (managers) and outsiders (shareholders). This means that the investors who have the ability to attain private information are fewer, leading to the reduction of the possibility of trading with investors who are better informed. This therefore increases the level of trade through the reduction of the probability that uninformed investors will increase prices for protection from the probability of incurring losses as a result of trading with investors who are informed (Elshandidy and Neri, 2015). This increase in trade enhances market liquidity. Based on these explanations, the increase in the level of disclosure ought to increase the performance of the firms. This is an angle of this study where performance will be examined in relation to voluntary and mandatory oil and gas reserves and decommissioning costs of exploration and production oil and gas companies listed in the UK.

Oluwagbemiga (2014) reported a link between company performance and the degree of information disclosed. The findings indicate that adequate disclosure significantly impacts on company performance. Performance was measured as a function of the perception of the respondents surveyed with regard to various aspects of the company. According to Oluwagbemiga (2014), investor decision making, and performance of the listed firms satisfactorily explained through voluntary disclosures.
The study has concluded that its findings support that voluntary disclosure was statistically significant in explaining an investor’s decision and performance of listed firms. This finding introduces a possible twist in the disclosure–performance relationship through the mention that there is an adequate level through which disclosure begins to impact on performance. The implication is that the relationship may not hold true if that level of adequacy is not reached. The authors, however, did not specify what that level is.

Among the US oil and gas companies, the disclosure of increased reserve quantities is linked with returns in oil and gas securities (Spear, 1994). Even when no production is on-going on the increased reserves obtained through discoveries and net purchases, mere disclosure of the existence of the reserves lead to returns on the securities.

3.4.1. Corporate disclosures and performance

Li et al. (2013) empirically examined the impact of firm performance on the disclosure of Corporate Social Responsibility (CSR) as regards the frequency and the quality of disclosures. The results show that firms that perform better have a higher likelihood of disclosing CSR information in comparison with those that perform worse. Performance was measured annually through the use of Return on Equity (ROE). Although the relationship was negative, it presented a correlation that was useful in explaining the impact of disclosures on performance. This relationship can be explained best through the impression management theory,[6] in the sense that firms with better performance would engage in CSR disclosures to enhance public perceptions, while firms that perform poorly would choose not to disclose as a way of avoiding a negative stakeholder reaction. Moreover, Lobo and Zhou (2001) also found a negative relationship between disclosure quality and earnings management. This means that firms with higher-quality disclosure tend not to smooth their earnings by use judgment in financial reporting to mislead some stakeholders or to influence contractual outcomes (Healy and Wahlen, 1999), and this could be attributed to superior performance.

In regard to corporate governance (CG) disclosures' impact on performance, the study carried out by Rouf (2012) was aimed at empirically testing the link between profitability and the degree of CG disclosure. Performance was measured as the percentage Return on Assets (ROA). The results indicated that disclosure had a positive relationship with profitability. The study of Ayodele et al. (2016) also revealed that the level of disclosure of corporate governance was positively and significantly related to the ROE. In the same way Al-Maghzom et al. (2016) confearm that there is a positive and significant relationship between voluntary disclosure and ROA. Panchasara and Bharadia (2013) examined the impact of corporate disclosures on performance. Disclosure was measured through both financial elements (mandatory financial disclosures) and non-financial elements (CG). Following regression analysis, CG disclosures were found to have a positive relationship with the ROA. These studies confirm the theoretical arguments surrounding the impact of disclosure on performance.

[6] Impression management theory posits that individuals or firms tend to present themselves or act in a certain way to obtain a favourable perception by the public or by others.

Another study, conducted by Singhvi and Desai (1971), investigated the characteristics of firms having quality disclosures. The annual reports of 155 US listed and non-listed firms were examined between 1965 and 1966. Quality was measured by reliability, accuracy and completeness. The results revealed that disclosure quality was positively related to profitability measured by rate of return (ratio of net profit to net worth) and earnings margin (ratio of net profit to net sales).

3.4.2. Adoption of IFRS and firm performance

The study of Ferrer (2016) sought to establish whether there was any significant difference in the performance of firms pre- and post-adoption of IFRS. The study was conducted in the Philippines. Given that IFRS have been regarded as increasing the level of disclosure and comparability of financial results, one can argue that the period of the adoption of IFRS indicates a shift to higher-quality financial reporting and thus causes the disclosure to reach the adequacy level as argued by Oluwagbemiga (2014). The results showed that no significant difference was evident in the performance when pre- and post-adoption of IFRS were compared.

The authors, however, did not test whether there was any significant difference in the level of disclosure pre- and post-IFRS. This was because the national GAAP of certain countries are close to IFRS and therefore, the adoption of IFRS may not have led to much significant variation in the level of reporting. Moreover, there is a possibility that a lack of significant difference may arise from sources other than the perceived disclosure quality, for instance the reduction of profitability due to the costs associated with the implementation of IFRS.

This study was conducted in the UK where the national GAAP is as strong and comparable to IFRS and, therefore, the cost of implementing IFRS may not have been significant. As such, the results stemming from the profitability measures are not significantly impacted on by the possible costs of changeover from the national GAAP to IFRS. The implication is that increased quality of disclosure that comes with the adoption of IFRS has the capability of impacting only on firm profitability measures.

3.4.3. Environmental disclosure and firm performance and value

Clarkson et al. (2008) conducted a content analysis in which an index was constructed based on the Global Reporting Initiative (GRI)[7] from 191 firms from the top five polluting industries. The results show a positive relationship between environmental performance and the degree of discretionary disclosures. The authors further explained that firms the legitimacy of which is under threat have a higher commitment to environmental performance.

In the same contacts, Lee (2017) used the content analysis and disclosure index for measure the quantity and quality of sentimental disclosures. The study adopted the GRI G4[8] mining and metals sector reporting guideline to evaluate corporate environmental disclosure in the Australian mining and metals sector. Lee (2017) provided an evidence that environmental disclosures positively and significantly correlated to the market capitalization. Furthermore, Hapsoro and Ambarwati (2018) confirm that disclosure on carbon emission positively impacts on firm's performance (ROA).

Broadstock et al. (2018) explore the empirical relationships between greenhouse gas emissions (GHG) disclosures and a number of business performance measures for UK FTSE-350 listed firms from 2000 to 2010. This study (Broadstock et al., 2018) used two types to measure performance, some money metrics (SALES, Earnings Before Interest Tax Depreciation and Amortization, PROFITS, Operating Profits, Market Capitalisation and Total Assets) and other ratios scaled by number of staff (PRICE, ROE - Return on Equity and Tobin's Q). Using regression analysis (Ordinary Least Squares), the researchers found that voluntary disclosure of emissions has been slow to be adopted by firms over the study period. Also, it was clearly stated that there was evidence of a non-linear relationship between voluntary environment disclosures and firm performance.

[7] Global Reporting Initiative is the independent, international organization that helps businesses and other organizations take responsibility for their impacts, by providing them with the global common language to communicate those impacts. It provides the world's most widely used standards for sustainability reporting, The GRI was established in 1997 in partnership with the United Nations' Environment Programme (https://www.globalreporting.org).

[8] The fourth generation of the GRI Guidelines, G4, was launched in May 2013 and has been revised and enhanced to reflect important current and future trends in sustainability reporting (https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/iso-gri-26000_2014-01-28.pdf).

Herbohn et al. (2014) also studied the relationship between disclosure and performance. Disclosure and performance were measured in terms of sustainability disclosure and sustainability performance. The disclosure of sustainability was measured in terms of social and environmental reporting within the companies' financial statements. The performance of corporate sustainability was established as strongly linked with disclosure. Moreover, sustainability disclosure was also established as greater for companies having a proactive strategy of communication manifested through press releases. While these studies are straightforward, there are other studies the results of which cannot be explained sufficiently by the relationships present in agency theory. For instance, Lorraine et al. (2004) sought to establish stock market reaction to the disclosure of information on environmental performance. The results indicated that the disclosure of bad news, and especially of fines, led to negative returns while the disclosure of good news did not have any significant positive returns. This means that the content of disclosure is likely to impact on the market performance of firms in one way, but not in two ways.

Finally, Li et al., (2018) provided an evidence that there is a positive relation between environmental, social and corporate governance (ESG)[9] disclosure and firm value. This study used to comprise of FTSE 350 listed firms at LSM, and they apply Tobin's Q as proxy for firm's value. The inclusive score of environmental, social and corporate governance (ESG) disclosure is determined from a total of 120 pointers, covering three characteristics: environment, social activities, and governance. The span is 0.1 (minimum disclosure) to 100. The level of ESG disclosure scores provided for large public firms. In the same regard, Tamimi and Sebastianelli (2017) used also ESG disclosure scores to analysis the effects on transparency of S&P 500 listed companies, the study revel that large capital market companies have significantly higher level of ESG disclosure level. These results can be best explained by signalling theory, whereby bad news sends a signal of managerial inefficiency and leads to the punishment of the management by investors through the denial of the capital that would enable better

[9] The ESG disclosure score proprietarily provided by Bloomberg is based on the extent of a company's ESG disclosure, the data being compiled from all available firm information, including websites, CSR reports, annual reports, and Bloomberg surveys. By 2015, Bloomberg was providing ESG data on more than 11,300 public companies who have the most active trading in 69 countries. For more information see Bloomberg reports related:
https://data.bloomberglp.com/company/sites/28/2017/01/BloombergSustReport2012-2.pdf.
https://www.bbhub.io/sustainability/sites/6/2016/04/16_0404_Impact_Report.pdf.

value, while good news signals better managerial performance and better firms' value, warranting investor appreciation through the provision of capital to fund value-added projects.

In summary, the above empirical studies establish the existence of a relationship between disclosures and firm's performance and value, this last being measured by a number of indicators such as ROA, ROE, ROCE and Tobin's Q. Increased disclosure can also be regarded as leading to an increase in performance. However, this appears to be dependent on the information content of what is disclosed. For instance, in the study of Spear (1994), the relationship holds true only for increased quantities of reserves. The implication is that companies disclosing lower reserve net balances, or lower net present value of reserves than that expected by investors, are likely to experience a lower market performance. The change in the relationship between disclosure and company performance can be explained through signalling theory in the sense that only good signals lead to an increase in performance while bad signals generated by bad news lead to decreased performance.

However, considering that the management of various firms is aware of possible negative reactions that follow negative disclosures, it is possible that such firms will tend to manage investor expectations through increasing or decreasing disclosures based on directed and controlled signals. This also introduces impression management theory, and the manner in which it impacts on the disclosure performance relationship, especially when disclosure is managed for the purpose of modifying stakeholder perceptions. Thus, the relationship between quality disclosure and performance may be distorted by the functioning of impression management.

3.5. Theoretical framework

The variation of the type and level of disclosure can be explained through ways other than the benefits of disclosure such as reduced cost of capital and information asymmetry. Several theories have been put forward, including agency theory, stakeholder theory, institutional theory, legitimacy theory, signalling theory and impression management theory. This study is focusing on the agency theory and signalling theory because these two theories complement each other in explaining the motives and the impacts of corporate disclosure. Furthermore, agency theory and signalling theory are the central theories that employed to explain the managers' incentive to disclose or not disclose information to the stockholders (e. g., Nekhili et al., 2012; Elzahar,2015). This current research is examining the impact of mandatory and voluntary disclosures of oil and gas reserves and decommissioning obligations of exploration and production oil and gas companies listed in the UK on these companies' value and performance. Thus, applies both agency theory and signalling theory to explain the impacts of such disclosures, also this research follows the previous researches used these theories to explained the impact of disclosures on oil and gas on performance and value (e. g., Ani et al., 2015; McChlery, et al., 2015; Odo, et al., 2016).

3.5.1. Agency theory

Agency theory is extensively employed in accounting arguments to explain the managers' motivation for disclosures (Lim et al., 2007). The need for disclosure stems from the agency problems between parties internal and external to a corporation, which in this case are the management and the investors or shareholders. According to agency theory, the owners represent the principal while the management represents the agent. The principal delegates powers to the agent to make decisions and in so doing, the manages the firm and performs services on the principal's behalf (see Jensen and Meckling, 1976; Eisenhardt, 1989; Healy and Palepu, 2001; Shapiro, 2005; Cotter et al., 2011).

The separation between the ownership and the management leads to adverse selection and moral hazard, given that the principal does not possess the full information that is at the disposal of the agent (Odo et al., 2016). The principal incurs costs in monitoring the activities of the agent in order to ensure that they are aligned with their interest. Jankensgård et al. (2014) posit that the increased disclosure leads to the reduction of such monitoring costs and, as such, disclosure has the capability to impact on the efficiency of investment and cause agency problems.

Nevertheless, when there is a fixed and positive cost of disclosure, only companies with information that has economic advantages beyond the costs will actually make disclosures (Oluwagbemiga, 2014). Forker (1992) indicates that the administrative costs surrounding disclosure have an adverse impact on the quality of disclosure. Such costs include the sum of monitoring costs by the principal, expenditures by the agent attributed to bonding cost which is expenditures by the agent to expend resources, and residual loss which is reduction in welfare experienced by principle (Jensen and Meckling, 1976). This means that firms considering the cost of disclosure may either disclose items only mandated by law, or disclose additional information but of lower quality, leading to increased information asymmetry.

The problem of information asymmetry can be solved through various means including optimal contracts between investors and entrepreneurs such as compensation agreements and debt contracts, regulation requiring full disclosure by managers and information demanded by intermediaries such as rating agencies and financial analysts (Healy and Palepu, 2001). Additionally, the reduction of the asymmetry of information between the company and the external stakeholders –and basically those within the investment community – occurs through voluntary disclosure (Brammer and Pavelin, 2008).

The idea of voluntary disclosure provides support for the notion that, even in the absence of regulation, managers still have the desire for information disclosure (Oluwagbemiga, 2014). This means that agents will make an attempt towards the reduction of agency costs and asymmetry of information for the maximisation of wealth. Agency costs comprise the cost of information asymmetry, where the agent has additional information regarding the performance of a firm in comparison with the principal. The result of information asymmetry is the trade-off that managers make between accounting choices and the provision of disclosures for communicating their superior performance knowledge to investors and the management of the reported performance for reasons of CG, contracting and politics (Oluwagbemiga, 2014).

Additionally, policies of disclosure are only influenced in the case that disclosures give information to competitors (Oluwagbemiga, 2014; Abdo et al., 2018). On the contrary, disclosures pertaining to their marketing strategies, technology, research and development may lead to the destruction of the firm's competitive advantage and companies may not be willing to disclose such information (Bhasin, 2012). Owing to the nature of some information, firms weigh the cost and the benefits that would be derived from voluntary disclosures and then decide on whether they will disclose or not.

This is, however, not the case for oil and gas companies because of the variation of establishing the environmental impact of the operations and the differing costs of estimating reserves. Moreover, as it pertains to economic advantages, the benefits of disclosure, for instance, better reputation or improved leverage, have to be weighed against the risk of reputational damage or the need for increased capital investment. Craswell and Taylor **(**1992) identified two factors that determined the extent of disclosure by oil and gas companies in Australia, namely the propriety costs associated with disclosure and the increased agency costs associated with non-disclosure. Based on costs versus benefits, the managers of oil and gas companies may not have any incentive towards disclosure (Abdo et al., 2018).

As it pertains to oil and gas companies, Patatoukas et al. (2015) reported that there is value relevance in mandatory disclosure of the discounted cash flow of reserves. Companies that disclose their reserve balances are perceived by investors as of either a higher or lower value depending on whether the specific disclosure leads to a positive or negative investor perception of the firm. This means that the relationship between disclosure and value can be explained by more than agency theory, since such disclosures appear to impact on investor perceptions by offering signals about cash flow and/or revenues.

Voluntary disclosure has an impact on the cost of capital of a firm and hence on its market value (Jankensgård et al., 2014). Jankensgård et al. (2014) indicate that the increase in disclosure decreases the capital costs. Furthermore, lowering the cost of capital by increased level of disclosures reflected on the market through encourages investors which is enhances the shares liquidity (Cuadrado-Ballesteros, et al., 2016).

The reduction of the asymmetry of information, which accompanies corporate disclosures and the decrease in agency problems and cost, result in efficient allocation of resources in capital markets. The disclosure of higher quality information has the capability of increasing capital flow into an organisation because increased transparency eases the identification of poor investment decisions (Kai and Matsunaga, 2015). This is because transparency is also associated with more efficient and effective management, and investors are more likely to invest in more transparent organisations. Disclosure is also a facilitator in the monitoring of decision making by the management and reduces the possibility of management pursuing projects of less value (Jankensgård et al., 2014). Allegrini and Greco (2013) and Salehi et al. (2017) highlight that, according to the agency theory, greater levels of voluntary disclosure are expected from firms in which practices of CG are intensively monitored. This activity leads to the reduction of the opportunistic behaviour of managers and the asymmetry of information. Managers operating within a monitored environment are thus less likely to withhold information for their private benefit, and there is enhanced quality and comprehensiveness of disclosure (Allegrini and Greco, 2013).

In the case of decommissioning, Ekins et al. (2006) and Kaiser (2005) highlight the considerations which influence the attitude of the management when deciding on certain disclosures as safety, feasibility, regulatory framework, environmental impacts, cost, the political environment and company reputation. Given their importanct, and especially because decommissioning is considered as a negative cash flow, companies may fail to disclose voluntarily information related to decommissioning. Moreover, it implies that 'costs' rather than net increases in reserves may outweigh agency benefits within an environment of decommissioning.

Agency theory can also be used to explain the relationship between disclosure, value and performance. Management, as an agent, is required legally and ethically to provide shareholders as principals, and wider stakeholders groups, with sufficient information to allow sensible decision making (Healy and Palepu, 2001; Brammer and Pavelin, 2008; Oluwagbemiga, 2014).

Agency theory is regarded as suitable for this study because it helps in explaining the impact of disclosure on corporate value. In particular, disclosure leads to the reduction of the asymmetry of information and, as a result, reduces the cost of equity capital for firms through the increase in the demand for the securities of a firm or the reduction of the bid–ask spreads.

3.5.2. Signalling theory

Signalling theory can be used to explain why firms disclose information to their stakeholders, and how disclosures may impact on stakeholder reaction and perception of the reporting entity. According to Spence (1974), signalling is a concept used to clarify how individuals who control superior information communicate such disclosure to others in the form of signals (Watson et al., 2002). They also argue that signalling involves the agent (management) conveying meaningful disclosure in its control about the firm to the principal (shareholders) meanwhile the management dominates more information as a result of its participation in the running of the firm. Also, Toms (2002) argues that the pattern of shareholding has the capability of pressuring managers in a heterogeneous manner and leads them to rely on quality signalling, such as by means of accounting disclosures, to provide a response to such pressures. The variations in patterns of shareholding can be in the form of institutional or individual investors or a mix of the two that pressurise the management to produce better performance. Such performance can therefore be signalled best through the use of accounting disclosures. On the other hand, Toms (2002) posits that managers will develop an incentive towards signalling only in the case that disclosure leads to higher returns. This means that irrespective of the level of pressure on the management, if disclosure would lead to sanctions by stakeholders, then the management will choose non-disclosure.

Signalling theory was initially introduced and developed to explain the information asymmetry in the labour market, then applied to explain the information provided voluntarily by managers to the market and shareholders (Hughes, 1986; Singh and Mitchell Van der Zahn, 2008; Connelly, et al., 2011). The information asymmetry problem will motivate the firm's managers to signal their quality information to the market to attract investment when they think their firms are better than other firms (Campell et al., 2001). Kumar et al. (2012) posit that high-quality financial disclosure sends a signal to investors that the managers are able to enhance the value of the firm. Consistent with the argument of Toms (2002), one can therefore consider that such signals would be positive in nature and represent better performance. Haniffa and Cooke (2002) also posit that companies having good news have a higher likelihood of disclosing additional information, therefore sending positive signals to stakeholders and markets.

Gomoi and Pantea (2016) explain that the purpose of signalling theory is to provide equivalent information to all the users of the capital market, who rely on the disclosure of information to uncover the inefficient entities trying to imitate the models of efficient entities. If these are effective, the mechanisms of control discipline managers to refrain from the actions that are regarded as value-destroying and, if possible, find a replacement for the managers who are inefficient. This means that managers have an incentive to disclose strategic information for the purpose of influencing the efficacy of the mechanisms of control (Kumar et al., 2012).

Kumar et al. (2012) explain that corporate managers are usually monitored and disciplined by the market and shareholders. This means that managers need to have a strong comprehension of the underlying competitive and economic environment. Moreover, managers must fully understand the manner in which a firm can succeed within such a competitive environment in order to provide high-quality information (Kai and Matsunaga, 2015). Furthermore, Graham et al. (2005) reveal that the managers attitude toward deliver voluntary disclosure is coming from their talent signalling, which is a statistically significant motivation for voluntary disclosure.

Based on these arguments, Jankensgård et al. (2014) sought to measure the relationship between risk disclosure and firm value. The risk involved was foreign exchange risk, which in many cases is less fully disclosed. The study sample comprised 114 derivative users in Sweden. The results indicated that with the degree of derivative usage kept constant, there was a decrease in firm value with the increase in the degree of firm risk disclosure. This relationship is based on the argument that increased risk disclosure triggers concerns with regard to, and sends signals about, the amount of resources channelled to the management of risk. The implication is that the disclosure raises doubt regarding the quality of managerial decision making as it pertains to resource allocation. Therefore, the relationship between disclosure and value is also dependent on what is being disclosed.

In support of these arguments, Blacconiere and Patten (1994) found that firms having extensive environmental disclosures have a less negative reaction to disasters such as chemical leaks compared with those with less extensive disclosures. The authors suggest that an extensive environmental disclosure is a positive signal of the firm’s management of its exposure to regulatory costs. Therefore, disclosure in itself is a signal to the investors regarding the conduct and efficiency of management. On the other hand, Ross (1979) uses signalling theory to explain how and why managers would be interested in disclosing information voluntarily about the prospects of a company to the capital market. He explains that the capital market evaluates the management’s performance through the company’s shares price.

Good or bad performance will drive the share price and the company’s market value up or down. According to signalling theory, the managers hold private information and the stakeholders have some information about the company, but would like to have more, which could be confidential in nature. They believe this information may enable them to make clearer and better decisions. Thus, information asymmetry between managers and stakeholders arises, and this may have a negative influence on the firm’s transparency and respectively on its value and performance. Hence, signalling theory can be used to explain the relationship between disclosure, value and performance. Signalling theory may be limited in explaining the impacts of disclosure on value owing to the knowledge of the management regarding the expectation of investors andmay distort disclosed information. In support of this argument, Cho et al. (2010) highlight from the findings of their research that companies disclosing environmental information have the tendency to bias the tone and the language of their disclosures. This is as a way of impression management to investors. Under situations of biased information, the signal sent to the investors is distorted.

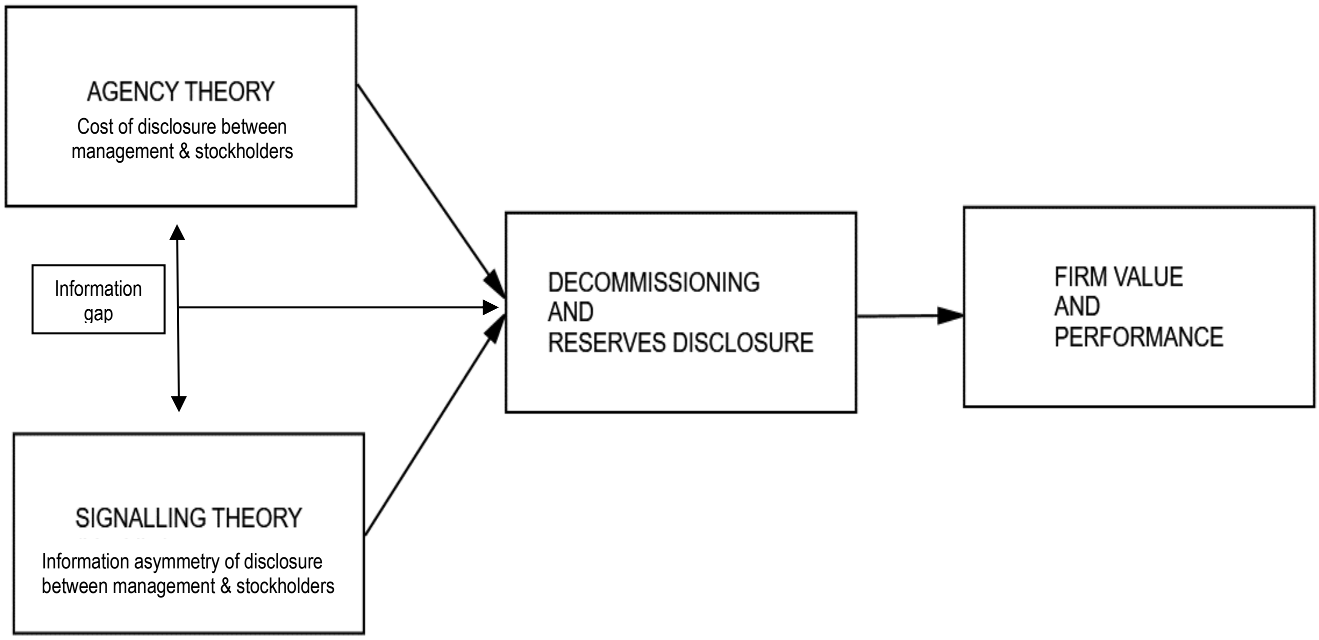
Finally, there is a significant link between signalling and agency theories, for example, relational behaviour of managers to provide information and resaved information in the market by investors. In this context, Morris (1987) argues that agency and signalling theories do not share the same necessary conditions. The monitoring cost and the separation between capital provider and managerial control are the underlying assumption of agency theory, while implied information asymmetry is the underlying assumption of signalling theory. Morris (1987, p. 53) states that “[g]iven the consistency of signalling and agency theories, it is conceivably possible to combine them to yield prediction about accounting methods choices not obtainable from either theory along”.

Morris (1987) demonstrates that combining the prediction aspects of both agency and signalling theories would improve accounting choices and predictions. Moreover, the combination of agency theory and signalling theory could even contain new concepts not included in either. Empirically, many studies related oil and gas industry employed agency theory and signalling theory together as theoretical framework to explained whether mandatory or voluntary disclosures influence (e. g., Ani et al., 2015; McChlery, et al., 2015; Odo, et al., 2016; Misund, 2018).

This study, therefore, employs both of these theories (agency theory and signalling theory) in explaining firm behaviour as it pertains to mandatory and voluntary disclosures related to reserve and decommissioning costs and how that behaviour impacts on the value and performance of the firms.

Figure 3.1 below depicts a graphical presentation of the theoretical framework for the study indicating the role of the agency theory and signalling theory in the relationship between disclosure and firm value and performance.

Figure 3. 1: Theoretical framework



Graphical presentation of the theoretical framework (Author's own)

3.6. Conceptual framework

A research conceptual framework is the procedure used by researchers to identify the study factors, concept or variables, and presupposed relationships among them, through the use of either a graphical or a narrative form (Miles and Huberman, 1994). The conceptual framework could be an aggregate of concepts or ideas that are coherently and logically integrated together and established on theoretical-driven assumptions to guide the empirical investigation. Moreover, it indicates and directs the selection of the appropriate technique for analysing research data and determining the empirical outcome (Rudestam and Newton, 2014). Therefore, it is key to provide a conceptual framework for a research study to address the research concept and direction.

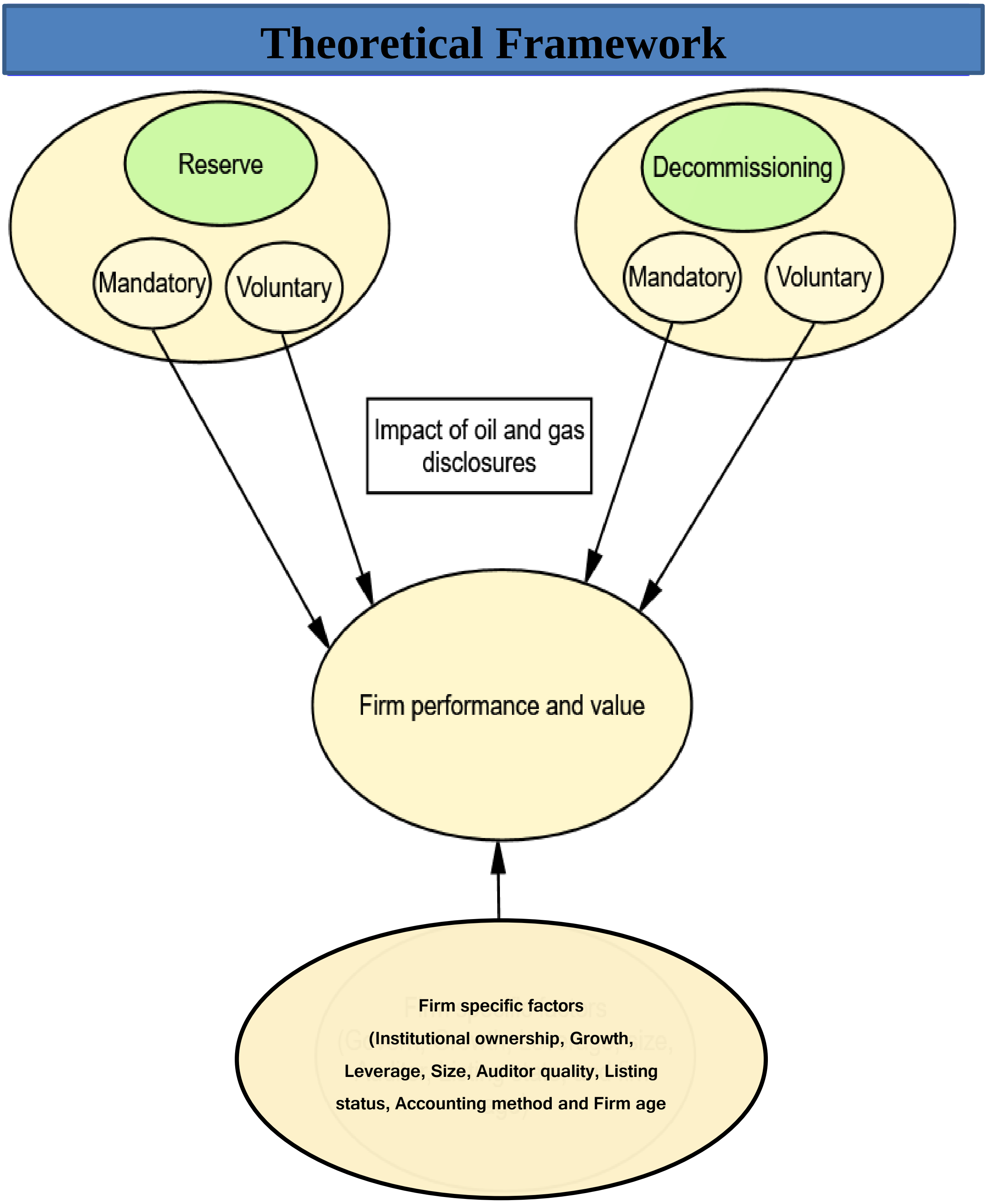
The aim of this study is to examine the impact of voluntary and mandatory discoursers of oil and gas reserves and decommissioning obligations of exploration and production oil and gas companies listed in the UK on these companies' value and performance. In essence, the study's ambitions from the empirical part after revealing the level of reserve and decommissioning levels are to: (a) determine the impact of accounting methods on the level of reserve and decommissioning disclosure among oil and gas companies; (b) examine the relationship between listing status and disclosure levels of oil and gas companies; (c) examine the impact of disclosure levels on firm performance among the oil and gas companies; (d) examine the impact of disclosure levels on firm value among the oil and gas companies; and (e) determine whether firm-specific characteristics impact the disclosure-value and performance relationship.

This study focuses on and is directed by three related literature themes: reserve disclosures, decommissioning disclosures, and firm performance and value. The literature demonstrates that there is a strong relationship between disclosure and firm value and performance (e.g., Oluwagbemiga, 2014; Jankensgård et al., 2014; Ani et al., 2015; McChlery, et al., 2015; Odo et al., 2016; Misund and Osmundse, 2015; Misund, 2017). Furthermore, the firm's disclosure (level or quality) is motivated by the firm's specific characteristics. In this study, disclosures are divided into four categories, namely Mandatory Reserve Disclosure, Voluntary Reserve Disclosure, Mandatory Decommissioning Disclosure and Voluntary Decommissioning Disclosure, in order to to meet the research objective.

These main disclosure variables are collected from annual reports of oil and gas companies listed in the UK, by constructing a disclosure index and using content analysis methods manually and electronically (NVivo software) to measure the disclosure level of each four disclosure categories.

The conceptual framework developed in this study (see Figure 3.2) comprises four disclosure categories that may influence an oil and gas firm's performance and value. The concept underlying this framework is that the oil and gas firm disclosures of reserves and decommissioning may have an impact on firm performance and value.

Figure 3. 2:Conceptual framework



Conceptual framework (Author’s own)

The conceptual framework developed in this research (see Figure 3.2) is under the umbrella of two theories, agency theory and the signalling theory. Signalling theory explains the relation between managers who transmit the information about the firm to the shareholders, leading them to rely on quality signalling of such accounting disclosures which influences the value and performance of the firm. Agency theory also explains and reduces the agency cost problem of information between the management and the shareholders. This conceptual framework includes two main elements of disclosure in the oil and gas industry (Reserves and Decommissioning) that influence a firm’s value and performance. These two elements are included in two specific types of disclosure: mandatory and voluntary disclosures. The argument presented in the framework is that each type of disclosure (Mandatory and Voluntary) for each element of disclosure (Reserves and Decommissioning) impacts on a firm’s value and performance. However, the impact of both Reserves and Decommissioning on firm value and performance are also contingent on other factors specific to the firm, namely Firm Size, Firm Age, Growth, Institutional Ownership, Leverage, Listing Status and Auditor Quality.

3.7. Summary

This chapter has reviewed the important studies that have examined the association between reserves and decommissioning disclosures based on the performance and value of oil and gas companies. In general, the findings indicate that while there are some studies which have determined the level of compliance of oil and gas decommissioning disclosures, there is no study which has investigated the impact of decommissioning disclosures on performance and value. Moreover, according to the researcher's knowledge, no study has explained the impact of both reserve and decommissioning disclosures on oil and gas firms' performance and value. Disclosures influence a firm's performance and value. This study finds that in the UK, there are different levels of compliance according to the decommissioning disclosure requirements. Most companies apply SORP and SEC disclosure as voluntary requirements, although IAS as mandatory requirements seem to be given a different degree of attention and compliance by different oil and gas companies listed in the UK market. Although there are many studies which investigate the impact of oil and gas reserve disclosures on a firm's performance and value, it is evident in this study that there is a mixed relationship, where some firms reveal a positive relationship and others reveal a negative relation between quality disclosures and a firm's performance and value.

The second part of this chapter has demonstrated the theoretical framework for this study, which is based on agency theory and the signalling theory. Agency theory is based on assumptions of separation between capital provider and managerial control. However, signalling theory implies information asymmetry as the main assumption. This study used these two theories to explain the impact of reserve and decommissioning disclosures on the performance and value of the oil and gas companies. Also, this chapter summarises the conceptual framework, which shows the relationship between the study and the presupposed relationships among disclosures and firm's performance and value.

CHAPTER FOUR: OIL AND GAS INDUSTRY IN THE UK

4.1. Introduction

This chapter focuses on the oil and gas sector in the UK as this research investigates the impact of reserve and decommissioning disclosures on the performance and value of oil and gas companies listed on the London Stock Market (LSM). This implies that oil and gas reserves and decommissioning figures are by far the most distinguishing factors in this industry because both figures reflect the significance of cash inflow and cash outflow in the oil and gas industry, as discussed in the previous literature review chapters. Thus, it is critical for this study to review and discuss the oil and gas sector situation in the UK economy and the current reserve and decommissioning disclosures as the main concept of this research. This information is especially important for oil and gas companies, regulators, government, investors and environment supra-national entities in the UK.

This chapter is designed to explore the oil and gas sector contribution to the UK economy and its history and background in the UK, and then to provide information on oil and gas reserves, production, exploration and decommissioning.

4.2. Oil and gas sector contribution

The oil and gas sector in the UK plays a significant role in supporting the British economy. It provides energy to homes, to almost all industries and transportation, and also contributes to tax revenues (Abdo, 2010). Studies such as those by Kemp (2013), Ward and Carvalho (2018) and many others have stated that there are over 120 onshore oil and gas sites in the UK. There are also over 250 operating wells that are able to produce between 20,0000 and 25,0000 barrels of oil in a single day. Oil and gas are considered the most important resources in the world. They play a crucial role in driving the global economy because petroleum as a raw material is used for numerous products and serves as the primary fuel source (Bret-Rouzaut and Favennec, 2011). The oil and gas industry has a significant impact on the UK economy, helping meet part of the country’s demand for domestic or industrial use. This industry has been in existence for over 150 years and has drilled over 2,000 wells (United Kingdom Onshore Operators Group, 2020). This industry considerably contributes to the UK Exchequer from payroll, corporation and production taxes, and it widely contributes to the UK GDP and balance of trade. Wood (2014) reiterates that the oil and gas industry in the UK has delivered not only growth but also many jobs as well as revenue to the UK economy. The industry has also provided an array of opportunities in different avenues that can be exploited. Furthermore, Wood (2014) observes that, apart from its contribution to energy and economic security, the energy sector's major contribution has been employment and taxes. The sector employed around 270,000 people across the UK in 2019 (Oil & Gas UK, 2019c). Further information about the oil and gas industry economy contributions are in the following sections.

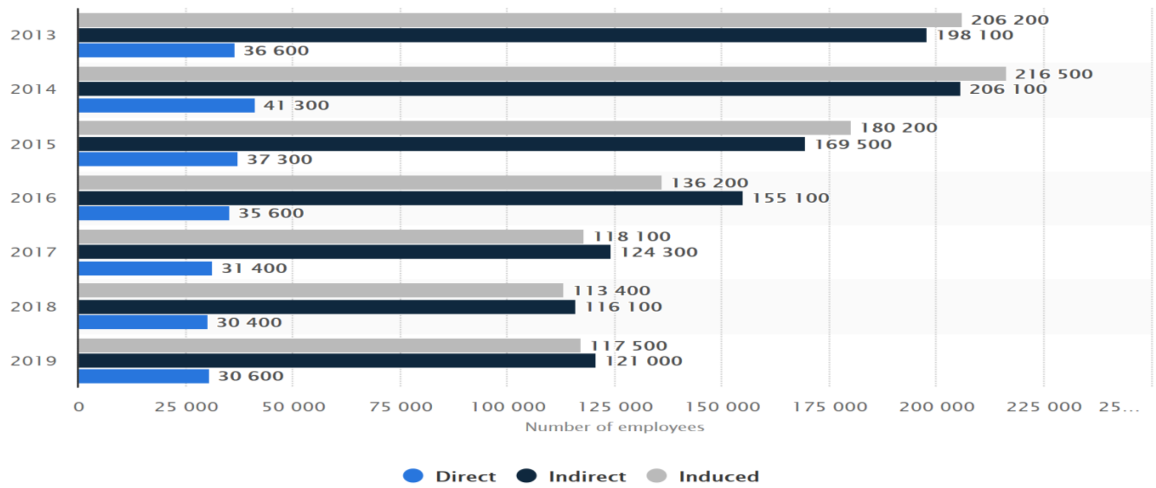
4.2.1. Economy contribution

The oil and gas industry makes a key contribution to the UK economy in the long term. Recently, in 2018, the oil and gas sector provided 45% of the energy needs and 59% of the oil and gas demand, and oil andS gas production contributed £24 billion to the UK GDP (Oil & Gas UK, 2019b).

4.2.2. Employment contribution

The offshore oil and gas industry has contributed significantly to employment in the UK, although the number of jobs in the sector has been declining on average, as summarised in Figure 4.1 below.

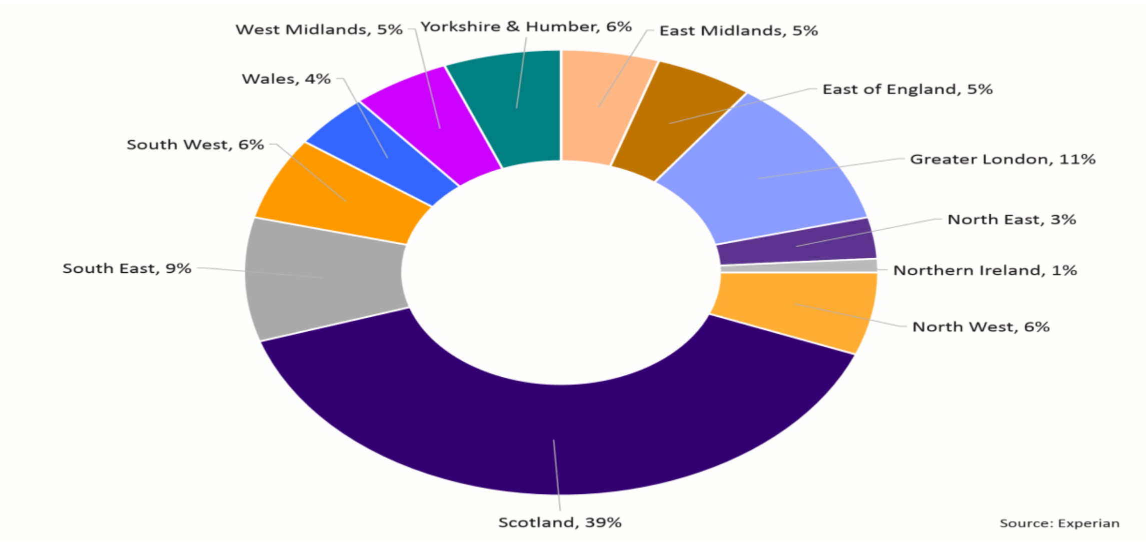
Figure 4. 1: Oil and gas offshore employment



Source: Oil & Gas UK, (2019c, p. 10)

As the Oil & Gas UK (2019c) Work Force Reportpoints out, while the largest percentage of employment supported by the industry is in Scotland, with a share of total employment reaching 39%, the sector continues to provide employment across the whole of the UK. This is summarised in Figure 4.2 below.

Figure 4. 2: Employment by the UK regions



Source: Oil & Gas UK, (2019c, p. 13)

4.2.3. Fiscal contribution

In the last 50 years, the oil and gas sector has contributed more than £350 billion to the UK tax system. Although the United Kingdom Continental Shelf (UKCS) is a mature basin now, it is still a high tax contributor in the UK economy, contributing £1.2 billion in each of the financial years 2017–18 and 2018–19 (Ahiaga-Dagbui et al., 2017; Oil & Gas UK, 2019c). Furthermore, Oil & Gas UK (2019c) argues that the oil and gas industry in the UK will remain placed to provide a significant contribution in the coming decades to the economic growth of the UK. In the subsequent years, the offshore total government revenues are shown in Table 4.1 (HM Revenue & Customs, 2021).

Table 4. 1: Total offshore revenues

Year £ millions	Total Govt Revenues	Offshore Corporation Tax (CT)			PRT Receipts
		Net CT Receipts	Repayments	Payments	
2017-18	1,188	1,757	179	1,936	(569)
2018-19	1,168	1,912	315	2,227	(744)
2019-20	863	1,274	136	1,410	(411)

Source: HM Revenue & Customs (2021, p. 3)

However, significant challenges confront the UK oil and gas industry, which are triggered by low oil prices, high cost of operation, uneconomical fields and high taxes (Ahiaga-Dagbui, et al., 2017).

4.3. UK oil and gas industry background

The historical background of the oil and gas industry in the UK can be examined under two main categories: onshore oil and gas, and offshore oil and gas.

4.3.1. Onshore oil and gas fields

Oil production started in the UK in 1850 in the form of shale oil in the Midland Valley of Scotland. Production remained very small, with the highest quantity being around 6,000 barrels per day in 1913 (Kemp, 2012). Although commercial production started in the early 1900s in a number of regions onshore, most commercial production started from 1939 onwards. In 1939, the British Petroleum Company (BP) discovered the Eakring Oilfield in East Midlands as major oil source, and since that, many important discoveries have been made, and oil and gas continued to be produced from onshore in the UK (British Geological Survey, 2011). The discovery of oil and gas in a water well being extracted rom1896 in East Sussex, led to the establishment of a company in 1902 to develop and supply the gas to the local community at Heathfield, Polegate and Eastbourne (British Geological Survey, 2011). United Kingdom Onshore Oil and Gas has recently reported that there are in the UK 120 onshore sites with 250 wells producing around 25,000 barrels of oil equivalent per day (United Kingdom Onshore Operators Group, 2020).

Abdo (2006) investigated the petroleum fiscal regime in the UK, which was established in the 1970s. New taxes were then introduced, with the objective of securing as much revenue as possible from this sector to grow the UK economy. This, however, changed with tax relaxations coming afterwards, and Abdo (2006) particularly focuses on the period between 1980 and 2000. These major changes in the governance and management of petroleum resources in the UK were aimed at improving the efficiency in the sector as much as possible and maximising the benefits that an economy can derive from the oil and gas sector. The North Sea Model, as Abdo (2006) points out, refers to petroleum resources being accommodated under specific mineral ownership (a concession system), which gave the concessionaire a number of rights, including the mining as well as the economic rights, but excluding the mineral rights. The UK petroleum tax relaxations, according to Abdo (2010), did not achieve their aims, especially the relaxations in 1983[10], but the 1987–88 relaxations were successful, especially because they succeeded in increasing extra investments in an array of new areas. The tax relations, however, had a negative impact on the amount of revenue collected by the government, especially the 1993 petroleum tax relaxations. In other words, the tax relaxations led to a situation where the UK government continually lost revenue, and perhaps, this is why the government decided to change governance from a proprietorial to non-proprietorial regime (Abdo, 2006; Abdo, 2010).

Merhej (2018) adds that since 1902 and up to 2015, over 2,000 wells had been drilled in the UK, and that by 2015, the onshore fields in the UK had produced over 500 million barrels of oil. This is, however, a small amount, especially when compared with over 45 billion barrels that has been produced in the North Sea. According to Ward and Carvalho (2018), by 2016 the UK held over 2,754,685,000 barrels of oil reserve. This means that in 2016, the UK was ranked 30th in the world in terms of oil reserves. The proven reserves in the UK, according to Wood (2014), are 4.8 times its annual consumption, which implies that the UK's oil is likely to be depleted in four years. The British Geological Survey (BGS) in association with the Department for Business,

[10] In year1983, the royalties were abolished under the Petroleum Royalties (Relief) Act 1983 for qualifying fields receiving development approval from the Secretary of State for Energy on or after 1st April 1982.

Energy & Industrial Strategy (BEIS), estimated the resource (gas-in-place) of shale gas in part of central Britain in an area between Wrexham and Blackpool in the west, and Nottingham and Scarborough in the east. The central estimate for the resource was 1,329 trillion cubic feet (tcf) compared to the annual consumption to the UK of just over 3 tcf. (United Kingdom Onshore Operators Group,2020).

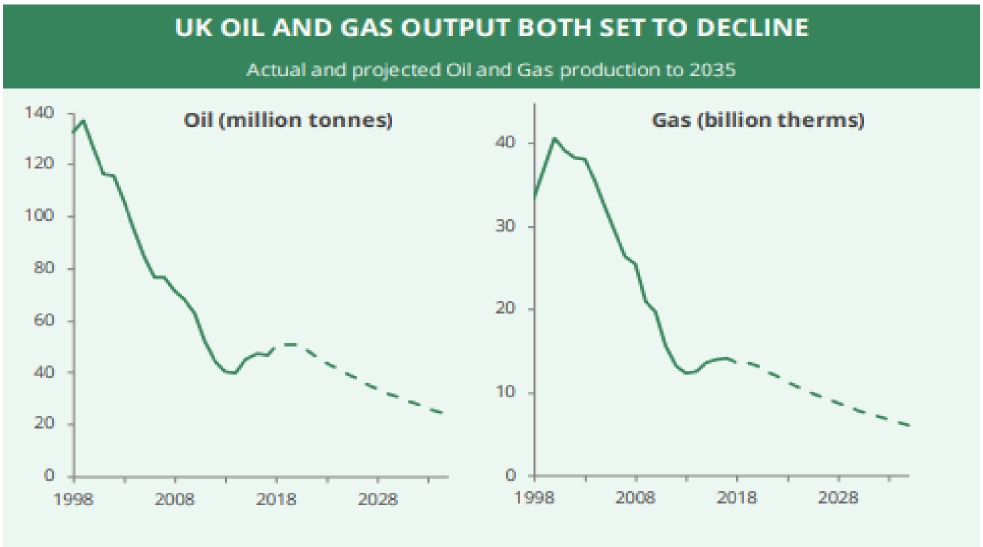
4.3.2. Offshore oil and gas fields

Oil and gas production in the North Sea from the UKCS provides a considerable source of income for the UK government. In November 1965, the BP found the first commercial offshore gas in the West Sole gas field in UK waters. The Department of Trade and Industry (DTI) reported that the first offshore oil in the North Sea was discovered by Shell in Gannet F field in March 1969, after that by BP Amoco in December 1969 and then in November 1970 in the Arbroath and Forties oil fields respectively. However, the production started at a later time. The Arbroath and Gannet F fields began production in April 1990 and June 1997 respectively, while Forties started production in September 1975 (Department of Trade and Industry, 1996). There were over 600 corporations of oil and gas active in the North Sea, 470 of them in UK waters, by 2015 (OSPAR Commission, 2015).

Oil and Gas Authority (2018a) reviews over 755 fields in total, and the potential developments both onshore and offshore are examined. In the UK, there are 120 offshore sites, with over 200 operating wells. These wells have the ability to produce 20,000 to 25,000 barrels in a single day (Oil and Gas Authority, 2018a). Most of these offshore wells are located in South England, South Wales, the Midlands and North Sea.

As of 2012, the UK had 15,729 kilometres of pipeline that linked 189 gas installations and 113 oil installations (Ward and Carvalho, 2018). However, Wood (2014) argues that these installations and wells could reduce in number in the near future because more and more wells are becoming depleted. In the same vein, Hinson et al. (2020) reported that offshore oil and gas production was at its peak in the 1980s, and recently there has been a decline in production from the UKCS. Also, the Oil and Gas Authority (Oil and Gas Authority, 2018a) believes that oil and gas will re-enter decline, after a slight upturn in 2015 to 2018, and this is summarised by Figure 4.3 below, which shows the expected decline of oil and gas production in the near future in the UK.

Figure 4. 3: Declining oil and gas output



Source: Hinson et al., 2020, p. 7)

4.4. Oil and gas reserves

The OGA in the UK confirmed that the remaining recoverable oil and gas resources could be between 10 to 20 billion barrels or more of oil equivalent (boe) in the UKCS. This will sustain production from the UKCS until 2038 (Oil and Gas Authority, 2019). The OGA (2019) and BBC News (2018) indicate that the UK has enough reserves to facilitate production for at least the next 20 years, and probably beyond. The OGA estimates the amount of remaining recoverable reserves at about 20 billion barrels. BBC News (2018) highlights that in 2018, around September, official statistics indicated that oil and gas production, particularly in the Scottish waters, dropped by 1.7%, having seen two years back-to-back growth. However, owing to the rising oil prices, the value of oil gas grew by over 18.2%.

Oil and gas reserves can be classified in three categories as provided by Oil and Gas Authority, oil and gas reserves presented in proven reserve (P1), probable reserve (P2) and possible reserve (P3). Contingent resources can be also classed as Resource volumes that on the available evidence, are virtually certain to be technically producible, i.e. have a better than 90% chance of being producible (C1), Resource volumes that are not yet 1C, but which are estimated to have a better than 50% chance of being technically producible C2 and Resource volumes that at present cannot be regarded as 2C, but which are estimated to have a significant – more than 10% but less than 50% chance of being technically producible C3 (Oil and Gas Authority, 2020).

The OGA stated that the UK had oil and gas reserves and resources at the end of 2019 based on the categories in Tables 4.2 and 4.3, as follows:

Table 4. 2: Oil reserves and resources as at end 2019 in billion boe

Reserves	1P	2P	3P
Reserves	3.6 (3.9)	**5.2 (5.5)**	6.3 (6.7)
Contingent resources	**1C**	**2C**	**3C**
Producing fields	1.4 (1.6)	**2.1 (2.3)**	3.0 (2.9)
Proposed new developments	1.3 (1.2)	**1.7 (1.9)**	2.4 (2.6)
Marginal discoveries	1.5 (1.4)	**3.5 (3.3)**	6.7 (6.3)
Total contingent resources	4.1 (4.2)	**7.4 (7.5)**	12.2 (11.8)

Source: Oil and Gas Authority (2020, p. 10)

Table 4. 3: Gas reserves and resources as at end 2019 in billion boe

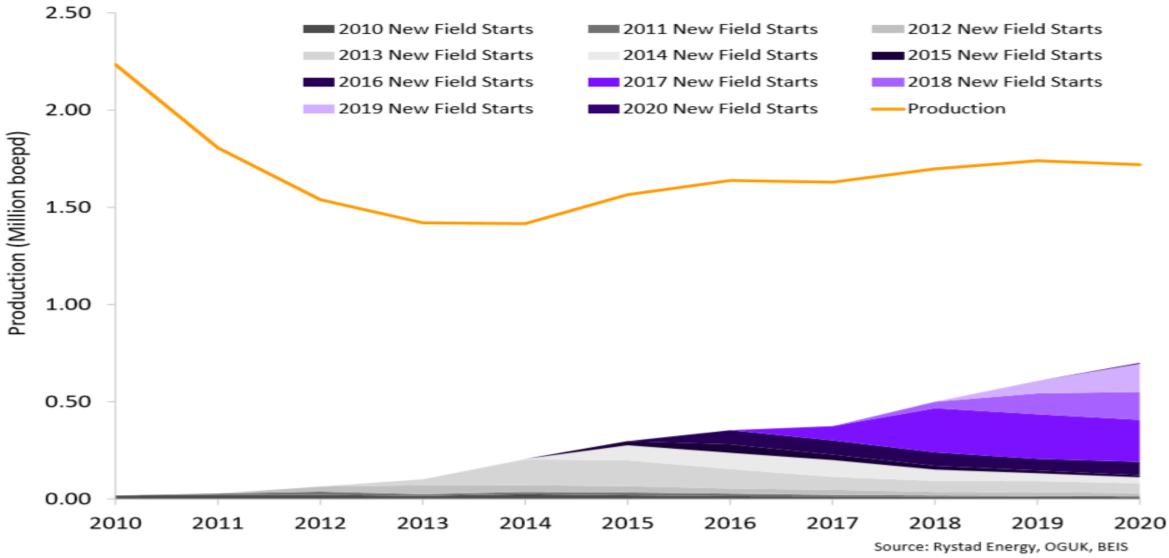
Gas	1P	2P	3P
Gas reserves	1.1 (1.1)	**1.6 (1.7)**	1.9 (2.0)
Gas contingent resources	**1C**	**2C**	**3C**
Producing fields	0.3 (0.4)	**0.7 (0.8)**	0.9 (1.0)
Proposed new developments	0.2 (0.2)	**0.3 (0.3)**	0.4 (0.5)
Marginal discoveries	0.6 (0.6)	**1.4 (1.2)**	2.5 (2.1)
Total contingent resources	1.1 (1.2)	**2.3 (2.3)**	3.8 (3.6)

Source: Oil and Gas Authority (2020, p. 11)

4.5. Oil and gas production

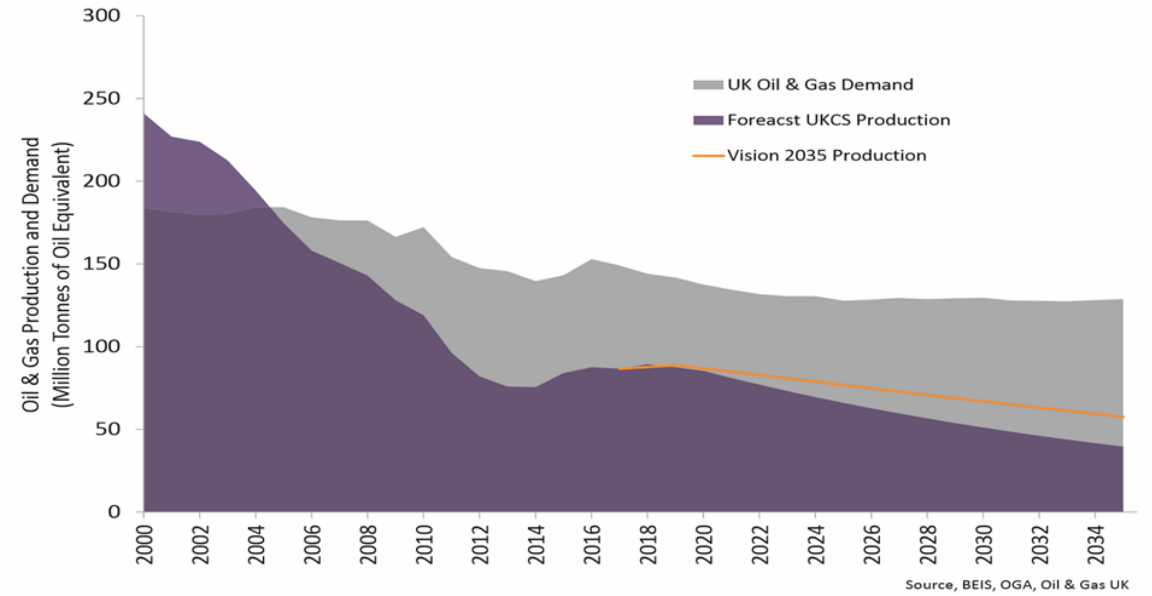
The production of oil and gas in the UKCS increased from 2014 to 2018 by 20% from 517 million boe to 619 million boe, at a daily production rate of 1.42 million boepd and 1.7 million boepd in 2014 and 2018 respectively. That level of production met just 59% of UK oil and gas demand in 2018 (Oil & Gas UK 2019). Figure 4.4 shows the production of oil and gas over the period 2010–2020. The graph illustrates that significant decline was seen between 2010 and 2013. However, since 2014 a resurgence in oil and gas production has taken place, which is driven by a new 42-field start-up production between 2014 and 2019 (Oil & Gas UK, 2019). Although the Oil & Gas UK report clarifies that this increase in oil and gas production in recent years was not enough to meet the domestic demand from 2006 (see Figure 4.5), and that shortage in production will continue until 2034 in the UK, the available oil and gas resources, according to Oil and Gas Reserves and Resources (2018a) will sustain production until at least 2038 with shortage of supply to meet demand. These statistics indicate that production is declining, oil and gas reserves are vanishing and thus decommissioning obligations are closer to being implemented. Therefore, it is vital for stakeholders to have access to clear and transparent disclosures (Abdo and Mangena, 2018). In theory, such disclosures signal information on the continuity of the oil and gas business, profitability and performance, thus allowing stakeholders to make sound decisions.

Figure 4. 4: UK oil and gas production and new field start-ups



Source: Oil & Gas UK (2019b, p. 25)

Figure 4. 5: Oil and gas production and demand

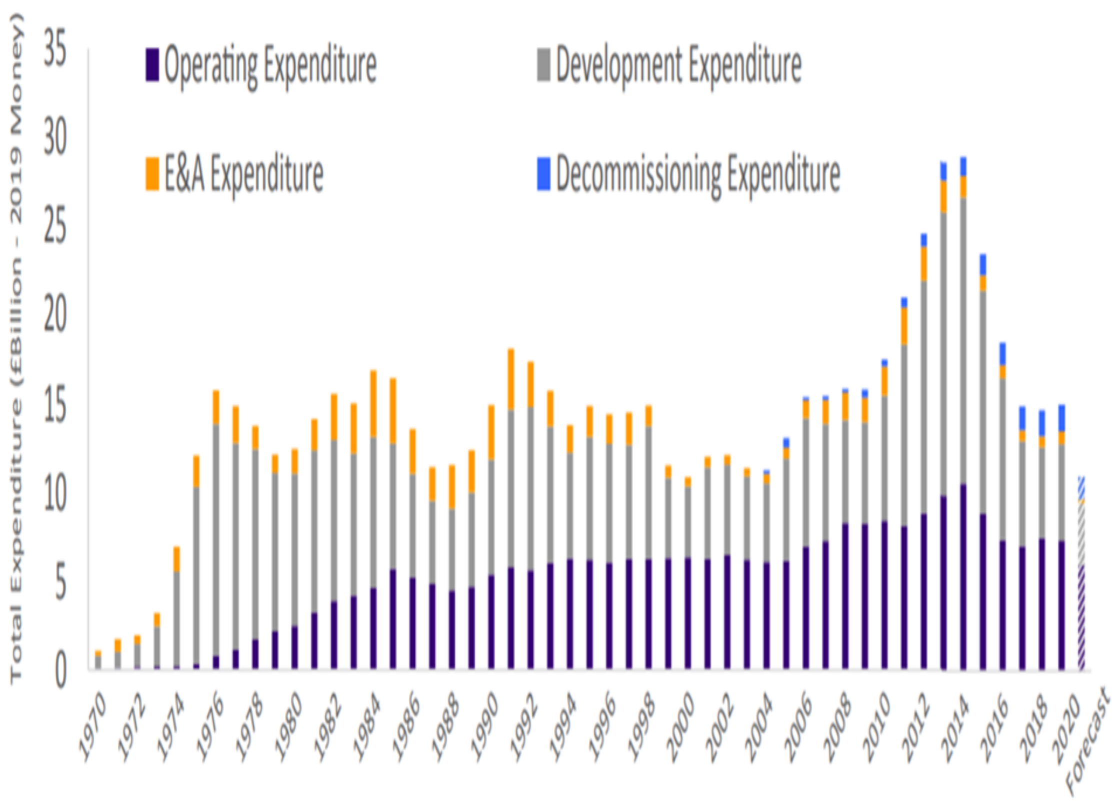


Source: Oil & Gas UK (2019b, p. 51)

4.6. Exploration activities

Although the level of exploration activities has declined in the recent years, there is increased optimism around oil and gas exploration activities on the UKCS (Oil & Gas , 2020). Figure 4.6 depicts the trend of exploration, development, appraisal and decommissioning during a long period, from 1964 until 2018. It shows the reduction in actual exploration activity and a start of a rapid increase in decommissioning activities between 2010 and 2018. That could be reflected in the oil and gas companies' disclosures as new pressures on the company budgets. Figure 4.6 shows that there is still substantial outstanding reserve potential in the UKCS. Nevertheless, drilling activity has lately been in decrease with exploration and appraisal (E&A) well activity declining steadily since 2008. Development well activity has halved since 2015 following the oil price drop (Oil and Gas Authority, 2018b).

Figure 4. 6: Total UKCS development and well decommissioning activity



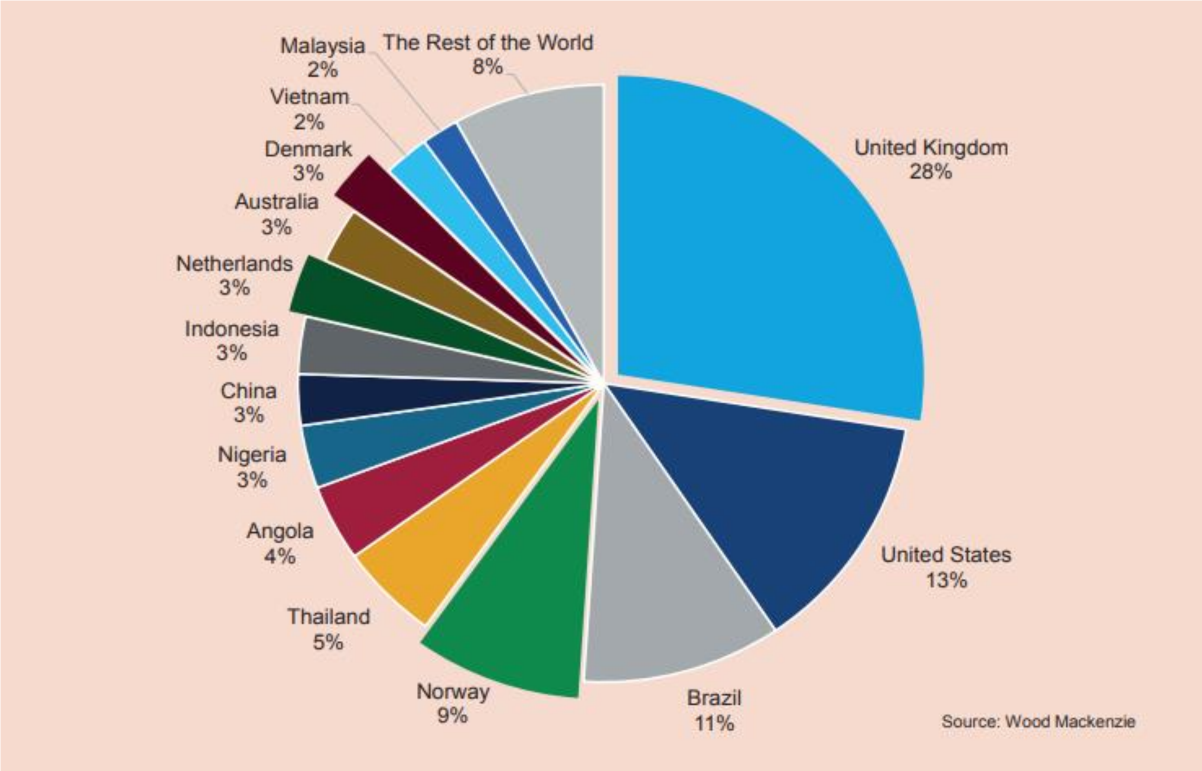
Source: Decommissioning Insight, (2020, p. 15)

4.7. Decommissioning activity

Decommissioning is the process of removing oil and gas structures upon complete economic depletion of an oil and/or gas well. Henrion et al. (2015) define decommissioning as the stopping or cessation of the oil and gas operations, particularly on offshore platforms, and ensuring that the seafloor has been returned to the pre-production state. It could also be viewed as the final stage of oil and gas projects. This is because it is carried out when the field production cycle comes to an end, and it involves the dismantling of the facilities, and ensuring that the surrounding area is back to its natural state. In the UK, this is a legal condition according to the *Petroleum Act 1998*.

Since 2010, decommissioning activities have been taking place in the UK. The Total company has been completing its Frigg Field Cessation Plan, and BP was in the final stages of the North West Hutton Decommissioning Project. By cessation of production in 2003, Frigg was estimated to have produced over 6.2 million barrel of condensate and 6.7 billions of standard cubic feet of gas (Kemp, 2013). Oil & Gas UK (2019a) confirms in its Decommissioning Insight Report that the UK could be a global hub for decommissioning activities for the next ten years, from 2019 to 2028. The decommissioning activities in the UK account for 28% of the 85 billion dollars of total global decommissioning expenditure (Oil & Gas UK 2019a). Figure 4.7 shows the decommissioning global market estimated by Wood Mackenzie that could provide a significant opportunity to lead the global market, which needs to be supported by planning, capability development and appropriate investment in the right areas across the UK's supply chain (Oil & Gas UK, 2019a).

Figure 4. 7: International market share of decommissioning expenditure 2019 to 2028



Source: Oil & Gas UK, 2019a, p. 25

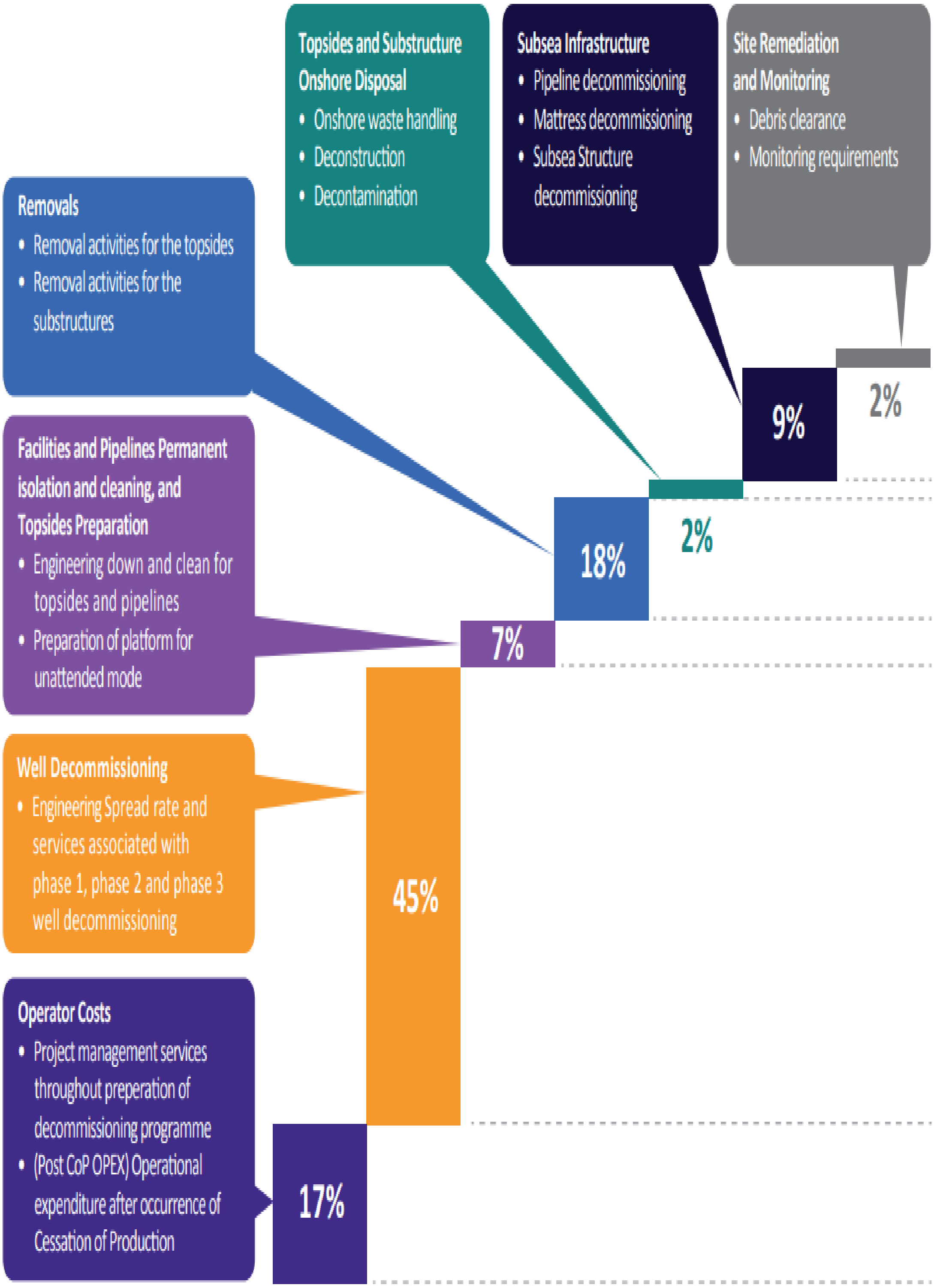
A major implication of the high decommissioning costs faced by the UK is the high costs that will have to be incurred by companies. For example, the Oil and Gas Authority (2018a and 2019) estimates that decommissioning is likely to cost the UK government between £45 and £77 billion, particularly in the next 20 years. In this regard National Audit Office (2019, p 5) highlighted that decommissioning cost the UK government through tax reliefs more than tax revenues in recent years, the report stated that:

"With decommissioning activity increasing, the government is paying out more in tax reliefs for decommissioning at the same time as tax revenues have fallen due to a combination of lower production rates, a reduction in oil and gas prices and operators incurring high tax-deductible expenditure. In 2016-17, the government paid out more to oil and gas operators in tax reliefs than it received from them in revenues for the first time, although revenues recovered in 2017-18 and were greater than tax relief payments".

What this means is that decommissioning is associated with very high cash outflow to the government, especially when compared to the oil and gas companies' expenditures, but they can recover some of these costs through tax reliefs. What this implies is that even though companies will have to take a significant 'hit' as far as their profitability and revenues are concerned, the government will rebate part of this cost via tax reliefs.

In 2019, a National Audit Office Report highlighted that the cost of decommissioning of the UKCS oil and gas assets would range between £45 billion and £77 billion, with government exposure of £24 billion through tax refunds. The report also clarified that the oil and gas industry hase contributed £334 billion in direct production tax payments since the 1970s (National Audit Office, 2019). Furthermore, in 2019, the Oil and Gas Authority(2019) estimated the total cost of decommissioning UK oil and gas installations to be £49 billion, which was estimated at £59.7 billion in 2017. However, the Oil & Gas UK (2019a) report on decommissioning expected the expenditure on decommissioning to be £15.2 billion over period from 2019 to 2028. This report breaks down the expenditure in decommissioning into seven main areas as presented in Figure 4.8. This figure demonstrates that the biggest cost of the decommissioning process comes from well decommissioning and removal activities.

Figure 4. 8: UKCS decommissioning expenditure breakdown 2019 to 2028



Source: Oil & Gas UK 2019a, p. 17)

4.8. Summary

The oil and gas industry in the UK has a very long history of exploration onshore and offshore. Currently, the level of production is experiencing a decline. However, the industry will continue production of oil and gas for the next 20 years. The decommissioning starts at the end of the life of the well or field, which is considered mainly as a new, specific business in the UK industry. The UK oil and gas industry are triggered by low oil prices, high cost of operation, uneconomical fields and high taxes in the recent decade. However, the exploration and production activity will continue in near future with shortage supply form local oil and gas activates. Furthermore, decommissioning cost is only estimated with high uncertainty, even for assets that will be decommissioned in the near future and decommissioning still controversial issue in oil and gas as it involves the biggest cash out flow and is a long process for oil and gas companies.

CHAPTER FIVE: RESEARCH METHODOLOGY AND METHODS

5.1. Introduction

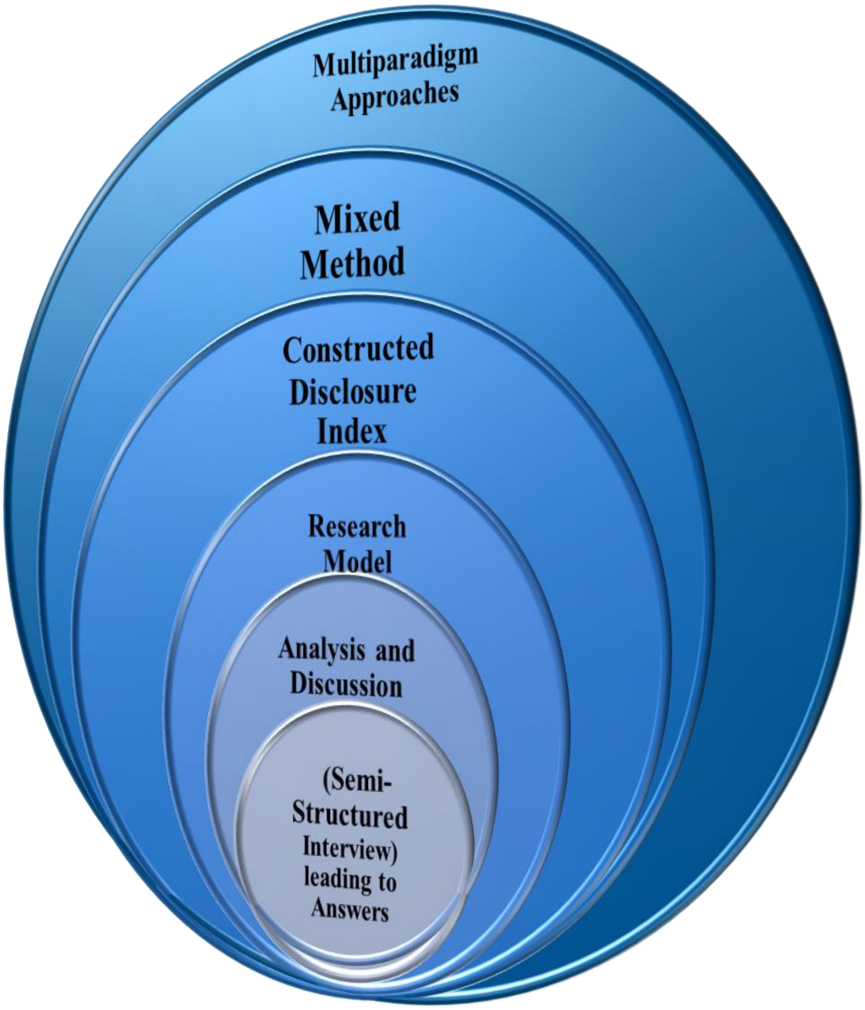
The literature reviewed in the previous chapters (two, three and four) has offered a basis for the research enquiry, shaped the theoretical framework for this study and helped in determining its methodology. The objective of this chapter is to discuss the research methodology and methods with a detailed explanation about the approaches, strategies and the philosophies that are used in the study to address the research questions and hypotheses. In addition, this chapter justifies the overall approach adopted in order to indicate the most appropriate methods for the study. Also, this chapter elaborates on the processes of data collection, sources of the data and the research instruments. The development of the econometric model to measure firms' values and performances is duly considered in this chapter. Special attention is given to the procedures for developing the disclosure index as it is used to evaluate the extent of mandatory and voluntary disclosures relating to oil and gas reserves and decommissioning costs by the listed exploration and production oil and gas firms on the London Stock Exchange. Furthermore, this chapter explains the use of interviews as a method for verifying the results of the statistical analysis.

5.1.1. Definition and concept of research methodology

There are misconceptions and confusions around the meaning of the terms 'methodology' and 'method' (Mingers, 2001). Method is simply defined as single techniques and tools that can be employed for the collection and analysis of data (Jankowicz, 2000; Saunders et al., 2019). On the other hand, methodology is the application of a combination of tools and methods to solve problems pertaining to a specific research in which they are employed and set to achieve certain aims and objectives (Babbie, 2015). Methodology is defined by Collis and Hussey (2014) as the research processes stemming from the development of a theoretical presumption to the collection and analysis of data. The focal point of a methodology is to explain in detail how a certain problem is addressed.

The methodological process takes three core approaches: identification of an interesting phenomenon for study, selecting the relevant philosophical approach and finally collection of data and analysis with the intention of answering the research questions (Silverman, 2006; Collis and Hussey, 2014; Saunders et al., 2019). Therefore, a research methodology can be defined as the process that involves identifying methods for data gathering and analysis. What influences and determines the choice of research methodology varies according to the objectives and assumptions of the study. Figure 5.1 shows the 'onion' layers of this research starting from philosophy all the way until data collection and analysis.

Figure 5. 1: The research onion' layers.



Summary of research methodology, Source: Adopted from Saunders et al. (2019, p130)

5.2. Research philosophy and paradigm

A research paradigm is a philosophical framework that guides the implementation of scientific research (Collis and Hussey, 2014). According to Saunders et al. (2019), the researcher's view of the world determines the philosophy. These assumptions support the research strategy and the research methods used by a researcher as part of that strategy. The first layer of the research phases in Figure 5.1 is research philosophy, which reflects the choices of philosophical assumptions. of ontology (realism versus nominalism), epistemology (positivism versus anti-positivism), human nature (determinism versus voluntarism) and methodology (nomothetic versus idiographic). These four assumptions are related to the nature of social science, and two methodological pillars based on these assumptions are the objective and subjective dimensions (Burrell and Morgan, 1979; Saunders et al., 2019).

Based on theoretical framework in this research (agency theory and signalling theory), the main objective of the present study is to examine empirically the relationship between reserve and decommissioning disclosures with oil and gas firm's performance and value listed in the UK. Also, the study seeks to find out the perception of the stakeholders about the empirical results of the study. Accordingly, the study attempts to provide predictions and derive generalisable conclusions regarding the reserve and decommissioning disclosures in the UK. To fulfil these research objectives, the current study adopts both objective and subjective methodological positions of philosophical assumptions. This study attempts to deliver predictions and provide generalisable conclusions about reserve and decommissioning disclosures practices and influences. Therefore, this study involves developing and testing hypotheses and investigate the reception of the oil and gas stakeholders about the study empirical results through using interviews. Thus, the significant limitations of use one paradigm can be solve by using a combination of objectivism and subjectivism in the research will most likely result in multi-paradigmatic research (Saunders et al., 2019).

Ontologically, the current research adopts a realism position. Ontology is mainly about what constitutes social reality (Blaikie, 1993). The ontological stance of this study is nearness to realism, which is in the line with empirical research rather than nominalism. The ontological premises are similar to this study's underlying assumption that the compliance of different companies with mandatory and voluntary disclosures, meeting evidential requirements is a matter of external reality, and they emphasise how these companies respond formally to the external environment. The study's assumption that the level of conformity with disclosure requirements, of oil and gas reserves and decommissioning costs, and their relationship to performance and value can be observed independently is also in line with the positivist paradigm.

Epistemologically, this study takes a positivism position. Epistemology is about what constitutes knowledge of the social reality (Blaikie, 1993). The epistemology of this study is near to a positivism position. In these respects, the epistemology of the study's assumption is that the level of conformity with disclosure requirements, of oil and gas reserves and decommissioning costs, and their relationship with performance and value, can be observed independently. Regarding the human nature assumptions, underpinning the ideographic methodology is voluntarism, where humans are completely autonomous and free willed who create the environment rather than being determined by it (Burrell and Morgan, 1979). Therefore, the current study assumes determinism which is including moral choices, are completely determined by previously existing causes. Accordingly, human beings are mainly considered as conditioned by their external circumstances. Methodology as the fourth philosophy assumption is directly dependent on the ontological, epistemological and human nature assumptions of the researcher.

The research questions are duly articulated to achieve the study aims and objective. This aids in selecting the appropriate method and helps clarify the philosophical standpoint of this study. The philosophical framework guiding this research aids in selecting the data collection methods and analytical techniques for answering the research questions (presented in section 1.6 in chapter one).

Constructivism and objectivism are the two main research philosophies (Holden and Lynch, 2004). Objectivism is the form of realism that is associated with the hypothetic-deductive approach (Ponterotto, 2005). Those who uphold objectivism values that the acceptance of objective facts, rationality, universality and value-free nature aim to explain human behaviour in deterministic terms (Burrell and Morgan, 1979; Leitch et al., 2010). However, objectivism does not take into account the process of the research subjectivity, the development of research instruments including the subjective factors that will influence the decision of what to study, the tests and the interpretation of research results.

On the other hand, constructivism is about attending to the subjective meaning and interpretations that actors in the social world use to explain human behaviour and ascribe it to a certain phenomenon (Leitch et al., 2010). Constructivism identifies the subjective part of a research process and places emphasis on the interaction of the researcher and the object, which has been to proven to uncover deep meaning (Ponterotto, 2005). The two elements, objectivist and constructivist philosophies, have been combined by some researchers to adopt a pragmatic research philosophy (Johnson and Onwuegbuzie, 2004).

Collis and Hussey (2014) expressly stated that a researcher's assumptions about the world and the nature of knowledge will determine their choice of paradigm. The research paradigms, with their set of assumptions, express their varying philosophical positions. At the ends of the spectrum are the two popular paradigms for social science researchers, positivism and interpretivism (Collis and Hussey, 2014). Table 5.1 below shows summaries of the philosophical premises around the positivist and interpretivist paradigms.

Table 5. 1: Assumptions of the two main paradigms

Philosophical assumption	**Positivism**	**Interpretivism**
Ontological premises (the nature of reality)	There is only one reality, which is objective and completely external to the researcher.	The realities are subjective and socially constructed by participants.
Epistemological premises (what makes up valid knowledge)	The researcher cannot personally influence the result of the research because the knowledge comes from objective evidence; there is a separation between the researcher and what is researched.	The researcher can directly influence the flow of the research because his/her knowledge comes from subjective evidence of the participants.
Axiological premises (the role of values)	To make the results unbiased, the researcher is completely separate from or independent from what is under study.	Owing to research subjectivity, the results are biased and value laden.
Rhetorical premises (the language of research)	Passive voice is used by the researcher and he or she also writes in a formal way, having agreed on the quantitative terms and set definitions.	The researcher writes from his or her personal view in an informal way, having agreed on the qualitative terms and limited definitions.
Methodological assumption (research process)	The researcher uses an inferential approach.	The researcher's approach is inductive.
	There is a static design used by the researcher to study the cause and effect. (Categories are identified in advance.)	The researcher studies the topic within the scope of the context and uses a regressing design (categories are identified during the process).
	Prediction and understanding including explanation often comes as the result of generalisations.	For the purpose of understanding, patterns and theories are created.
	The results are valid and reliable.	For the acceptability of the results' accuracy, the process has to be verified.
Sampling and analysis	Large number, selected randomly.	Small numbers for specific reasons.
	Qualify hypotheses according to supporting evidence or otherwise.	Produces typified meanings.
	Statistical tests of significance.	Inductive generalisation or abductive distillation.

Source: Adapted from Collis and Hussey (2014); Saunders et al. (2019); Hallebone and Priest (2009).

To give clarity to this study's research philosophy, positivist and interpretivist paradigms are discussed in detail in the following sub-sections.

5.2.1. Positivism

This is the adaptation of the natural sciences methods to the study of a social reality (Bryman, 2012). The assumption of positivism is that there is an independent space between the researcher and the reality of what is being studied (Collis and Hussey, 2014). Positivism focuses on quantitative data with precise objective measures (Cavana et al., 2001). Saunders et al. (2019) expressly opine that positivism is deductive with the literature being reviewed to explain the results and formulate hypotheses that can be tested by collecting and analysing the necessary data. Positivists gather quantitative data from their samples within the frame of statistical analysis, and the methodology used is structured to facilitate future replications and verification of findings (Saunders et al., 2019). The deductive approach requires the collection of quantitative data to test developed hypotheses, applying a highly structured methodology to assist replication of research findings (Gill et al., 2010). Therefore, the deductive approach aims at testing the research theory underlying the phenomena being examined.

The time efficiency aspect of the positivist paradigm makes it an attractive option for many social science researchers, and the acceptance of positivism values among researchers makes it easier for them to defend their positions and study findings. However, positivism has its own weaknesses, and Hussey and Hussey (1997) opine that the paradigm of positivism is not suitable for social science research that focuses on perceptions due to the notions that social experiences of human beings cannot be objectively quantified.

5.2.2. Interpretivism

This is a sharp contrast to positivism, and focuses on measuring social phenomena and exploring their complexity (Collis and Hussey, 2014). The assumption is that there is no single reality independent of actors but rather realities that are perceived differently among individuals (Krauss, 2005). Interpretivism describes and understands the social construction of realities to produce knowledge on a given social phenomenon (Hallebone and Priest, 2009; Collis and Hussey, 2014). Interpretivism acknowledges the notion that the researcher can have perceptions that can bias the research (Krauss, 2005). Greater emphasis is placed on the flexibility of the research process and the contextualisation of research findings with the expectation that researchers adjusts their approach in response to unidentified situations (Bryman, 2012). Interpretivism applies qualitative methods in explaining the meaning of the phenomenon under study (Collis and Hussey, 2014). The inductive approach collects data first and uses them to develop theory (Saunders et al., 2019). Individual observations lead to conclusions and the theory is identified as the result of research (Bryman and Bell, 2015).

There are many factors that influence the choice of paradigm, which includes the research objectives and problems and the tradition within the scope of the discipline (Collis and Hussey, 2014). The sections below discuss the main paradigms that have been employed in accounting research.

5.3. Paradigms in accounting research

Burrell and Morgan (1979) developed a framework that identifies four paradigms in social science research which they classified into subjective-objective including the social regulation-radical change continua. The researcher's assumptions are used in determining the subjective-objective continuum in reference to methodology, ontology, human nature and epistemology. The researcher may also see the unacceptable distribution of power and the conflict within the society as a way of making a radical change (Burrell and Morgan, 1979). A different taxonomy of accounting research was developed by Hopper and Powell (1985), using the framework of Burrell and Morgan (1979), in identifying the important four unrelated paradigms: functionalist, interpretive, radical humanist and radical structuralism.

Figure 5.3: Summary of research methodol

Burrell and Morgan (2017) opined that the functionalist paradigm has a problem-oriented approach, which is concerned with providing practical solutions to practical problems. The ontological position appropriate to this state is subjectivist. In the radical structuralist paradigm, the researcher's concern is to make a major change after analysing specific organisational phenomena (Saunders et al., 2019). Burrell and Morgan (2017, p.31) state that under the interpretive paradigm, "everyday life is accorded the status of miraculous achievement". This state predominantly requires the researcher to form an understanding of what is actually happening.Burrell and Morgan (2017, p.26) note the funcionalist paradigm as "often problem-oriented in approach, concerned to provide practical solutions to practical problems". Objectivism is the ontological position that fits with this paradigm. On the other hand, the structuralism paradigm is concerned about the analysis of specific organisational phenomena with a view to effecting significant changes (Saunders et al., 2019).

A radical humanist paradigm allows researchers to explicate the method by which humans can override the bonds and fetters which tie them into existing social patterns and influence their full potential (Burrell and Morgan, 2017, p. 32). Table 5.2 below shows the comparison between mainstream, interpretive and critical accounting research.

Table 5. 2: Comparison of mainstream, interpretive and critical accounting research

	Mainstream Accounting Research	**Interpretive Accounting Research**	**Critical Accounting Research**
Belief in knowledge	Quantitative data are used for the basis of generalisation and theory and observation are not related to each other.	Theory is propounded purposefully to explain human intentions. Its precision is measured through logical consistency and subjective interpretation.	Theories are judged based on temporal criteria and contextually. A social object can be studied and understood through historical development and the alteration in the totality of relations.
Perception of physical and social reality	There is a clear distinction between empirical reality and the researcher. Human subjects are essentially passive objects who are goal oriented.	Reality is socially created and objectified through human interaction. Human actions are influenced by the grounded social and historical context embedding each act.	Empirical reality is transformed in personal interpretation.
The interaction between accounting theory and practical	Accounting is value-neutral and concerned with the means, not ends, with its institutional structures taken for granted.	Accounting theory helps in explaining and understanding the creation of social order.	Theory helps in identifying and removing domination of ideological practices.

Source : Ryan et al. (2002, pp. 41-43)

The framework which was adapted by Hopper and Powell (1989) from Burrell and Morgan's (1979) ground=breaking research has been useful in categorising accounting research, although the framework is lacking in identifying all the dimensions required in the methodology of the accounting discipline (Ryan et al., 2002). Researchers like Laughlin (1995) also adapted the framework without the use of the subjective-objective dimension. The affected dimension is synonymous with that of Burrell and Morgan's social regulation-radical change continuum, while the level of theorisation is the major concern of theory and methodology (Ryan et al., 2002). Laughlin (1995, p 69) identifies three levels of accounting research. "A high levels of theoretically defining the methods of investigation for who believe in high level of clustering reflects high theory and methodology". Positivism, realism, instrumentalism and conventionalism fall within this category. As well, those who want to reduce to a minimum prior theorizing will prefer a similar minimal theoretical definition in the investigatory methods. Mainstream accounting can be characterised as high theory, high methodology and low change (Ryan et al. 2002).

5.4. Rationales for adopting a positivist paradigm

The main objective of this study is to investigate the impact of the disclosure of oil and gas reserve and decommissioning costs on the value and performance of exploration and production oil and gas companies listed in the UK. This requires that statistical tests be conducted to determine the impact of independent variables on the dependent variable. In this regard, the nature of the study requires the use of mixed methods – quantitative and qualitative data that can be empirically analysed to determine such impacts. The quantitative data on disclosure were obtained from annual reports, and by applying an econometric model, the researcher measured the impacts of these disclosures on the value and performance of the sampled companies. The qualitative data in this research were obtained from conducting semi-structured interviews with stakeholders in the oil and gas field, and were analysed to verify the study's empirical results. Consequently, the positivist paradigm is appropriate as the main research paradigm for the current study, based on the research questions and objectives, nature of the study and the data sought by the study (see Figure 5.1).

In addition, a positivist approach is the most appropriate for this study since it involves objectivity rather than subjectivity and allows for established scientific approaches to be used, such as descriptive statistics and inferential statistics. Using a positivist approach allowed the study to test the impact of two different variables that have opposing cash-flow effects on oil and gas companies: oil and gas reserves and decommissioning costs. In order to establish and test a possible link between these disclosures of oil and gas reserves, which underlie a cash inflow, and decommissioning costs, which indicate cash outflow, on one side and the value and performance of oil and gas companies on the other, quantitative data are required. These data were organised and managed in a self-constructed disclosure index and fed into an econometric model. In addition, the study draws on agency and signalling theories to build a conceptual framework that recognises, analyses, explains and predicts the relationship between disclosures of oil and gas firms on one side and firm performance and value on the other.

Moreover, previous studies on the interaction between oil and gas disclosures and performance have also followed a positivist philosophy (see Spear, 1994; Misund et al., 2008; De Abreu et al., 2016), oil and gas disclosure and value (see Dharan, 1984; Lys, 1986; Aboody, 1996; Berry et al., 2004; Cho et al., 2010; Gordon et al., 2010; Odo et al., 2016), and decommissioning disclosure and disclosure requirements (see Rogers and Atkins, 2015; Abdo et al., 2017; Abdo et al., 2018).

In order to develop these study models, test them and run them, a positivist paradigm is the best fit for this research study. Furthermore, this paradigm has been adopted in this study because it allows the researcher to use existing theories to explain the results of the study's empirically based framework of accounting practice that can be used or tested in other firms.

However, when it comes to choosing the research paradigm in accounting research, it is what is appropriate for the type of research being undertaken because it follows the transition zones that constitute multiparadigm approaches which is links both interpretive and functionalist paradigms provides an opportunity to benefit from broader integrated theoretical framework (Gioia and Pitre, 1990). Multiparadigm approaches provide the possibility of producing fresh insights because they begin from diverse ontological and epistemological assumptions, and that can produce markedly different and uniquely informative theoretical views of phenomenon under research (Gioia and Pitre, 1990). Therefore, this current research is in line with objective research philosophy and multiparadigm approaches.

5.5. Research strategy

A research strategy is presented in the second layer on the research onion in Figure 5.1; it is the researcher's plan for obtaining data to answer the research question (Saunders et al., 2019). The research strategy reflects the research approaches and is linked with the research philosophy and the gathering and analysing of relevant data pertaining to the study (Denzin and Lincoln, 2011). The adoption of the research strategy is influenced by the philosophical assumptions of the chosen paradigm (Collis and Hussey, 2014) and the nature of the problem being investigated (Bryman, 2012). The current research is established on the multiparadigm in the interpretive and functionalist transition zone. The research strategy seeks to describe the level of disclosures practices on reserve and decommissioning items and the relationship between that level of disclosures and firm's performance and value, as well as investigating the perception of stakeholders about the empirical study results. The positivist paradigm is generally associated with quantitative data collection methods and a deductive approach, and the interpretivism paradigm is generally associated with qualitative data collection methods and an inductive approach (Bryman, 2012; Saunders et al., 2019).

The inductive approach is used by researchers to move from data to theory whereas researchers move from theory to data when they use the deductive approach (Saunders et al., 2019). In other words, the deductive approach begins with developing hypotheses, drawing on the existing theories, and tests the theories empirically. This approach uses the theory to support the analysis and explain the research results (Gray, 2009). On the other hand, the inductive approach begins with collecting data about what the research focuses on; then the researcher looks for the pattern of data and analysis to construct a general relationship and even test or develop theories (Gray, 2009).

This current research applied a mixed method strategy by using quantitative method (secondary data); this data was used to run the econometric study model. Qualitative data obtained through conducting semi-structured interviews was also used. This mixed method was vital to address and answer the research questions.

While answering the research questions requires the measurement of the relationship between disclosures on one hand and value and performance on the other hand, the determination of the level of these disclosures is a matter of subjective judgement, given that scoring the constructed disclosure index involves subjective reasoning. This qualitative reasoning fulfils the explanatory aspect of the research. Qualitative methods are commonly believed to give a deeper understanding of social phenomena than would be obtained from purely quantitative methods (Silverman, 2005). Popular among qualitative methods are interviews, in which questions may be formulated to allow participants to answer in their own words (Hussey and Hussey, 1997; Silverman, 2005; Silverman, 2006; Creswell and Clark, 2011). In this regard, the current research uses semi-structured interviews with stakeholders to validate the quantitative-based results.

In the present study, qualitative methods helped the researcher to probe the merits of and justifications for the quantitative econometric model results by using semi-structured interviews. Therefore, this study employs interviews, which were vital to address the research question: what are the perceptions of key stakeholders in the oil and gas sector in the UK about the influence of mandatory and voluntary reserves and decommissioning disclosures on oil and gas firms' performance and value?

In this context, Creswell and Clark (2011) stated that mixed method research helps answering questions that would not be answered by either qualitative or quantitative methods alone. This study utilised a mixed methods approach under this multiparadigm approaches as a research strategy to prepare variables to run the study model and discuss its results, then validate the results through conducting semi-structured interviews to ensure or enhance the accreditation of the study's quantitative results.

5.5. Validity and reliability of annual reports as a data source

An annual report and accounts (financial statements) are presented in a document published by companies and used as an official document to provide information to stockholders. Investors use the annual report and accounts rather than other tools as the main source of information owing to their usefulness and credibility. Managers commonly use the annual report and accounts as a tool to signal what is important to the stakeholders (Guthrie and Petty, 2000; Guthrie et al., 2004). Past studies have emphasised that information contained in the annual reports and accounts provides important insight for researchers (e.g., Botosan, 1997; Eng and Mak, 2003; Brüggen et al., 2009). Moreover, Botosan (1997) stated that the annual report serves as a good proxy for the level of voluntary disclosure provided by companies across all disclosure avenues.

However, Unerman (2000) argued that, despite the availability of many disclosure media platforms, a limit must be put on the range of documents to be examined by researchers in order to ensure consistency and completeness of data. Hence, many studies used annual reports and accounts as the source to investigate compliance with disclosure requirements (e.g., Street and Gray, 2004; Kang and Gray, 2013; Glaum et al. 2013; Guthrie and Pang, 2013; Carlin et al. 2014; Abdo, 2016; Odo et al., 2016; Misund, 2017; Lee, 2017; Abdo et al., 2017; Abdo et al., 2018). Thus, given their usability, popularity as credible secondary data sources and validity, this current study focuses on the disclosure in the annual report and accounts as an official document that is accepted as a source of reserves and decommissioning disclosures by oil and gas companies. The annual report and accounts as a formalised structure helps this research to investigate the mandatory and voluntary disclosures and also provides other information related to calculate the research model variables.

5.6. Data collection methods

The researcher must decide the sort of data that need to be collected (qualitative, quantitative or a mixture), the sample area from which the data are to be collected, when data will be collected and the method of collection (Hussey and Hussey, 1997). This study uses a mixed method approach which is presented in the second layer in Figure 5.1. The research design requires that data be collected at different stages.

To start with, qualitative data are needed to construct a preliminary disclosure index, which is needed to evaluate the types and levels of disclosure for both mandatory and voluntary oil and gas reserves and decommissioning cost-related disclosures. This index will then be used to record the level of disclosures of exploration and production oil and gas companies listed in the UK over the period 2010 to 2017. Annual reports and accounts of the sampled companies were downloaded from the listed companies' websites. These provide the most current view of the state of disclosures of oil and gas companies listed in the UK. The data-gathering approach taken for constructing the disclosure index follows the assumption of disclosure index studies that use the disclosure index to measure the level of disclosure by investigate the availability of disclosures items selected. Whenever the presence or absence of an item is recorded, a binary coding scheme has been used where a score of 1 means present, otherwise a score of 0 (Beattie et al., 2004).

In the process of data collection, content analysis was used for both quantitative and qualitative data (Monterio and Aibar-Guzman, 2010). Content analysis as used in this study is the construction of a classified set of rules (disclosure items in this study) for assembling, measuring, coding and recording of the data being examined (Milne and Adler, 1999). Adopting the content analysis method elicits answers to the questions of ‘where?’ (identifying the right documents used for analysis – annual reports and accounts in this study), ‘what?’ (defining the mandatory and voluntary disclosures for reserves and decommissioning in the oil and gas industry) and ‘how?’ (codifying the data for calculating score of the disclosure index).

This research uses two techniques for constructing the disclosure index (NVivo software and manually) to identify major themes within disclosure items from annual reports of the sampled companies, and thus develop the required scores for each company. The findings of NVivo are also reviewed manually to identify any shortcoming or fault. First, the main items that this was study looking for were coded, namely reserves and decommissioning. Each annual report and accounts of the sampled companies were wholly scanned via NVivo before coding to search for these two items. To make judgement on the relevance of an item to develop a disclosure index, some words, such as ‘reservoir’ for reserves and ‘abandonment’ for decommissioning, were also added as terminologies for determining the same category in the disclosure index. After that, coding was carried out for all developed disclosure index items, to measure and score the different disclosure required in the index to use them in the study’s econometric model.

Quantitative data regarding firms’ performance and value (the dependent variables), institutional ownership, leverage, size, auditor quality, listing status, accounting method and firm age (control variables) were collected from firms’ annual reports and accounts and data providers such as the London Stock Exchange (LSE) and Bloomberg. The level of disclosures calculated from the disclosure index is the independent variable of interest in this study. Finally, this study uses semi-structured interviews to find out the perceptions of stakeholders about the empirical results of the impact of mandatory and voluntary reserves and decommissioning disclosures on oil and gas firms’ performance and value.

5.7. The disclosure index

Disclosure indices are tools for measuring the range of reported information in specific disclosure by one or more specific entities, which is presented in the third layer on Figure 5.1. Indices have been widely used to explain, assess and compare the information disclosed by firms in annual reports (Marston and Shrives, 1991; Hassan and Marston, 2010). Some researchers are likely to use the amount of disclosure as a proxy for disclosure quality (Beattie et al., 2004), with certain studies specifically suggesting that the quantity of information disclosed is a reflection of the quality of corporate disclosure (Botosan, 1997).

Hassan and Marston (2010) classify disclosure indices according to three criteria:

1. The degree of researcher involvement (complete involvement to zero involvement). Complete involvement is all about researchers controlling the entire process of constructing the index, and selecting the items of information and finally scoring them. At the opposite extreme, the researcher may use an index published in a previous study or by a professional organisation, such as the Financial Analysts Federation (FAF) or the Association for Investment Management and Research (AIMR), and will not alter the contents of the chosen index but use them as they are.
2. The type of information disclosure (mandatory only, voluntary only or both).
3. The list of items and information available in the index.

Although widely used, disclosure indices do have some limitations when it comes to measuring the quality of disclosures. Defining the number of disclosure items included in a self-constructed disclosure index is the researcher's responsibility, with the result that most such indices are constructed using only a small sample. This is a result of the laborious nature involved in the process of data collection. Furthermore, the results are appropriate only to the scope of the index used (Hassan and Marston, 2010). Healy and Palepu (2001) argue that it is particularly difficult to measure the extent of voluntary disclosure. Notwithstanding these limitations, this study used a self-constructed index to measure disclosure levels. The mandatory disclosure items in the index were grounded on International Accounting Standards (IAS) and International Financial Reporting Standards (IFRS) requirements. The voluntary disclosure items were based on recommendations of official bodies such the Securities and Exchange Commission (SEC), the Operating and Financial Review (OFR), and on Statements of Recommended Practice (SORP).This constructed disclosure index was sent to two academics in the UK for review before it was used to develop disclosure scores.

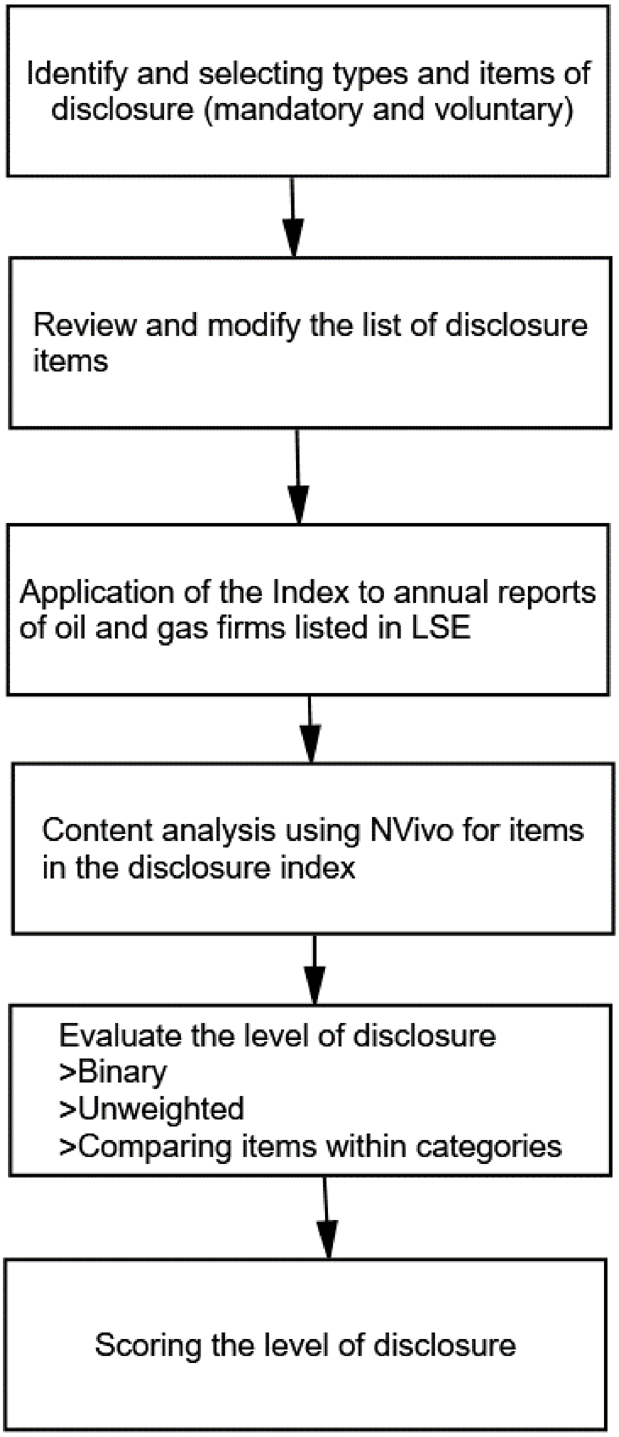
5.7.1. Constructing the reserve and decommissioning disclosure index (R&DDI)

Different authors suggest different steps in building a disclosure index, as discussed extensively in the literature review chapter (see section 2.6.3 'Self-constructed disclosure index approach'). While these suggestions mostly mirror each other, certain advances were made by some authors. For example, according to Hussainey (2004), constructing a disclosure index involves three main stages: identifying and choosing the preliminary list of disclosure topics, selecting the last list of disclosure topics and measuring the quality of disclosure. Ahmed (2015) identifies five steps in index construction: identifying the relevant information, exploring voluntary disclosure in annual reports, modifying the checklist, reviewing the initial checklist and constructing the final checklist. Finally, Hooks et al. (2002, p 518) suggest a generic method for creating public disclosure indices which comprises four discrete steps:

the creation of a stakeholder panel (e.g., auditors, lenders, regulators and academics) to itemise what should be included in the index and their relative importance, construction of the index and application of the index to annual reports, feedback of the results to the panel and report preparers to validate the findings.

All of the above suggested steps seem to follow a broadly similar process. This study benefits from these suggestions in building a comprehensive disclosure index. Figure 5.2 shows how this process has been adapted in this study. The steps followed in constructing the index are discussed next in some detail.

Figure 5. 2: Flowchart of disclosure index construction



Disclosure index construction in this study (Author’s own)

5.7.1.1. Identifying and selecting types and items of disclosure

The first step is to identify and select the types and items of disclosure-related information, including clarifying which disclosure items are mandatory and which are voluntary for oil and gas companies listed in the UK. Marston and Shrives (1991) acknowledge that the construction of a disclosure index involves subjective judgement but warn that the researcher should aim to minimise the subjectivity of the index as far as possible. Others advise that including a large number of disclosure topics not only increases the chances of covering the most relevant areas but also reduces risks of subjectivity and bias (Hooks et al., 2000). For the sake of this study, disclosure items were selected following a careful review of prior studies and a review of a sample of oil and gas companies' annual reports. Items related to mandatory disclosure were based on the International Accounting Standards (IAS) and the International Financial Reporting Standards (IFRS) requirements for oil and gas reserves and decommissioning, while those related to voluntary disclosure were based on the SORPs, Securities and Exchange Commission (SEC) recommendations and accepted best practices among professional organisations in the sector. These requirements/recommendations are summarised below.

1- *Accounting method*

Two accounting methods that have been primarily used under national Generally Accepted Accounting Principles (GAAPs) to account for exploration and evaluation (E&E) in the oil and gas industry are Successful Effort (SE) and Full Cost (FC). Area of Interest (AOI) is also commonly used by Australian oil and gas companies.

SE is used by integrated oil and gas companies and some smaller upstream companies. In SE accounting, only costs of successful exploratory wells are capitalised, and the costs of dry exploratory wells are expensed (Bandyopadhyay, 1994; Abdo, 2018). In the process of acquiring, finding and appraisal, the costs incurred are typically rendered on a field basis (PWC, 2017). In FC, the necessary cost expended in searching for, developing and acquiring the reserves in a large area cost centre is capitalised without regarding the success in finding of commercial reserves (PWC, 2017; Abdo, 2018). The AOI method is set out by the AASB[11] in standard 1022: *Accounting for the*

[11] The ASRB is the Accounting Standards Review Board, which was re-established under the *Australian Securities Commission Act 1989* and in 1991 renamed the Australian Accounting Standards Board (AASB). The AASB's standards then applied under corporate law.

Extractive Industries in Australia, which states that all the areas needed in the extractive industries shall be put into consideration independently based on an individual geological area, when choosing that area to explore and the extent to which the area shall be explored, and the cost of exploration, development and evaluation are carried forward or cancelled out (Accounting Standards Review Board, 1989).

According to International Financial Reporting Standards Foundation (IFRS 6), Exploration and Evaluation (E&E) expenditures must be categorised within the balance sheet as non-current assets. They must be disclosed in the financial statement and be identified separately from the producing assets (IFRS 6). IFRS 6 permits companies to use either the SE or FC methods (Abdo, 2016). Oil and gas companies are required to disclose the accounting method they use (Misund, 2017). Therefore, this study investigates whether different accounting methods influenced the level of reserve and decommissioning disclosures.

For example, proven and probable reserves or proved reserves might be used for depreciation, depletion and amortisation calculations.

2- *Reserve Disclosures: Mandatory Items*

A- Per the International Financial Reporting Standards Foundation (IAS 1), *Presentation of Financial Statements*, financial statements must contain information on the quantities of oil and gas reserves, and entities should consider presenting any change on an aggregated basis. For example, proven and probable reserves or proved reserves might be used for depreciation, depletion and amortisation calculations, and any changes in figures should be identified and communicated whenever certain reserves are subject to particular risks.

B- Some reserves such proved developed reserves might be used for production depreciation, amortisation calculations, depletion and depreciation. IAS 1 also requires the awareness of all the assumptions and sources of the forecast uncertainty at the balance sheet date including:

- The methodology used and key premises made for reserve estimates and hydrocarbon resource; and

- Changes in the underlying key assumptions, including the reserve estimates and hydrocarbon resource. These should be explained in detail (PWC, 2017).

3- Reserve Disclosures: Voluntary Items

A- The favoured approach to disclosure in the industry under the Securities and Exchange Commission SEC, (2009) guidance on the disclosure of reserves recommends the following:

- Disclosure of estimates of proved developed reserves, the total proved reserves and the proved undeveloped reserves should be presented according to the geographical area, including the countries where the company's overall reserve is over 15%.
- Disclosure of non-traditional sources like bitumen shale, coal-bed methane as part of oil and gas reserves.
- The disclosure of possible and probable reserves should be optional.
- Optional disclosure of the sensitivity of reserves' numbers to price.

B- The Oil Industry Accounting Committee (2001), provided the Statement of Recommended Practice (SORP), which recommended as voluntary requirements:

- The disclosure of oil and gas reserves at the beginning of the financial year.
- The disclosure of geographical regions and their total oil and gas quantity.
- The disclosure of revisions of preceding estimates including the acquisitions of the reserves in place and production and movement of oil and gas reserves.
- That oil and natural gas liquid must be presented in barrels while the gas reserves must be in cubic feet.

4- Decommissioning Disclosures: Mandatory Items

A- The following decommissioning provisions were set out by IAS:

- A provision is identified when an obligation exists to execute the clean-up (International Financial Reporting Standards Foundation, 2005, IAS 37, paragraph 14). The obligation to despatch or decommission an asset is established at the time of the placement of the asset. An example is that, when an offshore drilling platform is used, it must be decommissioned at the end of its final use. The obligation for the removal occurs at the time of the placement. However, there are differences in practice regarding the recognition of the entire expected liability at the commencement of the activity or whether the recognition takes place when there is an increment as the development of activity progresses. There are also some differences in the recognition of the decommissioning liabilities in the exploration phase of a project or at any particular point in time where there is a need to reflect on the specific facts and circumstances of the project and the entity's obligations (PWC, 2017).

- The measurement of the decommissioning provisions should be made in terms of the present value of the expected future cash flow required in performing the decommissioning (IAS 37, paragraph 45).
- The cost of provision should be included among the cost of assets whenever they are put in place and allow for devaluation over the asset's life span (International Financial Reporting Standards Foundation, 2003, IAS 16, paragraph 16c). Fixed asset total cost is depreciated, including the burden of decommissioning, on the ground that depreciation becomes obvious in the asset's economic benefits' consumption, especially the unit of production (UOP). Thus, at the time of installation asset, it is required to estimate the cost of decommissioning that asset.
- The recognition of the restoration of oil and gas sites and the provision for decommissioning is upheld even if the decommissioning is not undertaken in a long time, about 80 to 100 years (PWC, 2017).
- The discounting of the provision reflects the effect of the time of the expected decommissioning. The discount rate used is the pre-tax rate that reflects the assessment of the current market in the time value of money. In estimating the decommissioning cost, all entities need to reflect the associated specific risks.
- The future cash flows expected to be incurred in performing the decommissioning may be denominated in a foreign currency. When this is relevant, the foreign currency future cash flows should be

discounted at a rate relevant for that currency. The present value is translated into the entity's functional currency using the exchange rate at the balance sheet date.

B- Revisions to decommissioning provisions:

- The balance sheet is always updated with the inclusion of the decommissioning provisions for change within the estimated amount or the schedule of the cash flow and the discount rate changes (IAS 37, paragraph 59). Any alterations in the provisions that are related to the removal of an asset are deducted from or added to the current period related asset (International Financial Reporting Standards Foundation, 2004, IFRIC1,[12] paragraph 5). However, there is a restriction to the adjustment of an asset. The decrement in the asset must not result in a value below zero and must not increase above the recoverable amount (IFRIC 1, paragraph 5).
- If the fall in the provision exceeds the estimated amount of the asset, the difference becomes obviously the profit or loss: the changes that lead to the cost addition to the asset are assessed to ascertain whether the new amount is fully redeemable or not (PWC, 2017).

5- *Decommissioning Disclosures: Voluntary Items*

The Statement of Recommended Practice, SORP, (2001) recommendations include the following:

- The decommissioning provision of liabilities is to be accounted for and calculated using the present value of the expected decommissioning expenditure.
- In arriving at an appropriate estimate of a provision, all the risks and uncertainties must be taken into consideration. This can be achieved by reducing the approximated future decommissioning costs at the level of a pre-tax, free rate.

[12] IFRIC Interpretations are developed by the IFRS Interpretations Committee (previously the International Financial Reporting Interpretations Committee, IFRIC) and are issued after approval by the International Accounting Standards Board (IASB).

- The approximated amount to be reduced should be recorded as the cash flow value that is adjusted to reflect uncertainty.
- Decommissioning liabilities should include facilities where damage has been caused that will need to be rectified.
- To reflect the current estimate of the cost at the present value, all provisions should be reviewed at the date of the balance sheet.
- An adjusted provision, owing to changes in estimate, must have a corresponding opposite and equal adjustment to the decommissioning oil and gas asset.
- The remaining assets are to be decommissioned at the time of creating the decommissioning asset. The residual values estimated should be considered when creating the amortisation to the charged.

5.7.1.2. Revision and modification of the list of disclosure items

The self-constructed disclosure index for this study was reviewed in the light of the information disclosed by oil and gas companies. A pilot study was applied to 10% of the sampled companies, and a preliminary analysis was conducted in order to test the usefulness and validity of the disclosure index. Hooks et al. (2002) advise that a careful review of the proposed items is necessary to ensure the validity of the index. A further assurance procedure was undertaken by the researcher, which included sending the draft index to two academics to obtain their feedback on the design and contents of the index, they provided comments and suggestions to improve the final list of constructed index. Suggestions by academic reviewers were discussed with supervisors and carefully considered to ensure the applicability of the final list of the items in the index to make sure it captured all of the relevant and key disclosures in the annual reports and accounts of the sampled companies.

5.7.1.3. Content analysis

In this study, the content analysis technique was applied by using NVivo software to investigate the narrative disclosure related to reserves and decommissioning in the sample firms' annual reports and accounts for eight years (2010–2017) for all oil and gas listed firms on the UK market to construct the disclosure index (RDDI). The content analysis was used manually more one time to evaluate the level of disclosures in the annual reports for sampled oil and gas firms. The study comparing between manually and NVivo methods to constructed disclosures index as test for the reliability of constructed disclosure index results. The NVivo software was used to search for and code the items in the constructed disclosure index and to evaluate the individual disclosure item and total scour for each type of disclosures. Furthermore, the researcher read through annual reports and accounts of the sampled companies to establish the type of data being disclosed and the location of these data in the annual reports and accounts.

In terms of the disclosure scores, previous studies use the unweighted index method (e.g., Cooke, 1989; Hossain et al., 1994; Owusu-Ansah, 1998; Haniffa and Cooke, 2005; Abdo, 2016; Abdo et al., 2017; Abdo et al., 2018). The unweighted index method assumes that all items selected in the index are equally important. A dichotomous procedure was conducted whereby an item of disclosure was allocating a score of 1 if the company presents a disclosure item or a score of 0 if not. Thus, the study utilised the an equally-weighted dichotomous approach based on categorical coding is applied in this study to score the disclosure items and develop the disclosure index (see the constructed disclosure index in Appendix 2).

5.8. Reliability and validity of disclosure indices

Researchers view the disclosure index as one of the most useful instruments for measuring corporate disclosures (e.g., Cooke, 1989; Botosan, 1997; Hassan and Marston, 2010), even though, Botosan (1997) acknowledges that its reliance on the subjective judgment of the researcher increases the likelihood that it may lack stability and/or accuracy. Healy and Palepu (2001) point out that it is in the nature of self-construction both to increase the likelihood that the tool will truly capture what it is designed for and make findings more difficult to replicate. This leads Hassan and Marston (2010) to argue that such indices must be subjected to robust reliability tests.

Hassan and Marston (2010) identify three ways of assessing reliability. The first is test-retest, which allows the researcher to assess the stability of the results obtained using a disclosure index or content analysis. The second is inter-coder reliability testing, in which many coders code the same text and the results are examined for correlation: the higher the correlation coefficient, the more reliable the measurement instrument. The third way of assessing reliability is to test for internal consistency, with the most popular test here being Cronbach’s alpha, which is used to estimate the expected correlation between one test and a hypothetical alternative containing the same number of items. This test was used in a number of studies (Botosan, 1997; Hail, 2002; Kelton and Yang, 2008; Hassan et al., 2009) and is considered the best technique for evaluating the reliability of disclosure measurement instruments (Hassan and Marston, 2010).

This study used Cronbach’s alpha and inter-coder reliability testing to evaluate the reliability of the proposed disclosure index because they are more appropriate in establishing reliability and hence more accurate compared with other methods.

Hussainey et al. (2003) compared the disclosure scores generated by automated content analysis of firms’ annual reports with those obtained from manual content analysis and found a high level of correlation (0.96). Accordingly, this study used automated disclosure scores obtained using manual content analysis and compared them with result of automated software (NVivo) in developing a disclosure index to assess the reliability. In addition, data reliability tests for disclosure constructs was conducted by generating Cronbach’s alpha involving the measurement items for each construct. In addition, an inter-coder reliability test was performed by comparing correlations between automated-disclosure and manual-disclosure constructs. Convergent validity tests were conducted for the disclosure index constructed for this study by using Pearson correlation tests.

The validity of the index has implications for the strength of the conclusions that are drawn from the results. Validity relates to the extent to which the index measures what the researcher intended it to measure, and whether the resulting scores have any other meanings (Marston and Shrives, 1991). There are three ways to measure index validity: criterion validity, content validity and construct validity (Hassan and Marston, 2010). Content validity (face validity) is generally regarded as insufficient to test the validity of disclosure indices because it relies on the subjective judgement of non-experts (Hassan and Marston, 2010). Criterion validity may be concurrent or predictive. Concurrent validity is about the correlation between a measure and a current criterion, while predictive validity is about the correlation between a future criterion and a relevant measure (Hassan and Marston, 2010). When Hassan and Marston (2010) reviewed 50 studies employing a self-constructed disclosure index to see whether they had tested for validity and reliability, they found that 29 out of the 50 studies had tested for general validity, 23 had tested for construct validity, six had tested for content validity and nine had tested for index reliability. Beattie et al. (2004) argue that most researchers focus on construct validity.

Construct validity measures the extent to which the index performs in accordance with theory and the empirical findings of previous researchers. If there is a positive correlation evaluated between firm features and corporate disclosure scores, then it supports the disclosure scores' validity (see Botosan, 1997; Hassan and Marston, 2010). Since construct validity relies on establishing a pattern of consistency, most disclosure studies have examined the relationship between disclosure and similar firm characteristics such as firm size, listing status, profitability and performance (Hassan and Marston, 2010). Convergent validity tests were conducted for the disclosure index constructed for this study using Pearson correlation tests.

The lack of a general theory of disclosure may make the task of developing a measurement instrument more difficult. Most empirical studies identify variables used in measuring disclosure that might have a relationship with the level of disclosure. This study aims to test the relationship between disclosures of oil and gas reserves and decommissioning costs on one side, and value and performance of exploration and production oil and gas companies listed in the UK on the other. To this end, it has identified: 1) the mandatory and voluntary disclosure requirements for oil and gas companies listed in the UK; and 2) the variables that may have a relationship with mandatory and voluntary reserve and decommissioning costs disclosures in these companies. The next section discusses the models used to test these relationships.

5.9. Research hypotheses

The research objectives of this study are directed at understanding the impact of reserve and decommissioning disclosures on the value and performance of exploration and production oil and gas companies listed in the UK. Based on the conceptual framework, hypotheses were developed to test the relationships and meet the research objectives.

5.9.1. Mandatory oil and gas reserve disclosures

Mandatory disclosure refers to the information that accounting and regulatory bodies require companies to disclose in their annual reports and accounts. Dye (1990) argues that mandatory disclosure may affect investor perceptions about a company's competitors' prospects, that is, it may be likely to affect investors' beliefs about the company's competitors' prospects and so may lead to real or financial externalities. Real externality is known as a company's disclosure regarding its cash flow, which has an impact or is likely to have an impact on the company's cash flows (Dye, 1990). Berry and Wright (2001) posit outright that reserve disclosure information is value-relevant.

Tsalavoutas and Dionysiou (2014) argue that companies showing a higher level of compliance with the IFRS mandatory disclosure requirements have higher net income and value relevance for their shareholders' equity. These authors identify a significant and positive relationship between the reserve-related disclosure scores and market values of the reporting oil and gas companies. They also suggest that in the Greek market, the higher level of IFRS compulsory disclosure items in relation to Greek GAAP is likely to lead to an increase in transparency and reduce investor uncertainty regarding firms' financial information. In a similar study, Cotter et al. (2012) examined the impact of mandatory IFRS adoption on analysts' earnings' forecasts. It was found that in the year of adopting IFRS that there was an increase in disclosure levels when compared with the transition year, and that it was possible to estimate of the effect of adopting IFRS more accurately in the year of adoption. In this regard, the following hypotheses were developed:

Hypothesis 1

H1: There is a significant relationship between the Mandatory Reserve Disclosure required by IAS/IFRS and the performance of exploration and production oil and gas firms listed in the UK.

Hypothesis 2

H2: There is a significant relationship between Mandatory Reserve Disclosure required by the IAS/IFRS and the value of exploration and production oil and gas firms listed in the UK.

5.9.2. Mandatory Decommissioning Disclosure

To the best of the researcher's knowledge, no study has so far measured the impact of both Mandatory and Voluntary Decommissioning Disclosure on the performance and value of exploration and production oil and gas firms in the UK. Abdo et al. (2017; 2018) come the closest, providing evidence that IAS requirements regarding decommissioning cost disclosures have received widely varying levels of attention and compliance from oil and gas firms listed in the UK, with many companies supplying only the minimum required information about their decommissioning obligations, provision and expenditure. In the USA, Rogers and Atkins (2015) evaluated the oil and gas decommissioning liabilities of oil and gas companies registered with the SEC, covering the period 2003–2014. The results showed that the actual accounting and financial performance of the oil and gas companies compared with firms in other industries was extremely poor in terms of reporting periods, accuracy of estimates, funding and forecasting. Consequently, their findings appear to echo Standard and Poor's (2007) observation that when it comes to reporting decommissioning obligations, companies give the minimum possible amount of information. In this regard, the following hypotheses are developed:

Hypothesis 3

H3: There is a significant relationship between the Mandatory Decommissioning Disclosure required by IAS/IFRS and the performance of exploration and production oil and gas firms listed in the UK.

Hypothesis 4

H4: There is a significant relationship between the Mandatory Decommissioning Disclosure required by IAS/IFRS and the value of exploration and production oil and gas firms listed in the UK.

5.9.3. Voluntary Reserve Disclosures

A number of studies has measured levels of voluntary oil and gas reserve disclosures and found a significant relationship between disclosure levels and firm performance and/or value (e.g., Craswell and Taylor, 1992; Spear, 1994; Wright and Brock, 1999; Taylor, et al., 2012; McChlery et al., 2015; Odo et al., 2016). In this regard, the following hypotheses are developed:

Hypothesis 5

H5: There is a significant relationship between the level of voluntary oil and gas reserve disclosures and performance of reporting exploration and production oil and gas companies listed in the UK.

Hypothesis 6

H6: There is a significant relationship between the level of voluntary oil and gas reserve disclosures and value of reporting exploration and production oil and gas companies listed in the UK.

3.7.4. Voluntary Decommissioning Disclosure

As with Mandatory Decommissioning Disclosure, no study has yet employed a disclosure index to measure the level of voluntary disclosure of decommissioning costs by UK oil and gas companies or examined the impact of this disclosure on performance and value. The studies by Abdo et al. (2017 & 2018) focused on mandatory disclosure requirements by IAS. The study reveals that companies provide only limited information about decommissioning costs and calls for more information about timing, amount and changes to the decommissioning estimates; the reasons for these changes; timing of cash outflows; and discount rate used. The authors also point to the need for decommissioning obligations to be broken down by geographical areas and individual fields.

The disclosure index developed in the current study (see chapter five under the section ‘Constructing the disclosure index’) seeks to measure the extent of Voluntary Decommissioning Disclosure by taking into account not only the SORPs and OFR recommendations but also academics’ calls for extra information. This study flowed studies (e. g., Abdo et al., 2017; Lee, 2017; Abdo et al., 2018). In this regard, the following hypotheses are developed:

Hypothesis 7

H7: There is a significant relationship between the level of voluntary oil and gas decommissioning disclosures and financial performance of exploration and production oil and gas companies listed in the UK.

Hypothesis 8

H8: There is a significant relationship between the level of voluntary oil and gas decommissioning disclosures and value of exploration and production oil and gas companies listed in the UK.

5.10. Research model development

The models used to estimate the relationships between different types of disclosure and the performance and value of the sampled oil and gas companies follow a linear regression approach as per the literature review. The study models that are constructed to measure the impact of oil and gas firms' performance and value based on research hypotheses are shown in the following equations (see Table 5.3 for the definitions):

Equation 1

$$ROA_{i,t} = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8 Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10} FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

Equation 2

$$ROE_{i,t} = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8 Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10} FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

Equation 3

$$OCF_{i,t} = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8 Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10} FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

Equation 4

$$Tobin's\ Qi,t = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8 Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10} FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

Equation 5

$$EBITDA_{i,t} = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8\, Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10}\, FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

Equation 6

$$PROFITS_{i,t} = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8\, Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10}\, FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

Equation 7

$$P/Eratio_{i,t} = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8\, Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10}\, FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

Equation 8

$$MarketValue_{i,t} = \alpha_0 + \alpha_1 DisMRQ_{i,t} + \alpha_2 DisVRQ_{i,t} + \alpha_3 DisMDQ_{i,t} + \alpha_5 DisVDQ_{i,t} + \alpha_6 Govern_{i,t} + \alpha_7 Leverage_{i,t} + \alpha_8\, Size_{i,t} + \alpha_9 Auditor_{i,t} + \alpha_{10}\, FirmAge\varepsilon_{i,t} + \alpha_{11} AccMethod_{i,t} + \alpha_{12} Listing_{i,t} + \varepsilon_{i,t}$$

The firm-specific characteristics considered in this study as control variables are Firm Size, Leverage, Auditor Quality, Firm Age, Listing Status, Accounting Method and Institutional Ownership. Table 5.3 presents the variables' definitions that are discussed below in detail in the following sections. The current research chose these independent variables and control variables based on the previous studies in the similar area of research (e.g., Richardsn and Welker, 2001; Al-Matari et al., 2014; Sovbetov, 2015; Ayodele et al., 2016; Misund et al., 2008; Misund and Osmundse, 2015; Banerjee et al.,; Misund, 2017; Broadstock et al., 2017; Li et al., 2018).

Variables	Definition	Measurement	Sources of Data
DEPENDENT VARIABLES			
Firm performance			
ROA	Performance based on Return on Assets	Annual Return/ Total Assets	Bloomberg
ROE	Performance based on Return on Equity	Annual Return/ Total Equity	Bloomberg
OCF	Operational Cash Flow	Rank logarithm of year-end Operational Cash Flow	Bloomberg
PROFITS	Net Income, also known as After-tax Profits	Profit of the firm, after tax deductions	Bloomberg
Firm value			
Tobin's Q	A ratio of the firm's value	(Market Cap + Total Liabilities + Preferred Equity + Minority Interest)/Total Assets	Bloomberg
EBITDA	Earnings Before Interest, Tax Depreciation and Amortisation	Operating Profits before the deduction of non-cash items, Depreciation and Amortisation	Bloomberg
P/E ratio	The Price-earnings Ratio (P/E ratio)	The ratio for valuing a company that measures its current share price relative to its per-share earnings	Bloomberg
MV	Market Value	Logarithm of capital market value	Bloomberg
INDEPENDENT VARIABLES			
DisMRQ	Level of Mandatory Reserve Disclosure	The total number of points given for mandatory disclosure of reserves	Self-constructed disclosure index
DisVRQ	Level of Voluntary Reserve Disclosure	Total number of points awarded for voluntary disclosure of reserves	Self-constructed disclosure index
DisMDQ	Level of Mandatory Decommissioning Disclosure	Total number of points awarded for mandatory disclosure of decommissioning	Self-constructed disclosure index
DisVDQ	Level of Voluntary Decommissioning Disclosure	Total number of points awarded for voluntary disclosure of decommissioning	Self-constructed disclosure index
CONTROL VARIABLES			
Govern	Institutional ownership	The ratio of ordinary shares owned by financial institutions; institutions with equity of 5% or more take value 1, otherwise 0	Annual report, LSE website, Bloomberg
Leverage	Percentage of the total debt relative to total assets	Total debt divided by total assets	Annual report, LSE website, Bloomberg
Size	Total assets	Rank logarithm of year-end total assets	Annual report, LSE website, Bloomberg
Auditor	Auditor quality	Coded as 1 if auditor is one of the Big Four firms and 0 otherwise	Annual report, LSE website, Bloomberg
Listing Status	Firms listed on the Main Market or Alternative Investment Market (AIM)	Coded as 1 if listed on the Main Market or 0 if listed on the AIM	LSE website
Firm Listing Age	Number of years firm has been listed	The total number of years listed on the market	LSE website
Accounting Method (SE, FC or AOI)	The rules a company follows in reporting revenues and expenses	The two primary methods are accrual accounting and cash accounting	Company Annual Report

Table 5. 3: Dependent and independent variables

5.10.1. The dependent variables

The dependent variables included firm performance and firm value among the oil and gas companies listed in the UK.

5.10.1.1. Firm performance

Firm performance was measured using different constructs such as ROE, ROA, OCF and profits. The ROE ratio has been used in previous studies in evaluating the relationship existing between firm performance and the level of disclosure in the oil and gas industry to measure performance (e.g., Richardson and Welker, 2001; Sovbetov, 2015; Ayodele et al., 2016). ROE refers to total earnings divided by the total equity. As an accounting-based measurement, it has a direct impact on strategic decision making (Al-Matari et al., 2014). Managers use liquidity and earnings information such ROE, ROA, and OCF as indicator of firm's performance to reduce information asymmetry with investors (Camfferman and Cooke, 2002).

However, other studies have applied cash flows as a measurement of performance (e.g., Dechow, 1994; Cormier and Magnan, 2002; DeFond and Hung, 2003; Misund et al., 2008; Misund and Osmundse, 2015; Misund, 2017). Owing to differences in reported profits by oil and gas companies that use different accounting methods (FC, SE and AOI), profit-related measures may not be accurate indications of companies' performance. Hence, Misund (2017) argues that investors are likely to measure cash flows as both short- and long-term performance of oil and gas firms, and that cash flows from operations are more value-relevant than accounting earnings. Similarly, Dechow (1994) notes that cash flow might be a more reliable measure of firm performance than earnings because of the tendency among managers opportunistically to manipulate accruals. DeFond and Hung (2003), meanwhile, suggest that analysts consider earnings an unreliable way to measure oil and gas firms' performance and that they tend to use cash flow instead. Misund (2017) argues that, if investors use cash flow to measure firm performance, the association that exists between market value and cash flow should be stronger than accounting earnings.

5.10.1.2. Firm value

A number of prior studies has indicated that high-quality disclosures enhance firm value by decreasing their cost of capital and that the firm value reflects the level of share price anticipation of earnings, and both mandatory and voluntary disclosures are related with the share price response (Botosan, 1997; Ajinkya et al., 2005; Francis et al., 2008; Mangena et al., 2016; Popova et al., 2013). Diamond and Verrecchia (1991) linked together the disclosure and firm value (market value) and concluded that a high level of disclosure quality can reduce a firm's cost of capital by increasing the liquidity of the firm's shares. Botosan (1997), meanwhile, made available the evidence that stronger disclosure reduced firms' cost of capital when measured by the quantity of information disclosed in annual reports. In this study, the log of market value of a firm was used as a proxy for the firm value.

Firm value is measured using various constructs including Tobin Q, EBITDA, P/E ratio and MV. According to Banerjee et al., (2016), there are two well-established measures of firm value: total earnings before interest and tax divided by total assets (EBITDA/Asset), and total Market Value of the firm plus the book value of debt divided by total book value of assets (Tobin's Q). Also, Li et al., (2018) used Tobin's Q to measure the firm's value and clarify a strong positive relation with Environment disclosures by using ESG index as proxy for such disclosures. Also, regarding to Abdo and Fisher (2007), P/E ratio which is simply the share price divided by earnings per share (EPS), consider as indicator to measure firm's value. The P/E ratio measures how much investors are willing to pay per rand of current earnings, higher P/Es are often taken to mean the firm has significant prospects for future growth (Firer et al.,2004; Penman and Zhang, 2004).

The disclosure of reserves has the potential to impact on the value and performance of oil and gas companies. Value is enhanced by firms at financial risk through the increased quality of the disclosure of their reserve quantum (McChlery et al., 2015, p. 5917). The increased quality of disclosure changes impacts on the perception of investors and, prevents significant losses in the market value of the disclosing oil and gas firm.

5.10.1.3. Independent variables: Levels of disclosure

This study follows other studies in oil and gas disclosure (e.g., Odo et al., 2016; Abdo, 2016; Lee, 2017; Abdo et al., 2017; 2018) by evaluating disclosure levels against items in a self-constructed disclosure index (RDDI). These items are grouped into four variables representing the level of mandatory and voluntary disclosure of oil and gas reserves and decommissioning costs. These four independent variables are discussed in section 5.7 in this chapter.

5.10.1.4. Control variables: Firm-specific factors

The firm-specific variables serve as the control variables in the regression model. These characteristics have been examined by a large number of studies and are widely considered to be important determinants of levels of disclosure. These characteristics are discussed next in some detail.

1- Firm Size

A number of disclosure-related studies has used firm size as a parameter and found evidence that it is positively associated with disclosure levels (e.g., Chow and Wong-Boren, 1987; Cooke, 1989; Hossain et al., 1995; Watson et al., 2000; Tsalavoutas and Dionysiou, 2014). In terms of oil and gas disclosure studies specifically, Odo et al. (2016) argue that large oil and gas firms listed on the UK's main market disclose more information than smaller firms listed on the AIM. However, Craswell and Taylor (1992) suggest that while small companies are more likely to provide accurate information about their only productive resource such as reserves in the oil and gas industry, large companies may not bother to ensure that the information they give covers all their reserves. The current study follows previous studies (e.g. Coles et al., 2008; Choi et al., 2011; Mangena et al., 2012; Azeez, 2015) in using the book value of total assets to measure firm size.

2- Leverage

Leverage explains the financial structure of the firm, and it represents the firm's capacity to meet its obligations. The impact of the financial leverage variable has been a focus of a number of researchers: some have found a positive and significant relationship between leverage and level of disclosure (e.g., Hossain et al., 1995; Ahmed and Courtis, 1999; Merkley, 2014) while others report this variable to have no significant effect (e.g., Chow and Wong-Boren, 1987; Cerbioni and Parbonetti, 2007; Huafang and Jianguo, 2007; Nekhili, 2012). Those claiming the existence of a positive relationship between voluntary disclosure and financial leverage argue that high leverage incurs higher monitoring costs (Huafang and Jianguo, 2007), which leads to managers reducing using disclosure (Chavent et al., 2006). On the other hand, increasing leverage lowers equity agency costs by increasing debt and reducing total equity financing (Crutchley and Hansen, 1989). Reducing agency cost subsequently affects the dividend of firms with free cash flow so that it is available for managers to spend, underlining the importance of considering debt-related agency costs (Jensen, 1986). Although leverage has been widely examined in previous disclosure studies, conflicting results have been reported regarding the influence of leverage on corporate disclosure. This study, following the prior studies, uses total firm liabilities divided by total assets to measure leverage.

3- Governance

Prior studies have confirmed the relationship between disclosure and institutional ownership (e.g., Craswell and Taylor, 1992; Kai and Matsunaga, 2015). As the gap between ownership and control widens, managers are more likely to be required to disclose extra information that can be used to assess the firm's performance. Craswell and Taylor (1992) argue that the more the owners of a firm have diverse professional backgrounds, the greater the agency gap, and the more information is required by investors. Huafang and Jianguo (2007), meanwhile, assert that managers provide information to moderate the agency costs that arise from ownership dispersion. Institutional investors in particular always request a greater level of disclosure (see Healy et al., 1999; Ajinkya et al., 2005). Previous studies have distinguished block holders owning 5% or more of shares (e.g., Eng and Mak, 2003; Huafang and Jianguo, 2007). Similarly, in this study, the level of institutional ownership is estimated by the proportion of ordinary shares that are owned by institutional investors holding 5% or more of the firm's equity, scoring 1 if they do and 0 if not, with this information being collected from annual reports and accounts and sampled firms' websites.

4- Accounting method

The method of accounting used may impact on the ability of the disclosure quality to explain the performance of oil and gas companies. Misund et al. (2008, p. 398) compared the value-relevance of cash flows and book value in the face of the 1990s' oil industry upheaval. The results show that the value-relevance of book value increased while that of cash flows decreased, with the method of accounting (SE versus FC) impacting on the relationship. Moreover, Collins et al. (1981, p. 37) reported negative abnormal returns for firms where the stockholders' equity and reported earnings were impacted on negatively through the elimination of full cost accounting.

The quality of financial statements and reporting and the quality of accounting information, as well as disclosure system transparency, have been used commonly and interchangeably for defining the quality of accounting (Hla et al. 2013, p. 9). According to Penman (2003, p. 4), the quality of financial statements can only be determined based on the users or customers who are the shareholders. Based on this perspective, quality financial statements are those which can be used in predicting the future financial position of the firm and are dependent on the accounting standards used.

The study of Harris and Ohlson (1990, p. 764) sought to establish the relationship between book values and market values of oil and gas company, the investors in the market "incorrectly" uses book values (per equivalent barrel) to determine market values of oil and gas companies. This computation is based on recognition accounting whereby firms account for their reserves and possible decommissioning costs in their financial results. As such, recognition accounting can be argued as implicit disclosure and as having a relationship with firm value.

5- Auditor quality

The role of auditors is important in preventing opportunistic managers from displaying behaviour out of the norm and reducing agency costs for shareholders (Watts and Zimmerman, 1986). In their role as the reviewers of the firm's financial statements, auditors can help in reducing information asymmetries between managers and shareholders by encouraging the former to disclose more information (Baiman et al., 1987; Baiman, 1990; Craswell and Taylor, 1992). Prior studies have shown that firms using Big Four auditors tend to show better disclosure practice (e.g., Lang and Lundholm, 1993; Ajinkya et al., 2005). This is due to active encouragement by these auditors. Titman and Trueman (1986) and Craswell and Taylor (1992) note that the selection of a high-quality auditor is a signal to the market that the firm's disclosures are also of a high quality. In other words, appointing such an auditor is likely not only to reduce agency costs but also to protect the firm's reputation. Auditor quality is therefore used as a proxy for auditor, which is scored in the disclosure index as 1 if the oil and gas firm accounts are audited by one of the Big Four auditing firms or 0 if not

6- Listing status

One might expect that firms listed in the main market would be more likely to disclose more information in an effort to reduce information asymmetry and provide transparency (Cooke, 1992; Comnier and Magnan, 2002; Aksu et al., 2017). Furthermore, both studies of Mallin and Ow-Yong (2009), and Doukas and Hoque (2016) agreed that companies in listed on alternative markets (AIM) have the tendency to make less disclosure and companies listed on main market has higher level of disclosure requirements.

This appears to be supported by Ani et al. (2015), who argue that oil and gas firms listed in the main market of the LSM disclose more oil and gas reserve information than their counterparts listed in the AIM Market. Listing status is used in this study as a controlling variable to investigate its impact on disclosures and thence on company value and performance.

7- Firm age

The level of corporate disclosures is determined by firm age, which is often regarded as a critical factor. One might argue that older firms tend to have more information to include in the annual reports, and the experience to see its value for enhancing their image and reputation (Popova et al., 2013). In this context, Owusu-Ansah (1998) lists three vital reasons why new and recently established companies tend to disclose less information: 1) they may see themselves as suffering from a competitive disadvantage and therefore may be reluctant to disclose information; 2) the cost of gathering, processing and distributing the required information may be burdensome; and 3) they may lack a proven track record, or, if they are the result of a merger or acquisition, they may not have any information to disclose. Following previous studies (e.g., Choi et al., 2011; Chen et al., 2014), this study measures firm age as the number of years listed in the market, but it does not group firms based on their age.

5.11. Personal interviews

After conducting the quantitative analysis and obtaining results of the econometric model, this research aimed to gather semi-structured interview data from stakeholders in the oil and gas industry in the UK. This aimed to validate the quantitative results on the one hand and on the other hand to answer the research question: what are the perceptions of key stakeholders in the oil and gas sector in the UK about the impact of mandatory and voluntary reserves and decommissioning disclosures on oil and gas firms' performance and value?

Interview as a research method has been used in previous studies in oil and gas disclosures, such as in studies by Russell et al. (1998); Abdo et al. (2017) and Abdo et al. (2018). Cohen et al. (2001) advocate that an interview can fulfil the following three purposes: first, it can be the original means of gathering information which has a direct relevance to the study objectives; second, it can be used for testing the study hypotheses or as an explanatory tool to facilitate the identification of variables and relationships; and third, it can be used in aggregation with or to validate other research methods.

It was initially intended to interview finance and accounting managers of the sampled oil and gas companies; oil and gas consultants; Big Four oil and gas auditors; and the Oil and Gas Authority in the UK. However, owing to the lockdown during the Covid-19 pandemic (post-March 2020), collecting interview data proved to be extremely difficult, as most of the potential participants declined to participate in interviews, for example, the Oil and Gas Authority and sampled oil and gas companies listed on the LSE, and also the Big Four auditor firms. Owing to business closures during the Covid-19 pandemic and people working from home, it was not feasible to communicate with finance managers directly. Thus, the researcher had to use personal and his supervisor's contacts to recruit interviewees to verify the research's empirical results. In the end, it was only possible to conduct five interviews. Table 5.4 shows the number of interviews that were conducted.

Table 5. 4: Interviews conducted

	Interviewee	Area of expert
1	A	Oil and Gas Auditing
2	B	Oil and Gas Decommissioning Consultant
3	C	Oil and Gas Decommissioning Consultant
4	D	Oil and Gas Accounting and Finance
5	E	Oil and Gas Accounting and Finance

5.12. Sample selection and data collection

The target population for this study is the exploration and production oil and gas companies listed on the LSE. The sample for this study has been selected by means of purposive sampling. This involves the selection of a set of participants who/which have the particular qualities or characteristics desired by the researcher (Koerber and McMichael, 2008). As of October 2018, the population of this study was 111 oil and gas companies listed on the LSE (see Appendix 3), of which 31 were listed on the main market as oil and gas producers. The remaining 80 were listed on the AIM as oil and gas companies. The 111 firms were oil and gas upstream and downstream producers, hence the selected sample comprises active upstream oil and gas producers listed on both markets in the UK is 52 firms listed on LSM (see Appendix 4). The current study excluded companies which were not an upstream oil and gas one or were not in production stage. Therefore, all of these firms selected engaged in both exploration and production and therefore needed to make disclosures regarding their reserves and decommissioning activities.

As a leading location of investment banks, institutional investors and specialised business services, London's financial centre is in the first place based on the Global Financial Centres Index 23, offers easy access to capital market expertise and is a magnet for foreign listings (Yeandle, 2018). Wójcik and Burger (2010) argue that most oil and gas companies are listed on the LSE, which is the third largest stock market in the world. Furthermore, Whitmore (2006) confirms that London is increasingly seen as the centre for mining firms and mining financing. In the same vein, Luther (1996, p. 82) stated that the "London Stock Exchange is the most important for foreign source of equity finance for EI [Extractive Industries] companies worldwide,

[and] some 200 extractive industry companies are listed". Thus, this study focuses on the oil and gas companies listed on the LSE.

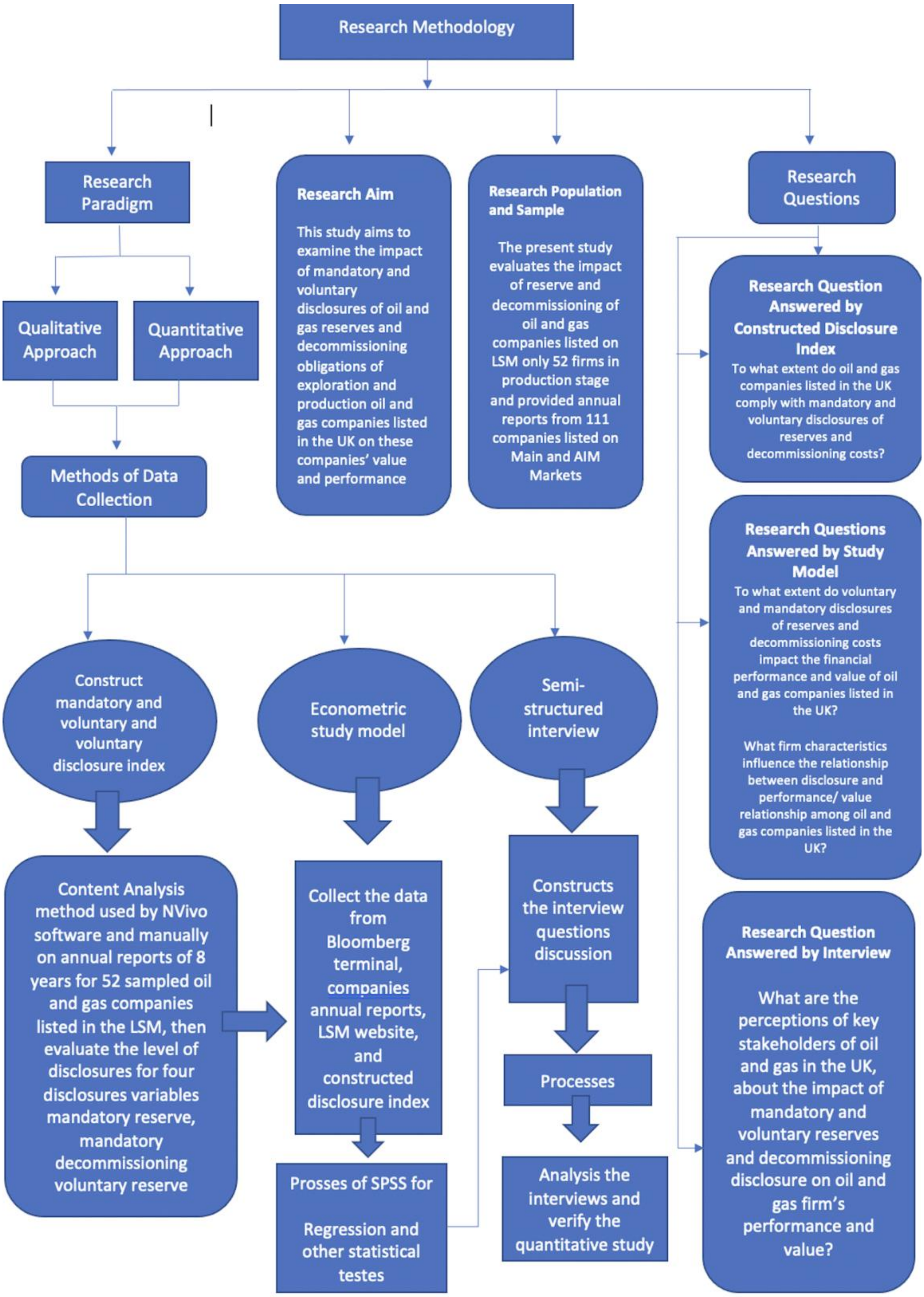
The study uses the last eight annual reports of the sampled companies from 2010 to 2017, which are available from their websites. This eight-year period has been selected in order to provide a relatively recent period view about the influence of reserve and decommissioning disclosure on the performance and value of oil and gas firms listed in the UK. The study period started from 2010, which was to avoid the impact of the 2007/08 international market crises which may have resulted in irregular disclosure practices, and unusual changes in companies' performance and value due to factors linked to the financial crisis. Data were extracted from these annual reports. This allowed the measurement of disclosure levels based on the constructed disclosure index of reserves and decommissioning. From that point the study then used a model to measure the impact of the disclosure levels on performance and value of oil and gas listed firms.

An additional justification for the use of the 2010 to 2017 period is that oil and gas companies were made aware of the discussion paper about extractive activities back in 2010 (International Accounting Standards Board , 2010a; International Accounting Standards Board, 2010b), and they may have started to prepare their disclosures in accordance with that discussion paper. However, since the project was started by the IASB in 2010, the reporting requirements may have changed. Therefore, the 2010 to 2017 period is ideal for this study. Moreover, decommissioning activity in the UK has been confirmed to be growing in recent years, with total decommissioning expenditure in 2014 at £1.6 billion, and in 2015 at £2.1 billion (Oil & Gas UK , 2019a). Furthermore, the total amount forecast to be spent on decommissioning oil and gas assets in the UKCS between 2016 and 2025 is £17.6 billion (Antonas and Hammerson, 2016), which means that more decommissioning disclosure will be presented in the annual reports. Also, the Oil & Gas UK report on decommissioning (Oil & Gas UK, 2019a) anticipated that about 2,379 wells would be decommissioned between 2019 and 2028. The increased of oil and gas decommissioning industry is associated with the wider interests of decommissioning-related disclosures by stakeholders' groups. This issue makes this study significant and demonstrates its timeliness and relevance.

5.13. Summary

This chapter has discussed the research philosophy, research strategy and methodology/methods underlying this research. As this research is using a multi-theoretical approach (agency theory and signalling theory), the main objective of the present study is to examine empirically the impact of oil and gas reserve and decommissioning costs' disclosures on the performance and value of exploration and production oil and gas firms listed on the LSE. This study, for the first time, tests the impact of four different variables (Mandatory and voluntary disclosures of reserve and decommissioning) together that have opposing cash flow effects on oil and gas companies. The developed econometric model was implemented by analysing the secondary data from a database provider, annual reports and accounts of exploration and production oil and gas firms that are listed on the LSE. Therefore, this study has adopted a positive paradigm and a mixed method approach (quantitative as main method and qualitative to validate the study results). Eight empirical research models were developed based on the literature review to address the aims and objectives of this study. The dependent variables of the study models were the mandatory and voluntary disclosures of reserves and decommissioning which were collected via the developed disclosure index for this study. Semi-structured interviews were used in this research as a qualitative method for verifying the research's empirical results. Finally, the research hypotheses have been formulated based on the integrated theoretical framework and conceptual framework presented in chapter 3. Figure 5.3 summarises the steps involved in the research methodology and methods.

Figure 5. 3: Summary of research methodology map



Research methodology map (Author's own)

CHAPTER SIX: RESULTS ANALYSIS

6.1. Introduction

The aim of this study is to examine the impact of voluntary and mandatory disclosures of oil and gas reserves and decommissioning obligations of exploration and production oil and gas companies listed in the UK based on these companies' value and performance. This study uses a quantitative approach to address the main research objective and a qualitative approach as a contrary to validate the quantitative results. The total sample size included 52 companies under upstream exploration and production of oil and gas resulting in 416 observations from annual reports, and five semi-structured interviews with stakeholders. Both descriptive statistics and inferential statistics were generated to test the hypotheses developed. The data was analysed by using NVivo software and checked manually to confirm the results. The empirical work aimed at quantitatively investigation the relation between reserve and decommissioning levels of mandatory and voluntary disclosures and firm's performance and value. It commences with carrying out some descriptive analysis of the variables of interest to measure the level of disclosures based on constructed disclosure index (RDDI), Moreover, corelation analyses are undertaken to detect any autocorrelations among study variables. Stationarity tests were conducted prior to model application to determine the variable data time series had unit roots. Using regression analysis, the chapter proceeds with testing the study hypotheses developed in the chapter five for examining the relationship in questions, while controlling for variable of characteristics. Finally, the study models tested to check the robustness of the main regression analysis.

This current chapter includes the results, findings and discussion based on the study objectives and research questions. In essence, the findings based on the level of Mandatory and voluntary of Reserve and Decommissioning Disclosure by Accounting Method, impact of disclosure levels on firm performance and impact of disclosure levels on firm value are outlined and discussions are presented accordingly, which are supported by the interviews for verifying the empirical results.

6.2. Data validity tests for disclosure constructs

Convergent validity tests were conducted for the reserve and decommissioning disclosure index (R&DDI) constructed for this study by using Pearson correlation tests. High inter-correlations between items implies that the items were related to each other or moving together when exposed to a particular construct. Measurement items for the Mandatory Reserve Disclosure, Voluntary Reserve Disclosure, Mandatory Decommissioning Costs Disclosure and Voluntary Decommissioning Costs Disclosure were correlated, and the results are presented in Table 6.1. The results show that there were significant and high correlations among all the measurement items for the various constructs ($p<0.05$) which suggest that there was convergent validity in the four disclosure constructs. The items denote the research variable

Table 6. 1: Correlation among measurement items for various constructs

Items	1	2	3	4	5	6	7
Mandatory Reserve Disclosure items							
1. DisMRQ1	-						
2. DisMRQ2	.832**	-					
3. DisMRQ3	.703**	.798**	-				
4. DisMRQ4	.641**	.694**	.852**	-			
5. DisMRQ5	.508**	.546**	.689**	.763**	-		
6. DisMRQ6	.519**	.556**	.581**	.577**	.626**		
Mandatory Decommissioning Disclosure items							
1. DisMDQ1	-						
2. DisMDQ2	.766**	-					
3. DisMDQ3	.670**	.568**	-				
4. DisMDQ4	.693**	.741**	.572**	-			
5. DisMDQ5	.636**	.717**	.484**	.706**	-		
6. DisMDQ6	.443**	.431**	.473**	.392**	.525**		
Voluntary Decommissioning Disclosure items							
1. DisVDQ1	-						
2. DisVDQ2	.348**	-					
3. DisVDQ3	.464**	.583**	-				
4. DisVDQ4	.268**	.080	.376**	-			
5. DisVDQ5	.434**	.582**	.714**	.296**	-		
6. DisVDQ6	.294**	.135**	.205**	.388**	.202**	-	
7. DisVDQ7	.245**	.267**	.173**	.399**	.137**	.402**	
Voluntary Reserve Disclosure items							
1. DisVRQ1	-						
2. DisVRQ2	.536**	-					
3. DisVRQ3	.655**	.517**	-				
4. DisVRQ4	.699**	.710**	.538**	-			
5. DisVRQ5	.286**	.284**	.324**	.218**	-		
6. DisVRQ6	.304**	.288**	.389**	.231**	.523**	-	
7. DisVRQ7	.579**	.456**	.616**	.490**	.246**	.406**	-
8. DisVRQ8	.683**	.529**	.773**	.522**	.351**	.404**	.653**

Note. **p < .01. *p <.05, the p-values quoted in the above parentheses are for a one-tail test of statistical significance. A small p-value indicates strong evidence against the null hypothesis.

6.3. Data reliability tests for disclosure constructs

Data reliability tests for disclosure constructs for the Reserve and Decommissioning Disclosure Index (R&DDI) were conducted by generating Cronbach's alpha involving the measurement items for each construct. The results for reliability tests are presented in Table 6.2. The table shows that all the constructs had valid reliability since Cronbach's alpha was above 0.8 (Taber, 2018).

Table 6. 2: Cronbach's alpha reliability results for disclosure constructs

Constructs	**Number of items in disclosure index**	**Reliability test (Cronbach's alpha)**
Mandatory Reserve Disclosure	6	.919
Voluntary Reserve Disclosure	8	.882
Mandatory Decommissioning Disclosure	6	.893
Voluntary Decommissioning Disclosure	7	.779

In addition, an inter-coder reliability test was performed to ensure the reliability of the research findings by comparing correlations between automated-disclosure and manual-disclosure constructs. The results in Table 6.3 show that correlation between manual and automated constructs of Mandatory Reserve Disclosure (r = .994**), Voluntary Reserve Disclosure (r = .994**), Mandatory Decommissioning Disclosure (r = .990**) and Voluntary Decommissioning Disclosure (r = .987**) were high, which suggests that reliability of disclosure constructs is confirmed.

Table 6. 3: Correlation between automated- and manual-disclosure constructs

Item	Manual
Mandatory Reserve Disclosure	
Manual	-
Automated	.994**
Voluntary Reserve Disclosure	
Manual	-
Automated	.994**
Mandatory Decommissioning Disclosure	
Manual	-
Automated	.990**
Voluntary Decommissioning Disclosure	
Manual	-
Automated	.987**

6.4. Descriptive statistics

This section is divided in three parts as shown below.

6.4.1. Independent variables

The tests reveal in Table 6.4 that the highest total disclosure scores for Mandatory Decommissioning Disclosure, Mandatory Reserve Disclosure, Voluntary Decommissioning Disclosure and Voluntary Reserve Disclosure (R&DDI) were 6.00, 6.00, 7.00 and 8.00 respectively among the sampled listed firms. The lowest total disclosure score was 0.00. Higher total disclosure score values imply that those firms were better at disclosing this information compared with those with lower total disclosure score values. The means for the four disclosure indices were respectively 3.58 (SD = 2.3) for Mandatory Decommissioning Disclosure, 4.12 (SD = 2.31) for Mandatory Reserve Disclosure, 2.44 (SD = 1.93) for Voluntary Decommissioning Disclosure and 4.10 (SD = 2.66) for Voluntary Reserve Disclosure. Higher mean disclosure score values imply that those firms were better at disclosing this information compared to those with lower mean disclosure score values. The table 6.4 also shows that sustainability represents the maximum standard skewness of 0.25, while the minimum standard skewness of -0.82. This indicated that the minimum and maximum skewness are within the normally distributed range ±1.96. However, the data are considered to be normally distributed if the slandered kurtosis statistics fall within the range of ± 3 (Haniffa and Hudaib, 2006).

Table 6. 4: Summary statistics for independent variables

	DISMDQ	DISMRQ	DISVDQ	DISVRQ
Mean	3.577295	4.120773	2.437198	4.103865
Std. Dev.	2.300135	2.306933	1.930930	2.655587
Median	4.000000	5.000000	3.000000	5.000000
Maximum	6.000000	6.000000	7.000000	8.000000
Minimum	0.000000	0.000000	0.000000	0.000000
Skewness	-0.544020	-0.825186	0.250093	-0.274298
Kurtosis	1.771198	2.087419	2.259096	1.786082
Jarque-Bera	46.46781	61.35021	13.78490	30.61109
Probability	0.000000	0.000000	0.001015	0.000000
Sum	1481.000	1706.000	1009.000	1699.000
Sum Sq. Dev.	2185.027	2197.961	1539.867	2912.534
Observations	414	414	414	414

6.4.2. Dependent variables

The tests presented in Table 6.5 revealed that ROA had a mean of -8.64 (SD = 28.97), which is rather low because it is negative and implies that the firms were less effective in using their assets to generate and realise higher net income. ROE had a mean of -18.25 (SD = 163.32), which is rather low and suggests that there is lower return on shareholders' investments in the firms.

OCF had a mean of 12657.09 (SD = 80411.25), which implies that the firms remained solvent hence most of the firms did not require to borrow money and raise more capital to pay their expenses. Tobin's Q had a mean of 8.46 (SD = 33.61) among the firms. Since Tobin's Q is greater than 1, this implies that their stock had been over-valued. In addition, a high Tobin's Q (greater than 1) implies that a firm's stock is more expensive than the replacement cost of its assets, which further implies that the stock is overvalued. This measure of stock valuation is the driving factor behind investment decisions in Tobin's Q ratio.

EBITDA had a mean of 13842.44 (SD = 86578.60) among the firms. Higher EBITDA values suggest that the firms had better financial performance compared with those with lower EBITDA values. EBITDA denotes the earnings before income and taxes, which denotes the profitability of the firm. Higher profitability means higher financial performance.

Profits had a mean of 6534.36 (SD = 41105.06). When firms have higher profit values, it suggests that they have been managing their expenses and sales effectively, leading to high revenues. The P/E ratio had a mean of 61.91 (SD= 200.74). Firms with higher P/E ratio are considered as being over-priced (Penman and Zhang, 2004). Market Value (MV) had a mean of 8159.46 (SD = 33352.86) among the firms. When the Market Value of firms is higher than the industry average, it is an indication that the investors have perceive that firms' business prospects are favourable.

The table 6.5 also shows that sustainability represents the maximum standard skewness of 9.5, while the minimum standard skewness of -5.7 This indicated that the minimum and maximum skewness are not within the normally distributed range ±1.96. However, the data of dependent variables are considered to be not normally distributed if the slandered kurtosis statistics fall within the range of ± 3 (Haniffa and Hudaib, 2006). As consequence, Dickey-Fuller test (ADF), and Phillips-Perron test (PP) applied for robust analysis to general forms of heteroskedasticity in the error term in the section 6.5 from this chapter, in this regard, this study use Durbin-Watson test in section 6.10 for endogeneity test to ascertain whether the residuals of the study models are correlated serially.

Table 6. 5: Summary statistics for dependent variables

	ROA	ROE	OCF	Tobin Q	EBITDA	Profits	P/E ratio	MV
Mean	-8.643410	-18.24562	12657.09	8.456426	13842.44	6534.357	61.91356	8159.458
Std. Dev.	28.97113	163.3152	80411.25	33.60948	86578.60	41105.06	200.7419	33352.86
Median	-3.113560	-5.616690	0.459429	1.927956	-0.700274	-3.180965	12.06500	350.7849
Maximum	62.70293	1810.959	744601.0	419.1577	872354.0	418805.0	1836.120	297186.1
Minimum	-329.6848	-2427.907	-7411.471	-0.107421	-9844.389	-43083.79	0.010000	0.000851
Skewness	-5.797172	-4.869739	7.393663	9.509061	7.492360	7.299357	6.761430	6.024097
Kurtosis	56.16042	159.1142	58.05156	102.5435	60.37131	58.36412	53.84660	41.23325
Jarque-Bera	50697.87	409813.8	57405.00	181875.1	63288.17	55184.86	15225.35	22430.20
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	-3552.442	-7334.738	5366608.	3593.981	5979933.	2639880.	8172.590	2733418.
Sum Sq. Dev.	344123.8	10695419	2.74E+12	478949.1	3.23E+12	6.81E+11	5278950.	3.72E+11
Observations	411	402	424	425	432	404	132	335

6.4.3. Control variables

Descriptive statistics for control variables are shown in Table 6.6. Leverage had a mean of 0.06 (SD = 0.06), which is low and an indication that the firms did not have high debt levels. An analysis of the balance sheet of the sampled firms reveals that the firms are not highly leveraged. Firm Size had a mean of 99592.41 (SD = 602310.20), which suggests that the firms were generally larger firms – expected, since they operate in the oil market in the longer term. Firm Age had a mean of 12.66 (SD = 11.55), which implies that generally, the firms have been in operation for over a decade in the oil sector.

Other control variables such as Corporate Governance, Auditor and Listing Status included dummy variables hence descriptive statistics were not necessary.

Table 6. 6: Summary statistics for control variables

	Govern	Leverage	Size	Auditor	Listing State	Firm Age	Accounting Method
Mean	0.434783	0.055434	99592.41	0.592593	0.384615	12.66000	2.339623
Median	0.000000	0.036457	130.7090	1.000000	0.000000	11.00000	2.000000
Maximum	1.000000	0.407070	6446605.	1.000000	1.000000	63.00000	3.000000
Minimum	0.000000	0.000000	0.082048	0.000000	0.000000	0.000000	1.000000
Std. Dev.	0.496403	0.059079	602310.2	0.491922	0.487090	11.54806	0.581622
Skewness	0.263117	2.040279	7.847496	-0.376889	0.474342	2.369742	-0.221388
Kurtosis	1.069231	8.423683	67.54291	1.142045	1.225000	9.722653	2.326043
Jarque-Bera	61.40682	819.6140	78131.29	72.36318	70.21083	1127.613	11.48809
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.003202
Sum	160.0000	23.67038	42326776	256.0000	160.0000	5064.000	992.0000
Sum Sq. Dev.	90.43478	1.486867	1.54E+14	104.2963	98.46154	53209.76	143.0943
Observations	368	427	425	432	416	400	424

6.5. Stationarity tests

Stationarity tests were conducted prior to model application using unit root tests involving both the augmented Dickey-Fuller test (ADF), and the Phillips-Perron test (PP) to determine whether the panel time series data had unit roots which can lead to spurious regression (Gujarati, 2009). If unit root was found, then differencing[13] would have been necessary to make the series stationary before estimation of the model.

Table 6.7 shows a summary of the stationarity test results for the time series data (detailed results for stationarity tests are presented in Appendices 5 and 6). The null hypothesis is rejected if MacKinnon's tau values are lower than computed tests statists at 5% significance level ($p < .05$), which implies that time series data was stationary. However, failure to reject it implies that there was unit root in the data, which indicates the data is non-stationary. According to the results, all the variables were stationary at levels, which implies that time series data was stationary. Therefore, the models were estimated using these variables without the need for differencing of the time series.

Table 6. 7: Stationarity tests for the series

Series	ADF		PP		Conclusion
	Intercept only	Intercept and trend	Intercept only	Intercept and trend	Stationary
ROA	216.957**	177.347**	244.247**	303.809**	Stationary
ROE	204.131**	170.245**	212.681**	262.365**	Stationary
OCF	233.586**	100.053**	155.421**	188.854**	Stationary
Tobin's Q	206.711**	180.792**	260.648**	275.13**	Stationary
EBITDA	248.091**	156.791**	247.613**	269.013**	Stationary
Profits	191.024**	141.318**	212.328**	261.223**	Stationary
P/E ratio	74.9160**	14.1028**	107.763**	23.0497**	Stationary
MV	179.178**	110.575**	137.619**	165.555**	Stationary
Leverage	168.157**	178.722**	268.007**	291.444**	Stationary
Size	131.2**	134.002**	123.244	219.812**	Stationary

Note. **p < .01.*p < .05.

[13] Differencing in time series is a standard method for removing a stochastic or 'random' trend in time series data by calculating the difference between a value, e.g., X in a given time and the value Y in the previous time period.

Stationarity tests were not conducted for categorical variables (e.g., DisMRQ, DisVRQ, DisMDQ and DisVDQ) since categorical data are not generated by the stationarity process. In addition, dummy variables (e.g., Governance, Auditor and Listing Status) were not tested for stationarity, given that they contain same number of observations (unbalanced with no variations), while panel unit root tests require strongly balanced data (i.e., data that vary over time).

6.6. Constructed index disclosures (R&DDI) results

In this section, the results of index disclosures for the four independent variables are presented as in the following:

6.6.1. Trends of Mandatory Decommissioning Disclosure

Mandatory Decommissioning Disclosure was measured using six items of disclosure as shown in Table 6.8. For disclosing each item in a given year (e.g., 2010), a firm scored 1, otherwise 0. All the scores for the whole study period (2010 to 2017) when added give a total of 48 (6 items x 8 years). Table 6.8 below illustrates how the items were scored.

Table 6. 8: Scoring of Mandatory Decommissioning

No	Items of disclosure in a given year	2010	2011	2012	2013	2014	2015	2016	2017	Total
1	Measurement of provisions for decommissioning is based on current value of cash flow expected in the future	1	1	1	1	1	1	1	1	8
2	Total fixed asset cost, as well as decommissioning cost, are depreciated in a manner that reflects the asset's economic benefit, i.e., UOP (unit of production)	1	1	1	1	1	1	1	1	8
3	Pre-tax rate is used as a discount rate to reflect present market assessment with consideration of money value over time	1	1	1	1	1	1	1	1	8
4	Provision cost is considered as an asset cost when depreciated over the useful life of an asset	1	1	1	1	1	1	1	1	8
5	Updating of decommissioning provisions in every balance sheet to cater for discount rate changes and future cash flow changes	1	1	1	1	1	1	1	1	8
6	Deferred tax accounting policy adopted for finance leases and decommissioning liabilities	1	1	1	1	1	1	1	1	8
	Total score	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**48**

Trends of Mandatory Decommissioning Disclosure among the sampled listed companies vary. Disclosure scores vary from 0 to 48 depending on the company level of disclosures. The trend in the Mandatory Decommissioning Disclosure was also plotted to provide an overview of series as shown in Figure A in Appendix 7 as example for a number of the sampled firms. However, it is noticeable that several companies disclose more than others. In this regard, the top ten companies on the list respectively are EGDON Resources PLC (total score = 48), President Energy PLC (total score = 48) and Sterling Energy PLC (total score = 48), these being the highest scores.

These firms were closely followed by BP PLC (total score = 47), Seplat Petroleum Development Company PLC (total score = 47), Zoltav Resources Incorporated (total score = 47), Total SA (total score = 46), EnQuest PLC (total score = 45), Sound Oil PLC (total score = 45) and Rockhopper Exploration PLC (total score = 44) – please see Table 6.9. Factors causing the differences in disclosure level were further investigated in the study in section 6.7 (Level of disclosure by Listing State) to section 6.8 (Level of disclosure with Accounting Methods).

Table 6. 9: Mandatory Decommissioning Disclosure

Name of company	**Mandatory Decommissioning Disclosure scores**								
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL SCORE**
AMINEX PLC	3	4	4	4	4	4	4	4	31
ASCENT RESOURCES PLC	3	3	3	4	4	4	4	4	29
BARON OIL PLC	2	2	2	2	2	2	2	2	16
BP PLC	5	6	6	6	6	6	6	6	47
CABOT ENERGY PLC		2	2	5	5	3	6	6	29
CAIRN ENERGY PLC	2	2	2	2	2	5	5	5	25
CASPIAN SUNRISE PLC	5	5	5	5	5	5	6	6	42
COLUMBUS ENERGY RESOURCES PLC	3	3	5	5	5	5	5	5	36
DIVERSIFIED GAS & OIL PLC						5	5	5	15
EGDON RESOURCES PLC	6	6	6	6	6	6	6	6	48
ELAND OIL & GAS PLC	0	0	4	5	6	6	6	6	33
EMPYREAN ENERGY PLC	0	0	0	0	4	4	6	0	14
ENQUEST PLC	4	6	6	5	6	6	6	6	45
EUROPA OIL & GAS HOLDINGS PLC	4	5	5	5	5	4	4	6	38
EXILLON ENERGY PLC	0	5	0	0	0	0	5	5	15
G3 EXPLORATION LTD	0	0	0	2	3	3	3	3	14
GENEL ENERGY PLC	0	4	5	5	5	5	5	5	34
GULF KEYSTONE PETROLEUM LIMITED	3	3	3	6	6	6	6	6	39
GULFSANDS PETROLEUM PLC	4	5	5	5	5	5	5	5	39

Name of company	Mandatory Decommissioning Disclosure scores								
	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL SCORE
HARDY OIL AND GAS PLC	4	6	6	6	6	4	4	4	40
HURRICANE ENERGY PLC	0	2	2	3	3	3	6	6	25
IGAS ENERGY PLC	0	2	5	6	6	6	6	6	37
INDEPENDENT OIL & GAS PLC	0	0	0	0	0	0	4	6	10
INDUS GAS LIMITED	0	3	4	4	3	5	5	5	29
JKX OIL & GAS PLC	4	4	5	5	5	5	5	5	38
KOSMOS ENERGY LIMITED	0	0	0	0	0	0	0	0	0
LEKOIL LTD	0	0	0	0	0	0	4	4	8
NOSTRA TERRA OIL & GAS COMPANY PLC	0	0	0	0	0	0	0	0	0
NOSTRUM OIL & GAS PLC	0	0	0	0	0	0	2	3	5
OILEX LIMITED	1	1	5	6	6	4	4	6	33
OPHIR ENERGY PLC	2	2	2	2	2	2	2	0	14
PARKMEAD GROUP PLC (THE)	0	0	0	0	0	4	4	4	12
PHOENIX GLOBAL RESOURCES PLC	0	0	0	5	6	6	6	6	29
PREMIER OIL PLC	0	0	0	0	0	0	3	3	6
PRESIDENT ENERGY PLC	6	6	6	6	6	6	6	6	48
PROVIDENCE RESOURCES PLC	3	3	3	3	3	3	3	5	26
RANGE RESOURCES LIMITED	0	4	5	5	5	5	5	5	34
REGAL PETROLEUM PLC	0	0	3	3	3	3	3	5	20
ROCKHOPPER EXPLORATION PLC	4	4	6	6	6	6	6	6	44
ROYAL DUTCH SHELL PLC	0	0	0	0	0	4	4	4	12
SEPLAT PETROLEUM DEVELOPMENT COMPANY PLC	5	6	6	6	6	6	6	6	47
SERICA ENERGY PLC									0
SOCO INTERNATIONAL PLC	0	0	0	5	5	6	6	6	28
SOUND OIL PLC	5	5	6	6	5	6	6	6	45
STERLING ENERGY PLC	6	6	6	6	6	6	6	6	48
TLOU ENERGY LTD	0	0	0	0	4	4	4	4	16
TOTAL SA	5	5	6	6	6	6	6	6	46
TOUCHSTONE EXPLORATION INC	0	0	0	0	0	0	0	0	0
TRINITY EXPLORATION & PRODUCTION PLC	5	5	5	5	5	5	5	5	40
TULLOW OIL PLC	0	0	0	0	5	5	5	5	20
VICTORIA OIL & GAS	0	5	5	6	6	6	6	6	40
ZOLTAV RESOURCES INCORPORATED	5	6	6	6	6	6	6	6	47

It is very much apparent from the above table that trends of Mandatory Decommissioning Disclosure among the sampled listed companies vary. Disclosure scores vary from 0 to 48 depending on the company's level of disclosures.

6.6.2. Trends of Mandatory Reserve Disclosure

Mandatory Reserve Disclosure was measured using six items, as is shown in Table 6.10. A firm earned one point for disclosing an item in a given year. These points were allocated on yearly basis. In the end these points are accumulated to obtain a sum of the total disclosed items by a firm in a given time period. Table 6.10 below illustrates how the items were scored.

Table 6. 10: Scoring of Mandatory Reserve Disclosure

No.	**Items of disclosure in a given year**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Totals**
1	Information provided by the company on possible reserves	1	1	1	1	1	1	1	1	**8**
2	Information provided by the company on proved developed reserves	1	1	1	1	1	1	1	1	**8**
3	Information provided by the company on probable reserves	1	1	1	1	1	1	1	1	**8**
4	Information provided by the company on proved undeveloped reserves	1	1	1	1	1	1	1	1	**8**
5	Explanation given by the company on changes to past reserve estimation and hydrocarbon resource, including any change made on key assumptions	1	1	1	1	1	1	1	1	**8**
6	Information provided by the company on unproved reserves	1	1	1	1	1	1	1	1	**8**
Total score		**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**48**

Trends of Mandatory Reserve Disclosure among the sampled listed companies vary (see Table 6.11). Disclosure scores vary from 0 to 48 depending on the disclosure value scored by a given company. The trend in the Mandatory Reserve Disclosure was also plotted to provide an overview of series as shown in Figure B in Appendix 7 for a number of firms as example of disclosure trend. However, it is noticeable that a number of companies disclose more than others. In this regard, the top ten companies on the list respectively are BP PLC (total score = 48), Independent Oil & Gas PLC (total score = 48), Rockhopper Exploration PLC (total score = 48), Serica Energy PLC (total score = 48), Total SA (total score = 48), Tullow Oil PLC (total score = 48), Empyrean Energy PLC (total score = 47), Exillon Energy PLC (total score = 47), Phoenix Global Resources PLC (total score =47) and Premier Oil PLC (total score = 47). This varies from the Mandatory Decommissioning Disclosure, as shown in prior sections, where other firms ranked higher. Factors causing these differences in disclosure level were further investigated in the study in section 6.7 (Level of disclosure by Listing Status) to section 6.8 (Level of disclosure with Accounting Methods).

Table 6. 11: Mandatory Reserve Disclosure

Name of company	**Mandatory Reserve Disclosure**								
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
AMINEX PLC	2	2	3	3	3	3	4	4	24
ASCENT RESOURCES PLC	4	5	5	6	6	6	6	6	44
BARON OIL PLC	1	1	1	1	1	3	3	3	14
BP PLC	6	6	6	6	6	6	6	6	48
CABOT ENERGY PLC		5	5	5	5	2	6	6	34
CAIRN ENERGY PLC	2	2	2	4	5	6	6	6	33
CASPIAN SUNRISE PLC	4	4	5	5	5	5	6	6	40
COLUMBUS ENERGY RESOURCES PLC	1	3	6	6	6	2	6	6	36
DIVERSIFIED GAS & OIL PLC	5	5	6	6	6	6	6	6	46
EGDON RESOURCES PLC	0	0	5	6	6	6	6	6	35
ELAND OIL & GAS PLC	0	0	0	0	5	6	6	0	17
EMPYREAN ENERGY PLC	5	6	6	6	6	6	6	6	47
ENQUEST PLC	2	4	4	4	4	2	2	6	28
EUROPA OIL & GAS HOLDINGS PLC	5	6	5	5	6	6	6	6	45
EXILLON ENERGY PLC	5	6	6	6	6	6	6	6	47
G3 EXPLORATION LTD	0	5	6	6	6	6	6	6	41
GENEL ENERGY PLC	2	4	6	6	6	2	2	2	30

Name of company	Mandatory Reserve Disclosure								
	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
GULF KEYSTONE PETROLEUM LIMITED	5	6	6	6	6	4	3	3	39
GULFSANDS PETROLEUM PLC	0	2	2	2	1	1	6	6	20
HARDY OIL AND GAS PLC	0	5	6	6	6	6	5	6	40
HURRICANE ENERGY PLC	0	0	0	5	5	4	6	6	26
IGAS ENERGY PLC	0	2	2	3	2	6	2	2	19
INDEPENDENT OIL & GAS PLC	6	6	6	6	6	6	6	6	48
INDUS GAS LIMITED	0	2	2	2	3	3	3	3	18
JKX OIL & GAS PLC	0	0	0	2	5	5	6	6	24
KOSMOS ENERGY LIMITED									0
LEKOIL LTD	0	0	0	0	0	0	2	5	7
NOSTRA TERRA OIL & GAS COMPANY PLC	3	6	6	6	6	3	3	6	39
NOSTRUM OIL & GAS PLC	4	4	5	5	5	6	6	0	35
OILEX LIMITED	0	0	0	0	0	4	6	6	16
OPHIR ENERGY PLC	0	0	3	4	6	6	6	6	31
PARKMEAD GROUP PLC (THE)	0	0	0	0	3	4	5	6	18
PHOENIX GLOBAL RESOURCES PLC	5	6	6	6	6	6	6	6	47
PREMIER OIL PLC	5	6	6	6	6	6	6	6	47
PRESIDENT ENERGY PLC	0	3	5	5	6	6	6	6	37
PROVIDENCE RESOURCES PLC	0	5	5	6	6	6	6	6	40
RANGE RESOURCES LIMITED	3	3	6	6	3	6	6	6	39
REGAL PETROLEUM PLC	0	0	0	0	0	4	4	5	13
ROCKHOPPER EXPLORATION PLC	6	6	6	6	6	6	6	6	48
SEPLAT PETROLEUM DEVELOPMENT COMPANY PLC	0	0	0	4	4	6	6	6	26
SERICA ENERGY PLC	6	6	6	6	6	6	6	6	48
SOCO INTERNATIONAL PLC	4	4	6	6	6	6	6	6	44
SOUND OIL PLC	0	0	0	0	5	6	6	6	23
STERLING ENERGY PLC	4	4	6	6	6	6	6	6	44
TLOU ENERGY LTD	0	0	0	0	0	0	2	5	7
TOTAL SA	6	6	6	6	6	6	6	6	48
TOUCHSTONE EXPLORATION INC	0	0	0	0	4	5	5	5	19
TRINITY EXPLORATION & PRODUCTION PLC	0	5	5	6	6	6	6	6	40
TULLOW OIL PLC	6	6	6	6	6	6	6	6	48
VICTORIA OIL & GAS	4	4	6	6	6	6	6	6	44
ZOLTAV RESOURCES INCORPORATED	0	0	0	0	5	6	6		17

6.6.3. Trend of Voluntary Decommissioning Disclosure

Voluntary Decommissioning Disclosure was measured using seven items – please see Table 6.12 below. For disclosing each item in a given year (e.g., 2010), a firm scored 1, otherwise 0, resulting into a maximum total score of seven for a given year (e.g., 2010). All the scores for the whole study period (2010 to 2017) when added give a total of 56. The table below illustrates how the items were scored.

Table 6. 12: Scoring of Voluntary Decommissioning Disclosure

No.	**Items of disclosure in a given year**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
1	Uncertainties and risks considered in calculating the best provision estimate. This can be attained through discounting future estimated cost of decommissioning at pre-tax rate.	1	1	1	1	1	1	1	1	8
2	Decommissioning liabilities include facilities in which damage occurred which need rectification	1	1	1	1	1	1	1	1	8
3	Provisions reviewed on balance sheet show the best estimate of current cost	1	1	1	1	1	1	1	1	8
4	If provision is adjusted because of estimate changes, a corresponding opposite and equal adjustment should be provided to the associated decommissioning asset	1	1	1	1	1	1	1	1	8
5	Discount unwinding (the difference from the liability payable now as compare to the liability payable in the future after reporting date usually 12 months) to be among financial items for interest but displayed separated from other forms of interest using a note or in profit and loss account	1	1	1	1	1	1	1	1	8
6	Asset residual values which are cost of decommissioning at the period of identifying decommissioning asset	1	1	1	1	1	1	1	1	8
7	Decommissioning obligations shown for each geographical region and for a given field	1	1	1	1	1	1	1	1	8
Total score		**7**	**7**	**7**	**7**	**7**	**7**	**7**	**7**	**56**

Trends of Voluntary Decommissioning Disclosure among sampled listed companies vary. Disclosure scores ranged from 0 to 56 depending on the value of the firm. The trend in the Voluntary Decommissioning Disclosure was also plotted to provide an overview of series as shown in Figure C in Appendix 7 for a number of firms as example of the disclosure trade. However, it is noticeable that a number of companies disclose more than others. Per Table 6.13, in this regard, the top ten companies on the list respectively are BP PLC (total score = 55), Enquest PLC (total score = 47), Seplat Petroleum Development Company PLC (total score = 46), Aminex PLC (total score = 36), Hardy Oil & Gas PLC (total score = 34), Total SA (total score = 34), Zoltav Resources Incorporated (total score = 33), Sound Oil PLC (total score = 30), Egdon Resources PLC (total score = 29), President Energy PLC (total score = 29) and Sterling Energy PLC (total score = 29). This list differs from the prior one as a different set of firms rank higher on this item. This varies from Mandatory Decommissioning Disclosure, as shown in prior sections, where other firms ranked higher. Factors causing these differences in disclosure level among the firms was further investigated in the study in section 6.7 (Level of disclosure by Listing State) to section 6.8 (Level of disclosure with Accounting Methods).

Table 6. 13: Voluntary Decommissioning Disclosure

Name of company	**Voluntary Decommissioning Disclosure**								
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
AMINEX PLC	3	4	4	5	5	5	5	5	36
ASCENT RESOURCES PLC	2	2	2	3	3	3	3	3	21
BARON OIL PLC	0	0	1	1	1	1	1	1	6
BP PLC	6	7	7	7	7	7	7	7	55
CABOT ENERGY PLC		1	1	3	3	2	5	6	21
CAIRN ENERGY PLC	2	2	2	2	2	5	5	5	25
CASPIAN SUNRISE PLC	0	0	0	0	3	3	3	3	12
COLUMBUS ENERGY RESOURCES PLC	0	1	2	2	2	2	4	5	18
DIVERSIFIED GAS & OIL PLC						3	3	3	9
EGDON RESOURCES PLC	2	3	4	4	4	4	4	4	29
ELAND OIL & GAS PLC	0	0	1	5	5	5	5	5	26
EMPYREAN ENERGY PLC	0	0	0	1	1	1	3	0	6
ENQUEST PLC	5	5	6	6	6	6	6	7	47
EUROPA OIL & GAS HOLDINGS PLC	2	3	3	3	3	2	2	4	22
EXILLON ENERGY PLC	0	6	0	0	0	0	6	6	18
G3 EXPLORATION LTD	0	0	0	1	1	1	1	1	5

Name of company	Voluntary Decommissioning Disclosure								
	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
GENEL ENERGY PLC	0	2	4	4	4	4	4	4	26
GULF KEYSTONE PETROLEUM LIMITED	1	1	1	3	3	3	4	4	20
GULFSANDS PETROLEUM PLC	2	3	3	4	4	3	3	3	25
HARDY OIL AND GAS PLC	2	5	5	5	5	4	4	4	34
HURRICANE ENERGY PLC	0	2	2	2	2	2	4	5	19
IGAS ENERGY PLC	0	2	3	3	4	4	3	4	23
INDEPENDENT OIL & GAS PLC	0	0	0	0	0	0	1	2	3
INDUS GAS LIMITED	0	1	1	1	1	2	3	3	12
JKX OIL & GAS PLC	3	3	3	3	3	3	3	3	24
KOSMOS ENERGY LIMITED	0	0	0	0	0	0	0	0	0
LEKOIL LTD	0	0	0	0	0	0	3	3	6
NOSTRA TERRA OIL & GAS COMPANY PLC	0	0	0	0	0	0	0	0	0
NOSTRUM OIL & GAS PLC	0	0	0	0	0	0	1	1	2
OILEX LIMITED	0	0	2	2	2	2	2	4	14
OPHIR ENERGY PLC	0	0	0	0	0	0	0	0	0
PARKMEAD GROUP PLC (THE)	0	0	0	0	0	2	2	2	6
PHOENIX GLOBAL RESOURCES PLC	0	0	0	3	4	4	4	4	19
PREMIER OIL PLC	0	0	0	0	0	0	2	2	4
PRESIDENT ENERGY PLC	3	3	3	4	4	4	4	4	29
PROVIDENCE RESOURCES PLC	3	3	3	3	3	3	3	4	25
RANGE RESOURCES LIMITED	0	3	3	3	3	3	3	3	21
REGAL PETROLEUM PLC	0	0	2	2	2	2	2	4	14
ROCKHOPPER EXPLORATION PLC	5	0	5	0	7	0	0	0	17
ROYAL DUTCH SHELL PLC	0	0	0	0	2	2	3		7
SEPLAT PETROLEUM DEVELOPMENT COMPANY PLC	2	5	5	6	7	7	7	7	46
SERICA ENERGY PLC	0	0	0	0	0	0	0	0	0
SOCO INTERNATIONAL PLC	0	0	0	3	3	3	3	3	15
SOUND OIL PLC	3	3	4	4	4	4	4	4	30
STERLING ENERGY PLC	3	3	3	4	4	4	4	4	29
TLOU ENERGY LTD	0	0	0	0	3	3	3	3	12
TOTAL SA	3	3	4	4	5	5	5	5	34
TOUCHSTONE EXPLORATION INC	0	0	0	0	0	0	0	0	0
TRINITY EXPLORATION & PRODUCTION PLC	3	3	3	3	3	3	3	3	24
TULLOW OIL PLC	0	0	0	0	3	3	3	4	13
VICTORIA OIL & GAS	0	3	3	4	4	4	5	5	28
ZOLTAV RESOURCES INCORPORATED	3	4	4	4	4	4	5	5	33

6.6.4. Trend of Voluntary Reserve Disclosure

Voluntary Reserve Disclosure was measured using eight items – please see Table 6.14. For disclosing each item in a given year, a firm scored 1, otherwise 0, resulting into a total score of eight for a given year (e.g., 2010). All the scores for the whole study period (2010 to 2017) when added give a total of 64. Table 6.14 below illustrates how the items were scored.

Table 6. 14: Scoring of Voluntary Reserve Disclosure

No.	Items of disclosure in a given year	2010	2011	2012	2013	2014	2015	2016	2017	Total
1	Commercial gas and oil reserves provided for each financial year (at the beginning and the end)	1	1	1	1	1	1	1	1	8
2	Total quantity of gas and oil reserves for each geographical region	1	1	1	1	1	1	1	1	8
3	Any detail and changes to gas and oil reserve movement as well as revisions of past estimates, existing reserve purchases and production	1	1	1	1	1	1	1	1	8
4	Gas liquid and oil measured in	1	1	1	1	1	1	1	1	8

	barrels and gas reserves measured in cubic feet									
5	Disclosure of any reserves from other sources including non-traditional sources like coalbed methane, shale, oil sands and bitumen as reserves for oil & gas	1	1	1	1	1	1	1	1	8
6	The price sensitivity of company reserves	1	1	1	1	1	1	1	1	8
7	Qualification of professionals involved in overseeing audit and preparation of estimates for the reserves	1	1	1	1	1	1	1	1	8
8	Progress of the company in generating proved developed reserves from the proved undeveloped reserves	1	1	1	1	1	1	1	1	8
Total score		**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**64**

Trends of Voluntary Reserve Disclosure among the sampled listed exploration and production oil and gas companies vary. Disclosure scores ranged from 0 to 64 depending on the disclosure value scored by a given company. The trend in the Voluntary Reserve Disclosure was also plotted to provide an overview of series as shown in Figure D in Appendix 7 for a number of sampled firms as example of level of disclosure trend. However, it is noticeable that a number of companies disclose more than others. Per Table 6.15, in this regard, the top ten companies on the list respectively are Trinity Exploration & Production PLC (total score = 64), Seplat Petroleum Development Company PLC (total score = 62), BP PLC (total score = 60), JKX Oil & Gas PLC (total score = 56), President Energy PLC (total score = 56), Egdon Resources PLC (total score = 50), Enquest PLC (total score = 50), Sound Oil PLC (total score = 50), Sterling Energy PLC (total score = 50) and Zoltav Resources Incorporated (total score = 49). This varies from Mandatory Decommissioning Disclosure and other items as shown in prior sections where other firms ranked higher. Factors causing these differences in disclosure level were further investigated in the study in section 6.7 (Level of disclosure by Listing State) to section 6.8 (Level of disclosure with Accounting Methods).

Table 6. 15: Voluntary Reserve Disclosure

Name of company	**Voluntary Reserve Disclosure**								
	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**TOTAL**
AMINEX PLC	2	2	2	2	2	2	3	3	18
ASCENT RESOURCES PLC	2	3	3	4	4	5	5	6	32
BARON OIL PLC	0	1	1	1	1	2	2	2	10
BP PLC	5	7	8	8	8	8	8	8	60
CABOT ENERGY PLC		3	4	7	7	3	7	7	38
CAIRN ENERGY PLC	2	2	2	3	4	4	4	4	25
CASPIAN SUNRISE PLC	3	3	4	4	4	4	6	6	34
COLUMBUS ENERGY RESOURCES PLC	2	3	7	7	7	2	7	7	42
DIVERSIFIED GAS & OIL PLC						4	4	4	12
EGDON RESOURCES PLC	3	3	6	6	8	8	8	8	50
ELAND OIL & GAS PLC	0	0	5	6	7	7	8	8	41
EMPYREAN ENERGY PLC	0	0	0	0	4	6	6	0	16
ENQUEST PLC	4	6	6	6	6	6	8	8	50
EUROPA OIL & GAS HOLDINGS PLC	2	3	3	4	4	2	2	7	27
EXILLON ENERGY PLC	2	7	2	2	2	6	6	6	33

Name of company	Voluntary Reserve Disclosure								
	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
G3 EXPLORATION LTD	3	6	6	6	6	6	6	6	45
GENEL ENERGY PLC	0	5	7	7	6	6	6	6	43
GULF KEYSTONE PETROLEUM LIMITED	1	1	3	5	5	5	6	6	32
GULFSANDS PETROLEUM PLC	2	3	5	6	6	1	1	1	25
HARDY OIL AND GAS PLC	3	5	5	5	5	3	3	3	32
HURRICANE ENERGY PLC	0	1	1	1	0	0	6	6	15
IGAS ENERGY PLC	0	2	5	5	5	5	3	6	31
INDEPENDENT OIL & GAS PLC	0	0	0	3	6	6	6	6	27
INDUS GAS LIMITED	0	2	2	3	2	6	2	2	19
JKX OIL & GAS PLC	5	5	7	7	8	8	8	8	56
KOSMOS ENERGY LIMITED	0	2	2	2	2	4	4	4	20
LEKOIL LTD	0	0	0	0	3	3	6	6	18
NOSTRA TERRA OIL & GAS COMPANY PLC									0
NOSTRUM OIL & GAS PLC	0	0	0	0	0	0	3	3	6
OILEX LIMITED	1	5	6	6	6	4	4	6	38
OPHIR ENERGY PLC	2	2	3	4	4	6	6	0	27
PARKMEAD GROUP PLC (THE)	0	0	0	0	0	5	7	8	20
PHOENIX GLOBAL RESOURCES PLC	0	0	0	3	6	6	6	6	27
PREMIER OIL PLC	0	0	0	0	1	1	4	6	12
PRESIDENT ENERGY PLC	6	7	7	7	7	7	7	8	56
PROVIDENCE RESOURCES PLC	5	5	5	5	5	5	7	8	45
RANGE RESOURCES LIMITED	0	2	5	5	5	5	6	6	34
REGAL PETROLEUM PLC	0	3	4	6	6	6	6	7	38
ROCKHOPPER EXPLORATION PLC	3	3	6	6	2	6	6	6	38
ROYAL DUTCH SHELL PLC	0	0	0	0	0	4	4	6	14
SEPLAT PETROLEUM DEVELOPMENT COMPANY PLC	7	7	8	8	8	8	8	8	62
SERICA ENERGY PLC									0
SOCO INTERNATIONAL PLC	0	0	0	3	3	6	6	6	24
SOUND OIL PLC	6	6	6	6	6	6	6	8	50
STERLING ENERGY PLC	5	5	5	7	7	7	7	7	50
TLOU ENERGY LTD	0	0	0	0	5	6	6	6	23
TOTAL SA	4	4	6	6	6	6	7	7	46
TOUCHSTONE EXPLORATION INC	0	0	0	0	0	0	0	5	5
TRINITY EXPLORATION & PRODUCTION PLC	8	8	8	8	8	8	8	8	64
TULLOW OIL PLC	0	0	0	0	5	6	6	6	23
VICTORIA OIL & GAS	0	4	5	6	6	6	7	8	42
ZOLTAV RESOURCES INCORPORATED	5	6	6	6	6	6	7	7	49

6.7. Level of disclosure by Listing Status

In order to investigate whether there are differences in disclosure levels among the sampled companies by Listing Status, the researcher conducted independent t-tests. Independent t-test results are shown in Table 6.16 and reveal that mean Mandatory Reserve Disclosure differs between AIM listed companies (mean = 3.81, Std. Deviation = 2.38, n = 249) and the main market based companies (Mean = 4.87, Std. Deviation = 1.87, n = 152) at 0.05 significance level ($t = -4.66$, $df = 399$, $p < 0.001$, 95% CI for Mean Difference -1.50 to -.61). The first observation is that on average, main market based companies tend to make higher Mandatory Reserve Disclosure than AIM listed companies.

The independent t-tests reveal that mean Voluntary Reserve Disclosure differs between AIM companies (mean = 3.66, Std. Deviation = 2.62, n = 249) and main market based companies (Mean = 5.11, Std. Deviation = 2.41, n = 152) at 0.05 significance level ($t = -5.58$, $df = 399$, $p < 0.001$, 95% CI for Mean Difference -1.98 to - .95). It is noticeable that on average, main market based companies tend to report higher Voluntary Reserve Disclosure levels than AIM companies.

The independent t-tests reveal that mean Mandatory Decommissioning Disclosure differs between AIM companies (Mean = 3.41, Std. Deviation = 2.31, n = 249) and main market companies (Mean = 4.15, Std. Deviation = 2.17, n = 152) at 0.05 significance level ($t = -3.21$, $df = 399$, $p < 0.001$, 95% CI for Mean Difference -1.20 to -.29). On average, main market companies tend to report higher Mandatory Decommissioning Disclosure levels than AIM companies.

The independent t-tests reveal that mean Voluntary Decommissioning Disclosure differs between AIM companies (Mean = 2.06, Std. Deviation = 1.74, n = 249) and main market companies (Mean = 3.20, Std. Deviation = 2.10, n = 152) at 0.05 significance level ($t = -5.583$, $df = 399$, $p < 0.001$, 95% CI for Mean Difference -1.51 to - 75). On average, main market companies tend to report higher Voluntary Decommissioning Disclosure levels than AIM companies.

Table 6. 16: Results of independent t-tests Disclosure Level by Listing Status

R&DDI score	Listing state									
	AIM companies			Main Market companies			95% CI for Mean Difference			
	n	Mean	Std. Deviation	N	Mean	Std. Deviation	Lower	Upper	t	df
Mandatory Reserve Disclosure	249	3.8072	2.37828	152	4.8618	1.87012	-1.49976	-.60946	-4.658**	399
Voluntary Reserve Disclosure	249	3.6506	2.62018	152	5.1118	2.41010	-1.97578	-.94670	-5.583**	399
Mandatory Decommissioning Disclosure	249	3.4056	2.30710	152	4.1513	2.17073	-1.20230	-.28908	-3.211**	399
Voluntary Decommissioning Disclosure	248	2.0645	1.73901	152	3.1974	2.10342	-1.51471	-.75100	-5.832**	398

Note. **p <.01. *p < .05.

6.8. Level of disclosure with Accounting Methods

In this section, this study will examine the relationship between four levels of disclosures with three Accounting Methods that are used by exploration and production oil and gas companies listed on the LSE.

6.8.1. Level of Mandatory Reserve Disclosure by Accounting Method

In order to investigate whether there are differences in Mandatory Reserve Disclosure levels among companies that use different Accounting Methods to report their investment activities, the researcher conducted ANOVA tests. ANOVA results (Table 6.17) show that there were significant disclosure differences among companies that use different Accounting Methods in terms of Mandatory Reserve Disclosure ($F (2, 406) = 3.32$, $p = .037$). Table 6.18 show the descriptive of Mandatory Disclosure with Accounting Methods. The Tukey HSD test (Table 6.19) (the test used to find the means which are different statistically from each other) showed that the sampled listed companies using the Successful Effort Method ($n = 224$, Mean = 4.29, Std. Deviation = 2.22) practise higher Mandatory Reserve Disclosure compared with those using the Area of Interest Method ($n = 24$, Mean = 3.04, Std. Deviation = 2.77), $p = .028$. No significant disclosure differences were found between companies using the Area of Interest Method and Full Cost Method ($p > 0.05$), or the Successful Effort Method and the Full Cost Method ($p > 0.05$).

Table 6. 17: ANOVA of Mandatory Reserve with Accounting Methods

		Sum of Squares	df	Mean Square	F	Sig.
Mandatory Reserve Disclosure	Between Groups	34.068	2	17.034	3.321	.037
	Within Groups	2082.543	406	5.129		
	Total	2116.611	408			

Table 6. 18: Descriptive of Mandatory Disclosure with Accounting Methods

		N	Mean	Std. Deviation
Mandatory Reserve Disclosure	Area of Interest Method	24	3.0417	2.77378
	Successful Effort Method	224	4.2946	2.22154
	Full Cost Method	161	4.1925	2.24309
	Total	409	4.1809	2.27767

Table 6. 19: Tukey HSD of Mandatory Disclosure with Accounting Methods

Dependent Variable	(I) Accounting Method	(J) Accounting Method	Mean Difference (I-J)	Std. Error	Sig.	95% CI	
						Lower Bound	Upper Bound
Mandatory Reserve Disclosure	Area of Interest Method	Successful Effort Method	-1.25298	.48644	.028*	-2.3973	-.1087
		Full Cost Method	-1.15088	.49557	.054	-2.3166	.0149
	Successful Effort Method	Area of Interest Method	1.25298	.48644	.028*	.1087	2.3973
		Full Cost Method	.10210	.23401	.900	-.4484	.6526
	Full Cost Method	Area of Interest Method	1.15088	.49557	.054	-.0149	2.3166
		Successful Effort Method	-.10210	.23401	.900	-.6526	.4484

Note. $^{**}p < .01$. $^{*}p < .05$.

6.8.2. Level of Voluntary Reserve Disclosure by Accounting Method

In order to investigate whether there are differences in Voluntary Reserve Disclosure levels among companies that use different Accounting Methods to report their investment activities, the researcher conducted ANOVA tests. ANOVA results show (Table 6.20) that there is a significant difference among companies that use different Accounting Methods in terms of Voluntary Reserve Disclosure ($F(2, 406) = 3.628$, $p = .027$). Table 6.21 shows the descriptive of Voluntary Reserve with Accounting Methods. The Tukey HSD test (Table 6.22) showed that the sampled listed companies using the Successful Effort Method (n = 224, Mean = 4.31, Std. Deviation = 2.69) have a higher Voluntary Reserve Disclosure level compared with those using the Area of Interest Method (n = 24, Mean = 2.79, Std. Deviation = 2.81, $p = .020$). Companies using the Full Cost Method (n = 161, Mean = 4.198, Std. Deviation = 2.5269) also have a higher Voluntary Reserve Disclosure level than those using the Area of Interest Method, $p = .040$. No significant disclosure differences were found between companies using the Successful Effort Method and the Full Cost Method ($p > 0.05$).

Table 6. 20: ANOVA of Voluntary Reserve with Accounting Methods

		Sum of Squares	df	Mean Square	F	Sig.
Voluntary Reserve Disclosure	Between Groups	50.248	2	25.124	3.628	.027
	Within Groups	2811.723	406	6.925		
	Total	2861.971	408			

Table 6. 21: Descriptive of Voluntary Reserve with Accounting Methods

		N	Mean	Std. Deviation
Voluntary Reserve Disclosure	Area of Interest	24	2.7917	2.81269
	Successful Effort Method	224	4.3125	2.68539
	Full Cost Method	161	4.1988	2.52690
	Total	409	4.1785	2.64852

Table 6. 22: Tukey HSD of Voluntary Reserve with Accounting Methods

Dependent Variable	(I) Accounting Method	(J) Accounting Method	Mean Difference (I-J)	Std. Error	Sig.	95% CI	
						Lower Bound	Upper Bound
Voluntary Reserve Disclosure	Area of Interest Method	Successful Effort Method	-1.52083	.56522	.020*	-2.8504	-.1912
		Full Cost Method	-1.40709	.57583	.040*	-2.7616	-.0526
	Successful Effort Method	Area of Interest	1.52083	.56522	.020*	.1912	2.8504
		Full Cost Method	.11374	.27190	.908	-.5259	.7534
	Full Cost Method	Area of Interest Method	1.40709	.57583	.040*	.0526	2.7616
		Successful Effort Method	-.11374	.27190	.908	-.7534	.5259

Note. **p <.01. *p < .05.

6.8.3. Level of Mandatory Decommissioning Disclosure by Accounting Method

In order to investigate whether there are differences in Mandatory Decommissioning Disclosure levels among companies that use different Accounting Methods to report their investment activities, the researcher conducted ANOVA tests. ANOVA results (Table 6.23) show that there is a significant difference among companies that use different Accounting Methods in terms of Mandatory Decommissioning Disclosure ($F(2, 406) = 8.34$, $p < .001$). Table 6.24 shows description of Mandatory Decommissioning with Accounting Methods. The Tukey HSD test (Table 6.25) showed that the sampled listed companies using the Successful Effort Method (n = 224, Mean = 3.594, Std. Deviation = 2.182) have a higher Mandatory Decommissioning Disclosure level compared with those using the Area of Interest Method (n = 24, Mean = 2.00, Std. Deviation = 2.395, $p = .003$). Companies using the Full Cost Method (n = 161, Mean = 3.987, Std. Deviation = 2.318) also have a higher Mandatory Decommissioning Disclosure level than those using the Area of Interest method, $p < .001$. No significant disclosure differences were found between companies using the Successful Effort Method and the Full Cost Method ($p > 0.05$).

Table 6. 23: ANOVA of Mandatory Decommissioning with Accounting Methods

		Sum of Squares	df	Mean Square	F	Sig.
Mandatory Decommissioning Disclosure	Between Groups	84.385	2	42.192	8.340	.000
	Within Groups	2054.006	406	5.059		
	Total	2138.391	408			

Table 6. 24: Description of Mandatory Decommissioning with Accounting Methods

		N	Mean	Std. Deviation
Mandatory Decommissioning Disclosure	Area of Interest Method	24	2.0000	2.39565
	Successful Effort Method	224	3.5938	2.18231
	Full Cost Method	161	3.9876	2.31837
	Total	409	3.6553	2.28936

Table 6. 25: Tukey HSD of Mandatory Decommissioning with Accounting Methods

Dependent Variable	(I) Accounting Method	(J) Accounting Method	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Mandatory Decommissioning Disclosure	Area of Interest Method	Successful Effort Method	-1.59375	.48310	.003*	-2.7302	-.4573
		Full Cost Method	-1.98758	.49216	0.00**	-3.1453	-.8299
	Successful Effort Method	Area of Interest Method	1.59375	.48310	.003*	.4573	2.7302
		Full Cost Method	-.39383	.23240	.208	-.9405	.1529
	Full Cost Method	Area of Interest Method	1.98758	.49216	0.00**	.8299	3.1453
		Successful Effort Method	.39383	.23240	.208	-.1529	.9405

Note. **p <.01. *p < .05.

6.8.4. Level of Voluntary Decommissioning Disclosure by Accounting Method

In order to investigate whether there are differences in Voluntary Decommissioning Disclosure levels among companies that use different Accounting Methods to report their investment activities, the researcher conducted ANOVA tests. ANOVA results (Table 6.26) show that there is a significant difference among the companies that use different Accounting Methods in terms of Voluntary Decommissioning Disclosure ($F(2, 405) = 6.548$, $p = .002$).Table 6.27 shows the description of Voluntary Decommissioning with Accounting Methods. The Tukey HSD test (Table 6.28) showed that the sampled listed companies using the Successful Effort Method (n = 224, Mean = 2.677, Std. Deviation = 2.1295) have a higher Voluntary Decommissioning Disclosure level compared with those using the Area of Interest Method (n = 24, Mean = 1.208, Std. Deviation = 1.4135), $p = .001$. Companies using the Full Cost Method (n = 161, Mean = 2.3851, Std. Deviation = 1.6958) also have a higher Voluntary Decommissioning Disclosure level compared with those using the Area of Interest Method (p = 016.

Existing methods such as the FC Method, the SE Method and the AOI Method adopt different perspectives on the unit of account issue. The FC Method uses a highly aggregated unit of account, whereas the SE method has a narrower scope on separate wells. The AOI Method focuses on the geological area. No significant disclosure differences were found between companies using the Successful Effort Method and Full Cost Method ($p > 0.05$).

Table 6. 26: ANOVA of Voluntary Decommissioning with Accounting Methods

		Sum of Squares	df	Mean Square	F	Sig.
Voluntary Decommissioning Disclosure	Between Groups	48.919	2	24.459	6.548	.002
	Within Groups	1512.836	405	3.735		
	Total	1561.755	407			

Table 6. 27: Description of Voluntary Decommissioning with Accounting Methods

		N	Mean	Std. Deviation
Voluntary Decommissioning Disclosure	Area of Interest Method	24	1.2083	1.41357
	Successful Effort Method	223	2.6771	2.12954
	Full Cost Method	161	2.3851	1.69581
	Total	408	2.4755	1.95889

Table 6. 28: Tukey HSD of Voluntary Decommissioning with Accounting Methods

Dependent Variable	(I) Accounting Method	(J) Accounting - Method	Mean Difference (I-J)	Std. Error	Sig.	95% CI	
						Lower	Upper
Voluntary Decommissioning Disclosure	Area of Interest Method	Successful Effort Method	-1.46880	.41520	.001**	-2.4455	-.4921
		Full Cost Method	-1.17676	.42290	.016*	-2.1716	-.1820
	Successful Effort Method	Area of Interest Method	1.46880	.41520	.001*	.4921	2.4455
		Full Cost Method	.29204	.19988	.311	-.1782	.7622
	Full Cost Method	Area of Interest Method	1.17676	.42290	.016*	.1820	2.1716
		Successful Effort Method	-.29204	.19988	.311	-.7622	.1782

Note. **p <.01. *p < .05.

To summarise, there are differences in Mandatory Reserve Disclosure levels, Voluntary Reserve Disclosure levels, Mandatory Decommissioning Disclosure levels and Voluntary Decommissioning Disclosure levels among companies that use different Accounting Methods to report their investment activities. The Tukey HSD test showed that the sampled listed companies using the Successful Effort Method practise higher Mandatory Reserve Disclosure level, Voluntary Reserve Disclosure level, Mandatory Decommissioning Disclosure level and Voluntary Decommissioning Disclosure level as compared with those using the Area of Interest Method. No significant disclosure differences were found between companies using the Area of Interest Method and the Full Cost Method, or the Successful Effort Method and the Full Cost Method. To conclude, the Full Cost Method (FC), the Successful Effort Method (SE) and the Area of Interest Method (AOI) adopt different perspectives on the unit of account issue, as the FC Method uses a highly aggregated unit of account, the SE Method adopts a narrower scope and the AOI Method focuses on the geological area.

6.9. Empirical examination of the relationship between level of disclosures and performance and value

6.9.1. Introduction

The underlying study makes use of the Ordinary Least Square (OLS) longitudinal panel regression with robust standard error is employed to test the developed research hypotheses. The robust standard error option is applied in order to adjust the OLS parametric test to fit with non- parametric data, and also regarding to some of the study data are not normally distributed. Multiple regression analysis using OLS is undertaken to examine the relationship between level of disclosure (mandatory and voluntary) of reserves and decommissioning with four dependent performance variables and with four dependent value variables.

6.9.2. Impact of disclosure levels on firm performance

The relationship between the level of disclosure and the performance of oil and gas firms was examined in the study based on four equations and eight models involving the dependent variable and independent variables and the addition of control variables.

Model estimation was conducted using panel OLS and the findings are discussed in the following sub-sections for each dependent variable.

6.9.2.1. Relationship between disclosure levels and ROA

Panel OLS regression was used to determine relationship between ROA and disclosure levels (Table 6.29). Model 1 estimation without control variables shows that the four disclosure variables accounted for 6.09% variation in ROA ($R2 = 0.060885$) and Model 1 was significant ($F = 6.240154$, $p < 0.001$). Voluntary Decommissioning Disclosure ($\beta = 2.632131$, $p < 0.05$) impacted significantly on ROA. Based on these results, the null hypothesis that level of disclosure does not impact on ROA is rejected.

Models 2 and 3 estimates added Govern (Institutional Ownership) and Leverage respectively as control variables, and the results revealed that 8.45% variation in ROA ($R2 = 0.084565$) was attributable to these variables and Model 2 was significant ($F = 6.152323$, $p < 0.001$). Voluntary Decommissioning Disclosure ($\beta = 2.711172$, $p < 0.05$) impacted significantly on ROA. Based on these results, the null hypothesis that level of disclosure does not impact on ROA is rejected.

Model 4 estimation added Govern (Institutional Ownership), Leverage and Size as control variables, and results revealed that 24.33% variation in ROA ($R2 = 0.243384$) was attributable to these variables and Model 4 was significant ($F = 15.21057$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 1.918477$, $p < 0.05$) and Voluntary Reserve Disclosure ($\beta = -2.646$, $p < 0.001$) impact significantly on ROA. Based on these results, the null hypothesis that level of disclosure does not impact on ROA is rejected.

Model 5 estimation added Govern (Institutional Ownership), Leverage, Size and Auditor as control variables, and results revealed that 26.10% variation in ROA ($R2 = 0.261023$) was attributed to these variables and Model 5 was significant ($F = 14.57$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 2.100011$, $p < 0.05$), Voluntary Reserve Disclosure ($\beta = -2.85929$, $p < 0.001$), Leverage ($\beta = -42.06508$, $p < 0.05$), Size ($\beta = 2.899830$, $p < 0.001$) and Auditor ($\beta = 6.169542$, $p < 0.001$) impact significantly on ROA. Based on these results, the null hypothesis that level of disclosure does not impact on ROA is rejected.

Model 6 estimation added Govern (Institutional Ownership), Leverage, Size, Auditor and Listing Status as control variables, and results revealed that 24.17% variation in ROA ($R2 = 0.\ 241769$) was attributable to these variables and Model 6 was significant ($F = 11.37267$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 1.947772$, $p < 0.05$), Voluntary Reserve Disclosure ($\beta = -2.72138$, $p < 0.001$), Leverage ($\beta = -38.31580$, $p < 0.05$), Size ($\beta = 2.58768$, $p < 0.001$) and Auditor ($\beta = 5.20735$, $p < 0.001$) impact significantly on ROA. Based on these results, the null hypothesis that level of disclosure does not impact on ROA is rejected.

Model 7 estimation added Govern (Institutional Ownership), Leverage, Size, Auditor, Listing Status and Firm Age as control variables, and results revealed that 25.54% variation in ROA (R2 = 0.553) was attributable to these variables and Model 7 was significant ($F = 10.7014$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 2.047212$, $p < 0.05$), Voluntary Reserve Disclosure ($\beta = -2.72353$, $p < 0.001$), Leverage ($\beta = -40.27724$, $p < 0.05$), Size ($\beta = 2.621557$, $p < 0.001$) and Auditor ($\beta = 5.189683$, $p < 0.001$) impact significantly on ROA. Based on these results, the null hypothesis that level of disclosure does not impact on ROA is rejected.

Finally, Model 8 estimation included all variables such as Govern (Institutional Ownership), Leverage, Size, Auditor, Listing Status, Firm Age and Accounting Method as control variables, and results revealed that 26.10% variation in ROA (R2 = 0.260868) was attributable to these variables and Model 8 was significant ($F = 9.978550$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 1.821195$, $p < 0.05$), Voluntary Reserve Disclosure ($\beta = -2.969696$, $p < 0.001$), Size ($\beta = 2.567505$, $p < 0.001$) and Auditor ($\beta = 6.347317$, $p < 0.001$) impact significantly on ROA. Based on these results, the null hypothesis that level of disclosure does not impact on ROA is rejected.

In summary, the regression analysis in all the eight models confirms that ROA of listed upstream oil and gas companies is significantly impacted by the level of Mandatory Decommissioning Disclosure, Voluntary Decommissioning Disclosure and Voluntary Reserve Disclosure. However, there is no impact of Mandatory Reserve Disclosure on the companies' ROA.

Table 6. 29: Regression summaries for ROA

	ROA							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	0.300973	0.084082	0.028370	1.918477*	2.100011*	1.947772*	2.047212*	1.821195*
Voluntary Decommissioning Disclosure	2.632131*	2.661341**	2.711172**	1.058870	0.673598	0.754011	0.942789	1.074413
Mandatory Reserve Disclosure	2.411368	1.537862	1.355193	1.507430	1.697045	1.545697	1.446602	1.696560
Voluntary Reserve Disclosure	-1.302910	-1.086114	-0.917155	-2.646815**	-2.85929**	-2.72138**	-2.72353**	-2.969696**
Govern		-2.766052	-2.961874	0.291685	-0.035233	-0.637274	-0.967274	-1.344470
Leverage			-18.34091	-47.66220**	-42.06508*	-38.31580*	-40.27724*	-28.97904
Size (Log)				3.315165**	2.899830**	2.587689**	2.621557**	2.567505**
Auditor					6.169542**	5.207356*	5.189683*	6.347317**
Listing State						2.094239	2.653272	3.542709
Firm Age							-0.091134	-0.094223
Accounting Method								3.508048
R-squared	0.060885	0.084565	0.087217	0.243384	0.261023	0.241769	0.255396	0.260868
Adjusted R-squared	0.051128	0.070820	0.070721	0.227383	0.243109	0.220511	0.231531	0.234725
S.E. of regression	28.60434	18.98920	18.99021	17.31565	17.13852	17.18440	17.04147	17.00600
Sum squared residuals	315010.1	120076.3	119728.5	99244.35	96930.58	94792.45	90608.42	89942.51
Log likelihood	-1858.758	-1475.965	-1475.474	-1443.668	-1439.670	-1405.956	-1368.636	-1367.445
F-statistic	6.240154	6.152323	5.287156	15.21057	14.57043	11.37267	10.70147	9.978550
Prob(F-statistic)	0.000071	0.000018	0.000032	0.000000	0.000000	0.000000	0.000000	0.000000

Note. $^{**}p < .01$. $^{*}p < .05$.

6.9.2.2. Relationship between disclosure levels and ROE

Panel OLS regression was used to determine relationship between ROE and disclosure levels (Table 6.30). As per the analysis, Model 1, Model 2, Model 3 and Model 8 were not significant ($p > 0.05$); hence, the relationship between variables could not be interpreted. Model 4 estimation included Governance (Institutional Ownership), Leverage and Size as control variables, and results reveal that 5.77% variation in ROE ($R2 = 0.057696$) was attributed to these variables and Model 4 was significant, $F = 2.860258$, $p < 0.001$. Therefore, we conclude that Mandatory Reserve Disclosure ($\beta = -20.89591$, $p < 0.05$) impacts significantly on ROE and Voluntary Reserve Disclosure ($\beta = -20.89591$, $p < 0.05$). Based on these results, the null hypothesis that level of disclosure does not impact on ROE is rejected. In addition, the control variables including Leverage ($\beta = -493.156$, $p < 0.001$) and Size ($\beta = 11.37540$, $p < 0.001$) had a significant relationship with ROE.

Model 5 estimation included Govern (Institutional Ownership), Leverage, Size and Auditor as control variables, and results revealed that 5.86% variation in ROE ($R2 = 0.058589$) was attributable to these variables and Model 5 was significant ($F = 2.536091$, $p < 0.05$). Mandatory Reserve Disclosure ($\beta = -21.27284$, $p < 0.05$) impacts significantly on ROE. Based on these results, the null hypothesis that level of disclosure does not impact on ROE is rejected. In addition, under Model 5 the control variables including Leverage ($\beta = -504.579$, $p < 0.001$) and Size ($\beta = 12.18752$, $p < 0.001$) had a significant relationship with ROE.

Model 6 estimation included Govern (Institutional Ownership), Leverage, Size, Auditor and Listing Status as control variables, and results revealed that 5.81% variation in ROE ($R2 = 0.058129$) was attributable to these variables and Model 6 was significant ($F = 2.173802$, $p < 0.05$). Mandatory Reserve Disclosure ($\beta = -20.91058$, $p < 0.05$) impacts significantly on ROE. Based on these results, the null hypothesis that level of disclosure does not impact on ROE is rejected. In addition, under Model 6 the control variables including Leverage ($\beta = -509.423$, $p < 0.001$) and Size ($\beta = 13.21625$, $p < 0.05$) had a significant relationship with ROE.

Model 7 estimation included Govern (Institutional Ownership), Leverage, Size, Auditor, Listing Status and Firm Age as control variables, and results revealed that 6.07% variation in ROE ($R2 = 0.060697$) was attributable to these variables and Model 7 was significant ($F = 1.990271$, $p < 0.05$). Mandatory Reserve Disclosure (β = -

21.67861, $p < 0.05$) impacts significantly on ROE. In addition, under Model 7 the control variables, including Leverage ($\beta = -504.190$, $p < 0.001$) and Size ($\beta = 13.50943$, $p < 0.001$) had a significant relationship with ROE.

To summarise, Mandatory Reserve Disclosure impacts significantly on ROE. Based on these results, the null hypothesis that level of disclosure does not impact on ROE is rejected. The results show that firms that perform better have a higher likelihood of disclosing mandatory reserve information in comparison with those that are performing less well. Performance was measured annually through the use of ROE. Although the relationship is presented in the mandatory reverse disclosure, it presents a correlation that is useful in explaining the impact of disclosures on performance. Also, Leverage and Size as control variables have a significant relation with ROE.

Table 6. 30: Regression summary for ROE

	ROE							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	2.949611	3.635427	2.488767	8.904750	8.560176	8.277054	8.925141	9.000898
Voluntary Decommissioning Disclosure	7.673403	6.813823	7.876602	2.220984	2.983531	3.209217	4.489210	4.445297
Mandatory Reserve Disclosure	-14.39919	-17.48243	-21.3694*	-20.89591*	-21.27284*	-20.91058*	-21.67861*	-21.76124
Voluntary Reserve Disclosure	9.795856	11.53233	15.15209	9.212460	9.657028	9.539476	9.748256	9.829035
Govern		-2.086606	-6.427735	4.986642	5.558072	6.093377	3.193808	3.322361
Leverage			-395.027*	-493.156**	-504.579**	-509.423**	-504.190**	-508.0181
Size Log				11.37540**	12.18752**	13.21625*	13.50943**	13.52818
Auditor					-12.28121	-10.17705	-11.33924	-11.72093
Listing Status						-9.638295	-6.300394	-6.610340
Firm Age							-0.679047	-0.677752
Accounting Method								-1.177876
R-squared	0.017763	0.018169	0.033985	0.057696	0.058589	0.058129	0.060697	0.060704
Adjusted R-squared	0.007369	0.003247	0.016314	0.037524	0.035487	0.031388	0.030200	0.027049
S.E. of regression	166.5897	173.8150	172.6720	170.8002	170.9809	173.3265	175.5532	175.8382
Sum squared residuals	10490299	9939633.	9779518.	9539474.	9530435.	9523337.	9492232.	9492157.
Log likelihood	-2500.186	-2200.244	-2197.524	-2193.361	-2193.203	-2144.658	-2095.618	-2095.617
F-statistic	1.708990	1.217622	1.923189	2.860258	2.536091	2.173802	1.990271	1.803696
Prob (F-statistic)	0.147254	0.300436	0.076512	0.006551	0.010870	0.023607	0.033977	0.052606

Note. $^{**}p < .01$. $^{*}p < .05$

6.9.2.3. Relationship between disclosure levels and OCF

Panel OLS regression was used to determine relationship between OCF and disclosure levels (Table 6.31). Model 1 estimation without control variables shows that the four disclosure variables accounted for 18.7537% variation in OCF ($R2 = 0.187537$) and Model 1 was significant ($F = 22.90940$, $p < 0.001$). Voluntary Decommissioning Disclosure ($\beta = 2.632131$, $p < 0.001$), Mandatory Reserve Disclosure ($\beta = -0.679685$, $p < 0.001$) and Voluntary Reserve Disclosure ($\beta = 0.923998$, $p < 0.001$) impacted significantly on OCF. Based on these results, the null hypothesis that level of disclosure does not impact on OCF is rejected. Thus, the level of disclosure impacts on the OCF regardless of the effects of any of the controlling variables.

Model 2 estimation added Governance (Institutional Ownership) as a control variable, and the results revealed that 23.75% variation in the OCF ($R2 = 0.237506$) was attribuable to these variables and that Model 2 was significant ($F = 21.36796$, $p < 0.001$). Voluntary Decommissioning Disclosure ($\beta = 0.553312$, $p < 0.001$), Mandatory Reserve Disclosure ($\beta = -0.60785$, $p < 0.001$), Voluntary Reserve Disclosure ($\beta = 0.894047$, $p < 0.001$) and Governance ($\beta = -1.68770$, $p < 0.001$) impacted significantly on OCF. Based on these results, the null hypothesis that the level of disclosure does not impact on OCF is rejected. Therefore, it can be concluded that the extent of disclosures impacts on the OCF, and Institutional Ownership is a factor that plays a role in such impact.

Model 3 estimation added Governance (Institutional Ownership) and Leverage as control variables, and results revealed that 36.57% variation in OCF ($R2 = 0.365781$) was attributable to these variables and that Model 3 was significant ($F = 32.87437$, $p < 0.001$). Voluntary Decommissioning Disclosure ($\beta = 0.494390$, $p < 0.001$) and Voluntary Reserve Disclosure ($\beta = 0.647622$, $p < 0.001$) impact significantly on OCF. Based on these results, the null hypothesis that level of disclosure does not impact on OCF is rejected. Therefore, and building on the conclusion of Model 2, adding Leverage to the influencing factors shows that level of disclosure impacts on OCF. Control variables including Governance ($\beta = -1.39512$, $p < 0.001$) and Leverage ($\beta = 25.77091$, $p < 0.001$) had a significant relationship with OCF.

Model 4 estimation added Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 52.37% variation in OCF ($R2 = 0.523725$) was attributable to these variables and that Model 4 was significant (F =

53.56762, $p < 0.001$). Voluntary Reserve Disclosure ($\beta = 0.306458$, $p < 0.05$) impacts significantly on OCF. Based on these results, the null hypothesis that level of disclosure does not impact on OCF is rejected. Control variables including Governance ($\beta = -0.75720$, $p < 0.05$), Leverage ($\beta = 19.56460$, $p < 0.001$) and Size ($\beta = 0.666957$, $p < 0.001$) had a significant relationship with OCF.

Model 5 estimation added Governance (Institutional Ownership), Leverage, Size and Auditor as control variables, and results revealed that 55.13% variation in OCF ($R2 = 0.551251$) was attributable to these variables and that Model 5 was significant, $F = 52.20763$, $p < 0.001$. Control variables including Governance ($\beta = -0.83350$, $p < 0.001$), Leverage ($\beta = 20.89380$, $p < 0.001$), Size ($\beta = 0.564575$, $p < 0.001$) and Auditor ($\beta = 1.541391$, $p < 0.001$) had a significant relationship with OCF.

Model 6 estimation added Governance (Institutional Ownership), Leverage, Size, Auditor and Listing Statusas control variables, and results revealed that 58.18% variation in OCF ($R2 = 0.581804$) was attributable to these variables and that Model 6 was significant ($F = 51.16617$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 0.290261$, $p < 0.05$), Mandatory Reserve Disclosure ($\beta = -0.31385$, $p < 0.001$) and Voluntary Reserve Disclosure ($\beta = 0.287204$, $p < 0.05$) impact significantly on OCF. Based on these results, the null hypothesis that level of disclosure does not impact on OCF is rejected.

Governance ($\beta = -0.97648$, $p < 0.001$), Leverage ($\beta = 21.30700$, $p < 0.001$), Size ($\beta = 0.342329$, $p < 0.001$), Auditor ($\beta = 1.064830$, $p < 0.001$) and Listing Status ($\beta = 2.049500$, $p < 0.001$) had a significant relationship with OCF.

Model 7 estimation added Governance (Institutional Ownership), Leverage, Size, Auditor, Listing Statusand Firm Age as control variables, and results revealed that 58.50% variation in OCF ($R2 = 0.585061$) was attributable to these variables and that Model 7 was significant ($F = 45.40173$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 0.270615$, $p < 0.05$) impacts significantly on OCF. Based on these results, the null hypothesis that level of disclosure does not impact on OCF is rejected.

Control variables including Governance ($\beta = -0.89761$, $p < 0.001$), Leverage ($\beta = 20.66001$, $p < 0.001$), Size Log ($\beta = 0.333383$, $p < 0.001$), Auditor ($\beta = 1.092053$, $p < 0.001$) and Listing Status ($\beta = 1.962360$, $p < 0.001$) had a significant relationship with OCF.

Finally, Model 8 estimation included all variables, which were Governance (Institutional Ownership), Leverage, Size, Auditor, Listing Status, Firm Age and

Accounting Method as control variables, and results revealed that 58.82% variation in OCF ($R2 = 0.588268$) was attributable to these variables and that Model 8 was significant ($F = 41.69395$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 0.305245$, $p < 0.05$), Mandatory Reserve Disclosure ($\beta = -0.327929$, $p < 0.05$) and Voluntary Reserve Disclosure ($\beta = 0.314361$, $p < 0.05$) impact significantly on OCF. Based on these results, the null hypothesis that level of disclosure does not impact on OCF is rejected. Control variables including Governance ($\beta = -0.83856$, $p < 0.001$), Leverage ($\beta = 18.90247$, $p < 0.001$), Size ($\beta = 0.341104$, $p < 0.001$), Auditor ($\beta = 0.921775$, $p < 0.05$) and Listing Status ($\beta = 1.811634$, $p < 0.001$) had a significant relationship with OCF.

To summarise, results indicate that Mandatory Decommissioning Disclosure, Mandatory Reserve Disclosure and Voluntary Reserve Disclosure impact significantly on OCF. In terms of control variables, the results indicate that Governance, Leverage, Size, Auditor, and Listing Status impact significantly on OCF. This can be explained by signalling theory. The expectation of this study is that disclosures of reserve quantities and/or values offer positive signals to the market that future cash flows are expected, therefore impacting positively on the performance and value of reporting companies.

Table 6. 31: Regression summary for log OCF

	log OCF							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	-0.166773	-0.244098	-0.165606	0.203207	0.244702	0.290261*	0.270615*	0.305245*
Voluntary Decommissioning Disclosure	0.485474**	0.553312**	0.494390**	0.177020	0.082083	0.038901	0.009893	-0.012666
Mandatory Reserve Disclosure	- 0.679685**	-0.60785**	-0.343971	-0.313513	-0.268245	-0.31385**	-0.289829	-0.327929*
Voluntary Reserve Disclosure	0.923998**	0.894047**	0.647622**	0.306458*	0.256980	0.287204*	0.276932	0.314361*
Govern		-1.68770**	-1.39512**	-0.75720*	-0.83350**	-0.97648**	-0.89761**	-0.83856**
Leverage			25.77091**	19.56460**	20.89380**	21.30700**	20.66001**	18.90247**
Size Log				0.666957**	0.564575**	0.342329**	0.333383**	0.341104**
Auditor					1.541391**	1.064830**	1.092053**	0.921775*
Listing Status						2.049500**	1.962360**	1.811634**
Firm Age							0.020046	0.020952
Accounting Method								-0.545198
R-squared	0.187537	0.237506	0.365781	0.523725	0.551251	0.581804	0.585061	0.588268
Adjusted R-squared	0.179351	0.226391	0.354655	0.513948	0.540692	0.570433	0.572175	0.574159
S.E. of regression	3.436559	3.475551	3.174381	2.754889	2.678028	2.602148	2.610351	2.604290
Sum squared residuals	4688.544	4143.252	3446.229	2587.990	2438.423	2241.259	2194.086	2177.127
Log likelihood	-1064.155	-926.9512	-894.8083	-844.8316	-834.4437	-804.8943	-786.4220	-785.1301
F-statistic	22.90940	21.36796	32.87437	53.56762	52.20763	51.16617	45.40173	41.69395
Prob (F-statistic)	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Note. **p <.01. *p < .05.

6.9.2.4. Relationship between disclosure levels and Profits

The relationship between disclosure levels and Profits' Panel OLS regression was used to determine relationship between Profits and disclosure levels (Table 6.32). As per the results, the findings of Model 1 were not significant ($p > 0.05$), hence the results for Model 1 are not considered in the analysis. Model 2 estimation with Governance (Institutional Ownership) as control variable shows that the four disclosure variables accounted for 4.20% variation in Profits ($R2 = 0.042055$) and Model 2 was significant ($F = 2.879903$, $p < 0.05$). All the disclosure types did not impact on profits ($p > 0.05$). Based on these results, the null hypothesis that level of disclosure does not impact on Profits was accepted. Control variable Governance ($\beta = -2186.62$, $p < 0.001$) had a significant relationship with Profits.

Model 3 estimation included all variables, which were Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 25.90% variation in Profits ($R2 = 0.259066$) was attributable to these variables and that Model 3 was significant ($F = 19.05580$, $p < 0.001$). None of the four disclosure variables impacted on Profits ($p > 0.05$). Based on these results, the null hypothesis that level of disclosure does not impact on Profits was supported. Control variables, including Governance ($\beta = -1581.66$, $p < 0.05$) and Leverage ($\beta = 56813.63$, $p < 0.001$), had a significant relationship with Profits. As per the literature, the enhanced disclosure allows companies to obtain capital at reduced cost, and therefore disclosures impact on profit. However, this is an indirect impact, and it is not supported the research hypothesis.

Model 4 estimation included all variables, which were Governance (Institutional ownership), Leverage and Size, as control variables, and results revealed that 32.71% variation in Profits ($R2 = 0.327194$) was attributable to these variables and that Model 4 was significant ($F = 22.64823$, $p < 0.001$). None of the four disclosure variables impacted on Profits ($p > 0.05$). Based on these results, null hypothesis that level of disclosure does not impact on Profits is supported. Control variables including Leverage ($\beta = 49059.45$, $p < 0.001$) and Size ($\beta = 747.6383$, $p < 0.001$) had a significant relationship with Profits.

Model 5 estimation included all variables, which were Governance (Institutional Ownership), Leverage, Size Log and Auditor, as control variables, and results revealed that 32.78% variation in Profits ($R2 = 0.327878$) was attributable to these variables and that Model 5 was significant ($F = 19.81787$, $p < 0.001$). None of four disclosure variables impact on Profits ($p > 0.05$). Based on these results, the null hypothesis that level of disclosure does not impact on Profits was supported. Control variables including Leverage ($\beta = 49437.41$, $p < 0.001$) and Size ($\beta = 720.5816$, $p < 0.001$) had a significant relationship with Profits.

Model 6 estimation included all variables, Governance (Institutional Ownership), Leverage, Size Log, Auditor and Listing Status, as control variables, and results revealed that 33.16% variation in Profits (R2 = 0.331660) was attributable to these variables and that Model 6 was significant, $F = 17.42366$, $p < 0.001$. None of the four disclosure variables impacted on Profits ($p > 0.05$). Based on these results, the null hypothesis that level of disclosure does not impact on Profits is supported. Control variables including Leverage ($\beta = 50074.60$, $p < 0.001$) and Size ($\beta = 799.8529$, $p < 0.001$) had a significant relationship with Profits.

Model 7 estimation included all variables, Governance, Leverage, Size Log, Auditor, Listing Status and Firm Age, as control variables, and results revealed that 34.39% variation in Profits (R2 = 0.343933) was attributableto these variables and that Model 7 was significant ($F = 16.09401$, $p < 0.001$). None of the disclosure variables impacted on Profits ($p > 0.05$). Based on these results, the null hypothesis that the level of the four disclosures variables (Mandatory Reserve, Mandatory Decommissioning, Voluntary Reserve and Voluntary Decommissioning) does not impact on Profits was supported. Control variables including Leverage ($\beta = 52564.87$, $p < 0.001$), Size ($\beta = 813.7092$, $p < 0.001$) and Firm Age ($\beta = -64.35961$, $p < 0.05$) had a significant relationship with Profits.

Model 8 estimation included Governance, Leverage, Size Log, Auditor, Listing Status, Firm Age and Accounting Method as control variables, and results reveal that 34.58% variation in Profits (R2 = 0.345896) was attributed to these variables and Model 8 was significant, $F = 14.71050$, $p < 0.001$. None of the disclosure variables impact on Profits ($p > 0.05$). Based on these results, the null hypothesis that level of disclosure does not impact on Profits was accepted. Control variables, including Leverage ($\beta = 50284.43$, $p < 0.001$), Size ($\beta = 821.4002$, $p < 0.001$) and Firm Age ($\beta = -63.15091$, $p < 0.05$) had a significant relationship with Profits.

To summarise, the null hypothesis that level of four disclosures does not impact on Profits is supported. Furthermore, Profits were also impacted on by Leverage and Company Size and negatively by Institutional Ownership and Firm Age. Higher profit values suggest that the firms had better financial performance compared to those with lower profit values. Higher profitability means higher financial performance.

Table 6. 32: Regression summary for Profits

	Profit							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	-44.21425	-18.81421	87.98293	513.1521	518.7165	478.2326	509.9526	550.1361
Voluntary Decommissioning Disclosure	391.8096	480.9107	406.7345	37.93367	16.76339	51.25876	135.5903	106.7018
Mandatory Reserve Disclosure	-637.0067	-593.9335	-24.04331	-0.301399	12.93142	8.878681	-70.52168	-121.4487
Voluntary Reserve Disclosure	431.0762	304.1476	-206.1935	-589.6553	-601.4411	-600.9691	-533.3219	-479.1048
Govern		-2186.62**	-1581.66*	-783.2269	-794.5279	-797.3975	-978.1897	-890.7681
Leverage			56813.63**	49059.45**	49437.41**	50074.60**	52564.87**	50284.43**
Size Log				747.6383**	720.5816**	799.8529**	813.7092**	821.4002**
Auditor					416.2253	548.1533	552.3642	342.1820
Listing Status						-846.6206	-511.0840	-702.0441
Firm Age							-64.35961*	-63.15091*
Accounting Method								-730.1139
R-squared	0.016997	0.042055	0.259066	0.327194	0.327878	0.331660	0.343933	0.345896
Adjusted R-squared	0.006623	0.027452	0.245471	0.312747	0.311333	0.312625	0.322563	0.322382
SE of regression	6293.159	6664.971	5870.576	5602.748	5608.507	5669.843	5697.225	5697.983
Sum squared residuals	1.50E+10	1.46E+10	1.13E+10	1.02E+10	1.02E+10	1.02E+10	9.96E+09	9.93E+09
Log likelihood	-3901.288	-3411.642	-3368.743	-3352.635	-3352.465	-3275.086	-3195.605	-3195.128
F-statistic	1.638335	2.879903	19.05580	22.64823	19.81787	17.42366	16.09401	14.71050
Prob (F-statistic)	0.163884	0.014645	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Note. **p < .01.*p < .05.

6.9.2.5. Relationship between disclosure levels and EBITDA

Panel OLS regression was used to determine the relationship between EBITDA and disclosure levels (Table 6.33). Model 1 estimation without control variables shows that the four disclosure types accounted for 6.86% variation in EBITDA (R2 = 0.068694) and that Model 1 was significant ($F = 7.431433$, $p < 0.001$). Mandatory Reserve Disclosure ($\beta = -1678.949$, $p < 0.001$) and Voluntary Reserve Disclosure ($\beta = 1808.703$, $p < 0.001$) impacted significantly on EBITDA. Based on these results, the null hypothesis that the level of disclosure does not impact on EBITDA is rejected.

Model 2 estimation added Governance (Institutional Ownership) as a control variable, and results revealed that 8.45% variation in EBITDA (R2 = 0.084565) was attributable to this variable and that Model 2 was significant ($F = 9.364951$, $p < 0.001$). Voluntary Decommissioning Disclosure ($\beta = 976.9399$, $p < 0.05$), Mandatory Reserve Disclosure ($\beta = -1538.714$, $p < 0.001$), Voluntary Reserve Disclosure ($\beta = 1608.087$, $p < 0.001$) and Governance ($\beta = -4702.64$, $p < 0.001$) impacted significantly on EBITDA. Based on these results, the null hypothesis that the level of disclosure does not impact on EBITDA is rejected. Thus, it can be concluded that Governance (Institutional Ownership) plays a role in the impact of disclosure types on EBITDA.

Model 3 estimation added Governance (Institutional Ownership) and Leverage as control variables, and results revealed that 40.35% variation in EBITDA (R2 = 0.403591) was attributable to these variables and that Model 3 was significant ($F = 38.57201$, $p < 0.001$). Control variables included Governance ($\beta = -3590.50$, $p < 0.001$) and Leverage ($\beta = 102249.4$, $p < 0.001$). Based on these results, the null hypothesis that the level of disclosure does not impact on EBITDA is rejected.

Model 4 estimation added Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 60.47% variation in EBITDA (R2 = 0.604784) was attributable to these variables and that Model 4 was significant ($F = 74.54564$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 1075.425$, $p < 0.001$) impacted significantly on EBITDA. Based on these results, the null hypothesis that the level of disclosure does not impact on EBITDA is rejected. Control variables including Governance ($\beta = -1672.264$, $p < 0.05$), Leverage ($\beta = 83586.91$, $p < 0.001$) and Size ($\beta = 2005.549$, $p < 0.001$) had a significant relationship with EBITDA.

Model 5 estimation added Governance (Institutional Ownership), Leverage, Size and Auditor as control variables, and results revealed that 60.48% variation in

EBITDA ($R2 = 0.604843$) was attributable to these variables and that Model 5 was significant ($F = 65.05223$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 1070.305$, $p < 0.001$) impacted significantly on EBITDA. Based on these results, the null hypothesis that level of disclosure does not impact on EBITDA is rejected. Control variables including Governance ($\beta = -1662.848$, $p < 0.05$), Leverage ($\beta = 83422.88$, $p < 0.001$) and Size ($\beta = 2018.184$, $p < 0.001$) had a significant relationship with EBITDA.

Model 6 estimation added Governance (Institutional Ownership), Leverage, Size, Auditor and Listing Status as control variables, and results revealed that 61.45% variation in EBITDA ($R2 = 0.614566$) was attributable to these variables and that Model 6 was significant ($F = 58.64138$ $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 959.9470$, $p < 0.001$) impacted significantly on EBITDA. Based on these results, the null hypothesis that the level of disclosure does not impact on EBITDA is rejected. Control variables including Governance ($\beta = -1576.236$, $p < 0.05$), Leverage ($\beta = 84141.10$, $p < 0.001$), Size ($\beta = 2299.767$, $p < 0.001$) and Listing Status ($\beta = -2814.02$, $p < 0.001$) had a significant relationship with EBITDA.

Model 7 estimation added Governance (Institutional Ownership), Leverage, Size, Auditor, Listing Status and Firm Age as control variables, and results revealed that 62.74% variation in EBITDA ($R2 = 0.627489$) was attributable to these variables and that Model 7 was significant ($F = 54.24051$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 1008.766$, $p < 0.001$) impacted significantly on EBITDA. Based on these results, the null hypothesis that the level of disclosure does not impact on EBITDA is rejected. Control variables including Governance ($\beta = -1906.068$, $p < 0.05$), Leverage ($\beta = 88119.17$, $p < 0.001$), Size ($\beta = 2325.151$, $p < 0.001$), Listing Status ($\beta = -2306.98$, $p < 0.05$) and Firm Age ($\beta = -104.33$, $p < 0.001$) had a significant relationship with EBITDA.

Finally, Model 8 estimation included all variables, which were Governance (Institutional Ownership), Leverage, Size, Auditor, Listing Status, Firm Age, and Accounting Method, as control variables, and results revealed that 63.88% variation in EBITDA ($R2 = 0.638836$) was attributable to these variables and that Model 8 was significant ($F = 51.61762$, $p < 0.001$). Mandatory Decommissioning Disclosure ($\beta = 1184.393$, $p < 0.001$) impacted significantly on EBITDA. Based on these results, the null hypothesis that the level of disclosure does not impact on EBITDA is rejected. Control variables including Governance ($\beta = -1606.522$, $p < 0.05$), Leverage ($\beta =$

79205.67, $p < 0.001$), Size ($\beta = 2364.304$, $p < 0.001$), Listing Status ($\beta = -3071.39$, $p < 0.001$), Firm Age ($\beta = -99.736$, $p < 0.001$) and Accounting Method ($\beta = -2765.00$, $p < 0.001$) had a significant relationship with EBITDA.

To summarise, the null hypothesis that level of disclosure does not impact on EBITDA is rejected. The results show that Mandatory Decommissioning Disclosure impacts positively on EBITDA. Mandatory Reserve Disclosure impacts negatively on EBITDA. Voluntary Reserve Disclosure impacts positively on EBITDA. In addition, EBITDA was positively impacted on by Leverage and Company Size and negatively by Governance (Institutional Ownership), Listing Status, Firm Age and Accounting Method. A higher EBITDA value suggests that the firms had better financial performance compared to those with lower EBITDA values. EBITDA denotes the earnings before interest and taxes, depreciation and amortisation, which denotes the profitability of the firm. Higher profitability means higher financial value. The relation between level of types of disclosures with EBITDA is not in line with the relation between level of types of disclosures with Profit as the study demonstrated earlier, in section 6.9.2.4. Earnings before interest, taxes, depreciation and amortisation (EBITDA) adds depreciation and amortisation expenses back into a company’s operating profit. Analysts usually rely on EBITDA to evaluate a company’s ability to generate profits from sales alone and to make comparisons across similar companies with different capital structures. That could explain why investors use EBITDA as an indicator for the managers’ attitude to generating profit from the main activities and the performance of the firm based on it.

Table 6. 33: Regression summary for EBITDA

	EBITDA							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	-278.4700	-355.8760	-33.60089	1075.425**	1070.305**	959.9470**	1008.766**	1184.393**
Voluntary Decommissioning Disclosure	740.7041	976.9399*	735.4395	-218.8969	-207.1812	-118.0013	26.86320	-87.54603
Mandatory Reserve Disclosure	-1678.949**	-1538.714**	-535.1078	-443.5193	-449.1056	-389.2328	-518.3621	-711.5889
Voluntary Reserve Disclosure	1808.703**	1608.087**	660.3750	-365.5107	-359.4049	-382.2309	-272.0653	-82.24231
Governance		-4702.64**	-3590.50**	-1672.264*	-1662.848*	-1576.236*	-1906.068*	-1606.522*
Leverage			102249.4**	83586.91**	83422.88**	84141.10**	88119.17**	79205.67**
Size Log				2005.549**	2018.184**	2299.767**	2325.151**	2364.304**
Auditor					-190.2157	344.2302	310.9353	-552.6385
Listing Status						-2814.02**	-2306.98*	-3071.39**
Firm Age							-104.33**	-99.736**
Accounting Method								-2765.00**
R-squared	0.068694	0.118897	0.403591	0.604784	0.604843	0.614566	0.627489	0.638836
Adjusted R-squared	0.059450	0.106201	0.393128	0.596671	0.595545	0.604086	0.615921	0.626460
SE of regression	9489.169	9900.395	8201.483	6686.108	6695.433	6696.349	6668.747	6576.614
Sum squared residuals	3.63E+10	3.40E+10	2.30E+10	1.52E+10	1.52E+10	1.48E+10	1.43E+10	1.39E+10
Log likelihood	-4312.837	-3745.576	-3636.886	-3565.081	-3565.055	-3482.761	-3399.041	-3393.890
F-statistic	7.431433	9.364951	38.57201	74.54564	65.05223	58.64138	54.24051	51.61762
Prob (F-statistic)	0.000009	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Note. **p <.01. *p < .05.

6.9.3. Impact of disclosure levels on firm market value

The relationship between level of disclosure and the firm value of oil and gas firms was examined in the study based on four equations and eight models involving the dependent variable and independent variables and the addition of control variables. In essence, model estimation was conducted using panel OLS and the findings summarised are in the following sub-sections for each dependent variable.

6.9.3.1. Relationship between disclosure levels and Tobin's Q

The Tobin's Q ratio is a measure of firm assets in relation to a firm's market value. A Tobin's Q above 1.0 means that the firm is worth more than the cost of its assets. Because Tobin's premise is that firms should be worth what their assets are worth, anything above 1.0 theoretically indicates that a company is over-valued. Panel OLS regression was used to determine the relationship between Tobin's Q and disclosure levels (Table 6.34).

Model 1 shows that the four disclosure types accounted for 5.30% variation in Tobin's Q (R2 = 0.053084) and that Model 1 was significant ($F = 5.577962$, $p < 0.05$). Only Mandatory Reserve Disclosure impacted on Tobin's Q negatively ($\beta = -4.21849$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected.

Model 2 estimation with Governance (Institutional Ownership) as a control variable shows that the four disclosure types accounted for 4.42% variation in Tobin's Q (R2 = 0.044256) and that Model 1 was significant ($F = 3.176537$, $p < 0.05$). Only Mandatory Reserve Disclosure impacted on Tobin's Q negatively ($\beta = -2.602123$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected. The control variable, Governance ($\beta = 1.911421$, $p < 0.001$), had a significant relationship with Tobin's Q.

Model 3 estimation included the variables, which were Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 4.5% variation in Tobin's Q (R2 = 0.045114) was attributable to these variables and that Model 3 was significant ($F = 2.692973$, $p < 0.001$). Only Mandatory Reserve Disclosure impacted on Tobin's Q negatively ($\beta = -2.482136$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected. Control variables including Governance (β =

2.044455, $p < 0.05$) and Leverage ($\beta = 11.71788$, $p < 0.01$) had a significant relationship with Tobin's Q.

Model 4 estimation included the variables of Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 6.47% variation in Tobin's Q (R2 = 0.064733) was attributable to these variables and that Model 4 was significant ($F = 3.371672$, $p < 0.001$). Only Mandatory Reserve Disclosure impacted on Tobin's Q negatively ($\beta = -2.541824$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected. Control variables including Leverage ($\beta = 23.88019$, $p < 0.01$) and Size ($\beta = -1.307014$, $p < 0.01$) had a significant relationship with Tobin's Q.

Model 5 estimation included the variables, which were Governance (Institutional Ownership), Leverage, Size and Auditor, as control variables, and results revealed that 6.67% variation in Tobin's Q (R2 = 0.066762) was attributable to these variables and that Model 5 was significant ($F = 3.040356$, $p < 0.001$). Only Mandatory Reserve Disclosure impacteds on Tobin's Q negatively ($\beta = -2.473486$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected. Control variables including Leverage ($\beta = 25.88676$, $p < 0.001$) and Size ($\beta = -1.461571$, $p < 0.01$) had a significant relationship with Tobin's Q.

Model 6 estimation included the variables, which were Governance (Institutional Ownership), Leverage, Size, Auditor and Listing Status, as control variables, and results revealed that 7.37% variation in Tobin's Q (R2 = 0.073723) was attributable to these variables and that Model 6 was significant ($F = 2.927181$, $p < 0.001$). Only Mandatory Reserve Disclosure impacted on Tobin's Q negatively ($\beta = -2.640292$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected. Control variables including Leverage ($\beta = 28.85992$, $p < 0.01$) and Size ($\beta = -1.493219$, $p < 0.01$) had a significant relationship with Tobin's Q.

Model 7 estimation included the variables, which were Govern, Leverage, Size, Auditor, Listing Status and Firm Age, as control variables, and results revealed that 7.96% variation in Tobin's Q (R2 = 0.079601) was attributable to these variables and that Model 7 was significant ($F = 2.784833$, $p < 0.001$). Only Mandatory Reserve Disclosure impacted on Tobin's Q negatively ($\beta = -2.508128$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected. Control variables including Leverage ($\beta = 0.227369$, $p < 0.05$), Size ($\beta = -1.485205$, $p < 0.01$) and Firm Age ($\beta = 0.161675$, $p < 0.05$) had a significant relationship with Tobin's Q.

Model 8 estimation included Governance, Leverage, Size, Auditor, Listing Status, Firm Age and Accounting Method as control variables, and results reveal that 9.29% variation in Tobin's Q (R2 = 0.092973) was attributable to these variables and that Model 8 was significant ($F = 2.991216$, $p < 0.001$). Only Mandatory Reserve Disclosure impacted on Tobin's Q negatively ($\beta = -2.945621$, $p > 0.05$). Based on these results, the null hypothesis that the level of Mandatory Reserve Disclosure does not impact on Tobin's Q was rejected. Control variables including Leverage ($\beta = 2.781529$, $p < 0.01$), Size ($\beta = -1.396557$, $p < 0.01$) and Accounting Method ($\beta = -6.260362$, $p < 0.05$) had a significant relationship with Tobin's Q.

To summarise, the null hypothesis that level of disclosure Mandatory Decommissioning Disclosure, Voluntary Decommissioning Disclosure and Voluntary Reserve Disclosure does not impact on Tobin's Q was accepted. However, Mandatory Reserve Disclosure does impact on Tobin's Q and the hypothesis was rejected. A Tobin's Q greater than 1 implies that firms' stock had been over-valued. Conversely, a high Tobin's Q (greater than 1) implies that a firm's stock is more expensive than the replacement cost of its assets, which implies that the stock is over-valued. This measure of stock valuation is the driving factor behind investment decisions in the Tobin's Q ratio. In addition, Tobin's Q was negatively impacted on by Size, Accounting Method and Leverage and positively by Institutional Ownership and Listing Status.

Table 6. 34: Regression summaries for Tobin's Q

	Tobin Q							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	-0.036486	0.354894	0.390584	-0.332167	-0.269526	-0.510559	-0.353160	0.044484
Voluntary Decommissioning Disclosure	-0.885006	-0.954275	-0.981067	-0.359127	-0.502445	-0.341501	-0.543723	-0.802762
Mandatory Reserve Disclosure	-4.21849*	-2.602123*	-2.482136*	-2.541824*	-2.473486*	-2.640292*	-2.508128*	-2.945621*
Voluntary Reserve Disclosure	1.212772	0.791244	0.679196	1.347764	1.273072	1.400906	1.049646	1.479433
Governance		1.911421**	2.044455**	0.794339	0.679150	0.113463	0.227369	0.905583
Leverage			11.71788**	23.88019**	25.88676**	28.85992**	22.96299*	2.781529**
Size (Log)				-1.307014**	-1.461571**	-1.493219*	-1.485205**	-1.396557**
Auditor					2.326906	1.832334	1.387535	-0.567721
Listing Status						-0.580832	-1.523534	-3.254279
Firm Age							0.161675*	0.172077
Accounting Method								-6.260362*
R-squared	0.053084	0.044256	0.045114	0.064733	0.066762	0.073723	0.079601	0.092973
Adjusted R-squared	0.043567	0.030324	0.028361	0.045534	0.044803	0.048538	0.051017	0.061891
SE of regression	33.70628	21.63569	21.65757	21.46534	21.47355	21.65851	21.86320	21.73759
Sum squared residuals	452173.2	160559.4	160415.3	157119.4	156778.5	155269.1	153915.9	151679.8
Log likelihood	-1986.943	-1565.130	-1564.973	-1561.350	-1560.971	-1527.494	-1494.154	-1491.717
F-statistic	5.577962	3.176537	2.692973	3.371672	3.040356	2.927181	2.784833	2.991216
Prob (F-statistic)	0.000223	0.008106	0.014415	0.001714	0.002575	0.002362	0.002569	0.000834

Note. **p <.01. *p < .05

6.9.3.2. Relationship between disclosure levels and P/E ratio

Panel OLS regression was used to determine the relationship between the P/E ratio and disclosure levels (Table 6.35). Model 1 estimation without control variables shows that the four disclosure types accounted for 9.13% variation in the P/E ratio ($R2 = 0.091339$) and that Model 1 was significant ($F = 2.965354$, $p < 0.05$). Mandatory Decommissioning Disclosure ($\beta = 33.25337$, $p < 0.05$) impacted significantly on the P/E ratio. Based on these results, the null hypothesis that the level of disclosure does not impact on the P/E ratio is rejected. None of the control variables had a significant association with the P/E ratio.

Model 2 estimation with Governance (Institutional Ownership) as a control variable shows that the four disclosure variables accounted for 12.90% variation in the P/E ratio ($R2 = 0.129086$) and that Model 2 was significant ($F = 3.053313$, $p < 0.05$). None of the control variables had an impact on Profits ($p > 0.05$). Based on these results, the null hypothesis that the level of disclosure does not impact on P/E ratio is accepted. None of the control variables had a significant association with P/E ratio.

Model 3 estimation included the variables, which were Governance (Institutional Ownership), Leverage and Size, as control variables, and results revealed that 13.86% variation in the P/E ratio ($R2 = 0.138667$) was attributable to these variables and that Model 3 was significant ($F = 2.736860$, $p < 0.05$). None of the disclosure variables impacted on the P/E ratio. Based on these results, the null hypothesis that the level of disclosure does not impact on Profits is accepted. None of the control variables had a significant association with the P/E ratio.

Mandatory Reserve Disclosure ($\beta = -45.24631$, $p < 0.05$) impacted significantly on the P/E ratio. Based on these results, the null hypothesis that level of disclosure does not impact on the P/E ratio is rejected. None of the control variables had a significant association with the P/E ratio.

Model 4 estimation included the variables such as Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 14.32% variation in the P/E ratio ($R2 = 0.143264$) was attributable to these variables and that Model 4 was significant ($F = 2.412749$, $p < 0.05$). None of the disclosure variables impacted on the P/E ratio. Based on these results, the null hypothesis that the level of disclosure does not impact on the P/E ratio is accepted. None of the control variables had a significant association with the P/E ratio.

Model 5 estimation included the variables, which were Governance (Institutional Ownership), Leverage, Size and Auditor, as control variables, and results revealed that 17.27% variation in the P/E ratio (R2 = 0.172757) was attributable to these variables and that Model 5 was significant,(F = 2.610425, $p < 0.05$). None of the disclosure variables impacted on the P/E ratio. Based on these results, the null hypothesis that the level of disclosure does not impact on Profits is accepted. None of the control variables had a significant association with the P/E ratio.

Model 6 estimation included the variables, which were Governance (Institutional Ownership), Leverage, Size, Auditor and Listing Status as control variables, and results revealed that 18.04% variation in the P/E ratio (R2 = 0.180437) was attributable to these variables and that Model 6 was significant (F = 2.397319, $p < 0.05$). None of the disclosure variables impacted on the P/E ratio. Based on these results, the null hypothesis that the level of disclosure does not impact on Profits is accepted. None of the control variables had a significant association with Price-Earnings ratio.

Model 7 estimation included the variables such as Governance, Leverage, Size, Auditor, Listing Status and Firm Age as control variables and results revealed that 18.26% variation in the P/E ratio (R2 = 0.182676) was attributable to these variables and that Model 7 was significant(F = 2.078602, $p < 0.05$). None of the disclosure variables impacted on the P/E ratio. Based on these results, the null hypothesis that the level of disclosure does not impact on Profits is accepted. None of the control variables had a significant association with the P/E ratio.

Model 8 estimation included all variables which were Governance, Leverage, Size, Auditor, Listing Status, Firm Age and Accounting Method as control variables, and results revealed that 18.49% variation in the P/E ratio (R2 = 0.184910) was attributed to these variables and that Model 8 was significant (F = 1.897366, $p < 0.05$). None of the disclosure variables impacted on the P/E ratio. Based on these results, the null hypothesis that level of disclosure does not impact on Profits is accepted. None of the control variables had a significant association with the P/E ratio.

To summarise, the null hypothesis that the level of disclosure does not impact on Profits is accepted. None of the control variables had a significant association with the P/E ratio. A possible explanation for these results is that there are a small number of P/E ratio observations compared with other dependent variables.

Table 6. 35: Regression summary for P/E ratio

	P/E ratio							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	33.25337 *	29.26626	29.65119	34.63726	20.55704	15.92283	14.18180	15.75029
Voluntary Decommissioning Disclosure	-15.43929	-17.72282	-17.90432	-21.20288	-16.21826	-13.63510	-12.22236	-12.57208
Mandatory Reserve Disclosure	-32.31721	-41.26755	- 45.24631*	-42.00971	-35.71341	-42.40901	-36.10020	-38.94278
Voluntary Reserve Disclosure	-9.520648	0.758979	6.646924	1.874145	11.55888	16.34612	13.35336	16.06055
Governance		80.64953	70.11582	72.97972	63.07318	55.33623	46.84832	45.29572
Leverage			-423.9370	-691.0641	-579.8634	-400.9388	-486.0214	-586.0904
Size Log				8.596791	8.238916	2.346560	2.730133	2.027946
Auditor					-120.1143	-142.3866	-161.8635	-181.1660
Listing Status						18.91002	11.34190	3.719214
Firm Age							0.424964	0.448986
Accounting Method								-34.51622
R-squared	0.091339	0.129086	0.138667	0.143264	0.172757	0.180437	0.182676	0.184910
Adjusted R-squared	0.060537	0.086809	0.088001	0.083886	0.106577	0.105171	0.094792	0.087454
S. of regression	201.0947	210.0525	209.9153	210.3884	207.7665	208.7971	213.0212	213.8829
Sum squared residuals	4771809.	4544570.	4494573.	4470589.	4316690.	4272430.	4220158.	4208623.
Log likelihood	-824.3416	-734.4405	-733.8376	-733.5460	-731.6368	-724.8657	-699.3412	-699.1989
F-statistic	2.965354	3.053313	2.736860	2.412749	2.610425	2.397319	2.078602	1.897366
Prob (F-statistic)	0.022446	0.013045	0.016583	0.025154	0.012308	0.016839	0.033862	0.049567

Note. **p <.01. *p < .05.

6.9.3.3. Relationship between disclosure levels and Market Value

Panel OLS regression was used to determine relationship between Market Value and disclosure levels (Table 6.36). Model 1 estimation without control variables shows that the four disclosure variables accounted for 9.32% variation in Market Value (R2 = 0.093173) and that Model 1 was significant (F = 8.194019, p < 0.001). Mandatory Reserve Disclosure (β = -0.517, p < 0.001) and Mandatory Decommissioning Disclosure (β = 0.302884, p < 0.05) impact significantly on Market Value.

Model 2 estimation with Governance (Institutional Ownership) as a control variable shows that the four disclosure variables accounted for 9.38% variation in Market Value (R2 = 0.0938) and that Model 2 was significant (F = 5.775981, p < 0.001). Mandatory Decommissioning Disclosure (β = 0.310053, p < 0.05) and Mandatory Reserve Disclosure (β = -0.55361, p < 0.001) impact significantly on Market Value.

Model 3 estimation included the variables which were Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 9.96% variation in Market Value (R2 = 0.099646) was attributable to these variables and that Model 3 was significant (F = 5.090992, p < 0.001). Mandatory Decommissioning Disclosure (β =0.324055, p < 0.001) and Mandatory Reserve Disclosure (β =-0.52763, p < 0.001) impact significantly on Market Value.

Model 4 estimation included the variables which were Governance (Institutional Ownership), Leverage and Size as control variables, and results revealed that 28.12% variation in Market Value (R2 = 0.281268) was attributable to these variables and that Model 4 was significant (F = 15.37401, p < 0.001). Mandatory Decommissioning Disclosure (β = 0.5232060 p < 0.001), Mandatory Reserve Disclosure (β = -0.55716, p < 0.001) and Size (β = 0.48132, p < 0.001) impact significantly on Market Value.

Model 5 estimation included the variables which were Governance (Institutional Ownership), Leverage, Size and Auditor as control variables, and results revealed that 30.20% variation in Market Value (R2 = 0.302044) was attributable to these variables and that Model 5 was significant (F = 14.82186, p < 0.001). Mandatory Decommissioning Disclosure (β = 0.555944 p < 0.001), Mandatory Reserve Disclosure (β = -0.53398 p < 0.001), Size (β = 0.422832 p < 0.001) and Auditor (β = 0.924910 p < 0.001) impact significantly on Market Value.

Model 6 estimation included the variables which were Governance (Institutional Ownership), Leverage, Size, Auditor and Listing Status as control variables, and results revealed that 30.23% variation in Market Value (R2 = 0.302320) was attributable to these variables and that Model 6 was significant ($F = 13.14411$, $p < 0.001$). Mandatory Decommissioning Disclosure (β =.557770 $p < 0.001$), Mandatory Reserve Disclosure (β = -0.53519 $p < 0.001$), Size (β = 0.410855 $p < 0.001$) and Auditor (β = 0.905343 $p < 0.001$) impact significantly on Market Value.

Model 7 estimation included the variables, which were Govern, Leverage, Size, Auditor, Listing Status and Firm Age as control variables, and results revealed that 31.14% variation in Market Value (R2 = 0.311439) was attributable to these variables and that Model 7 was significant,($F = 12.30266$, $p < 0.001$). Mandatory Decommissioning Disclosure (β = 0.553338 $p < 0.001$), Mandatory Reserve Disclosure (β = -0.56061 $p < 0.001$), Size (β = 0.413419 $p < 0.001$) and Auditor (β = 0.909906 $p < 0.001$) impact significantly on Market Value.

Model 8 estimation included Governance, Leverage, Size , Auditor, Listing Status, Firm Age and Accounting Method as control variables, and results revealed that 31.20% variation in Market Value (R2 = 0.312006) was attributable to these variables and that Model 8 was significant, $F = 11.17264$, $p < 0.001$. Mandatory Decommissioning Disclosure (β = 0.569334 $p < 0.001$), Mandatory Reserve Disclosure (β = -0.56976 $p < 0.001$), Size (β = 0.415421 $p < 0.001$) and Auditor (β = 0.882330 $p < 0.001$) impact significantly on Market Value. Based on these results, the null hypothesis that the level of disclosure does not impact on Market Value is rejected.

To summarise, Mandatory Decommissioning Disclosure, Mandatory Reserve Disclosure, Size and Auditor impact significantly on Market Value. Mandatory Decommissioning Disclosure has a positive relationship, while Mandatory Reserve has a negative relationship. Based on these results, the null hypothesis that the level of disclosure does not impact on Market Value is rejected. The disclosure of efforts as well as abilities to discover reserves are significantly related to the Market Value of oil and gas firms. This means that even though a company may not have a net increase in its reserves, anything that signals capabilities and efforts towards discovery, such as the acquisition of new technology, may signal future positive firm value.

Table 6. 36: Regression summary for MV

	log MV							
Independent variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**	**Model 7**	**Model 8**
Mandatory Decommissioning Disclosure	0.302884**	0.310053**	0.324055**	0.5232060**	0.555944**	0.557770**	0.553338**	0.569334**
Voluntary Decommissioning Disclosure	0.162367	0.170641	0.157819	-0.118690	-0.174953	-0.179597	-0.136095	-0.143553
Mandatory Reserve Disclosure	-0.51796**	-0.55361**	-0.52763**	-0.55716**	-0.53398**	-0.53519**	-0.56061**	-0.56976**
Voluntary Reserve Disclosure	0.220508	0.212077	0.185045	0.049325	0.015453	0.018061	0.037311	0.044202
Govern		-0.024116	0.029105	0.516943	0.526560	0.526498	0.450861	0.467412
Leverage			4.127074	1.424794	2.744925	2.769573	3.388194	2.899206
Size Log				0.481324**	0.422832**	0.410855**	0.413419**	0.415421**
Auditor					0.924910**	0.905343**	0.909906**	0.882330**
Listing Status						0.116251	0.246784	0.202368
Firm Age							-0.024534	-0.024235
Accounting Method								-0.151987
R-squared	0.093173	0.093803	0.099646	0.281268	0.302044	0.302320	0.311439	0.312006
Adjusted R-squared	0.081802	0.077562	0.080073	0.262973	0.281666	0.279320	0.286124	0.284080
SE of regression	2.425572	2.474702	2.478462	2.218438	2.190125	2.193698	2.183317	2.186440
Sum squared residuals	1876.804	1708.638	1695.406	1353.404	1314.281	1313.761	1296.590	1295.521
Log likelihood	-744.3024	-659.6097	-654.8772	-622.9973	-618.8467	-618.7907	-616.9291	-616.8125
F-statistic	8.194019	5.775981	5.090992	15.37401	14.82186	13.14411	12.30266	11.17264
Prob (F-statistic)	0.000003	0.000043	0.000056	0.000000	0.000000	0.000000	0.000000	0.000000

Note. **p <.01. *p < .05.

6.10. Endogeneity tests

The Durbin-Watson test is an endogeneity test used to ascertain whether the residuals of the study models are correlated serially. Non-serial correlation is an assumption that must be met before linear regression is carried out. This assumption will be tested for all the eight models/equations. The Durbin–Watson (DW) criterion could be used for the determination of the number of latent variables and might help in the understanding of model behaviour (Rutledge and Barros, 2002).

The value of the Durbin-Watson is between 0 and 4. If the Durbin-Watson value is ≥ 1.5 and ≤ 2.5, it can be concluded that residuals are not correlated serially from one residual to the next, and thus the assumption is met. Otherwise, the residuals are correlated serially from one residual to the next, and thus the assumption is not met.

The results are shown in Table 6.37 For the results of equation 1, the Durbin-Watson value = 1.729, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met. For the results of equation 2, the Durbin-Watson value = 1.883, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met. For the results of equation 3, the Durbin-Watson value = 2.166, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met. For the results of equation 4, the Durbin-Watson value = 1.550, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met. For the results of equation 5, the Durbin-Watson value = 2.175, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met. For the results of equation 6, the Durbin-Watson value = 2.193, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met. For the results of equation 7, the Durbin-Watson value = 1.944, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met. For the results of equation 8, the Durbin-Watson value = 2.190, which means it lies in the range ≥ 1.5 and ≤ 2.5, and the assumption is met.

Table 6. 37: Endogeneity tests

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.509[a]	.259	.055	12.271464059	1.739
2	.508[a]	.258	.054	21.840507030	1.883
3	.994[a]	.987	.984	568.885827495	2.166
4	.429[a]	.184	-.040	1.531434123	1.550
5	.989[a]	.979	.973	893.002389255	2.175
6	.981[a]	.963	.953	419.454558349	2.193
7	.576[a]	.332	.149	8.440033046	1.944
8	.428[a]	.183	-.042	2.877687787	2.190

6.11. Summary

This chapter demonstrates the convergent validity tests that were conducted for the construction of a disclosure index by using Pearson correlation tests. High inter-correlations between items imply that the items are related to each other or move together when exposed to a particular disclosure construct. Data reliability tests for disclosure constructs were conducted by generating Cronbach’s alpha involving the measurement of items for each construct. In addition, an inter-coder reliability test was performed to increase the reliability of the research findings by comparing the correlations between automated-disclosure and manual-disclosure constructs. It is evident that higher mean disclosure score values imply that firms are better in disclosing this information compared with those with lower mean disclosure score values. The empirical models in this study were designed to investigate the impacts of mandatory and voluntary level of disclosures of reserve and decommissioning on eight different variables of performance and value. The empirical results show that the impact varies between the disclosure level and performance and the value of oil and gas companies listed on the LSE.

The chapter explained the descriptive statistics which focused on the variables, that is, the independent, dependent and control variables. It also explained the stationarity tests which were conducted by using the Dickey-Fuller test and Phillips-Perron test.

The analysis of disclosure index results for the study sample was done by using NVivo software and manually to confirm the results. The results of applying four types of disclosure were analysed by applying Listing Status and Accounting Methods. A regression test was employed to test the hypotheses. This chapter also provided results of measuring the impact of disclosure levels on firm value and performance by running the regression models with independent variables only and then adding one control variable to each model after that (see the appendix 5, 6, 7, and 8 for disclosure level data and regression models' calculation). Finally, the endogeneity tests results were applied to determine whether the residuals of the study models were correlated serially (see appendix 9). The next chapter focuses on the discussion of these findings.

CHAPTER SEVEN: DISCUSSION OF RESULTS

7.1. Introduction

The main aim of this research is to examine the impact of mandatory and voluntary disclosures of oil and gas reserves and decommissioning obligations of exploration and production oil and gas companies listed in the UK on these companies' value and performance. In more details, this research objectives were specified in chapter one.

i. To determine the level of mandatory and voluntary disclosures of reserves and decommissioning costs of exploration and production oil and gas companies listed in the UK;
ii. To determine the impact of listing status on the market and accounting methods on the level of reserve and decommissioning disclosure among exploration and production oil and gas companies listed in the UK;
iii. To examine the impact of reserve and decommissioning disclosure levels on the performance and value of the exploration and production oil and gas companies listed in the UK;
iv. To determine the impact of firm-specific characteristics on the relationship between disclosure and firm performance and value of exploration and production oil and gas companies listed in the UK;
v. To verify the empirical results of the impact of reserves and decommissioning disclosure on firm performance and value; and
vi. To gather perceptions of key stakeholders of the impact of reserves and decommissioning-related disclosures on exploration and production oil and gas companies' value and performance.

The hypotheses regarding the relationship between level of mandatory and voluntary oil and gas disclosures (reserve and decommissioning) and firms' performance and value were developed in chapter five. The approach to testing these hypotheses was discussed in chapter six.

This chapter is designed to discuss the results of the disclosure index constructed for this study, then the empirical results of running the study models and finally the interviews results of the stakeholders' perception of the empirical results.

7.2. Disclosure impacts on performance and value

The concept of disclosure was examined using four disclosure types, including two mandatory and two voluntary. These are Mandatory Decommissioning Disclosure, Mandatory Oil and Gas Reserve Disclosure, Voluntary Decommissioning Costs Disclosure and Voluntary Oil and Gas Reserve Disclosure. In the first place, the descriptive statistics show that the level of disclosure greatly affected the voluntary disclosures. It is expected that the quantity of information in the voluntary forms of disclosure would vary greatly because they are only complementary to what is legally required, and thus, firms determine the complementary information that they disclose to stakeholders. Moreover, it is expected that voluntary disclosures will vary because firms may choose to disclose only positive news (Júnior, et al., 2014, p. 177). Thus, variation may be observed not only from one firm to another but also from one year to another.

On the other hand, companies may be driven by different reasons to offer disclosures on different matters. However, the cost of disclosures and competitive advantages may be two of the reasons that deter companies from disclosing too much information. In addition, the probable impact of both voluntary and mandatory disclosures on firms' value and performance may be explained by signalling theory and agency theory.

However, the variability of mandatory disclosure could be a consequence of the variation in the compliance level of firms with accounting standards and their associated disclosure requirements (Hla et al. 2013, p. 9) owing to the imperfection of these accounting and auditing regulations (Guidry and Patten 2012, p. 82). This implies that firms which had a higher level of mandatory disclosures (reserves and decommissioning) can be considered as more compliant, while those that had a lower level of mandatory disclosures can be considered to be less compliant with the reporting standards.

In addition, the probable impact of both voluntary and mandatory disclosures on firms' value and performance may be explained by signalling theory and agency theory. In terms of impact of disclosures on companies' value and performance, this analysis offers interesting results that can be used by stakeholders when making decisions. As mentioned in the literature studies (e.g., Lys, 1986; Aboody, 1996; Camfferman and Cooke, 2002; Comnier and Magnan, 2002; Taylor;s, et al., 2012; Oluwagbemiga, 2014; Ani et al., 2015; McChlery, et al., 2015; Odo et al., 2016;Lee, 2017; Broadstock, et al., 2018; Li et al., 2018). Mandatory Reserve Disclosure is found to impact negatively on a firm's performance, measured by a number of ratios: ROE, OCF, EBITDA and firm value, measured by Tobin's Q, P/E ratio and Market Value. However, Voluntary Reserve Disclosure is found to have a positive impact on a number of measures of performance (OCF and EBITDA) and negative impact on one particular measure (ROA) with no impact on firm value. These results are discussed further in the following sections.

7.3. Study Constructed Disclosure Index (R&DDI)

The analysis, after applying the constructed disclosure index (R&DDI) in section 6.6 on chapter 6, reveals that among the sampled companies, Egdon Resources PLC, President Energy PLC, and Sterling Energy PLC had the highest levels of Mandatory Decommissioning Disclosure. Similarly, those that had the highest scores in Mandatory Reserve Disclosure included BP PLC, Independent Oil & Gas PLC, Rockhopper Exploration PLC, Serica Energy PLC, Total SA and Tullow Oil PLC. All these firms had the highest score of 48. These firms can be considered to have the highest level of compliance with the reporting standards. It is, however, significant to note that in the findings, the firms which were listed among those with the highest Mandatory Decommissioning Disclosure levels did not appear among the firms with the highest Mandatory Reserve Disclosure Levels.

According to the findings from interviews, (see the list of interviewees on section 5.10) that related to answering the question about the need for an R&DDI to provide a clear requirement of the biggest cash inflow and cash outflow for oil and gas companies, the participants believed that this is an excellent idea because IFRS does not provide specific guidance for oil and gas companies and there is a weakness in the SEC requirements; also, there is a need for technical issues to be included in the oil and gas company disclosures. In this context, Interviewee A states:

I think it would help comparatively; at the moment I think as a UK independent and as US independent at the moment they could well be following different reserves' guidelines in generating estimates in reserves which would, in turn, affect key judgement for key financial statement line items it could improve, it is challenging at the moment as unless you get full alignment across all the different regions you end up with another option which increases the range of potential approaches that a client could take or prepared to take.

Interviewee B observed that:

There is need to provide a clear disclosure index for mandatory and voluntary reserve and decommissioning; that will be standardizing it, yes. And I would also go as far as saying that it should also have permissions of what is thought to be acceptable. I think also this index should be there is a requirement to put in some place an instrument, you can call it a technical instrument, related to the reserve and decommissioning.

Also, Interviewee C said that:

I think there [are] clearly weaknesses in SEC in estimating the value or the number of reserves or value of those reserves based on the price, and IFRS doesn't have a lot of detail on how to regenerate oil and gas estimates. Therefore, it would be better if we can see a clear requirement for reserves and decommissioning disclosures.

In regard to the disclosure index, prior studies such as those by Craswell and Taylor, 1992; Taylor, et al., 2012; McChlery et al., 2015; Odo et al., 2016, show that there are many areas of reporting in the context of the oil and gas industry which remain unknown other than to specialists. These incorporate capital reporting, infrastructure asset reporting, environmental reporting and governance reporting. Therefore, to enhance disclosure of accountability information in oil and gas companies, the disclosure index should adopt a binary or dichotomous approach of scoring each disclosure item. The index should also be developed based on the accountability paradigm of the public, which requires that the public, and not only those who want to make certain decisions, have the right to information. The items included in the disclosure index should be based primarily on user need for accountability information (Tamimi and Sebastianelli, 2017).

Other factors listed in the literature which may also have contributed to the high variability of disclosure levels include the costs associated with the disclosure, which differ for voluntary and mandatory disclosures; the lack of compliance with SORP and political sensitivity (McChlery, et al. 2015, p. 5917). The variability in the level of disclosure was also echoed in past studies. For example, Alciatore and Callaway Dee (2006, p. 49) found that firms failed to quantify social and environmental participation targets. Moreover, Odo et al. (2016, p. 34) did not find an acceptable level of information quality that complies with the SORP requirements in the firms studied. Furthermore, Abdo et al. (2017; 2018) established in their studies that UK oil and gas companies have varied levels of compliance. Lastly, in a study of UK oil and gas companies, Abdo and Mangena (2018) and Abdo et al. (2018) found not only that companies reported minimum information on decommissioning but also that reporting was variable among firms. The variability in the level of disclosure was also established in the findings of Ahmed (2015). Although the primary purpose of these studies was not to indicate high variability in disclosure quality, they provide the empirical support and justification for the high variability established in this study.

As far as the theoretical perspective is concerned, agency theory and signalling theory explain that, within the same sector, companies are required to align with each other in terms of their disclosure practices, because any deviation will be considered as bad news by the market. To elaborate, the theory of political process suggests that regulators make decisions based on the information disclosed by firms (Watts and Zimmerman, 1986). As a result, firms are disclosing voluntary information in order to minimise the underlying political costs. Their profitability and size are incentives for firms to reveal a greater amount of information for the purpose of reducing underlying costs. Larger-sized companies are subject to greater political costs; therefore, their level of disclosure is higher (Urquiza et al. 2010).

In addition, signalling theory can be used to explain the relationship between disclosure, value and performance. The expectation of this study is that disclosures of reserves quantities and/or values offer positive signals to the market that future cash flows are expected, therefore impacting positively on the performance and value of reporting companies.

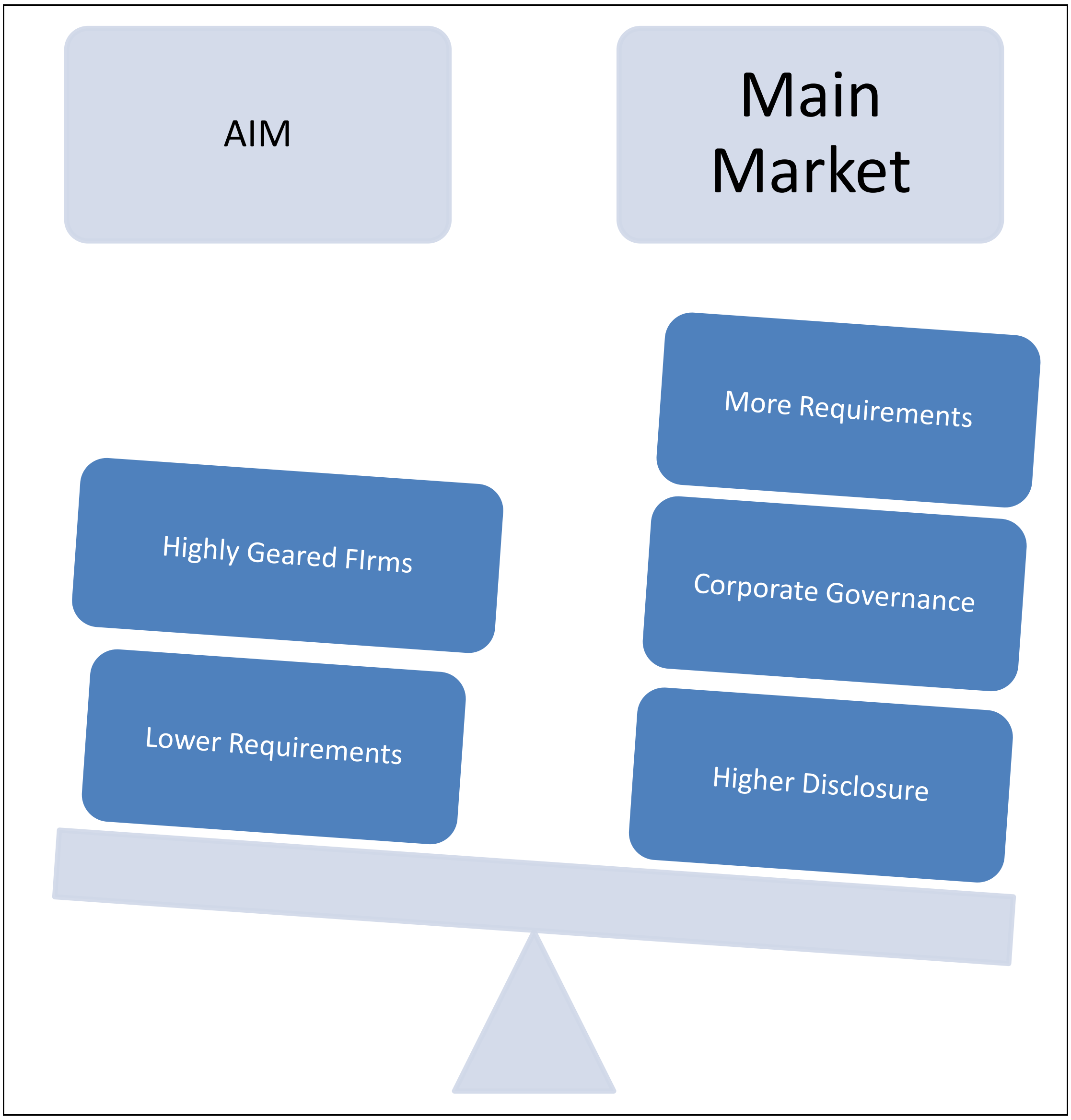
7.3.1. The impact of Accounting Method used and Listing Status

To understand further the variation in the disclosure levels, the differences in the levels of disclosures were tested by reference to the Accounting Method and Listing Status. The findings indicate significant differences in the disclosure levels by Listing Status and by the Accounting Method used. These findings are summarised and discussed below.

7.3.1.1. Differences in disclosure levels by reference to Listing Status

This research results in the chapter 6 provide that all four types are higher with main market comparing with alternative market (AIM). Figure 7.1 below summarises the findings, which show that firms on the main LSE market demonstrate higher disclosure levels compared with the AIM-listed companies, regardless of the type of disclosure (mandatory and voluntary disclosure). These findings agree with those of Mallin and Ow-Yong (2009), who also established that more highly geared companies in the AIM have the tendency to make less disclosure. Additionally, Doukas and Hoque (2016, p. 378) indicated that "the main market has higher regulations as it pertains to corporate governance, and by extension, disclosure requirements". Specifically, on the oil and gas industry, Ani, et al., (2015) confirm that oil and gas companies listed in the main market of LSE disclose higher level of reserve information than their counterparts listed in AIM. It therefore appears that firms within the Main Market may be subjected to more requirements, leading to a significantly higher level of disclosure, while firms in the AIM may be subject to lower requirements and thus have more freedom as it pertains to the choice of what to disclose. Since disclosure in itself is costly, firms listed in a less stringent environment are more likely to disclose less, compared with firms listed on a more stringent market. This result could be explained by agency theory, that the higher level of disclosures from oil and gas firms listed on the Main Market can be considered as one of the common devices to alleviate agency problems (Healy and Palepu, 2001).

Figure 7. 1: Differences in disclosure levels by reference to Listing Status

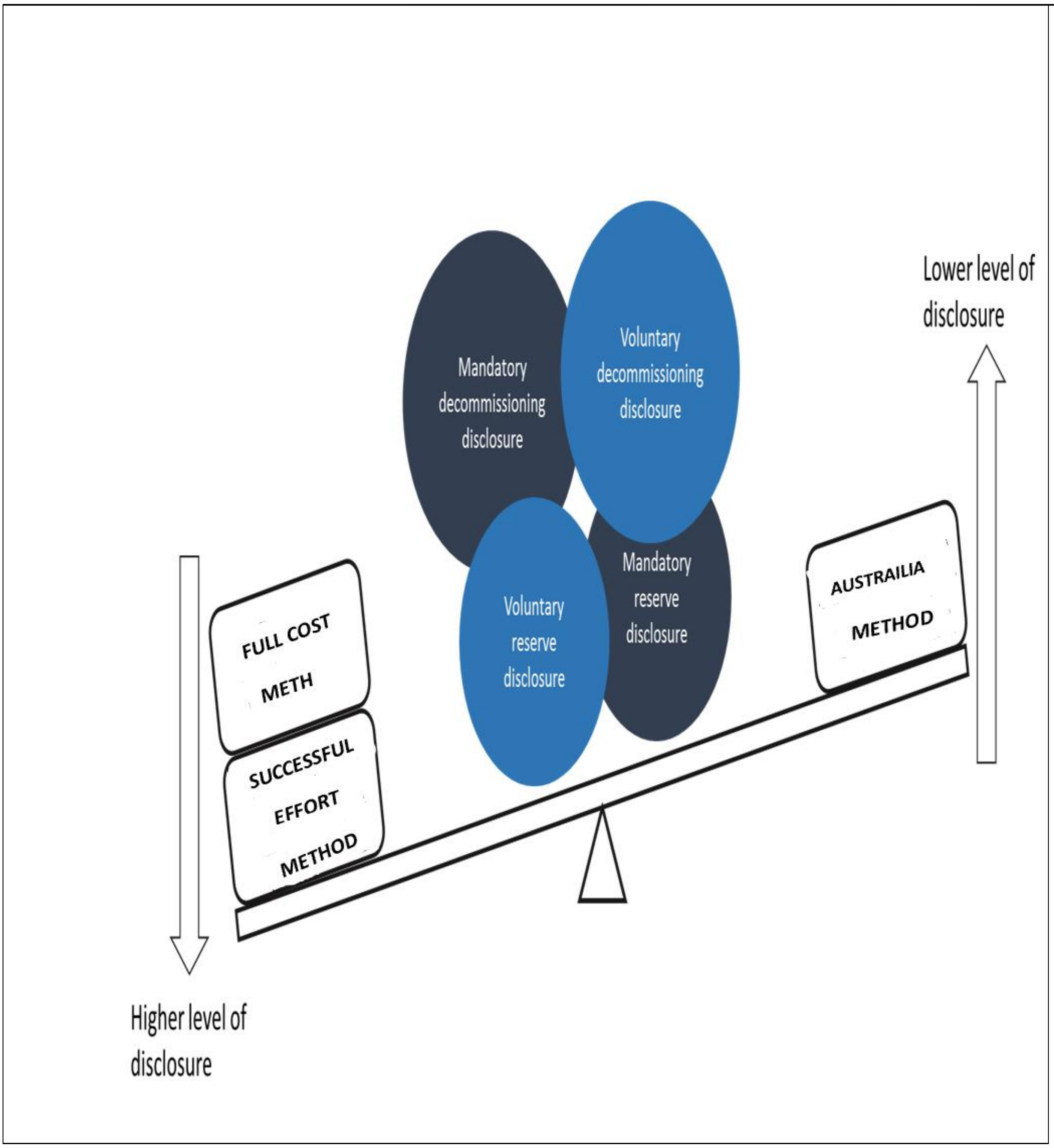


The differences in the level of disclosure by reference to Listing Status used for all the four levels of disclosure (Author's own)

7.3.1.2. Differences in disclosure levels by reference to Accounting Method

The figure below summarises the significant differences in the levels of disclosure by the Accounting Method for all the four identified categories of disclosures.

Figure 7. 2: Differences in disclosure levels by reference to Accounting Method



The differences in the level of disclosure by reference to Accounting Method used for all the four levels of disclosure (Author's own)

As shown in Figure 7.2 above, firms that use either the Full Cost (FC) Method or the Successful Effort (SE) Method have higher levels of disclosure compared with those that use the Area of Interest (AoI) Method. The exception here is the level of Mandatory Reserve Disclosure, which was found to be significantly higher only for firms using the SE Method compared to the AoI Method. Although no study was found which compared the FC and the SE Accounting Method with the AoI Method, one cannot argue that the SE and FC Methods may have rules that require a higher level of disclosure compared to the AoI Method. Another argument is that the two methods (FC and SE) could be more aligned to IFRS and SORP and more concise, and thus provide a less favourable environment for earnings manipulation by the auditing companies, although the AoI Accounting Method aligns more with the requirements of the Australian Accounting Standard, AASB 1022 (Accounting Standards Review Board, 1989). However, companies listed in the USA do not follow IFRS but are required to offer detailed disclosures based on Statement of Financial Accounting Standards No. 69 (SFAS 69), which is provided a requirement for oil and gas producing activities disclosures (Financial Accounting Standards Board, 1982).

The findings also indicate no significant difference in the level of disclosure for firms that use the FC Method, compared with those which use the SE Method. These findings are supported by the findings of Bandyopadhyay (1994, p. 673), who studied the differences between the FC and the SE Accounting Method used by oil and gas companies, based on the persistence of reported earnings, and found no significant difference, although there was a variation in the earnings response coefficient. Misund (2017), on the other hand, established that the heterogeneity of Accounting Methods, together with management discretion, do not provide clear information to investors. The author seemed not to find a distinction between which method provides a higher-quality level of disclosure, and thus support the findings of this study. As per analysis of this research, smaller companies follow the FC Method of accounting, but these companies are not as strong financial position as larger companies that follow SE. Therefore, it is expected that companies that follow FC will disclose less compared to those that follow SE. However, the research findings do not confirm this assumption because the impact of firm size on selection of FC or SE Method is not great, making it irrelevant for incorporation into the research hypothesis. In this regard, Abdo et al., (2018) argues that many scholars in the oil and gas industry advise stakeholders to use the cash flow statement instead of the income statement and balance sheet to take decisions. Also, the authors suggest that the International Accounting Standards Board should improve IFRS 6 in a way that harmonises accounting practices between different accounting methods using in oil and gas industry.

7.4. Disclosure level impact on performance and value

The impact of reserve and decommissioning (mandatory and voluntary) disclosures on performance and value was examined using a number of performance variables including ROA, ROE, OCF, EBITDA, Tobin's Q, Profit and P/E ratio. Moreover, the performance and value variables were controlled by a number of factors including Company Size, Leverage, Institutional Ownership, Auditor, Listing Status, Firm Age and Accounting Method. These are discussed below.

7.4.1. Reserve disclosures' impact on performance and value

Voluntary Reserve Disclosure was found to have a mixed impact on the performance variables. While it positively impacted on the OCF and the EBITDA, it had a negative impact on ROA and no significant impacts on the ROE, Tobin's Q, Profit, the P/E ratio and the Market Value. The positive and negative relationships established can be explained using signalling theory. Voluntary disclosure is one of the most common means used by managers to send a signal to the stakeholder about the quality of the company and its management attitude, such that signals received are reflected on the firm's Market Value or reduction in the cost of capital (see, for example, Connelly et al., 2011; Cotter et al., 2011; Omran and El-Galfy, 2014). According to Júnior et al. (2014), it is indicated that firms will only choose to disclose favourable information and decide not to disclose unfavourable information. Also, Graham et al. (2005) reveal that the attitude toward the drivers of voluntary disclosure is coming from management talent signalling, which is a statistically significant motivation for voluntary disclosure. Therefore, in the situation where the impact on performance is through the channel of news, the ability to choose which type of news to disclose certainly is a contributing factor to the positive impact on performance. However, the findings contradict those of Al-Maghzom et al. (2016, p. 1), which revealed a positive and significant relationship between voluntary disclosure and ROA.

It is important for the company to send a signal to the investors in the market regarding Voluntary Reserve Disclosure owing to its impact. The empirical results are matched by the findings from the interviews. When asked what they thought was the relation between level of voluntary disclosure and performance and value of oil and gas companies, the interviewees argued that normally is a positive relation. In the words of Interviewee A:

> *I think in terms of SEC as voluntary requirements, clients would have to report in terms of SEC which would have to include some disclosures which would*

eventually include less properties. I think because the SEC mandates reserves are estimated on 12-month reserves' prices it can reduce some subjectivity in that area and therefore some analysis and some disclosures are, you know, broadly useful.

On the other hand, Interviewee B argues that:

it depends on the purpose of the voluntary disclosure. If you are looking more to the investors or to stabilize your share prices, for example, you will be required, I think, to have optimistic views of the world, so on that basis you are in danger of actually over-emphasizing the up-side of the company's potential performance against what is actually doable, and on that basis you set up expectations in the market where for you to fail so it is a very dangerous game. The voluntary one here if you are factually accurate when you make a voluntary reply or a voluntary release to the market you are actually setting expectations, and again the question comes what is the purpose of releasing that information.

On other hand, some empirical results show a negative impact and no impact on performance and value, for example, on ROA, and no significant impacts on the ROE, Tobin's Q, Profit, the P/E ratio and the Market Value. The result of no impact of voluntary reserve disclosure or negative impacts is also consistent with the interview findings. According to Interviewee A:

I think to some extent a reserve disclosure in terms of volumes would be useful to specialists; they might be able to interpret the value of certain reserves, but without signing the cash flow projections and values to those projections, the usefulness of that is limited.

Also, Interviewee D made this statement:

I think that could only happen in situations where the disclosure is in line with what everyone had thought and that basically the difference between what everyone was thinking and the information voluntarily disclosed could be the only reason because if it comes below or above what people were expecting or *the reserves could be a very small part of what is being disclosed. It could be a very small part of the company that would drive them to release again and that could drive the value.*

Contrary to the case of Voluntary Reserve Disclosure, Mandatory Reserve Disclosure negatively impacts on the ROE, OCF, Tobin's Q, EBITDA, Market Value and the P/E ratio. However, it has no impact on ROA and Profit. Based on the good/bad news argument (signalling theory), the impact of reserve disclosure on performance is expected to be positive. Since it is expected that firms would voluntarily disclose positive news, one can argue that mandatory disclosure helps in the exposure of negative news, and thus negatively impacts on the firm's performance and Market Value. Agency theory also explains the impact of Mandatory Reserve Disclosure in that the interest conflict between the agent and principal(s) leads to an agency problem, and managers tend to make decisions that advantage their interests, even though these decisions might be harmful to interests of principals. Consequently, principals will need to monitor whether their agent performs according to the contractual agreements (see, for instance, Healy and Palepu, 2001; Cotter et al., 2011; Omran and El-Galfy, 2014).

The findings from the interviews confirm this result about Mandatory Reserve Disclosure when they explain the impact on performance and value. The mandatory reserves are the most important disclosures for investors and others such as banks when considering lending money to the oil and gas companies.

n this context, interview participants pointed out that mandatory reserve disclosures are required by governments, regulators and under accounting standard GAAP or IFRS regulations, so the oil and gas companies have no choice but to deliver these types of mandatory disclosures. However, Interviewee B made the following comment:

It is supposed that mandatory reserves disclosure [has] an impact on performance and value; when the company present reserves' information to investors, they use that information with other information as [an] indicator whether this company doing well or not, so I think that mandatory reserves goes with oil and gas performance hand-in-hand.

In this connection, Interviewee D demonstrated a clear connection between Mandatory Reserve Disclosure and the oil and gas company performance and value when he said:

Basically, I think mandatory reserve impacts significantly. Most of the company's performance and value is driven from the reserves. What happens in most of the companies is also the financing of the companies is impacted by the reserves because what happens is oil and gas companies usually borrow money on the basis of their reserves, known as reserves-based lending, so what happens is most companies get their financing from those reserves, so if those reserves go down, then the financing from the banks could be giving back rather than going forward, the mandatory release of this information can have a big financial impact on the company but might not on performance or value of the company.

Regarding the research empirical result of no impacts or negative impact of Mandatory Reserve Disclosure on performance and value, the participants explained that mandatory reserve information is delivered with any level of company performance or value in the market. In this regard, Interviewee A argued that IFRS as mandatory requirements are not enough to deliver the main information about reserves, so mainly oil and gas companies instead use SORP and SEC as guides for reserve disclosures. He made this statement:

IFRS as mandatory requirements [don't] have a lot of detail on how to regenerate oil and gas estimates and therefore companies would usually use Petroleum Resources Management System (PRMS) or SEC guidance in generating reserve estimates and they would generate their own IFRS accounting policy in terms of how they would use it in accounting.

Also, Interviewee B stated that mandatory reserve reflects the government requirements. He said:

Sometimes there is a negative impact or no impact of mandatory reserve oil and gas disclosures because the mandatory requirements set your expectations in the ground and what you can realistically recover and it is usually a down-side view so that they don't over-promise things to the regulators, and I think as an investor you should be paying attention to the mandatory side rather than the voluntary side, and the reason I say that is because if you are looking at the worst case scenario at the reserves base of your company, then theoretically you *have less chance of the investment going down and more of it going up if you look at the voluntary side at the optimistic view of the world.*

This is further supported by the argument by Patatoukas et al. (2015, p. 2449), Abdo and Mangena (2018) and Abdo et al. (2018) that the perception of disclosing companies (for mandatory disclosures) is dependent on the content of disclosure.

Other explanations have been provided in the literature for the possible relationships between reserve disclosure and performance. The positive impacts of reserve disclosure on performance is also in agreement with the literature, as Kai and Matsunanga (2015, p. 1017) explain that voluntary disclosures indicate increased transparency, which is associated with the effectiveness and efficiency of management.

The impact of reserve disclosure on Market Value as established in the case of mandatory disclosure is explained by McChlery et al. (2015, p. 5917) as resulting from the valuation of a firm's Market Value through the firm's reserve quantum. Oil and gas reserves are sources of revenue for oil and gas companies and are the most important tangible asset. Therefore, reporting reserve quantities signals to the market that revenues are occurring, therefore enhancing the Market Value of reporting entities. This means that the higher the reserves, the higher the Market Value.

Concerning value, the analysis in this thesis shows that Mandatory Reserve Disclosure has a negative impact on firm value. However, the analysis shows that Voluntary Reserve Disclosure has no impact at all on the Market Value. This finding agrees with that of Banghøj and Plenborg (2008, p. 159), which also established that voluntary disclosures do not provide the kind of information that can be easily interpreted by investors as enabling the prediction of future earnings. Moreover, Abdo et al. (2017, p. 4) indicated that these disclosures are difficult to understand for investors without a finance background. Additionally, Aboody (1996, p. 21) differentiated between recognised value and disclosed value, thus agreeing that disclosure by itself may not necessarily provide information that leads to increased value, if investors fail to understand and recognise the financial flows from the disclosed information. Taking this finding into account, it can therefore be argued that although the information provided in the voluntary disclosures may be positively biasedly, some of the information may be confusing to investors, and may be not useful in predicting the future value of the company. Moreover, this agrees with the findings of Owusu-Ansah (1998, p. 616), which also established a positive relationship between mandatory disclosure and profitability, although measured using ROCE.

The findings of Santos and Coelho (2018, p. 390), however, contradict the notion that investors may not understand the content of disclosure, as the authors established that the information about risk indicates informational relevance for valuation of firms. Moreover, Oluwagbemiga (2014, p. 263) found that voluntary disclosures explain investor decision making and firm performance. Therefore, (Santos and Coelho, 2018) inferred that risk disclosure has an impact on the perception of investors whose approximations of return are based on the availability and comprehensiveness of such information. Although the authors did not separate mandatory from voluntary disclosures, their inference that the perception of investors is based on the comprehensiveness of information leads to the question of whether voluntary disclosures would contain more information as compared with mandatory disclosures. Taking from the tenets of this study theoretical framework, it is arguable that the biased nature of voluntary disclosure may not provide sufficient information to facilitate comprehension and, thus, the relationship between disclosure and value as inferred in this study is only applicable in the mandatory forms of disclosure. Given that the findings of Santos and Coelho (2018, p. 399) find a negative relationship between disclosure and firm value, this further confirms the findings of this study.

The study of Abdullah et al. (2015) is more specific in that it addresses the relationship between voluntary risk disclosures and firm value. The authors clearly indicate that the voluntary disclosure of damaging information was found to have no significant relationship with firm value, although it had been hypothesised to be negative. The authors further separate the impacts of good news from bad news and find that beneficial risk management disclosures have positive impacts on firm value. This suggests that either the mixed effects of beneficial and damaging information may not have had sufficient impacts on firm value, or that the information is altogether confusing and fails to impact significantly on performance.

These results are further in the line with the findings of Hassan et al. (2009, p. 79), which revealed dissimilar impacts of voluntary and mandatory disclosures. Their empirical results indicate that following a control of factors of study econometric model, for instance, profitability and firm size, mandatory disclosures have a significant but negative relationship with firm value, while voluntary disclosures positively impact on firm value, though the relationship lacks significance. The authors attribute the lack of significance to the interaction between complex factors. Abdel-Azim and Abdelmoniem (2015, p. 1) also found the relationship between voluntary risk disclosure and firm value to be positive, although in their case, the relationship was established as significant. This could, however, be an isolated case, as the findings of Al-Maghzom et al. (2016, p. 1) confirm a lack of significance in the relationship between voluntary disclosure and firm value.

7.4.2. Impact of Decommissioning Disclosure on performance and value

The analysis in this thesis shows that Mandatory Decommissioning Disclosure impacts positively on the firms' ROA, OCF, EBITDA and Market Value. However, this type of disclosure was found to have no significant impact on ROE, Tobin's Q, Profit and the P/E ratio. Furthermore, the findings show that Voluntary Decommissioning Disclosure positively impacts on ROA, OCF and EBITDA, but has no effect on the ROE, Tobin's Q, Profit, the P/E ratio and Market Value.

This relationship between decommissioning disclosure and firm's performance and value can be explained by this research theoretical frame. Signalling theory (Hughes, 1986) and agency theory (Jensen and Meckling, 1976) argue that firms disclose information to reduce asymmetries of disclosures in respect of stakeholders. Signalling theory underlines that disclosures send a signal to the market in favour of the quality of the firm. The level of disclosures encourages investors in the market and enhances liquidity, which is reflected in lowering the cost of capital (Cuadrado-Ballesteros, et al., 2016). Decommissioning disclosure is unfavourable information to disclose (Abdo, et al. 2018) although oil and gas firms have incentives to provide more details about the decommissioning provision or process to reduce the probability of being considered as 'a lemon' by investors (Akerlof, 1970). If a company does not provide disclosures, this might be seen as withholding negative information and that would drive the investors in the market to lower the Market Value of the company (Abdo et al., 2018). On the other hand, the agency theory also expresses that disclosures reduce agency cost between managers and shareholders (Luther, 1996). Thus, decommissioning disclosures would help shareholders to understand the operations and performance of the company, in that they improve the shareholders' ability to observe the company managers' attitude, behaviour and performance (Abdo et al., 2018).

The results are validated by the findings from the interviews about Mandatory and Voluntary Decommissioning Disclosure effects on performance and value. Most participants believed that decommissioning is an exceptionally long process with uncertain costs. Interviewee D said that:

Decommissioning is a lot more uncertain. Disclosing mandatory information about present decommissioning is to do with an event that will happen in 10–20 years so basically it's really uncertain. I think the item of decommissioning you can report is not how much you are contributing to decommissioning at a certain field but how that decommissioning came about and the price of the field because actually it can be a bit different or changed in the future. If new rules come into place it doesn't actually make a lot of sense to disclose a lot of information that then ends up not being confirmed.

In the same way, Interviewee E observed:

I think the most important thing about decommissioning is also of course how can we recover those costs because you know you are going to have that huge expense at the end of the field's life, and you know there aren't any profits to offset the cost. Then you know you are going to have to anticipate the life of the field to make sure that the cost is *recognised in advance, so the most impact to the business is you have a tax deduction in advance and when you spend the money on the decommissioning, the most impact it has is the tax situation, right, because of course if you underestimate the decommissioning, that can also be a problem but the decommissioning is something that you keep updating to make sure it is accurate in terms of how much money you would have to put in in terms of field and all of that so that the main impact is on decommissioning now.*

Interviewees A and B believed that Mandatory and Voluntary Decommissioning Disclosures should be clear and aligned for all users. Interviewee A commented that:

When it comes to decommissioning issues around here, one is that under the accounting legislation, you are supposed to account for your liability to demonstrate that you are making provisions for liability, etc., so when you start talking decommissioning numbers you have a double-edged sword here. On one hand you have to make sure that the taxman understands how much the decommissioning is likely to cost and how much tax revenue they have to hand you back in due course to compensate for decommissioning.

Interviewee B made the following comment:

> *Historically what you tend to find is the decommissioning numbers reported in the annual report and accounts tend to be optimistically low and because of the alignment issue you struggle to come up with different numbers in front of the regulators so the mandatory and voluntary numbers have to be clear and aligned because otherwise it will confuse everybody.*

Regarding the empirical results of a positive impact of Mandatory Decommissioning Disclosure on performance and value, Interviewee B believed that positive impact is a good message to the investors although it is a dangerous game at the same time. He said:

> *In theory the fact that you are making adequate provisions to clean up your mess is a good message to send to stakeholders; that's a good message. The difficulty comes when it is clear that the message has been doctored to be more attractive to investors and regulators by taking the numbers down and then you start to see that you don't want to do the decommissioning because it will cost too much. It's a very dangerous game.*

Also, Interviewee C observed that companies do not provide enough information about decommissioning figures. He said:

> *The problems come when you have told the public the provisions you have provided for them and don't quote the numbers for decommissioning, so that these members are hugely optimistic, and then you start to reduce the bill. You start running into trouble so you might not meet the expectations of society by declaring these numbers but generally very few companies openly declare what their decommissioning numbers are and might have a one-way statement in their accounts, but you will not get any details as to where the money is spent. Do you want to get that the money is being spent at X oil field or gas field Y?*

Referring to the empirical findings about a Voluntary Decommissioning Disclosure that show a positive impact on ROA, OCF and EBITDA, but no effect on the ROE, Tobin's Q, profit, the P/E ratio and Market Value, the interview findings explain this result by answering the question of why there is a positive impact of Voluntary Decommissioning Disclosure. Interviewee C observed this:

> *In general terms, I would say the voluntary reporting of liabilities and cost is an exercise used to allow escalation in a staged manner.*

According to Interviewee B, before starting the decommissioning process, the Voluntary Decommissioning Disclosure might be a positive relation because the cost figures are low estimates so the investors use that as good signalling about company performance and value. He observed that:

> *In reality, of course, what happens is that you declare the tax number to the regulators, and you put that in your accounts, and once the decommissioning gets involved and fired up, you see what the damage is; the real decommissioning numbers tend to appear, and that upsets the regulator as they are being told the numbers are much higher than what they were. It also attacks investors' interests as these decommissioning numbers are usually much larger than they thought they were going to be. So the industry effectively lies for years about what it thinks the costs are and there are always very optimistic numbers about decommissioning bills, which invariably are proved wrong after the decommissioning arises and then the regulator gets upset and the investor gets upset simultaneously.*

In the same way, Interviewee E commented that oil and gas companies provide mandatory decommissioning information as part of their environmental responsibility. He said:

> *The reality is that society expects you to clean your mess up and that is the base case by society, and by the fact that you are declaring that you are making adequate provisions in theory demonstrates to society that you are as stakeholders being responsible and the corporation has taken social responsibility seriously.*

Finally, all interviewees agreed that most oil and gas companies do not provide the right estimate of decommissioning numbers because that affects their performance and value. In this regard, Interviewee A made this statement:

> *Well, they can lie and lie and pretend that their decommissioning numbers are lower than what they actually are, and I have seen that as an example and that basically helps present a case that is far more optimistic than is real – the reality – and this is where the fine line comes in when you're talking about doing an activity viable in 10 years' time your estimates are based on today's technology and today's scope of work, etc,. and you can assume that the scope of work probably wouldn't change much. So then the real question is how much do you project that technology will ever improve and that your bills will be reduced because of this new technology? And quite often the management will halve bills because the technology will improve things and in the view of the world there is no evidence to back that up. It is just an opinion as to where things are going to go, and by doing that you can reduce liabilities, your decommissioning liabilities, but will result in the overall picture of the company's health being much better than it actually is.*

This study's findings confirm that there is a positive relation between decommissioning disclosures and firm's performance, but no impact on firm's value. The findings do not agree with the argument that decommissioning has cash outflow impacts (Rogers and Atkins, 2015, p. 2) because it potentially decreases firm value and performance (Aldersey-Williams and McKenna, 2016). Furthermore, they contradict studies such as that of O'Hanlon and Taylor (2007) which focused on the concept of cash outflow disclosure (mandatory disclosure of equity liabilities) and established that it has a negative relationship with value relevance coefficients. However, given that oil and gas companies do not disclose much information about their decommissioning obligations, and in many cases underestimate the actual decommissioning liabilities (Abdo et al., 2018).

Furthermore, a counter argument would be based on the perception of environmental responsibility, in which the content of decommissioning disclosure appeals to the investment community, and thus increases the support of the disclosing firms through providing capital for new projects or prospects. Although some decommissioning disclosures are technical and others are financial, environmental disclosures could be used positively by companies to ascertain their legitimacy to show good corporate citizenship and social responsibility. The findings are in line with the study of Hapsoro and Ambarwati (2018, p. 108), which established that disclosure on carbon emission (an environmental concern, as in the case of decommissioning) among oil and gas companies positively impacts on ROA. These findings are also in line with those of Ayodele et al. (2016), which found a positive relationship between corporate governance disclosures (comparable to the environmental concept) and ROA.

Therefore, although decommissioning portrays an image of cash outflows, for environmental-related decommissioning disclosures, other factors such as prospects and existing reserves may dilute the bad news, thus enabling the appreciation of environmental restoration efforts. This argument is further supported by the findings of suties such (Herbohn et al., 2014 Lee, 2017; Sebastianelli, 2017; Hapsoro and Ambarwati, 2018), which showed increased market value and performance among firms with environmental disclosures.

Following this argument, voluntary disclosures therefore ought to have higher performance impacts, since they enhance and complement the content mandated by law. Moreover, they could be viewed as enhancing the level of transparency and therefore should lead to reduced information asymmetry and enhanced legitimacy, which then should enhance performance. This argument is supported by the findings of Aksu et al. (2017, p. 141), which associate reduced information asymmetry with value relevance. However, these reductions are not attributed to voluntary disclosures, but rather, enhanced strictness of mandatory disclosures. Therefore, it seems that the transparency argument may be applicable within the confines of mandatory reporting. Moreover, Kai and Matsunga's (2015, p. 1017) transparency argument does not seem to explain the higher number of performance ratios positively associated with Mandatory Decommissioning Disclosure compared with Voluntary Decommissioning Disclosure. However, mandatory disclosures enable a more structured disclosure that is easily understood by investors, while voluntary disclosure gives freedom for manipulation and misrepresentation, and thus, items disclosed may not be translated into value, but the very concept of disclosure lowers the cost of capital and thus impacts positively on performance.

7.4.3. The impact of firm-specific factors on the performance and value

Several control variables were found to impact significantly on performance. For instance, ROA was positively impacted on by Company Size and Auditor and negatively impacted on by Leverage. In the same way, ROE was positively impacted on by Company Size and negatively impacted on by Leverage. OCF was positively impacted on also by Leverage, Company Size, Auditor and Listing and negatively impacted on by Institutional Ownership. Furthermore, Profits were also impacted on by Leverage and Company Size and negatively by Institutional Ownership and Firm Age. The study findings also revealed that the firm value was influenced by firm-specific factors. Tobin's Q, on the other hand, was negatively impacted on by Size and the Accounting Method, while EBITDA was positively impacted on by Leverage and Company Size and negatively by Institutional Ownership, Listing Status, Firm Age and Accounting Method. Lastly, Market Value was positively impacted by Company Size and Auditor.

Among the control variables, the effect of Firm Size in the disclosure–performance relationship was realised in most of the models. Moreover, in all the cases where Firm Size was significant, it had a positive contribution to performance. This is expected as it is related to the economy of scale.

Once more, the findings from the interviews support these results. Referring to Leverage as one control variable in this study, some participants believed that oil and gas companies should provide a RBL (Reserve Based Lending) statement as supplementary disclosure to the banks to evaluate the leverage situation and the clear effect of leverage factor on company value. Interviewee D, for instance, said:

> *The only thing I can think of is the RBL (reserve-based lending) for your financing you updated every six months to make it clear or for your financing information which have to be done by independent parties and all that, and then there is the case of how much interest rate you could get, how much you could get from the bank when you borrow from the bank.*

In the same context, Interviewee E observed:

> *RBL is when the banks get together they see how much your reserves are worth based on market value and they lend you the money based on this RBL agreement, and they say how much money you could borrow and how much interest you can take and that takes into account the quality of the reserves, how much reserves you have and if they have gone up or down, and this RBL is updated every six months where the banks come to you and ask how are your reserves; have they suffered any hits? And if your reserves are taking a hit that is because it has an impact on the, uh, the RBL because [that] might change because if the reserves have become a bit more risky and they can say 'now you*

can't take as much money' and you would need to give back some of that money or they say 'you cannot have that full amount', and this statement also might look at the project if the decommissioning is affecting the situation of lending from the banks.

In regard to the company size and auditing by one of the Big Four, the participants argue that larger-sized companies and those using one of the Big Four auditors would have better disclosures and trusted more by investors. Interviewee A argued as follows:

I think listing requirements and focus of users is clearly a factor, so the larger companies are more open to more challenge or more demand for information from the users of financial, and I think disclosure requirements of listed companies only increase. About auditing by Big Four, I think so; I would like to think that being audited by a Big Four company would be … Well, I guess you could say they are more likely to have more oil and gas clients, and therefore I think the key or the benefit of having a Big Four auditing brings is the ability to compare and benchmark across companies in the sector and experience elsewhere and might be able to point to another oil and gas client and say something specifically was being disclosed and there was an improvement and there a Big Four auditor might able to improve the eventual disclosure in terms of going beyond the standards.

Interviewee D commented:

I think firm size should influence it, and I think institution ownership and auditing by one of the Big Four should and accounting method would affect it, I think accounting method is a very big one. I think firm size and age shouldn't but it does at some stage.

Also, Interview C added:

I mean, definitely legal, size and then ownership and then also the type of assets and also depending on the type of assets they are and that's it. I mean, maybe the life cycle of the project may affect the level of providing disclosures as well. In the size issue, some companies think that it is better to just disclose what is

> *required by the law, and some companies think that the more disclosure the better, but I think it would have to be how that board of the company view that information and discloses it, if it is a private company then it would have a much more stringent picture, but if you have like a family-owned oil and gas company completely private, I'm sure they wouldn't want to disclose that information for nothing, right.*

These empirical results and verification by interviewees confirm earlier studies' results, which find that larger firms have a higher likelihood of disclosing more because they are more scrutinised by stakeholders on one side and financially able to cover the required costs of disclosures on the other. The findings are in agreement with, for example, the study of McChlery et al. (2015), which established that reserve disclosure is linked to a number of factors, including those established to be significant in this study such as Leverage and the Size of the firm as well as the identity of the Auditors. This is also affirmed in the study of Ani et al. (2015), which also found that factors such as Firm Size, Audit Firm Size and Listing Status (which are significant in this study) have an impact on the level of disclosure. The relationship between the control variables and disclosure is also echoed by other scholars, including Craswell and Taylor (1992, p. 298). Thus, it is agreed that the control variables interact not only with disclosure but also with performance and firm value, and their use in the models is fully supported in the literature and past studies.

7.5. Summary

This chapter has discussed the results according to the study objectives and research questions. Additionally, the discussion of findings based on the level of Mandatory Reserve Disclosure by Accounting Method, impact of disclosure levels on firm performance and impact of disclosure levels on firm value were outlined, and discussed accordingly. This study uses the interview results as a method to verify the empirical results, which are found consistent with the findings yielded by the semi-structured interviews. In general, this study provides evidence that there is an impact of Mandatory and Voluntary Reserve Disclosures on performance with no impact on value. However, there is an impact of Mandatory Decommissioning Disclosure on performance and value, but Voluntary Decommissioning Disclosure has an impact on performance and no impact on value. Hence, oil and gas reserve and decommissioning disclosures enhance the performance but do not clearly influence the firm's value.

CHAPTER EIGHT: CONCLUSION

8.1. Introduction

Disclosure, especially of reserves and decommissioning, is of great significance in the oil and gas industry owing to the significant investment, cash outflow implications and the need for the information for decision making by both government and the investment community (Byard and Shaw, 2003; Arnott, 2004; Standard and Poors, 2007; De Abreu et al. 2016). Given that the oil and gas industry is extremely sensitive to news, it is possible that the content of disclosures (whether considered good or bad) may have a higher impact on the value and performance of the companies than in any other industries. This impact has been studied in the case of reserve disclosure only, but no study has investigated the impact on decommissioning disclosure or on a combination of the reserve and decommissioning. This study addressed the gap by investigating the impact of voluntary and mandatory disclosures of oil and gas companies' reserves and decommissioning on the value and performance of these companies. Reserve disclosures reflect cash inflows whereas decommissioning disclosures reflect cash outflows; therefore, studying a combination of the two disclosures is the key to understand their impact on companies' values and performance.

8.2. Summary of methodological approach

The study used a multiparadigm approaches encompassed by a quantitative and qualitative design. The levels of mandatory disclosures of oil and gas reserves and decommissioning were determined by examining whether certain information was disclosed through content analysis using NVivo software and manually by assigning a dichotomous value (1 for content disclosed, 0 for non-disclosure) on the constructed reserve and decommissioning disclosure index (R&DDI). The other variables were quantitative in nature (or derived from other variables by computation). The population of this study was 111 companies listed on the LSE website under the category 'oil and gas'. The research selected 52 (19 listed on the main market and 33 on the AIM) firms which have upstream production and exploration activities disclosed in their annual report.

The main methods of analysis used in the study were the examination of the descriptive statistics, determining the differences between the means and the relationships between a set of dependent and independent variables. All the data were tested for convergent validity using the Pearson correlation test and for reliability using Cronbach's alpha. Furthermore, aside from the descriptive tests, the differences between means and the determination of relationships required the consideration of whether certain assumptions had been met, to enable the choice of an appropriate test. The main assumption test was stationarity of the time series data. The non-categorical data were found to exhibit stationarity. The study used interviews with some stakeholders in the oil and gas industry as a supplementary qualitative method to verify the results.

8.3. Summary of the findings

The aim of this study was to examine empirically the impact of mandatory and voluntary reserves and decommissioning disclosures on the performance and value of exploration and production oil and gas companies listed in the UK and investigate the perceptions of key stakeholders about such disclosures impact. The underlying research provided answers to the question of what extent do exploration and production oil and gas companies listed in the UK comply with reserves and decommissioning disclosure requirements? what extent do the listing status in the market and accounting method influence the level of disclosures? what extent do voluntary and mandatory disclosures of reserves and decommissioning costs impact on the financial performance and value? what firm characteristics influence the relationship between disclosure and performance/value of exploration and production oil and gas companies listed in the UK? and finally, what are the perceptions of key stakeholders about the impact of mandatory and voluntary reserves and decommissioning disclosures on exploration and production oil and gas firms' performance and value?

In order to answer the questions of the current study and meet its research aims and objectives, both objective (quantitative) measurement and subjective (qualitative) assessment were required. In addition, the probable impact of both voluntary and mandatory disclosures on firms' value and performance was explained by signalling theory and agency theory.

The findings revealed that there is a high variability in the practice of voluntary and mandatory disclosures of reserves and decommissioning in oil and gas companies. Voluntary disclosure was expected to vary because of its non-binding nature and the biased nature of such disclosure. Also, mandatory disclosure was found to vary owing to the different levels of compliance with regulation requirements, and the ability of use judgement/discretion in applying the accounting standards.

One of the findings of this study is that the levels of disclosure practices by companies vary according to a number of characteristics. This high variability was also established by reference to the firms' Listing Status. Firms listed on the main market had significantly higher levels of disclosure compared with firms listed in the AIM. This was explained by the variation of strictness of regulations in the two markets, with the AIM having more relaxed disclosure rules compared with the main market. Further, the disclosure levels were significantly higher in firms using the Successful Effort and Full Cost Accounting Method, compared with the Area of Interest Method. This was explained by the clearer accounting rules applicable in the use of Full Cost and Successful Effort Methods, which enabled a higher level of disclosure and provided a less favourable environment for the exercise of judgement and/or discretion compared to those in the Area of Interest Method. However, there was no significant difference in the disclosure level between the Successful Effort Method and the Full Cost Accounting Method. The lack of significant differences between the Full Cost and the Successful Effort was explained by the lack of significance in the quality of disclosure arising from the use of the two methods.

In terms of the impact of disclosures on companies' value and performance, the results offered interesting facts that can be used by stakeholders when making decisions. Mandatory Reserve Disclosure was found to impact negatively on performance, measured by a number of ratios: ROE, OCF, EBITDA and P/E ratio, and value, measured by Tobin's Q and Market Value. Voluntary Reserve Disclosure was found to have a positive impact on a number of measures of performance (OCF and EBITDA) and negative impact on one particular measure (ROA) with no impact on firm value. These relationships were explained using the agency theory and signalling theory (sections 7.4.1 and 7.4.2). It was established that firms disclosing voluntarily will choose to disclose only positive news, and thus their disclosure is bound to contribute positively to performance. On the contrary, mandatory disclosure requires firms to disclose good and bad news, and thus may have a negative impact on performance. The failure of the positive news disclosed voluntarily to impact on the value of the company was further explained by the argument that some of the disclosures may be confusing and thus may fail to enhance investors' positive valuation of firms. Therefore, voluntary disclosure with an increased bias would still decrease the cost of capital for the disclosing firms by virtue of increased transparenc,y thus enhancing certain aspects of performance, but fail to raise firm value.

The analysis revealed that Mandatory Decommissioning Disclosure positively impacted on the performance measured by ROA, OCF and EBITDA, and firm value. Voluntary Decommissioning Disclosure also positively impacted on the performance, but not the firm value. Except for the direction of impact, the findings are consistent with those of mandatory and voluntary reserve disclosures because both mandatory and voluntary disclosures impact onthe firm. Although decommissioning was viewed as having cash outflow impacts and therefore ought to be bad news, and ought to have negative impacts on performance and firm value, a contrary explanation to this was put forward: the concept of environmental responsibility. It was established that – consistent with the past studies that examined the impact of environmental news on firm performance and value – the disclosure of decommissioning sent signals of environmental responsibility as opposed to cash outflows, and therefore investors were more willing to support more socially and environmentally responsible firms. However, mandatory disclosure enabled a more structured disclosure that was easily understood by investors, while voluntary disclosure gave freedom to exercise judgement and discretion – if not manipulation, and misrepresentation – and thus, items disclosed might not be taken as representative of truth, thus not impacting firm value. This concept of disclosure lowers the cost of capital and thus impacts performance. The control variables used were found to impact the relationship between the disclosures and the firm performance and value.

The study findings from the interviews, as a qualitative method to verify the study's statistical results, confirmed these in regard to Voluntary Reserve Disclosure. Some of the respondents indicated that Voluntary Reserve Disclosure could have a positive impact in the sense that the investors could view the company as transparent, especially because it released the information voluntarily. However, other respondents, as established in the analysis, were not very optimistic about the impact that voluntary disclosure could have on performance or value of the company. The interviews revealed that voluntary disclosure could be meaningful if the information released was aligned with people's expectations. Sometimes investors would be aware that voluntary disclosures would just be aimed at inspiring confidence in the market.

The interview results indicated that Mandatory Reserve Disclosure could impact on the performance and value of a company, since the information disclosed was used by investors to make investment decisions. When investors felt that the company disclosed information that was useful to them, they would be most likely to invest in that company, and this would make financing easier for the company, which in turn could impact on its performance and value. The interviews also clarified that oil and gas companies used the mandatory reserve disclosures to support their requirements for financing their activities from banks by issuing the RBL (Reserve Based Lending) statement. Thus, the mandatory release of this information could have a big financial impact on the company but might not impact on the performance or value of the company. The respondents, in general, believed that mandatory and voluntary decommissioning disclosers tended to have a positive impact on performance, and that the explanation was a complex one. They argued that, since these moves indicated that a company was making an effort to 'clean its mess', they sent a 'good' message to the stakeholders. They, however, acknowledged that it could become a double-edged sword when the message sent out appeared to have been edited in order to be appealing to the regulators and the investors. This could have a very negative impact on performance and value. Society, in general, expects companies to clean up their mess, as the respondents pointed out, and when a company demonstrated that it was making an effort to do this, it sent a ‘good’ message that the company is socially responsible.

The respondents made several recommendations on how reserves and decommissioning disclosures could be improved. They indicated that there is a need to introduce specific regimes about what companies need to do, and how they need to do it. This would ensure that whatever needs to be disclosed is uniform, and this would ensure fairness in how information is analysed. Others recommended the need to harmonise the mandatory and voluntary requirements on an international level, to which all companies should adhere in order to estimate the reserves and decommissioning costs, and also during the decommissioning process. This would enhance transparency and consistency, and help iron out some of the persistent uncertainties, especially for the investors.

8.4. Implications of the study

The findings have implications for teaching and research, as well as practice and policy. As countries continue to adopt a single accounting method that aligns with IFRS and/or local GAAP, the choice of the accounting method is significant, as it is seen to influence disclosure quantity and quality. The findings of this study reveal that the Full Cost and the Successful Effort Methods do not significantly differ in the quality of disclosure they offer. This would be important, especially in deciding on the fate of companies that are cross-listed in different countries and markets and which must meet the differing disclosure requirements. While with regard to accounting figures produced by companies that use one of the two methods, Full Cost versus Successful Effort, the impact of disclosures on firms’ performance and value does not differ between these two methods. This suggests that no one method is superior to the other. The practical implication is that investors should not consider accounting methods (Full Cost or Successful Effort) when considering the value and performance of firms.

This study also determined that these methods permit the use of judgement and discretion – if not manipulation – by accounting and auditing firms, and thus lead to high variability in disclosure. The effect of choosing one accounting method over another is apparent when periodic financial results involving the income and cash flow statements are compared, with an emphasis on the way each method treats the individual costs falling into the categories of acquisition, exploration, development and production. However, such a comparison will also point out the impact on periodic results caused by differing levels of capitalised assets under the two accounting methods.

This presents an opportunity for researchers and learning institutions and policy makers to establish ways through uniformity in reporting to reduce information asymmetry between managers and other stakeholders (government and the investment community) by re-examining, and possibly modifying, the constructs of the accounting methods. Harmonising accounting practices by extractive industries in general, and the oil and gas industry in particular, should eliminate the opportunity to manipulate accounts and offer a clearer pathway for investors when making decisions.

This research also provides valuable insights for oil and gas companies' managers wishing to stimulate the efficiency of the reserve and decommissioning disclosures that managers convey to various stakeholders, including investors in the market, regulators bodies, auditing firms, and environmental observers.

In addition, this study has determined that voluntary reporting is potentially biased and leads to the provision of information that is less well understood by investors, and fails to serve the objective of increased transparency. This has implications especially for regulators in various markets. It would be imperative either to develop with guidelines for voluntary reporting in order to reduce bias, and to enhance the clarity of information provided to investors and other stakeholders, or to increase the amount of required disclosures by companies on a mandatory basis.

8.5. Significance of the results

The results of the study are significant as they unveil the difference in value and performance resulting from each of these disclosure types individually and collectively. As per the research findings, Mandatory Decommissioning Disclosure, Mandatory Reserve Disclosure, Voluntary Decommissioning Disclosure and Voluntary Reserve Disclosure influence the value and performance of the exploration and production oil and gas companies listed in the UK. In addition, the firm-specific characteristics also impact on the relationship between disclosure level and the firm value and performance. The results are important for investors interested in investing in the oil and gas industry and the stakeholders in this industry. The research findings are also useful for regulating bodies inside the UK, so that they can see how firms are dealing with, if not manipulating, the disclosure requirements and using these to their benefit in the long run. In addition, managers working in oil and gas companies can also understand the important and relevant role played by disclosure and how it impacts on a firm's dynamics, as it directly impacts on the stakeholders' interest. Based on the study results, it can be argued that managers need to focus more on both voluntary reserve and decommissioning disclosure as the most effective means of enhancing companies' performance and value.

8.6. Contribution of the study

As far as the literature review contribution is concerned, this study offers a holistic perspective on factors impacting on theoretical framework (section 3.5) and its dynamics. A synopsis of the academic literature reveals that the agency theory and signalling theory considers disclosure as a communication tool in regard to stakeholders. This is based on the assumption that, even in the capital markets that are considered to be efficient, the information on the future performance of the firm, as held by the management, is superior in comparison with that of investors. Furthermore, because of the imperfections of the accounting and auditing regulations, there is an incentive by the management towards managing the reporting of financial performance for various reasons, including political, contracting and corporate governance. In addition, the findings contribute to the bridging of gaps in the literature and provide ways potentially to increase the level of reserve and decommissioning disclosures among oil and gas companies. In addition, the findings enable better valuation of companies and increased investor support to oil and gas firms, leading to long-term sustainable performance. Furthermore, the research depicts that there is consensus among stakeholders about enhancing disclosure on provisions for decommissioning costs.

As far as the literature review is concerned, the literature demonstrates that there is a strong relationship between disclosure and a firm's value and performance. Furthermore, a firm's disclosure (level or quality) is motivated by a firm's specific characteristics. A reserve and decommissioning disclosure index (R&DDI) was constructed in this research, and it is the first time that this index has been used to measure the level for main cash inflow and outflow (Reserves And Decommissioning) in the oil and gas industry (Mandatory with Voluntary). Hence researchers and experts might use this index to evaluate the level of disclosures. This index could be used by researchers to investigate disclosures of other extractive, and similar, industries such as coal, metal and nuclear. The disclosure measurement used in the study includes this self-constructed disclosure index. In addition, the R&DDI enables precise measurement to be achieved, since the process involves identifying the relevant information, exploring the level of mandatory and voluntary disclosures of reserve and decommissioning in annual reports of oil and gas firms, modifying the checklist, reviewing the initial checklist and constructing the final checklist. Policies could be put in place by governments or international accounting bodies to guide how, and the type of information related to reserves and decommissioning that, should be disclosed. There is an urgent need for a clear disclosure index in the oil and gas industry to harmonise the different guidance by different bodies.

The main contribution or originality of the current research is its being the first research, to the best of my knowledge, that empirically address mandatory and voluntary level of reserve and decommissioning disclosures together that measures by the constructed index disclosure, assessment in the line with accounting methods, listing statues, and finally the impacts on oil and gas firm's performance and value.

The quantitative and qualitative perspectives explained that signalling and agency theories seem to be relevant to disclosure of oil and gas reserves as 'good' news, and decommissioning costs and obligations as being 'bad' news. This study, therefore, implemented both of these theories in explaining firm behaviour as it pertains to mandatory and voluntary disclosures related to reserve and decommissioning and how that behaviour impacts on the value and performance of the firms. In addition, most of the prior empirical studies discovered how to measure disclosure through identifying variables that might have a relationship with level of disclosure.

Signalling theory underpins the idea that disclosure of good news provides positive signals related to companies' cash flow and profitability. On the other hand, bad news signals reduced profitability and cash outflows, which both impacts negatively on companies' value. Consequently, management, as an agent, is required legally and ethically to provide shareholders, as principals, and wider stakeholders groups, with sufficient information to allow sensible decision making.

There are two other important contributions, made especially by the qualitative analysis. The first one is that there is an urgent need for harmonising the mandatory and voluntary requirements on an international level, to which upstream oil and gas companies should adhere, to estimate reserves' and decommissioning costs. The second one is that the oil and gas industry can improve decommissioning disclosures by introducing specific regimes about what companies need to do, and how they need to consider the decommissioning process. This will enhance transparency and consistency, and help iron out some of the persistent uncertainties, especially for investors, which will ensure fairness in how information is analysed. The third one is that reserves disclosures and decommissioning disclosures are highly required by specific stakeholders in oil and gas industry, banks to lend money based on expected cash flow of reserve information, and environmental representatives to evaluate the risks and challenges of decommissioning project on the environment.

Finally, this study contributes that decommissioning challenges recognise as negative information, however, that not all decommissioning challenges are negative; there are some positivity which can afford opportunities for reducing liabilities, costs and providing a competitive advantage within oil and gas industry.

8.7. Limitation of the study

This research entailed a sample of 52 companies which were in production stage and delivered reserves and decommissioning disclosures. Their financial statements were examined over a period from 2010 to 2017. These were all the oil and gas companies with both exploration and decommissioning activities and listed in the UK's AIM and main market. Statistically, the sample is small and therefore presents the possibility that the small effect size produced by smaller samples may not have permitted certain coefficients to be significant (Hedges, 1984; Maas, and Hox, 2005; Sink and Mvududu, 2010). However, the underlying research is valid because the selected sample and the period of study offer a suitable number of observations which provide a clear and effective presentation of the research questions. Also, lowering the confidence level below the 95% used in this study may result in a Type I error (Dobson and Cook, 1980). Therefore, a possible way to enhance the sample size in future research is to go beyond a single market and study of companies that operate within a region, and especially the countries with homogenous corporate governance and disclosure practices.

A further concern arises that this study focusing on oil and gas firm's annual report disclosures only, where reserve and decommissioning disclosures could be provided via alternative vehicles of communication, although, the heterogeneous of the information disclosed on alternative media impeded comparability and, consequently, generalization.

8.8. Further research

In explaining the positive relationships established for decommissioning disclosures, it was determined that these emanated from the view of decommissioning by the investment community as an environmental issue, as opposed to a cash outflow driver. This was, however, only an argument, and the scope of this study did not permit the exploration of that concept. Furthermore, no single study or theory has been developed which explains the shift in investor priorities, although concepts such as pollution and environmental responsibility have been acknowledged widely (Ekins, et al., 2006; Schroeder and Love, 2004; Fowler, et al., 2014). It also fits the argument in the research since decommissioning also presents a broad environmental challenge. Based on this foundation, it would be of significance to examine this in greater depth. More particularly, future research needs to explore and ascertain the shift in investor focus from cash outflows to environmental damage, and whether this is a concern only in the UK and other countries in the West where issues of corporate governance are strongest, or whether it is a global phenomenon. Alternatively, future research could consider also the links between the level of reserves and decommissioning disclosures as dependent variables and factors effecting the level of disclosures, such as corporate governance variables and financial characteristics to determinants/likelihood of disclosures in AIM and the Main Market.

This study was conducted before the global Covid-19 pandemic, which has had detrimental effects on oil and gas investments worldwide. Oil prices have been volatile and declined to pre-2014 levels during the pandemic, and this may have impacted on the commerciality of oil and gas reserves for many projects. Thus, it may have shortened these projects' lives and accelerated the decommissioning procedure. Therefore, repeating the same research and using the R&DDI developed by this study, would offer insights into the impact of the disclosures during and beyond the Covid-19 pandemic on the value and performance of oil and gas companies.

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Appendix 1: Studies on the impact of disclosure and performance and value

Corporate disclosure and value		
Author	**Objective**	**Results**
Aboody (1996)	Whether recognition and disclosure have equivalent pricing consequences in the oil & gas industry	Whether a write-down is recognised or disclosed has significant impact on firms' values

Berry and Wright (2001)	Determine whether supplemental reserve disclosures contain value relevant information by examining the extent to which they convey information regarding firms' effort and ability to discover reserves	Both effort and ability to discover reserves are significant in explaining the market value of full cost firms
Gordon, et al. (2010)	Assess empirically the market value of voluntary disclosures of items pertaining to information security	Voluntarily disclosing items concerning information security is associated positively with the market value of a firm
Jiao (2011)	The relationship between the Association for Investment Management and Research disclosure rankings and several corporate performance measures	Disclosure rankings are highly correlated with firm value
Castillo-Merino, et al. (2014)	Analyses the effects of mandatory International Financial Reporting Standards (IFRS) adoption by Spanish firms in 2005 on the cost of equity capital	A significant reduction in their cost of equity capital after the mandatory adoption of IFRS in 2005
Abdel-Azim and Abdelmoniem (2015)	The impact of risk management and disclosure on firm value	A positive relationship exists between voluntary disclosure and firm value

Mangena, et al. (2016)	Whether intellectual capital (IC) and financial disclosures jointly affect the firm's cost of equity capital	A negative relationship between the cost of equity capital and IC disclosure
Jankensgård, et al., (2014)	Empirically investigate the value-relevance of corporate risk disclosure	Holding the level of derivative usage constant, firm value decreases in the level of risk disclosure

Corporate disclosure and performance		
Author	**Objective**	**Results**
Spear (1994)	Examine the information content of the components of the annual change in the quantity of proved reserves reported by U.S oil & gas (O&G) producers	Discoveries are highly associated with security returns even after controlling for production
Boone (1998)	Oil & gas reserve value disclosures and bid–ask spreads	Relative bid–ask spreads of oil & gas firms exhibited a significant decline after controlling for the effects of other factors that influence bid–ask spreads
Jiao (2011)	The relationship between the Association for Investment Management and Research disclosure rankings and several	A positive relationship between these rankings and stock returns

	corporate performance measures	
Vitezić, et al. (2012)	Investigate the link between corporate sustainability and financial performance	Results of the research confirm positive relation between sustainability concept of performance and financial result
Rouf (2012)	Aims to test empirically the relationship between the Financial Performances(Profitability) and the level of Corporate Governance Disclosure (CGD) by the listed non-financial companies in Bangladesh	The level of Corporate Governance Disclosure (CGD) is positively correlated with the Financial Performance (Profitability)
Sovbetov (2015)	Capturing the impact of IFRS adoption on key financial indicators of firms	Profitability and gearing ratios are affected by IFRS adoption
Ferrer (2016)	Determine the effects of international financial reporting standards disclosure for small and medium enterprises (IFRS for SMEs) on profitability under the retail sector	There has been a significant difference on the financial performance of the entities before and after adapting the Philippine Financial Reporting Standards (PFRS) for SMEs as evidenced by the entities' financial ratios
Ayodele, et al. (2016)	Examines the nature of relationships that exist between corporate governance mechanisms and financial performance	Corporate governance disclosure level has a positive and significant impact on the ROE

	in the Nigerian oil & gas industry	
Hughey and Sulkowski (2012)	Testing whether greater data availability about companies leads to their having better CSR reputations and possibly CSR performance	A significant positive relationship: the more data is available about a company in the international oil & gas industry, the better its CSR reputation tends to be
Herbohn, et al. (2014)	Explores the relation between sustainability performance and sustainability disclosure within the Australian extractive industries.	Corporate sustainability performance is strongly associated with disclosure
Piatti (2014)	Verifise with reference to Italian Mutual Banks, whether the intensity of Social Disclosure (SD) is indeed representative of social responsibility	The degree of SD intensity does not appear to be completely represented in actual social-environmental performance

Li, et al. (2013)	Examines the effect of firm performance on CSR disclosure in terms of disclosure frequency and quality among Chinese listed firms and the possible mediating effect of corporate ownership on the relationship between firm performance and CSR disclosure	Better-performing firms are more likely than worse-performing ones to disclose CSR information and to produce higher quality CSR reports

Appendix 2: Disclosure Index for Reserves and Decommissioning Disclosure among Oil & gas Companies Listed in LSE

Reserve and Decommissioning Disclosure Index (R&DDI)
Company Name:--.

Year of Disclosure:--.

Market Listed:
1- Main Market
2- AIM
3- Number of years listing (   )

Accounting Method:
- Successful Effort
- Full Cost
- Area of Interest
- Not disclosed

Auditing by one of the Big Four (yes / no)

No.	Disclosure Item	Score		Notes
		Disclosed	Not Disclosed	
1	**Mandatory Reserve Disclosure**			
1.1	Information about proved developed reserves			
1.2	Information about proved undeveloped reserves			
1.3	Information about unproved reserves			
1.4	Information about probable reserves			
1.5	Information about possible reserves			
1.6	Explanation of change made to past hydrocarbon resource and reserve estimation, including change to underlying key assumptions			
	Total Score for Mandatory Reserve Disclosure			
2	**Voluntary Reserve Disclosure**			

2.1	Commercial oil & gas reserves at the beginning and at the end of each financial year			
2.2	Oil & gas reserves' quantity in total and by geographical region			
2.3	Any changes and detail of movement in oil & gas reserves including revisions of previous estimates, purchases of reserves in place and production			
2.4	Oil and natural gas liquid to be shown in barrels and gas reserves to be shown in cubic feet			
2.5	Disclosure of reserves from non-traditional sources (i.e., bitumen, oil sands, shale, coalbed methane) as oil & gas reserves			
2.6	The sensitivity of reserves numbers to price			
2.7	The qualifications of the technical person primarily responsible for overseeing the preparation or audit of the reserves estimates			
2.8	Company's progress in converting proved undeveloped reserves into proved developed reserves			
	Total Score for Voluntary Reserve Disclosure			
3	**Mandatory Decommissioning (Abandonment) Disclosure**			
3.1	Decommissioning provisions are measured at the present value of the expected future cash flows			
3.2	The total cost of the fixed asset, including the cost of decommissioning, is depreciated on the basis that best reflects the consumption of the economic benefits of the asset, typically unit of production (UOP)			
3.3	The discount rate used is the pre-tax rate that reflects current market assessments of the time value of money			
3.4	The cost of the provision is recognised as part of the cost of the asset when it is put in place and depreciated over the asset's useful life			

3.5	Decommissioning provisions are updated at each balance sheet date for changes in the estimates of the amount or timing of future cash flows and changes in the discount rate			
3.6	A consistent policy should be adopted for deferred tax accounting for decommissioning liabilities and finance leases			
	Total Score for Mandatory Decommissioning Disclosure			
4	**Voluntary Decommissioning Disclosure**			
4.1	Risks and uncertainties to be taken into account in reaching the best estimate of a provision. It is recommended that this is achieved through discounting the estimated future decommissioning costs at a pre-tax, free rate.			
4.2	Decommissioning liabilities should include facilities where damage has been caused that will need to be rectified			
4.3	Provisions should be reviewed at each balance sheet date to reflect the current best estimate of the cost at present value			
4.4	Where there is an adjustment to the provision as a result of a change in estimate, there should be a corresponding equal and opposite adjustment to the related decommissioning asset			
4.5	The unwinding of the discount should be included as a financial item adjacent to interest but shown separately from other interest either on the face of the profit and loss account or in a note			
4.6	Residual values of assets that are to be decommissioning cost at the time of establishing the decommissioning asset			
4.7	Decommissioning obligations to be broken down by geographical areas and individual field			
	Total Score for Voluntary Decommissioning Disclosure			

Appendix 3: Oil & gas producer firms listed on the London Stock Market as of October 2018.

S/N	Admission Date	Company Name	Country of Incorporation	World Region	Market	Company Market Cap (£m)
1.	03/02/2012	88 ENERGY LIMITED	Australia	Pacific	AIM	£85.10
2.	16/11/2004	AMERISUR RESOURCES PLC	United Kingdom	Europe	AIM	£228.08
3.	06/07/1995	AMINEX PLC	Ireland	Europe	MAIN MARKET	£105.66
4.	06/03/2017	ANGLO AFRICAN OIL & GAS PLC	United Kingdom	Europe	AIM	£7.12
5.	14/11/2016	ANGUS ENERGY PLC	United Kingdom	Europe	AIM	£23.79
6.	29/07/2010	ARGOS RESOURCES LIMITED	Falkland Islands	Latin America	AIM	£8.90
7.	10/11/2004	ASCENT RESOURCES PLC	United Kingdom	Europe	AIM	£28.93
8.	16/06/2010	BAHAMAS PETROLEUM COMPANY PLC	Isle of Man	Europe	AIM	£13.97
9.	14/07/2004	BARON OIL PLC	United Kingdom	Europe	AIM	£3.79
10.	24/05/2005	BORDERS & SOUTHERN PETROLEUM PLC	United Kingdom	Europe	AIM	£18.88
11.	07/12/2004	BOWLEVEN PLC	United Kingdom	Europe	AIM	£102.32
12.	29/03/1954	BP PLC	United Kingdom	Europe	MAIN MARKET	£99,555.46
13.	22/12/1995	CABOT ENERGY PLC	United Kingdom	Europe	AIM	£31.77
14.	23/06/2008	CADOGAN PETROLEUM PLC	United Kingdom	Europe	MAIN MARKET	£18.86
15.	22/12/1988	CAIRN ENERGY PLC	United Kingdom	Europe	MAIN MARKET	£1,206.13
16.	04/04/2014	CANADIAN OVERSEAS PETROLEUM LIMITED	Canada	North America	MAIN MARKET	£10.28
17.	03/03/2008	CASPIAN SUNRISE PLC	United Kingdom	Europe	AIM	£154.44
18.	19/05/2008	CHARIOT OIL & GAS LIMITED	Guernsey	Europe	AIM	£57.29
19.	30/06/2005	CLONTARF ENERGY PLC	United Kingdom	Europe	AIM	£2.01
20.	16/11/2007	COLUMBUS ENERGY RESOURCES PLC	United Kingdom	Europe	AIM	£35.38
21.	04/10/2017	CURZON ENERGY PLC	United Kingdom	Europe	MAIN MARKET	£7.44

22.	**03/02/2017**	**DIVERSIFIED GAS & OIL PLC**	**United Kingdom**	**Europe**	**AIM**	**£110.26**
23.	**12/12/2005**	**ECHO ENERGY PLC**	**United Kingdom**	**Europe**	**AIM**	**£53.27**
24.	**08/02/2017**	**ECO (ATLANTIC) OIL & GAS LTD**	**Canada**	**North America**	**AIM**	**£49.59**
25.	**17/01/2008**	**EGDON RESOURCES PLC**	**United Kingdom**	**Europe**	**AIM**	**£17.37**
26.	**03/09/2012**	**ELAND OIL & GAS PLC**	**United Kingdom**	**Europe**	**AIM**	**£187.14**
27.	**27/07/2005**	**EMPYREAN ENERGY PLC**	**United Kingdom**	**Europe**	**AIM**	**£48.48**
28.	**17/12/2007**	**ENDEAVOUR INTERNATIONAL CORPORATION**	**United States**	**North America**	**MAIN MARKET**	**£0.85**
29.	**06/04/2010**	**ENQUEST PLC**	**United Kingdom**	**Europe**	**MAIN MARKET**	**£444.19**
30.	**11/11/2004**	**EUROPA OIL & GAS (HOLDINGS) PLC**	**United Kingdom**	**Europe**	**AIM**	**£13.26**
31.	**17/12/2009**	**EXILLON ENERGY PLC**	**Isle of Man**	**Europe**	**MAIN MARKET**	**£141.97**
32.	**28/03/2013**	**FALCON OIL & GAS LTD.**	**Canada**	**North America**	**AIM**	**£160.00**
33.	**27/06/2003**	**FAROE PETROLEUM PLC**	**United Kingdom**	**Europe**	**AIM**	**£395.97**
34.	**14/03/2005**	**FRONTERA RESOURCES CORPORATION**	**Cayman Islands**	**North America**	**AIM**	**£79.37**
35.	**17/08/2006**	**G3 EXPLORATION LIMITED**	**Cayman Islands**	**North America**	**MAIN MARKET**	**£97.55**
36.	**22/06/2011**	**GENEL ENERGY PLC**	**Jersey**	**Europe**	**MAIN MARKET**	**£368.30**
37.	**07/03/2005**	**GLOBAL PETROLEUM LIMITED**	**Australia**	**Pacific**	**AIM**	**£4.48**
38.	**08/09/2004**	**GULF KEYSTONE PETROLEUM LTD**	**Bermuda**	**North America**	**MAIN MARKET**	**£276.69**
39.	**08/04/2005**	**GULFSANDS PETROLEUM PLC**	**United Kingdom**	**Europe**	**AIM**	**£27.95**
40.	**14/02/2007**	**HAIKE CHEMICAL GROUP LTD**	**Cayman Islands**	**North America**	**AIM**	**£8.05**
41.	**20/02/2008**	**HARDY OIL & GAS PLC**	**Isle of Man**	**Europe**	**MAIN MARKET**	**£10.51**
42.	**03/02/2016**	**HIGHLANDS NATURAL RESOURCES PLC**	**United Kingdom**	**Europe**	**MAIN MARKET**	**£25.11**
43.	**04/02/2014**	**HURRICANE ENERGY PLC**	**United Kingdom**	**Europe**	**AIM**	**£707.01**
44.	**25/07/2017**	**I3 ENERGY PLC**	**United Kingdom**	**Europe**	**AIM**	**£14.26**

45.	**31/12/2007**	**IGAS ENERGY PLC**	**United Kingdom**	**Europe**	**AIM**	**£109.76**
46.	**30/09/2013**	**INDEPENDENT OIL & GAS PLC**	**United Kingdom**	**Europe**	**AIM**	**£21.34**
47.	**06/06/2008**	**INDUS GAS LIMITED**	**Guernsey**	**Europe**	**AIM**	**£686.15**
48.	**09/05/2008**	**IOFINA PLC**	**United Kingdom**	**Europe**	**AIM**	**£25.04**
49.	**17/03/2011**	**JERSEY OIL & GAS PLC**	**United Kingdom**	**Europe**	**AIM**	**£44.20**
50.	**18/07/1995**	**JKX OIL & GAS PLC**	**United Kingdom**	**Europe**	**MAIN MARKET**	**£30.05**
51.	**21/08/2017**	**KOSMOS ENERGY LTD**	**Bermuda**	**North America**	**MAIN MARKET**	**£1,970.14**
52.	**21/04/2006**	**LANSDOWNE OIL & GAS PLC**	**United Kingdom**	**Europe**	**AIM**	**£8.04**
53.	**17/05/2013**	**LEKOIL LIMITED**	**Cayman Islands**	**North America**	**AIM**	**£98.72**
54.	**25/11/2011**	**MAGNOLIA PETROLEUM PLC**	**United Kingdom**	**Europe**	**AIM**	**£1.55**
55.	**14/01/2013**	**MAYAN ENERGY LIMITED**	**British Virgin Islands**	**North America**	**AIM**	**£7.58**
56.	**20/03/2014**	**MOSMAN OIL & GAS LIMITED**	**Australia**	**Pacific**	**AIM**	**£2.62**
57.	**16/12/2005**	**MX OIL PLC**	**United Kingdom**	**Europe**	**AIM**	**£10.86**
58.	**12/03/2007**	**NIGHTHAWK ENERGY PLC**	**United Kingdom**	**Europe**	**AIM**	**£5.06**
59.	**23/02/2005**	**NOSTRA TERRA OIL & GAS COMPANY PLC**	**United Kingdom**	**Europe**	**AIM**	**£5.91**
60.	**20/06/2014**	**NOSTRUM OIL & GAS PLC**	**United Kingdom**	**Europe**	**MAIN MARKET**	**£585.25**
61.	**20/03/2008**	**NU-OIL & GAS PLC**	**United Kingdom**	**Europe**	**AIM**	**£12.73**
62.	**16/02/2006**	**OILEX LD**	**Australia**	**Pacific**	**AIM**	**£3.59**
63.	**13/07/2011**	**OPHIR ENERGY PLC**	**United Kingdom**	**Europe**	**MAIN MARKET**	**£391.29**
64.	**05/04/2006**	**PANTHEON RESOURCES PLC**	**United Kingdom**	**Europe**	**AIM**	**£112.73**
65.	**13/03/2000**	**PARKMEAD GROUP (THE) PLC**	**United Kingdom**	**Europe**	**AIM**	**£35.12**
66.	**21/12/2017**	**PENNPETRO ENERGY PLC**	**United Kingdom**	**Europe**	**MAIN MARKET**	**£47.86**
67.	**18/08/2000**	**PETREL RESOURCES PLC**	**Ireland**	**Europe**	**AIM**	**£3.04**
68.	**01/05/2008**	**PETRO MATAD LIMITED**	**Isle of Man**	**Europe**	**AIM**	**£25.41**

69.	02/10/2007	PHOENIX GLOBAL RESOURCES PLC	United Kingdom	Europe	AIM	£888.01
70.	07/05/1997	PJSC LUKOIL	Russian Federation	Europe	MAIN MARKET	£29,906.24
71.	20/02/1973	PREMIER OIL PLC	United Kingdom	Europe	MAIN MARKET	£632.15
72.	20/07/2004	PRESIDENT ENERGY PLC	United Kingdom	Europe	AIM	£121.66
73.	24/06/2005	PROVIDENCE RESOURCES PLC	Ireland	Europe	AIM	£60.66
74.	19/04/2006	QUADRISE FUELS INTERNATIONAL PLC	United Kingdom	Europe	AIM	£71.91
75.	23/10/2007	RANGE RESOURCES LIMITED	Australia	Pacific	AIM	£13.29
76.	23/06/2011	RED EMPEROR RESOURCES NL	Australia	Pacific	AIM	£5.36
77.	27/09/2002	REGAL PETROLEUM PLC	United Kingdom	Europe	AIM	£77.59
78.	15/08/2005	ROCKHOPPER EXPLORATION PLC	United Kingdom	Europe	AIM	£116.56
79.	13/01/2016	ROCKROSE ENERGY PLC	United Kingdom	Europe	MAIN MARKET	£19.47
80.	02/06/2004	ROSE PETROLEUM PLC	United Kingdom	Europe	AIM	£4.11
81.	20/07/2005	ROYAL DUTCH SHELL PLC	United Kingdom	Europe	MAIN MARKET	£206,691.82
82.	24/02/2017	SAFFRON ENERGY PLC	United Kingdom	Europe	AIM	£8.13
83.	21/09/2016	SAN LEON ENERGY PLC	Ireland	Europe	AIM	£125.06
84.	01/08/2014	SAVANNAH PETROLEUM PLC	United Kingdom	Europe	AIM	£87.60
85.	30/06/1963	SCHLUMBERGER LD	Curacao	Europe	MAIN MARKET	£71,627.19
86.	20/05/2016	SDX ENERGY INC.	Canada	North America	AIM	£103.27
87.	14/04/2014	SEPLAT PETROLEUM DEVELOPMENT COMPANY PLC	Nigeria	Africa	MAIN MARKET	£709.94
88.	13/12/2005	SERICA ENERGY PLC	United Kingdom	Europe	AIM	£222.55
89.	27/06/2005	SIRIUS PETROLEUM PLC	United Kingdom	Europe	AIM	£31.11
90.	29/05/1997	SOCO INTERNATIONAL PLC	United Kingdom	Europe	MAIN MARKET	£381.75
91.	12/04/2007	SOLO OIL PLC	United Kingdom	Europe	AIM	£16.67
92.	13/07/2006	SOUND ENERGY PLC	United Kingdom	Europe	AIM	£489.45

93.	18/07/2007	SPITFIRE OIL LIMITED	Bermuda	North America	AIM	£2.14
94.	21/10/2002	STERLING ENERGY PLC	United Kingdom	Europe	AIM	£31.58
95.	30/11/2015	TLOU ENERGY LIMITED	Australia	Pacific	AIM	£44.47
96.	21/07/2011	TOMCO ENERGY PLC	Isle of Man	Europe	AIM	£0.95
97.	26/09/1973	TOTAL S.A.	France	Europe	MAIN MARKET	£104,029.45
98.	26/06/2017	TOUCHSTONE EXPLORATION INC	Canada	North America	AIM	£15.61
99.	17/01/2006	TOWER RESOURCES PLC	United Kingdom	Europe	AIM	£3.27
100	14/02/2013	TRINITY EXPLORATION & PRODUCTION PLC	United Kingdom	Europe	AIM	£45.89
101	18/12/2000	TULLOW OIL PLC	United Kingdom	Europe	MAIN MARKET	£2,769.67
102	30/07/2013	UNION JACK OIL PLC	United Kingdom	Europe	AIM	£4.98
103	10/11/2015	UNITED OIL & GAS PLC	United Kingdom	Europe	MAIN MARKET	£12.77
104	09/08/2005	URALS ENERGY PUBLIC COMPANY LIMITED	Cyprus	Europe	AIM	£12.31
105	27/07/2004	VICTORIA OIL & GAS PLC	United Kingdom	Europe	AIM	£54.03
106	25/04/2007	VOLGA GAS PLC	United Kingdom	Europe	AIM	£48.07
107	25/10/2011	WENTWORTH RESOURCES LIMITED	Canada	North America	AIM	£52.22
108	02/10/1995	WESTMOUNT ENERGY LIMITED	Jersey	Europe	AIM	£3.57
109	11/07/2013	XPLORER PLC	United Kingdom	Europe	MAIN MARKET	£1.70
110	11/01/2017	ZENITH ENERGY LTD.	Canada	North America	MAIN MARKET	£13.05
111	18/05/2004	ZOLTAV RESOURCES INC	Cayman Islands	North America	AIM	£35.49

Appendix 4: List of sampled oil and gas companies

Number	Name of company
1	AMINEX PLC
2	ASCENT RESOURCES PLC
3	BARON OIL PLC
4	BP PLC
5	CABOT ENERGY PLC
6	CAIRN ENERGY PLC
7	CASPIAN SUNRISE PLC
8	COLUMBUS ENERGY RESOURCES PLC
9	DIVERSIFIED GAS & OIL PLC
10	EGDON RESOURCES PLC
11	ELAND OIL & GAS PLC
12	EMPYREAN ENERGY PLC
13	ENQUEST PLC
14	EUROPA OIL & GAS HOLDINGS PLC
15	EXILLON ENERGY PLC
16	G3 EXPLORATION LTD
17	GENEL ENERGY PLC
18	GULF KEYSTONE PETROLEUM LIMITED
19	GULFSANDS PETROLEUM PLC
20	HARDY OIL AND GAS PLC
21	HURRICANE ENERGY PLC
22	IGAS ENERGY PLC
23	INDEPENDENT OIL & GAS PLC
24	INDUS GAS LIMITED
25	JKX OIL & GAS PLC
26	KOSMOS ENERGY LIMITED
27	LEKOIL LTD
28	NOSTRA TERRA OIL & GAS COMPANY PLC
29	NOSTRUM OIL & GAS PLC
30	OILEX LIMITED
31	OPHIR ENERGY PLC
32	PARKMEAD GROUP PLC (THE)
33	PHOENIX GLOBAL RESOURCES PLC
34	PREMIER OIL PLC
35	PRESIDENT ENERGY PLC
36	PROVIDENCE RESOURCES PLC
37	RANGE RESOURCES LIMITED
38	REGAL PETROLEUM PLC
39	ROCKHOPPER EXPLORATION PLC

Number	Name of company
40	ROYAL DUTCH SHELL PLC
41	SEPLAT PETROLEUM DEVELOPMENT COMPANY PLC
42	SERICA ENERGY PLC
43	SOCO INTERNATIONAL PLC
44	SOUND OIL PLC
45	STERLING ENERGY PLC
46	TLOU ENERGY LTD
47	TOTAL SA
48	TOUCHSTONE EXPLORATION INC
49	TRINITY EXPLORATION & PRODUCTION PLC
50	TULLOW OIL PLC
51	VICTORIA OIL & GAS
52	ZOLTAV RESOURCES INCORPORATED

Appendix 5: Unit Root tests at levels (individual intercept and trend)

1- ROA

Panel unit root test: Summary
Series: ROA
Date: 05/10/19 Time: 22:54
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-25.0302	0.0000	53	339
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.48627	0.0000	52	336
ADF - Fisher Chi-square	216.957	0.0000	53	339
PP - Fisher Chi-square	244.247	0.0000	53	347

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

2- ROE

Panel unit root test: Summary
Series: ROE
Date: 05/10/19 Time: 22:56
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-219.029	0.0000	51	324
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-31.0535	0.0000	51	324
ADF - Fisher Chi-square	204.131	0.0000	51	324
PP - Fisher Chi-square	212.681	0.0000	51	335

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

3- OCF

Panel unit root test: Summary
Series: OCF
Date: 05/10/19 Time: 22:56
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-269.602	0.0000	54	344
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-38.5863	0.0000	54	344
ADF - Fisher Chi-square	233.586	0.0000	54	344
PP - Fisher Chi-square	155.421	0.0019	54	368

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

4- Tobin's Q

Panel unit root test: Summary
Series: TOBIN'S_Q
Date: 05/10/19 Time: 22:57
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-43.5131	0.0000	54	354
Null: Unit root (assumes individual unit root process)				

Im, Pesaran and Shin W-stat	-8.18070	0.0000	54	354
ADF - Fisher Chi-square	206.711	0.0000	54	354
PP - Fisher Chi-square	260.648	0.0000	54	369

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

5- EBITDA

Panel unit root test: Summary
Series: EBITDA
Date: 05/10/19 Time: 22:58
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-21.6971	0.0000	54	357
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.21484	0.0000	54	357
ADF - Fisher Chi-square	248.091	0.0000	54	357
PP - Fisher Chi-square	247.613	0.0000	54	378

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

6- PROFITS

Panel unit root test: Summary
Series: PROFITS
Date: 05/10/19 Time: 22:58
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs

Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-12.1827	0.0000	53	338
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.34416	0.0000	52	335
ADF - Fisher Chi-square	191.024	0.0000	53	338
PP - Fisher Chi-square	212.328	0.0000	53	349

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

7- P/E ratio

Panel unit root test: Summary
Series: P_E_RATIO
Date: 05/10/19 Time: 22:58
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-34.6194	0.0000	15	67
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-13.0272	0.0000	10	52
ADF - Fisher Chi-square	74.9160	0.0000	15	67
PP - Fisher Chi-square	107.763	0.0000	15	68

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

8- MV

Panel unit root test: Summary
Series: MARKET_VALUE___M_
Date: 05/10/19 Time: 22:59
Sample: 2010 2017
Exogenous variables: Individual effects

Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-17.9736	0.0000	43	268
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-7.08968	0.0000	41	262
ADF - Fisher Chi-square	179.178	0.0000	43	268
PP - Fisher Chi-square	137.619	0.0003	43	282

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

9- Leverage

Panel unit root test: Summary
Series: LEVERAGE
Date: 05/10/19 Time: 22:59
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6.07638	0.0000	54	353
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.93767	0.0017	54	353
ADF - Fisher Chi-square	168.157	0.0002	54	353
PP - Fisher Chi-square	268.007	0.0000	54	371

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

10- Size

Panel unit root test: Summary
Series: SIZE
Date: 05/10/19 Time: 23:00
Sample: 2010 2017
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.71065	0.0001	54	352
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.97840	0.8361	54	352
ADF - Fisher Chi-square	131.282	0.0633	54	352
PP - Fisher Chi-square	123.244	0.1499	54	369

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Appendix 6 : Unit Root tests at levels (individual intercept and trend)
1- ROA

Panel unit root test: Summary
Series: ROA
Date: 05/10/19 Time: 23:58
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-23.8575	0.0000	52	344
Breitung t-stat	-0.53312	0.2970	52	292
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.39681	0.0083	52	344
ADF - Fisher Chi-square	177.347	0.0000	52	344
PP - Fisher Chi-square	303.809	0.0000	52	344

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

2- ROE

Panel unit root test: Summary
Series: ROE
Date: 05/10/19 Time: 23:59
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-151.803	0.0000	52	337
Breitung t-stat	2.3E-14	0.5000	52	285
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-9.38951	0.0000	51	335
ADF - Fisher Chi-square	170.245	0.0000	51	335

PP - Fisher Chi-square	262.365	0.0000	51	335

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

3- OCF

Panel unit root test: Summary
Series: OCF
Date: 05/10/19 Time: 23:59
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-11.0675	0.0000	54	368
Breitung t-stat	2.12215	0.9831	54	314
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.78458	0.7836	54	368
ADF - Fisher Chi-square	100.053	0.6946	54	368
PP - Fisher Chi-square	188.854	0.0000	54	368

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

4- TOBIN'S_Q

Panel unit root test: Summary
Series: TOBIN'S_Q
Date: 05/11/19 Time: 00:00
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				

Levin, Lin & Chu t*	-42.1975	0.0000	54	369
Breitung t-stat	3.50679	0.9998	54	315
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.69271	0.0035	54	369
ADF - Fisher Chi-square	180.792	0.0000	54	369
PP - Fisher Chi-square	275.134	0.0000	54	369

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

5- EBITDA

Panel unit root test: Summary
Series: EBITDA
Date: 05/11/19 Time: 00:00
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-17.2595	0.0000	54	378
Breitung t-stat	-1.37221	0.0850	54	324
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.16019	0.1230	54	378
ADF - Fisher Chi-square	156.791	0.0015	54	378
PP - Fisher Chi-square	269.013	0.0000	54	378

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

6- PROFITS

Panel unit root test: Summary
Series: PROFITS
Date: 05/11/19 Time: 00:00
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-16.8993	0.0000	52	346
Breitung t-stat	-0.50465	0.3069	52	294
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.74215	0.2290	52	346
ADF - Fisher Chi-square	141.318	0.0088	52	346
PP - Fisher Chi-square	261.223	0.0000	52	346

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

7- P_E_RATIO

Panel unit root test: Summary
Series: P_E_RATIO
Date: 05/11/19 Time: 00:00
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Cross-

Method	Statistic	Prob.**	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	10.9547	1.0000	12	57
Breitung t-stat	9.0E-15	0.5000	12	45
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.35342	0.6381	10	53
ADF - Fisher Chi-square	14.1028	0.8252	10	53
PP - Fisher Chi-square	23.0497	0.2864	10	53

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

8- MARKET_VALUE___M_

Panel unit root test: Summary
Series: MARKET_VALUE___M_
Date: 05/11/19 Time: 00:01
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-42.0226	0.0000	41	276
Breitung t-stat	1.39729	0.9188	41	235
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.72542	0.0422	41	276
ADF - Fisher Chi-square	110.575	0.0194	41	276
PP - Fisher Chi-square	165.555	0.0000	41	276

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

9- Leverage

Panel unit root test: Summary
Series: LEVERAGE
Date: 05/11/19 Time: 00:01
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-31.1475	0.0000	54	371
Breitung t-stat	-0.44281	0.3290	54	317
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.94867	0.0257	54	371
ADF - Fisher Chi-square	178.722	0.0000	54	371
PP - Fisher Chi-square	291.444	0.0000	54	371

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

10- Size

Panel unit root test: Summary
Series: SIZE
Date: 05/11/19 Time: 00:01
Sample: 2010 2017
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-12.3933	0.0000	54	369
Breitung t-stat	3.25652	0.9994	54	315

Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.17551	0.5697	54	369
ADF - Fisher Chi-square	134.002	0.0456	54	369
PP - Fisher Chi-square	219.812	0.0000	54	369

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Appendix 7: Trends in the levels of disclosure

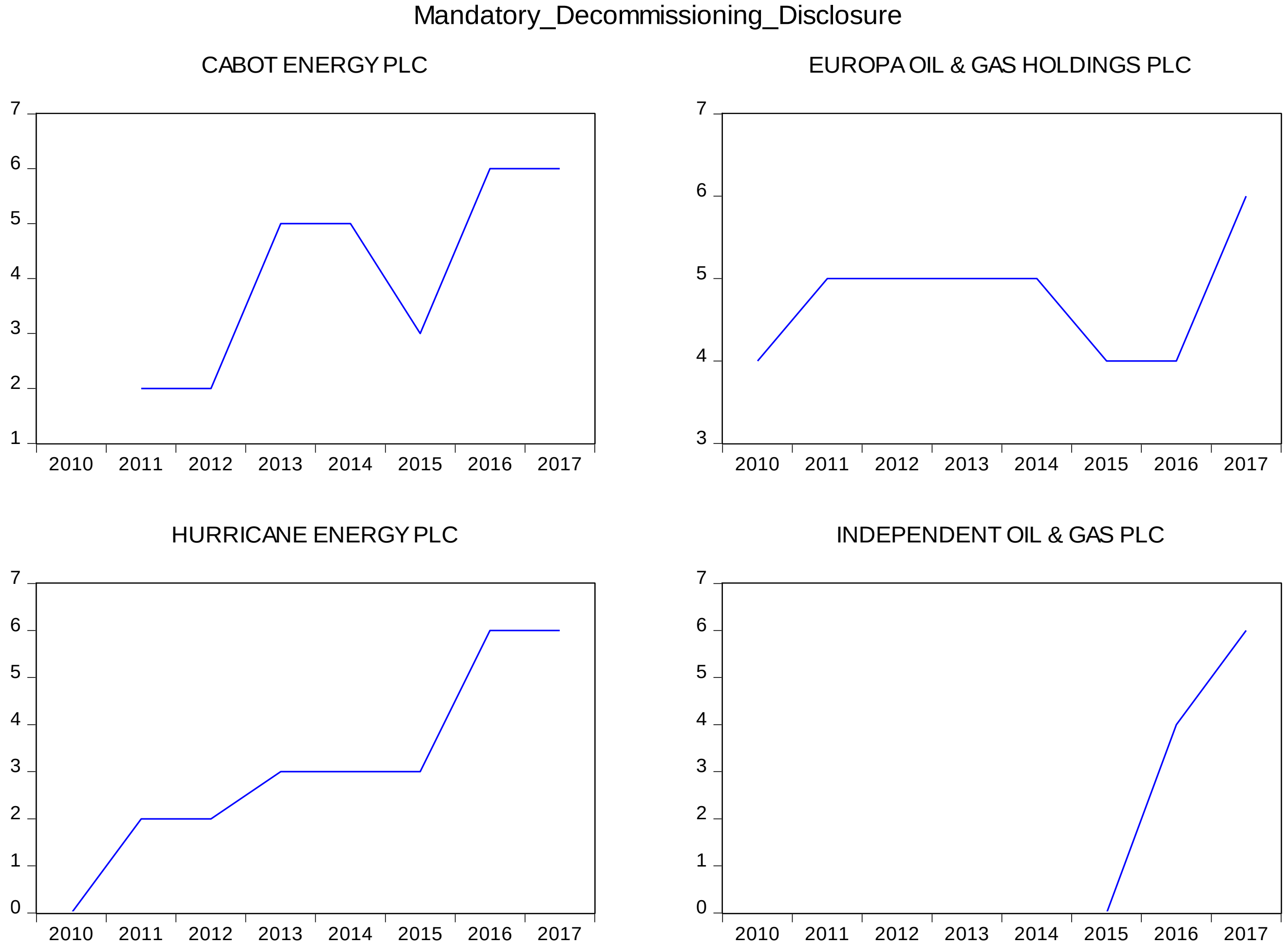

Figure A: Mandatory Decommissioning Disclosure

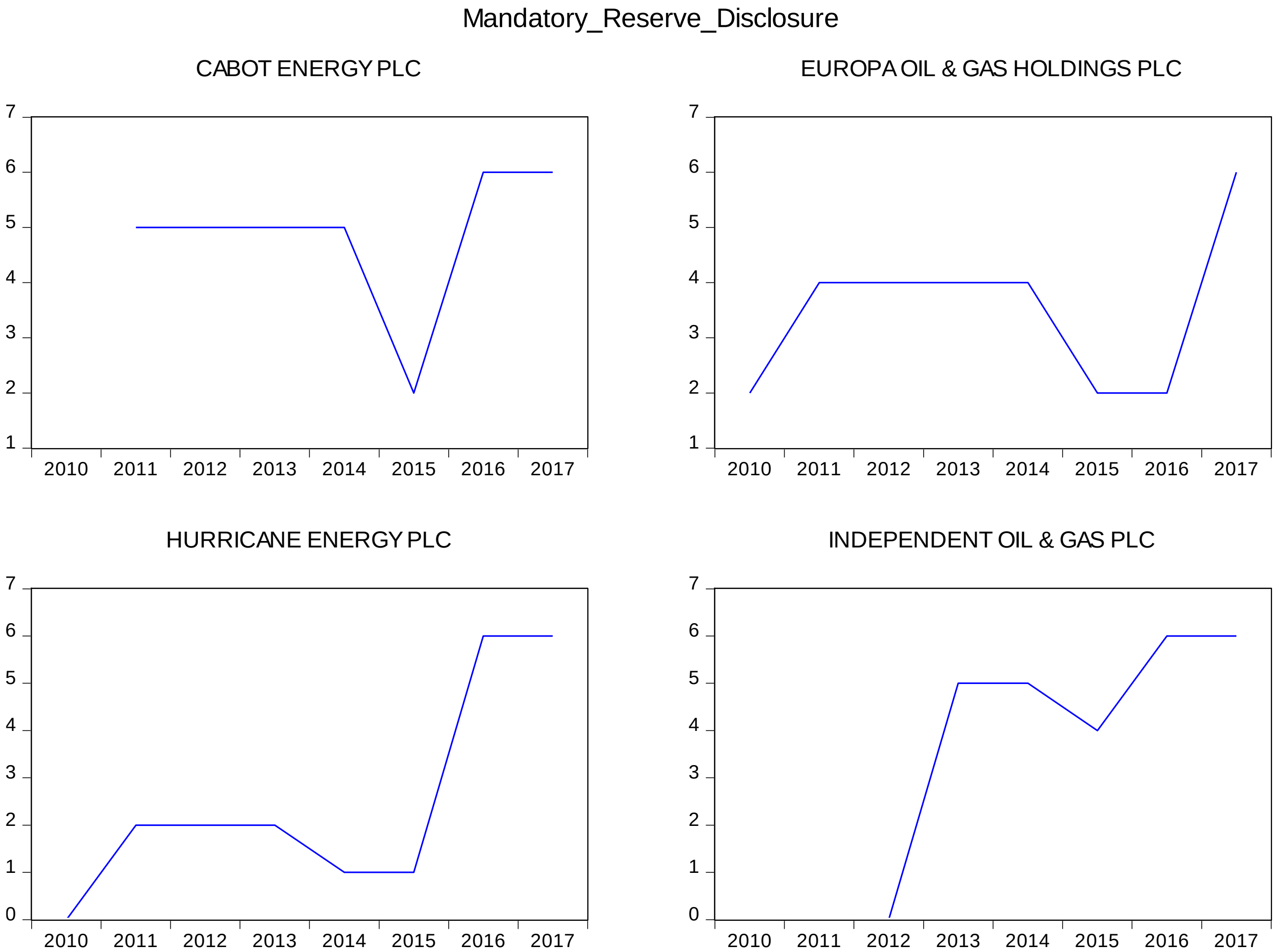

Figure B: Mandatory Reserve Disclosure

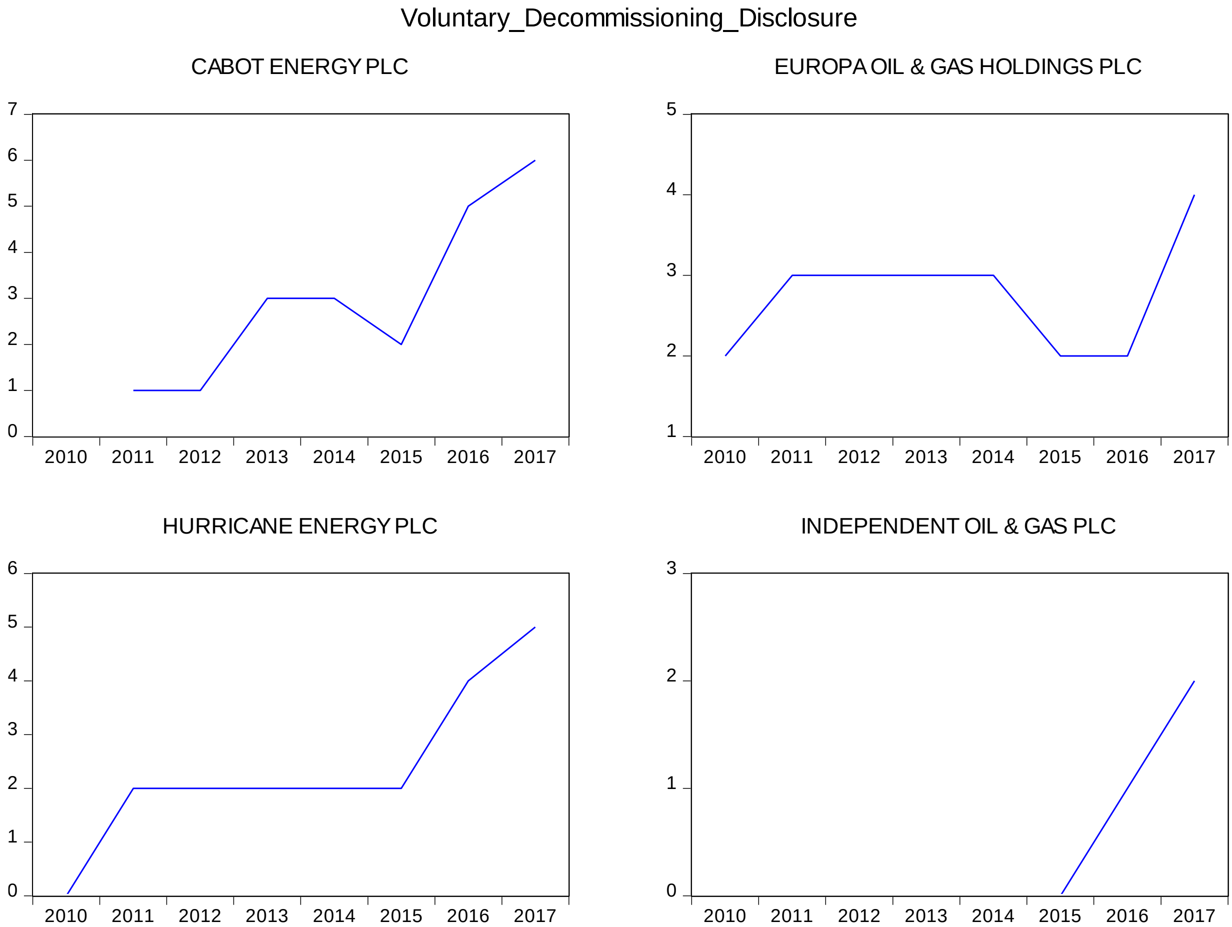

Figure C: Voluntary Decommissioning Disclosure

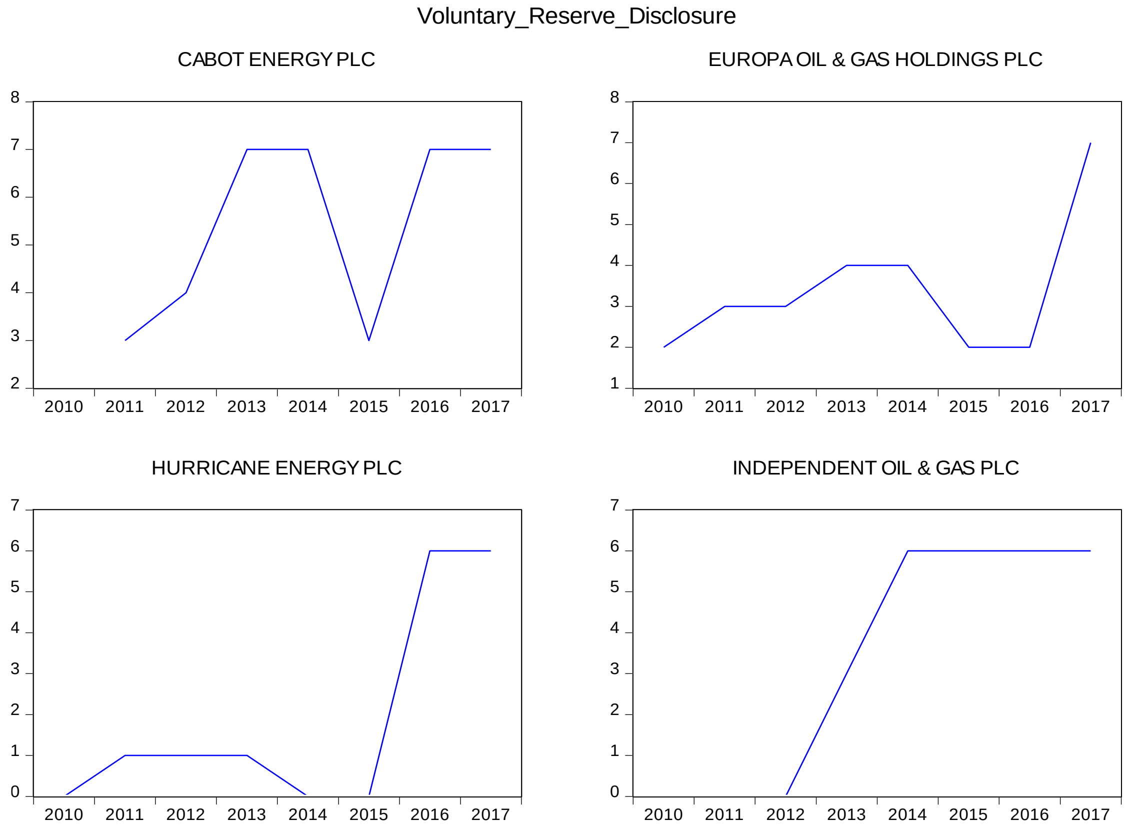

Figure D: Voluntary Reserve Disclosure

Appendix 8: Regression models

Model 1: Impact of disclosure levels on value and performance without control variables

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 19:20
Sample: 2010 2017
Periods included: 8
Cross-sections included: 52
Total panel (unbalanced) observations: 390

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21.31592	3.174257	-6.715245	0.0000
Mandatory_decommissioning_disclosure	0.300973	1.331085	0.226111	0.8212
Voluntary_decommissioning_disclosure	2.632131	1.308943	2.010883	0.0450
Mandatory_reserve_disclosure	2.411368	1.593404	1.513344	0.1310
Voluntary_reserve_disclosure	-1.302910	1.464099	-0.889906	0.3741

R-squared	0.060885	Mean dependent var	-8.978313
Adjusted R-squared	0.051128	S.D. dependent var	29.36487
S.E. of regression	28.60434	Akaike info criterion	9.557731
Sum squared resid	315010.1	Schwarz criterion	9.608579
Log likelihood	-1858.758	Hannan-Quinn criter.	9.577888
F-statistic	6.240154	Durbin-Watson stat	1.417401
Prob(F-statistic)	0.000071		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:39
Sample: 2010 2017
Periods included: 8
Cross-sections included: 52
Total panel (unbalanced) observations: 383

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-29.79778	18.98876	-1.569233	0.1174
Mandatory_decommissioning_disclosure	2.949611	7.807356	0.377799	0.7058
Voluntary_decommissioning_disclosure	7.673403	7.661333	1.001576	0.3172
Mandatory_reserve_disclosure	-14.39919	9.345289	-1.540797	0.1242
Voluntary_reserve_disclosure	9.795856	8.556139	1.144892	0.2530

R-squared	0.017763	Mean dependent var	-18.98131
Adjusted R-squared	0.007369	S.D. dependent var	167.2069
S.E. of regression	166.5897	Akaike info criterion	13.08191

Sum squared resid	10490299	Schwarz criterion	13.13345
Log likelihood	-2500.186	Hannan-Quinn criter.	13.10236
F-statistic	1.708990	Durbin-Watson stat	1.050186
Prob(F-statistic)	0.147254		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:00
Sample: 2010 2017
Periods included: 8
Cross-sections included: 52
Total panel (unbalanced) observations: 402

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.364129	0.373416	-0.975130	0.3301
Mandatory_decommissioning_disclosure	-0.166773	0.156998	-1.062264	0.2888
Voluntary_decommissioning_disclosure	0.485474	0.154950	3.133097	0.0019
Mandatory_reserve_disclosure	-0.679685	0.189369	-3.589212	0.0004
Voluntary_reserve_disclosure	0.923998	0.172132	5.367960	0.0000

R-squared	0.187537	Mean dependent var	1.266020
Adjusted R-squared	0.179351	S.D. dependent var	3.793543
S.E. of regression	3.436559	Akaike info criterion	5.319178
Sum squared resid	4688.544	Schwarz criterion	5.368885
Log likelihood	-1064.155	Hannan-Quinn criter.	5.338859
F-statistic	22.90940	Durbin-Watson stat	0.547281
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN’S_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:15
Sample: 2010 2017
Periods included: 8
Cross-sections included: 52
Total panel (unbalanced) observations: 403

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	23.84527	3.641089	6.548938	0.0000
Mandatory_decommissioning_disclosure	-0.036486	1.539591	-0.023698	0.9811
Voluntary_decommissioning_disclosure	-0.885006	1.519768	-0.582330	0.5607
Mandatory_reserve_disclosure	-4.218489	1.855525	-2.273474	0.0235
Voluntary_reserve_disclosure	1.212772	1.688018	0.718459	0.4729

R-squared	0.053084	Mean dependent var	8.879935
Adjusted R-squared	0.043567	S.D. dependent var	34.46543
S.E. of regression	33.70628	Akaike info criterion	9.885575
Sum squared resid	452173.2	Schwarz criterion	9.935189
Log likelihood	-1986.943	Hannan-Quinn criter.	9.905217

F-statistic	5.577962	Durbin-Watson stat	1.101724
Prob(F-statistic)	0.000223		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:21
Sample: 2010 2017
Periods included: 8
Cross-sections included: 52
Total panel (unbalanced) observations: 408

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1017.173	1007.254	1.009848	0.3132
Mandatory_decommissioning_disclosure	-278.4700	432.5794	-0.643743	0.5201
Voluntary_decommissioning_disclosure	740.7041	426.7864	1.735538	0.0834
Mandatory_reserve_disclosure	-1678.949	514.7418	-3.261731	0.0012
Voluntary_reserve_disclosure	1808.703	469.8523	3.849514	0.0001

R-squared	0.068694	Mean dependent var	2366.500
Adjusted R-squared	0.059450	S.D. dependent var	9784.471
S.E. of regression	9489.169	Akaike info criterion	21.16587
Sum squared resid	3.63E+10	Schwarz criterion	21.21503
Log likelihood	-4312.837	Hannan-Quinn criter.	21.18532
F-statistic	7.431433	Durbin-Watson stat	0.464651
Prob(F-statistic)	0.000009		

Dependent Variable: PROFITS
Method: Panel Least Squares
Date: 05/16/19 Time: 20:52
Sample: 2010 2017
Periods included: 8
Cross-sections included: 51
Total panel (unbalanced) observations: 384

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	986.0154	710.6191	1.387544	0.1661
Mandatory_decommissioning_disclosure	-44.21425	302.1011	-0.146356	0.8837
Voluntary_decommissioning_disclosure	391.8096	298.9276	1.310718	0.1907
Mandatory_reserve_disclosure	-637.0067	352.3670	-1.807793	0.0714
Voluntary_reserve_disclosure	431.0762	318.8944	1.351784	0.1773

R-squared	0.016997	Mean dependent var	966.8547
Adjusted R-squared	0.006623	S.D. dependent var	6314.102
S.E. of regression	6293.159	Akaike info criterion	20.34525
Sum squared resid	1.50E+10	Schwarz criterion	20.39669
Log likelihood	-3901.288	Hannan-Quinn criter.	20.36565

F-statistic	1.638335	Durbin-Watson stat	0.884393
Prob(F-statistic)	0.163884		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:18
Sample: 2010 2017
Periods included: 8
Cross-sections included: 40
Total panel (unbalanced) observations: 123

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	174.4078	54.00881	3.229246	0.0016
Mandatory_decommissioning_disclosure	33.25337	15.82878	2.100817	0.0378
Voluntary_decommissioning_disclosure	-15.43929	13.49496	-1.144079	0.2549
Mandatory_reserve_disclosure	-32.31721	20.52591	-1.574459	0.1181
Voluntary_reserve_disclosure	-9.520648	17.65853	-0.539153	0.5908

R-squared	0.091339	Mean dependent var	65.79146
Adjusted R-squared	0.060537	S.D. dependent var	207.4726
S.E. of regression	201.0947	Akaike info criterion	13.48523
Sum squared resid	4771809.	Schwarz criterion	13.59955
Log likelihood	-824.3416	Hannan-Quinn criter.	13.53166
F-statistic	2.965354	Durbin-Watson stat	0.511876
Prob(F-statistic)	0.022446		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 21:04
Sample: 2010 2017
Periods included: 8
Cross-sections included: 47
Total panel (unbalanced) observations: 324

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.661499	0.331540	17.07637	0.0000
Mandatory_decommissioning_disclosure	0.302884	0.123723	2.448095	0.0149
Voluntary_decommissioning_disclosure	0.162367	0.110845	1.464814	0.1440
Mandatory_reserve_disclosure	-0.517964	0.145250	-3.566024	0.0004
Voluntary_reserve_disclosure	0.220508	0.133885	1.646995	0.1005

R-squared	0.093173	Mean dependent var	5.983056
Adjusted R-squared	0.081802	S.D. dependent var	2.531314
S.E. of regression	2.425572	Akaike info criterion	4.625323
Sum squared resid	1876.804	Schwarz criterion	4.683668
Log likelihood	-744.3024	Hannan-Quinn criter.	4.648611
F-statistic	8.194019	Durbin-Watson stat	0.263135
Prob(F-statistic)	0.000003		

Model 2: Impact of disclosure levels on value and performance while controlling for Govern

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 19:19
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 339

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-15.32894	2.584225	-5.931735	0.0000
Mandatory_decommissioning_disclosure	0.084082	0.930274	0.090384	0.9280
Voluntary_decommissioning_disclosure	2.661341	0.894757	2.974372	0.0032
Mandatory_reserve_disclosure	1.537862	1.123596	1.368697	0.1720
Voluntary_reserve_disclosure	-1.086114	1.018124	-1.066779	0.2868
Govern	-2.766052	2.113735	-1.308608	0.1916

R-squared	0.084565	Mean dependent var	-7.328803
Adjusted R-squared	0.070820	S.D. dependent var	19.69957
S.E. of regression	18.98920	Akaike info criterion	8.743158
Sum squared resid	120076.3	Schwarz criterion	8.810875
Log likelihood	-1475.965	Hannan-Quinn criter.	8.770143
F-statistic	6.152323	Durbin-Watson stat	1.237077
Prob(F-statistic)	0.000018		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:41
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 335

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21.83652	23.88931	-0.914071	0.3613
Mandatory_decommissioning_disclosure	3.635427	8.543757	0.425507	0.6707
Voluntary_decommissioning_disclosure	6.813823	8.194947	0.831466	0.4063
Mandatory_reserve_disclosure	-17.48243	10.35480	-1.688341	0.0923
Voluntary_reserve_disclosure	11.53233	9.354099	1.232863	0.2185
Govern	-2.086606	19.49742	-0.107020	0.9148

R-squared	0.018169	Mean dependent var	-16.33667

Adjusted R-squared	0.003247	S.D. dependent var	174.0979
S.E. of regression	173.8150	Akaike info criterion	13.17161
Sum squared resid	9939633.	Schwarz criterion	13.23992
Log likelihood	-2200.244	Hannan-Quinn criter.	13.19884
F-statistic	1.217622	Durbin-Watson stat	1.043823
Prob(F-statistic)	0.300436		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:02
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.398027	0.460071	0.865143	0.3876
Mandatory_decommissioning_disclosure	-0.244098	0.168489	-1.448745	0.1483
Voluntary_decommissioning_disclosure	0.553312	0.161246	3.431487	0.0007
Mandatory_reserve_disclosure	-0.607858	0.203247	-2.990734	0.0030
Voluntary_reserve_disclosure	0.894047	0.183416	4.874416	0.0000
Govern	-1.687706	0.381078	-4.428768	0.0000

R-squared	0.237506	Mean dependent var	1.417765
Adjusted R-squared	0.226391	S.D. dependent var	3.951509
S.E. of regression	3.475551	Akaike info criterion	5.346425
Sum squared resid	4143.252	Schwarz criterion	5.412702
Log likelihood	-926.9512	Hannan-Quinn criter.	5.372809
F-statistic	21.36796	Durbin-Watson stat	0.563509
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:14
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.05545	2.863996	5.256800	0.0000
Mandatory_decommissioning_disclosure	0.354894	1.048865	0.338360	0.7353
Voluntary_decommissioning_disclosure	-0.954275	1.003772	-0.950689	0.3424
Mandatory_reserve_disclosure	-2.602123	1.265236	-2.056631	0.0405
Voluntary_reserve_disclosure	0.791244	1.141787	0.692987	0.4888
Govern	1.911421	2.372253	0.805741	0.4210

R-squared	0.044256	Mean dependent var	6.980306

Adjusted R-squared	0.030324	S.D. dependent var	21.97138
S.E. of regression	21.63569	Akaike info criterion	9.003608
Sum squared resid	160559.4	Schwarz criterion	9.069885
Log likelihood	-1565.130	Hannan-Quinn criter.	9.029991
F-statistic	3.176537	Durbin-Watson stat	0.838625
Prob(F-statistic)	0.008106		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:23
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 353

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3307.601	1292.199	2.559669	0.0109
Mandatory_decommissioning_disclosure	-355.8760	478.7695	-0.743314	0.4578
Voluntary_decommissioning_disclosure	976.9399	458.3595	2.131384	0.0338
Mandatory_reserve_disclosure	-1538.714	570.4801	-2.697227	0.0073
Voluntary_reserve_disclosure	1608.087	516.9954	3.110447	0.0020
Govern	-4702.643	1079.978	-4.354387	0.0000

R-squared	0.118897	Mean dependent var	2738.038
Adjusted R-squared	0.106201	S.D. dependent var	10472.07
S.E. of regression	9900.395	Akaike info criterion	21.25539
Sum squared resid	3.40E+10	Schwarz criterion	21.32111
Log likelihood	-3745.576	Hannan-Quinn criter.	21.28154
F-statistic	9.364951	Durbin-Watson stat	0.489739
Prob(F-statistic)	0.000000		

Dependent Variable: PROFITS
Method: Panel Least Squares
Date: 05/16/19 Time: 20:52
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 334

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2090.897	900.0576	2.323071	0.0208
Mandatory_decommissioning_disclosure	-18.81421	340.7795	-0.055209	0.9560
Voluntary_decommissioning_disclosure	480.9107	325.8545	1.475845	0.1409
Mandatory_reserve_disclosure	-593.9335	396.0733	-1.499554	0.1347
Voluntary_reserve_disclosure	304.1476	357.0600	0.851811	0.3949
Govern	-2186.628	747.4063	-2.925621	0.0037

R-squared	0.042055	Mean dependent var	1117.082
Adjusted R-squared	0.027452	S.D. dependent var	6758.381
S.E. of regression	6664.971	Akaike info criterion	20.46492
Sum squared resid	1.46E+10	Schwarz criterion	20.53338
Log likelihood	-3411.642	Hannan-Quinn criter.	20.49222
F-statistic	2.879903	Durbin-Watson stat	0.908551
Prob(F-statistic)	0.014645		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:18
Sample: 2010 2017
Periods included: 8
Cross-sections included: 35
Total panel (unbalanced) observations: 109

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	171.1314	63.91147	2.677633	0.0086
Mandatory_decommissioning_disclosure	29.26626	17.06114	1.715375	0.0893
Voluntary_decommissioning_disclosure	-17.72282	14.62987	-1.211413	0.2285
Mandatory_reserve_disclosure	-41.26755	22.49430	-1.834578	0.0695
Voluntary_reserve_disclosure	0.758979	19.91372	0.038113	0.9697
Govern	80.64953	45.93762	1.755631	0.0821

R-squared	0.129086	Mean dependent var	71.28046
Adjusted R-squared	0.086809	S.D. dependent var	219.8097
S.E. of regression	210.0525	Akaike info criterion	13.58606
Sum squared resid	4544570.	Schwarz criterion	13.73421
Log likelihood	-734.4405	Hannan-Quinn criter.	13.64614
F-statistic	3.053313	Durbin-Watson stat	0.533048
Prob(F-statistic)	0.013045		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 21:03
Sample: 2010 2017
Periods included: 8
Cross-sections included: 41
Total panel (unbalanced) observations: 285

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.874075	0.410138	14.32218	0.0000
Mandatory_decommissioning_disclosure	0.310053	0.135854	2.282255	0.0232
Voluntary_decommissioning_disclosure	0.170641	0.116743	1.461683	0.1450
Mandatory_reserve_disclosure	-0.553613	0.156310	-3.541759	0.0005
Voluntary_reserve_disclosure	0.212077	0.146154	1.451052	0.1479
Govern	-0.024116	0.299759	-0.080450	0.9359

R-squared	0.093803	Mean dependent var	6.072070
Adjusted R-squared	0.077562	S.D. dependent var	2.576644
S.E. of regression	2.474702	Akaike info criterion	4.670945
Sum squared resid	1708.638	Schwarz criterion	4.747840
Log likelihood	-659.6097	Hannan-Quinn criter.	4.701770
F-statistic	5.775981	Durbin-Watson stat	0.230138
Prob(F-statistic)	0.000043		

Model 3: Impact of disclosure levels on value and performance while controlling for Govern and Leverage.

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 19:17
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 339

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-14.06458	2.887250	-4.871272	0.0000
Mandatory_decommissioning_disclosure	0.028370	0.932051	0.030438	0.9757
Voluntary_decommissioning_disclosure	2.711172	0.896242	3.025044	0.0027
Mandatory_reserve_disclosure	1.355193	1.138944	1.189868	0.2349
Voluntary_reserve_disclosure	-0.917155	1.032610	-0.888192	0.3751
Govern	-2.961874	2.123230	-1.394985	0.1640
Leverage	-18.34091	18.67449	-0.982137	0.3267

R-squared	0.087217	Mean dependent var	-7.328803
Adjusted R-squared	0.070721	S.D. dependent var	19.69957
S.E. of regression	18.99021	Akaike info criterion	8.746157
Sum squared resid	119728.5	Schwarz criterion	8.825160
Log likelihood	-1475.474	Hannan-Quinn criter.	8.777639
F-statistic	5.287156	Durbin-Watson stat	1.235614
Prob(F-statistic)	0.000032		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:42
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 335

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	5.097331	26.42544	0.192895	0.8472
Mandatory_decommissioning_disclosure	2.488767	8.501983	0.292728	0.7699
Voluntary_decommissioning_disclosure	7.876602	8.153964	0.965984	0.3348
Mandatory_reserve_disclosure	-21.36994	10.42259	-2.050348	0.0411
Voluntary_reserve_disclosure	15.15209	9.422953	1.607998	0.1088
Govern	-6.427735	19.45958	-0.330312	0.7414
Leverage	-395.0277	170.4646	-2.317360	0.0211

R-squared	0.033985	Mean dependent var	-16.33667
Adjusted R-squared	0.016314	S.D. dependent var	174.0979
S.E. of regression	172.6720	Akaike info criterion	13.16134
Sum squared resid	9779518.	Schwarz criterion	13.24104
Log likelihood	-2197.524	Hannan-Quinn criter.	13.19311
F-statistic	1.923189	Durbin-Watson stat	1.065450
Prob(F-statistic)	0.076512		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:06
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.401166	0.472620	-2.964679	0.0032
Mandatory_decommissioning_disclosure	-0.165606	0.154178	-1.074120	0.2835
Voluntary_decommissioning_disclosure	0.494390	0.147443	3.353083	0.0009
Mandatory_reserve_disclosure	-0.343971	0.188327	-1.826459	0.0687
Voluntary_reserve_disclosure	0.647622	0.170123	3.806795	0.0002
Govern	-1.395126	0.349829	-3.988021	0.0001
Leverage	25.77091	3.098597	8.316962	0.0000

R-squared	0.365781	Mean dependent var	1.417765
Adjusted R-squared	0.354655	S.D. dependent var	3.951509
S.E. of regression	3.174381	Akaike info criterion	5.167956
Sum squared resid	3446.229	Schwarz criterion	5.245278
Log likelihood	-894.8083	Hannan-Quinn criter.	5.198736
F-statistic	32.87437	Durbin-Watson stat	0.733627
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN'S_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:14
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	14.23737	3.224504	4.415368	0.0000
Mandatory_decommissioning_disclosure	0.390584	1.051898	0.371313	0.7106
Voluntary_decommissioning_disclosure	-0.981067	1.005949	-0.975265	0.3301
Mandatory_reserve_disclosure	-2.482136	1.284882	-1.931800	0.0542
Voluntary_reserve_disclosure	0.679196	1.160681	0.585170	0.5588
Govern	2.044455	2.386750	0.856585	0.3923
Leverage	11.71788	21.14053	0.554285	0.5797

R-squared	0.045114	Mean dependent var	6.980306
Adjusted R-squared	0.028361	S.D. dependent var	21.97138
S.E. of regression	21.65757	Akaike info criterion	9.008441
Sum squared resid	160415.3	Schwarz criterion	9.085763
Log likelihood	-1564.973	Hannan-Quinn criter.	9.039221
F-statistic	2.692973	Durbin-Watson stat	0.840968
Prob(F-statistic)	0.014415		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:24
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3781.781	1221.084	-3.097069	0.0021
Mandatory_decommissioning_disclosure	-33.60089	398.3422	-0.084352	0.9328
Voluntary_decommissioning_disclosure	735.4395	380.9416	1.930583	0.0544
Mandatory_reserve_disclosure	-535.1078	486.5706	-1.099754	0.2722
Voluntary_reserve_disclosure	660.3750	439.5370	1.502433	0.1339
Govern	-3590.506	903.8359	-3.972520	0.0001
Leverage	102249.4	8005.685	12.77210	0.0000

R-squared	0.403591	Mean dependent var	2769.420
Adjusted R-squared	0.393128	S.D. dependent var	10527.95
S.E. of regression	8201.483	Akaike info criterion	20.88187
Sum squared resid	2.30E+10	Schwarz criterion	20.95919
Log likelihood	-3636.886	Hannan-Quinn criter.	20.91265
F-statistic	38.57201	Durbin-Watson stat	0.781890
Prob(F-statistic)	0.000000		

Dependent Variable: PROFITS
Method: Panel Least Squares
Date: 05/16/19 Time: 20:51
Sample: 2010 2017

Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 334

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1866.315	889.9463	-2.097110	0.0368
Mandatory_decommissioning_disclosure	87.98293	300.3605	0.292924	0.7698
Voluntary_decommissioning_disclosure	406.7345	287.1162	1.416620	0.1575
Mandatory_reserve_disclosure	-24.04331	353.6922	-0.067978	0.9458
Voluntary_reserve_disclosure	-206.1935	318.7962	-0.646788	0.5182
Govern	-1581.661	661.2192	-2.392038	0.0173
Leverage	56813.63	5805.336	9.786450	0.0000

R-squared	0.259066	Mean dependent var	1117.082
Adjusted R-squared	0.245471	S.D. dependent var	6758.381
S.E. of regression	5870.576	Akaike info criterion	20.21403
Sum squared resid	1.13E+10	Schwarz criterion	20.29390
Log likelihood	-3368.743	Hannan-Quinn criter.	20.24588
F-statistic	19.05580	Durbin-Watson stat	1.190236
Prob(F-statistic)	0.000000		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:18
Sample: 2010 2017
Periods included: 8
Cross-sections included: 35
Total panel (unbalanced) observations: 109

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	190.3211	66.36180	2.867931	0.0050
Mandatory_decommissioning_disclosure	29.65119	17.05383	1.738682	0.0851
Voluntary_decommissioning_disclosure	-17.90432	14.62131	-1.224536	0.2236
Mandatory_reserve_disclosure	-45.24631	22.78783	-1.985548	0.0498
Voluntary_reserve_disclosure	6.646924	20.65412	0.321821	0.7482
Govern	70.11582	46.96065	1.493076	0.1385
Leverage	-423.9370	397.9903	-1.065194	0.2893

R-squared	0.138667	Mean dependent var	71.28046
Adjusted R-squared	0.088001	S.D. dependent var	219.8097
S.E. of regression	209.9153	Akaike info criterion	13.59335
Sum squared resid	4494573.	Schwarz criterion	13.76619
Log likelihood	-733.8376	Hannan-Quinn criter.	13.66344
F-statistic	2.736860	Durbin-Watson stat	0.548206
Prob(F-statistic)	0.016583		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 21:02
Sample: 2010 2017
Periods included: 8
Cross-sections included: 41
Total panel (unbalanced) observations: 283

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.615632	0.447844	12.53927	0.0000
Mandatory_decommissioning_disclosure	0.324055	0.136632	2.371733	0.0184
Voluntary_decommissioning_disclosure	0.157819	0.117636	1.341582	0.1808
Mandatory_reserve_disclosure	-0.527638	0.159475	-3.308586	0.0011
Voluntary_reserve_disclosure	0.185045	0.148875	1.242962	0.2149
Govern	0.029105	0.302878	0.096094	0.9235
Leverage	4.127074	2.917988	1.414356	0.1584

R-squared	0.099646	Mean dependent var	6.079505
Adjusted R-squared	0.080073	S.D. dependent var	2.584077
S.E. of regression	2.478462	Akaike info criterion	4.677577
Sum squared resid	1695.406	Schwarz criterion	4.767748
Log likelihood	-654.8772	Hannan-Quinn criter.	4.713733
F-statistic	5.090992	Durbin-Watson stat	0.232109
Prob(F-statistic)	0.000056		

Model 4: Impact of disclosure levels on value and performance while controlling for Govern, Leverage and Size log.

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 19:16
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 339

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-29.39159	3.220157	-9.127377	0.0000
Mandatory_decommissioning_disclosure	1.918477	0.880091	2.179862	0.0300
Voluntary_decommissioning_disclosure	1.058870	0.841306	1.258602	0.2091
Mandatory_reserve_disclosure	1.507430	1.038676	1.451300	0.1476
Voluntary_reserve_disclosure	-2.646815	0.964528	-2.744154	0.0064
Govern	0.291685	1.975616	0.147643	0.8827
Leverage	-47.66220	17.39337	-2.740251	0.0065
Size_log	3.315165	0.401084	8.265511	0.0000

R-squared	0.243384	Mean dependent var	-7.328803

Adjusted R-squared	0.227383	S.D. dependent var	19.69957
S.E. of regression	17.31565	Akaike info criterion	8.564415
Sum squared resid	99244.35	Schwarz criterion	8.654704
Log likelihood	-1443.668	Hannan-Quinn criter.	8.600395
F-statistic	15.21057	Durbin-Watson stat	1.397558
Prob(F-statistic)	0.000000		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:44
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 335

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-47.18154	31.86534	-1.480654	0.1397
Mandatory_decommissioning_disclosure	8.904750	8.702177	1.023278	0.3069
Voluntary_decommissioning_disclosure	2.220984	8.303058	0.267490	0.7893
Mandatory_reserve_disclosure	-20.89591	10.31094	-2.026577	0.0435
Voluntary_reserve_disclosure	9.212460	9.548035	0.964854	0.3353
Govern	4.986642	19.65564	0.253700	0.7999
Leverage	-493.1568	172.0519	-2.866326	0.0044
Size_log	11.37540	3.965606	2.868515	0.0044

R-squared	0.057696	Mean dependent var	-16.33667
Adjusted R-squared	0.037524	S.D. dependent var	174.0979
S.E. of regression	170.8002	Akaike info criterion	13.14246
Sum squared resid	9539474.	Schwarz criterion	13.23354
Log likelihood	-2193.361	Hannan-Quinn criter.	13.17877
F-statistic	2.860258	Durbin-Watson stat	1.095161
Prob(F-statistic)	0.006551		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:08
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.495784	0.502912	-8.939499	0.0000
MANDATORY_DECOMMISSIONING_DISCLOSURE	0.203207	0.138225	1.470112	0.1425
VOLUNTARY_DECOMMISSIONING_DISCLOSURE	0.177020	0.131393	1.347253	0.1788
MANDATORY_RESERVE_DISCLOSURE	-0.313513	0.163465	-1.917925	0.0560
VOLUNTARY_RESERVE_DISCLOSURE	0.306458	0.151087	2.028360	0.0433
GOVERN	-0.757204	0.309470	-2.446782	0.0149
LEVERAGE	19.56460	2.751724	7.109943	0.0000
SIZE_LOG	0.666957	0.062719	10.63408	0.0000

R-squared	0.523725	Mean dependent var	1.417765
Adjusted R-squared	0.513948	S.D. dependent var	3.951509
S.E. of regression	2.754889	Akaike info criterion	4.887287
Sum squared resid	2587.990	Schwarz criterion	4.975656
Log likelihood	-844.8316	Hannan-Quinn criter.	4.922465
F-statistic	53.56762	Durbin-Watson stat	0.848641
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:14
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.30180	3.918554	5.180941	0.0000
Mandatory_decommissioning_disclosure	-0.332167	1.077015	-0.308415	0.7580
Voluntary_decommissioning_disclosure	-0.359127	1.023779	-0.350785	0.7260
Mandatory_reserve_disclosure	-2.541824	1.273673	-1.995665	0.0468
Voluntary_reserve_disclosure	1.347764	1.177225	1.144865	0.2531
Govern	0.794339	2.411301	0.329424	0.7420
Leverage	23.88019	21.44068	1.113780	0.2662
Size_log	-1.307014	0.488688	-2.674539	0.0078

R-squared	0.064733	Mean dependent var	6.980306

Adjusted R-squared	0.045534	S.D. dependent var	21.97138
S.E. of regression	21.46534	Akaike info criterion	8.993412
Sum squared resid	157119.4	Schwarz criterion	9.081780
Log likelihood	-1561.350	Hannan-Quinn criter.	9.028589
F-statistic	3.371672	Durbin-Watson stat	0.849020
Prob(F-statistic)	0.001714		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:25
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13087.35	1220.567	-10.72235	0.0000
Mandatory_decommissioning_disclosure	1075.425	335.4728	3.205701	0.0015
Voluntary_decommissioning_disclosure	-218.8969	318.8908	-0.686432	0.4929
Mandatory_reserve_disclosure	-443.5193	396.7286	-1.117941	0.2644
Voluntary_reserve_disclosure	-365.5107	366.6866	-0.996793	0.3196
Govern	-1672.264	751.0816	-2.226474	0.0266
Leverage	83586.91	6678.427	12.51596	0.0000
Size_log	2005.549	152.2183	13.17548	0.0000

R-squared	0.604784	Mean dependent var	2769.420
Adjusted R-squared	0.596671	S.D. dependent var	10527.95
S.E. of regression	6686.108	Akaike info criterion	20.47611
Sum squared resid	1.52E+10	Schwarz criterion	20.56448
Log likelihood	-3565.081	Hannan-Quinn criter.	20.51128
F-statistic	74.54564	Durbin-Watson stat	1.070882
Prob(F-statistic)	0.000000		

Dependent Variable: PROFITS
Method: Panel Least Squares
Date: 05/16/19 Time: 20:50
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 334

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5286.146	1037.148	-5.096809	0.0000
Mandatory_decommissioning_disclosure	513.1521	296.0550	1.733300	0.0840
Voluntary_decommissioning_disclosure	37.93367	281.4353	0.134786	0.8929
Mandatory_reserve_disclosure	-0.301399	337.5813	-0.000893	0.9993
Voluntary_reserve_disclosure	-589.6553	311.4863	-1.893038	0.0592
Govern	-783.2269	646.1733	-1.212100	0.2264
Leverage	49059.45	5702.493	8.603159	0.0000
Size_log	747.6383	130.1266	5.745470	0.0000

R-squared	0.327194	Mean dependent var	1117.082
Adjusted R-squared	0.312747	S.D. dependent var	6758.381
S.E. of regression	5602.748	Akaike info criterion	20.12356
Sum squared resid	1.02E+10	Schwarz criterion	20.21485
Log likelihood	-3352.635	Hannan-Quinn criter.	20.15996
F-statistic	22.64823	Durbin-Watson stat	1.292423
Prob(F-statistic)	0.000000		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:18
Sample: 2010 2017
Periods included: 8
Cross-sections included: 35
Total panel (unbalanced) observations: 109

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	140.3455	95.04286	1.476655	0.1429
Mandatory_decommissioning_disclosure	34.63726	18.38553	1.883942	0.0624
Voluntary_decommissioning_disclosure	-21.20288	15.32409	-1.383630	0.1695
Mandatory_reserve_disclosure	-42.00971	23.25858	-1.806203	0.0739
Voluntary_reserve_disclosure	1.874145	21.69236	0.086397	0.9313
Govern	72.97972	47.22701	1.545296	0.1254
Leverage	-691.0641	539.2627	-1.281498	0.2030
Size_log	8.596791	11.67885	0.736099	0.4634

R-squared	0.143264	Mean dependent var	71.28046
Adjusted R-squared	0.083886	S.D. dependent var	219.8097
S.E. of regression	210.3884	Akaike info criterion	13.60635
Sum squared resid	4470589.	Schwarz criterion	13.80388
Log likelihood	-733.5460	Hannan-Quinn criter.	13.68645

F-statistic	2.412749	Durbin-Watson stat	0.565536
Prob(F-statistic)	0.025154		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 21:00
Sample: 2010 2017
Periods included: 8
Cross-sections included: 41
Total panel (unbalanced) observations: 283

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.483372	0.475514	7.325495	0.0000
Mandatory_decommissioning_disclosure	0.523206	0.124609	4.198786	0.0000
Voluntary_decommissioning_disclosure	-0.118690	0.110396	-1.075135	0.2833
Mandatory_reserve_disclosure	-0.557166	0.142788	-3.902039	0.0001
Voluntary_reserve_disclosure	0.049325	0.134246	0.367424	0.7136
Govern	0.516943	0.277346	1.863892	0.0634
Leverage	1.424794	2.631892	0.541357	0.5887
Size_log	0.481324	0.057739	8.336179	0.0000

R-squared	0.281268	Mean dependent var	6.079505
Adjusted R-squared	0.262973	S.D. dependent var	2.584077
S.E. of regression	2.218438	Akaike info criterion	4.459345
Sum squared resid	1353.404	Schwarz criterion	4.562397
Log likelihood	-622.9973	Hannan-Quinn criter.	4.500665
F-statistic	15.37401	Durbin-Watson stat	0.272329
Prob(F-statistic)	0.000000		

Model 5: Impact of disclosure levels on value and performance while controlling for Govern, Leverage, Size and Auditor.

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 19:14
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 339

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-30.57847	3.215148	-9.510748	0.0000
Mandatory_decommissioning_disclosure	2.100011	0.873486	2.404173	0.0168
Voluntary_decommissioning_disclosure	0.673598	0.843939	0.798160	0.4254
Mandatory_reserve_disclosure	1.697045	1.030268	1.647188	0.1005
Voluntary_reserve_disclosure	-2.859292	0.957659	-2.985710	0.0030
Govern	-0.035233	1.958873	-0.017986	0.9857
Leverage	-42.06508	17.33057	-2.427219	0.0157
Size_log	2.899830	0.423666	6.844613	0.0000
Auditor	6.169542	2.198192	2.806643	0.0053

R-squared	0.261023	Mean dependent var	-7.328803
Adjusted R-squared	0.243109	S.D. dependent var	19.69957
S.E. of regression	17.13852	Akaike info criterion	8.546725
Sum squared resid	96930.58	Schwarz criterion	8.648300
Log likelihood	-1439.670	Hannan-Quinn criter.	8.587202
F-statistic	14.57043	Durbin-Watson stat	1.444021
Prob(F-statistic)	0.000000		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:46
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 335

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-44.86161	32.17071	-1.394486	0.1641
Mandatory_decommissioning_disclosure	8.560176	8.733394	0.980166	0.3277
Voluntary_decommissioning_disclosure	2.983531	8.424204	0.354162	0.7234
Mandatory_reserve_disclosure	-21.27284	10.34408	-2.056524	0.0405
Voluntary_reserve_disclosure	9.657028	9.591514	1.006830	0.3148
Govern	5.558072	19.70325	0.282089	0.7781
Leverage	-504.5797	173.4546	-2.909001	0.0039
Size_log	12.18752	4.229926	2.881261	0.0042

Auditor	-12.28121	22.08563	-0.556072	0.5785

R-squared	0.058589	Mean dependent var	-16.33667
Adjusted R-squared	0.035487	S.D. dependent var	174.0979
S.E. of regression	170.9809	Akaike info criterion	13.14748
Sum squared resid	9530435.	Schwarz criterion	13.24995
Log likelihood	-2193.203	Hannan-Quinn criter.	13.18833
F-statistic	2.536091	Durbin-Watson stat	1.096377
Prob(F-statistic)	0.010870		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:10
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.801235	0.493435	-9.730220	0.0000
Mandatory_decommissioning_disclosure	0.244702	0.134676	1.816968	0.0701
Voluntary_decommissioning_disclosure	0.082083	0.129408	0.634293	0.5263
Mandatory_reserve_disclosure	-0.268245	0.159213	-1.684818	0.0929
Voluntary_reserve_disclosure	0.256980	0.147270	1.744957	0.0819
Govern	-0.833508	0.301299	-2.766383	0.0060
Leverage	20.89380	2.690740	7.765075	0.0000
Size_log	0.564575	0.064960	8.691084	0.0000
Auditor	1.541391	0.337528	4.566706	0.0000

R-squared	0.551251	Mean dependent var	1.417765
Adjusted R-squared	0.540692	S.D. dependent var	3.951509
S.E. of regression	2.678028	Akaike info criterion	4.833488
Sum squared resid	2438.423	Schwarz criterion	4.932902
Log likelihood	-834.4437	Hannan-Quinn criter.	4.873063
F-statistic	52.20763	Durbin-Watson stat	0.901805
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN'S_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:14
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45

Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	19.84068	3.956571	5.014615	0.0000
Mandatory_decommissioning_disclosure	-0.269526	1.079887	-0.249587	0.8031
Voluntary_decommissioning_disclosure	-0.502445	1.037648	-0.484216	0.6285
Mandatory_reserve_disclosure	-2.473486	1.276637	-1.937502	0.0535
Voluntary_reserve_disclosure	1.273072	1.180875	1.078075	0.2818
Govern	0.679150	2.415942	0.281112	0.7788
Leverage	25.88676	21.57548	1.199823	0.2310
Size_log	-1.461571	0.520878	-2.805974	0.0053
Auditor	2.326906	2.706441	0.859766	0.3905

R-squared	0.066762	Mean dependent var	6.980306
Adjusted R-squared	0.044803	S.D. dependent var	21.97138
S.E. of regression	21.47355	Akaike info criterion	8.996971
Sum squared resid	156778.5	Schwarz criterion	9.096385
Log likelihood	-1560.971	Hannan-Quinn criter.	9.036545
F-statistic	3.040356	Durbin-Watson stat	0.851327
Prob(F-statistic)	0.002575		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:27
Sample: 2010 2017
Periods included: 8
Cross-sections included: 45
Total panel (unbalanced) observations: 349

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13049.65	1233.655	-10.57804	0.0000
Mandatory_decommissioning_disclosure	1070.305	336.7079	3.178734	0.0016
Voluntary_decommissioning_disclosure	-207.1812	323.5376	-0.640362	0.5224
Mandatory_reserve_disclosure	-449.1056	398.0542	-1.128252	0.2600
Voluntary_reserve_disclosure	-359.4049	368.1958	-0.976124	0.3297
Govern	-1662.848	753.2884	-2.207452	0.0279
Leverage	83422.88	6727.215	12.40081	0.0000
Size_log	2018.184	162.4094	12.42652	0.0000
Auditor	-190.2157	843.8659	-0.225410	0.8218

R-squared	0.604843	Mean dependent var	2769.420
Adjusted R-squared	0.595545	S.D. dependent var	10527.95
S.E. of regression	6695.433	Akaike info criterion	20.48169
Sum squared resid	1.52E+10	Schwarz criterion	20.58110
Log likelihood	-3565.055	Hannan-Quinn criter.	20.52126
F-statistic	65.05223	Durbin-Watson stat	1.070482
Prob(F-statistic)	0.000000		

Dependent Variable: PROFITS

Method: Panel Least Squares
Date: 05/16/19 Time: 20:48
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 334

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5383.513	1051.926	-5.117766	0.0000
Mandatory_decommissioning_disclosure	518.7165	296.5172	1.749364	0.0812
Voluntary_decommissioning_disclosure	16.76339	284.1191	0.059001	0.9530
Mandatory_reserve_disclosure	12.93142	338.7107	0.038178	0.9696
Voluntary_reserve_disclosure	-601.4411	312.4792	-1.924740	0.0551
Govern	-794.5279	647.1359	-1.227760	0.2204
Leverage	49437.41	5746.057	8.603710	0.0000
Size_log	720.5816	138.4950	5.202944	0.0000
Auditor	416.2253	723.6941	0.575140	0.5656

R-squared	0.327878	Mean dependent var	1117.082
Adjusted R-squared	0.311333	S.D. dependent var	6758.381
S.E. of regression	5608.507	Akaike info criterion	20.12853
Sum squared resid	1.02E+10	Schwarz criterion	20.23123
Log likelihood	-3352.465	Hannan-Quinn criter.	20.16948
F-statistic	19.81787	Durbin-Watson stat	1.294932
Prob(F-statistic)	0.000000		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:17
Sample: 2010 2017
Periods included: 8
Cross-sections included: 35
Total panel (unbalanced) observations: 109

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	201.1952	99.23691	2.027423	0.0453
Mandatory_decommissioning_disclosure	20.55704	19.62811	1.047327	0.2975
Voluntary_decommissioning_disclosure	-16.21826	15.36166	-1.055763	0.2936
Mandatory_reserve_disclosure	-35.71341	23.20952	-1.538740	0.1270
Voluntary_reserve_disclosure	11.55888	22.02751	0.524747	0.6009
Govern	63.07318	46.93264	1.343909	0.1820
Leverage	-579.8634	535.7889	-1.082261	0.2817
Size_log	8.238916	11.53487	0.714262	0.4767
Auditor	-120.1143	63.61395	-1.888176	0.0619

R-squared	0.172757	Mean dependent var	71.28046
Adjusted R-squared	0.106577	S.D. dependent var	219.8097
S.E. of regression	207.7665	Akaike info criterion	13.58967
Sum squared resid	4316690.	Schwarz criterion	13.81189

Log likelihood	-731.6368	Hannan-Quinn criter.	13.67979
F-statistic	2.610425	Durbin-Watson stat	0.557399
Prob(F-statistic)	0.012308		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:59
Sample: 2010 2017
Periods included: 8
Cross-sections included: 41
Total panel (unbalanced) observations: 283

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.182705	0.481105	6.615408	0.0000
Mandatory_decommissioning_disclosure	0.555944	0.123552	4.499694	0.0000
Voluntary_decommissioning_disclosure	-0.174953	0.110753	-1.579669	0.1153
Mandatory_reserve_disclosure	-0.533981	0.141199	-3.781750	0.0002
Voluntary_reserve_disclosure	0.015453	0.133063	0.116134	0.9076
Govern	0.526560	0.273827	1.922968	0.0555
Leverage	2.744925	2.639098	1.040100	0.2992
Size_log	0.422832	0.060570	6.980878	0.0000
Auditor	0.924910	0.323857	2.855922	0.0046

R-squared	0.302044	Mean dependent var	6.079505
Adjusted R-squared	0.281666	S.D. dependent var	2.584077
S.E. of regression	2.190125	Akaike info criterion	4.437079
Sum squared resid	1314.281	Schwarz criterion	4.553012
Log likelihood	-618.8467	Hannan-Quinn criter.	4.483564
F-statistic	14.82186	Durbin-Watson stat	0.282617
Prob(F-statistic)	0.000000		

Model 6: Impact of disclosure levels on value and performance while controlling for Govern, Leverage, Size, Auditor and Listing state.

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 19:12
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 331

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-28.26485	3.489355	-8.100308	0.0000
Mandatory_decommissioning_disclosure	1.947772	0.889847	2.188884	0.0293
Voluntary_decommissioning_disclosure	0.754011	0.853495	0.883439	0.3777
Mandatory_reserve_disclosure	1.545697	1.042644	1.482478	0.1392
Voluntary_reserve_disclosure	-2.721385	0.963037	-2.825836	0.0050
Govern	-0.637274	1.991175	-0.320049	0.7491
Leverage	-38.31580	17.51718	-2.187327	0.0294
Size_log	2.587689	0.512096	5.053132	0.0000
Auditor	5.207356	2.302769	2.261345	0.0244
Listing_state	2.094239	2.711997	0.772213	0.4406

R-squared	0.241769	Mean dependent var	-6.764528
Adjusted R-squared	0.220511	S.D. dependent var	19.46387
S.E. of regression	17.18440	Akaike info criterion	8.555627
Sum squared resid	94792.45	Schwarz criterion	8.670494
Log likelihood	-1405.956	Hannan-Quinn criter.	8.601441
F-statistic	11.37267	Durbin-Watson stat	1.443009
Prob(F-statistic)	0.000000		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:48
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 327

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-48.87083	35.28465	-1.385045	0.1670
Mandatory_decommissioning_disclosure	8.277054	8.993273	0.920361	0.3581
Voluntary_decommissioning_disclosure	3.209217	8.614528	0.372535	0.7097
Mandatory_reserve_disclosure	-20.91058	10.58706	-1.975108	0.0491
Voluntary_reserve_disclosure	9.539476	9.753254	0.978081	0.3288
Govern	6.093377	20.24646	0.300960	0.7636
Leverage	-509.4233	177.2743	-2.873644	0.0043

Size_log	13.21625	5.169727	2.556470	0.0110
Auditor	-10.17705	23.41631	-0.434614	0.6641
Listing_state	-9.638295	27.49690	-0.350523	0.7262

R-squared	0.058129	Mean dependent var	-15.58253
Adjusted R-squared	0.031388	S.D. dependent var	176.1125
S.E. of regression	173.3265	Akaike info criterion	13.17833
Sum squared resid	9523337.	Schwarz criterion	13.29424
Log likelihood	-2144.658	Hannan-Quinn criter.	13.22458
F-statistic	2.173802	Durbin-Watson stat	1.096795
Prob(F-statistic)	0.023607		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:11
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 341

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.961899	0.517781	-7.651687	0.0000
Mandatory_decommissioning_disclosure	0.290261	0.132866	2.184606	0.0296
Voluntary_decommissioning_disclosure	0.038901	0.126882	0.306591	0.7593
Mandatory_reserve_disclosure	-0.313851	0.156060	-2.011087	0.0451
Voluntary_reserve_disclosure	0.287204	0.143479	2.001713	0.0461
Govern	-0.976487	0.296709	-3.291064	0.0011
Leverage	21.30700	2.635371	8.085011	0.0000
Size_log	0.342329	0.075902	4.510167	0.0000
Auditor	1.064830	0.341507	3.118031	0.0020
Listing_state	2.049500	0.399823	5.126014	0.0000

R-squared	0.581804	Mean dependent var	1.488006
Adjusted R-squared	0.570433	S.D. dependent var	3.970240
S.E. of regression	2.602148	Akaike info criterion	4.779438
Sum squared resid	2241.259	Schwarz criterion	4.891810
Log likelihood	-804.8943	Hannan-Quinn criter.	4.824209
F-statistic	51.16617	Durbin-Watson stat	0.986174
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN'S_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:13
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 341

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.62190	4.309657	5.017080	0.0000
Mandatory_decommissioning_disclosure	-0.510559	1.105889	-0.461673	0.6446
Voluntary_decommissioning_disclosure	-0.341501	1.056079	-0.323367	0.7466
Mandatory_reserve_disclosure	-2.640292	1.298941	-2.032650	0.0429
Voluntary_reserve_disclosure	1.400906	1.194224	1.173068	0.2416
Govern	0.113463	2.469600	0.045944	0.9634
Leverage	28.85992	21.93503	1.315700	0.1892
Size_log	-1.493219	0.631754	-2.363610	0.0187
Auditor	1.832334	2.842474	0.644627	0.5196
Listing_state	-0.580832	3.327857	-0.174536	0.8616

R-squared	0.073723	Mean dependent var	7.137331
Adjusted R-squared	0.048538	S.D. dependent var	22.20407
S.E. of regression	21.65851	Akaike info criterion	9.017561
Sum squared resid	155269.1	Schwarz criterion	9.129932
Log likelihood	-1527.494	Hannan-Quinn criter.	9.062331
F-statistic	2.927181	Durbin-Watson stat	0.861964
Prob(F-statistic)	0.002362		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:29
Sample: 2010 2017
Periods included: 8
Cross-sections included: 44
Total panel (unbalanced) observations: 341

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13919.25	1332.454	-10.44633	0.0000
Mandatory_decommissioning_disclosure	959.9470	341.9174	2.807541	0.0053
Voluntary_decommissioning_disclosure	-118.0013	326.5170	-0.361394	0.7180
Mandatory_reserve_disclosure	-389.2328	401.6048	-0.969194	0.3332
Voluntary_reserve_disclosure	-382.2309	369.2286	-1.035215	0.3013
Govern	-1576.236	763.5476	-2.064358	0.0398
Leverage	84141.10	6781.845	12.40682	0.0000
Size_log	2299.767	195.3247	11.77407	0.0000
Auditor	344.2302	878.8324	0.391690	0.6955
Listing_state	-2814.017	1028.903	-2.734969	0.0066

R-squared	0.614566	Mean dependent var	2834.613
Adjusted R-squared	0.604086	S.D. dependent var	10642.35
S.E. of regression	6696.349	Akaike info criterion	20.48540
Sum squared resid	1.48E+10	Schwarz criterion	20.59777
Log likelihood	-3482.761	Hannan-Quinn criter.	20.53017
F-statistic	58.64138	Durbin-Watson stat	1.094932
Prob(F-statistic)	0.000000		

Dependent Variable: PROFITS
Method: Panel Least Squares
Date: 05/16/19 Time: 20:47
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 326

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5523.040	1147.296	-4.813964	0.0000
Mandatory_decommissioning_disclosure	478.2326	303.8032	1.574153	0.1165
Voluntary_decommissioning_disclosure	51.25876	289.7845	0.176886	0.8597
Mandatory_reserve_disclosure	8.878681	345.2854	0.025714	0.9795
Voluntary_reserve_disclosure	-600.9691	316.7333	-1.897398	0.0587
Govern	-797.3975	663.5939	-1.201635	0.2304
Leverage	50074.60	5858.878	8.546790	0.0000
Size_log	799.8529	168.2964	4.752644	0.0000
Auditor	548.1533	759.3094	0.721910	0.4709
Listing_state	-846.6206	878.9167	-0.963255	0.3362

R-squared	0.331660	Mean dependent var	1144.782
Adjusted R-squared	0.312625	S.D. dependent var	6838.707
S.E. of regression	5669.843	Akaike info criterion	20.15390
Sum squared resid	1.02E+10	Schwarz criterion	20.27007
Log likelihood	-3275.086	Hannan-Quinn criter.	20.20026
F-statistic	17.42366	Durbin-Watson stat	1.299238
Prob(F-statistic)	0.000000		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:17
Sample: 2010 2017
Periods included: 8
Cross-sections included: 34
Total panel (unbalanced) observations: 108

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	264.6649	125.0078	2.117187	0.0368
Mandatory_decommissioning_disclosure	15.92283	20.28206	0.785069	0.4343
Voluntary_decommissioning_disclosure	-13.63510	15.64931	-0.871291	0.3857
Mandatory_reserve_disclosure	-42.40901	25.43042	-1.667649	0.0986
Voluntary_reserve_disclosure	16.34612	23.06341	0.708747	0.4802
Govern	55.33623	48.08926	1.150698	0.2527
Leverage	-400.9388	567.8756	-0.706033	0.4818
Size_log	2.346560	14.44785	0.162416	0.8713
Auditor	-142.3866	74.00092	-1.924120	0.0572
Listing_state	18.91002	66.04058	0.286339	0.7752

R-squared	0.180437	Mean dependent var	71.93898
Adjusted R-squared	0.105171	S.D. dependent var	220.7264
S.E. of regression	208.7971	Akaike info criterion	13.60862
Sum squared resid	4272430.	Schwarz criterion	13.85697
Log likelihood	-724.8657	Hannan-Quinn criter.	13.70932
F-statistic	2.397319	Durbin-Watson stat	0.554328
Prob(F-statistic)	0.016839		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:58
Sample: 2010 2017
Periods included: 8
Cross-sections included: 41
Total panel (unbalanced) observations: 283

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.214330	0.491400	6.541170	0.0000
Mandatory_decommissioning_disclosure	0.557770	0.123878	4.502587	0.0000
Voluntary_decommissioning_disclosure	-0.179597	0.111830	-1.605987	0.1094
Mandatory_reserve_disclosure	-0.535190	0.141478	-3.782857	0.0002
Voluntary_reserve_disclosure	0.018061	0.133516	0.135270	0.8925
Govern	0.526498	0.274274	1.919607	0.0559
Leverage	2.769573	2.644467	1.047308	0.2959
Size_log	0.410855	0.070770	5.805494	0.0000
Auditor	0.905343	0.329802	2.745112	0.0065
Listing_state	0.116251	0.353655	0.328714	0.7426

R-squared	0.302320	Mean dependent var	6.079505
Adjusted R-squared	0.279320	S.D. dependent var	2.584077
S.E. of regression	2.193698	Akaike info criterion	4.443751
Sum squared resid	1313.761	Schwarz criterion	4.572565
Log likelihood	-618.7907	Hannan-Quinn criter.	4.495401
F-statistic	13.14411	Durbin-Watson stat	0.282854
Prob(F-statistic)	0.000000		

Model 7: Impact of disclosure levels on value and performance while controlling for Govern, Leverage, Size, Auditor, Listing state and Firm age.

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 19:04
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 323

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-27.62624	3.522001	-7.843904	0.0000
Mandatory_decommissioning_disclosure	2.047212	0.899450	2.276070	0.0235
Voluntary_decommissioning_disclosure	0.942789	0.862175	1.093501	0.2750
Mandatory_reserve_disclosure	1.446602	1.041497	1.388965	0.1658
Voluntary_reserve_disclosure	-2.723536	0.975507	-2.791918	0.0056
Govern	-0.967274	2.022200	-0.478328	0.6328
Leverage	-40.27724	17.77392	-2.266087	0.0241
Size_log	2.621557	0.510016	5.140150	0.0000
Auditor	5.189683	2.328192	2.229062	0.0265
Listing_state	2.653272	2.731275	0.971441	0.3321
Firm_age	-0.091134	0.091255	-0.998677	0.3187

R-squared	0.255396	Mean dependent var	-6.757292
Adjusted R-squared	0.231531	S.D. dependent var	19.43988
S.E. of regression	17.04147	Akaike info criterion	8.542639
Sum squared resid	90608.42	Schwarz criterion	8.671289
Log likelihood	-1368.636	Hannan-Quinn criter.	8.593994
F-statistic	10.70147	Durbin-Watson stat	1.458134
Prob(F-statistic)	0.000000		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:49
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 319

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-44.00822	36.37665	-1.209793	0.2273
Mandatory_decommissioning_disclosure	8.925141	9.286933	0.961043	0.3373
Voluntary_decommissioning_disclosure	4.489210	8.886353	0.505180	0.6138
Mandatory_reserve_disclosure	-21.67861	10.80530	-2.006295	0.0457
Voluntary_reserve_disclosure	9.748256	10.09156	0.965981	0.3348
Govern	3.193808	20.98994	0.152159	0.8792
Leverage	-504.1908	183.9148	-2.741437	0.0065

Size_log	13.50943	5.258355	2.569136	0.0107
Auditor	-11.33924	24.18803	-0.468795	0.6395
Listing_state	-6.300394	28.31817	-0.222486	0.8241
Firm_age	-0.679047	0.943560	-0.719665	0.4723

R-squared	0.060697	Mean dependent var	-15.77768
Adjusted R-squared	0.030200	S.D. dependent var	178.2657
S.E. of regression	175.5532	Akaike info criterion	13.20764
Sum squared resid	9492232.	Schwarz criterion	13.33747
Log likelihood	-2095.618	Hannan-Quinn criter.	13.25949
F-statistic	1.990271	Durbin-Watson stat	1.100469
Prob(F-statistic)	0.033977		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:13
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 333

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.078785	0.529016	-7.710139	0.0000
Mandatory_decommissioning_disclosure	0.270615	0.135852	1.991981	0.0472
Voluntary_decommissioning_disclosure	0.009893	0.129725	0.076260	0.9393
Mandatory_reserve_disclosure	-0.289829	0.157658	-1.838345	0.0669
Voluntary_reserve_disclosure	0.276932	0.146925	1.884850	0.0604
Govern	-0.897631	0.305078	-2.942301	0.0035
Leverage	20.66001	2.702860	7.643760	0.0000
Size_log	0.333383	0.076443	4.361215	0.0000
Auditor	1.092053	0.349333	3.126108	0.0019
Listing_state	1.962360	0.407690	4.813363	0.0000
Firm_age	0.020046	0.013841	1.448344	0.1485

R-squared	0.585061	Mean dependent var	1.528649
Adjusted R-squared	0.572175	S.D. dependent var	3.990851
S.E. of regression	2.610351	Akaike info criterion	4.789321
Sum squared resid	2194.086	Schwarz criterion	4.915116
Log likelihood	-786.4220	Hannan-Quinn criter.	4.839483
F-statistic	45.40173	Durbin-Watson stat	0.971974
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN’S_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:13
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43

Total panel (unbalanced) observations: 333

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.37258	4.430814	4.823622	0.0000
Mandatory_decommissioning_disclosure	-0.353160	1.137842	-0.310377	0.7565
Voluntary_decommissioning_disclosure	-0.543723	1.086525	-0.500424	0.6171
Mandatory_reserve_disclosure	-2.508128	1.320473	-1.899416	0.0584
Voluntary_reserve_disclosure	1.049646	1.230585	0.852966	0.3943
Govern	0.227369	2.555204	0.088983	0.9292
Leverage	22.96299	22.63803	1.014355	0.3112
Size_log	-1.485205	0.640253	-2.319716	0.0210
Auditor	1.387535	2.925869	0.474230	0.6357
Listing_state	-1.523534	3.414641	-0.446177	0.6558
Firm_age	0.161675	0.115924	1.394666	0.1641

R-squared	0.079601	Mean dependent var	7.305139
Adjusted R-squared	0.051017	S.D. dependent var	22.44319
S.E. of regression	21.86320	Akaike info criterion	9.039962
Sum squared resid	153915.9	Schwarz criterion	9.165757
Log likelihood	-1494.154	Hannan-Quinn criter.	9.090124
F-statistic	2.784833	Durbin-Watson stat	0.870143
Prob(F-statistic)	0.002569		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:30
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 333

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13390.29	1351.494	-9.907771	0.0000
Mandatory_decommissioning_disclosure	1008.766	347.0663	2.906552	0.0039
Voluntary_decommissioning_disclosure	26.86320	331.4133	0.081056	0.9354
Mandatory_reserve_disclosure	-518.3621	402.7728	-1.286984	0.1990
Voluntary_reserve_disclosure	-272.0653	375.3547	-0.724822	0.4691
Govern	-1906.068	779.3922	-2.445582	0.0150
Leverage	88119.17	6905.084	12.76149	0.0000
Size_log	2325.151	195.2909	11.90609	0.0000
Auditor	310.9353	892.4528	0.348405	0.7278
Listing_state	-2306.979	1041.539	-2.214971	0.0275
Firm_age	-104.3301	35.35921	-2.950578	0.0034

R-squared	0.627489	Mean dependent var	2902.960
Adjusted R-squared	0.615921	S.D. dependent var	10760.53
S.E. of regression	6668.747	Akaike info criterion	20.48073
Sum squared resid	1.43E+10	Schwarz criterion	20.60652

Log likelihood	-3399.041	Hannan-Quinn criter.	20.53089
F-statistic	54.24051	Durbin-Watson stat	1.146258
Prob(F-statistic)	0.000000		

Dependent Variable: PROFITS
Method: Panel Least Squares
Date: 05/16/19 Time: 20:46
Sample: 2010 2017
Periods included: 8
Cross-sections included: 42
Total panel (unbalanced) observations: 318

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5219.391	1175.582	-4.439837	0.0000
Mandatory_decommissioning_disclosure	509.9526	312.5603	1.631533	0.1038
Voluntary_decommissioning_disclosure	135.5903	295.9852	0.458098	0.6472
Mandatory_reserve_disclosure	-70.52168	349.2664	-0.201914	0.8401
Voluntary_reserve_disclosure	-533.3219	325.5856	-1.638039	0.1024
Govern	-978.1897	685.0407	-1.427929	0.1543
Leverage	52564.87	6025.623	8.723558	0.0000
Size_log	813.7092	169.9258	4.788615	0.0000
Auditor	552.3642	781.8648	0.706470	0.4804
Listing_state	-511.0840	899.0973	-0.568441	0.5702
Firm_age	-64.35961	30.32840	-2.122090	0.0346

R-squared	0.343933	Mean dependent var	1173.913
Adjusted R-squared	0.322563	S.D. dependent var	6921.956
S.E. of regression	5697.225	Akaike info criterion	20.16732
Sum squared resid	9.96E+09	Schwarz criterion	20.29746
Log likelihood	-3195.605	Hannan-Quinn criter.	20.21930
F-statistic	16.09401	Durbin-Watson stat	1.323186
Prob(F-statistic)	0.000000		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:17
Sample: 2010 2017
Periods included: 8
Cross-sections included: 33
Total panel (unbalanced) observations: 104

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	274.3296	139.7350	1.963213	0.0526
Mandatory_decommissioning_disclosure	14.18180	21.09899	0.672155	0.5032
Voluntary_decommissioning_disclosure	-12.22236	16.28322	-0.750611	0.4548
Mandatory_reserve_disclosure	-36.10020	26.84062	-1.344984	0.1819
Voluntary_reserve_disclosure	13.35336	24.40027	0.547263	0.5855

Govern	46.84832	52.84340	0.886550	0.3776
Leverage	-486.0214	612.4839	-0.793525	0.4295
Size_log	2.730133	15.50719	0.176056	0.8606
Auditor	-161.8635	84.61180	-1.913014	0.0588
Listing_state	11.34190	69.44886	0.163313	0.8706
Firm_age	0.424964	1.635500	0.259837	0.7956

R-squared	0.182676	Mean dependent var	70.50087
Adjusted R-squared	0.094792	S.D. dependent var	223.8972
S.E. of regression	213.0212	Akaike info criterion	13.66041
Sum squared resid	4220158.	Schwarz criterion	13.94010
Log likelihood	-699.3412	Hannan-Quinn criter.	13.77372
F-statistic	2.078602	Durbin-Watson stat	0.542971
Prob(F-statistic)	0.033862		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:57
Sample: 2010 2017
Periods included: 8
Cross-sections included: 41
Total panel (unbalanced) observations: 283

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.409431	0.499761	6.822123	0.0000
Mandatory_decommissioning_disclosure	0.553338	0.123314	4.487237	0.0000
Voluntary_decommissioning_disclosure	-0.136095	0.113636	-1.197644	0.2321
Mandatory_reserve_disclosure	-0.560616	0.141444	-3.963515	0.0001
Voluntary_reserve_disclosure	0.037311	0.133270	0.279963	0.7797
Govern	0.450861	0.275870	1.634325	0.1033
Leverage	3.388194	2.652060	1.277571	0.2025
Size_log	0.413419	0.070448	5.868422	0.0000
Auditor	0.909906	0.328250	2.771989	0.0060
Listing_state	0.246784	0.358638	0.688115	0.4920
Firm_age	-0.024534	0.012927	-1.897927	0.0588

R-squared	0.311439	Mean dependent var	6.079505
Adjusted R-squared	0.286124	S.D. dependent var	2.584077
S.E. of regression	2.183317	Akaike info criterion	4.437662
Sum squared resid	1296.590	Schwarz criterion	4.579357
Log likelihood	-616.9291	Hannan-Quinn criter.	4.494477
F-statistic	12.30266	Durbin-Watson stat	0.290412
Prob(F-statistic)	0.000000		

Model 8: Impact of disclosure levels on value and performance while controlling for Govern, Leverage, Size, Auditor, Listing state, Firm age and Accounting Method

Dependent Variable: ROA
Method: Panel Least Squares
Date: 05/16/19 Time: 18:59
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 323

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-36.56270	6.858285	-5.331172	0.0000
Mandatory_Decommissioning_Disclosure	1.821195	0.909853	2.001636	0.0462
Voluntary_Decommissioning_Disclosure	1.074413	0.864742	1.242466	0.2150
Mandatory_Reserve_Disclosure	1.696560	1.052302	1.612237	0.1079
Voluntary_Reserve_Disclosure	-2.969696	0.986901	-3.009112	0.0028
Govern	-1.344470	2.033244	-0.661244	0.5089
Leverage	-28.97904	19.23634	-1.506474	0.1330
Size_Log	2.567505	0.510199	5.032357	0.0000
Auditor	6.347317	2.445394	2.595622	0.0099
Listing_State	3.542709	2.787906	1.270742	0.2048
Firm_Age	-0.094223	0.091088	-1.034419	0.3017
Accounting_Method	3.508048	2.311848	1.517422	0.1302

R-squared	0.260868	Mean dependent var	-6.757292
Adjusted R-squared	0.234725	S.D. dependent var	19.43988
S.E. of regression	17.00600	Akaike info criterion	8.541454
Sum squared resid	89942.51	Schwarz criterion	8.681800
Log likelihood	-1367.445	Hannan-Quinn criter.	8.597479
F-statistic	9.978550	Durbin-Watson stat	1.464831
Prob(F-statistic)	0.000000		

Dependent Variable: ROE
Method: Panel Least Squares
Date: 05/16/19 Time: 19:51
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 319

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-41.01031	71.05770	-0.577141	0.5643
Mandatory_decommissioning_disclosure	9.000898	9.428888	0.954609	0.3405
Voluntary_decommissioning_disclosure	4.445297	8.945522	0.496930	0.6196

Mandatory_reserve_disclosure	-21.76124	10.95268	-1.986842	0.0478
Voluntary_reserve_disclosure	9.829035	10.24073	0.959798	0.3379
Govern	3.322361	21.18614	0.156818	0.8755
Leverage	-508.0181	200.0006	-2.540082	0.0116
Size_log	13.52818	5.280696	2.561818	0.0109
Auditor	-11.72093	25.44187	-0.460694	0.6453
Listing_state	-6.610340	29.05693	-0.227496	0.8202
Firm_age	-0.677752	0.945460	-0.716849	0.4740
Accounting_method	-1.177876	23.96886	-0.049142	0.9608

R-squared	0.060704	Mean dependent var	-15.77768
Adjusted R-squared	0.027049	S.D. dependent var	178.2657
S.E. of regression	175.8382	Akaike info criterion	13.21390
Sum squared resid	9492157.	Schwarz criterion	13.35553
Log likelihood	-2095.617	Hannan-Quinn criter.	13.27046
F-statistic	1.803696	Durbin-Watson stat	1.100624
Prob(F-statistic)	0.052606		

Dependent Variable: OCF_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:14
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 333

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.685547	1.027062	-2.614785	0.0093
Mandatory_decommissioning_disclosure	0.305245	0.137295	2.223282	0.0269
Voluntary_decommissioning_disclosure	-0.012666	0.130208	-0.097277	0.9226
Mandatory_reserve_disclosure	-0.327929	0.159126	-2.060811	0.0401
Voluntary_reserve_disclosure	0.314361	0.148483	2.117153	0.0350
Govern	-0.838567	0.306653	-2.734581	0.0066
Leverage	18.90247	2.916663	6.480852	0.0000
Size_log	0.341104	0.076421	4.463455	0.0000
Auditor	0.921775	0.364778	2.526946	0.0120
Listing_state	1.811634	0.417763	4.336513	0.0000
Firm_age	0.020952	0.013820	1.516014	0.1305
Accounting_method	-0.545198	0.344781	-1.581289	0.1148

R-squared	0.588268	Mean dependent var	1.528649
Adjusted R-squared	0.574159	S.D. dependent var	3.990851
S.E. of regression	2.604290	Akaike info criterion	4.787568
Sum squared resid	2177.127	Schwarz criterion	4.924798
Log likelihood	-785.1301	Hannan-Quinn criter.	4.842289
F-statistic	41.69395	Durbin-Watson stat	0.971570
Prob(F-statistic)	0.000000		

Dependent Variable: TOBIN'S_Q
Method: Panel Least Squares
Date: 05/24/19 Time: 11:11
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 333

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	37.37075	8.572725	4.359262	0.0000
Mandatory_decommissioning_disclosure	0.044484	1.145977	0.038817	0.9691
Voluntary_decommissioning_disclosure	-0.802762	1.086825	-0.738630	0.4607
Mandatory_reserve_disclosure	-2.945621	1.328201	-2.217753	0.0273
Voluntary_reserve_disclosure	1.479433	1.239363	1.193705	0.2335
Govern	0.905583	2.559582	0.353801	0.7237
Leverage	2.781529	24.34492	0.114255	0.9091
Size_log	-1.396557	0.637877	-2.189381	0.0293
Auditor	-0.567721	3.044747	-0.186459	0.8522
Listing_state	-3.254279	3.487000	-0.933260	0.3514
Firm_age	0.172077	0.115357	1.491694	0.1368
Accounting_method	-6.260362	2.877830	-2.175376	0.0303

R-squared	0.092973	Mean dependent var	7.305139
Adjusted R-squared	0.061891	S.D. dependent var	22.44319
S.E. of regression	21.73759	Akaike info criterion	9.031334
Sum squared resid	151679.8	Schwarz criterion	9.168564
Log likelihood	-1491.717	Hannan-Quinn criter.	9.086055
F-statistic	2.991216	Durbin-Watson stat	0.878195
Prob(F-statistic)	0.000834		

Dependent Variable: EBITDA
Method: Panel Least Squares
Date: 05/16/19 Time: 20:41
Sample: 2010 2017
Periods included: 8
Cross-sections included: 43
Total panel (unbalanced) observations: 333

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6324.408	2593.641	-2.438428	0.0153
Mandatory_decommissioning_disclosure	1184.393	346.7105	3.416085	0.0007
Voluntary_decommissioning_disclosure	-87.54603	328.8143	-0.266248	0.7902
Mandatory_reserve_disclosure	-711.5889	401.8414	-1.770820	0.0775
Voluntary_reserve_disclosure	-82.24231	374.9640	-0.219334	0.8265
Govern	-1606.522	774.3904	-2.074564	0.0388
Leverage	79205.67	7365.451	10.75368	0.0000

Size_log	2364.304	192.9871	12.25110	0.0000
Auditor	-552.6385	921.1752	-0.599928	0.5490
Listing_state	-3071.394	1054.977	-2.911337	0.0039
Firm_age	-99.73583	34.90070	-2.857702	0.0045
Accounting_method	-2765.001	870.6751	-3.175697	0.0016

R-squared	0.638836	Mean dependent var	2902.960
Adjusted R-squared	0.626460	S.D. dependent var	10760.53
S.E. of regression	6576.614	Akaike info criterion	20.45580
Sum squared resid	1.39E+10	Schwarz criterion	20.59303
Log likelihood	-3393.890	Hannan-Quinn criter.	20.51052
F-statistic	51.61762	Durbin-Watson stat	1.151522
Prob(F-statistic)	0.000000		

Dependent Variable: PROFITS
Method: Panel Least Squares
Date: 05/16/19 Time: 20:44
Sample: 2010 2017
Periods included: 8
Cross-sections included: 42
Total panel (unbalanced) observations: 318

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3364.378	2264.866	-1.485464	0.1385
Mandatory_decommissioning_disclosure	550.1361	315.4019	1.744238	0.0821
Voluntary_decommissioning_disclosure	106.7018	297.5556	0.358595	0.7201
Mandatory_reserve_disclosure	-121.4487	353.3324	-0.343723	0.7313
Voluntary_reserve_disclosure	-479.1048	330.5076	-1.449603	0.1482
Govern	-890.7681	691.1789	-1.288766	0.1985
Leverage	50284.43	6479.270	7.760817	0.0000
Size_log	821.4002	170.1378	4.827852	0.0000
Auditor	342.1820	812.1469	0.421330	0.6738
Listing_state	-702.0441	921.0330	-0.762236	0.4465
Firm_age	-63.15091	30.35865	-2.080162	0.0383
Accounting_method	-730.1139	761.9044	-0.958275	0.3387

R-squared	0.345896	Mean dependent var	1173.913
Adjusted R-squared	0.322382	S.D. dependent var	6921.956
S.E. of regression	5697.983	Akaike info criterion	20.17062
Sum squared resid	9.93E+09	Schwarz criterion	20.31258
Log likelihood	-3195.128	Hannan-Quinn criter.	20.22732
F-statistic	14.71050	Durbin-Watson stat	1.321302
Prob(F-statistic)	0.000000		

Dependent Variable: P_E_RATIO
Method: Panel Least Squares
Date: 05/24/19 Time: 11:16
Sample: 2010 2017
Periods included: 8
Cross-sections included: 33
Total panel (unbalanced) observations: 104

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	379.8561	252.6793	1.503313	0.1362
Mandatory_decommissioning_disclosure	15.75029	21.41338	0.735535	0.4639
Voluntary_decommissioning_disclosure	-12.57208	16.36392	-0.768281	0.4443
Mandatory_reserve_disclosure	-38.94278	27.53732	-1.414182	0.1607
Voluntary_reserve_disclosure	16.06055	25.08515	0.640242	0.5236
Govern	45.29572	53.14717	0.852270	0.3963
Leverage	-586.0904	646.4445	-0.906637	0.3670
Size_log	2.027946	15.63259	0.129726	0.8971
Auditor	-181.1660	93.24594	-1.942884	0.0551
Listing_state	3.719214	71.36301	0.052117	0.9585
Firm_age	0.448986	1.642812	0.273303	0.7852
Accounting_method	-34.51622	68.73687	-0.502150	0.6168

R-squared	0.184910	Mean dependent var	70.50087
Adjusted R-squared	0.087454	S.D. dependent var	223.8972
S.E. of regression	213.8829	Akaike info criterion	13.67690
Sum squared resid	4208623.	Schwarz criterion	13.98202
Log likelihood	-699.1989	Hannan-Quinn criter.	13.80052
F-statistic	1.897366	Durbin-Watson stat	0.549253
Prob(F-statistic)	0.049567		

Dependent Variable: MV_LOG
Method: Panel Least Squares
Date: 05/16/19 Time: 20:55
Sample: 2010 2017
Periods included: 8
Cross-sections included: 41
Total panel (unbalanced) observations: 283

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.766959	0.906803	4.154110	0.0000
Mandatory_decommissioning_disclosure	0.569334	0.128041	4.446510	0.0000
Voluntary_decommissioning_disclosure	-0.143553	0.114886	-1.249519	0.2126
Mandatory_reserve_disclosure	-0.569761	0.142961	-3.985431	0.0001

Voluntary_reserve_disclosure	0.044202	0.134255	0.329242	0.7422
Govern	0.467412	0.278473	1.678479	0.0944
Leverage	2.899206	2.850120	1.017223	0.3100
Size_log	0.415421	0.070676	5.877840	0.0000
Auditor	0.882330	0.333853	2.642867	0.0087
Listing_state	0.202368	0.371234	0.545123	0.5861
Firm_age	-0.024235	0.012961	-1.869907	0.0626
Accounting_method	-0.151987	0.321459	-0.472805	0.6367

R-squared	0.312006	Mean dependent var	6.079505
Adjusted R-squared	0.284080	S.D. dependent var	2.584077
S.E. of regression	2.186440	Akaike info criterion	4.443904
Sum squared resid	1295.521	Schwarz criterion	4.598482
Log likelihood	-616.8125	Hannan-Quinn criter.	4.505884
F-statistic	11.17264	Durbin-Watson stat	0.291512
Prob(F-statistic)	0.000000		

Appendix 9: Endogeneity Tests

The Durbin-Watson test is an endogeneity test that is used in testing if the residuals are correlated serially. It is an assumption that must be met before linear regression is carried out. This assumption will be tested for all the 8 models/equations.

For equation 1

For the results of equation 1, Durbin-Watson = 1.729, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.509[a]	.259	.055	12.271464059	1.739
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure, Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: ROA					

Equation 2:

For the results of equation 2, Durbin-Watson = 1.883, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.508[a]	.258	.054	21.840507030	1.883
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure, Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: ROE					

Equation 3:

For the results of equation 3, Durbin-Watson = 2.166, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.994[a]	.987	.984	568.885827495	2.166
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure, Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: Operational Cash flow					

Equation 4:

For the results of equation 4, Durbin-Watson = 1.550, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.429[a]	.184	-.040	1.531434123	1.550
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure, Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: Tobin Q					

Equation 5:

For the results of equation 5, Durbin-Watson = 2.175, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.989[a]	.979	.973	893.002389255	2.175
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure, Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: EBITDA					

Equation 6:

For the results of equation 6, Durbin-Watson = 2.193, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.981[a]	.963	.953	419.454558349	2.193
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure, Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: Profits					

Equation 7:

For the results of equation 7, Durbin-Watson = 1.944, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.576[a]	.332	.149	8.440033046	1.944
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure, Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: P/E ratio					

Equation 8:

For the results of equation 4, Durbin-Watson = 2.190, which means it lies in the range ≥1.5 and ≤2.5, and as such, the assumption is met.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.428[a]	.183	-.042	2.877687787	2.190
a. Predictors: (Constant), Accounting method, Firm age, Leverage, Auditor, Mandatory Reserve Disclosure, Govern, Listing Status, Voluntary Reserve Disclosure Size, Voluntary Decommissioning Disclosure, Mandatory Decommissioning Disclosure					
b. Dependent Variable: Market Value					