The Value Relevance and Timeliness of Write-Downs reported by U.S. and European Firms in the Oil and Gas Industry

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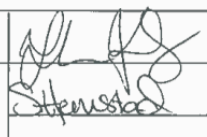

Abstract

In this thesis we study the value relevance and timeliness of quarterly-write-downs reported by U.S. and European firms in the oil and gas industry during Q1 2012 to Q4 2015. The chosen period reflects both a period before and after the initial oil price drop inmid-2014. The period after the initial drop has had major impact on company finances, as the oil price as the oil price has not yet recovered to normal levels. The period with low oil price provides a feasible setting in which to study value relevance of write-downs as the lower price leads to lower estimated future cash flows, which in turn increases the risk of write-downs. Further, by including the period before the oil price decline we are enabled to study changes of value relevance of accounting information when the economic environment changes.

We investigate the value relevance of write downs by performing two tests; an incremental association test measuring the association between write-downs and contemporaneous share price and share returns; and a relative association test investigating whether net including write-downs explain more of the variation in share price and share return than net income excluding write-downs. Lastly, we test whether write-downs are timely reported by examining the association between write-downs and lead and lagged returns. Our study of value relevance is a way to operationalise the characteristics of relevance and reliability as defined by FASB and IASB in their joint Conceptual Framework.

In the incremental association test show a significantly negative association between write-downs and both share price and share return. Based on these results we find the write-downs undertaken by firms in the oil and gas industry in the period under study to be value relevant for investors. The results of the relative association test show that value relevance of accounting information decrease in the periods after the oil price drop in mid-2014, a period where the oil price is at its lowest levels. However, we believe that the observed increased frequency and total dollar amount of reported losses is the reason for the observed lower value relevance of accounting information in this period. Lastly, we find write-downs to be associated with both contemporaneous and lead return, indicating write-downs to be partly anticipated and partly unanticipated. The association with contemporaneous return is evidence that write-downs are reported in a timely manner. We find write-downs to be of confirmatory value to investors as the reported write-downs partly confirm what have already been anticipated by the market. The association with lead return suggest that write-downs also are of predictive value for investors, as write-downs can be perceived as new information to the market. We believe the findings of write-downs being of confirmatory and predictive value for investors confirms the relevance of the reporting write-downs. The finding of the reported write-downs to be both value relevant and timely also confirms that the write-downs are free from measurement error, and thus reliably recognised.

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Abbreviations

AICPA	The American Institute of Certified Public Accountants
FAF	Financial Accounting Foundation
FASB	Financial Accounting Standards Board
IASB	International Accounting Standards Board
IFRS	International Financial Reporting Standards
SEC	United States Securities and Exchange Commission
US GAAP	Unites States Generally Accepted Accounting Standards
ASC	Accounting Standards Codification
IAS	International Accounting Standard

1. Introduction

The objective of this master thesis is to study the value relevance and timeliness of write-downs in the oil and gas industry during the period before and during the present oil price decline. The study outlines what accounting quality is and how it can be measured. Theory of accounting quality is followed by an empirical study of the accounting quality in terms of value relevance for companies in the oil and gas industry in Europe and the USA. In the next section we introduce the background for our problem statement, research questions and purpose of the thesis.

1.1 Background for Choice of Research Design

The oil and gas industry is presently in its deepest downturn since the 1990s due to the drastic decline in oil price that begun in the second half of 2014. The downturn has turned record profits into large earning losses, prompting oil exploration companies to decommission their rigs and to cut their investments in exploration and production. In addition, the lower price leads to lower estimated future cash flows, which in turn increases the risk of impairment of assets. The oil price drop has also caused a lot of companies to file for bankruptcy, and a great number of workers in the oil sector have lost their jobs (Krauss, 2016). The causes behind the sharp oil price drop are many, some of which include geopolitical conflicts in some oil-producing regions, OPEC announcements, and the appreciation of the U.S. dollar. In addition, long-term developments in supply and demand have played important roles in driving the recent decline in oil prices (World Bank Group, 2015)(World Bank Group, 2015).

It is not only the oil exploration companies who are negatively affected by the drastic oil price decline. The oil and gas industry is highly capital-intensive and the reductions in capital expenditure budgets of upstream exploration and production companies will reduce the demand and market for equipment used in the industry. Thus, it can also be argued that service companies in the industry will be affected by the lower oil price (Khetan & Yahya, 2015). Oil companies have to make large investments in terms of platforms, expensive workforce and have to perform the drilling of oil before they are capable of making revenues. These investments need to be financed, which is usually done by issuing debt. Lower cash

inflow lead to oil companies struggling to pay their debts, risking the oil price crisis to spill over to the bank industry. The *New York Times* posted an article in January 2016 stressing that the oil price drop will be the first big test for the United States' banking systems since the financial crisis, implying the extensive impact the oil price drop may have. In addition, low oil prices are shaking global markets and threatening economies around the world dependent on exporting oil (Corkery, 2016).

Since the companies in the oil and gas industry have a large variety of important stakeholders, it is vital that these companies provide accounting information of high quality. An essential part of high quality financial reporting is to inform stakeholders about the value of the firm and firm prospects of future earnings and cash flow generating capacity. An important contribution of the information of firm value and future prospects is given by impairment tests and impairments (KPMG, 2010). Thus, conducting impairment tests and recognising impairments are vital constituents of financial reporting of high quality. Financial reporting of high quality is defined by both the IASB and the FASB in their joint Conceptual Framework as information that the user finds decision-useful (IASB, 2010).

The decline in oil price leaves consequences for companies' financial statements and tax planning. The low oil price affects oil companies' forecast estimations and result in lower expected future profit from their assets. Consequently, this reduces the present value of the assets, and if the value currently carried on balance sheets cannot be recovered in full, this results in write-downs of the assets. The accounting standards related to impairments of assets in both US GAAP and IFRS state tests of impairments to be performed when circumstances and events are present that indicate worsening prospects for the assets. According to IAS 36.1, IFRS impairment of assets standard, impairments should be recognised when the carrying amount is higher than either fair value of the asset or its estimated future cash inflows. Oil and gas companies adhering to US GAAP can account for their oil reserves either by using the successful-efforts method or the full-cost method. The successful-efforts method requires impairments to be recognised when the carrying amount is greater than the fair value. Using the full-cost method, impairments should be recognised when capitalised costs of searching for oil and gas reserves exceeds the value of the capitalised costs, as determined by the average of the previous 12 months commodity price (Ernst & Young,

2009). The volatile and uncertain environment in the oil and gas industry and the rapidly changing oil prices make it difficult for companies to make judgements estimating the present value of assets for impairment valuations (Deloitte, n.d.).

In their study of value relevance of write-downs reported by financial institutions during the financial crisis, Beltratti, Spear, & Szabo (2013) evaluate the validity of two opposing views of fair value accounting (FVA). On one side, FVA is considered leading to institutions taking unnecessary write-downs based on temporarily depressed market prices. The contrasting view is that FVA gives managers considerable discretion in avoiding taking unnecessary write-downs. Similarly, Vyas (2011) considers the same debate, and also points to evidence of asset values being overstated relative to contemporary price levels of external benchmarks, exemplified by write-downs undertaken by Lehman Brothers. Since oil and gas companies reporting under the scope of IFRS and US GAAP impairment standards use fair value estimates to determine asset values and subsequent write-down amounts, the FVA debate existing for financial institutions' asset values is also applicable for oil and gas companies' asset values.

Decision-usefulness of financial information can be measured by studying value relevance and timeliness of reported accounting information. As periods of economic downturn have negative consequences for company finances, they constitute a feasible setting in which to study value relevance and timeliness of write-downs (Vyas, 2011). Beltratti et al. (2013) study the value relevance and timeliness of write-downs of American and European banks during the financial crisis of 2007 to 2009. Vyas (2011) studies the timeliness of write-downs recognised by financial institutions during the same financial crisis in the years of 2007 to 2008. The two studies come to different conclusions; Vyas, using credit indices as a benchmark, find write-downs to be untimely, whilst Beltratti et al. (2013) investigate the association between share return and write-downs, and find write-downs throughout the crisis to be both timely and value relevant. Similar to our study, Alciatore, Easton, & Spear (2000) investigate value relevance and timeliness of impairments of long-lived assets in the petroleum industry due to the application of the SEC full-cost ceiling test during a period of a major oil price decline between 1984 and 1987. Alciatore et al. find the association between write-downs and lagged returns to be higher than the association between write-downs and

contemporaneous returns. Thus, these results imply that the decline in asset value caused by drop in future oil and gas prices is partly anticipated by the market before the asset value decline is reported by the firm.

When operationalising value relevance and timeliness of write-downs in this thesis, we perform three tests; an incremental association test, a relative association test, and lastly, a test to determine timeliness of reported write-downs. The incremental association test is performed by running four regression models that are well-established within the value relevance literature; two price regressions models and two return regressions models. The relative association test is performed on three of these regression models: one price regression and two specifications of the return regression. Timely reported accounting information will further enhance value relevance, and we therefore investigate the association between write-downs and lead or lagged returns to test the timeliness of reported write-downs in the oil and gas industry. The regression models applied in the test to determine timeliness is inspired by the research conducted by Beltratti et al. (2013). An association with lagged return implies untimely reported write-downs; while an association with lead return suggests that write-downs are reported before the decline in asset value is anticipated by the market.

The variety of important stakeholders of the oil and gas industry generates a need for the companies within this industry to provide high quality financial reporting. A vital constituent of financial reporting of high quality is the recognition of impairment losses when asset values veritably have declined. In addition, we believe that the difficulties in making judgements on estimating the present value of assets for impairment valuations caused by the volatile and uncertain environment in the oil and gas industry may have implications for the value relevance of write-downs. We therefore find it important to investigate whether the impairment standards developed by FASB and IASB ensure that impairments conducted by oil and gas companies provide information contributing to financial reporting of high quality. Thus, we have developed the following research question and related sub-questions:

1) *What is the value relevance of write-downs for U.S. and European firms in the oil and gas industry during the period of Q1 2012– Q4 2015?*

1a) How is value relevance of accounting information for U.S. and European firms in the oil and gas industry affected when the industry experiences negative changes in the economic environment?

1b) What is the timeliness of write-downs reported by U.S. and European firms in the period of Q2 2012–Q3 2015?

The purpose of this thesis is therefore to provide evidence of the quality of the accounting information reported by oil and gas companies. The evidence provided by this thesis will be of interest to standard setters as our study contributes information on whether current accounting standards are fulfilling their purposes in ensuring decision-useful accounting information for decision-makers. The users of accounting information reported by oil and gas companies will also benefit from this study's contribution, as high accounting quality indicates trustworthy information to be used for decision-making.

1.2 Disposition of Thesis

This thesis is structured in the following order: The subsequent parts start with the theoretical framework, which consists of four sections. The first section concerns financial reporting as information source. In the second section we define accounting quality and decision-usefulness of accounting information, followed by a section outlining measures of value relevance and previous related research. The last section of the theoretical framework is a description of US GAAP and IFRS standards for impairment of assets. The four sections in the theoretical framework lay the foundation for the subsequent part where our hypotheses are developed and presented. In the fourth part of this thesis, we describe the most prominent regression models employed within value relevance research and their related econometric concerns in the methodology section. The methodology section is followed by a presentation of the employed regression models in this study, data description, and descriptive statistics for all variables. In the final part of the thesis we present and interpret our empirical results. The results are followed by a discussion of the practical implications of our findings, and proposals for future research within the field of value relevance of write-downs.

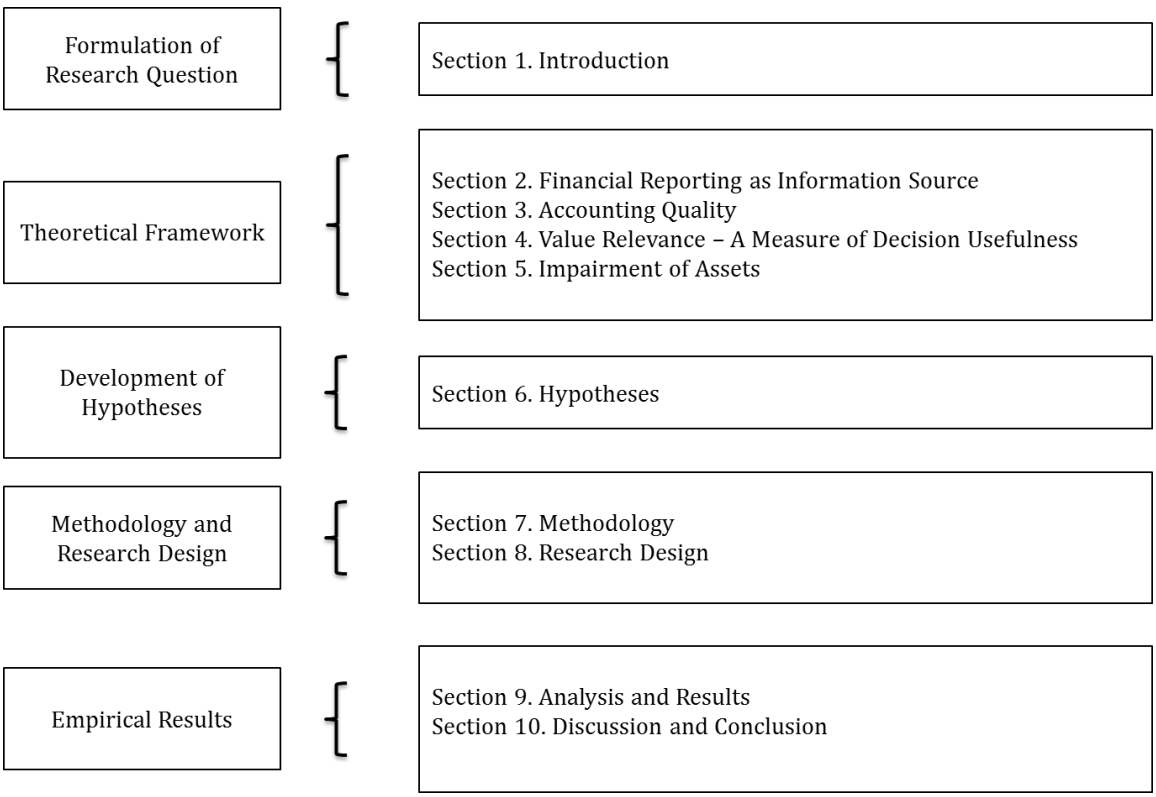

Figure 2: Thesis disposition

2. Financial Reporting as Information Source

In this section we address the function and users of financial reporting as outlined by the two leading accounting regulators, FASB and IASB. These are the two accounting regulators that set the accounting standards that the U.S. and European firms in our data selection adhere to. We continue with describing the problem of information asymmetry in relation to financial reporting. Lastly, we discuss the role of accounting regulators and their principles and quality requirements that financial reporting should be based on.

In 2002, FASB and IASB agreed to join forces to develop a common conceptual framework, based on the existing frameworks already developed by them separately. The agreement of collaboration between FASB and IASB is known as The Norwalk Agreement, and the purpose of the agreement is to ensure higher coordination between the two, and to remove differences between US GAAP and IFRS standards (FASB, n.d.). The first phase of the joint project resulted in revised definitions of the objective of financial reporting and qualitative characteristics of useful information, completed in 2010 (IFRS, 2011), before the joint project was reactivated in 2012. The work on convergence on issues adressing impairments to arrive at a common resolution, that would have been of importance for the purpose of this thesis, is currently discontinued (Deloitte, 2015), and we outlinethe impairment standards developed by US GAAP and IFRS in section 5.

In FASB's first series of Statements of Financial Accounting Concepts, FASB defines the objectives of financial reporting without drawing a clear distinction between financial reporting and the financial statement, as they state that the objectives of the two are considered essentially equal. FASB point out that financial reporting may provide more information that is not covered in the financial statement (FASB, 1978). In IASB's first Framework for the Preparation and Presentation of Financial Statements from 1989, IASB provides the following definition; "*financial statements form part of the process of financial reporting*" (IASB, 1989, p. 78), and emphasises objectives for the financial statement. In the joint definition of the objective of financial reporting, the financial statement is defined as "*a central part of financial reporting*" (IASB, 2010, p. 43). As the previously separate objectives of IASB and FASB are revised, the new, joint objectives are established for both financial reporting and financial statements, combined. Thus, the scope of the revised Conceptual

Framework is broader than the previous versions presented by FASB and IASB separately. In the remainder of this thesis, we use IASB's and FASB's definition of financial reporting as constituting the process of providing financial information. The terms financial reporting, financial information and accounting information will be used interchangeably.

2.1 The Users of Financial Reporting

Financial reporting has an informative function; it is a communicative device used by managers of a firm to inform various stakeholders of firm performance and financial condition. Information from financial reporting is a desirable commodity if it serves specific quality characteristics. These qualitative characteristics will be further described in section 3.1 concerning accounting quality. The definition of quality will depend on the perspective from which quality is judged. As there are various stakeholders that depend on information from an enterprise's financial reporting, the perception of quality may differ from the various user perspectives. Freeman (1984) defines stakeholders as the groups of individuals or individuals that are affected by an organisation's achievements of its objectives. In FASB´s first Statement of Financial Accounting Concepts, FASB defined the potential users as:

"*Owners, lenders, suppliers, potential investors and creditors, employees, management, directors, customers, financial analysts and advisors, brokers, underwriters, stock exchanges, lawyers, economists, taxing authorities, regulatory authorities, legislators, financial press and reporting agencies, labour unions, trade associations, business researchers, teachers and students, and the public*" (FASB, 1978, p. 13).

In FASB's first Statement of Financial Accounting Concept, FASB suggested that the various users would have a common interest in the enterprise's ability to generate sufficient cash flows. Furthermore, FASB recognised investors, creditors and their advisors as the primary groups in need of financial reporting information provided by the enterprise management. According to FASB, the issue of conflicting information need was solved by the notion that if the needs of investors, creditors and their advisors are satisfied, then the financial reporting information is regarded as being useful for other groups who have interest in the same financial information (FASB, 1978).

IASB previously operated with a definition of users of the financial statement that included "*present and potential investors, employees, lenders, suppliers and other trade creditors, customers, governments and their agencies and the public*" (IASB, 1989, p. 78). IASB´s definition of the primary user of financial statements was even narrower than FASB´s definition, and was limited to the investor. Similarly to FASB, IASB stated that where the need of the investor – as a provider of risk capital to the enterprise – is covered, the common needs of the users would implicitly be satisfied. In the jointly prepared Conceptual Framework, the primary user of financial reporting is defined as potential investors, lenders and other creditors. Furthermore, FASB and IASB recognise the possible conflicting interests and information needs of the various users of financial reporting. FASB and IASB suggest that the entity may provide additional information that is more useful to particular subsets of users, rather than suggesting that when the needs of the investor, creditors and other advisors are satisfied, other non-primary users of financial reporting would also be satisfied. FASB and IASB maintain general purpose financial reporting as the most efficient way to satisfy the need for information for the various users (IASB, 2010).

In this thesis, we follow FASB and IASB in narrowing the primary user of financial reporting. We study the value relevance of accounting information seen from a single external decision-maker, namely the investor. According to FASB (1978), investors are either equity security holders or debt security holders. More specifically, our chosen user perspective is the one of equity investors, as shareholders and owners of the enterprise. Equity investors provide equity financing for the enterprise in return for a fraction of the enterprise's future profits and cash flow. Further, equity investors holds the claim to the net cash flows, i.e. equity investors is the residual claimant after the debt claim, and the equity investor is therefore exposed to higher risk relative to other providers of capital. This is reflected in the cost of equity capital in terms of their required rate of return relative to the cost of debt expressed as interest rates on bank loans. While stakeholder theory suggests that the enterprise should act in a way that maximises value for all stakeholders, not just shareholders, it is widely accepted that the main objective of an enterprise is to maximise shareholder value, at least for "Anglo-Saxon" economies (Brealey, Myers, & Franklin, 2014). This notion adds weight to FASB's and IASB's definition that the investor is one of the primary users of financial reporting.

2.2 The Objective of Financial Reporting

The traditionalist view of accounting sees accounting as serving the purpose of the stewardship of management, with decision-usefulness as a potential additional benefit (Whittington, 2008). In the previous versions of FASB's and IASB's conceptual frameworks, the decision-usefulness purpose of financial reporting was emphasised, whereas financial reporting serving as a tool for the stewardship of management was regarded a secondary purpose (IASB, 2010). In FASB's and IASB's joint Conceptual Framework, the objective of general purpose financial reporting is described as:

"*to provide financial information about the reporting entity that is useful to existing and potential investors, lenders and other creditors in making decisions about providing resources to the entity*" (IASB, 2010, p. 9).

Where financial reporting for decision-making purposes was previously emphasised as the main objective of financial reporting, the new Conceptual Framework now combines the two objectives, and IASB and FASB seem not to differentiate between the two. FASB and IASB acknowledge that if accounting information is useful for decision-making for potential investors, lenders and other creditors, the accounting information also serves the purpose as stewardship of management.

2.3 The Problem of Information Asymmetry in Relation to Financial Reporting

The two purposes of financial reporting previously addressed can be explained by theory of information economics: a theoretical perspective that recognises the information advantage of individuals relative to other individuals (Scott, 2009). More specifically, two types of information asymmetry – adverse selection and moral hazard – help explain the two purposes of financial reporting.

2.3.1 Adverse Selection

The main purpose of financial reporting, as previously described, is to serve as a source of information on which to base economic decisions, i.e. investment decisions. The adverse selection is a type of information asymmetry problem describing management's problem of communicating financial information to external stakeholders. The problem of adverse selection is best explained the Lemons problem as described by (Akerlof, 1970). The Lemons

problem illustrates the cost of market inefficiency caused by asymmetric information, and is related to financial reporting as a tool for making investment decisions, rather than a tool for controlling the stewardship of management. In order for financial reporting to give information that is useful for investment decisions, investors should be able to identify the enterprise's true profitability and prospects. However, firms' management may have incentives to exploit its information advantage and distort investors' perception of firm performance, for example in order to raise funding on favourable terms (Dechow, Sloan, & Sweeney, 1996). The Lemons problem describes a market where two products are sold: a poor quality product, and a good quality product. The provider of the products holds more information about the quality of the products than the buyer, and the buyer is unable to detect the quality of the product before the transaction takes place. Due to the information asymmetry, the buyer is unable to detect differences in quality, and will therefore be paying the same price for both products. Analogous to the Lemons problem is a market of both good and bad investment opportunities, where the prospects of the different investment opportunities are given by the financial information for the individual investment. However, as the management holds more information than investors considering making the investment, the management providing information may choose not to disclose the true quality of the investment opportunity. Good investment opportunities are potentially driven out of the market as a result of the Lemons problem in this context. Furthermore, enterprises with honest financial reporting would be punished by a higher cost of equity financing, as equity investors lacks the information needed in order to distinguish between good and bad investments, and therefore is forced to set its requirements to correct for information asymmetry. Akerlof (1970) argues that the implication of adverse selection apparent in a market transaction negatively affects the economy by reducing investment willingness. Accordingly, capital market efficiency is reduced when financial reporting does not serve its purpose as being informative for the purpose of making economic decisions.

2.3.2 Moral Hazard

The second purpose of financial reporting, seen from the equity investors' perspective, is best explained from the enterprise characterisation of the *separation of ownership and control.* The shareholders may own the enterprise; yet, in most enterprises the shareholders do not control or manage the enterprise directly. A management team is chosen by its shareholders

to run the enterprise in the interest of the shareholders (Brealey, Myers, & Franklin, 2014). Management is therefore accountable to its owners, and the relationship between the two parties can be described as an agency relationship. (Jensen & Meckling, 1976)define an agency relationship as:

"*A contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent*" (Jensen & Meckling, 1976, p. 308).

The agency problem is a moral hazard type of information asymmetry, where the agent in a business transaction can fully observe the actions in fulfilling the transaction. However, the principal cannot observe the same kind of actions that fulfil the transaction (Scott, 2009). Both the principal and the agent are assumed to be rational, and in that sense act to maximise their own utility level. In a world without perfect information, the agent has incentives to exploit their superior information of firm performance and maximise their own utility level on behalf of the principal's utility level. The principal is unable to observe the acts of the agent without incurring costs of doing so. The agency problem is associated with the separation of ownership and control, where the agents do not bear a substantial share of the wealth effects of their decisions (Fama & Jensen, 1983; Jensen & Meckling, 1976). The incentives to devote efforts in searching for profitable activities lessen with the reduction in the manager's ownership claim. Further, management will not provide efforts when the cost of doing so exceeds its increase in wealth for the same level of efforts. Thus, the specification of individual rights in the contract between management and the owner of the enterprise raises the issue of agency costs. Healy & Palepu (2001)point to that the information asymmetry that exists between the two parties creates a demand for financial reporting as a device for owners to control the stewardship of management.

The information asymmetry problem illustrates the various options that management holds for the use of financial reporting. The first option is for management to communicate their superior information of the enterprise performance to investors and, in that respect, present a true and fair view of the financial performance of the enterprise. Alternatively, management may manage financial reporting for contracting, political or corporate governance reasons.

The underlying assumption that allows for the latter option is that there are imperfections in the role of regulators in governing the credibility of financial reporting (Healy & Palepu, 2001). According to Scott (2009), the fundamental problem of financial accounting theory is how to make the most appropriate trade-offs between the control purpose and the investor-informing purpose of financial reporting with the help of designing and implementing appropriate concepts and standards. We continue the next section with outlining the role of accounting regulators in mitigating the problem of information asymmetry in the relationship between management and external users of financial reporting.

2.4 The Role of Regulators in Mitigating Information Asymmetry

According to Healy & Palepu (2001) and Scott (2009), regulation of accounting information serves as a means to control for the information asymmetry problems of moral hazard and adverse selection as mentioned in section 2.3. The role of regulation of economic activity, such as the production of accounting information, would arguably be superfluous if managers and investors had access to the same information, and management's actions were fully observable by investors. As we seek to investigate the value relevance and timeliness of write-downs for U.S. and European listed oil and gas companies, we explain the role of the predominant standard setters FASB and IASB. Furthermore, we discuss the role of the U.S. Securities Exchange Commission (SEC).

2.4.1 Standard Setters

Standard setting is one of several regulation means for controlling accounting information, where an enterprise's preparation of external information is regulated by some central authority (Scott, 2009). FASB was established in 1973 and holds the role of setting the financial accounting standards known as U.S. Generally Accepted Accounting Principles (US GAAP). According to FASB, their mission is to "*establish and improve standards of financial accounting and reporting that foster financial reporting by nongovernmental entities that provides decision-useful information to investors and other users of financial reports*" (FASB, n.d). FASB is not explicit in stating their responsibility of reducing the information gap between managers and investors in their mission statement. However, FASB does recognise the role of their standard setting process as a means of ensuring an efficient capital market by developing standards that enhance financial information. Enhanced financial information

brings transparency to the economics of an enterprise (FAF, n.d.), which implicitly mitigates information asymmetry.

The accounting standards developed by FASB are enforced by SEC (Scott, 2009) who oversees the key participants in the U.S. securities markets, and is concerned with the provision of timely, comprehensive, and accurate information on which investors can make decisions (SEC, 2013). The SEC is also concerned with the issue of accounting standards for disclosure outside financial statements (Scott, 2009). Included in these standards is the accounting for reserve recognition for oil and gas companies, which we outline in section 5.2.2.

The IFRS Foundation and IASB were established in 2001 with the purpose of developing "*a single set of high quality, understandable, enforceable and globally accepted financial reporting standards based upon clearly articulated principles*" (IFRS, n.d.). IASB states that their mission is "*to develop International Financial Reporting Standards (IFRS) that bring transparency, accountability and efficiency to financial markets around the world*" (IFRS, n.d.). According to their mission statement, IASB is more explicit than FASB in recognising that the purpose of IFRS is to strenghten accountability of financial reporting. Strengthened accountability of financial reporting reduces the existing information asymmetry between investors and management, which contributes to economic efficiency by helping investors identify investment opportunities and risks.

Today, over 100 jurisdictions permit or require IFRS for domestic listed companies, Europe included (Deloitte , 2015). In contrast to FASB, IASB does not have a regulatory body with enforcement authority that ensures the consistency of IFRS application (Alali & Cao, 2010). The enforcement of application and consistency of the application of IFRS is therefore in the hands of national regulatory bodies. The different countries adhering to IFRS may therefore not necessarily apply IFRS consistently. According to Alali & Cao (2010), this raises the issue of whether IFRS actually contributes to improved comparability and transparency of financial reports. Christensen, Hail, & Leuz (2013) investigate whether strong institutions and legal systems, as well as effects of enforcement changes during the time when countries first adopted IFRS, have stronger capital market effects than countries where these factors are not present. The findings of Christensen et al. (2013) suggest that countries with strong and

regulatory systems adopting IFRS do not necessarily yield liquidity benefits. However, the findings of Christensen et al. (2013) do suggest that enforcement changes play a critical role for the observed liquidity improvements around the IFRS adoption.

The major difference between the standards provided by FASB and IASB is that US GAAP is rules-based, whilst IFRS is principles-based (AICPA, n.d.). Different from rules-based accounting, the implication of principles-based accounting standards is that it provides more freedom in the interpretation of the standards, and thus, may provide multiple alternatives of applying the standards. Multiple alternatives could have the potential of reducing the reliability and credibility of the standards (Alali & Cao, 2010). The rules-based accounting of US GAAP has also received criticism, especially after the accounting scandals with Enron and WorldCom during 2001–2002 (Alali & Cao, 2010). The existing differences between the two standard setters have inspired several comparative studies with mixed results. Barth, Landsman, Lang, & Williams (2007) find that U.S. firms applying US GAAP have higher accounting quality than firms adhering to IFRS. The same result is found by Van der Meulen, Gaeremynck, & Willekens (2007) who claim that US GAAP outperform IFRS earnings on value relevance, timeliness, predictability and accrual quality[1]. In contrast, Bartov, Goldberg, & Kim (2005) do not find a significant difference in value relevance between US GAAP and IFRS.

[1] Accrual quality may be defined as the degree to which earnings map closely into cash flow (Francis, LaFond, Olsson, & Schipper, 2005).

3. Accounting Quality

As of today, there is neither a universal definition of accounting quality as a concept, nor a general view of what should be considered good accounting quality. Good accounting quality can, for example, be defined as financial information that provides an objective picture of a firm's financial position, free from managerial manipulation (Petersen & Plenborg, 2012). Correspondingly, the financial statement is usually described as a source showing the true and fair view of the firm's financial position and its performance, if performed with high quality (IASB, 1989). Barth et al. (2007) express a similar view of accounting quality and define it as information with little earnings management (i.e. manipulation), timely loss recognition, and high value relevance. However, from an analyst's perspective, accounting quality can instead be viewed as to what degree current earnings are able to predict future earnings. Thus, permanent accounting items are characterised as having high quality for analysts while transitory accounting items are perceived as being of lower quality. Further, from a lender's perspective, good accounting quality would imply that all assets and liabilities should be valued at their real liquidation value to be able to assess a firm's ability to repay its debt (Petersen & Plenborg, 2012). Thus, as indicated from the different perspectives above, the definition of accounting quality should depend on the user of the financial information.

3.1 FASB and IASB – Definition of Accounting Quality

As previously addressed, both IASB and FASB emphasise investors as one of the primary users of the financial statements, and that the main purpose of financial information is to be a basis for the investors' decision-making process. As also previously addressed, one of the goals of IASB is to develop an internationally acceptable set of high quality financial reporting standards. To achieve this goal, IASB has developed principles-based standards that will require accounting measurement that reflect a firm's economic performance. FASB has a similar mission to IASB's, which is to improve financial reporting for the benefit of investors and other users of the financial information in the U.S., achieved by setting high-quality standards. FASB defines high-quality standards as:

"*Standards that provide users of financial statements with information that is clear, useful, and relevant to their needs, while considering whether the expected benefits of that information justify the costs of providing and using it.*" (FASB, n.d.)

IASB and FASB have jointly developed qualitative characteristics to identify the type of information that is likely to be most important to both existing and new investors. These qualitative characteristics are divided into two categories: "fundamental" and "enhancing". If accounting quality equals useful financial information, then accounting quality could be defined in the same way as FASB and IASB define the qualitative characteristics:

"*If financial information is to be useful, it must be relevant and faithfully represented [the fundamental qualitative characteristics] what it purports to represent. The usefulness of financial information is enhanced if it is comparable, verifiable, timely and understandable [the enhancing qualitative characteristics]*" (IASB, 2010, p. 16).

3.1.1 Fundamental Characteristics – Relevance and Faithful Representation (Reliability)

According to IASB's and FASB's joint conceptual framework and qualitative characteristics, relevance of accounting information is defined as to what extent the financial information is capable of making a difference for users when making decisions. Relevant accounting information can be translated into what degree the information has predictive value, confirmatory value, or both[2]. These values are generally interrelated which implies that if information is predictive it is often also confirmatory (IASB, 2010). Financial reports have to represent the firm's economic events, in terms of text and number, but also represent these in a faithful way. A report that is perfectly faithfully represented is complete, neutral and free from errors. However, in reality a completeness of the information would translate to information that discloses all information necessary for the user to understand a firm's financial situation and its underlying operation. Neutrally presented information means that the information disclosed is free from all kinds of manipulation. Further, free from errors does not mean that the information is accurate in all respects, but rather that there should be no errors in the descriptions of, or processes to produce, the disclosed information. Information

[2] Information has predictive value if it can be used to predict future outcomes. Confirmatory value equals information that provides feedback to previous predictions.

that is faithfully represented does not inevitably have to be useful. For example, when estimating an impairment of an asset, which is faithfully represented, the reporting entity has to apply an appropriate process, properly describe the estimate and explain the underlying uncertainties that will have an impact on the estimate. However, if these uncertainties are significantly large, the information about the estimate will still not be very useful. Faithful representation has replaced the previously used term reliability, as different stakeholders interpreted reliability differently (IASB, 2010). We do not believe that the differences in the definitions of faithful representation and reliability will have a major impact on accounting, and we therefore do not make any distinction between the two terms hereafter.

Accounting information has to be both relevant and reliable in order to be useful. However, there may be a trade-off between the two concepts. An accounting method that entails to gain relevance might lessen reliability, and vice versa (FASB, 1980). For example, accounting methods that limit managers' alternatives may also limit their opportunistic behaviour (i.e. earnings management) and thereby force them to produce information of higher accounting quality (i.e. information with higher reliability). On the other hand, limiting alternatives may also limit the firms' ability to report accounting measures that better reflect the firms' economic performance (i.e. less relevant information) (Barth et al., 2007).

3.1.2 Enhancing Characteristics

The enhancing qualitative characteristics have the purpose of enriching the fundamental characteristics to increase the usefulness of information. In addition, they should be used when determining which out of two equally relevant and faithfully represented options to choose. The enhancing characteristics consist of *verifiability, understandability, comparability* and *timeliness*.

Verifiability of disclosed information enhances faithful representation of financial reporting by making "knowledgeable and independent observers" reach a consensus about the information disclosed. Verifiability does not require independent experts to come to complete agreement that the presented information is a faithful representation. Understandability is another enhancing characteristic, which indicates that information is clear and concise, in order for the user to be able to understand its content. Comparable information is more useful as it helps to make decisions, as making decisions often implies a choosing of two alternatives.

Thus, financial information has high comparability if it enables users to compare similar financial information from different entities and compare equal financial information from different periods of time. Timeliness of accounting information implies that information should be available in time to influence decision-makers' decisions. The timing of the declaration of the information is important as, in general, the older accounting information, the less relevant the information is for the users (IASB, 2010). (Ball, Kothari, & Robin, 2000, p. 2)define timeliness as: "*The extent to which current-period accounting income incorporates current-period economic income.*"

3.2 Decision-Usefulness from Two Opposing Perspectives

In accordance with IASB and FASB we judge accounting quality from the equity investor's perspective and thus define good accounting quality as information that is decision-useful for investors. In theory, there are two perspectives of decision-usefulness: the information perspective and the measurement perspective (Scott, 2009).

The information perspective defines the degree to which the financial reporting information has information content for investors. The degree of information content can be measured by the extent of volume or price change after the announcement of the information. In other words, information is useful if it triggers investors to buy or sell shares (Scott, 2009). In general, research questions concerned with *what* accounting amounts that provide information of firm value, takes an information perspective (Barth, 2000). Thus, the information perspective assumes semi-strong market efficiency (Hitz, 2007). In addition, the information perspective assumes that rational investors revise their expectations of future enterprise performance and share returns based on current earnings information (Scott, 2009).

The competing view of decision-usefulness is the measurement perspective, where a greater use of current values is emphasised in financial reporting, given that current values may be applied with reasonable reliability (Scott, 2009). According to the measurement perspective, financial reporting serves a more basic role in reporting firm value, rather than functioning as one fraction of the total mix of available information sources, as seen from the information perspective. Thus, considering the measurement perspective, investors are enabled by a more

informative information system on which to base their predictions of future firm performance (Scott, 2009). Research questions aimed at answering *how well* accounting amounts provide information of firm value are raised from a measurement perspective point of view (Barth, 2000). The measurement perspective rests on the assumption of an efficient market, although this assumption may be relaxed (Beaver, 1989).

3.2.1 Value Relevance

Studying value relevance of accounting information is a way to measure the decision-usefulness of the information. A common definition of value relevance is to what extent accounting information is able to capture and clarify information that determines the firm value. Value relevance can be measured as the degree of association between accounting amounts (e.g. book value of equity or earnings) and a measure of firm value, such as share prices (Ball & Brown, 1968; Barth, 2000; Beltratti et al., 2013; Soderstrom & Sun, 2007). Thus, an accounting amount will be considered value relevant only if it reflects information that is relevant to investors when valuing the firm, and is measured with reliability to be reflected in the measure of firm value. It is important to note that determining value relevance is not an estimation of firm value for valuation purposes even though share price is used as a benchmark for firm value. For valuation purposes, all variables that would help determine firm value are included in the analysis. Determining value relevance is done by selectively including accounting amounts of interest to define the valuation characteristics of that particular amount (Barth, Beaver, & Landsman, 2001).

Several researchers have proven negative earnings to be less value relevant than positive earnings. (Hayn, 1995) confirms her hypothesis that negative earnings are not perceived by shareholders to persist and that negative earnings therefore are less informative than positive earnings about the future prospects of the firm. Beisland (2008) also examines the relationship between negative earnings by investigating the return model's change in explanatory power when accounting for the negative sign of earnings. He finds that the value relevance of negative earnings increases both when negative earnings are disaggregated into several components, and when the negative sign of earnings is accounted for when specifying the applied model.

3.2.2 Timeliness of Accounting Information

Timeliness is a dimension of value relevance, and is important when measuring new information to the capital market (Barth, 2000). As previously addressed, accounting information should be available to influence decision-makers' decisions according to IASB and FASB in the conceptual framework. The fact that the accounting information has to be able to influence decisions implies that the information should consist of at least, to some extent, new information to the market. Thus, if the accounting amount is timely, then the accounting amount is value relevant from an information perspective.

The trade-off between relevance and reliability is present in the timeliness of the reporting of accounting amounts as timely disclosure of accounting information enhances the decision-usefulness and thus the relevance of the information. When studying timeliness of write-downs, Vyas (2011) predicts that more timely write-downs would help the market participants to adjust for potential losses more quickly, relative to untimely announcements of write-downs. His prediction rests on the assumption of semi-efficient capital markets, implicitly assuming that managers hold private information of risk exposure and future potential losses, which is communicated through write-downs. This means that the more timely the write-downs, the faster the change in firm value will be reflected in share prices. Vyas does confirm his predictions with the finding that negative returns for firms with more timely write-downs are larger than the return of firms with less timely write-downs, suggesting that investors are able to adjust more quickly to changes in risk exposure. The example by the study of Vyas underlines that timely accounting information is value relevant and decision-useful information to investors.

The trade-off between relevance and reliability previously addressed is also apparent in relation to timeliness. Too much emphasis put on verifiability and objectivity (i.e. enhanced reliability) may cause timeliness to suffer. In a real setting, emphasis on reliability over relevance translates to delayed information with the benefit of more reliable estimates, as more information is taken into consideration before the information is provided to external users. The benefit of reliable information may outweigh the potential costs of relevant information, in terms of timely information based on unreliable estimates. The trade-off between relevance and reliability is applicable to both income recognition and recognition of

expenses. A higher degree of verifiability is needed for recognition of "good news" than for "bad news" (Beisland, 2008). A strict demand for objectivity and verifiability creates, in general, conservatism in accounting for good news. In addition, conservative accounting denotes that losses are generally recognised before positive earnings, which is confirmed by Basu, (1997) who finds that "bad news" are usually more timely than "good news", which emphasises the fact that income recognition depends more on reliable recognition rather than relevant recognition, through timeliness. Expense recognition emphasises immediate recognition, which means that relevance is traded off against reliability.

3.2.3 Earnings Management

As outlined in section 2.3, concerning information asymmetry, the risk of accounting information being biased is inevitable, even in the presence of standard setters as a means to reduce or mitigate the existing information asymmetry between management and owners of the firm. Definition, recognition, measurement and classification of accounting amounts are possible subjects for manipulation through firm management's accounting choices, estimates and judgements (Tho12). Manipulation may not be intentional; nevertheless, unintentional biased financial reporting reduces the decision-usefulness to investors. However, the absence of earnings management does not guarantee higher accounting quality, as the information that affects future earnings may not always be disclosed in the financial reports (Akers, Giacomino, & Bellovary, 2007).

Presence of earnings management is implicitly measured, as we believe that if accounting information is both value relevant and timely, we also interpret the information to be free from noteworthy earnings management.

4. Value Relevance – A Measure of Decision-usefulness

In the previous section we have defined accounting quality as decision-useful information to investors. Related to decision-usefulness of financial information, we defined the related concepts of value relevance, timeliness and earnings management. In this section we describe how value relevance and timeliness of accounting amounts can be measured, and present previous research within the field of value relevance literature.

4.1 Valuation Models within Value Relevance Research

When we investigate value-relevance of write-downs, we investigate the extent to which write-downs measure firm value. Furthermore, we investigate the extent to which write-downs provide information of firm-value by addressing timeliness of write-downs. Thus, the objective is to study the relationship between market values of equity and write-downs. When measuring value relevance, we need a benchmark for firm value, i.e. a measure that summarises the information that is relevant for the investors. A measure for firm value commonly used is share price, which under the assumption of an efficient capital market, reflects any information available, including accounting information. Even in a semi-efficient market, share prices reflect the investors' valuation of the firm. Share price may therefore be used as a measure of firm value for the purpose of measuring value relevance (Barth, 2000). Another measure commonly used as a benchmark to assess the usefulness of accounting numbers to investors is share returns (Stenheim, 2012). Where share price is a benchmark for firm value, share return is a benchmark for changes in firm value. Share price and share return as measures of firm value and changes in firm value stem from the formal expression of value relevance, where the relationship between accounting numbers and stock price can, according to Stenheim (2012), be expressed as:

$$MVE = \phi(AI) + \varepsilon_1$$

$$R = \rho(AI) + c_2$$

Where

MV = Market Value of Equity

R = Market Return on Equity

AI = Accounting number

ε_m = Residual term of equation m where m ∈ [1,2]

This expression of the relationship between stock prices and accounting amounts is interpreted as evidence that accounting amounts are able to capture and summarise economic fundamentals reflected in the stock prices (Stenheim, 2012). In addition to a measure of firm value, a valuation model is needed in order to perform a value relevance research (Barth, 2000). It is important that the valuation model used is appropriate for valuing the firm-specific characteristics in order to avoid consequences such as incorrect predictions for the signs and magnitudes of coefficients of accounting amounts (Holthausen & Watts, 2001). We will now describe the most commonly used valuation models of which value-relevance research is justified. However, we believe it is important to note that there is no standardised way of how to measure value relevance.

4.1.1 Dividend Discount Model

The dividend discount model is the most commonly used valuation model, where the price at time t (P_t) equals the expected value of future dividends (d_{t+r}) (Barth, 2000):

$$P_t = \left(\sum_{r=1}^{\infty} R^{-r} E_t[d_{t+r}] \right)$$

Where

E = expectation operator

r = discount factor, which is assumed to be constant over time

R = (1+r)

The discounted divided model can also be expressed as:

$$EV_0 = \sum_{t=1}^{\infty} \frac{E(d_t)}{(1+r_t)^1}$$

Where

EV = the theoretical equity value, the present value of all future dividends (d)

E (d) = expected dividend (can be replaced with expected free cash flow to equity to get the discounted cash flow model).

The dividend discount model implies that only future dividends and the discount factor (i.e. required rate of return on equity) determine the market value of a firm (Petersen & Plenborg, 2012). Thus, to express this dividend discount model in terms of accounting amounts, a link between expected future dividends and accounting amounts must be addressed (Barth, 2000). The dividend discount model is the basis for the other models we are now going to discuss; The Earnings Model, Balance-sheet Model, and Ohlson Model (Stenheim, 2012).

4.1.2 Earnings Model[3]

Accounting amounts can be linked to firm value by the earnings model, which is expressed as:

$$P_t = \frac{1}{r} E^*$$

Where

E* = Permanent earnings

The earnings model is based on the assumptions of perfectly efficient capital markets, were dividends have no wealth effect on shareholders, in accordance with the Modigliani-Miller theorem (Stenheim, 2012). Barth (2000) also refers to Miller and Modigliani, when stressing that net income (NI) can be used as an approximation for permanent earnings. Using the earnings model to gain insight into accounting earnings requires a specification of how accounting earnings relate to permanent earnings. Thus, it is important to address what additional variables that need to be included in the estimation equation in order for accounting earnings to be a proxy for permanent earnings (Barth, 2000). How realistic the model is depends on the relation between NI and E, the stability of NI, and how realistic the time-horizon for the study is. In addition, the model is usually referred to as a non-growth model and is based on the assumption that the discount rate is constant (Barth, 2000; Kothari & Zimmerman, 1995). These underlying assumptions of the earnings model are unrealistic as capital markets are arguably not perfectly efficient, and thus, constant discount rates may not be realistic in a less than perfect capital market. Another unrealistic assumption that the earnings model implies is that NI is equal in all future reporting periods (Stenheim, 2012).

[3] The Earnings Model is sometimes also referred to as the Earnings-Capitalisation Model.

Thus, the researcher must consider whether transitory earnings components should be included in the proxy for permanent earnings.

4.1.3 Balance-Sheet Model

The balance-sheet model is, in accordance with the earnings model, also based on the assumption of totally efficient markets, and is thus exposed to the same criticisms as the earnings model (Stenheim, 2012). The model expresses price (or market value) of a firm as a function of the market value of assets and liabilities (Barth, 2000) and can be expressed as:

$$MVE_t = MVA_t + MVL_t$$

Where

MVE_t = Market Value of Equity, at time t

MVA_t = Market Value of Assets, at time t

MVL_t = Market Value of Liabilities, at time t

The reasoning behind the model is that market values of assets and liabilities are equal to the present value of the expected dividends, or cash flows, related to the underlying asset or liability. Given fair-value accounting, balance sheet amounts of assets and liabilities can be used as an approximation for these market values. However, the model requires careful consideration of which accounting assets and liabilities that should be included or excluded, and what other variables should be included, in the estimation of the market values (Barth, 2000).

4.1.4 The Ohlson Model

The Ohlson model provides a link between accounting amount and firm value by including earnings and equity book value as independent variables. The theoretical essentials of the Ohlson model are found in the Feltham-Ohlson model, which is often referred to as the residual income model. The Feltham-Ohlson model estimates the value of a firm on the basis of book values and the discounted value of future expected abnormal returns (Feltham & Ohlson, 1995; Stenheim, 2012). The Feltham-Ohlson model measures firm value and is expressed as:

$$MV_t = BVE_t + \sum_{T=1}^{\infty} \frac{E[I_t - r_t B_{t-1}]}{(1+r_t)^t} = BVE_t + \sum_{T=1}^{\infty} R^{-T} E_t[x^a_{t+T}]$$

Where

BVE_t = Book value of Equity, at time t

$E_t[\,]$ = Expected value based on available information at time t

I_t = Earnings at time t

r_t = Required rate of return at time t

B_{t-1} = Book value of Equity at the previous period

X^a = Abnormal earnings

R = Discount rate R = (1+r)

The expected value on earnings minus the required return on equity is what is usually referred to as a firm's residual income (Petersen & Plenborg, 2012).

The Feltham-Ohlson model is based on the following three assumptions (Ohlson, 1995):

1. The present value of expected future dividends determines the market value.
2. "*Accounting data and dividends satisfy the clean surplus relation, and dividends reduce book value without affecting current earning*" (p. 662). Thus, the clean surplus assumes all revenues, expenses, gains and losses to be recognised in the income statement in the forecast period (Petersen & Plenborg, 2012). The clean surplus assumption enables earnings or book values adjusted to present value to replace dividends, which means that the change in dividends between two dates equals earnings minus dividends (Ohlson, 1995):

$$BVE_t = BVE_{t-1} + I_t - dividend_t$$

3. The third assumption is usually referred to as the linear information dynamic and implies that "a linear model frames the stochastic time-series behaviour of abnormal earnings" (p. 662). The linear information dynamics specifies that both abnormal earnings and non-accounting information are autoregressive, which means that past earning have an impact on current earnings (Lundholm, 1995).

For analytical convenience purposes, Ohlson (1995) adjusted the model by adding assumptions of information dynamics of abnormal earnings and non-accounting information (Barth, 2000). The revised Feltham-Ohlson model, the Ohlson model, is presented as follows:

$$V_t = k(\varphi NI_t - d_t) + (1 - k)BVE_t + \alpha_2 v_t$$

Where

V_t = The market value, or price, of the firm's equity at date t

k = A function of the discount rate and the persistence of abnormal earnings

φ = A function of the discount rate *r*

$NI_t - d_t$ = Net income less dividends in period t

BVE_t = (Net) book value of equity

v_t = Other information

The factor *k* in the model represents relative weights added to NI and BVE terms. The relative weights also show that if *k* = 1, the Ohlson model is simply an earnings model, and if *k* is 0, the Ohlson model equals the balance sheet model (Stenheim, 2012).

The Ohlson-model describes firm value as a linear function of book value of equity and the present value of expected future abnormal earnings. The assumption of linear information dynamic enables the firm-value to be re-expressed as a linear function of equity book value, net income, dividends and other information. Unlike the earnings model and the balance-sheet model, the Ohlson-model does not rely on assumptions of permanent earnings or asset and liability values, and therefore does not require a specified link between accounting amounts and economic constructs, such as market values (Barth et al., 2001). Thus, the model specifies how firm value can be estimated based on accounting amounts instead of having to trust market values.

4.3 Previous Research of Value Relevance

Capital market research concerned with the relation between capital markets and financial statements has several topics, value relevance research being one. Within capital market research, fundamental analysis has the primary focus of valuation aimed at identifying mispriced securities. Another topic within capital market research concerns tests of market efficiency and how security prices are influenced by financial information (Kothari, 2001).

Different from fundamental analysis and research of market efficiency, the motivation of value relevance research is primarily standard setting (Holthausen & Watts, 2001). The first study examining the association between an accounting amount and market value was performed by Miller and Modigliani as early as in 1966 (Barth et al., 2001). From the 1990s and onwards, value relevance has been a major research area for accounting studies (Beaver, 2002). The purpose of value relevance research is to operationalise key qualitative characteristics set by FASB and IASB, and thus, to assess the relevance and reliability of accounting amounts (Barth et al., 2001). According to Barth et al. (2001, p. 80)

"*...an accounting amount will be value relevant, i.e., have a predicted significant relation with share prices, only if the amount reflects information relevant to investors in valuing the firm and is measured reliably enough to be reflected in share prices.*"

Holthausen & Watts (2001) define three categories of value-relevance research; relative association studies, incremental association studies, and marginal information content studies. The three categories of value relevance research are introduced separately in the following three sections.

4.3.1 Relative Association Studies

While most studies fall into one specific category, some studies fall into several of the three categories. "*Relative association studies compare the association between stock market values (or changes in values) and alternative bottom-line measures*" (Holthausen & Watts, 2001, p. 5), where associations are studied over a long observation window (i.e. typically more than a year). Relative association research can for example study the association between accounting amounts and value measures for firms applying different accounting standards (e.g. IFRS versus US GAAP). An alternative example of a relative association study is the assessment of different measures of net earnings including or excluding a specific earnings component. The earnings measure that explains most of variations in market values or return over the other earnings measure is considered the most value relevant accounting amount.

4.3.2 Incremental Association Studies

Even though much of the value relevance research is based on the summary measures, such as book value of equity and net income, there is also a large number of research which focuses on disaggregated accounting amounts. In the accounting literature, studies that investigate

the association between disaggregated components and stock price or return are referred to as incremental association studies. Similar to relative association studies, incremental association study is also tested under a long observation window. However, rather than a relative comparison of bottom line measures, incremental association studies examine whether disaggregated accounting amounts are helpful in explaining values or share returns, when keeping other variables fixed. Thus, incremental association studies test whether individual components in the financial statement are value relevant. An accounting amount is considered value relevant if the association between the accounting amount and measures of firm value are statistically significant. Within this category, value relevance of a component of earnings or book value of equity may also be judged by either the size of the coefficient of the component of interest, or the degree to which the value of the coefficient deviates from a predicted value. Holthausen & Watts (2001) refer to such studies of balance sheet components as measurement studies, where the objective is to determine *how* accurately the component is a measure of the market value of the balance sheet component whose incremental association is being studied. The details of the interpretation of measurement studies are presented in section 7.1.3.

Ohlson & Penman (1992) stress that the summary measures, the bottom line items of the financial statements, have become known as serving as primary indicators of a firm's value even though they may be insufficient measures for the purpose. Measurement error can stem from the fact that the summary measures are derived from line items, which to investors have different valuation implications. Thus, if the measurement errors in the line items are significant, the aggregation is not satisfied. In their empirical analysis, Ohlson & Penman run regressions of earnings components (including depreciation expenses, gross margin, and extraordinary line items) to explain how these different components explain returns. In their empirical analysis, Olson & Penman find that disaggregation of earnings improves the explanation power of the regressions. However, in the longer run, the aggregated income measure becomes more accurate. In contrast, the opposite results are found for the individual balance-sheet items, which indicate that the balance-sheet items appear to contain less material information when disaggregated.

4.3.3 Marginal Information Content Studies

Where relative and incremental association studies both take a measurement perspective of decision-usefulness in determining value relevance of accounting amounts, marginal information content studies are considered short-term return studies with an information perspective. Marginal information studies, also referred to as event studies, examine whether a particular accounting amount adds any new information to investors, in addition to information already available. Generally, event studies are used to determine if the publicity of accounting information (amounts) incur any difference in the market value shortly after this information is released. A significant price reaction is interpreted as evidence of value relevance, and thus, decision-usefulness of the accounting amount under study. The event study of Ball & Brown (1968) was the first to provide evidence that security market prices do respond to accounting information. Ball & Brown (1968) studied the market reaction to a firm's release of its current net income, and found that the market responded to good and bad news reflected in earnings in the month following the earnings announcement.

It is worth emphasising that it is the short-term window used in event studies that allows this design to capture the effect of announcements of information on share returns. When the relationship between earnings and returns is studied under longer time intervals, the incremental information content of earnings may be overstated as other important parts of information may explain the variation in returns (Lev, 1989). Thus, the reason for narrowing the time interval for marginal information content purposes is to eliminate noise from other potential information sources (Easton, Harris, & Ohlson, 1992).

An explanation for lack of information content of earnings is often rationalised by the notion that prices lead earnings. In an efficient market, security prices will reflect all available information from other medias in addition to accounting information. Parts of the effect from the earnings announcement will therefore be anticipated by the market and incorporated in the share price before earnings are announced, thus, prices lead earnings. The lack of timeliness of earnings is caused by transaction-based earnings recognition, whereas the securities market reflects current and expected future net revenues (Kothari, 2001).

4.4 Previous Research on Value Relevance and Timeliness of Write-Downs

As previously addressed, most research measuring value relevance and timeliness of accounting amounts use stock price or returns as a measure of firm value. However, Vyas (2011) measures the timeliness of write-downs during the financial crisis for U.S. financial institutions by using cumulative write-downs devaluated as implied by exposure-specific credit indices, as a benchmark for when write-downs should take place. Vyas then compares these devalued cumulative write-downs with the cumulative write-downs reported by the firms. Vyas finds that write-downs reported by these firms lagged in relation to what the exposure-specific indices implied. In addition, Vyas concludes write-downs to be less timely for firms with greater financial leverage, tighter regulatory constraints, and more complex exposures. Vyas criticises the use of share return as a news measure and argues that the credit indices he uses as a benchmark for timely write-downs are a more context-specific measure of news. The opportunity to use credit indices, as a benchmark measure for implied write-downs, is a unique opportunity for researchers studying financial institutions during the financial crisis. However, equivalent indices may not be available to value relevance studies of write-downs of firms in other industries.

A related study to that of Vyas (2011) is the research of Beltratti et al. (2013) who also examine the value relevance and timeliness of write-downs reported by financial institutions in North America and Europe during the financial crisis. Beltratti et al. criticise the use of the information from credit indices applied in Vyas (2011) research and argue that such indices can be subject to liquidity concerns. Beltratti et al. (2013) evaluate the timeliness and value relevance of write-downs using information from the liquid stock market, and base their results on studying the association between share returns and write-downs. They find that write-downs are associated with contemporaneous share returns and thereby conclude write-downs to be timely and value relevant during the financial crisis. These results are thus opposing to the findings of Vyas (2011). Beltratti et al. (2013) stress that the opposing results partly have to do with the difference in their samples, in addition to the distinction in benchmark measure.

Value relevance and timeliness of write-downs is not exclusively applicable to firms in the financial sector. Alciatore et al. (2000) investigate write-downs of long-lived assets for firms

in the oil and gas industry under the SEC ceiling-test in the full-cost method. Alciatore et al. do this by studying the relationship between contemptuous returns and asset write-downs during a period of the largest oil price drop (1984–1987) since the implementation of the ceiling-test in 1978. Alciatore et al. find significant association between write-downs and contemporaneous returns, suggesting that the mandatory full-cost ceiling test for the oil and gas firms provides a value relevant adjustment to the earnings of these firms as the write-downs. However, the association between lagged returns and write-downs was found to be even stronger than the association to contemporaneous returns, implying that the write-downs are reported after the market has reacted. Alciatore et al. state that the findings suggest that untimely write-downs are due to the market being able to anticipate future decline in oil and gas prices before write-downs are announced. Since the information inherent in write-downs was found to already be incorporated into share prices, the oil and gas producers' concerns about write-downs leading to unrealistic and harmful effects on the equity values were disproved.

In addition to value relevance research considering write-downs, we have also taken inspiration from research studying other disaggregated accounting measures such as amortisation of goodwill as in the research of Jennings, LeClere, & Thompson II (2001). Jennings et al. perform a relative association study evaluating the effect of goodwill amortisation on the usefulness of earnings as an indicator of stock price for publicly traded companies. They do this by comparing explanatory power (R^2) of the association between stock prices and earnings before goodwill amortisation and earnings after goodwill amortisation. The study is performed in a period before FASB implemented standard change favouring annual goodwill impairment tests and eliminating the systematic amortisation of goodwill to find evidence of the potential effect of this change. Jennings et al. find that earnings before goodwill amortisation explain significantly more of the share return than earnings after goodwill amortisation and could therefore conclude goodwill amortisation not to be value relevant for investors. Inspirations drawn from the study of Jennings et al. allow us to test value relevance from an alternative perspective, through relative association rather than incremental association.

5. Impairment of Assets

In the following sections we introduce the accounting standards related to impairments of assets in IFRS and US GAAP, respectively. The reason for presenting these standards is due to our firm selection of firms operating in Europe and the U.S. We start by presenting the related standards in IFRS, followed by an introduction to the standards related to impairments in US GAAP and SEC. A summary table of the standards concerning impairments of assets according to IFRS, US GAAP and SEC ends this section. The terms impairments of assets and write-downs will be used interchangeably throughout the thesis.

Most non-current assets, both tangible and intangible, are expensed as depreciation over the assets' assumed lifetime. However, additional expenses should be recognised as write-downs when an asset is considered impaired. An asset is considered impaired when its book value is greater than its recoverable amount, i.e. market value. Even though impairments have no cash flow consequences, they may still have an impact on the firm's value as impairment losses can be interpreted as a signal of expected poor future performance. The definition of impairment can, in addition, often be subjective as estimating the recoverable amount involves a great deal of judgement. Determining the recoverable amount of an asset can therefore be challenging and the subjectivity makes it possible for different experts to arrive at different conclusions. This may leave room for management to manipulate the accounting information, as a write-down of a non-current asset reduces future depreciation and amortisation expenses, which makes it easier to improve profits in future periods (Petersen & Plenborg, 2012).

5.1 IFRS Standards Related to Impairments of Assets

IAS 36 Impairment of Assets provides all the requirements an entity should account for and report concerning impairments of almost all non-financial assets, apart from a few exceptions. These requirements include clarification of when an entity needs to perform an impairment test, how to perform it, and specifies the recognition of any impairment losses and the related disclosures (Ernst & Young, 2010). The objective of IAS 36 is to provide the firms with the procedures they have to conduct in order to ensure that their assets are carried at no more than their recoverable amount. To meet this objective, IAS 36 requires entities to test their assets for impairment if indications of impairment exist at the end of each reporting period (IAS 36.1). In addition, IAS 36 requires that goodwill and intangible assets with indefinite useful lives have to be tested for impairment at least annually. These assets are required to be tested for impairment more frequently than annually if there are changes in the circumstances that indicate that the asset may be impaired. An asset is considered impaired and an impairment test should be recognised if the carrying amount exceeds the recoverable amount (Ernst & Young, 2010).

5.1.1 When to Test if Assets are Impaired

At the end of each reporting period, IAS 36 requires the entities to assess if there are any indications that the assets may be impaired. This can be evaluated based on the use of both internal and external sources of information. Examples of internal indications are available evidence of obsolescence or physical damage to the asset, internal restructurings, or evidence from internal reporting that the economic performance of the asset is, or will be, worse than expected. External sources of information includes observable indications that the asset's value has declined significantly more than expected, changes in market interest rates, or changes in the market, technological, economic or legal environment in which the entity operates, which negatively affects the entity (IAS 36.7). *IFRS 6 Exploration for evaluation of mineral resources* contains a few exceptions from the requirements in IAS 36 for oil and gas companies. As for other assets within the scope of IAS 36, capitalised exploration and evaluation activities are required to be tested for impairment when impairment indicators are present. However, the impairment indication requirements under IFRS 6 are less strict than those in IAS 36. An example of circumstances indicating impairment can for example be a significant change in commodity prices (BDO, 2013).

5.1.2 Recoverable Amount

As mentioned above, the impairment test involves a comparison of the carrying amount with the recoverable amount of the asset. The recoverable amount of an asset is the higher of 'fair value less costs to sell' and 'value in use' (Ernst & Young, 2010).

Fair value less costs to sell (fair value) is defined as:
"The amount obtainable from the sale of an asset in an arm's length transaction between knowledgeable and willing parties, less the cost of disposal" (Ernst & Young, 2010, p. 6)

If no information from a binding sale agreement is available, the fair value can be determined by using the asset market price if the asset is traded in an active market. Otherwise, fair value is to be estimated based on the best information available, to reflect the amount that could be obtained for the asset or by using the discounted cash flow approach. The latter approach includes calculation reflecting all future events that would affect the expected cash flows for a typical market participant that holds the asset (Ernst & Young, 2010).

Value in use is defined as the present value of the future cash inflows expected to be derived from an asset. An estimation of value in use includes cash flow prediction and a discount rate to be able to calculate the present value of future cash flows (Ernst & Young, 2010). Value in use is very subjective and needs a lot of managerial judgement to be estimated and therefore requires extensive disclosure. Generally, value in use would be the higher out of value in use and fair value less cost to sell, since the value to the entity is greater holding the asset (McEwen, 2009).

The recoverable amount is, if possible, determined for individual assets. However, if an asset does not generate cash inflows, which is largely independent of cash inflows from other assets, the recoverable amount is determined for the cash-generating unit to which the asset belongs (Ernst & Young, 2010). A cash-generating unit is defined by IFRS as:

> *"… the smallest identifiable group of assets that generates cash inflows that are largely independent of the cash inflows from other assets or groups of assets*" (IAS 36.6).

For oil and gas companies each cash-generating unit has to be at least at the size of an operating segment according to *IFRS 6 Exploration for evaluation of mineral resources* (BDO, 2013).

5.1.3 Reversal of Impairment Loss

In the same manner as internal and external sources of information can indicate that an asset is considered impaired, there can also be internal or external information that indicates that the impairment has decreased or no longer exists. Significant positive changes in the asset's value and market conditions are examples of external indications, and changes in the asset's use and performance may count as internal indicators. If the estimates used to calculate the asset's recoverable amount have improved since the write-down, the amount of which the asset was written down should be reversed. However, a reversal cannot be based only on improvement in the general market condition. If an impairment reversal is recognised the carrying amount of the asset should not exceed the amount that the asset should have had if the asset was never considered impaired in the first place. This amount should also account for depreciations and amortisations that should have been recognised if the impairment had never taken place (Ernst & Young, 2010). The reversal of impairment losses never applies to goodwill. Thus, if goodwill is written down, it should not be reversed even if there are indications that the impairment no longer exists (IAS 36.124).

5.1.4 Disclosure According to IFRS and IAS 36

An impairment loss under the scope of IAS 36 should be recognised immediately in the profit and loss statement. A recognised impairment loss will affect the size of the depreciation (or amortisation) charge of the impaired asset for subsequent periods. The depreciation charge should be adjusted to match the revised carrying amount of the asset on a systematic basis over the asset's remaining useful life. The opposite applies when an impairment loss is reversed and the reversal of the impairment should be recognised immediately in profit and loss. Similarly, the depreciation (or amortisation) should be adjusted to match the higher reversed carrying amount of the asset.

5.2 US GAAP Standards Related to Impairments

Under US GAAP, companies that engage in exploration or development of oil and gas can account for their reserves either by using the successful-efforts method or the full-cost method. These two methods mainly differ in the treatment of expenses related to the

exploration of new reserves (Ernst & Young, 2009). The costs related to a successful identification of new oil and gas reserves may be capitalised as assets if the successful-efforts method is applied. In relation to this standard, costs of an unsuccessful identification of oil and gas reserves should be recognised as a cost in the income statement immediately and are thus not carried forward as an asset. In contrast, almost all costs related to exploration and location of new oil and gas reserves can be capitalised, regardless of their success, if the full-cost method is used instead (Deloitte, 2014). These standards will be presented separately below, followed by a presentation of impairment accounting for firms applying the full-cost method.

5.2.1 Successful-Efforts Method

For companies applying the successful-efforts method, the standards for impairments of assets are found under the scope of *ASC 360 Property, Plant and Equipment* and *ASC 350 Goodwill and indefinite-lived intangible assets.* In addition, *ASC 932 Extractive Activities – Oil and Gas* applies to the oil and gas properties accounted for using the successful-efforts method. Regulations addressing impairments are found in ASC 360-10 and ASC 350-30.

The assets included in ASC 360-10 are divided into three subcategories; long-lived assets that are held and used, long-lived assets held for sale and long-lived assets to be disposed of by other means. ASC 360 also contains industry-specific considerations for some industries, including oil and gas. In addition to the above mentioned assets, ASC 360-10 applies to "definite-lived intangible assets," i.e. intangible assets that are subject to amortisations (Ernst & Young, 2011).

5.2.1.1 When to Test if Assets are Impaired

The first step required to establish whether an asset is impaired, is to identify if there are any events or changes in circumstances that indicate that impairments are present. In line with IFRS and IAS 36, the identification step implies that an entity only has to perform a test of recoverability if there are indications that an asset may be impaired. If no such indicators are present, then no further impairment investigation is required. According to ASC 350, intangible assets with an indefinite useful life and goodwill should be tested for impairment at least annually if no impairment indicators are present (Ernst & Young, 2011). As in IAS 36, if indications of impairment exist for goodwill and intangible assets, the impairment test should be performed more frequently than annually.

5.2.1.2 Test of Recoverability

The second step when determining if an asset is impaired is to perform a recoverability test, which applies only if indicators of impairment exist. The recoverability test is a comparison between the asset's carrying amount and the undiscounted future cash flows the asset is expected to generate. A carrying amount of a long-lived asset is considered recoverable if it is exceeded by the aggregated future undiscounted cash flows. If the opposite is true and the carrying amount exceeds the sum of undiscounted future cash flows, then the asset might be impaired. The test should be performed at the lowest level for which identifiable cash flows are largely independent, at a so-called asset group-level. Thus, assets that are collectively used and that generate joint cash flows should be grouped together (Ernst & Young, 2011). Goodwill should be included in the asset group if the group is or includes the reporting unit with goodwill (McEwen, 2009). Testing an intangible with indefinite life for impairment does not include the recoverability test required for long-lived assets and goodwill.

For oil exploration companies the level at which impairment is assessed differs between proved and unproved oil properties. Proved properties should be grouped at the lowest level for which there are identifiable, independent cash in- and out-flows (typically on a field-to-field basis e.g. a platform). Unproved properties should be assessed by an appropriate grouping if acquisition costs are not significant and on a property-by-property basis otherwise (Deloitte, 2014).

5.2.1.3 Measurement of an Impairment

The last step when determining if impairment of an asset exists is to establish the size of the impairment loss that may be recognised. This final impairment test is a comparison of the assets' carrying amount with its fair value. US GAAP's definition of fair value is similar to IFRS' and is defined as:

> *"The price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date*" (ASC 810-10-20).

Only if the carrying amount is greater than the fair value should an impairment loss be recognised, which corresponds to the difference between these two amounts. The two-step

impairment analysis (recoverability test and impairment test) applies in general to successful, capitalised oil and gas properties when impairment indicators of these properties exist. However, unproven properties should be tested for impairment periodically (i.e. at least annually as for goodwill and intangible with indefinite life).

5.2.1.4 Disclosure of Impairment

In the income statement the impairment losses should be recognised as a component of income from continuing operations before income taxes. In addition, it is prohibited to record an impairment loss as an extraordinary item due to the fact that FASB believes that this amount is equal to what the firm should have been charged over time anyway through depreciations, if the impairment had never occurred. An impairment loss recognised for proved oil properties should reduce the carrying amount of the assets in the group by using their present carrying amount as distribution ratio. However, the impairment amount distributed to an oil property should not decrease the carrying amount to less than its fair value. If impairments are assessed for unproven properties, a loss should be recognised for the property (Ernst & Young, 2011).

5.2.1.5 Reversal of Impairment

As the recognition of impairments has to be permanent, the reversal of previously recognised impairment losses is prohibited for long-lived assets to be held or used, intangible assets and goodwill. This also applies to any impairment recognised for indefinite-lived intangible assets and goodwill. A long-lived asset classified as being held for sale should initially be measured at the lowest of its 'carrying amount' and 'fair value less cost to sell' and an impairment loss of the difference between these two amounts should be recognised. Any increase or decrease of the fair value less cost to sell during the periods in which the asset is classified as being held for sale should be reported as an adjustment in the carrying amount for the asset in question (Ernst & Young, 2011).

5.2.2 Full-Cost Method

Companies that apply the full-cost method find impairment requirements in SEC regulation S-X Rule 4-10 (Ernst & Young, 2011). In contrast to the successful-efforts method, the full-cost method allows firms to capitalise on unsuccessful wells, so-called dry holes. Thus, all costs incurred when searching for oil and gas reserves within a large geopolitical "full-cost pool" (e.g. a country or a continent) are capitalised as assets with a limitation that the total amount

carried forward does not exceed the estimated value of the reserves located and discovered in the "full-cost pool" ("the cost-pool ceiling") (Lev, 1979). These full-cost pools are subjected to amortisation (Deloitte, 2014).

5.2.2.1 When to Test if Assets are Impaired

Under the full-cost method, impairment of assets must be assessed for proved properties each reporting period (i.e. each quarter). Unproved properties have to be assessed for impairment periodically (i.e. annually) for inclusion in the full-cost pool (Deloitte, 2014).

5.2.2.2 Measurement of Impairment Loss

These quarterly impairment tests under the full-cost method are known as 'ceiling tests' and require firms to permanently write-down capitalised costs of oil and gas assets to the extent the capitalised costs exceeds the full-cost ceiling (Alciatore et al., 2000). Impairments under the ceiling test are measured as the amount to which the net unamortised cost of the cost pool exceeds either:

- The discounted cash flows from proved properties
- The cost of unproved properties not included in the costs being amortised
- The cost of unproved properties included in the cost being amortised (Deloitte, 2014).

The ceiling test requires the value of the oil reserves to be determined using an average of the previous 12 months commodity oil price (Ernst & Young, 2009). Thus, when commodity prices are volatile, massive impairment losses are likely to be reported for exploration companies applying the full-cost method. Impairments under the full-cost method are usually assessed at the cost-pool level. A cost pool is usually established on a country-to-country basis (Deloitte, 2014).

5.2.2.3 Impairment Loss Recognition

An impairment loss should be recognised as the excess amount of which the full-cost pool exceeds the cost-pool ceiling. Reversal of recognised impairment losses is prohibited even under the full-cost method (Deloitte, 2014).

5.3 Summary of the Different Impairment Methods

The levels at which assets are tested for impairment, impairment assessment, and reversals of recognised impairments are the main differences for impairment of assets in IFRS and US

GAAP (McEwen, 2009). A summary of the explanations of the standards addressing the issue of impairments is presented in the table below:

Topic	IFRS	US GAAP Successful-efforts method	SEC Full-cost method
Long-lived assets and intangibles with definite lives			
Measure impairments for long-lived assets and intangibles with definite lives	If impairment indicators are present the asset's carrying amount is compared to its recoverable amount (the higher of fair value less costs to sell and Value in use). An impairment loss should be recognised as the amount to which an asset's carrying amount exceeds its recoverable amount.	If impairment indicators are present, a two-test method for impairments is required; 1. Recoverability test – comparing sum of undiscounted expected future cash flows with carrying amount. 2. Impairment test is required if an asset is considered not recoverable in the recoverability test (i.e. if carrying amount > undiscounted future cash flows). An impairment loss should then be recognised as the amount equal to the difference between carrying amount and the asset's fair value.	Firms need to assess each reporting period whether the capitalised costs exceed the full-cost centre ceiling. Unproved properties (not subjected to amortisation) have to be tested for inclusion in impairment at least annually.
Reversal of Impairment Loss	Prohibited for goodwill impairments. For other long-lived assets, a reversal of impairment loss should be recognised if appropriate.	Prohibited for all assets that are held and used including long-lived assets, goodwill and intangibles.	Impairment losses recognised under the full-cost method are permanent and reversals are thus prohibited.
Goodwill			
Method of determining Impairment for goodwill	One-step method that involves only an impairment test, which compares the carrying amount (including) with the recoverable amount of a cash-generating unit.	Two-step method including a recoverability test at reporting unit level comparing the carrying amount with fair value of the reporting unit. If this carrying amount exceeds the fair value then the second step, the impairment test, is required.	N/A

Impairment loss calculations for goodwill	Impairment loss (= carrying amount – recoverable amount for cash generating unit) first assessed onto the goodwill until no goodwill remains. The remaining impairment loss is then allocated onto the other assets in the cash-generating unit by using the carrying amount of these assets as distribution key.	The impairment loss recognised is the amount to which the carrying amount of goodwill exceeds the implied fair value of the goodwill within the reporting unit.	N/A
Allocation of goodwill	For the purpose of impairment testing goodwill is allocated to a cost-generating unit.	Goodwill impairment estimations are made at reporting unit level (operating level or a level under operating level).	N/A
Intangible assets with indefinite life			
Impairment loss calculation for intangibles with indefinite life	At least an annual impairment test (more frequent if impairment indicators are present) Impairment loss = carrying amount – recoverable amount (greater of value in use and fair value less cost to sell)	At least an annual impairment test (more frequent if impairment indicators are present) Impairment loss = Carrying amount – Fair Value	N/A

Table 1: Summary of impairment standards

6. Hypotheses

The previous sections of this thesis have created a platform for the development of our hypotheses. These hypotheses need to be either rejected or accepted in order for us to answer our research question concerning the value relevance of write-downs reported by companies in the oil and gas industry.

Investors are commonly exclusively interested in the return on their investment. Return is either appreciation of stock value or dividends, which again is dependent on the ability to generate future positive cash flows. The ability to generate positive future cash flow is determined by the decisions of management, or increase in value that is beyond management control. Thus, the oil price is arguably of great importance for firm value, i.e. share price, as the oil price dominates future earnings prospects. The oil price decline is not only affecting exploration companies directly affected by the decline, but also downstream service companies as the demand for equipment are likely to decrease. The oil price is to a large extent included in the estimation of future cash inflows from assets of the firms in the oil and gas industry, and thus, affects the determination of asset values and subsequent write-down amounts. Because write-downs reflect negative changes in firm value, we believe that write-downs are information useful to investors in determining firm value. Thus, we expect that write-downs are significantly negatively associated with share price and share return. Furthermore, we expect net income including write-downs to be superior over net income excluding reported write-downs for investors when determining firm value and changes in firm value. Based on the arguments presented above we develop the following two hypotheses:

Hypothesis 1a. Write-downs reported by U.S. and European firms in the oil and gas industry in the period of Q1 2012 to Q4 2015 is negatively associated with share price and share return, and thus, are value relevant to investors.

Hypothesis 1b. Net income including write-downs explains more of the variation in share price and share return than net income pre write-downs, indicating value relevant write-downs.

In section 1.1 we outlined the impact the dropping oil price has had on company finances for firms in the oil and gas industry. After the initial drop in the oil price in mid-2014 the oil price continues to remain at a low level. We therefor expect to observe an increase in frequency and total dollar amount of write-downs in the quarters after the initial drop in oil price. We have previously argued that the oil price is not only affecting determination of asset values and subsequent impairments, but also future earnings prospects. Thus, since the oil price level remains low after its initial drop, we also expect to see an increase in reported negative earnings. In section 3.4.1, we noted that negative earnings are found to be less value relevant to investors than positive earnings. More specifically, Hayn (1995) confirms her hypothesis that negative earnings are not perceived by shareholders to persist and that negative earnings therefore are less informative than positive earnings about the future prospects of the firm. Thus, as we expect to see an increase in the frequency and total dollar amount of both earnings and write-downs in the periods after the initial oil price drop, we believe that accounting information will be less value relevant to investors in these periods. Thus, we develop the following hypothesis:

Hypothesis 2. Accounting information explains less of the variation in share price and share return in periods with a more uncertain and volatile economic environment as reflected in the oil price level.

In section 3.1.3 we outlined the enhancing characteristics that improve usefulness of financial information. One of the enhancing characteristics of financial information is timeliness. Timeliness has been defined as accounting information available in time to influence decision-makers' decisions. Further, the less timely the accounting information, the less relevant the information is to users. According to FASB and IASB's definition of relevant accounting information, we believe that for reported write-downs to be relevant to investors, write-downs need to have predictive value, confirmatory value or both – in other words, reported write-downs need to confirm what the market has already anticipated, bring new information to the market, or both. In an efficient market, all available information is incorporated into share prices. The availability of information of oil price levels to investors may be incorporated into share prices before firms report the consequences of the oil price level on firm financials. Thus, if the asset value has declined, and is anticipated by the market before

write-downs of assets are reported, the reported write-downs will have confirmatory value. On the other hand, the inherent complexity in estimating asset values and subsequent write-down amounts may give room for write-downs serving as new information to the market if the complexity prevents the market in preparing similar estimation. If the latter is true, reported write-downs might also have predictive value to investors. It is in our belief that reported write-downs are relevant to investors, and thus, have confirmatory value, predictive value, or both. Based on our belief we develop the following hypothesis:

Hypothesis 3. Reported write-downs by firms in the oil and gas industry in the period from Q2 2012 to Q3 2015 are associated with contemporaneous return, lead return or both.

7. Methodology

In this section we outline the regression counterparts of the valuation models presented in section 4.1. We will also account for the econometric issues related to the operationalisation of value relevance and timeliness of accounting information. Finally, we specify the models chosen for the purpose of this thesis, and we outline our data collection process and describe our data selection.

7.1 Model Specification

The relationship between accounting amounts and measures of firm value can be studied by observing the correlation between them in a regression analysis. The two most prominent regression models applied within value-relevance research are the price regression and the return regression (see, e.g. Barth et al., 2001; Kothari & Zimmerman, 1995). In the following section we outline the basics of price- and earnings regressions, explain their differences, and the purpose of applying them.

7.1.1 Price Regression Models

The price regression is a regression model that represents the regression counterpart of the earnings model presented in section 4.1.2. One variant of the price regression is the price-earnings regression, which uses share price as a measure of firm value. The price-earnings regression explains the relationship between earnings and share price and is expressed as follows (Stenheim, 2012):

$$(1) \qquad P_{i,t} = \beta_0 + \beta_1 E_{i,t} + \varepsilon_{i,t}$$

Where

$P_{i,t}$ = Stock price of firm *i,* time *t*

$E_{i,t}$ = Earnings per share of firm *i,* time *t*

$\varepsilon_{i,t}$ = Residual of firm *i,* time *t*

An additional regression model that determines the relationship between share price and accounting amounts is the Ohlson regression. The Ohlson regression includes both book value of equity and earnings as explanatory variables and is regarded the regression counterpart of

the Ohlson model (Barth & Clinch, 1998; Beisland, 2008; Stenheim, 2012). The Ohlson regression is expressed as follows:

$$(2) \qquad P_{i,t} = \beta_0 + \beta_1 E_{i,t} + \beta_2 BVE_{i,t-1} + \varepsilon_{i,t}$$

Where

$P_{i,t}$ = Stock price of firm *i,* time *t*

$E_{i,t}$ = Earnings per share of firm *i,* time *t*

$BVE_{i,t-1}$ = Book value of equity per share of firm *i,* time *t-1*

$\varepsilon_{i,t}$ = Residual of firm *i,* time *t*

The assumptions of the Ohlson model of clean surplus accounting and perfect and complete markets also apply to the Ohlson regression (2), in addition to the assumptions of the ordinary-least-square regression (Stenheim, 2012).

In both models (1) and (2), the coefficient β_1 represents "*the monetary unit change in stock price in response to one monetary unit change in earnings-per-share*" (Stenheim, 2012, p. 112). A coefficient significantly different from zero of the accounting amounts in regression models (1) and (2) would suggest that the accounting amounts summarise information that is useful to predict firm value. It is important to note that a significant coefficient does not imply value relevance of the accounting amount alone; the sign of the coefficient also needs to be in line with predictions (Barth et al., 2001). Price level regressions will indicate value relevance, rather than timeliness, of accounting amounts. In the return regression, where the association between share returns and accounting amounts is being studied, a significant association will indicate both value relevance and timeliness of the accounting amounts (Barth et al., 2001; Stenheim, 2012).

7.1.2 The Return Regression Model

Beisland (2008) argues that the share price is not necessarily the information of most interest to investors once the stock is invested in, rather the focus is on the investment return.

Therefore, the relationship between earnings and share returns, rather than earnings and stock price, can be investigated. The return regression is presented in its simplest form as the relationship between return and earnings, expressed as follows:

$$(3)\ R_{i,t} = \beta_0 + \beta_1 E_{i,t} + \varepsilon_{i,t}$$

Where

$R_{i,t}$ = Share return of firm *i,* time *t*

$E_{i,t}$ = Earnings for firm *i,* time *t,* scaled by stock price, time *t-1*

$\varepsilon_{i,t}$ = Residual of firm *i,* time *t*

Similar to the price-earnings regression, the return-earnings regression is the counterpart of the earnings model. The coefficient β_1 is often referred to as the earnings-response-coefficient, which reflects the change in return for a given change in earnings. A significant association between contemporaneous changes in value and accounting amounts would not only imply that the accounting amount is value relevant but also that it is timely reported. Thus, return models are often applied in marginal information content studies, where the objective is to assess to the extent the accounting amount represents new and relevant information to the capital market (Stenheim, 2012).

Timeliness of accounting amounts can also be assessed by investigating the relationship between lead or lagged share returns (Stenheim, 2012). Beltratti et al. (2013) employ both a regression model with lead share returns and a model with lagged share returns as the dependent variable to assess the timeliness of fair value write-downs. If the coefficient of write-downs is significantly different from zero in a lagged returns regression, Beltratti et al. considered the write-downs to be untimely. Conversely, a coefficient significantly different from zero for write-downs in a lead return regression would suggest conservative accounting where write-downs pre-empt future decline in asset prices, or that the asset price decline is not yet anticipated by the market. Further, Beltratti et al. stress that the write-down coefficient represents the extent of the association between write-downs and share returns. They thus anticipate the coefficient to be equal to negative one if write-downs are timely reported on average, with a one-to-one association with share returns over the same period. However, the one-to-one association between share returns and write-downs can be distorted by many factors including distorted market prices, delayed or misstated write-downs, and write-downs that have more persistent effect on earnings or future cash flows.

7.1.3 Incremental Association Study

In addition to focusing on the aggregated accounting amounts of book value of equity and earnings, it is also possible to investigate the relation between disaggregated accounting amounts by substituting either book value of equity or earnings by disaggregated accounting amounts (See, e.g., Barth & Clinch, 1998; Ohlson & Penman, 1992). As an example of disaggregation, Beltratti et al. (2013) and Alciatore et al. (2000) apply the following return regression to examine the association between contemporaneous share returns and write-downs:

$$(5)\ R_{i,t} = \beta_0 + \beta_1 NI^*_{i,t} + \beta_2 WD_{i,t} + \varepsilon_{i,t},$$

Where

$R_{i,t}$ = Raw share return for firm *i,* time *t*

$NI^*_{i,t}$ = Net income after tax, before write-downs for firm *i,* time *t,* deflated on share price for firm *i,* time *t*

$WD_{i,t}$ = Aggregated after-tax write-down as recorded in net income for firm *i,* time *t*

The studies of Beltratti et al. (2013) and Alciatore et al. (2000) use disaggregated return regressions to assess the effect of value relevance of write-downs. The same disaggregation to study the value relevance of write-downs return regression has been applied in this thesis.

In measurement studies, as briefly described in section 4.3.2, coefficients of liabilities are predicted to be minus one, whereas coefficients of assets are predicted to be one. According to Holthausen & Watts (2001), the degree of difference between predicted value and observed value is interpreted as the degree of error in which the accounting amount component measures market value of the same component. Beltratti et al. (2013) interpret the magnitude of the coefficient of write-downs in a similar manner as the measurement studies referred to by Holthausen & Watts (2001). Beltratti et al. (2013) argue that the magnitude of the coefficient of write-downs in the return-earnings regression is a measure of the timeliness of write-downs. Furthermore, they argue that *"the relationship between any value-relevant write-down and the corresponding stock return is expected to be 1:1*" (Beltratti et al., 2013, p. 473). According to Barth et al. (2001), the objective of studies that test the magnitude of coefficients against predictions is to measure the reliability of accounting amounts.

7.2 Price Regressions versus Return Regressions

In the different regression models listed above, the objective is to assess whether the accounting amount of interest has significant incremental power in explaining equity value, or change in equity value, and thus, concluding on its value relevance. As previously explained, relevance of an accounting amount is the degree to which the amount represents information that is capable of making a difference to the decisions made by the users of the information. If the accounting amount is not value relevant, the accounting amount will have no relation to equity value, which is equivalent to observing an insignificant coefficient or a coefficient with a sign that contradicts predictions (Barth et al., 2001). Barth (2000) states that another explanation for failure to detect a relationship between accounting information and equity value is that the accounting amount may be biased through measurement error. If reported information is not free from measurement error, the reported information is not fulfilling the qualitative characteristic of being faithfully represented. If the reported accounting information is not faithfully represented, then the usefulness of the information reported to users is reduced. Thus, a lacking relationship between the accounting amount and equity value may be attributable to either lack of relevance or lack of reliability, or both.

The price-earnings regression and the return-earnings regression are economically equivalent as a cash flow model underpins them both (Christie, 1987). Gu (2005)refers to the studies of Holthausen & Watts (2001) and Barth et al., (2001) and concludes that there is no consensus regarding if price level models should be preferred over returns models. (Barth et al., 2001, p. 95) point out that the price and return regressions are related, but that they address different questions, more specifically "*the key distinction between value relevance studies examining price levels and those examining price changes, or returns, is that the former are interested in determining what is reflected in firm value and the latter are interested in determining what is reflected in changes in value over a specific period of time.*" This relates to the specification added to the return regression above, where the return regression may be applied to study the information content of a particular accounting amount and, thus, the timeliness of the accounting amount. The price regression may be applied for the purpose of the assessment of the degree to which an accounting amount is value relevant for investors in assessing firm value.

7.2.1 Econometric Concerns with the Price- and Return Regressions

Christie (1987) points out that the choice of model should be guided by econometric issues, as the price regression and the return regression model also differ in terms of econometric concerns. Kothari & Zimmerman (1995) state that return regressions are preferred over price regressions because less econometric issues are apparent when running return regressions. However, they do not reach the conclusion that one model should be chosen over the other. In the following section we list the potential concerns that limit the validity of inferences drawn from value relevance studies.

7.2.1.1 Independent/Uncorrelated Omitted Variables and Biased Coefficients

Kothari & Zimmerman (1995) compare price and return regressions and underline the problem of an uncorrelated omitted variable for the price regression. The problem is described by the notion that earnings consist of a surprise component and a stale component, where the stale component describes the information that is already anticipated by the market. Furthermore, under the assumption that price leads earnings, current price in the price regression will consist of the cumulative effects of earnings information, in addition to information about future earnings. Since information of future earnings is not included in current earnings, the price regression leaves out an explanatory variable. Information of future earnings is not correlated with the earnings variable; however, the failure to include future earnings as a variable in the price regression results in an omitted-variable problem with the consequences of reducing the price model's explanatory power, while the estimated coefficient of the earnings coefficient remains unbiased. The consequence of the omission is that more care must be exercised when drawing statistical inferences from the model.

Where both components of earnings are relevant for the explanation of variation in price, the anticipated component is irrelevant for the explanation of current return. Thus, the anticipated component represents an error in the independent variable of earnings. While the return regression model does not suffer from the same omitted variable problem as the price regression model, it does suffer from an error in measuring the variable of interest. The measurement error biases the slope coefficient of earnings downwards. The slope coefficients of earnings are not of main interest in explaining the value relevance of write-downs in this study. However, this error represents a weakness when the return regression model is applied, which implies that we cannot fully trust the coefficient estimates for earnings given in our model. Easton & Harris (1991) propose that the earnings variable measurement error

may be mitigated if variables for both earnings level and earnings change are included in return-earnings regressions. Another possible solution to the problem of biased coefficient is therefore to run the price model, in addition to the return model, to strengthen our analysis.

The Ohlson regression is also subject to omission bias similar to that of the price regression. Stenheim (2012) points to that omitted variables affecting the persistence of earnings may result in violation of the basic regression assumption of linearity. He proposes running fixed effects regression to control for potential correlated omitted variables.

7.2.1.2 Heteroscedasticity

Kothari & Zimmerman (1995) also judge the price and return regression by the extent of heteroscedasticity present in each regression model. They find that price regressions more often reject the null hypothesis of homoscedasticity, implying more heteroscedasticity problems relative to return regression. The heteroscedasticity problem is formally known as the violation of the important assumption for linear regressions of equal variance. If the variance of the predicted dependent variable (Y) increases (decreases) as the independent variable (X) increases (decreases), the problem of heteroscedasticity is apparent (Gujarati, 2003). The problem of heteroscedasticity creates inefficient parameter estimates and inconsistent covariance matrix estimates, thus resulting in faulty inferences (White, 1980).

7.2.1.3 Scale Effects

When analysing cross-sectional data in value relevance research, scale effects appear because firms with high market values generally have high book value of equity and high net earnings (Barth & Kallapur, 1996; Stenheim, 2012). Christie (1987) uses accounting depreciation within manufacturing firms as an example of an accounting amount that tends to differ with firm size. Thus, we expect that the same relationship applies for firm size and write-downs in our selection of oil and gas industry firms. The econometric problem of scale effect affects the understanding of the association between equity book or earnings measures and measures of firm value because the association may reflect differences in scale rather than differences in the firm's economic fundamentals (Barth & Clinch, 2009).

Alternative specifications to avoid the problem with scale effects have been discussed in previous research. Christie (1987) finds that the correct deflator for return regressions is the

beginning of period market value of equity, whereas he states that there is no such natural deflator for levels regressions. Furthermore, Christie (1987) states that scale differences in levels regression may be eliminated by deflation if the deflator is a function of the independent variables. The choice of deflator is therefore a potential source of model misspecification. However, a commonly applied deflator in levels regression is the number of outstanding shares (Stenheim, 2012). Barth & Clinch (2009) provided an extensive study of scale effects in capital-market based accounting research and tested six specifications of the Ohlson regression's performance on mitigating five specific scale effects. Barth & Clinch find that share-deflated and un-deflated specifications of regressions, in general, outperform other regression specifications when testing for the different scale effects. We describe how we control for scale effects by several means in section 8.1 where our chosen research design is described.

According to Barth & Kallapur (1996), heteroscedasticity caused by scale effects is avoided when applying return regressions. Barth & Kallapur find that inclusion of a proxy for scale, as an independent variable, is more efficient than deflated specifications of regression in mitigating biased coefficient and reducing heteroscedasticity. In line with the findings of Barth & Kallapur, Stenheim (2012) argues that deflation by number of outstanding shares in price regressions may not fully correct for scale-related issues in price regressions. He bases his argument on that the relationship between number of outstanding shares and size is not one-to-one. Based on his argument he proposes that price regressions should include a robustness test by including scale as a proxy, in addition to deflation as a remedy to scale effects in the price regression. Beisland (2008) includes the natural logarithm of end of period market value of equity as a control variable of size.

7.2.1.4 Scale Effects and R^2

In value relevance research, R^2 is commonly used as a measure of value relevance because R^2 explains the variation in share price caused by the included independent accounting variables (see e.g.Barth et al., 2007; Basu, 1997; Collins, Maydew, & Weiss, 1997; Francis & Schipper, 1999). The same measure of value relevance is also commonly applied when comparing value relevance across different samples, such as across countries (see Alford, Jones, Leftwich, & Zmijewski, 1993; Barth, Landsman, & Lang, 2008). However, Brown, Lo, & Lys (1999) argue

that between-sample comparisons of R^2 are invalid when scale effects are present in levels regressions. Scale effects increase R^2, which in effect increases the scale factor's coefficient of variation. By controlling for the scale effect by running deflated regression specifications, differences in R^2 can be correctly measured, rather than that differences in R^2 are driven by differences in the coefficient of variation in the scale factor. Brown et al. (1999) continue with suggesting the use of P_{t-1} as a proxy for scale prevents R^2 from being affected. Brown et al. further argue that the results from the time-series studies of increasing value relevance (R^2) over time, as conducted by Collins et al. (1997) and Francis & Schipper (1999), are in fact caused by an increase in the scale effect. Thus, when Brown et al. (1999) re-run the test and control for scale effects, the conclusion is quite the contrary to the findings of Collins et al. (1997) and Francis & Schipper (1999); value relevance has decreased over time. Gu (2007) has also criticised the use of R^2 in cross-sample comparisons, and proposes regression residual dispersion controlled for scale as an alternative measure of the explanatory power for comparisons across samples.

7.3 Value Relevance Research and Assumptions of Market Efficiency

As described in the introduction of the methodology section, studies of value relevance commonly use market value of equity as a benchmark for firm value. As such, value relevance studies are based on the assumption of market efficiency.

Theory of market efficiency is concerned with the degree to which available information is reflected in share prices (Fama, 1970). Market efficiency is generally specified in three categories: strong market efficiency, semi-strong market efficiency and weak market efficiency. Strong market efficiency describes a capital market where all available information is reflected in share prices. Semi-strong market efficiency describes a capital market where publically available information is reflected in share prices. Lastly, weak market efficiency is the characterisation of a capital market where share price only reflects historic information.

Holthausen & Watts (2001) note that it is not necessary for value relevance research to assume perfectly efficient capital markets, rather that markets are *"reasonably efficient*" (Holthausen & Watts, 2001, p. 18). Their statement rests on the belief that standard setting motivates value relevance research. Therefore, if the capital market is inefficient, share prices

are not proper benchmarks for standard setters. If share prices are not proper benchmarks for standard setters then value relevance research employing share price as a benchmark loses its relevance for standard setters. Barth et al. (2001) state the opposite, namely that market efficiency is not a requirement for value relevance research. According to Barth et al. (2001, p. 94) "*Value relevance research need only to assume that share prices reflect investors' consensus beliefs.*" It is nevertheless recognised by Barth et al. (2001) that the assumption of market efficiency is of greater importance when the value relevance research relates to analysis of whether accounting amounts reflect the true underlying value.

We deployed share price and share return as a benchmark for firm value and changes in firm value in this study, resting on the underlying assumption that the capital market is at least semi-efficient. Alternatively, we could have searched for another benchmark. However, we believed that the general consensus of the efficiency of capital markets is that they are categorised as semi-efficient.

8. Research Design

In this section of the thesis we describe our data selection, followed by an outline of the specific models we have chosen to answer our hypotheses. In the last part of this section we present six basic assumptions that ensure OLS estimators of regression parameters to be unbiased and efficient, making the OLS estimators appropriate for statistical inference.

8.1 Chosen Regression Models

In this section we outline the model specifications of the price and return regression we have chosen in order to assess the value relevance and timeliness of write-downs for listed U.S. and European firms in the oil and gas industry.

Our research question regards the value relevance of write-downs for firms in the oil and gas industry for the chosen period of Q1 2012 – Q4 2015. As previously mentioned, timeliness of write-downs may be regarded as a dimension of value relevance. Thus, following Barth et al. (2001) we could have employed a price regression to answer hypothesis 1a concerning value relevance, and a return regression to answer hypothesis 3 concerning timeliness. However, taking econometric issues into consideration, we chose to employ four disaggregated regression models: the price regression, the Ohlson regression, the return regression and the return regression including earnings changes to answer hypothesis 1a concerning the value relevance of write-downs. The choice of deploying four models to investigate value relevance of write-downs rested on our beliefs that the more the models provide aligned results, the higher the reliability of our results. Applying the four models will also to a certain extent control for the weaknesses of each individual model. Hypothesis 3 regarding the timeliness of write-downs was answered by deploying a return model testing for the association between lead and lagged share returns. We have outlined our choice of models in the subsections that follow.

8.1.1 The Disaggregated Price Regression

The price regression chosen for this study is disaggregated to account for the value relevance of write-downs. All variables are deflated by number of shares in the corresponding quarter of price and the model is expressed as follows:

Model 1: $P_{i,t} = \beta_0 + \beta_1 NIpreWD_{i,t} + \beta_2 WD_{i,t} + \varepsilon_{i,t}$

Where

$P_{i,t}$ = Stock price for firm *i* in quarter *t*

$NIpreWD_{i,t}$ = Net income per share after tax, before write-downs for firm *i* in period *t*

$WD_{i,t}$ = Write-downs per share before tax for firm *i* in quarter *t.*

8.1.2 The Disaggregated Ohlson Regression

In addition to the simple price regression, we also deployed the Ohlson regression disaggregated to account for write-downs as an additional explanatory variable alongside net income and book value of equity. All variables are deflated by number of shares. The Ohlson regression employed in this study is expressed as follows:

Model 2: $P_{i,t} = \beta_0 + \beta_1 NIpreWD_{i,t} + \beta_2 WD_{i,t} + \beta_3 BVE_{i,t} + \varepsilon_{i,t}$

Where

$P_{i,t}$ = Share return for firm *i* in quarter *t*

$NIpreWD_{i,t}$ = Net income per share after tax, before write-downs for firm *i* in period *t*

$WD_{i,t}$ = Write-downs per share before tax for firm *i* in quarter *t.*

$BVE_{i,t}$ = Book value of equity per share for firm *i* in quarter *t*

8.1.3 The Disaggregated Return Regression

The return regression we used is inspired by the regression models applied by Beltratti et al. (2013) and Alciatore et al. (2000). Similar to their studies, we applied the following disaggregated return regression, where all variables are stated on a per share basis and deflated by beginning of period share price:

Model 3: $R_{i,t} = \beta_0 + \beta_1 \frac{NIpreWD_{i,t}}{P_{i,t-1}} + \beta_2 \frac{WD_{i,t}}{P_{i,t-1}} + \varepsilon_{i,t}$

Where

$R_{i,t}$ = Share return for firm *i* in quarter *t*

$NIpreWD_{i,t}$ = Net income per share after tax, before write-downs for firm *i* in period *t,*

WD_{it} = Write-downs before tax per share for firm *i* in quarter *t.*

8.1.4 The Return Regression with Earnings Changes

In section 7.2.1.1, we described the problem of the measurement error in the return regression when earnings level is the explanatory variable. We expected the measurement error to affect the coefficient of both earnings components in the return model. Therefore, we assumed that the coefficient of the earnings components in the return model would be more aligned with the corresponding coefficient in the price model if we follow Easton & Harris's (1991) suggested corrections. We therefore included the return regression with earnings changes in our selection of regression models. For the sake of completeness, we added an explanatory variable for changes in write-downs. The return regression including earnings and write-down changes will be referred to as the return change regression in the following sections of the thesis:

$$\textit{Model 4:} \qquad R_{i,t} = \beta_0 + \beta_1 \frac{NIpreWD_{i,t}}{P_{i,t-1}} + \beta_2 \Delta \frac{NIpreWD_{i,t}}{P_{i,t-1}} + \beta_3 \frac{WD_{i,t}}{P_{i,t-1}} + \beta_4 \Delta \frac{WD_{i,t}}{P_{i,t-1}} + \varepsilon_{i,t}$$

Where

$R_{i,t}$ = Share return for firm *i* in quarter *t*

$NIpreWD_{i,t}$ = Net income per share after tax, before write-downs for firm *i* in period *t*

$\Delta NIpreWD_{i,t}$ = Changes in net income per share after tax, before write-downs for firm *i* from period *t-1* to *t*

$WD_{i,t}$ = Write-downs before tax per share for firm *i* in quarter *t*

$\Delta WD_{i,t}$ = Changes in write-downs per share after tax, before write-downs for firm *i* from period *t-1* to *t*

8.1.5 Interpretation and Expectations of Variable Coefficients

As previously noted, the four model specifications described above were applied when we tested hypotheses 1a concerning value relevance of write-downs Q1 2012-Q4 2015. In all of the four regression models, the coefficient for the write-down variable was the coefficient of main interest. This did not exclude also judging models by the coefficient of net income. Previous value relevance has established evidence of significant association between bottom line earnings and both share price and return. Thus, our expectation was that the significant association with share price and return also applied to net income, which has been used as a proxy for earnings in the four regression models.

The interpretation of the signs of variable coefficients was important, as an incorrect sign of variable coefficients suggests that the earnings components were not value relevant. This also applied even if the association between earnings components and share price or return was found to be statistically significant. We expected net income pre write-downs to be positively associated with share price and return. Write-downs, as an expense, were expected to be negatively associated with both share price and returns.

8.1.6 Negative Earnings

As noted in the methodology section, negative earnings may be found to be less value relevant than positive earnings. This may have influenced our analysis, as several firms reported losses in the quarters after the initial decline in oil price, as will be illustrated in the section of descriptive statistics that follows. In the test of hypothesis 1b we applied a relative association test of measuring value relevance of write-downs by judging which of the two net income measures – net income including write-downs and net income excluding write-downs – that explained most of the variation in stock price or share return over the period from 2012 to 2015. The amount of explained variation in stock price or share return was judged by the regression model's explanatory power (R^2). If write-downs were to be considered value relevant in determining either stock price or changes in stock price, we expected to see net income including write-downs explaining more of variation of stock price or share return, relative to net income pre write-downs.

Our data selection consisted of a high number of reported negative earnings, as we outline in section 9.2. Inspired by Beisland (2008), we applied a return change model to account for the amount of reported negative earnings, as a robustness test. The model is similar to the return change model, the only difference being that negative earnings were accounted for by including a dummy for negative earnings. Model 5 described above were applied to both measures of net income:

$$\textit{Model 5:}\ R_{i,t} = \beta_0 + \beta_1 \frac{NI_{i,t}}{P_{i,t-1}} + \beta_2 \Delta \frac{NI_{i,t}}{P_{i,t-1}} + \beta_3 D * \frac{NI_{i,t}}{P_{i,t-1}} + \beta_4 D * \Delta \frac{NI_{i,t}}{P_{i,t-1}} + \beta_5 D + + \varepsilon_{i,t}$$

Where

$R_{i,t}$ = Share return for firm *i* in quarter *t*

$NI_{i,t}$ = Net income per share after tax, for firm *i* in period *t.*

$\Delta NI_{i,t}$ = Changes in net income per share after tax, for firm *i* from period *t-1* to *t*

D = Equal to 1 if net income of firm *i* in period *t* is negative, 0 if otherwise

8.1.7 Lead and Lagged Return Regression

As noted in the previous section, the return regression can provide evidence of value relevance as well as timeliness of accounting information, given that the accounting amount of the coefficient of interest is significantly different from zero with the correct coefficient sign. To test hypothesis 3 concerning timeliness of write-downs, we deployed a different specification of the return regression. Inspired by the work of Beltratti et al. (2013), we tested hypothesis 3 by studying the relationship between lead and lagged share returns:

Model 6: $$R_{i,t-1} = \beta_0 + \beta_1 \frac{NI\ incl.WD_{i,t-1}}{P_{i,t-2}} + \beta_2 \frac{NI\ pre\ WD_{i,t}}{P_{i,t-2}} + \beta_3 \frac{WD_{i,t}}{P_{i,t-2}} + \varepsilon_{it}$$

Model 7: $$R_{i,t+1} = \beta_0 + \beta_1 \frac{NI\ incl.WD_{i,t-1}}{P_{i,t-2}} + \beta_2 \frac{NI\ pre\ WD_{i,t}}{P_{i,t-2}} + \beta_3 \frac{WD_{i,t}}{P_{i,t-2}} + \varepsilon_{it}$$

Where

$R_{i,t-1}$ = Lagged share return in the period before benchmark period *t*

$R_{i,t+1}$ = Lead share return in the period after benchmark period *t*

NI incl. WD = Net income after tax, including write downs in either period *t-1* or *t+1*

NI pre WD = Net income before tax, excluding write downs in period *t*

Association between write-downs and lagged returns (model 6) would suggest that write-downs were reported in an untimely manner, under the assumption that the write-down association with contemporaneous return suggests timeliness. Association between write-downs and contemporaneous return suggests that the market anticipated parts of the write-down, and that the reported write-down served a confirmatory role. Conversely, if write-downs pre-empted future share returns (model 7) and write-downs were significantly associated with lead share return this may suggest conservative accounting.

8.2 Regression Assumptions

In this section we present five general linear regression assumptions for ordinary least square (OLS) estimators with cross-sectional time series data. Fulfilment of the assumptions ensures OLS estimators of regression parameters to be unbiased and efficient, which means that the OLS estimators are appropriate for statistical inference (Wooldridge, 2012). The results from regression diagnostics for each respective model are presented with the results of each specification of the price and return model in sections 9. 3 – 9.5.

Assumption no. 1: Linear in Parameters

Assumption no. 1 states that for each independent variable *X*, holding all other variables constant, the change in the mean value of the dependent variable *Y* is the same, regardless of the value of the independent variable *X.* The key of this assumption is that there are no restrictions to how *Y* relates to *X,* as long as the equation is linear in the parameters (Wooldridge, 2012). Breach of the linearity assumption may suggest several corrections; amongst others, removal of influential outliers, the need for transformed variables, or that the relationship simply cannot be detected with a linear model. Assessment of linearity can be done through a fitted line plot, where the fitted line should illustrate that the regression line follows the data quite well. Alternatively or additionally, a plot of residuals versus fitted value should illustrate randomness, rather than patterns.

Assumption no. 2: No Perfect Collinearity

Perfect collinearity is defined as the sample of one independent variable to be an exact linear combination of one or more of the other independent variables. Imperfect but high correlation between two or more independent variables is known as the problem of multicollinearity. Although multicollinearity is not regarded as a violation of the assumption of perfect collinearity, multicollinearity proposes a threat to the estimation of coefficients (Wooldridge, 2012). In our case, where estimated coefficients were of main interest, it was preferable to have less correlation between independent variables.

The most common diagnostics tool for detecting multicollinearity is the VIF-test (Variance Inflation Factor), which determines the relationship between an independent variable and other independent variables (Wooldridge, 2012). A maximum VIF-score of 10 is sometimes

proposed as the limit which suggests that multicollinearity is a problem (Gujarati, 2003; Wooldridge, 2012). All else equal, the higher the VIF-score, the larger are the variances of the OLS estimators. We chose to operate with a VIF-score limit of 5 for each independent variable, as this should provide more robust estimation of the coefficients of interests in our study. The VIF-test may indicate multicollinearity, but the VIF-test does not indicate which variables are correlated, and to what degree the variables correlate. We therefore deployed a correlation matrix of coefficients for all the independent values. High values for one or more of the variables of interest propose problems for the inference of estimated coefficients. Our tolerance level for correlation between main independent variables was set to 0.6.

Assumption no. 3: Zero Conditional Mean

Assumption no. 3 implies that the error term has an expected value of zero for any values of the independent variables. This assumption is commonly breached when the model's functional form is not correctly specified (Wooldridge, 2012). In our case, this assumption has been violated if we had mistakenly specified the relationship between accounting amounts and price or return. Omission of an explanatory variable correlated with any of the other explanatory variables would also cause violation of this assumption.

In addition to examining the normal probability plot for residuals, we assessed the skewness and kurtosis measures for residuals. A normal random variable is symmetric about its mean and will therefore have zero skewness (Wooldridge, 2012). Furthermore, one can measure the kurtosis for a random variable, which is a measure of the tails of a distribution. The value of kurtosis for a standard normal distribution is three (Gujarati, 2003).

Assumption no. 4: Homoscedasticity

The assumption of homoscedasticity requires that for all the independent variables, the variance of the error term is constant across all values of each individual independent variable. Heteroscedasticity, in contrast, is the situation where the error term does not have a constant variance, i.e. the variance of the error term might increase with increasing values of the independent variable (Berry, 1985). As previously mentioned, the problem of heteroscedasticity creates inefficient parameter estimates and inconsistent covariance matrix estimates, thus resulting in faulty inferences (White, 1980). We employed White's test to

examine whether heteroscedasticity proposed a problem to our models, and ran the regression with robust standard errors to reduce the influence of heteroscedasticity wherever applicable.

Assumption no. 5: No Serial Correlation

No serial correlation, or no autocorrelation, describes the case where the residuals/deviations from the predicted *Y* do not follow systematic patterns (Gujarati, 2003). If the residuals suffer from autocorrelation the errors are correlated over time. In our case, this could be the case if an industry disruption that affects earnings in one period, also affects earnings in the next period. We assessed the level of autocorrelation by looking for systematic patterns in the plot of residuals versus fitted values.

8.3 Data Selection

Our primary data set could best described as panel data, where the same cross-sectional units were observed over several time periods (Wooldridge, 2012), and it is the primary data set employed when we ran our models. For parts of our analysis, we ran tests on a sub selection only consisting of firm-quarters with reported write-downs.

8.3.1 Data Collection and Description

Our total data selection consists of 154 publicly listed firms: 106 U.S. firms and 48 European firms respectively. Of the total selection of 106 U.S. firms, 81 firms were classified with crude oil extraction as core business, whilst the remaining 25 firms fell under the industry classification of support activities. The 48 European firms in the selection represented 12 crude oil extraction firms, and 36 firms within the support activities classifications. During the period of Q4 2012 to Q4 2015, 912 write-downs were recorded.

Our selection of firms were defined with the help of Orbis, where we collected publicly listed U.S. and European firms within the industry classification of extraction of crude petroleum and support activities for petroleum and natural gas extraction. Our search criteria provided a list of 638 firms – however, lack of quarterly data availability significantly reduced the selection of firms. The firms in the selection were observed over the time period of Q1 2012 to Q4 2015, where a sub-analysis was conducted on the period from Q4 2014 to Q4 2015.

Our study of value relevance and timeliness is strongly dependent on accounting variables. The firm-specific accounting figures extracted were quarterly reported net income, quarterly book value of equity and quarterly reported write-downs. Furthermore, we extracted quarterly-end share price, adjusted for share split and share issues, and quarterly dividends, in addition to quarter-end outstanding shares. All variables were extracted from Bloomberg and data for quarter-end share prices were compared to data extracted from DataStream to ensure correctness.

8.3.2 Data Selection Processing

From our initial search result of 638 firms, we excluded firms based on several criteria. Firstly, we removed firms where no data was available in Bloomberg. Secondly, we chose to remove firms that consequently reported three quarters per year. Firms that appeared to report every quarter, but where no data for one or more random quarters could be found, was included in the data set as we expected that the lacking observations would not weaken our results dramatically. Thirdly, we excluded firms where reporting could not be observed for one or more years – in other words, several repeated quarters. The exclusion was based on the belief that the firms would not contribute to inference of the value relevance and timeliness of write-downs on the same basis as firms with reported figures in all quarters. Lastly, we removed firms lacking quarterly share price data for the chosen period.

The collection of reported write-downs figures in Bloomberg proposed certain challenges. Firstly, we found the same amount of reported write-downs to be listed in more than one group of expenses for a firm in a given quarter. The write-down amount listed in Bloomberg could stem from the firm's income statement, the notes, or both, without consistency across firms. Secondly, Bloomberg did not extract write-down charges for all quarters for a given firm. The last notion was discovered by manually checking the financial statements as source for Bloomberg figures. By more closely investigating financial statements, we also found that some reported write-down expenses also included amortisation expenses. We therefore decided to manually cross-check all write-down data extracted for Bloomberg to ensure that write-down amounts used in this study represent write-downs excluding amortisation, in addition to the actual write-down amounts reported in each quarter.

9. Analysis and Results

In this section we present the analysis of this study. We start by describing the variables included in the analysis, followed by a description of the trends of reported write-downs and losses in the period of Q1 2012 – Q4 2015. We thereafter assess the strength of each individual regression model judging by the OLS regression assumptions. We continue with presenting the results of the tests of our hypotheses.

9.1. Descriptive Statistics

In this section we present the variables for each of the four models employed, how they are calculated and the related descriptive statistics. Table 2 below defines the variables used for each individual price and return regression.

***Price Regression / Ohlson Regression*:** *All income statement and market based figures are measured on a per share basis*		
Variable	Abbreviation	Description
Share price	*P_t*	Firm share price, end of period t
Net income, including write-downs	*NI_t_Shares*	Net income after tax, including write-downs, period t
Net income, excluding write-downs	*NIpreWD_t_Shares*	Net income after tax, before write-downs, period t
Write-downs	*WD_t_Shares*	Write-downs, period t
Book value of equity	*BVE_t1_Shares*	Beginning of period t book value of equity
Return/Return Change Regression All income statement and market based figures are measured on a per share basis and deflated by beginning of period share price		
Variable	Abbreviation	Description
Return	*Return*	Appreciation/depreciation in stock price, including quarterly dividends, from period t-1 to period t
Net income, included write downs	*NI_Pt1_Shares*	Net income after tax, including write-downs, period t
Net income, excluded write-downs	*NIpreWD_Pt1_Shares*	Net income after tax, excluding write-downs, period t
Write-downs	*WD_Pt1_Shares*	Write-downs in period t
Δ Net income, excluded write-downs	*ChangeNIpreWD_Pt1_Shares*	Changes in net income excluding write-downs before tax from period t-1 to t
Δ Write-downs	*ChangeWD_Pt1_Shares*	Changes in write-downs excluding write-downs before tax from period t-1 to t

Table 31: Variable description – Price- and return regressions

Lagged Return Regression All income statement and market based figures are measured on a per share basis period t-1 and deflated by beginning of period share price period t-2		
Variable	Abbreviation	Description
Lagged return	*Return_t1_Pt2*	Appreciation/depreciation in stock price, including quarterly dividends, from period t-2 to period t -1
Net income, included write-downs	*NI_t1_Shares_t1_Pt2*	Net income after tax, including write-downs, period t -1
Net income, excluded write-downs	*NIpreWD_Shares_t1_Pt2*	Net income after tax, excluding write-downs, period t
Lead Return Regression All income statement and market based figures are measured on a per share basis period t+1 and deflated by beginning of period share price period t		
Variable	Abbreviation	Description
Lagged return	*Return_tplus1_Pt*	Appreciation/depreciation in stock price, including quarterly dividends, from period t to period t+1
Net income, included write-downs	*NI_tplus1_Shares_tplus1_Pt*	Net income after tax, including write-downs, period t +1
Net income, excluded write-downs	*NIpreWD_tShares_tplust1_Pt*	Net income after tax, excluding write-downs, period t

Table 3: Variable description – Lead and lagged return regression

In section 7.2.1.3 we outlined the issue of scale effects and the related econometric consequences. To control for scale effects, all explained and explanatory variables in the two price regressions are expressed on a per share basis. For the return regressions, explanatory variables are expressed on a per share basis and deflated by share price in the beginning of the contemporaneous quarter.

Table 4 below describes the control variables added in the various regression models. As we do not treat our data as panel data with fixed effects, we need to control for observable firm-specific characteristics that do not change over time. We therefore add dummy variables for whether firms operate within service or extraction. The classification of extraction versus service firms is constructed on the basis of information provided by Orbis. We also add a dummy variable depending on if firms adhere to IFRS or US GAAP, as given by information in the individual firm's financial statements. An advantage of only having data from firms in one

industry is that we do not have to correct for time-invariant, industry-specific variations. In the calculations of after tax net income excluding write-downs, we have decided to add back write-downs before tax, rather than constructing an average tax rate in which to subtract from write-downs before adding them back to net income after tax. We control for differences in tax rates across countries by grouping firms depending on tax rate intervals from 0–15%, 15%–25% and 25%–35% (Deloitte, 2015). The firms are grouped depending on ISIN-country codes and the countries' respective corporation tax. However, the tax dummies may collect information other than country-specific tax rates, and the tax dummies may therefore represent a weakness in our analysis. Lastly, we add time dummies for each quarter to catch the effects that affect all firms within a given quarter.

Control Variables		
Variable	Abbreviation	Description
Company classification dummy	*Ext1Serv0*	Dummy variable, where oil extraction companies = 1, 0 = oil and gas service companies
Standard adherence dummy	*USGAAP1IFRS0*	Dummy variable, where US GAAP adherence= 1, 0 = IFRS adherence
Time dummies	*Q2_2012 - Q4_2015*	Dummy variable for each quarter
Tax dummy	*Tax2Dummy*	Dummy variable, where 1 = tax group 2, 0 = other tax group
Tax dummy	*Tax3Dummy*	Dummy variable, where 1 = tax group 3, 0 = other tax group
Dummy for reported negative net income	*NegativeEarningsDummy*	Dummy variable, where 1 = reported negative net income, 0 = otherwise
Size	*lnMVE*	The natural logarithm of end of period market value of equity

Table 4: Variable description – Control variables

Table 5 provides the descriptive statistics for the main variables for each model applied in the incremental association test. Descriptive statistics for the control variables is amended in appendix 1. We start by presenting descriptive statistics for the variables included in the test of hypotheses 1a and 2, where we test the value relevance of write-downs in the period of Q1 2012 – Q4 2015. All figures are listed before outliers are removed. Outlier adjusted selections for individual tests are provided in appendix 2.

Variable	n	Mean	St. Dev.	Min	Max
Price/Ohlson Model					
P_t	2402	44.407	195.945	.0051	4732.40
NIpreWD_t_Shares	2352	-2.024	114.295	-5337.74	1103.173
WD_t_Shares	2376	2.936	34.591	0	916.202
BVE_t1_Shares	2400	69.990	1416.564	-710.666	68421.9
Return/Return Change Regression					
Return	2385	-0.043	0.2811	-1.002	2.915
NIpreWD_Pt1_Shares	2331	0.017	3.214	-74.976	123.357
WD_Pt1_Shares	2355	0.139	1.257	0	39.631
ChangeNIpreWD_Pt1_Shares	2274	-0.001	3.214	-74.976	123.356
ChangeWD_Pt1_Shares	2331	0.020	0.786	-16.277	17.253

Table 5: Descriptive statistics: Price and return regressions –Variables in the incremental association test

In answering hypothesis 1b, we run a relative association test of value relevance of net income including write-downs relative to net income pre write-downs. When applying the alternative test we also answer hypothesis 2. This preliminary test is run on the price regression and the return regression. We run a robustness test based on the return change regression, accounting for reported negative net income by the inclusion of an additional dummy variable. The relative association test is run after outlier adjustments and the descriptive statistics for the variables included in the test is provided in table 6 below.

Variable	n	Mean	St. Dev.	Min	Max
Price Regression					
P_t	2066	24.411	24.765	0.179	121.48
NIinclWD_Shares	2037	-0.026	1.145	-6.805	2.064
NIpreWD_Shares	2023	0.331	0.646	-1.384	2.298
Return Regression					
Return	2047	-0.037	0.201	-0.615	0.497
NIinclWD_Pt1_Shares	2011	-0.021	0.098	-0.877	0.111
NIpreWD_Pt1_Shares	2003	0.006	0.038	-0.163	0.112

Table 6: Descriptive statistics: Price and return regression – Variables in the relative association test

Variable	n	Mean	St. Dev.	Min	Max
Return Change Regression with Negative Earnings Dummy					
Return	2049	-0.042	0.203	-0.615	0.497
NIinclWD_Pt1_Shares	2013	-0.016	0.092	-1.717	0.245
NIpreWD_Pt1_Shares	2003	0.007	0,051	-0.288	0.245
ChangeNIinclWD_Pt1_Shares	1966	0.004	0.221	-6.393	2.365
Change_NIpreWD_Pt1_Shares	1952	-0.007	0.183	-6.393	2.063
NIincWD_D	2013	-0.031	0.084	-1.712	0
Change_ NIincWD_D	1966	-0.004	0.153	-1.320	2.365
NIpreWD_D	2003	-0.012	0.034	-0.288	0
Change_ NIpreWD_D	1952	-0.010	0.084	-1.254	0.983

Table 7: Descriptive statistics: Return change regression with dummy for negative net income – Variables in the relative association test

Hypothesis 3 concerns the timeliness of write-downs in the period of Q2 2012 – Q3 2015. As described in the research design section, we test this hypothesis by running the lagged and lead return regression specifications on a sub-selection consisting of firms undertaking write-downs. The descriptive statistics for the two return regression specifications are provided in table 8 below.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Lagged Return Regression					
Lagged Return	639	-0.021	0.235	-0.774	2.915
NIpreWD_t_Shares_t1_Pt2	636	0.015	0.050	-0.397	0.327
WD_t_Shares_t1_Pt2	639	0.048	0.083	0	0.503
NI_t1_Shares_t1_Pt2	630	-0.026	0.151	-2.048	0.252
Lagged Return Regression					
Lead Return	640	-0.062	0.241	-0.879	1.102
NIpreWD_t_Shares_tplus1P_t	637	0.016	0.067	-0.467	0.426
WD_t_Shares_tplus1P_t	640	0.066	0.125	0	0.815
NI_tplus1_Shares_tplus1P_t	629	-0.068	0.246	-3.165	0.252

Table 8: Descriptive statistics – Test of the timeliness of write-downs

9.2 Trend in Activity for Reported Losses and Write-Downs

As can be seen from figure 2 below, average write-downs remain stable until the third quarter of 2014, which could resemble the initial point at which the oil price shifts in a negative direction.

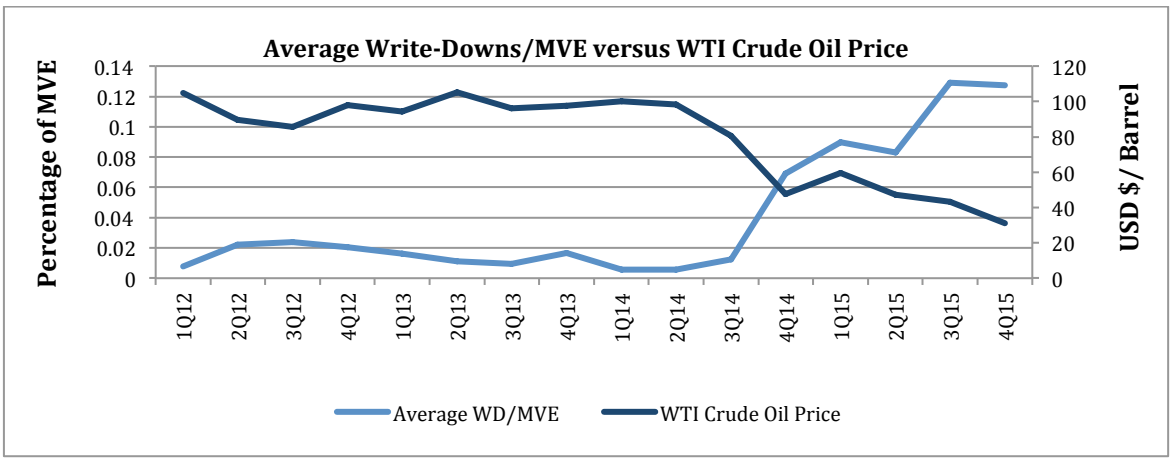

Figure 2: End of quarter average WD/MVE versus end of quarter WTI crude oil price (Mactrotrends, 2016)

The oil price does not bounce back to previous levels after the initial drop. The initial point where the oil price shifts is also the point where the average write-downs for firms in our selection start to escalate. We observe that the decline in oil price has affected oil and gas companies in such manner that the increase in average write-downs is almost perfectly mirroring the decline in oil price.

Figure 3 below displays the frequency of write-downs relative to the total dollar amount of write-downs for our total selection of 154 firms in the quarters from 2012 to 2015. Of the 154 firms, only 16 firms do not report write-downs in any of the quarters. What can be seen from figure 3 below is that the frequency of write-downs remains relatively stable in the period leading up to Q4 2014. The total dollar amount follows the pattern of the frequency of write-downs, where both measures undertake two smaller waves before both peak rather dramatically from Q4 2014. The foundation of hypothesis 2 is laid on the basis of the observed relative change in write-down activity from of Q4 2014 up to the latest records of Q4 2015. As noted, hypothesis 2 concerns the development of value relevance of accounting information when the economic environment for the industry changes.

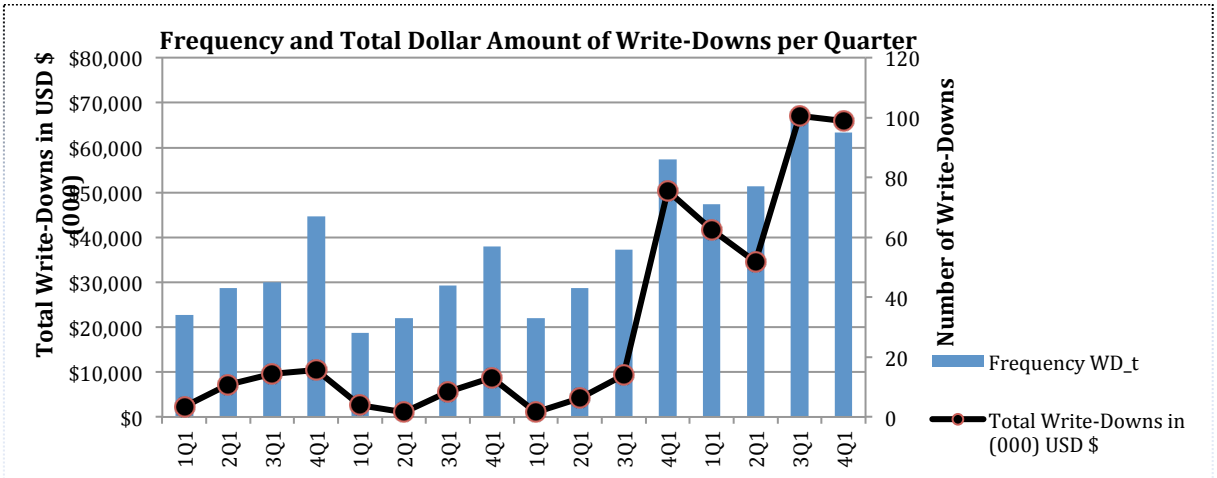

Figure 3: Quarterly frequency and total USD amount of write-downs

In 2014, the total USD amount of recorded write-downs for our firm selection reached 4.1 billion USD. Moving to Q3 2014, the total USD amount of recorded write-downs reached 9.3 billion USD, more than double the total write-down amount in the previous quarter. As can be seen from figure 3 above, 43 of the total 154 firms undertake write-downs in Q2 2014, while the number increases to 56 firms in Q3 2014. The highest recorded frequency of write-downs is in Q3 2015, with 100 firms reporting write-downs. Q3 2015 is also the quarter where the total dollar amount of write-downs peaks, at 64.1 billion USD. The highest single standing write-down in our selection is recorded in Q4 2015 with a total of 8.3 billion USD. Of the 912 recorded write-downs in the period from 2012 to 2015, the 93 extraction firms undertake 675 write-downs. The remaining 237 write-downs are reported by the 63 oil and gas service companies.

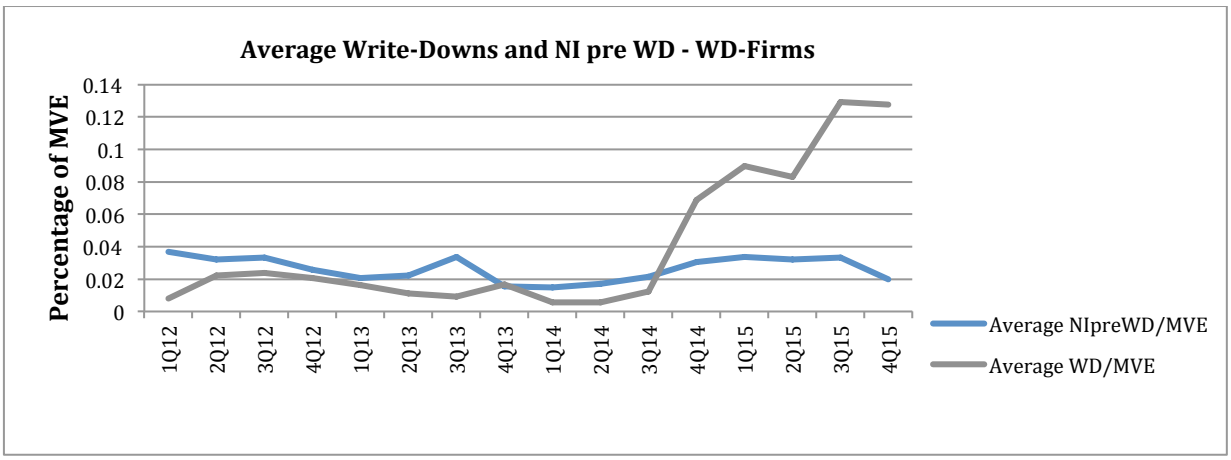

Figure 4: Write-down firms: average write-down and net income (before tax, pre write-downs) divided by market value of equity in period t-1

Figure 4 above displays average quarterly write-downs and net income before write-downs for firms undertaking write-downs. Interestingly, average net income pre write-downs appear to remain relatively stable compared to average write-downs. This observation is especially true when focusing on the period of Q3 2014 to Q4 2015. The results of the relatively stable development in net income may rely on what we believe must be hedging of oil prices against future price declines. Thus, a larger decline in net income may be observable in later periods if the oil price remains at a low level.

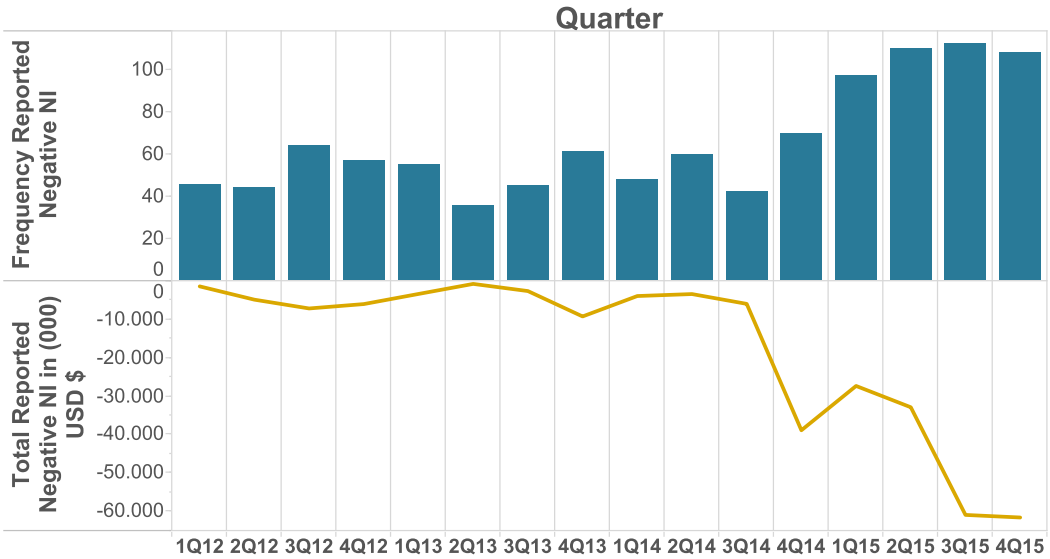

Figure 5: Frequency and total dollar amount of reported losses

The frequency and total dollar amount of reported losses are illustrated in figure 5 above. As can be observed from figure 5 is that both frequency and total dollar amount of reported losses increases from Q4 2014, reflecting the underlying economic event of the substantial oil price decline. Both the highest frequency and total dollar amount for the firms in our selection are observed in Q3 2015, with 100 reported losses of a total of 60.9 billion USD.

What is also apparent when investigating the data is the proportion of net income turning negative due to write-downs increases from the fourth quarter of 2014. In Q4 2014, 54% of the 71 reported losses are caused by the write-down recognised by firms. In Q3 and Q4 2014, the proportion of reported losses caused by write-downs is 29% and 25%, respectively. The proportion increases to 60% in Q3 2015 and 52% in Q4 2015.

9.3 Value Relevance of Write-Downs Q1 2012 – Q4 2015

In sections 9.3.1 to 9.3.7 we present the results of the four regression models employed in the incremental association test. The results from the incremental test are interpreted together with the results from the relative association test in section 9.3.8 to answer hypothesis 1a.

Hypothesis 1a. Write-downs reported by U.S. and European firms in the oil and gas industry in the period of Q1 2012 to Q4 2015 is negatively associated with share price and share return, and thus, are value relevant to investors.

9.3.1 The Disaggregated Price Regression

As explained when outlining our research design, we have employed two specifications of the price regression: a disaggregated price regression and a disaggregated Ohlson regression. Both of the price regressions are run to study the association between stock price and the earnings components, net income pre write-downs (NI) and write-downs (WD). As previously addressed, both of the earnings components are expressed on a per share basis.

We start by presenting the results of the disaggregated price regression. The results of the regression run without control variables are shown in table 9 below. The results of the disaggregated price regression show that NI and WD explain 23.89% of the variation in share price. What is immediately observable is that WD is associated with share price at a 5% significance level; however the coefficient of WD is positive. We observe NI to be insignificant with a negative sign. The sign of both NI and WD is intuitively wrong, and not in line with the predictions of the earnings valuation model as we have presumed NI and WD to have a positive and negative association to price, respectively.

n 2339	**R^2** 0.2395	**Adjusted R^2** 0.2389		
P_t	**Coefficient**	**Std. Dev.**	**t-stat**	**p-value**
NIpreWD_Shares	-0.0313957	0.0259309	-1.21	0.226
WD_t_Shares	2.423315	0.0893797	27.11	0.000
Constant	34.75981	2.958673	11.75	0.000

Table 9: Price regression outputs before adding control variables (OLS)

These results indicate that none of the earnings components are significantly associated with share price and thus not value relevant for investors when determining firm stock price. However, it is possible that important variables are left out of the model, and we therefore test whether adding control variables changes the result. We include the control variables for

company classification and standard adherence, quarter dummies, and lastly, the two tax dummies. The stepwise changes of results are provided in appendix 2.1.2. The results from the regression run with all control variables are presented in table 10 below. From adjusted R^2 we can see that the regression model's explanatory power increases, but not in the extent that is illustrated in the return regression model in the section that follows.

n 2339	**R^2** 0.2638	**Adjusted R^2** 0.2571		
P_t	**Coefficient**	**Std. Dev.**	**t-stat**	**p-value**
NIpreWD_Shares	-0.0342973	0.0257369	-1.33	0.183
WD_t_Shares	2.425272	0.0886735	27.35	0.000
EXT1SERV0	-27.02014	6.798109	-3.97	0.000
USGAAP1IFRS0	23.74207	18.54328	1.28	0.201
Q2_2012	7.732099	16.62648	0.47	0.642
Q3_2012	7.174957	16.54971	0.43	0.665
Q4_2012	-5.839506	16.87694	-0.35	0.729
Q1_2013	22.69663	16.51613	1.37	0.170
Q2_2013	2.698106	16.55072	0.16	0.871
Q3_2013	0.0786195	16.41612	0.00	0.996
Q4_2013	0.5434356	16.60183	0.03	0.974
Q1_2014	-0.1113948	16.35472	-0.01	0.995
Q2_2014	-1.124263	16.35482	-0.07	0.945
Q3_2014	-19.11869	16.33327	-1.17	0.242
Q4_2014	-31.31745	16.57757	-1.89	0.059
Q1_2015	-27.06919	16.33138	-1.66	0.098
Q2_2015	-27.8762	16.3553	-1.70	0.088
Q3_2015	-35.04015	16.38211	-2.14	0.033
Q4_2015	-34.46466	17.49453	-1.97	0.049
Tax2Dummy	-84.90201	18.14178	-4.68	0.000
Tax3Dummy	-83.0855	24.80448	-3.35	0.001
Constant	124.4192	20.54832	6.05	0.000

Table 1032: Price regression output including control variables (OLS)

After having run diagnostics tests we find that the price regression suffers from several issues. First of all, residuals seem not to be normally distributed, judging by the residual vs. fitted plot (appendix 2.3.3). Secondly, after visually inspecting the scatter plots we find no evidence of strong linear relationships between main independent variables and the dependent variable, stock price (appendix 2.3.6). Thirdly, we suspect that the incorrect signs of the coefficient of NI and WD may be caused by the presence of multicollinearity. However, neither the VIF-test, nor correlation coefficients confirm high correlation between main variables of

interest (appendix 2.3.1 and 2.2.1). To the contrary, the correlation coefficient between NI and WD is at 0.2415, which is far below our tolerance level of 0.6 (appendix 2.2.1). As the results from the diagnostic tests do not indicate any severe presence of multicollinearity in the price regression, multicollinearity does not seem to explain the opposing signs of the two earning variables coefficients, NI and WD.

Nevertheless, in line with the criticism of Kothari & Zimmerman (1995) against the price regression, we find that the price regression suffers from heteroscedasticity. The presence of heteroscedasticity in the price regression is confirmed by both the White's test and the plot of residuals versus fitted values (appendix 2.3.2 and 2.3.3). The plot of residual versus fitted values also suggests that autocorrelation may propose a problem, as there is more evidence of residuals following a systematic pattern, rather than random pattern.

Since the model violates several of the assumptions underlying OLS regression, we also run the price regression with robust standard errors in STATA[4], a method that may limit influence of non-normally distributed errors and heteroscedasticity, and influential outliers. The change in results from the robust regression is limited. NI remains insignificant, while WD remains significant. The regression with robust standard errors (robust regression) does not change the sign of the coefficients, and thus the problem of incorrect signs for both earnings components remains. As several of the linear assumptions are violated, we suspect that influential outliers may affect the results and we therefore run the regression adjusted for outliers.

The Disaggregated Price Regression Adjusted for Outliers

When adjusting for outliers we remove the lowest and the highest observations for the dependent variable Price (P) and each of the independent variables NI and WD, in total 5% of the observations per variable. Diagnostic tests show that the price regression model still suffers from non-normally distributed residuals and heteroscedasticity (see appendix 2.3.4 figure 20, 2.3.2 figure 16 and 2.3.3 figure 18). Judging by the improvement of skewness and kurtosis for the residuals, the distribution of residuals has dramatically improved (appendix 2.3.5). Judging by the scatterplots, the linear relationship between the dependent variable P

[4] *"Using the STATA defaults, robust regression is about 95% as efficient as OLS (Hamilton, 1991). In short, the most influential points are dropped, and then cases with large absolute residuals are down-weighted*" (Institute for Digital Research and Education n.d.).

and the main independent variables has seemingly improved after removal of outliers (appendix 2.3.6). Thus, outlier adjustment has improved the regression estimates and made the estimates more appropriate for statistical inferences. However, we run the price regression with robust standard errors to mitigate the presence of heteroscedasticity. The results from the robust regression are presented in table 11 below.

The results from the outlier adjusted price regression show that both NI and WD are significant at 5% significance level. The variable coefficients adopt the expected signs, aligned with predictions of NI being positively associated to stock price, whereas the association between WD and stock price is negative. Thus, the interpretation of the regression results changes after having removed outliers, and evidently, both earnings components are value relevant.

n 2010	**R^2** 0.2885			
P_t	**Coefficient**	**ROBUST Std. Dev.**	**t-stat**	**p-value**
NIpreWD_Shares	15.18721	0.9706013	15.65	0.000
WD_t_Shares	-2.961466	0.5768369	-5.13	0.000
EXT1SERV0	2.998096	1.022033	2.93	0.03
USGAAP1IFRS0	3.640515	2.509061	1.45	0.147
Q2_2012	-6.255122	2.51322	-2.49	0.013
Q3_2012	2.045498	2.719836	0.75	0.452
Q4_2012	-1.190023	2.550832	-0.47	0.641
Q1_2013	0.2307053	2.614273	0.09	0.930
Q2_2013	-5.168285	2.442565	-2.12	0.034
Q3_2013	-0.0690854	2.644977	-0.03	0.979
Q4_2013	2.76181	2.725085	1.01	0.311
Q1_2014	2.653827	2.737197	0.97	0.332
Q2_2014	7.01208	2.824011	2.48	0.013
Q3_2014	-3.628665	2.523139	-1.44	0.151
Q4_2014	-10.69974	2.931895	-3.65	0.000
Q1_2015	-3.09529	2.73492	-1.13	0.258
Q2_2015	-0.3881706	2.935417	-0.13	0.895
Q3_2015	-8.113958	2.755303	-2.94	0.003
Q4_2015	-4.187976	3.06562	-1.37	0.172
Tax2Dummy	4.688287	1.512287	3.10	0.002
Tax3Dummy	12.81752	2.744521	4.67	0.000
Constant	7.4576	2.23595	3.34	0.001

Table 11: Price regression output, including control variables – Outlier adjusted (Robust standard errors)

The most prominent issue concerning the price regression is that it suffers from heteroscedasticity, even after having removed outliers. The presence of heteroscedasticity in our regression models is likely to be caused by cross-sectional scale differences. The heteroscedasticity we observe in the price regression may be caused by number of outstanding shares not fully correcting for scale differences across firms. We therefore conduct a robustness test by including firm size as an additional control variable. The results from the price regression run with size variable do not solve the heteroscedasticity problem in our price regression (appendix 2.4). Due to the presence of heteroscedasticity in the price regression, inferences based on this regression model are drawn from the robust regression.

9.3.2 The Disaggregated Ohlson Regression

The results from the disaggregated Ohlson regression run without control variables provided in table 12 below, explains more of the variation of share price (35.84%) relative to the price regression. This is due to the inclusion of beginning of period book value of equity per share (BVE) as an additional explanatory variable.

n 2334	**R^2** 0.3592	**Adjusted R^2** 0.3584		
P_t	**Coefficient**	**Std. Dev.**	**t-stat**	**p-value**
NIpreWD_Shares	1.959518	0.0983735	19.92	0.000
WD_t_Shares	1.644529	0.0902333	18.23	0.000
BVE_t1_Shares	0.1635514	0.0078405	20.86	0.000
Constant	29.06609	2.736141	10.62	0.000

Table 12: Ohlson regression output before adding control variables (OLS)

The results of the Ohlson regression show that all explanatory variables are associated with share price at a 5% significance level. Interestingly, the sign of NI is positive, as expected, whereas the sign of WD conflicts with expectations of a negative association with share price, suggesting that WD is not value relevant. However, as illustrated in table 13 the VIF-test suggests that there is a strong collinear relationship between the main variables BVE and NI, even before including control variables. The coefficient estimates cannot be trusted if multicollinearity is causing the incorrect sign of the coefficient.

Variable	VIF
BVE_t1_Shares	17.19
NIpreWD_Shares	17.04
WD_t_Shares	1.21
Mean VIF	11.81

Table13: VIF-test: Ohlson regression before adding control variables

The results from the Ohlson regression including all control variables are presented in table 14 below. When adding control variables, the regression's explanatory power increases only incrementally. The coefficient signs of NI, BVE and WD do not change after adding control variables, and the problem of multicollinearity remains.

n 2334 **R^2** 0.3762 **Adjusted R^2** 0.3702

P_t	Coefficient	Std. Dev.	t-stat	p-value
NIpreWD_Shares	1.910124	0,0983901	19,41	0,000
WD_t_Shares	1.663919	0,0998749	18,51	0,000
BVE_t1_Shares	0.1597297	0,0078438	20,36	0,000
EXT1SERV0	-23.96912	6,268698	-3,82	0,000
USGAAP1IFRS0	22.39141	17,09109	1,31	0,190
Q2_2012	-3.889989	15,41427	-0,25	0,801
Q3_2012	-0.4019409	15,33849	-0,03	0,979
Q4_2012	-8.281865	15,63412	-0,53	0,596
Q1_2013	17.9223	15,30534	1,17	0,242
Q2_2013	1.253214	15,33611	0,08	0,935
Q3_2013	-2.795724	15,21365	-0,18	0,854
Q4_2013	-3.286719	15,38266	-0,21	0,831
Q1_2014	-3.581399	15,18098	-0,24	0,814
Q2_2014	-3.701303	15,15744	-0,24	0,807
Q3_2014	-18.40745	15,13772	-1,22	0,224
Q4_2014	-29.64192	15,36055	-1,93	0,054
Q1_2015	-41.23653	15,1729	-2,72	0,007
Q2_2015	-26.23858	15,15821	-1,73	0,084
Q3_2015	-32.92407	15,18311	-2,17	0,030
Q4_2015	-33.68249	16,2033	-2,08	0,038
Tax2Dummy	-52.91958	17,03582	-3,11	0,002
Tax3Dummy	-51.3362	23,09238	-2,22	0,026
Constant	90.15584	19,37326	4,65	0,000

Table 133: Ohlson regression output, including control variables (OLS)

The results from the stepwise inclusion of control variables in the Ohlson regression are provided in appendix 3.1.2. The correlation matrix shows that the correlation coefficient between the variables NI and BVE is 0.9705, which is far above our tolerance level of 0.6 (appendix 3.1.1). The Ohlson regression also suffers from non-linearity and non-normally distributed residuals (appendix 3.3.4). Aligned with the price regression, the Ohlson regression suffers from heteroscedasticity, evidential from the White's test output provided in appendix 3.3.2, and the residuals versus fitted values plot in appendix 3.3.3. The plot of residuals versus fitted values also implies that the autocorrelation assumption is violated, as it does not seem to be a random spread of residuals.

The Disaggregated Ohlson Regression Adjusted for Outliers

In an attempt to improve the model to better fit the linear assumptions, we also run the Ohlson regression adjusted for outliers. In line with the outlier removal procedure performed on the price regression, we remove 2.5% of top and bottom observations for the variables P, NI, WD and BVE. However, heteroscedasticity remains a problem, and we therefore run the outlier adjusted Ohlson regression with robust standard errors. The results of the Ohlson regression run with robust standard errors after outlier removal are presented in table 15 below. After removal of outliers the Ohlson-regression's explanatory power has increased to 57% when all control variables are included. The regression model response to outlier removal is an improved linear relationship between the explained and the explanatory variables, as can be seen in the scatter plots (appendix 3.3.6). After removal of outliers the distribution of residuals in the Ohlson regression improves drastically, as can be seen from the much straighter line in the normal probability plot (appendix 3.3.4). The relative decrease in skewness and kurtosis of the residuals confirms this observation (appendix 3.3.5).

n 1906	R^2 0.5708			
P_t	**Coefficient**	**ROBUST Std. Dev.**	**t-stat**	**p-value**
NIpreWD_Shares	6.172508	0.7948716	7.77	0.000
WD_t_Shares	-2.898126	0.4074167	-7.11	0.000
BVE_t1_Shares	1.079576	0.0417405	25.86	0.000
EXT1SERV0	3.340473	1.523622	6.43	0.000
USGAAP1IFRS0	9.79794	0.7775732	4.30	0.000
Q2_2012	-3.340473	1.944882	-1.90	0.057
Q3_2012	0.8175521	2.065069	0.40	0.692
Q4_2012	-0.2206391	1.948212	-0.11	0.910
Q1_2013	-0.0155493	1.881074	-0.01	0.993
Q2_2013	-3.177775	1.88522	-1.69	0.092
Q3_2013	0.7819064	1.994371	0.39	0.695
Q4_2013	3.474085	1.975365	1.76	0.079
Q1_2014	3.37267	2.108311	1.60	0.110
Q2_2014	6.942965	2.132129	3.26	0.001
Q3_2014	-0.6966019	1.915972	-0.36	0.716
Q4_2014	-5.462642	2.23094	-2.45	0.014
Q1_2015	-3.842956	2.154893	-1.78	0.075
Q2_2015	-2.286449	2.229071	-1.03	0.305
Q3_2015	-8.446119	1.974454	-4.28	0.000
Q4_2015	-6.53108	2.265476	-2.88	0.004
Tax2Dummy	0.7861034	1.01686	0.77	0.440
Tax3Dummy	-1.923978	1.660784	-1.16	0.247
Constant	-0.4296967	1.524126	-0.28	0.778

Table 15: Ohlson regression output, including control variables – Outlier adjusted (Robust standard errors)

The most significant change in results after removing outliers is that the collinearity between NI and BVE is reduced. High VIF-scores are only to be found for control variables, where the coefficients of these variables are of less interest. Our inferences of the earnings coefficients are therefore not affected by correlation between control variables. The correlation coefficient between NI and BVE is reduced to 0.5015, which is below our tolerance level of 0.6, as can be seen in the correlation matrix in appendix 3.2.1. Where the model is no longer affected by multicollinearity, the sign of the coefficients of interest is considered more reliable and thus proper for statistical inferences. We therefore believe the coefficient estimates provided by the outlier adjusted Ohlson regression to be more trustworthy than before outliers were removed. The coefficient signs of NI, WD and BVE are aligned with our

expectations in addition to being significantly associated with share price at a 5% significance level. Accordingly, we interpret the results from the outlier adjusted Ohlson regression as evidence of NI and WD being value relevant for investors.

9.3.4 The Disaggregated Return Regression Model

Different from the two price regressions described above, the return regression studies the association between share return and the earnings components, NI and WD. As previously addressed in the descriptive statistics, both of the earnings components are deflated by share price in the beginning of period and number of shares in the corresponding period. We start by presenting the results of the return regression. Table 16 below shows the results of the return regression including only the earnings components, NI and WD, for the entire sample selection.

n 2329	**R^2** 0.0129	**Adjusted R^2** 0.0120		
Return	**Coefficient**	**Std. Dev.**	**t-stat**	**p-value**
NIpreWD__Pt1_Shares	0.0035369	0.0018131	1.95	0.051
WD_Pt1_Shares	-0.0218146	0.0046141	-4.73	0.000
Constant	-0.0379851	0.0057751	-6.42	0.000

Table 16: Return regression outputs before adding control variables

The WD-coefficient is significantly different from zero at a 5% significance level and the NI-coefficient is significant at a 10% significance level. In addition, both coefficients of the earnings components adopt the predicted sign, negative for WD and positive for NI. The significance level and the confirmed predicted sign of both earnings components suggest that both NI and WD is value relevant. However, the explanatory power (R^2) of the return regression excluding control variables, is only 1.2%. The return regression's R^2 is remarkably low relative to 24% generated in the price regression. As described in section 7.2.1.1, Kothari & Zimmerman (1995) address that the return regression often suffers from measurement error, as it is only the surprise component in net earnings, and not the stale component, that is relevant for current share return. We believe that the irrelevance of the stale component for share return may explain the low R^2 of the return regression. However, when including change variables to serve as an approximation for the surprise component in the return change regression, the R^2 remains low (the results of the return change regression are introduced in the following section). The low R^2 of the return regression can also be related to

omission of explanatory variables. The latter explanation seems more likely since R^2 increases to 30% when including control variables in the regression. The greatest increase in R^2 occurs when the time dummies are added to account for time-variant effects.

The measurement error addressed by Kothari & Zimmerman (1995) may also cause the earnings component coefficients in the return regression to be biased towards zero. Aligned with the explanation of Kothari & Zimmerman, our earnings components coefficients may suffer from downward bias, as is evident from the remarkably low value of the NI and WD coefficient. However, scaling of variables in the return regression by both number of outstanding shares and beginning of period share price, may also cause the low coefficient values. The results of the return regression including control variables are presented in table 17 below.

n 2329	**R^2** 0.3101	**Adjusted R^2** 0.3038		
Return	**Coefficient**	**Std. Dev.**	**t-stat**	**p-value**
NIpreWD__Pt1_Shares	0.0027669	0.0027669	1.81	0.070
WD_Pt1_Shares	-0.0104607	0.0039421	-2.65	0.008
EXT1SERV0	-0.0110983	0.0112311	-0.99	0.323
USGAAP1IFRS0	0.0126563	0.0306026	0.41	0.679
Q2_2012	-0.2777803	0.0276496	-10.05	0.000
Q3_2012	-0.050831	0.0275	-1.85	0.065
Q4_2012	-0.1686341	0.0281504	-5.99	0.000
Q1_2013	-0.0242485	0.027452	-0.88	0.377
Q2_2013	-0.176593	0.027498	-6.42	0.000
Q3_2013	-0.0162792	0.0273195	-0.60	0.551
Q4_2013	-0.1088554	0.0275909	-3.95	0.000
Q1_2014	-0.0522752	0.0272762	-1.92	0.055
Q2_2014	-0.0352796	0.0272175	-1.30	0.195
Q3_2014	-0.3260485	0.0271479	-12.01	0.000
Q4_2014	-0.5012726	0.0275042	-18.23	0.000
Q1_2015	-0.2159368	0.0271954	-7.94	0.000
Q2_2015	-0.1433754	0.0272609	-5.26	0.000
Q3_2015	-0.4716365	0.0273586	-17.24	0.000
Q4_2015	-0.2029473	0.0291438	-6.96	0.000
Tax2Dummy	0.0376858	0.0301294	1.25	0.211
Tax3Dummy	0.0284924	0.0410841	0.69	0.488
Constant	0.1029599	0.0343836	2.99	0.003

Table 17: Return regression outputs, including control variables (OLS)

Appendix 4.1.2 shows the development of the return regression when control variables are added one by one. When all control variables are added to the regression, WD and NI have the expected sign and are significant at a 1% and 10% significance level, respectively.
The return regression does not seem to be suffering from severe multicollinearity. The VIF test in appendix 4.3.1 shows that multicollinearity is present among some of our control variables that have a VIF score higher than 5 but not for either of the earnings components. The same interpretation can be made from the correlation matrix, additionally indicating which variables are correlated with which (appendix 4.1). Thus, multicollinearity will not have a severe impact on the interpretations of the results.

The results of the White´s test show that heteroscedasticity is also present in the return regression (appendix 4.3.2). The plot of residual versus fitted values in appendix 4.3.3 confirms the White´s test. Our study does therefore not provide further evidence of the return regression being less affected by heteroscedasticity compared with the price regression, as stated by Kothari & Zimmerman (1995). Due to the presence of heteroscedasticity, we run the return regression with robust standard errors; NI becomes significant at a 5% significance level and R^2 increases slightly (appendix 4.1.3).

The Disaggregated Return Regression Adjusted for Outliers

To adjust for outliers we remove 2.5% of the highest and 2.5% of the lowest observations of return and earnings variables. When running the robust regression after the removal of outlier, both NI and WD are significantly different from zero at a 1% significance level and R^2 increases to 38%, shown in table 18 below. The improvements are also evidential when comparing the normal probability plots from before and after removal of outliers, as shown in figure 6 below. The better the dotted line fits the straight line in the normal probability plot, the closer the residuals are to a normal distribution. The same conclusion can be drawn from the slightly reduced skewness and of the residuals (see appendix 4.3.5).

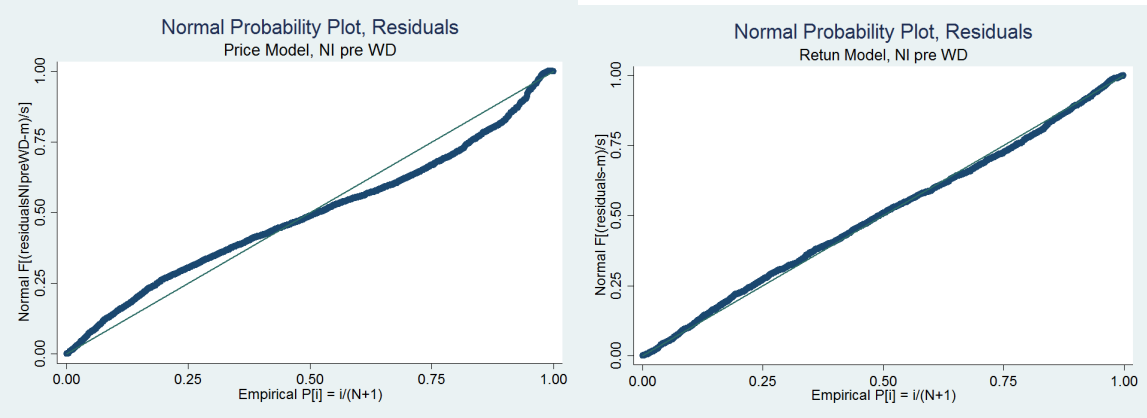

Figure 6: Normal probability plots, before (left) and after (right) outlier adjustment - Return regression

We also find that the independent variables seem to have a weak linear association with the dependent variables, and thus regression assumption of linearity in parameters is also violated.

n 2002 **R^2** 0.3796

Return	Coefficient	ROBUST Std. Dev.	t-stat	p-value
NIpreWD__Pt1_Shares	0.2877295	0.0951055	3.03	0.003
WD_Pt1_Shares	-0.2264082	0.0687592	-3.29	0.001
EXT1SERV0	0.0195002	0.0200808	0.97	0.332
USGAAP1IFRS0	0.006446	0.0083414	0.77	0.440
Q2_2012	-0.2295379	0.0195584	-11.74	0.000
Q3_2012	0.026604	0.019939	1.33	0.182
Q4_2012	-0.1016148	0.0201565	-5.04	0.000
Q1_2013	0.0069541	0.0227365	-0.31	0.760
Q2_2013	-0.11622	0.0196375	-5.92	0.000
Q3_2013	0.0334864	0.0211798	1.58	0.114
Q4_2013	-0.0687246	0.0209143	-3.29	0.001
Q1_2014	-0.0384818	0.020473	-1.88	0.060
Q2_2014	0.0111295	0.0199421	0.56	0.577
Q3_2014	-0.2582098	0.0194753	-13.26	0.000
Q4_2014	-0.3736943	0.0229842	-16.26	0.000
Q1_2015	0.1364043	0.023368	-5.84	0.000
Q2_2015	-0.0964297	0.0229806	-4.20	0.000
Q3_2015	-0.3179871	0.0229226	-13.87	0.000
Q4_2015	-0.1211593	0.0278709	-4.35	0.000
Tax2Dummy	0.0763647	0.0275489	2.77	0.006
Tax3Dummy	0.0681192	0.0329565	2.07	0.039
Constant	-0.0152016	0.0308319	-0.49	0.622

Table 34: Return regression output, including control variables – Outlier adjusted (Robust standard errors)

The most obvious disadvantage of the return regression is the low coefficient values of earnings components. Judging by the residual plots, the return regression seems to suffer from less econometric concerns relative to the two price regressions. Despite its weakness with the presence of heteroscedasticity we believe that the return regression run with robust standard errors adjusted for outliers is appropriate for statistical inferences. Evidentially, we interpret both earnings components to be value relevant, as NI and WD are statistically significant and adopt the predicted sign, as shown in table 18.

9.3.5 The Disaggregated Return Change Regression Model

As previously mentioned, the return model can be extended with change in the earnings variables to account for the measurement error in the earnings components. Thus, we include two more variables: change in net income between period t-1 and period t (NI_Change) and change in write-downs between the corresponding periods (WD_Change). However, when running the return change regression including only the earnings components and change components, neither NI, nor the change variables are significantly associated with share return. The R^2 of the regression is low at only 1.38% as presented in table 19 below. The observation of the low R^2 for the return change regression is aligned with the low R^2 observed for the return regression.

n 2274 **R^2** 0.0138 **Adjusted R^2** 0.0121

Return	Coefficient	Std. Dev.	t-stat	p-value
NIpreWD__Pt1_Shares	0.0036472	0.0036155	1.01	0.313
ChangeNipreWD_Pt1_Shares	-0.0003312	0.003316	-0.10	0.920
WD_Pt1_Shares	-0.0266558	0.0057772	-4.61	0.000
ChangeWD_Pt1_Shares	0.0139866	0.0091087	1.54	0.125
Constant	-0.0379257	0.0058425	-6.49	0.000

Table 35: Return change regression outputs before adding control variables

Similar to the response of the return regression, R^2-adjusted increases considerably to 31% when control variables are included in the return change regression. Further, as with the return regression results, it is the time dummies that have the greatest impact on R^2 in the return change regression. The results in table 20 below suggest that WD is value relevant, while NI is not. This observation violates our expectations of at least finding NI to be significantly associated with return. However, in contrast to the return regression, the return

change regression suffers from multicollinearity between the NI_Change variable and NI. This is not evidential in the VIF test in appendix 5.3.1 but the correlation matrix in appendix 5.1.1 shows a correlation of -0.8654 between the two variables, which is far above our tolerance level of 0.6. Multicollinearity in the regression is a major issue when the regression is used to interpret the coefficients as we do to conclude the value relevance and timeliness of write-downs. Thus, as long as multicollinearity is present in the return change regression, we cannot draw correct inferences of the NI coefficient.

n 2274	**R^2** 0.3155	**Adjusted R^2** 0.3085		
Return	**Coefficient**	**Std. Dev.**	**t-stat**	**p-value**
NIpreWD__Pt1_Shares	0.0046572	0.0030338	1.54	0.125
ChangeNipreWD_Pt1_Shares	-0.0022581	0.0027825	-0.81	0.417
WD_Pt1_Shares	-0.016112	0.0049136	-3.28	0.001
ChangeWD_Pt1_Shares	0.0168557	0.0076936	2.19	0.029
EXT1SERV0	-0.0077782	0.0113091	-0.69	0.492
USGAAP1IFRS0	0.0039166	0.031179	0.13	0.900
Q2_2012	-0.2757123	0.028444	-9.69	0.000
Q3_2012	-0.0459581	0.0283881	-1.62	0.106
Q4_2012	-0.1658891	0.0289212	-5.74	0.000
Q1_2013	-0.0064761	0. 0289217	-0.22	0.823
Q2_2013	-0.1740802	0.0283871	-6.13	0.000
Q3_2013	-0.0158081	0.0282969	-0.56	0.576
Q4_2013	-0.1069696	0.0283893	-3.77	0.000
Q1_2014	-0.0505241	0.0283861	-1.78	0.075
Q2_2014	-0.0328755	0.0280265	-1.17	0.241
Q3_2014	-0.3230007	0.0280293	-11.52	0.000
Q4_2014	-0.5003681	0.0283126	-17.67	0.000
Q1_2015	-0.2006514	0.0283831	-7.07	0.000
Q2_2015	-0.1424412	0.0280771	-5.07	0.000
Q3_2015	-0.4687238	0.028162	-16.64	0.000
Q4_2015	-0.1961989	0.0299499	-6.55	0.000
Tax2Dummy	0.0299561	0.0310604	0.96	0.335
Tax3Dummy	0.0283592	0.0421631	0.67	0.501
Constant	0.1068599	0.0357692	2.99	0.003

Table 36: Return change regression output, including control variables (OLS)

Except from multicollinearity problems there is no substantial difference in the results from the return regression when applying the return change regression. In short, the return change

regression does also suffer from heteroscedasticity problems, evident from the White's test and the plot of residual versus fitted values (appendix 5.3.3). The plot of residuals versus fitted values does not suggest autocorrelation to be an issue. The independent variables have a weak association to the dependent variable, as shown in the scatterplots (see appendix). Furthermore, the return change regression does not fulfil the assumption of normally distributed residuals (see appendix 5.3.4). In the same manner as the return regression seems to respond negatively in the presence of outliers, we believe this also applies to the return change regression. We therefore run the return change regression adjusted for outliers.

The Disaggregated Return Change Regression Adjusted for Outliers

Removal of outliers improves the distribution of the residuals, as can be seen when comparing the normal probability plots before and after removal of outliers (appendix 5.3.4). The independent variables have a weak association with the dependent variable evidential in the scatter plots in appendix 5.3.6. However, the problem with multicollinearity previously addressed seems to be solved by removing outliers. Multicollinearity is still present in the return change regression, but only among control variables. Thus, our interpretations of the earnings component coefficients are not influenced by high correlation between control variables. The absence of severe multicollinearity between the earnings components makes the sign of the coefficients more reliable and thus proper for statistical inferences. Since the return change regression still suffers from heteroscedastic residuals after outliers have been removed, we run the regression with robust standard errors, as shown in table 21 below. After removal of outliers both the earnings variables, NI and WD, are significantly associated with share return. Thus, we believe that the return change regression confirms that both NI and WD are value relevant. This result is aligned with the interpretation of the output from the two price regressions and the return regression.

n 2274	R^2 0.3155	Adjusted R^2 0.3085		
Return	**Coefficient**	**ROBUST Std. Dev.**	**t-stat**	**p-value**
NIpreWD__Pt1_Shares	0.2857271	0.0966174	2.96	0.003
ChangeNipreWD_Pt1_Shares	0.0013644	0.0320246	0.04	0.966
WD_Pt1_Shares	-0.2473691	0.0720124	-3.44	0.001
ChangeWD_Pt1_Shares	0.0247805	0.0386432	0.64	0.521
EXT1SERV0	0.008999	0.008365	1.08	0.282
USGAAP1IFRS0	0.0100927	0.0196213	0.51	0.607
Q2_2012	-0.2273979	0.203789	-11.16	0.000
Q3_2012	0.0317976	0.0207401	1.53	0.125
Q4_2012	-0.098823	0.029264	-4.72	0.000
Q1_2013	0.0058541	0.0240993	0.24	0.808
Q2_2013	-0.1135094	0.0205305	-5.53	0.000
Q3_2013	0.0331759	0.0219233	1.51	0.130
Q4_2013	-0.0663868	0.0216921	-3.06	0.002
Q1_2014	-0.03941	0.02147	-1.84	0.067
Q2_2014	0.0132389	0.0207438	0.64	0.523
Q3_2014	-0.2559694	0.0202941	-12.61	0.000
Q4_2014	-0.3715712	0.0236982	-15.68	0.000
Q1_2015	-0.1332489	0.0242478	-5.50	0.000
Q2_2015	-0.0933998	0.0236964	-3.94	0.000
Q3_2015	-0.3147362	0.0236798	-13.29	0.000
Q4_2015	-0.1151809	0.0285098	-4.04	0.000
Tax2Dummy	0.0751314	0.0293492	2.56	0.011
Tax3Dummy	0.0738842	0.0341635	2.16	0.031
Constant	-0.0161806	0.0329284	-0.49	0.623

Table 21: Return change regression output, including control variables – Outlier adjusted (Robust standard errors)

9.3.6 Regression Test on Sub-Selection

We also run the price and return regression models on a sub-sample of the data selection only consisting of firm-quarters where write-downs have been reported. Only including firm-quarters with write-downs in our regression models is performed as a robustness test to examine if zero-write-down quarters influence the results of the write-down coefficient. However, regression results from the robustness test for each of the four models are consistent with the results from the regression tests run on all firm-quarters when outliers are removed. The only noteworthy difference is that the explanatory power increases for all regressions, implying that the write-down variable may have an increased importance for this sub-selection. The results and descriptive statistics are provided in appendix 6.

9.3.7 Summarising Remarks – Incremental Association Test

In order to answer our research question we formulated four hypotheses. The first hypothesis is answered based on the test results provided by each of the four regression models. Thus, to be able to come to any conclusions of whether write-downs undertaken by firms in the oil and gas industry are value relevant for investors, we start by summarising these results.

In the price regression before outlier removal, WD is significantly different from zero although the WD coefficient does not adopt the predicted sign. NI is neither significantly associated with share price, nor adopts the expected sign. Thus, the results of the price regression before outlier removal indicate neither of the accounting amounts, NI and WD, to be value relevant.

The results of the Ohlson regression before removal indicate NI to be value relevant information to determine stock price, as NI is significantly different from zero and adopts the predicted sign. However, the Ohlson regression results indicate a significant positive association between WD and share price, opposing our prediction of a negative association between the two variables. Judging by the results of the Ohlson regression before outlier removal, WD can be interpreted as not being value relevant to investors.

When running the two specifications of the return regressions before adjusting for outliers, the regressions provide different results of the value relevance of NI and WD. Running the return regression, both WD and NI are significantly different from zero, at a 5% and 10 % significance level, respectively. In addition, the WD coefficient adopts a negative sign implying a significant negative association with share return, whilst NI adopts a positive sign implying a positive association with share return, as predicted. The fact that the coefficients of both earnings components are significantly different from zero and adopt the predicted sign suggests that the two accounting amounts summarise information to investors that is useful to predict firm value. Thus, the return regression before outlier removal provides evidence of both NI and WD being value relevant.

In contrast to the return regression output, the results of the return change regression before outlier removal show that WD is significantly associated with share return, whilst NI is

statistically insignificantly associated with the independent variable. However, both NI and WD adopt the predicted signs. These results indicate that at least WD is value relevant to determine share returns. Conversely, the test does not provide enough evidence to state that NI is value relevant. The results before outlier adjustment of each of the four regression models applied are summarised in table 22 below:

Variable: NI			
	Significance Level	**Coefficient Sign**	**Value Relevance**
Price Regression	Not significant	Negative	Not value relevant
Ohlson Regression	Significant at 1% significance level	Positive	Value relevant
Return Regression	Significant at 10% significance level	Positive	Value relevant
Return Change Regression	Not significant	Positive	Not value relevant

Variable: WD			
	Significance Level	**Coefficient Sign**	**Value Relevance**
Price Regression	Significant at 1% significance level	Positive	Not value relevant
Ohlson Regression	Significant at 1% significance level	Positive	Not value relevant
Return Regression	Significant at 1% significance level	Negative	Value relevant
Return Change Regression	Significant at 1% significance level	Negative	Value relevant

Table 22: Summary of regression model output before outlier adjustment (OLS)

As addressed in the previous sections, the regressions run before outlier removal suffer from econometric problems and violated linear assumptions that may jeopardise the regression outputs. The price regression suffers from severe heteroscedasticity and the Ohlson regression from heteroscedasticity and multicollinearity, in line with the critics against the price regression addressed by Kothari & Zimmerman (1995). The price regressions' independent variables do not seem to have a linear relationship to their respective dependent variables and the residuals do not seem to be perfectly normally distributed. In the return regressions, the earnings coefficients seem to be biased towards zero, a result that is also in alignment with the findings of Kothari & Zimmerman. Furthermore, the return change regression suffers from multicollinearity between NI variables. However, as the regressions seem to suffer from different econometric concerns, including all four regression models to answer hypothesis 1a may fill the role of a remedy against the different weaknesses of each

individual regression model. Thus, we believe that the validity of our conclusions increases as we interpret the results of all four regression models combined.

We find the return regression to be the regression with the least econometric concerns. The return regression is also the only regression with coherent results before and after outliers was removed. When adjusting each individual regression model for outliers, all regression models better fit the linear assumptions. After removing outliers, all four regressions provide aligned results. All four regressions provide positive NI coefficient and negative WD coefficient, and we find both variables to be significantly associated with either stock price or share return. We believe these aligned results are evidence that both NI and WD are value relevant and decision-useful for investors in the oil and gas industry during the period 2012–2015. Thus, in line with Beltratti et al. (2013) we find write-downs to be value relevant accounting information.

Variable: NI			
	Significance Level	**Coefficient Sign**	**Value Relevance**
Price Regression	Significant at 1% significance level	Positive	Value relevant
Ohlson Regression	Significant at 1% significance level	Positive	Value relevant
Return Regression	Significant at 1% significance level	Positive	Value relevant
Return Change Regression	Significant at 1% significance level	Positive	Value relevant

Variable: WD			
	Significance Level	**Coefficient Sign**	**Value Relevance**
Price Regression	Significant at 1% significance level	Negative	Value relevant
Ohlson Regression	Significant at 1% significance level	Negative	Value relevant
Return Regression	Significant at 1% significance level	Negative	Value relevant
Return Change Regression	Significant at 1% significance level	Negative	Value relevant

Table 23: Summary of regression model output after outlier adjustment (Robust standard errors)

9.3.8 Relative Association Test – Value Relevance of Net Income Measures

Hypothesis 1b. Net income including write-downs explains more of the variation in share price and share return than net income pre write-downs, indicating value relevant write-downs.

The results from the incremental association test above suggest that write-downs are value relevant to investors in the period of Q1 2012 – Q4 2015. The relative association test allows us to investigate the relative value relevance of net income pre write-downs over net income including write-downs. The results implicitly provide information on the value relevance of write-downs. The difference between the two net income measures is judged by assessing which net income amount that explains most of the variation in share price or share return, i.e. R^2, in the quarters spanning from 2012 to 2015. For the purpose of the relative association test, we only employ the price and return regression, without disaggregation. Both the return regression and price regression are run separately for each net income measure. The Ohlson regression has been left out of this sub-analysis, as we do not wish to see R^2 of the models to be affected by other accounting amounts, such as book value of equity. As all models in the previous section responded well on removal of outliers, all models in the alternative test of value relevance are run after outlier adjustment.

9.3.8.1 Price Regression Results

The results from the price regression run on both net income including write-downs and net income pre write-downs are provided in table 24 below. The highest of R^2 between the two net income measures in each period is marked in bold figures. The results of the price model show that net income pre write-downs explain more of the variation in share price, relative to net income including write-downs in 14 out of 16 quarters, the two exceptions being Q1 2012 and Q2 2015. This result suggests that net income pre write-downs are of higher value relevance than net income including write-downs**,** implicitly degrading value relevance of write-downs. It is important to note that write-downs may still be value relevant for investors – however, the results suggest that investors may prefer reported net income pre write-downs to net income including write-downs in determining firm value.

NI incl. WD					NI pre WD			
Coef.	t - value	p - value	R^2	Period	Coef.	t-value	p -value	R^2
22.96	8.12***	0.000	**0.3847**	2012-Q1	24.61	8.09***	0.000	0.3834
9.02	4.84***	0.000	0.1835	2012-Q2	15.23	6.1***	0.000	**0.2528**
10.71	4.68***	0.000	0.1777	2012-Q3	15.02	5.1***	0.000	**0.1998**
10.61	4.66***	0.000	0.1831	2012-Q4	23.85	7.6***	0.000	**0.3523**
13.16	4.46***	0.000	0.2142	2013-Q1	20.97	7***	0.000	**0.3289**
25.77	10.19***	0.000	0.4985	2013-Q2	26.61	11.32***	0.000	**0.5465**
21.25	8.11***	0.000	0.3974	2013-Q3	27.00	9.97***	0.000	**0.4853**
13.93	5.22***	0.000	0.2681	2013-Q4	24.47	7.97***	0.000	**0.4114**
34.85	11.35***	0.000	0.5555	2014-Q1	36.50	12.33***	0.000	**0.5922**
29.36	8.56***	0.000	0.4566	2014-Q2	30.95	9.62***	0.000	**0.5035**
8.50	3.98***	0.000	0.2170	2014-Q3	22.53	8.8***	0.000	**0.4507**
3.88	2.33**	0.022	0.1065	2014-Q4	14.20	4.49***	0.000	**0.2186**
0.80	0.45	0.652	0.0685	2015-Q1	13.89	4.05***	0.000	**0.1760**
4.15	2.47**	0.015	**0.1012**	2015-Q2	7	2.09**	0.039	0.0882
1.83	1.81*	0.074	0.0514	2015-Q3	5.74	2.46**	0.015	**0.0749**
0.12	0.10	0.921	0.0365	2015-Q4	5.38	1.56	0.121	**0.0694**

Table 24: Price regression by quarter: Net income including write-downs versus net income pre write-downs. "*" Denotes significance at 1% level. "**" denotes significance at 5% level. "*" denotes significance at 10% level.**

We also run the price regression with net income pre write-downs and net income excluding write-downs on a per-year-basis. The results are provided in table 25 below. The results of running observations on a per-year basis confirm the findings from the results run on quarterly observations, where net income pre write-downs has higher R^2 over net income including write-downs.

NI incl. WD					NI pre WD			
Coef.	t - value	p - value	R^2	Period	Coef.	t-value	p -value	R^2
10.31	9.91***	0.000	0.1912	2012	17.13	12.12***	0.000	**0.2509**
16.53	12.33***	0.000	0.2956	2013	23.81	16.99***	0.000	**0.4146**
10.30	8.97***	0.000	0.2347	2014	20.36	13.09***	0.000	**0.3376**
2.01	2.96***	0.000	0.0614	2015	7.05	4.60***	0.000	**0.0888**

Table 25: Price regression by year: Net income including write-downs versus net income pre write-downs. "*" Denotes significance at 1% level. "**" denotes significance at 5% level. "*" denotes significance at 10% level.**

We also run the price regression on both net income measures for a sub-selection consisting of the firms reporting write-downs in the period from 2012 to 2015. Relative to the tests run

on the whole selection, the results of running tests on the selected sub-selection do not dramatically alter our results. The results from the sub-selection are provided in appendix 7.1.5.

9.3.8.2 Return Regression Results

The return regression is run by the same procedure as described for the price regression above. The results of the return regression are provided in table 26 below. The result of the return regression is not as consistent as for the price regression when judging the relative R^2 of the two net income measures. Thus, the return regression does not provide results that allow us to conclude that one net income measure is more value relevant than the other.

The results in table 26 show that net income including write-downs is only associated with return at a 5% significance level in 4 out of 16 periods, whereas net income pre write-downs is significant in 3 of 16 periods. This finding is not as expected, as we would expect to see association between either of the net income measures and share returns in most of the periods. The association between share price and the net income measures is significant in far more periods than what is observed between net income and return in the price regression.

NI incl. WD					NI pre WD			
Coef.	**t - value**	**p - value**	**R^2**	**Period**	**Coef.**	**t - value**	**p - value**	**R^2**
0.59	1.45	0.149	**0.1368**	2012-Q1	-0.26	-0.54	0.592	0.1234
0.30	1.62	0.108	0.0303	2012-Q2	1.02	2.63***	0.010	**0.0618**
0.23	1.58	0.116	**0.0584**	2012-Q3	0.59	1.46	0.145	0.0558
0.27	2.14**	0.035	**0.1451**	2012-Q4	-0.14	-0.33	0.742	0.1112
0.69	1.70*	0.091	0.1607	2013-Q1	1.09	2**	0.019	**0.1777**
0.97	3.42***	0.001	**0.1394**	2013-Q2	0.91	2.48**	0.014	0.1041
0.44	2.14**	0.034	0.1216	2013-Q3	1.80	4.44***	0.000	**0.2098**
0.20	0.86	0.391	**0.0925**	2013-Q4	0.40	0.83	0.407	0.0921
0.22	0.52	0.606	**0.0610**	2014-Q1	-0.18	-0.35	0.728	0.0600
0.45	1.69*	0.093	0.2184	2014-Q2	1.20	3.03***	0.003	**0.2520**
0.72	2.63***	0.009	**0.0616**	2014-Q3	0.59	1.54	0.125	0.0315
0.15	0.84	0.403	0.0178	2014-Q4	-0.32	-0.86	0.393	**0.0181**
0.20	1.73*	0.087	**0.0689**	2015-Q1	0.62	1.59	0.114	0.0655
0.14	1.29	0.198	0.0351	2015-Q2	0.49	1.77*	0.080	**0.0473**
0.30	2.64***	0.010	**0.1207**	2015-Q3	-0.05	-0.16	0.877	0.0584
0.10	0.86	0.394	**0.1185**	2015-Q4	0.06	0.14	0.888	0.1070

Table 26: Return regression by quarter: Net income including write-downs versus net income pre write-downs. "*" Denotes significance at 1% level. "**" denotes significance at 5% level. "*" denotes significance at 10% level.**

When aggregating the 16 quarterly observations into 4 years, the relative value relevance of the two net income measures is clearer. The results suggest that net income including write-downs is superior relative to net income pre write-downs, in explaining variation in yearly share returns in 3 out of 4 years. This observation contradicts the results of the net income measures run in the price model, where net income pre write-down is the superior net income measure. Also observable by running the return regression on a year-basis is that the coefficient of net income including write-downs is significant in all years. These results may imply that the return regression is more sensitive to the chosen time interval than the price model.

NI incl. WD					NI pre WD			
Coef.	**t - value**	**p - value**	**R^2**	**Year**	**Coef.**	**t - value**	**p - value**	**R^2**
0.21	2.05**	0.041	**0,024**	2012	-0.03	-0.13	0.894	0.0156
0.49	3.66***	0.000	0,080	2013	1.13	5.2***	0.000	**0.1019**
0.61	3.82***	0.000	**0,044**	2014	-0.68	-2.42**	0.016	0.0288
0.16	2.6***	0.010	**0,018**	2015	0.038	0.19	0.847	0.0025

Table 27: Return regression by year: Net income including write-downs versus net income pre write-downs. "*" Denotes significance at 1% level. "**" denotes significance at 5% level. "*" denotes significance at 10% level.**

When investigating the association between return and the two measures of net income in quarterly intervals, the return regression does not provide consequent results of which net income measure that explains the largest variation in share returns. When the time interval for assessing the relationship is expanded, net income including write-downs seems to be the net income measure with the largest R^2. However, for both net income measures R^2 is low in all years, relative to the explanatory power given by the models run on a shorter time interval. This result may suggest that even though at least net income including write-downs is significant, net income including write-downs does not explain a considerable amount of the variation in return on a yearly basis. The explanation for the low R^2 in the return model may be that factors other than net income explain the variation in share return within a year.

We also run the return regression with both net income measures on the sub selection of write-down firms. The results from this test are similar to the test run on the whole selection

(see figure 30 in section 9.4 or appendix 7.2.5). There is no consistency in which net income measure that explains more of the variation of return over the other, independent of time horizon. Similarly, the association between return and the two net income measures is not found to be insignificant in most quarters and years.

9.3.8.3 Robustness Test – Return Change Regression with Negative Net Income

The overall inconsequent results of the return regression may be attributable to the measurement error as previously referred to by Kothari & Zimmerman (1995). In addition, we question if the number of reported negative earnings in our data selection affects the results of the return regression. As outlined in section 3.4.1, previous research has found negative earnings to be less value relevant relative to positive earnings. We therefore run the return change regression with a negative net income dummy to examine whether this regression provides more consistency in the relative difference of R^2 between net income measures. The results from the return change regression are presented in table 28 below. The positive difference in R^2 of running the return change regression with negative net income dummy rather than the return regression is marked in bold figures.

Period	P- value NI incl. WD	P- value Change NI incl. WD	P- value NI incl. WD*D	P- value Change NI incl. WD*D	R^2	Increase/Decrease in R^2 from Return Regression
2012-Q1	0.327	0.147	0.955	**0.043****	0.2115	**0.07**
2012-Q2	0.472	0.417	0.541	0.315	0.0519	**0.02**
2012-Q3	**0.073***	**0.066***	0.092	**0.038****	0.0803	**0.02**
2012-Q4	0.650	**0.047****	0.890	0.848	**0.1789**	**0.03**
2013-Q1	0.606	**0.007*****	0.368	0.123	**0.2627**	**0.10**
2013-Q2	0.948	0.850	0.670	0.520	0.1341	-0.01
2013-Q3	0.504	**0.042****	0.711	0.207	0.2111	**0.09**
2013-Q4	**0.012****	**0.000*****	0.038	**0.003*****	0.2009	**0.11**
2014-Q1	0.134	0.443	0.155	0.923	0.0949	**0.03**
2014-Q2	0.756	0.345	0.940	0.434	0.2277	**0.01**
2014-Q3	0.931	0.452	0.191	0.621	**0.0995**	**0.04**
2014-Q4	**0.016****	0.714	**0.008*****	0.337	**0.1238**	**0.11**
2015-Q1	**0.022****	0.334	**0.003*****	0.674	0.2265	**0.16**
2015-Q2	**0.016****	0.483	**0.003*****	0.293	0.1855	**0.15**
2015-Q3	**0.013****	0.773	**0.006*****	0.660	**0.1595**	**0.04**
2015-Q4	0.349	0.460	0.328	0.468	0.1166	-0.00

Table 28: Return change regression by quarter: Net income including write-downs.

"*" Denotes significance at 1% level. "**" denotes significance at 5% level. "*" denotes significance at 10% level.**

Period	P- value NIpreWD	P- value Change NIpreWD	P- value NIpreWD*D	P- value Change NIpreWD*D	R^2	Increase/Decrease in R^2 from return regression
2012-Q1	0.339	**0.051***	**0.069***	**0.069***	**0.2204**	**0.0970**
2012-Q2	0.924	0.489	0.158	0.670	**0.0845**	**0.0227**
2012-Q3	**0.081***	0.141	0.578	0.724	**0.0974**	**0.0416**
2012-Q4	0.504	0.278	0.209	0.857	0.1324	**0.0212**
2013-Q1	0.333	**0.044****	0.126	**0.078***	0.2337	**0.0560**
2013-Q2	0.803	0.979	0.398	0.415	**0.1631**	**0.0590**
2013-Q3	0.250	**0.014****	0.356	0.235	**0.2727**	**0.0629**
2013-Q4	**0.004*****	**0.000*****	0.151	**0.012****	**0.2278**	**0.1357**
2014-Q1	0.178	0.280	0.169	**0.027****	**0.1739**	**0.1139**
2014-Q2	0.527	0.394	0.759	0.834	**0.2537**	**0.0017**
2014-Q3	0.778	**0.072***	0.975	0.491	0.0982	**0.0667**
2014-Q4	0.205	0.665	0.874	0.718	0.0787	**0.0606**
2015-Q1	**0.019****	0.115	**0.000*****	0.258	**0.2441**	**0.1786**
2015-Q2	0.126	0.231	**0.017****	**0.060***	**0.1872**	**0.1399**
2015-Q3	**0.052***	0.924	0.424	0.232	0.1084	**0.0500**
2015-Q4	0.308	0.172	0.371	0.113	**0.1607**	**0.0537**

Table 29: Return change regression by quarter: Net income pre write-downs.
"*" Denotes significance at 1% level. "**" denotes significance at 5% level. "*" denotes significance at 10% level.**

The return change regression run with negative net income dummy confirms the findings of Beisland (2008) of increasing value relevance of negative earnings when accounting for negative earnings. For both net income measures, R^2 increases notably in most quarters. The increase holds for both net income measures, the only exception being Q2 2013 and Q4 2015 when the regression is run on net income including write-downs. Parts of the increase in R^2 in the return change regression relative to the return regression may also be attributed to the change variable of net income. However, running the return change regression does not provide more consistent answers in which net income measure that is superior in explaining the variation in share returns. The same observation holds when running the return change regression on years (see appendix 7.3.2 and 7.3.4 for yearly regression outputs).

What can be observed when running the return change regression with dummy on net income including write-downs is that net income including write-downs (NIinclWD) and the interaction term of net income and the negative net income dummy (NIinclWD_Dummy) are significantly associated with return from Q4 2014 to Q3 2015. The significant relationship between return and NIinclWD in these quarters may be attributed to the increase in both

frequency and total dollar amount of reported negative net income from Q4 2014, as illustrated in section 9.2. We would expect to find the same significant relationship in Q4 2015, and suspect that the small number of observations in Q4 2015 causes the insignificant relationship between net income including write-downs and return (see appendix 7.3.1 figure 236). The same association cannot be expected for net income pre write-downs, as a large fraction of the reported negative earnings are caused by write-downs. However, the return change regression run on net income including write-downs is affected by multicollinearity. The highest correlation between main variables is found between NIinclWD and NIinclWD_Dummy, where the correlation coefficient 0.9016. This correlation is far above over our set limit of 0.6 for correlation between main variables. We must therefore moderate inferences drawn on the coefficients and p-statistics of these variables.

9.3.9 Summary of Results of Value Relevance of Write-Downs Q1 2012 – Q4 2015

From the incremental association test of value relevance we found write-downs to be value relevant. We believe that the results are robust, as each of the four regression models provide the same evidence. If judging by the price regression in the relative association test of value relevance of write-downs, net income pre write-downs is of higher value relevance than net income including write-downs**,** implicitly degrading value relevance of write-downs. This is evident since net income pre write-downs on average explain more of the variation in share price relative to net income pre write-downs. However, the relative association test results must not be misinterpreted into write-downs not to being value relevant at all. Thus, the incremental and the relative association test results are not in complete contradiction.

The results from the return regression in our relative association test do not fully support the findings of the price regression. The return regression does not provide consequent results of which net income measure that explains the largest variation in share return. The results of the return change regression provide similar results to that of the return regression. Evidence for which of the two net income measures that is superior in explaining the variation in share return cannot be established. However, taking the results of the price regression into consideration, we reject hypothesis 1b as we find net income pre write-downs to be superior over net income including write-downs in explaining variation in share price.

The results from the return change regression accounting for negative earnings may suggest that accounting for the sign of negative net earnings may have an impact on the results of other models applied to study value relevance. However, explanatory power is the statistical measure of main interest in the relative association test. Explanatory power is also an important measure in the other tests, yet not the measure of main interest.

On the basis of the test results summarised above, we confirm hypothesis 1a and establish write-downs reported by oil and gas industry firms in the period from 2012 to 2015 to be value relevant.

9.4 Value Relevance When the Economic Environment Changes Within an Industry

Hypothesis 2. Accounting information explains less of the variation in share price and share return in periods with a more uncertain and volatile economic environment as reflected in the oil price level.

The description of the trends in frequency and total dollar amount of write-downs in figures in section 9.2 suggests that firm financials experience a negative downturn from Q4 2014 and onwards. An alternative interpretation of the relative association test addressed in sections 9.3.8 is to study the changes of value relevance of the accounting information over time. Thus, by interpreting the development of the net income measures we can also test hypothesis 2 – of whether value relevance of accounting information changes in periods with greater economic uncertainty.

Judging from R^2 of the price regression, it is interesting to observe that value relevance of both net income measures is lowest in the periods from Q4 2014 and onwards, the same period as firm financials experience a negative downturn. The same observation is made when the price regression is run on firm-quarter observations with reported write-downs (section 9.3.8.1 figure 24). The return regression does not provide similar interpretations of R^2 when the regression is run on the whole selection of firm-quarter observations, as R^2 fluctuate across quarters rather than dropping consistently. However, when the return regression is run on firm-quarter observations with reported write-downs, the outputs show that value relevance

is low in the quarters from Q4 2014 to Q4 2015 for both net income measures, with the exception of Q3 2015 shown in table 30 below.

Return Model

NI incl. WD					NI pre WD			
Coef.	**t - value**	**p - value**	**R^2**	**Period**	**Coef.**	**t - value**	**p - value**	**R^2**
1,66	2,91***	0,007	**0,4168**	**2012-Q1**	-1,22	-0,95	0,349	0,2463
0,20	0,95	0,350	0,0363	**2012-Q2**	1,12	1,63	0,112	**0,0838**
0,21	1,49	0,146	**0,1631**	**2012-Q3**	0,36	0,54	0,591	0,1149
0,28	2,23**	0,030	**0,1839**	**2012-Q4**	0,06	0,11	0,910	0,1086
-0,28	-0,45	0,657	**0,3525**	**2013-Q1**	-0,45	-0,40	0,696	0,3510
0,42	1,10	0,285	0,2911	**2013-Q2**	-1,35	-1,89*	0,071	**0,3572**
0,16	0,88	0,387	0,2801	**2013-Q3**	2,22	3,94***	0,000	**0,4901**
0,16	0,74	0,463	0,1225	**2013-Q4**	1,58	2,63**	0,012	**0,2369**
0,73	1,29	0,208	**0,1853**	**2014-Q1**	-0,13	-0,12	0,908	0,1336
0,07	0,19	0,850	0,3192	**2014-Q2**	0,75	1,05	0,299	**0,3395**
1,02	2,75***	0,008	**0,2129**	**2014-Q3**	1,67	2,21**	0,032	0,1718
0,16	0,79	0,433	**0,0600**	**2014-Q4**	-0,16	-0,27	0,788	0,0504
0,18	1,33	0,188	0,0690	**2015-Q1**	0,97	1,73*	0,090	**0,0880**
0,05	0,49	0,629	0,0290	**2015-Q2**	0,42	1,18	0,246	**0,0519**
0,30	2,73***	0,008	**0,2162**	**2015-Q3**	-0,06	-0,17	0,867	0,1143
0,05	0,40	0,693	0,0560	**2015-Q4**	0,21	0,43	0,666	**0,0565**

NI incl. WD					NI pre WD			
Coef.	**t - value**	**p - value**	**R^2**	**Period**	**Coef.**	**t - value**	**p - value**	**R^2**
0,25	2,27**	0,025	**0,0661**	**2012**	-0,11	-0,25	0,802	0,0364
0,16	1,09	0,279	0,1138	**2013**	0,77	2,04**	0,043	**0,1329**
0,64	3,26***	0,001	**0,0984**	**2014**	-1,12	-2,31**	0,022	0,0727
0,09	1,33	0,186	**0,0137**	**2015**	0,00	-0,01	0,993	0,0062

Table 37: Return regression by quarter and year – firm-quarters with reported write-downs: Net income including write-downs vs. net income pre write-downs. "*" Denotes significance at 1% level. "**" denotes significance at 5% level. "*" denotes significance at 10% level.**

When the price and return regression are run on yearly observations, rather than quarterly, the results of both regression models show that both net income measures explain less of the variation in share price and return in 2015, relative to the preceding years (see table 25 and 27 above).

The results of the price and return regressions may indicate that value relevance of accounting information to investors is reduced during periods with greater uncertainty. However, in spite of the evidence we find of lower value relevance of both net income measures, our test design does not allow us to draw causal inference of the decline in value relevance. Thus, we cannot conclude that it is the decline in oil price causing what can be perceived as a drop in value relevance. We can only draw parallels in which to suggest that there exists a relationship between the developments of the trends of value relevance and the oil price.

The return change regression with a negative net income dummy does not provide evidence of decreased value relevance of accounting information in periods with greater uncertainty. The observations drawn further confirm the findings of Hayn (1995) and Beisland (2008), suggesting negative earnings to be less value relevant than positive earnings. Thus, the decline in value relevance may rather be explained from the increased frequency of reported negative net income in our data selection (see figure 5, section 9.1).

To further investigate if accounting information is value relevant, even in periods with greater uncertainty, we run all four regressions applied in the incremental association test on a sub-period from Q4 2014 to Q4 2015 (see descriptive statistics and test output in appendix 8). In contrast with the tests run on the whole period from Q1 2012 to Q4 2015 showing consistent results after removal of outliers, the test results from regressions run on the sub-period are conflicting. According to the price regression, NI is value relevant, whilst WD is not. The Ohlson regression provides opposing results, suggesting WD to be value relevant, while NI is not significantly associated with share price. The results of the two return regressions are coherent, where both NI and WD are significantly associated with return[5]. The results provided by the four regressions do suggest that NI and WD are value relevant in 3 of 4 tests. The inconclusive result of whether value relevance of accounting information during periods of greater uncertainty may point to that value relevance of accounting information lessens. However, we do not believe that these results suggest that NI and WD are no longer value relevant for investors.

[5] When running the regression exclusively on firm-quarter observations with write-downs, the results are equally inconsistent (appendix 8.5-8.8)

Interpreting the results provided by the price and return regression, accounting information may be of less value relevance to investors in periods with greater financial uncertainty. The four regression models run on the sub-period from Q4 2014 to Q4 2015 may also suggest lower value relevance of accounting information. We believe that the results of the return change regression accounting for negative net income provide evidence that negative net income explains the lower value relevance. Furthermore, we believe that the oil price decline affects company finances as we observe a higher frequency and total dollar amount of losses from Q4 2014. As pointed out by Hayn (1995) and Beisland (2008) reported losses are of less value relevance to investors, which we believe the results from the return change regression confirms. We accept hypothesis 2, since we believe the oil price collapse are increasing the frequency of reported losses, which in turn are accounting information perceived by investors to be less value relevant. Thus, the uncertainty caused by the oil price collapse affects the value relevance of accounting information negatively.

9.5 Timeliness of Write-Downs Q2 2012 – Q3 2015

When testing our hypothesis 1a we established evidence of write-downs, undertaken by firms in the oil and gas industry in the period 2012–2015, to be value relevant for investors when determining firm value. As is evident from the return regression in section 9.3.4, the significant positive relationship between write-downs and return indicate that write-downs are timely reported. However, to further investigate the timeliness of the reported write-downs we also assess the association with lead and lagged returns.

Hypothesis 3. Reported write-downs by firms in the oil and gas industry in the period from Q2 2012 to Q3 2015 are associated with contemporaneous return, lead return or both.

To test hypothesis 3 we examine whether reported write-downs are association with contemporaneous return, lead return, or both. As previously addressed, a significant association with lagged returns would imply untimely write-downs. Furthermore, significant association between write-downs and contemporaneous returns suggests that write-downs are reported in a timely manner and serve a confirmatory role of the market anticipations. Lastly, a significant association with lead returns indicates conservative accounting or simply

that the market has not yet anticipated the decline in asset values. Thus, if write-downs are associated with lead return write-downs can be argued to have predictive value. The related descriptive statistics and regression outputs for this test are amended in appendix 9.

When running the lead and lagged return regression we drop the observations in Q1 2012 and Q4 2015 in order to compare the results for the two regression tests. To be able to compare the results of lead and lagged return regressions to the return regression with contemporaneous returns, the contemporaneous return regression is applied on the same time period as for lead and lagged return regressions, i.e. 2012 Q2 – 2015 Q3. The three regressions are run on firm-quarters with reported write-downs only. The sample has been adjusted for outliers on the whole selection before zero write-down firm-quarters were removed. Table 31 below shows the results from the three regressions: lagged, contemporaneous and lead returns run both with OLS and robust regression.

	OLS regression			**Robust regression**		
Return$_m$	*Lagged*	*Contemp.*	*Lead*	*Lagged*	*Contemp.*	*Lead*
	m =t-1	*m= t*	*m = t+1*	*m =t-1*	*m= t*	*m = t+1*
n	627	640	626	627	640	626
Adjusted R^2	0.406	0.508	0.463			
R^2				0.425	0.522	0.480
NI_m/P_{m-1}	-0.332		0.067	-0.332		0.067
t-Stat	-6.42***		2.11**	-1.28		1.34
$NIpreWD_t/P_{m-1}$	1.121	0.383	0.341	1.121	0.383	0.341
t-Stat	7.1***	3.2***	3.15***	1.74*	2.39**	2.5**
WD_t/P_{m-1}	-0.195	-0.226	-0.346	-0.195	-0.226	-0.346
t-Stat	-2.01**	-3.15***	-5.3***	-0.88	-2.6***	-5.2***

Table 38: Regression output from lead, lagged and contemporaneous return regression– Outlier adjusted
All variables are measured on a per share basis and deflated by beginning of period price (P_{m-1}).
"*" denotes significance at 1% level. "**" denote significance at 5% level "*" Denote significance at 10% level.**

In table 31 above we report lagged and lead returns using the *m* subscript, where *m* is equal to t-1 in the lagged regression and t+1 in the lead regression. The beginning of period share price, expressed as Pm-1, deflates all variables in the regressions. When running the three

regression models as OLS regressions (shown on the left side in table 31) WD is significantly associated with both lead and contemporaneous returns at a 1% significance level, while the association with lagged returns is statistically significant at a 5% significance level. These results imply write-downs to be partially untimely, partially unanticipated by the market, and partially timely, on average.

When running regression diagnostics we find that all regressions suffer from heteroscedastic residuals and we therefore run the regressions with robust standard errors to account for this issue (results shown on the right side of table 31). When running the robust regressions, the write-downs no longer seem to be associated with lagged returns. However, the WD coefficient is still strongly associated with both lead and contemporaneous returns when running the regressions with robust standard errors, indicating the write-downs to be timely on average. In addition to being timely, the evidence also suggests that write-downs are reported before the market anticipates the asset value decline. Thus, we accept hypothesis 3 and define write-downs to be reported in a timely manner during the period of Q2 2012 to Q3 2015.

10. Discussion and Conclusion

The change in oil companies' business environment due to the declining oil price has provided a feasible setting for us to study value relevance and timeliness of write-downs, as periods of economic downturn have negative consequences for company finances. By including periods before the oil price decline we also enabled to study the development in value relevance when the economic environment changes. In detail, this thesis investigates the decision-usefulness of write-downs undertaken by firms in the oil and gas industry from Q1 2012 to Q2 2015. Decision-useful information is interpreted as accounting information that is value relevant and reported in a timely manner. Thus, the objective of this thesis is to examine whether reported write-downs contribute to ensuring accounting information of high quality. The information in impairment contributes to accounting information of high quality by giving guidance about firm value and its future prospects to investors and other users. Information about firm value and future prospects increases the decision-usefulness of financial information, as recognised impairments can be interpreted as a signal of expected poor future performance. Thus, conducting impairment tests and recognising impairment is an essential part of producing high quality financial reports (KPMG, 2010).

Our study of value relevance is a way to operationalise the characteristics of relevance and reliability as defined by FASB and IASB in their joint Conceptual Framework. Relevance is defined as to what extent accounting information has predictive or confirmatory value, or both (IASB, 2010). We therefore believe that write-downs should have at least confirmatory or predictive value in order to be relevant for investors. We find the confirmatory role of write-downs to be embedded in the impairment standards, as the objective of the impairment standards is to ensure that book value does not exceed the market value of the asset. Thus, the standards ensure capitalised asset values to reflect market predictions and expectations of its value. The market value of the asset can be determined either to the amount the firm can expect to receive from an open market sale, or to the estimated future cash inflow from the asset according to the impairment standards in IFRS and US GAAP. Private information held by management is necessary for the purpose of value estimation, and thus if the information provided in write-down recognition reflects this private information, the information content

of the recorded write-downs may characterise as new to market participants. If the information content of reported write-downs is perceived as news to market participants, write-downs also have predictive value.

Even though IFRS and US GAAP provide oil and gas companies with extensive standards of how and when impairment tests should be performed, and to what extent impairments should be recognised, the estimation requires managerial judgements and subjectivity. The subjectivity inherent in impairment estimations can make different experts arrive at contrasting estimations of asset values, and thus, enhance the possibility of managerial bias and earnings management. In turn, the increased possibility of managerial bias and earnings management threatens the reliability of reported financial information.

In this thesis, we measure relevance and reliability of write-downs by performing a value relevance study that assesses the association between measures of firm value and write-downs. We conduct both an incremental association test and a relative association test of different net income measures to determine whether write-downs are value relevant to investors. The incremental association test is performed by running four regression models that are well-established within the value relevance literature. The relative association test is performed on three of these regression models: one price earnings regression and two specifications of the return earnings regression. Timely reported accounting information will further enhance value relevance, and we therefore investigate the association between write-downs and lead or lagged returns to test the timeliness of reported write-downs in the oil and gas industry. An association with lagged return implies untimely reported write-downs, while an association with lead return suggests that write-downs are reported before the market anticipates the decline in asset value.

The incremental association test suggests that write-downs reported by firms in the oil and gas industry in the quarters from 2012 to 2015 are value relevant, as all four regression models applied present this result. However, the relative association test results suggest that net income pre write-downs is perceived as more value relevant to investors, rather than net income including write-downs. Without rejecting our findings of write-downs being value relevant, the latter results implicitly degrade the value relevance of write-downs. As the

results of the different regression models in the relative association test of net income measures are not consistent, we believe the validity of the incremental association test to be superior over the relative association test. Thus, we maintain the results of write-downs undertaken by firms in the oil and gas industry in the chosen period to be value relevant. Our findings of write-downs being value relevant is further strengthened by the finding of write-downs being timely reported, evidential from the association between write-downs and both contemporaneous and lead return, rather than lagged share return.

Assuming semi-efficient capital markets, the firm will always have private information not available to investors, thus information asymmetry between firms and investors will always be present. One purpose of financial reporting is to reduce this inherent information gap between the firm and investors. However, given the information advantage of the firm, the firm has incentives to provide financial reporting that secures its own interests, rather than the interests of investors. Since our findings suggest value relevant and timely reported write-downs we believe there are sufficient incentives present for firms in the oil and gas industry to provide financial reporting that contributes to reducing the information gap.

One such incentive can arguably be the standards concerning impairments of assets. In addition to the general standards for impairments of assets, firms operating with extractive activities are subject to more extensive regulation. The reporting of value relevant write-downs may point to that accounting standards for impairment of assets for oil and gas firms are sufficiently strict in preventing management from distorting information to investors. Thus, the standards may fulfil the purpose of forcing firms to perform write-downs when their asset book value exceeds asset market value. Another influencing factor in securing value relevant write-downs for firms in the oil and gas industry is that the level of the oil price largely governs the size and timing of write-downs. Information about the level and changes in oil price is information that is available to both firm management and investors. The availability of information to both the producer and the user of financial information make it difficult to deliberately avoid reporting bad news. Furthermore, firms operating in the oil and gas industry are of high interest and importance, not only to investors, but also to national economies. Since the oil and gas industry is of great economic importance to the countries they operate in, we believe the industry to be highly monitored, increasing the risk of

identification of unfaithful reporting. The firms may have incentives to use financial reporting for contracting, political or corporate governance reasons that can decrease their incentive to report negative prospects in terms of write-downs. However, we believe that the risk of identification and the consequences of unfaithful reporting provided to the stakeholders of the oil and gas industry positively influence the quality of accounting information.

Vyas (2011) argues that timelier write-downs can assist the market participants to adjust for potential losses quicker than if write-downs are untimely, resting on the assumption of semi-efficient capital markets. The firm's information advantage over investors may diminish the firm's incentives to report write-downs if the same information is not already anticipated by the market. We believe our findings of value relevant and timely reported write-downs are evidence that write-downs are reported at least to the extent already anticipated by the market, and thus, that write-downs are of confirmatory value to investors. Our findings that write-downs are associated with lead returns in addition to contemporaneous returns further imply write-downs to have predictive value. The predictive value of write-downs further indicates that the write-downs may be reported partly based on important firm-internal information not available to investors. Thus, it can be argued that write-downs act as a messenger of valuable information of expected poor future performance that the investors themselves are not able to anticipate. The association with both contemporaneous and lead return indicates that the market is able to predict write-downs, but unable to anticipate the full extent of reported write-downs. This can be due to firms in the oil and gas industry being obliged by FASB and IASB to adhere to industry-specific standards covering impairment losses. Due to the complexity inherent in the process of conducting impairment tests and estimating impairments, the complexity of the impairment estimation prevents investors from gaining this information by own means. Thus, the complexity of the procedures proposed by the standards may increase the information gap between the firm and investors. However, an alternative interpretation of the association between lead returns and write-downs can be that the investors did not expect the magnitude of the decline in oil price, or the duration of the decline. In that sense, the investors' anticipations of asset value decline would not be aligned with the reported asset value declines, nor would the asset value decline be incorporated into share prices. Regardless of the reasons for the predictive value of write-

downs, the predictive value increases the value relevance of the reported accounting amounts as it provides information that could influence investors' decisions.

In order for accounting information to be faithfully represented, firms have to apply the appropriate process, properly describe the estimate, and explain the underlying uncertainties that will have an impact on the estimate (IASB, 2010). Even though it is the firm's intention to report reliable information, the uncertainties of the underlying factors affecting the estimates may cause value relevance of accounting information to deteriorate. The volatile and uncertain environment in the oil and gas industry caused by the rapidly changing oil price makes the estimations required to determine present value of assets difficult. We believe the uncertainty surrounding the severity and duration of the oil price decline further complicates the process of estimating asset value. The uncertainties surrounding present value estimation in the oil and gas industry is aligned with our results of finding value relevance of accounting information to be lower in periods where we expect greater uncertainty relative to periods with a less volatile economic environment. Thus, the results may suggest that in periods of greater uncertainty, investors may tend to other sources of information, rather than accounting information, in the determination of firm value.

Related to the discussion of value relevance of accounting information in periods with greater uncertainty is the value relevance of reported losses to investors. As noted, Hayn (1995) finds that investors do not perceive negative earnings to persist nor do investors believe that negative earnings are beneficial in the assessment of firms' future prospects. What is apparent from our test results in section 9.3.8.3 is that when accounting for negative earnings, there is no remarkable difference in value relevance of accounting information in the periods before and during economic turbulence. The results imply that the explanation for the low value relevance of accounting information in periods with greater uncertainty rests on the number of reported losses in the period. Our findings confirm the findings of Hayn (1995), where investors do not find losses to be either persistent, or informative of firms' future prospects.

This study does not explicitly measure earnings management in write-downs reported by firms in the oil and gas industry. However, our study shows that the write-downs reported are, on average, value relevant for investors. In addition, they are timely reported and provide

new value relevant information not anticipated by the market. If earnings management would have been present we believe we would have established contrary results.

10.1 Strength of Chosen Research Design

In section 7.2.1 we presented the various econometric concerns of price and return regressions that threaten the efficient and unbiased estimators for statistical inference. The strength of our chosen research design lies in the choice of employing four regression models: two price regression models and two return regression models – each regression model with its individual econometric concerns. Our belief is that the statistical inferences drawn in this study are more robust where the results of the regression models are consistent. Furthermore, when studying value relevance of write-downs, we deploy several categories within value relevance research: an incremental association test as well as a relative association test. By applying more than one research category, our research design allows us to examine value relevance of write-downs from several angles. While having studied the characteristics of the various regression models, and gained knowledge of the various possibilities offered by different research categories within value relevance research, we allow ourselves to question the validity of the conclusions drawn from studies where only one model and one research category is employed. In our experience, it is not obvious that the researcher arrives at an unambiguous conclusion when taking different regression models or research categories into consideration.

10.2 Limitations of Chosen Research Design

Before concluding the value relevance of write-downs, we address two specific limitations of the tests applied to study the value relevance of write-downs. First of all, we need to highlight that net income pre write-downs are calculated by adding back write-downs before tax to net income after tax. This means that both write-downs and net income pre write-downs are overstated, as the tax benefit of recognising write-downs is not subtracted from net income after tax. The tax dummies constructed will control for tax differences across countries; however, the tax dummies do not resolve this limitation.

The implication of subtracting the tax benefit from net income after tax is that inferences drawn on NI pre WD and WD variables must be interpreted with care. For the tests run in sections 9.3.1 – 9.3.7, we believe that the tax calculation does not dramatically alter our

results. We believe that even though the tax benefit is not subtracted from the write-down amounts we deploy in our study, the value of write-down still represents the actual decrease in asset value. However, the precision of the results would arguably improve if write-downs after tax were added back by employing an average tax rate. For the tests in 9.3.1 – 9.3.7with outlier adjustment, we do trust the significance level and the adopted sign of NI pre WD. However, interpreting the size of the coefficient would give less meaning, and thus, coefficient size is not interpreted in this thesis. The limitation due to the tax calculation may have larger implications for the relative association test in section 9.3.8. Since net income pre write-downs are overstated, the results of relative comparisons of R^2 between net income measures may not be valid. Thus, we cannot with complete confidence conclude that net income pre write-downs is of higher relevance relative to net income including write-downs, as is evident in the price regression. Furthermore, the relative association test is limited by the small number of observations when the test is run on periods of quarters.

The second limitation of our applied methods is that we run pooled OLS estimation, which ignores the panel structure of our data. Alternatively, we could have accounted for the panel structure and employed fixed effects estimation, which would allow us to control for unobserved, time-invariant effects. In the fixed effects model, unobserved effects that may correlate with any of the explanatory variables are allowed to vary with the explanatory variables, thus reducing the chances of biased and inconsistent estimates (Wooldridge, 2012). As noted in section 9.1, we have chosen to control for the time-invariant effects in which we can observe. However, the fixed effects model would arguably better control for these effects, and the choice of not running tests with fixed effects regression therefore proposes a weakness of our analysis.

Lastly, while not necessarily characterising as a limitation of our chosen research design, our chosen period from 2012 to 2015 in which to study value relevance of write-downs in the oil and gas industry may seem random. The period cannot in itself be characterised as a period where we find an industry in crisis, nor as a period where the economic environment in which the industry operates is stable and not influenced by larger exogenous events. In our opinion, the chosen period may reflect an industry in a relatively stable economic environment up to mid-2014, when the industry may suffer from greater uncertainty and oil price decline. It

follows that our study could have been more specific in terms of examining value relevance of write-downs for firms in the oil and gas industry in crisis if we had chosen a time frame that specifically focused on periods after the oil price decline gained momentum.

10.3 Suggestions for Further Research

As argued, the severity and length of the oil price decline have provided a rich setting in which to study the value relevance of write-downs for the firms in the oil and gas industry. As the oil price level remains low, relative to past levels, the period in which to investigate the value relevance of write-downs continues to expand. Thus, the oil price decline may open doors for future relevance research particularly focusing on the oil and gas industry.

What was initially meant as being the purpose of this thesis was to study the effect that the oil price decline has had on value relevance of accounting information reported by firms in the oil and gas industry, inspired by the work of Vyas and Beltratti. However, as the oil price decline is arguably still affecting company finances of oil and gas companies, there is no definite start point or end point of the economic turbulence the oil and gas industry is currently experiencing. Thus, future stabilisation of the economic environment proposes an opportunity to study the effects of the oil price decline on value relevance of write-downs.

As outlined in section 5, the accounting standards for impairment of assets vary depending on whether firms adhere to IFRS or US GAAP. Furthermore, within the regulations of US GAAP, firms may apply either the full-cost method or the successful-efforts method. The different standards provide firms with different procedures in which to perform impairment tests and recognise write-downs. The differences across impairment standards distort the convergence that FASB and IASB previously have been trying to achieve. Furthermore, the differences propose challenges for users of the financial information in terms of comparability. Thus, studying the relative value relevance of write-downs undertaken according to the various standards may provide information useful to standard setters of which of the procedures that are superior in enhancing quality of financial reporting. Furthermore, the superior standard for impairments may serve as a benchmark that FASB and IASB can use in order to create better alignment of FASB's and IASB's standards.

10.4 Conclusion

This thesis aims at answering questions concerning value relevance of quarterly write-downs reported in the oil and gas industry during 2012–2015. It further addresses our sub-research questions regarding the effects on accounting quality when the industry experiences negative changes in the economic environment, and whether the write-downs are reported in a timely manner. In this thesis, high accounting quality has been defined as information that is decision-useful to investors. According to FASB and IASB, accounting information must fulfil the requirements of being both relevant and reliable in order to be decision-useful. We have operationalised the key qualitative characteristics of relevance and reliability through our research of value relevance.

Firstly, to answer our first sub-research question we find value relevance of accounting information to be lower in the periods when the industry experiences negative changes in the economic environment relative to the periods before. We further find the lower value relevance to be linked to the low value relevance of negative earning. Secondly, in answering our second sub-research question we find write-downs to be timely reported which is evidential from the significant association with both contemporaneous returns and lead returns. Lastly, to answer our main research question we have found that write-downs reported by oil and gas companies are value relevant, as we found write-downs to be negatively associated with both stock price and share return. We also find that write-downs are value relevant as they have both predictive and confirmatory value, which makes write-downs fulfil the fundamental characteristic of being relevant. While reliability has not been explicitly measured, the finding of the reported write-downs to be both value relevant and timely also confirms that the write-downs are free from measurement error and managerial bias, and thus reliably recognised.

This study will be of specific interest to standard setters and users of financial reporting, as high quality of accounting information is arguably in their shared interest. This thesis has contributed with evidence of write-downs being a trustworthy reported accounting amount, containing information that users of oil and gas financial reporting can base their decisions on.

This study has provided evidence of write-downs being both value relevant and timely. We believe that our results are of specific interest to standard setters as the evidence support the purpose of financial reporting of being information in which users can base their decisions on, as proposed by FASB and IASB. Although our results show that the standards contribute to enhancing decision-usefulness of accounting information, the same results may imply that the complexity inherent in the impairment standards does not reduce the information gap existing between firm management and investors.

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Accounting Standards

Financial Accounting Standards Board (FASB): ASC 350 – Intangibles - Goodwill and Other
Financial Accounting Standards Board (FASB): ASC 360 – Property, Plant, and Equipment
Financial Accounting Standards Board (FASB): ASC 810 – Consolidation
Financial Accounting Standards Board (FASB): ASC 932 – Extractive Activities – Oil and Gas

International Accounting Standards Boards (IASB): IAS 36 – Impairments of Assets
International Accounting Standards Boards (IASB): IFRS 6 – Exploration for and Evaluation of Mineral Resources