# Earnings management in response to the oil price shock of 2014: Evidence from the Oslo Stock Exchange

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**IAEE Intenational Conference, May/June 2019**

**Abstract**

We study the relationship between the oil price shock of 2014 and earnings management in Oslo Stock Exchange listed oil companies. The results show a significant increase in earnings management following the oil price drop. Moreover, we find that companies adjust their earnings and find abnormal income-decreasing accruals during the third and fourth quarters of 2014. We attribute this finding to the big bath strategy. This contribution 1) promotes the understanding of the effect of macroeconomic shocks on earnings management behaviour and 2) supplements the earnings management literature on oil-related companies.

## 1 Introduction

The oil price drop of 2014 sent shock waves throughout the oil industry. From June 2014 to January 2015, the price of Brent crude oil per barrel dropped from approximately $115 to $46. This downfall is mainly attributed to USA's increased shale oil production and OPEC's decision to maintain their level of production based on the rationale that low oil prices offer more long-term benefits than does giving up market shares (McCain, 2015). In turbulent times, the reliability of financial statements is particularly essential to the stakeholders. However, information asymmetry between preparers and users of financial information makes opportunistic altering possible, an action that reduces the quality of financial reporting (Arthur, Tang and Lin, 2015). Basu *et al*. (2013) state that financial reports are the most important source of information to investors, analysts and debtors. Knowledge of an industry's inclination to engage in earnings management activities in times of crisis[1] is therefore of critical value to users of financial information.

The earnings management literature has traditionally focused on the determinants and consequences of financial information manipulation, while holding the macroeconomic environment constant or assuming that it does not to have an impact. In the post financial crisis era, this assumption has been challenged. Empirical research indicates that dramatic changes in the economic climate impact the propensity of companies to manage earnings, but it provides no consensus on how or in what direction that management occurs. The purpose of this paper is to supplement the earnings management literature by examining accounting choices in Oslo Stock Exchange listed oil companies as they respond to the oil price shock of 2014.

Intuitively, there are reasons to support assumptions of both more and less earnings management in an industry in crisis. Higher scrutiny by regulators, financial analysts and other stakeholders provides incentives to take fewer risks and produce more accurate financial statements. Conversely, volatile environments could also encourage more earnings management. A decrease in actual performance may be met by income-increasing accounting choices to maintain the reported performance (Filip and Raffournier, 2014). However, if substantial losses are unavoidable, a big bath strategy could be encouraged, whereby companies make poor results worse

[1] We define the oil price shock of 2014 as a crisis for the oil industry.

and thus enhance next year's earnings as the accruals reverse. The empirical evidence is inconclusive as to how macroeconomic crises affect earnings management behaviour. While most studies find an effect, there is no consensus on the direction of the effect (Rusmin, Scully and Tower, 2012, Filip and Raffournier, 2014, Persakis and Iatridis, 2015).

Due to the historical proximity of the oil price crisis of 2014, no earnings management research has been conducted regarding this event. While previous events are analogous, important differences exist. First, the financial crisis literature investigates all sectors of the economy. By analysing the oil industry alone, we manage to isolate the response to a dramatic change in output price for the most affected companies. Second, to the best of our knowledge, no studies have analysed the effect of a negative oil price shock on earnings management in the oil industry. The purpose of this paper is to fill these gaps and provide valuable insights for users of financial statements.

Following prior research, earnings management is measured using discretionary accruals models that are well-established in the literature. By estimating the models using a sample of 782 quarterly observations, our results indicate that the Oslo Stock Exchange listed oil companies managed earnings to a larger degree during the oil price crisis than they did during the preceding period. Further analysis provides evidence of significant income-decreasing earnings management in the third and fourth quarters of 2014, pointing to big bath accounting choices. This implies reduced trustworthiness in and value of the financial reports from the oil industry during times of crisis.

The remainder of this paper is organised as follows. Section 2 discusses the relevant previous literature. Section 3 provides the theoretical development of the hypotheses, which is followed by section 4's analysis of the dataset and discussion of the research design. Section 5 presents the empirical results, and section 6 concludes the study by presenting findings, limitations and suggestions for future research.

## 2 Literature review

Healy and Wahlen's (1999, p. 368) definition of earnings management is the most commonly cited:

> *Earnings management occurs when managers use judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers.*

The definition contains two distinct ways to alter financial reporting. Accrual-based earnings management occurs when management opportunistically applies accounting standards to manage earnings in a desired direction. Real activities manipulation occurs when management changes the timing or structuring of operations, investments or financial transactions. Contrary to accrual-based earnings management, these activities have direct and suboptimal business consequences (Zang, 2012). In a comprehensive survey, Graham, Harvey and Rajgopal (2005) find that both techniques are used to manipulate earnings. Our study focuses on accrual earnings management.

The majority of previous papers study different incentives for earnings management. These incentives are categorised by Fields, Lys and Vincent (2001) into three main groups, namely, contractual arrangements, asset pricing and third-party decisions. Examples of these incentives for earnings management are managers' bonus schemes, tax reductions, management buyouts, IPO's and meeting or exceeding analysts' expectations.[2] Studies indicate that a common characteristic of incentives is that they hold the macroeconomic environment constant. Macroeconomic events, however, could work as incentives themselves.

Healy (1985, p. 86) states:

> *If earnings are so low that no matter which accounting procedures are selected target earnings will not be met, managers have incentives to further reduce current earnings by deferring revenues or accelerating write-offs, a strategy known as "taking a bath".*

When used as an earnings management technique, big baths deteriorate the information climate and obscure operating performance. However, if the asset market value is less than the book value, write-downs can improve the information environment and reduce information asymmetry (Hope and Wang, 2018).

[2] Managers' bonus schemes (Healy, 1985; Holthausen, Larcker and Sloan, 1995; Gaver, Gaver and Austin, 1995), tax reductions (Burgstahler and Dichev, 1997; Tao, 2014), management buyouts (Perry and Williams, 1994; Mao and Renneboog, 2015), IPOs (Loughran and Ritter, 1995; Spiess and Affleck-Graves, 1995; Teoh, Welch and Wong, 1998), meeting or exceeding analysts' expectations (Degeorge, Patel and Zeckhauser, 1999; Bartov, Givoly and Hayn, 2002; Yu, 2008)

Leuz, Nanda and Wysocki (2003) investigate earnings management across different countries and find that the level of investor protection strongly affects earnings management behaviour and that Norway is among the countries with the lowest degree of earnings management. Filip and Raffournier (2014) find that although Norwegian companies follow the same pattern as most other European countries, they engaged in less earnings management following the financial crisis of 2008.

Empirical research on the effect of different economic environments is ambiguous. Agarwal *et al.* (2007) study Japanese banks in the context of three distinct economic environments, namely, high-growth, stagnant growth and severe recession. The banks used loan loss provisions to manage earnings during both economic high-growth and stagnant growth periods, but not during periods of recession. Similarly, Jenkins, Kane and Velury (2009) report that accounting conservatism and value relevance of earnings are higher during economic contractions because firms report more conservatively during a recession to avoid litigation risk and regulatory scrutiny. Ze-To (2012), who studies companies on the NYSE and AMEX markets for the period 1989 to 2007, presents contrary findings. His evidence suggests that firms manage earnings in both economic growth states and recession states.

Although no prior literature exists on the effect of the oil price drop of 2014, other events such as the Asian financial crisis, Mexican currency crisis and the global financial crisis of 2008 are similar in that they represent major negative shocks to the economy. This study will provide indications about what to expect from earnings management activity following an oil price shock. Davis-Friday and Gordon (2005) find that the relevance of earnings did not decline during the Mexican currency crisis. However, on the contrary, Graham, King and Bailes (2000) and Ho, Liu and Sohn (2001) state that earnings relevance decreased during the Asian financial crisis. Ahmad-Zaluki, Campbell and Goodacre (2011) identify more income-increasing earnings management for IPO firms during the Asian financial crisis, whereas in the context of the Malaysian financial crisis, Saleh and Ahmed (2005) find income-decreasing earnings management for financially distressed firms.

The global financial crisis of 2008 is arguably the crisis that is the most comparable to the oil shock crisis of 2014 since it is the most recent and the majority of the research is conducted in European settings. Numerous studies examine the effects of the 2008 crisis on financial reporting choices. For example, Persakis and Iatridis (2015) study the impact of the global financial crisis on earnings quality in publicly listed firms in advanced countries as per level of investor protection. Their results indicate that earnings decreased during the financial crisis, especially in those countries that are characterised by medium and weak shareholder protection. In a study of Asian transportation firms, Rusmin, Scully and Tower (2012) find the adoption of smoothing behaviour in seven Asian countries and find empirical evidence suggesting that corporate managers opportunistically smooth income to exceed earnings targets and engage in big bath practises. Habib, Bhuiyan and Islam (2013) investigate the managerial earnings management practices of financially distressed firms and examine whether these practices changed during the financial crisis. The results indicate that managers of troubled firms engage in more income-decreasing earnings management compared to managers of healthy firm counterparts.

The literature is, however, conflicting. Filip and Raffournier (2014) conclude that there is a significant decrease in income smoothing and improved accruals quality during the crisis period. This trend is confirmed for most of the 16 EU countries under review. Furthermore, similar findings are reported by Kousenidis, Ladas and Negakis (2013), who examine whether, and to what extent, the financial crisis of 2008 impacted the quality of the reported earnings of listed firms in EU countries with weak fiscal sustainability. The results indicate that, on average, earnings quality improved during the financial crisis. Arthur, Tang and Lin (2015) compare the earnings quality of firms in 14 European countries during the 2005 to 2007 period and during the financial crisis period of 2008 to 2010). The results indicate that firms tended to present higher-quality financial reports during the financial crisis than they did prior to the crisis. Cimini (2015) presents similar findings in a study of non-financial entities listed in EU countries.

Differences in the research design may explain, in part, why the crisis literature is inconclusive. Some studies take a country-by-country approach (Persakis and Iatridis, 2015), while others merge all countries into the same sample (Arthur, Tang and Lin, 2015). Differences in reporting on culture, investor protection and economic environment may affect how a crisis changes earnings management behaviour, and accordingly, these differences may lead to conflict results. Moreover,

most event studies take into account the whole economy. However, because downturns do not have the same impact on every industry, these downturns could result in contrasting incentives. Thus, this study focuses on the industry hardest hit by the oil price drop of 2014, and we believe that the reporting incentives should be more similar than they are in the majority of previous studies.

Most previous studies on the oil industry examine the effect of a positive change in oil prices. Studies on the Persian Gulf crisis (Han and Wang, 1998), on hurricanes Katrina and Rita (Byard, Hossain and Mitra, 2007), and on the Arab Spring (Hsiao, Hu and Lin, 2016) point to income-decreasing earnings management following the respective shocks. Byard, Hossain and Mitra (2007) and Han and Wang (1998) attribute their findings to the political cost hypothesis (Watts and Zimmerman, 1986), while the findings of Hsiao, Hu and Lin (2016) suggest that there may be other incentives, such as income smoothing. Cormier and Magnan (2002) study Canadian oil and gas firms over a 12-year period (1985 to 1996), with no connection to any particular event, and find some evidence of systematic earnings management. These studies signal that oil companies are willing to engage in earnings management, but there is a gap in the literature as to how these companies would react to an oil price drop.

## 3 Hypothesis development

Intuition and research on comparable crises offer conflicting guidance about of what to expect with respect to accounting choices made by oil companies listed on the Oslo Stock Exchange in response to the crisis. Solid intuitive arguments support improved quality of financial reporting during an economic recession. Since investors already expect the performance to be weak, the consequences of delivering negative numbers become less, and similarly, the incentives to artificially inflate earnings become weaker (Filip and Raffournier, 2014). Another aspect is that during an economic downturn, conservativeness from auditors is required as the probability of client bankruptcy and the risk of litigation increase. This development could result in a greater tendency to issue qualified audit reports (Xu *et al.*, 2013).

Despite the incentives for less earnings management during a crisis, there is research that also points in the opposite direction. For instance, during periods of financial distress, information asymmetry increases, a phenomenon that provides managers better opportunities and incentives to

exercise accounting discretion (Liao *et al.*, 2013). Moreover, when operational performance is expected to be low, managers have an opportunity to clean up their accounts by engaging in big bath practices (Saleh and Ahmed, 2005). There is also evidence suggesting that managers of financially distressed firms engage in income-increasing earnings management activities to avoid debt covenant violations or IPOs (Sweeney, 1994; Ahmad-Zaluki, Campbell and Goodacre, 2011; Anand, 2013). Most importantly, prior event studies on oil price increases find that the oil industry has previously taken advantage of volatile environments to exercise their discretion over the accrual process (Han and Wang, 1998; Byard, Hossain and Mitra, 2007; Hsiao, Hu and Lin, 2016), which gives reason to suspect that similar decisions are made during crisis periods.

Based on these arguments we present the following hypothesis:

*H1: Oslo Stock Exchange listed companies in the oil industry engage in more earnings management during the oil price crisis than they do during the period preceding the crisis.*

If there is more earnings management during the crisis period, it can take the form of either income-decreasing or income-increasing accounting choices. Income-increasing choices can be rational during an oil price crisis when several companies are struggling with profitability. By managing earnings upwards, managers give the impression that they are able to cope with the crisis better than their competitors do. Moreover, Degeorge, Patel and Zeckhauser (1999) highlight the importance of meeting last year's results and avoiding negative results. The empirical evidence also suggests that managers of financially distressed firms may have an increased tendency towards income-increasing choices (Defond and Jiambalvo, 1994; Sweeney, 1994; Smith, Kestel and Robinson, 2001; Anand, 2013). In a relevant event study, Ahmad-Zaluki, Campbell and Goodacre (2011) find evidence of income-increasing earnings management during the Asian financial crisis.

Nonetheless, the use of income-decreasing earnings management maybe a rational response to an oil price drop. For managers of companies with substantial debt, a decrease in earnings could lead to benefits in debt renegotiations. With respect to the financial crisis in Malaysia, Saleh and Ahmed (2005) find an extensive use of negative discretionary accruals for financially distressed firms. Furthermore, another reason for downward earnings management during a crisis is to establish a

buffer for the future (Ghazali, Shafie and Sanusi, 2015). Because stakeholders already expect the operational performance to be low, managers can blame the current low earnings on the economic environment. The firm can then report better results in the aftermath of the crisis as the accruals reverse. Specifically, Rusmin, Scully and Tower (2012) find evidence of such big bath behaviour in their study of Asian transportation firms during the Asian financial crisis.

We expect the incentives to managers from downward earnings management, especially big bath accounting choices, to dominate the incentives from upward earnings management. However, considering that accruals reverse, this strategy is difficult to use for several consecutive periods, and therefore, we predict that the strategy will be most prevalent at the onset of the crisis. This leads to our second hypothesis:

*H2: Oslo Stock Exchange listed oil companies engage in income-decreasing earnings management in the third and fourth quarters of 2014.*

## 4 Sample selection and research design

### *4.1 Event period*

Identification of the event period and the preceding period is required to conduct an event study. The beginning of the crisis period is quite easily identifiable. During the third quarter of 2014, the price per barrel of Brent crude oil went from more than $110 to less than $50, the largest drop since 2008. The fourth quarter of 2016 mark the end of the crisis period as companies on the Oslo Stock Exchange were no longer required to report quarterly financial statements, effective beginning January 2017 (Oslo Børs, 2016). Hence, two competing considerations come into play when deciding the length of the preceding period. While we wanted as many observations as possible to increase the power of the statistical techniques, it is also preferred that stable oil prices characterise the baseline period. Accordingly, we selected the first quarter of 2011 as a compromise. After recovering from the dramatic decrease caused by the financial crisis of 2008, the oil price was relatively stable during this period (Figure 1).


**Figure 1:** Daily Brent Crude Oil Spot Price Per Barrel, January 2010-December 2017 extracted from Thomson Reuters.

*4.2 Data and sample selection*

Our initial dataset consisted of quarterly financial statements from 54 Oslo Stock Exchange listed companies on the fossil energy index in the Thomson Reuters Eikon database. A qualitative assessment of the financial statements was executed to ensure that the firms were adequately affected by the oil price crisis. Companies not mentioning the oil price drop were excluded, including six companies that dealt with natural gas. To increase comparability between the two periods, we deleted companies with unavailable data for the research period.[3] For the same purpose, we excluded companies not reporting according to the IFRS (International Financial Reporting Standards). Since GAAP (Generally accepted accounting principles) allows less managerial discretion (Evans *et al*., 2014), we argue that including such companies could distort our data. Three companies were added to our initial sample because they were listed in our research period but delisted prior to the data extraction. Every variable was deflated with lagged total assets to mitigate problems related to heteroscedasticity, thus resulting in the loss of 31 observations. Our final sample consists of 34 companies and 782 firm-quarter observations. Ideally, a larger sample

[3] We manually added data for companies lacking certain posts based on published quarterly reports.

would have been preferred, but similar sample sizes have been used in comparable studies (Cormier and Magnan, 2002; Byard, Hossain and Mitra, 2007; Hsiao, Hu and Lin, 2016).

**Table 1:** Sample selection.

| | |
|---|---|
| Oslo Stock Exchange listed fossil energy companies | 54 |
| - GAAP firms | 3 |
| - Non-oil related firms | 6 |
| - Firms lost due to lack of data | 14 |
| + Additional firms added to the sample | 3 |
| = Firms included in the sample | 34 |
| Initial firm-quarter observations for 2011-2016 | 1296 |
| - GAAP firm-quarters | 72 |
| - Non-oil related firm quarters | 144 |
| - Observations lost due to lack of data | 336 |
| - Observations lost due to requirement of lagged total assets | 31 |
| + Additional firm quarter observations added to sample | 69 |
| = Final sample | 782 |

Similar to Byard, Hossain and Mitra (2007) and Hsiao, Hu and Lin (2016), we use data from quarterly reports for the analysis. Quarterly data provide a sharper focus on the event by catching more of the fluctuations in earnings, which, in turn, increases the likelihood of detecting earnings management. Furthermore, most of the financial statements for the interim quarters are unaudited, which allows greater managerial discretion and requires less detailed disclosure than do annual financial statements (Jeter and Shivakumar, 1999).

### *4.3 Measurement of earnings management*

To test our hypotheses, we employ different discretionary accrual models that are well-established in the literature. The intuition behind these regression models is that accruals unexplained by specific firm characteristics are discretionary accruals, which could be due to either unintentional misjudgement or intentional earnings management. The techniques are heavily debated among researchers and criticised for producing errors of both type 1 and type 2 (Dechow, Ge and Schrand, 2010, Gerakos, 2012). Correlations between the proxy of earnings management and total accruals, correlated omitted variables and model misspecification can lead to both false positives and false negatives.

With respect to H1, we attempt to mitigate these problems by using three different models, namely, the modified Jones model (1995), the Kothari, Leone and Wasley model (2005) and the Larcker model modified by Cimini (2015). The first two models are conventional in the earnings management literature, while Cimini's model is applied in a relevant financial crisis study. If the different models yield the same indications, it should increase the reliability of the findings and reduce the probability of erroneous conclusions. All variables used in the different models are winsorized at the top and bottom 1 %t of their distributions to control for outliers.[4]

The first metric of earnings management is the modified Jones model developed by Dechow, Sloan and Sweeney (1995). In equation (1), $A_{it}$, $\Delta REV_{it}$, $\Delta REC_{it}$ and $PPE_{it}$ are included to control for size, changes in sales and accounts receivables, and the level of property plant and equipment, respectively. The residuals of equation (1) represent abnormal or discretionary accruals and are the component of interest in this part of the study. Francis *et al*. (2005) argue that large discretionary accruals do not necessarily translate to poor accrual quality, providing the level is consistently high and, thus, predictable. Large standard deviations, however, indicate low accrual quality and more earnings management. Accordingly, the standard deviation of the residuals is our measure of earnings management.

$$TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \varepsilon_{it} \quad (1)$$

Variable definitions:

| | |
|---|---|
| $TA_{it}$ | total accruals, computed as net income after tax – operating cash flow, deflated by lagged total assets for company i in quarter t |
| $A_{it-1}$ | lagged total assets for company i in quarter t |
| $\Delta REV_{it}$ | change in total sales deflated by lagged total assets for company i in quarter t |
| $\Delta REC_{it}$ | change in account receivables deflated by total assets for company i in quarter t |
| $PPE_{it}$ | net value of property, plant and equipment deflated by lagged total assets for company i in quarter t |

The second model is developed by Kothari, Leone and Wasley (2005), who extend the modified Jones model by adding return on assets as an additional variable. Kothari, Leone and Wasley (2005) argue that both economic intuition and empirical evidence suggest that accruals correlate

[4] Winsorizing is a common procedure employed in empirical research on earnings management (Francis *et al*., 2005; Kothari, Leone, and Wasley, 2005; Dechow *et al*., 2012).

with a firm's present and past performances. By including ROA in the model, the impact of firm performance on unexpected accruals is controlled. The standard deviation of the residuals from equation (2) represents the proxy of earnings management. With respect to the modified Jones model, a low standard deviation of the residuals indicates higher accrual quality.

$$TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 ROA_{it} + \varepsilon_{it} \quad (2)$$

New variable definition:

$ROA_{it}$ net income after tax deflated by lagged total assets for company i in quarter t

The remaining variables in equation (2) have been previously defined.

Cimini's (2015) modification of the Larcker and Richardson (2004) model takes a slightly different approach and provides the last metric of earnings management. By adding market-to-book to the modified Jones model, the model controls for firms' characteristics such as income persistence and stability. Dechow *et al*. (2012) argue that the discretionary accruals models are misspecified for firms with extreme performance, but by including operating cash flow as an explicative variable, this concern is avoided (Cimini, 2015). Similar to the two previous models, the standard deviation of the residuals represents our proxy of earnings management.

$$TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 MB_{it} + \beta_5 OCF_{it} + \varepsilon_{it} \quad (3)$$

Definitions of new variables:

$MB_{it}$ market-to-book ratio (i.e., market value to book value of equity) for company i in quarter t

$OCF_{it}$ operating cash flow for company i in quarter t

The remaining variables in equation (3) have been previously defined.

H2 is tested with a methodology used in previous studies on earnings management in the American oil industry (Han and Wang, 1998; Byard, Hossain and Mitra, 2007; Hsiao, Hu and Lin, 2016). In equation (4), CRISISQ3 and CRISISQ4 are dummy variables that equal 1 for the third and fourth quarters of 2014, respectively, and zero otherwise. They are the variables of interest and test

whether firms book abnormal income-decreasing accruals in the third and fourth fiscal quarters of 2014. Earlier studies suggest that firms book more accruals in the last quarter of the year (Das, Shroff and Zhang, 2009). Therefore, quarterly dummies for Q2, Q3 and Q4 are implemented to avoid attributing this effect to the crisis period variables. Since the second hypothesis predicts income-decreasing earnings management during the crisis, the two crisis variables are expected to have a negative sign.

$$TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 OCF_{it} + \beta_5 ROA_{it} \quad (4)$$
$$+ \beta_6 LEV_{it} + \beta_7 MB_{it} + \alpha_1 Q_2 + \alpha_2 Q_3 + \alpha_3 Q_4 + \gamma_1 Y_{12} + \gamma_2 Y_{13} + \gamma_3 Y_{14}$$
$$+ \gamma_4 Y_{15} + \gamma_5 Y_{16} + \lambda_1 CRISISQ3 + \lambda_2 CRISISQ4 + \varepsilon_{it}$$

Definitions of new variables:

| | |
|---|---|
| $LEV_{it}$ | leverage for company i in quarter t, calculated as total liability deflated by lagged total assets |
| $Q_j$ | indicator variable, which equals 1 for fiscal quarter j (j = 2, 3 or 4), and zero otherwise |
| $Y_k$ | indicator variable, which equals 1 for fiscal year k (k = 2012, 2013, 2014, 2015, 2016), and zero otherwise |
| CRISISQ3 | dummy variable equal to 1 for the third quarter of 2014, and zero otherwise. |
| CRISISQ4 | dummy variable equal to 1 for the fourth quarter of 2014, and zero otherwise |

The remaining variables in equation (4) have been previously defined.

We initially estimated equations (1) to (4) using ordinary least squares (OLS). An additional analysis of the residuals from these estimations displayed significant first and fourth order autocorrelation and heteroscedasticity. To adjust for this distortion, we estimate equations (1) to (3) using a random effects panel data regression with robust standard errors. Equation (4) is estimated using a fixed effects regression with robust standard errors. [5] Since a high correlation between independent variables may lead to imprecise results, we perform a multicollinearity test in the form of a correlation matrix and variance inflation factors. The correlation matrix and VIF

[5] We used a Hausman test (see Appendix) for our panel data showing that a random effects estimator is a better fit for models 1, 2 and 3 than is the fixed effects estimator. The two estimation techniques provide the same conclusions with respect to our hypotheses.

index for the variables are reported in the Appendix. All VIFs are below 5, indicating that multicollinearity is not a problem in the models. The correlation matrix confirms this conclusion.

## 5 Empirical results

### *5.1 Summary statistics*

Table (2) reports the descriptive statistics for our sample firms. Panels A and B summarise the pre-crisis and crisis periods, respectively, and panel C presents t-tests for differences of means between the two periods. The table further indicates that the oil price crisis affected important firm characteristics. For example, mean total assets increased from 31,115 million NOK before the crisis to 38,131 million NOK after. Similarly, operating quarterly cash flow increased from 1,092 MNOK to 1,135 MNOK from the pre-crisis period to the crisis period. Revenue, leverage and different performance metrics, however, decreased following the oil price drop. Similarly, unweighted ROA decreased from 0,4 % (1,7 % annually) to -2,3 % (-9 % annually), and ROA weighted by firm size decreased from 1,7 % (6,8 % annually) to -1 % (-4 % annually). The mean net income after tax declined from 515 million NOK to -371 million NOK. Panel C indicates that the differences are significant at either the 1 % or 5 % level for net income after tax, ROA and market-to-book. Accordingly, the summary statistics confirm that the oil price drop had a major effect on the Norwegian listed oil companies.

**Table 2:** Summary statistics

| Variable | Mean | Median | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| *Panel A: Pre-crisis period (N = 490)* | | | | | |
| Revenue | 5533,32 | 245,13 | 27290,35 | -6,58 | 191599,30 |
| Total assets | 31115,70 | 15343,66 | 131452,70 | 151,02 | 904701,80 |
| Net income | 515,93 | 16,93 | 2913,75 | -1593,91 | 26868,69 |
| Operating cash flow | 1092,36 | 75,04 | 5526,65 | -479,26 | 54074,66 |
| ROA, unweighted | 0,004 | 0,005 | 0,040 | -0,279 | 0,224 |
| ROA, weighted | 0,017 | | | | |
| Market-to-book | 1,07 | 0,85 | 1,26 | -7,88 | 6,35 |
| Leverage | 0,56 | 0,58 | 0,24 | 0,00 | 1,97 |
| | | | | | |
| *Panel B: Crisis period (N=330)* | | | | | |
| Revenue | 4304,51 | 223,11 | 19837,09 | -0,40 | 15933,00 |
| Total assets | 38131,22 | 4943,53 | 158260,50 | 70,42 | 996587,20 |
| Net income | -371,27 | -15,26 | 2606,18 | -36828,26 | 6791,09 |
| Operating cash flow | 1135,27 | 99,44 | 4974,20 | -624,54 | 47907,59 |
| ROA, unweighted | -0,023 | -0,009 | 0,085 | -0,511 | 0,597 |
| ROA, weighted | -0,01 | | | | |
| Market-to-book | 0,71 | 0,49 | 3,31 | -56,67 | 6,51 |
| Leverage | 0,58 | 0,60 | 0,27 | 0,00 | 1,49 |

| *Panel C: t-test for difference of means between pre-crisis period and crisis period* | | | | |
|---|---|---|---|---|
| Variable | Mean pre-crisis | Mean crisis | Difference | t-test |
| Revenue | 5533,32 | 4304,51 | 1228,81 | 0,72 |
| Total assets | 31115,70 | 38131,22 | -7015,52 | -0,70 |
| Net income | 515,93 | -371,27 | 887,20 | 4,54*** |
| Operating cash flow | 1092,36 | 1135,27 | -42,91 | -0,12 |
| ROA | 0,004 | -0,022 | 0,026 | 5,33*** |
| Market-to-book | 1,07 | 0,71 | 0,36 | 2,11** |
| Leverage | 0,56 | 0,58 | 0,02 | -0,82 |

**Notes:** Our full sample includes 34 oil and oil-related companies listed on the Oslo Stock Exchange. The sample period spans the years 2011 to 2016. Panel A reports the summary statistics of our sample during the pre-crisis period (2011 Q1 to 2014 Q2), and Panel B shows the summary statistics of our sample for the crisis period (2014 Q3 to 2016 Q4). Panel C presents the results of t-tests for the mean value differences between the two periods. ***, ** and * indicate the significance level at 1 %, 5 % and 10 %, respectively (two-tailed). All figures above are in million NOK.

### *5.2 Results hypothesis 1*

To test our first hypothesis, we estimate equation 1-3 for both the pre-crisis and crisis period. The results are presented in Table 3. The significance testing is conducted using a bootstrapping procedure similar to the one used by Filip and Raffournier (2014). Using 50 randomly extracted

observation, we preform 10,000 simulations of the respective regression models for each period. The standard deviations of the residuals from every simulation are then saved in a separate file. Finally, a t-test is used to test the difference of the means between the two periods.

**Table 3:** Earnings management metrics for the pre-crisis period and the crisis period.

| Period | N | Modified Jones | Kothari | Larcker |
|---|---|---|---|---|
| Pre-crisis | 442 | 0,047 | 0,041 | 0,033 |
| Crisis | 340 | 0,092 | 0,062 | 0,060 |
| Difference | | -0,045*** | -0,022*** | -0,027*** |
| t-value | | -140,00 | -59,13 | -140,00 |

**Notes:** Modified Jones is the ratio of the standard deviation of the residuals from the modified Jones model developed by Dechow (1995): $TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \varepsilon_{it}$ (1); Kothari is the standard deviation of the residuals from the Kothari (2005) model: $TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 ROA_{it} + \varepsilon_{it}$ (2); Larcker is the standard deviation of the residuals from the Larcker (2004) model modified by Cimini (2015): $TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 MB_{it} + \beta_5 OCF_{it} + \varepsilon_{it}$ (3).
All variables mentioned above are defined in section 4.3. The difference between the two periods is tested with a bootstrapping procedure using 10,000 simulations and 100 randomly extracted observations to calculate our proxies of earnings management 10,000 times for each model. We use an independent t-test with unequal variances to test the mean difference between the periods. ***, **, and * indicate significance at the 1 %, 5 % and 10 %, respectively (two-tailed).

All three measures of earnings management display higher standard deviations of the residuals meaning the crisis period, thus suggestion that there is an increase in earnings management and a decrease in earnings quality. The differences are significant at the 1 % level. Because every metric reveals the same trend, the findings appear robust. The two models that control for performance, Kothari (2005) and Larcker (2004), generally have higher explanatory power (see Appendix) and lower standard deviations with respect to the residuals than does the basic modified Jones model. This is consistent with the arguments of Dechow *et al*. (2012) and Kothari, Leone and Wasley (2005), and hence, they are not surprising in a volatile environment.

The results support our first hypothesis that there is increased earnings management after the oil price shock and provide evidence of a link between earnings management behaviour and the macroeconomic environment. Our findings are in agreement with the conclusions of Rusmin, Scully and Tower (2012), Habib, Bhuiyan and Islam (2013) and Persakis and Iatridis (2015) in the financial crisis literature. They are also consistent with previous research on the oil industry (Han and Wang, 1998; Byard, Hossain and Mitra, 2007; Hsiao, Hu and Lin, 2016), and they provide

further evidence on how oil price changes affect a company's inclination to engage in earnings management. That said, our findings somewhat conflict with previous studies on earnings management in a Norwegian context (Leuz, Nanda and Wysocki, 2003; Filip and Raffournier, 2014).

*5.3 Results hypothesis 2*

To further investigate the findings from H1, we study in which quarters and in what direction companies manage earnings. Figure (2) presents the development of discretionary accruals for the complete period. The graph indicates large discretionary accruals in the two quarters immediately following the onset of the crisis.

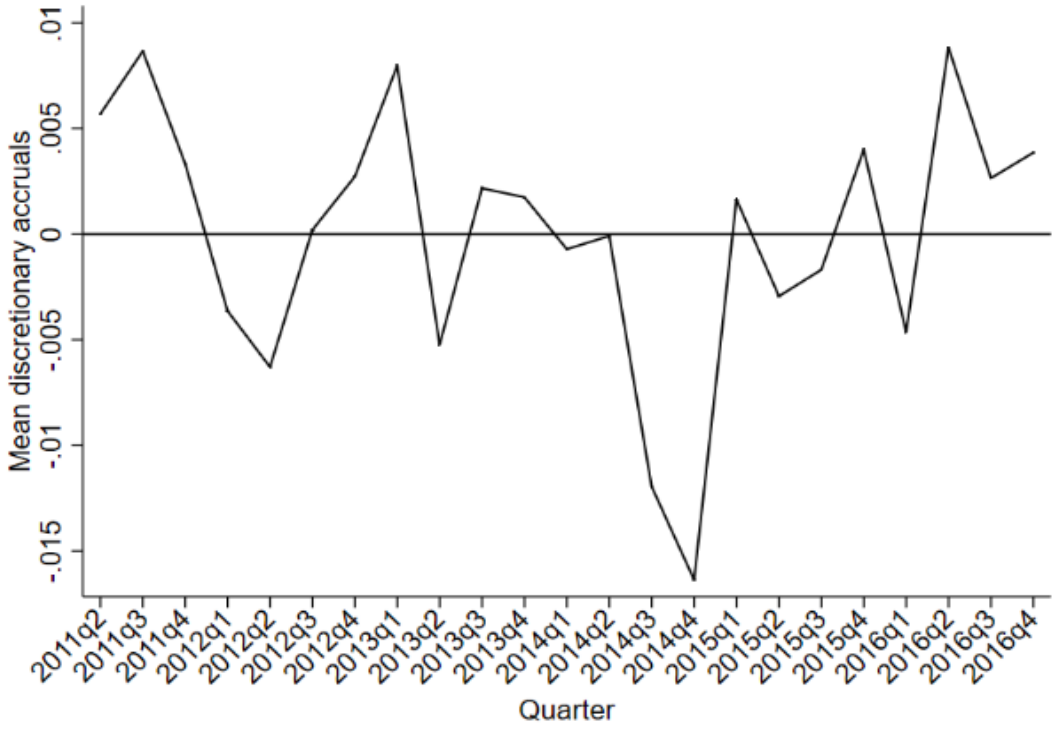


**Figure 2:** Mean discretionary accruals development for the estimation period.

**Table 4:** Testing for abnormal income-decreasing total accruals using the Byard (2007) model.

| Variables | Coefficient estimates | Z-stat |
|---|---|---|
| Intercept | 0,0281 | 2,96 *** |

| | | |
|---|---|---|
| CRISISQ3 | -0,0100 | -2,20 ** |
| CRISISQ4 | -0,0158 | -2,16 ** |
| $1/A_{it-1}$ | 9116812 | 1,95 * |
| $\Delta REV_{it}$ - $\Delta REC_{it}$ | -0,0670 | -2,88 *** |
| $PPE_{it}$ | 0,0135 | 1,40 |
| $ROA_{it}$ | 0,9574 | 20,97 *** |
| $LEV_{it}$ | 0,0123 | 0,61 |
| $MB_{it}$ | 0,0007 | 0,27 |
| $OCF_{it}$ | -0,0002 | -8,30 *** |
| $Q_2$ | 0,0023 | 0,61 |
| $Q_3$ | 0,0045 | 1,49 |
| $Q_4$ | -0,0022 | -0,34 |
| $Y_{12}$ | -0,0053 | -1,30 |
| $Y_{13}$ | 0,0007 | 0,15 |
| $Y_{14}$ | 0,0024 | 0,64 |
| $Y_{15}$ | -0,0024 | -0,55 |
| $Y_{16}$ | -0,0023 | -0,41 |
| Model summary | | |
| F(17,33) | 218,56 *** | |
| $R^2$ | 0,75 | |
| Sample size | 780 | |

**Notes:** This table shows the results of equation (4) for our sample of 34 oil and oil-related companies. The equation is estimated using a fixed effects regression, where the model explains the effect of the oil price crisis on total accruals. The equation for the Byard model is $TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 OCF_{it} + \beta_5 ROA_{it} + \beta_6 LEV_{it} + \beta_7 MB_{it} + \alpha_1 Q_2 + \alpha_2 Q_3 + \alpha_3 Q_4 + \gamma_1 Y_{12} + \gamma_2 Y_{13} + \gamma_3 Y_{14} + \gamma_4 Y_{15} + \gamma_5 Y_{16} + \lambda_1 CRISISQ3 + \lambda_2 CRISISQ4 + \varepsilon_{it}$ (4). The dependent variable is quarterly total accruals. The test variables are the two indicator variables, CRISISQ3 and CRISISQ4, which equals 1 for the third and fourth quarters of 2014, respectively, and zero otherwise. Remaining variables are defined in section 4.3. ***, ** and * indicate the significance level at 1 %, 5 % and 10 %, respectively (two-tailed).

The fixed effects estimation of equation (4), presented in table (4), checks the significance of these effects and verifies that both CRISISQ3 and CRISISQ4 are statistically significant at the 5 % level. Furthermore, both coefficients are negative, indicating the use of income-decreasing earnings management at the beginning of the crisis. For Hsiao, Hu and Lin (2016), the model has a high explanatory power (0,75), meaning that the variables explain well the variation in total accruals. The remaining variables included in the model are control variables for different firm characteristics and are not central to our study.

The results support the second hypothesis and imply that managers exploit the crisis environment by engaging in earnings management practices and, more specifically, the use of the big bath strategy. This is consistent with Hope and Wang (2018), who state that an adverse economic

environment could lead managers to pack negative surprises in the current financial statement to enhance earnings in future periods. Our results find empirical support in Rusmin, Scully and Tower (2012), who report that Asian transportation firms made poor results even worse during the global financial crisis. By reviewing the graph and testing different quarter dummy variables, there are no signs of further income-decreasing earnings management during the rest of the crisis period despite 2015 and 2016 being difficult years for the industry. This is expected from big bath accounting choices. In future periods, as the oil price recovers, we anticipate positive discretionary accruals.

## 6 Conclusion

The aim of this study is to investigate whether and how accounting choices by the oil companies listed on the Oslo Stock Exchange changed in response to the oil price shock of 2014. Through statistical analysis, we find that more earnings management occurs during the crisis period than during the period preceding the crisis. More specifically, by taking advantage of the uncertain macroeconomic environment, companies booked large income-decreasing accruals during the third and fourth quarters of 2014. We attribute these events to the big bath strategy.

This paper supports the studies that find downward earnings management in times of crisis (Saleh and Ahmed, 2005; Rusmin, Scully and Tower, 2012). However, it contradicts those studies that find more accurate financial reporting during an economic downturn (Filip and Raffournier, 2014; Arthur, Tang and Lin, 2015). Less earnings management is often explained by increasing conservativeness and scrutiny by stakeholders such as regulators and auditors. Despite having a severe impact, the scope of our event is smaller and may not induce the same level of scrutiny.

Another potential reason is that while most previous research is conducted on the economy as a whole and often across several countries, this study focuses on the presumably most affected industry. Although our sample is not entirely homogenous, the impact and incentives are more similar than those of many previous studies.

This study contributes to the literature on earnings management in the oil industry. While earlier studies examine the oil industry after positive oil price shocks, we fill a gap by studying the effect of a negative oil price drop on earnings management. Although both events lead to income-

decreasing accounting choices, Han and Wang (1998) and Byard, Hossain and Mitra (2007) attribute this phenomenon and their findings to another theory, i.e., the political cost hypothesis.

Our findings have valuable implications for stakeholders in the oil industry. This study's findings, combined with prior research, indicate that investors must always be alert, i.e., in both good times and bad. In addition, big bath accounting choices impact future accounting periods, such that undervalued assets give lower accruals and overstated earnings in subsequent periods. If investors and other stakeholders are unaware of this practice, company stock prices will become overvalued.

Our study is not without certain limitations. We rely on proxy measures for earnings management, meaning that we cannot rule out whether our findings are subject to more natural explanations, such as the conservatism principle, rather than earnings management. Even though erroneous conclusions due to model shortcomings cannot be ruled out, we believe that using four different models strengthens the reliability of the findings. Finally, the relatively small sample size may affect the results, and as we only focus on companies listed on the Oslo Stock Exchange, the external validity of the findings is constrained.

Future research may examine whether our findings are comparable to the oil industries in other countries, particularly in European countries and in America. It would also be interesting to investigate accounting choices in the oil industry as the oil price recovers. In the last decade, neural network techniques have shown promising capabilities to detect earnings management (Höglund, 2012; Namazi and Maharluie, 2015). Future researchers may explore these detection techniques to determine whether they yield the same results.

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## Appendix

**Table A1:** Definitions of applied variables.

| | |
|---|---|
| $TA_{it}$ | total accruals computed as net income after tax – operating cash flow, deflated by lagged total assets for company i in quarter t |
| $A_{it-1}$ | lagged total assets for company i in quarter t |
| $\Delta REV_{it}$ | change in total sales deflated by lagged total assets for company i in quarter t |
| $\Delta REC_{it}$ | change in account receivables deflated by total assets for company i in quarter t |
| $PPE_{it}$ | net value of property, plant and equipment deflated by lagged total assets for company i in quarter t |
| $ROA_{it}$ | net income after tax deflated by lagged total assets for company i in quarter t |
| $MB_{it}$ | market-to-book ratio, i.e., market value to book value of equity, for company i in quarter t |
| $OCF_{it}$ | operating cash flow for company i in quarter t |
| $LEV_{it}$ | leverage for company i in quarter t and calculated as total liability deflated by lagged total assets |
| $Q_j$ | indicator variable, which equals 1 for fiscal quarter j (j = 2, 3 or 4), and zero otherwise |
| $Y_k$ | indicator variable, which equals to 1 for fiscal year k (k = 2012, 2013, 2014, 2015, 2016), and zero otherwise |
| CRISISQ3 | dummy variable equal to 1 for the third quarter of 2014, and zero otherwise |
| CRISISQ4 | dummy variable equal to 1 for the fourth quarter of 2014, and zero otherwise |

**Table A2:** Modified Jones model developed by Dechow, Sloan and Sweeney (1995).

| | Pre-crisis | | Crisis | |
|---|---|---|---|---|
| Variables | Coefficients | z-value | Coefficients | z-value |
| Constant | -0,029 | -2,67*** | -0,068 | -5,18*** |
| $1/A_{it-1}$ | 5 117 414 | 1,37 | 11 100 000 | 6,40*** |
| $\Delta REV_{it}$-$\Delta REC_{it}$ | -0,150 | -2,71*** | -0,252 | -1,54 |
| $PPE_{it}$ | 0,011 | 0,80 | 0,027 | 1,46 |
| | | | | |
| Model statistics | | | | |
| $R^2$ | 0,04 | | 0,11 | |
| N | 442 | | 340 | |
| Wald chi2 | 10,27*** | | 80,28*** | |

**Notes:** The equation for the modified Jones developed by Dechow, Sloan and Sweeney: $TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \varepsilon_{it}$ (1).

**Table A3:** Hausman test modified Jones (1995) model.

| | Pre-crisis | Crisis |
|---|---|---|
| Prob>chi2 | 0,861 | 0,232 |

**Notes:** Test of $H_0$: difference in coefficients not systematic. The random effects estimator is chosen if the p-value is > 0,05.

**Table A4:** Kothari et al. (2005) model.

| | Pre-crisis | | Crisis | |
|---|---|---|---|---|
| Variables | Coefficients | z-value | Coefficients | z-value |
| Constant | -0,029 | -2,65*** | -0,039 | -2.70*** |
| $1/A_{it-1}$ | 10 200 000 | 1,37 | 11 100 000 | 5,14*** |
| $\Delta REV_{it}$-$\Delta REC_{it}$ | -0,147 | -3,54*** | -0,252 | -1,35 |
| $PPE_{it}$ | 0,012 | 0,83 | 0,027 | 0,72 |
| $ROA_{it}$ | 0,828 | 5,81*** | 1,002 | 8,71*** |
| | | | | |
| Model statistics | | | | |
| $R^2$ | 0,01 | | 0,42 | |
| N | 442 | | 340 | |
| Wald chi2 | 67,73*** | | 251,78 *** | |

**Notes:** The equation for the Kothari model: $TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 ROA_{it} + \varepsilon_{it}$ (2).

**Table A5:** Hausman test for Kothari et. al. (2005) model.

| | Pre-crisis | Crisis |
|---|---|---|
| Prob>chi2 | 0,713 | 0,192 |

**Notes:** Test of $H_0$: difference in coefficients not systematic. The random effects estimator is chosen if the p-value is > 0,05.

**Table A6:** Larcker and Richardson (2004) model modified by Cimini (2015).

| | Pre-crisis | | Crisis | |
|---|---|---|---|---|
| Variables | Coefficients | z-value | Coefficients | z-value |
| Constant | -0,002 | -0,24 | -0,038 | -2,84*** |
| $1/A_{it-1}$ | -4 443 244 | -1,60 | 3 224 299 | 1,72* |
| $\Delta REV_{it}$-$\Delta REC_{it}$ | -0,012 | -0,28 | -0,135 | -1,46 |
| $PPE_{it}$ | 0,008 | 0,71 | 0,020 | 1,18 |
| $MB_{it}$ | 0,003 | 0,80 | 0,003 | 0,59 |
| $OCF_{it}$ | -0,091 | 12,47*** | -0,884 | -7,36*** |
| | | | | |
| Model statistics | | | | |
| $R^2$ | 0,54 | | 0,233 | |
| N | 440 | | 340 | |
| Wald chi2 | 175,47*** | | 146,05*** | |

**Notes:** The equation for the Larcker model modified by Cimini (2015: $TA_{it} = \beta_0 + \beta_1(1/A_{it-1}) + \beta_2(\Delta REV_{it} - \Delta REC_{it}) + \beta_3 PPE_{it} + \beta_4 MB_{it} + \beta_5 OCF_{it} + \varepsilon_{it}$ (3).

**Table A7:** Hausman test for Larcker (2004) model.

| | Pre-crisis | Crisis |
|---|---|---|
| Prob>chi2 | 0,363 | 0,088 |

**Notes:** Test of $H_0$: difference in coefficients not systematic. The random effects estimator is chosen if the p-value is > 0,05.

**Table A8:** Hausman test for the Byard (2007) model.

| | 2011-2016 |
|---|---|
| Prob>chi2 | 0,0053 |

**Notes:** Test of $H_0$: difference in coefficients not systematic. The random effects estimator is chosen if the p-value is > 0,05.

**Table A9:** Correlation matrix

| | $TA_{it}$ | $1/A_{it-1}$ | $\Delta REV_{it}$-$\Delta REC_{it}$ | $PPE_{it}$ | $LEV_{it}$ | $ROA_{it}$ | $MB_{it}$ | $OCF_{it}$ | CRISIS Q3 | CRISIS Q4 |
|---|---|---|---|---|---|---|---|---|---|---|
| $TA_{it}$ | 1,000 | | | | | | | | | |
| $1/A_{it-1}$ | 0,103 | 1,000 | | | | | | | | |
| $\Delta REV_{it}$-$\Delta REC_{it}$ | -0,127 | 0,012 | 1,000 | | | | | | | |
| $PPE_{it}$ | 0,030 | -0,418 | 0,001 | 1,000 | | | | | | |
| $LEV_{it}$ | -0,076 | -0,254 | -0,006 | 0,455 | 1,000 | | | | | |
| $ROA_{it}$ | 0,614 | -0,105 | -0,033 | 0,068 | -0,120 | 1,000 | | | | |
| $MB_{it}$ | 0,033 | 0,067 | 0,023 | -0,255 | -0,255 | 0,138 | 1,000 | | | |
| $OCF_{it}$ | -0,493 | -0,304 | 0,079 | 0,114 | 0,085 | 0,177 | 0,101 | 1,000 | | |
| CRISISQ3 | -0,018 | -0,000 | -0,033 | -0,005 | -0,026 | 0,009 | -0,015 | 0,029 | 1,000 | |
| CRISISQ4 | -0,215 | -0,002 | 0,057 | 0,015 | 0,010 | -0,148 | -0,053 | 0,096 | -0,046 | 1,000 |

**Table A10:** Variance inflation factors

| Variable | VIF | 1/VIF |
|---|---|---|
| $1/A_{it-1}$ | 1,33 | 0,751 |
| $\Delta REV_{it}$-$\Delta REC_{it}$ | 1,01 | 0,986 |
| $PPE_{it}$ | 1,50 | 0,665 |
| $LEV_{it}$ | 1,34 | 0,744 |
| $ROA_{it}$ | 1,12 | 0,894 |
| $MB_{it}$ | 1,14 | 0,877 |
| $OCF_{it}$ | 1,18 | 0,850 |
| CRISISQ3 | 1,01 | 0,994 |
| CRISISQ4 | 1,05 | 0,955 |
| Mean VIF | 1,19 | |