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Master Thesis

Thesis Master of Science

The Relative and Incremental Information Content of Cash Flows and Accruals: An Empirical Study on Oslo Stock Exchange

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Start:	15.01.2020 09.00
Finish:	01.09.2020 12.00

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An Empirical Study on Oslo Stock Exchange

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Oslo

2020

Acknowledgments

We would like to thank our supervisor, Associate Professor at the Department of Accounting, Auditing and Business Analytics at BI Norwegian Business School Ignacio Garcia de Olalla Lopez, for the valuable inputs and guidance from the beginning of the process working with this master thesis.

Abstract

This study examines the relative and incremental information content of accruals and cash flows based on Norwegian data. The motivation for the study is the lack of conclusive evidence on the topic and that no information content study has been conducted in a Norwegian context. We estimate the association between cumulative abnormal returns and unexpected components of net income, working capital from operations, cash flow from operations, cash flow after investments, and net cash flow. Based on annual cross-sectional and pooled regressions from 2007 to 2018, we find that the aggregate effect of cash flows has the highest information content for companies listed on the Oslo Stock Exchange. Further, we find evidence suggesting that both accruals – in particular earnings – and cash flows have incremental information content. We observe the following ranking of the performance measures: 1) cash flow from operations, 2) net income, 3) net cash flow, 4) cash flow after investments, and 5) working capital from operations. Unlike previous studies on the topic, we introduce control variables that are distinct for the market. In this study, we control for industry, in particular oil companies, and government ownership. We find some evidence suggesting that earnings are relatively more important for government-owned firms.

Table of Contents

Abbreviations

Abbreviation	**Explanation**
AR	Abnormal Return
CAR	Cumulative Abnormal Return
CF	Cash Flow
CFAI	Cash Flow After Investments
CFF	Cash Flow from Financing Activities
CFI	Cash Flow from Investing Activities
CFO	Cash Flow from Operating Activities
FAS	Financial Accounting Standard
HML	Fama-French Factor High Minus Low
IAS	International Accounting Standard
IFRS	International Financial Reporting Standards
LIQ	Liquidity Factor
MVE	Market Value of Equity
NCF	Net Cash Flow
NI	Net Income
NR	Normal Return
OSE	Oslo Stock Exchange
PR1YR	Cahart Momentum Factor
MRP	Market Risk Premium
SMB	Fama-French Factor Small Minus Big
U.S. GAAP	United States Generally Accepted Accounting Principles
WCFO	Working Capital from Operations

1. Introduction

The cash flow statement, which has been around for decades, was introduced to meet the information needs of investors and other users of financial statements. The underlying assumption for the introduction of the cash flow statement is that it contains information beyond that of the income statement and balance sheet alone. Cash flow statements are now required as a part of the reporting by all firms following reporting standards such as U.S. GAAP and IFRS. Since the commencement of the cash flow statement, researchers and practitioners have been interested in its information content relative to the information contained in the other statements. Although extensive research has been devoted to this topic, the literature has not yielded a definite conclusion.

The primary motivation behind this paper is that previous literature on the topic has been inconclusive. The results have not only varied from country to country, but there have also been some studies conducted within the same country that have yielded different conclusions. This leads us to believe that different industry compositions, as well as *when* the research was conducted, could influence the result. Furthermore, there have not been conducted any information content studies on Norwegian accruals and cash flows. Ali and Pope (1995) suggest that the relative information content of earnings differs between countries. This implies that conclusions drawn in one market cannot be transferred to another. Based on this finding, it is necessary to examine the information content of the performance measures in Norway.

Foreign ownership on the Oslo Stock Exchange (OSE) is, as of the end of 2019, at almost 40 percent (Oslo Stock Exchange, 2019). This is the highest level since the 2008 financial crisis. The increased cross-border trade makes the examination of incremental information content more critical. It is essential that investors outside Norway gain an understanding of the information content surrounding Norwegian accruals and cash flows. There is an increased demand for unbiased information with foreign ownership as there is an information asymmetry between domestic and foreign investors (Dvořák, 2005; Ferreira, Matos, Pereira & Pires, 2017).

The Oslo Stock Exchange differs from other markets in two main areas: 1) OSE has a high degree of government ownership. The Norwegian Government owns roughly 30 percent of the stock market[1]. Compared to The United States, where the public sector holds 3 percent, and Europe, where the public sector owns 9 percent (Cruz, Medina, & Tang, 2019, p. 11), the Norwegian Government has a greater influence over the market. This could impact what reflects the highest information content, as the government may react differently to events in the capital markets. 2) The energy sector has a significant presence on the Oslo Stock Exchange. As of June 15th, 2020, 51 out of 200 stocks traded at OSE are directly or indirectly associated with the energy sector (Oslo Stock Exchange, 2020). Given that one industry has such a large presence, it would be interesting to see if there are different levels of information content of measures between the sectors. Controlling for industries has not, as far as we can see, been done in previous literature.

Based on the objectives of the thesis, we formulate the following research question:

> *"Does accrual-based or cash flow-based performance measures contain most information for securities listed on Oslo Stock Exchange?"*

To answer the research question, we use annual cross-sectional and pooled data in the period 2007 to 2018. We run OLS regressions on cumulative abnormal return against a set of accrual and cash flow-based performance measures. The cumulative abnormal return is estimated based on a five-factor market model. The thesis is mostly quantitative, and we follow a deductive research approach.

This paper examines the information contained in three components of the statement of cash flows required by IAS 7 and two accrual-based performance measures. The cash flow components are cash flows from operations, cash flow after investments, and net cash flow. In line with Plenborg (1999), we examine the accrual-based measures net income and working capital from operations.

[1] We calculate this figure using data on government ownership provided by the Norwegian Government and market values of the respective firms.

We hope to contribute to the literature in two ways. Firstly, we want to improve the understanding of the information content of accruals and cash flows for Norwegian firms. Secondly, we want to expand on previous studies by controlling for industry and government ownership.

In the first part of the paper, we present and discuss previous literature and its' implications for our study. Secondly, we formulate the hypotheses that we will later test and discuss theoretical frameworks that will aid our expectations on the amount and direction of information content in the different components. Next, we introduce the data that we use in the analysis before we explain the methodology. We then move on to the results from annual cross-sectional and pooled regressions as well as the hypotheses tests. Based on the results, we will conclude on which performance measures that contain the highest amount of information for shares listed on OSE. Lastly, we discuss limitations to the study and implication for future research.

2. Literature Review

In this chapter, we discuss previous literature related to our research question. First, we will define the term incremental information content by presenting research conducted on this topic. Second, we look at literature directly linked to the information content of accruals and cash flows before we take a broader perspective on related research on equity pricing. Third, we discuss literature on security pricing at the Oslo Stock Exchange to identify particularities in this market.

2.1 Incremental Information Content

Biddle, Seow, and Siegel (1995) explain the *incremental information content* as to whether one accounting measure, or a set of them, provides information content beyond what is provided by another. It is, however, important to point out that the concept of incremental information content is not mutually exclusive. If accounting measure A has incremental information content beyond accounting measure B, accounting measure B can have incremental information content beyond A (Bowen, Burgstahler & Daley, 1987). The term *relative information content*, on the other hand, asks which measure that has *greater* information content (Biddle et al., 1995).

To measure the incremental information content of a performance measure, several authors (e.g., Kinnunen & Niskanen, 1993; Clubb, 1995; Plenborg, 1999) uses the correlation with stock prices. Put differently; they find the predictive ability of the accounting measure on future stock prices.

The incremental and relative information content is, in terms of statistical dependencies, a conditional statistical relationship between accounting measures and stock returns (Kusuma, 2014). In his study, Kusuma (2014) finds the difference between the expected stock returns given operating, financing, and investing cash flows against a model where operating cash flows are omitted. With this model, Kusuma is able to test whether the additional variable operating cash flow changes the expected security return distribution. Kusuma only considers the incremental information content of cash flow components, but the principle is the same for accruals versus cash flows.

Accounting numbers are backward-looking as they are a summary measure of performance during a fiscal period. They reflect some value-relevant information about the firm in that period. Stock returns are, on the other hand, forward-looking and more comprehensive because they take the entire set of available value-relevant information into account. Examination of the relationship between accounting measures and stock returns is interesting because it provides insight into how well the accounting measures reflect value-relevant information. If one accounting measure has a higher correlation with stock returns relative to another, it contains more value-relevant information (Chia, Czernkowski, & Loftus, 1997).

2.2 Information Content of Accruals and Cash Flows

Over the past decades, several studies have attempted to increase the understanding of the usefulness of earnings and other accounting measures with mixed results (Melumad & Nissim, 2009). Some of these studies have been motivated by new regulations on reporting of cash flows (e.g., Livnat & Zarowin, 1990; Plenborg, 1999). Others have been motivated by finding empirical results for a new country (e.g., Kusuma, 2014).

One set of studies attempts to explain the relative information content in accrual measures versus cash flow measures. Studies on the information content of accruals and cash flows (e.g., Wilson 1986, 1987; Rayburn, 1986; Bowen et al., 1987) can be interpreted in a common framework where accounting earnings are decomposed (Bernard & Strober, 1989). Accounting earnings can be decomposed into cash flow from operations, current and noncurrent accruals, and working capital from operations[2]. Current accruals contain items such as the increase in receivables and inventories and decrease in payables. Noncurrent accruals include depreciation and deferred income taxes. The studies generally regress stock return metrics against the unexpected portion of the components above (or a combination of them)[3].

There is no conclusive evidence of the information content of accruals and cash flows across the studies. However, it seems to be a slight overweight in studies concluding that accruals – in particular earnings – have incremental information content over cash flows. In the Danish market, which is geographically and socially the closest to Norway, Plenborg (1999) finds that earnings have incremental information content over individual cash flow components, but the aggregated cash flows have relative information content beyond that of earnings. His conclusion differs from Wilson (1986) on US data. Wilson (1987) followed up his study and showed that both cash flow and total accrual components have information content beyond that of accounting earnings.

Wilson (1986, 1987) contradicts the findings of Rayburn (1986) and Bowen et al. (1987), who also use US data. This may suggest that differences between markets

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[2] Cash flow from operations + current accruals = working capital from operations + noncurrent accruals = net income

[3] In general these regressions are on the form $R_{i,t} = b_0 + b_1 UCF_{j,t} + b_2 UCA_{j,t} + b_3 UNCA_{j,t} + u_{j,t}$, where $R_{i,t}$, UCF, UCA, UNCA, b_0, b_1, b_2, b_3, and $u_{j,t}$ are the return on stock *i* at time *t*, unexpected cash flow from operations, unexpected current accruals, unexpected noncurrent accruals, model specific parameters and the error term. Unexpected components are the change in a component from one year to the next (Bernard & Strober, 1989).

alone cannot explain the different results of studies. Further, Rayburn (1986) suggests that both cash flow from operations and aggregated accruals are associated with abnormal returns. Using UK data, Clubb (1995) finds that accounting earnings have incremental information content over cash flows. This is the opposite conclusion of Wilson (1987). Charitou (1997), also using UK data, finds that cash flow has information content beyond accruals.

Wilson (1986, 1987) has been criticized for only using two quarters of data for 1981 and 1982 (Bernard & Strober, 1989). Due to the short period he investigates, Bernard and Strober (1989) question the robustness and validity of the study.

Board and Day (1989) find that earnings contain information content beyond that of fund flows and cash flow from operations in the UK. Furthermore, they find that there is “very little” information conveyed in the measures closest to cash flow (p. 3). They point out that this is inconsistent with existing literature. The authors go as far as suggesting that there is no support for the use of cash flow-based reports (p. 3). This is a controversial claim, and cash flow reports are still required by all major accounting standards.

Charitou (1997) concludes that cash flow has incremental information content over accruals. His study contained data on UK firms for the period 1984-1992. Charitou improved the model previously used in similar studies by incorporating the operating cycle, the magnitude of accruals, and measurement interval in the cash flow return relationship and thereby strengthened the conclusion of Board and Day (1989).

There might be several reasons why the conclusions of the existing literature diverge. One explanation is that there are differences between markets. Ali and Pope (1995) suggest that the relative information content of earnings differs between countries. This implies that conclusions drawn in one market cannot be transferred to another.

Table 1: Summary of previous literature

Author	*Year*	*Country*	*Topic*	*Conclusion*
Rayburn	*1986*	*US*	*Information content of operating CF and accounting earnings*	*Operating CF*
Wilson	*1986*	*US*	*Information content of CF and accruals*	*Accruals*
Wilson	*1987*	*US*	*Information content of accrual and CF components controlling for earnings*	*CF and total accruals components have information content over earnings*
Bowen, Burgstahler & Daley	*1987*	*US*	*Information content of CF and accruals*	*CF and accruals have incremental information content*
Clubb	*1995*	*UK*	*Information content of CF and accounting earnings*	*Accounting earnings*
Ali & Pope	*1995*	*UK*	*Information content of CF and accounting earnings*	*CF and earnings have incremental information content*
Charitou	*1997*	*UK*	*Information content of CF and accruals*	*CF*
Plenborg	*1999*	*Denmark*	*Information content of CF and accruals*	*Earnings alone but CF combined*

Table 1 This table summarizes the results of studies on the information content of cash flow and accruals. Only the most relevant studies are included.

Most of the studies assume a linear relation between abnormal return and unexpected components of cash flow and earnings (e.g., Wilson, 1987; Board & Day, 1989; Livnat & Zarowin, 1990). Others (e.g., Ali, 1994, 1995) allows for non-linearities in these relations. However, the results of Ali (1994) were consistent with existing literature assuming a linear relationship. On the other hand, Freeman and Tse (1992) documented that there is, in fact, a non-linear relation between abnormal returns and unexpected earnings. Besides, they show that forcing a linear specification will lead to a slope coefficient on unexpected earnings that is biased towards zero.

A common criticism of many studies on the information content of cash flows is that they focus solely on operating cash flows (e.g., Rayburn, 1986; Wilson, 1986, 1987; Ali, 1994) rather than a broader set of measures including cash flow from investing and financing activities. In addition, they fail to incorporate insights from valuation theory (Arnold, Clubb, Manson & Wearing, 1991; Kinnunen &

Niskannen, 1991). In more recent studies, cash flow from financing and investing activities have been included in several studies (e.g., Kusuma, 2014). Dechow (1994) suggests that the information content of net cash is higher than the one of operating cash flow. The approach of including other cash flow components is supported by Plenborg (1999), Clubb (1995), and Livnat and Zarowin (1990).

The level of disaggregation of cash flow components matters to the results. One of the most detailed studies conducted on the information content of cash flow components was conducted by Livnat and Zarowin (1990). They disaggregate cash flow into all components required by FAS No. 95, a more detailed disaggregation than the cash flow from operating, investing, and financing activities. They find that the disaggregation of net income into cash flow from operations and accruals does not contribute to the association of security returns beyond net income alone. This is in line with the findings of Bernard and Strober (1989). At the same time, Livnat and Zarowin find that a further disaggregation into the components of cash flow from operating and financing activities improves the association significantly. They do not find the same effect of disaggregation into the components of investing cash flows.

Many of the influential studies on the topic of information content were conducted in the ’80s and ’90s. We cannot be certain that the conclusions of these studies are valid today. This argument is supported by the finding of Ali and Pope (1995, p. 20), suggesting that the sign of the cash flow coefficients change from year to year. The implication of this is that the information content may change over time. This calls for updated research on the topic.

Another weakness of the previously conducted studies is that they build on contemporary financial and valuation theory. Some of these theories have been modified since the time of the studies. One such advance has been in asset pricing models[4] (e.g., Fama and French, 1993, 2015). By incorporating the improved models, the conclusions may change.

[4] Asset pricing models are applied in several studies to estimate returns used as the dependent variable.

2.3 Related Research on Equity Pricing

In a study that is considered the foundation of market-based accounting research (Lev & Ohlson, 1982), Ball and Brown (1968) found that earnings explain security pricing significantly better than cash flows. This study was criticized (e.g., Beaver & Dukes, 1972) for the measurement of accounting earnings, which had been a concern for users of accounting data.

Lev (1989) criticized the empirical research of the usefulness of accounting earnings for low R^2 in market-based tests of earnings quality. He suggests that the focus on capital market research in accounting should concentrate on examining the earnings quality account-by-account. Lev's suggestion is supported by Penman (1992), who called for concentrated accounting research aimed at studying fundamentals.

Contrary to the popular view, Liu, Nissim, and Thomas (2002) find that there are not different "best" multiples for different industries. They suggest that some multiples are superior across industries. In terms of relative performance, they observe the following ranking: (i) forward earnings measures, (ii) historical earnings measure, (iii) cash flow measures and book value of equity (tied), and (iv) sales performance. For forward earnings measures, performance increases when the forecast horizon is lengthened (1-year to 2-year to 3-year out EPS) and when earnings forecasted over different horizons are aggregated. That the time-horizon of a measure impacts the results, are inconsistent with the findings of Livnat and Zarowin (1990) and Plenborg (1999).

Liu et al. (2002) describe the performance of cash flow measures as "poor" (p. 137). Surprisingly, they also observe that more complex measures of intrinsic value based on short-cut residual income models have worse performance. The conclusions we can draw from this are that (i) complex models and measures are not necessarily better than simpler ones, and (ii) earnings measures are better predictors for stock prices than cash flow measures. Further, they find that (i) accruals improve the performance of cash flow measures, and (ii) top-line revenue has little relevance for valuation purposes before it is matched with expenses. From the latter, we assume that accruals closer to the top-line, such as accounts receivables, will perform worse than accruals that have been subject to expenses.

2.4 Oslo Stock Exchange

The common belief among actors in the Norwegian market seems to be that classic financial theory holds. However, there have been few empirical studies conducted on OSE to prove this (Næs, Skjeltorp, & Ødegaard, 2009, p. 2).

Two important characteristics of OSE is government ownership and the importance of oil companies. These two factors may impact the conclusion in empirical studies.

Practitioners seem to accept the fact that oil price is a significant driver of OSE. Næs et al. (2009) find that fluctuations in the oil price impact the cash flows of most industries on OSE, but that it is not priced as a risk factor in the market (p. 6). This is supported by Bjørnland (2009). She finds that a 10 percent increase in oil price is followed by a 2.5 percent increase in stock returns. The effect gradually declines after this point. The impact of the oil price will, naturally, vary from market to market (Wang, Wu, & Yang, 2013). We expect that it will be an important factor in an oil-dependent country like Norway.

The Norwegian Government is a major shareholder on OSE. As of January 2020, the government holds shares worth NOK 684 billion, giving it approximately 30 percent ownership on OSE. This is significantly higher than in The United States and the average in Europe, where the public sector holds 3 and 9 percent of the values, respectively (Cruz, Medina, & Tang, 2019). The high degree of government ownership may impact several factors on OSE because the government will respond differently to capital market events than a private investor. There is, however, seemingly not conducted any research on the effect of government ownership on OSE. Internationally, research on government ownership's effects on stock markets is limited. As far as we can see, there are not conducted such studies on western markets.

3. Hypotheses

In this chapter, we will formulate and discuss hypotheses. We formulate our hypotheses based on financial theory and existing literature on information content. The possible outcomes of the hypotheses are illustrated in Appendix C.

H1: Accruals have incremental information content beyond cash flows

For many years, accruals were the only accounting measures available. Prior to the introduction of the cash flow statement, accruals had no competition. The information content of earnings is well documented in the literature. Earnings are also, to some extent, used for valuation purposes (e.g., P/E multiple). However, there is no conclusive evidence of the information content of other accrual measures.

H2: Cash flows have incremental information content beyond accruals

As discussed in the literature review, the concept of incremental information content is not mutually exclusive. Thus, it is possible that both H1 and H2 are true. Because the introduction of IAS 7 (cash flow statement) builds on the assumption that cash flows have information content beyond what is contained in the other statements, we want to test if this is the case. Further, some valuation models (e.g., discounted cash flow model) assume that cash inflows and outflows in the current period affect security prices through future and current cash flows. Previous literature generally finds that there is information contained in cash flows.

H3: Cash flows have relative information content over accruals

As we have already discussed in Chapter 2, the literature provides contradictory findings about the relative information content of cash flows and accruals. Arguably, the Danish market is more similar to the Norwegian market than the other countries where information content studies have been conducted. Plenborg (1999) finds that cash flows have the highest information content for Danish securities. In the absence of more convincing theoretical arguments, we expect similar results for the Norwegian market as the Danish.

4. Theory

In this chapter, we will apply theoretical frameworks to aid expectations on the direction and amount of information content of the accrual and cash flow components. The main framework we lean on is the Miller and Rock (1985) paper on information asymmetry. We will employ their models to explain the signaling effect of the different components. We will, however, not derive the model. See Miller and Rock (1985) for a complete theoretical and mathematical explanation of the model.

To understand the association between security returns and earnings and cash flows, we can consider the Miller and Rock (1985) model. They show that the value V_1 of a firm after an earnings/dividend/investment announcement can be expressed by using the current level of earnings X_1, investments I_1, and the discounted expected earnings of year 2, $\frac{F(I_1)+\gamma\varepsilon_1}{1+i}$:

$$V_1 = X_1 - I_1 + \frac{F(I_1) + \gamma\varepsilon_1}{1 + i} \tag{1}$$

where $F(I_1)$ is the earnings function of the investment I in year 1, ε_1 is a random increment and γ is an earnings persistence coefficient of the increment (i.e., the portion of ε_1 that will remain in the future).

4.1 Theoretical Considerations on Earnings

It may come as no surprise that theory suggests that a higher level of earnings than expected is associated with an increase in firm value. Miller and Rock (1985) base the earnings announcement effect on the model above. They show that the impact on firm value may be expressed as:

$$V_1 - E_0(V_1) = \left(X_1 - E_0(\tilde{X}_1)\right)\left[1 + \frac{\gamma}{1 + i}\right] \tag{2}$$

where V_1 is the actual value of the firm in year 1 after the earnings announcement, $E_0(V_1)$ is the market pre-announcement expectations of the value in year 1, X_1 is the actual earnings in year 1, $E_0(\tilde{X}_1)$ is the expected earnings for year 1, and $\frac{\gamma}{1+i}$ is the discounted earnings persistence coefficient. The interpretation of the Eqn. 2 is that the effect on firm value is equal to the difference between actual and expected earnings plus the discounted value of the earnings persistence, i.e., the present value of the amount remaining in the future. Thus, we expect a positive association between unexpected earnings and security returns.

4.2 Theoretical Considerations on Investing Cash Flows

Increasing investments typically signal higher future cash flows. Consequently, it is generally positively associated with security returns (Livnat & Zarowin, 1990). From Eqn. 1, we can see that an increase in investments I_1 will lead to an increase in stock value if the discounted expected earnings given the investment are larger than the actual investment, i.e., $\frac{F(I_1)+\gamma\varepsilon_1}{1+i} > I_1$. Assuming that the managers act in the best interest of the shareholders, this will always be the case. In other words, the net present value of the investment should be expected to be positive.

Amihud and Lev (1981) make an argument leaning on agency theory that managers hold an undiversified personal portfolio due to their non-tradable human investments in the firm. Thus, managers have an incentive to undertake negative net present value investments in other firms to diversify their portfolio. This corresponds to the situation where $\frac{F(I_1)+\gamma\varepsilon_1}{1+i} < I_1$ in the Miller and Rock (1985) model. If shareholders expect such behavior, investments signal reduced future cash flows, and hence, are associated with a fall in the share price. We can, therefore, conclude that the value effect of increased cash flow from investment activities is positive in the absence of the principal-agent problem but may be negative if the market expects adverse manager behavior.

4.3 Theoretical Considerations on Financing Cash Flows

Ross (1977) and Brealey, Leland, and Pyle (1977) suggest that information asymmetry between managers and investors leads to a positive perception of debt issuance. Because owners retain a larger portion of equity compared to a situation with stock issuance, future cash flows are expected to be higher. In contrast, Miller and Rock (1985) argue that future operating cash flows will be lower than expected, and thus, market reactions to external financing announcements are negative. In light of their model, Miller and Rock argue that financing is essentially a negative net dividend. If we let dividends in year t = D_t and funds (equity and debt) raised in year t = B_t, then the net dividend can be expressed as $D_t – B_t$. Because dividends have a positive signaling effect, $B_t > D_t$ should be a negative signal. Hence, financing announcements are interpreted negatively in the market and are negatively associated with security returns.

Financing cash flows also contain dividend payments. As already implied above, dividends are usually positively associated with security returns. Miller and Rock (1985) argue that dividend announcements contain information about the firm's future earnings. Dividend levels above or below the market expectations, thus, trigger a price change. Assuming that the firm has chosen an optimal level of investments, I_1^*, the difference between expected and actual dividends will be[5]:

$$(D_1 - B_1) - E_0(D_1 - B_1) = X_1 - E_o(\tilde{X}_1) = \varepsilon_1 \tag{3}$$

where $(D_1 - B_1)$ is the actual net dividend in year 1, $E_0(D_1 - B_1)$ is the expected net dividend in year 1, X_1 is the actual earnings in year 1, $E_o(\tilde{X}_1)$ is the expected earnings in year 1, and ε_1 is the random increment.

Consequently, the price change triggered by the announcement of net dividends can be expressed as:

$$\begin{aligned} V_1 - E_0(V_1) &= \big((D_1 - B_1) - E_0(D_1 - B_1)\big)\left[1 + \frac{\gamma}{1+i}\right] \\ &= \varepsilon_1 \left[1 + \frac{\gamma}{1+i}\right] \end{aligned} \tag{4}$$

From the equation above, we can see that a net dividend above expectation, i.e., $\varepsilon_1 > 0$, will lead to an increase in the share price. Similarly, net dividends below expectations, i.e., $\varepsilon_1 < 0$, is associated with a fall in share price.

[5] Because $D_1 - B_1 = X_1 - I_1 \;\Rightarrow\; (D_1 - B_1) - E_0(D_1 - B_1) = (X_1 - I_1^*) - \big(E_o(\tilde{X}_1) - I_1^*\big)$ $= X_1 - E_o(\tilde{X}_1)$, given $I_1 = I_1^*$

The conclusion drawn from Miller and Rock (1985) is the opposite of the Modigliani and Miller (1961) dividend irrelevance theory. Modigliani and Miller postulate that, under perfect market conditions with no taxes, no transaction costs, and infinitely divisible shares, dividends do not affect the value of the company. It does, however, seem like empirical evidence supports the claim that dividends have signaling effects influencing the share price (Miller and Rock, 1985).

Based on the theoretical implications of financing cash flows, we cannot easily conclude in which direction the aggregate financing cash flows impact security prices. The effects will, to a large extent, depend on the composition of the different components of financing cash flows.

5. Data and Descriptive Statistics

In this chapter, we are going to present the data we will use in the analysis. We start by declaring where we sourced the data and discuss the quality of it. Then we will discuss, select, and define independent variables before we perform descriptive statistics on the data.

5.1 Data Sources and Data Quality

Stock prices and accounting data were retrieved from Bloomberg. The prices are at the end of each month in the period from the 30th of September 1997[6] to the 31st of March 2019 – a period of 20 years and six months. The extra months were included to ensure that the CAR-calculation in January 1998 contained a valid value and that we could cumulate abnormal returns for April 2018 through March 2019[7]. Accounting data is downloaded for the period 1997 to 2018. Including the year 1997 was necessary to calculate the unexpected components of the variables for 1998.

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[6] Due to few observations in the years before 2007, we only present results from 2007-2008. The reason for doing this is to avoid an unbalanced dataset. A deeper discussion of this is included in Section 6.3.

[7] This is one of two ways to cumulate abnormal returns. See Section 6.1 for a detailed explanation.

We use data for all companies listed on OSE except firms in the financial sector[8]. Companies in the financial sector are excluded due to special reporting. Shares delisted before January 2020 are not included. We believe that our results will be more representative by including all firms rather than a smaller sample.

For the data collected in Bloomberg, we have the following criteria: 1) There must be at least two consecutive years of data, and 2) The data must be continuous – i.e., there cannot be gaps in the data. The first criterion is required as calculating cumulative abnormal returns and unexpected components of cash flows and accruals require the previous 12 months. Furthermore, having only one data point would not have yielded a meaningful regression. The second criterion is required as data with a "gap" could yield a skewed regression line.

We consider the data gathered from Bloomberg to be of high quality. Bloomberg collects the financial data from audited annual reports. This ensures that the data has an overall high quality and represents the firm as correctly as possible. Information contained in the data we use is precisely the same as investors make their decisions based upon.

Due to the long time horizon in the analysis, some accounting standards have changed during the period. This might lead to discrepancies in the data when calculating the unexpected components of cash flows and accruals.

For the calculation of normal returns, we use data on four risk pricing factors, as well as the market return and risk-free rate calculated by Professor Bernt Arne Ødegaard. The data is made available at the Department of Finance at BI Norwegian Business Schools' online database. The data in the database was provided by OSE up until 2010. Because OSE stopped providing accounts in 2010, the data after this point in time is sourced from Datastream. This might lead to discrepancies when comparing calculations of SMB and HML (see Section 6.1) series before and after 2010. The calculations for the financial years 2017 and 2018

[8] We use the OSE industry classification to determine which firms that belongs to the financial sector. Firms in the sectors 'equity certificates' and 'finance' are here classified as financial. These are mainly banking and holding companies but also some other financial service providers.

are preliminary and might change if accounting data are updated. We do not believe this will have significant effects on the population level of our analysis.

5.2 Identification of Independent Variables

This chapter is dedicated to the discussion and selection of relevant performance measures that will be used as independent variables in our model. As we want to compare the information content in accrual-based performance measures and cash flow-based performance measures, we will select measures in both categories.

5.2.1 Accrual-Based Performance Measures

Most information content studies focus solely on accounting earnings as an accrual (e.g., Rayburn, 1986; Board & Day, 1989; Ali & Pope, 1995). Some studies, however, have examined a broader set of accruals. Plenborg (1999) examines net income after extraordinary items, comprehensive income, and working capital from operations. Bowen et al. (1987) examines net income before extraordinary items and discontinued operations and working capital from operations. The approach of Bowen et al. is similar to the one of Plenborg, except that the earnings figure utilized by Plenborg contains extraordinary items while Bowen et al. exclude them. Additionally, Plenborg includes comprehensive income.

Working capital from operations (WCFO) incorporates adjustments to net income (NI), not affecting working capital. In the empirical literature, working capital from operations is often considered a cash flow measure (e.g., Rayburn, 1986; Wilson 1986, 1987; Ali, 1994). The rationale behind this classification is that WCFO adjustments include the removal of depreciation and amortization, which is a non-cash item adjustment. However, Bowen et al. (1987, p. 729) argue that WCFO should be considered an accrual-based measure because it incorporates adjustments to net income for gains and losses on asset sales, investments accounted for by the equity method, amortization of bond premiums or discounts, and deferred taxes. This classification was adopted by Plenborg (1999).

In addition to NI and WCFO, Plenborg (1999) includes comprehensive income (CI) as an accrual-based measure. Comprehensive income is the sum of NI and items that bypass the income statement because they are not realized. CI includes items like unrealized foreign currency translation gains or losses or holding gain or loss from sales of securities. The reason for the inclusion of CI was that flexibilities in the accounting system allow several items to bypass the income statement. In the analysis, NI and CI yielded identical results[9]. This suggests that the admittance of CI is obsolete. For this reason, we chose not to include CI in our analysis.

Livnat and Zarowin (1990) use aggregated accruals (NI – CFO) while Bernard and Strober (1989) use current accruals (WCFO – CFO) and noncurrent accruals (NI – WCFO). Nevertheless, we cannot use aggregate accruals or current and noncurrent accruals in combination with NI and WCFO due to multicollinearity (see footnote 2). We chose to follow the approach of Plenborg (1999).

Our study will, in line with Bowen et al. (1987) and Plenborg (1999), regard WCFO as an accrual-based performance measure. We will use this in addition to NI. Concerning accrual measures, we will have identical variables as the ones reported by Plenborg (1999).

5.2.2 Cash Flow-Based Performance Measures

In the early literature, the only cash flow-based performance measure being examined was cash flow from operation (CFO) (e.g., Rayburn, 1986; Wilson, 1986, 1987; Ali, 1994). This has been criticized by later researchers (e.g., Livnat & Zarowin, 1990).

Previous studies on the information content of cash flows use different levels of disaggregation. The most extensive study was conducted by Livnat and Zarowin (1990), who analyzed all the components of the statement of cash flows required by FAS no. 95. In total, this yielded fourteen independent variables. Livnat and Zarowin's objective was not to compare the information content of cash flows to accruals[10]. A high level of disaggregation does, therefore, make sense. Given our research question, however, this seems to be a too detailed disaggregation. Arnold, Clubb, and Wearing (1991) use cash flow from operation (CFO), investing activities (CFI), change in cash (NCF), and free cash flow to the firm/cash flow

[9] Due to this, Plenborg does not report on the information content of CI.
[10] They do however control for aggregated accruals defined as net income minus operating cash flows.

after investing activities (CF – CFI). In addition, they use two working capital measures, which they consider cash flow measures. Plenborg (1999) examines CFO, cash flow after investments/free cash flow (CFAI), and net change in total cash flow (NCF).

Including a broader set of cash flow measures than only CFO has broad support in the literature. Livnat and Zarowin (1990) find that the disaggregation into components of cash flows has incremental information content. This study will, therefore, examine several cash flow measures. We will take an approach similar to Plenborg (1999), by adopting the findings of Livnat and Zarowin (1990) without examining all components of cash flow.

We will use the main components of the statement of cash flows required by IAS 7; CFO, CFI, and CFF, as a starting point. However, we will not use these three components as they are. Because the discounted cash flow model, which is a commonly used model to find the market value of equity, use free cash flow, we think this is a more interesting figure than CFI. Free cash flow to the firm, or cash flow after investments (CFAI), is defined as CFO + CFI. We cannot use both CFI and CFAI due to multicollinearity. In line with Plenborg (1999), we will include net cash flow (NCF). This is an alternative to CFF. Due to multicollinearity, we cannot use both. Because CFF is the difference between NCF and CFAI, NCF will reflect the information content of CFF.

5.2.3 Unexpected Components of Accruals and Cash Flows

Information content studies typically use the unexpected components of cash flows and accruals (e.g., Livnat & Zarowin, 1990; Plenborg, 1999; Givoly, Hayn & Lehavy, 2009). The predicted value of the component is the previous year's value. Hence, the unexpected components can be defined as *the change in the measure between two years*. Both Livnat and Zarowin (1990) and Plenborg (1999) base their calculations on the random walk assumption. We follow the same approach. The random walk prediction model can be seen in Section 6.2.

Our tests will be based on a cross-sectional comparison. To minimize heteroskedasticity in the dataset, the unexpected components should be deflated by some measure of size. Christie (1987) recommends deflating the unexpected components by the market value at the beginning of the year. Livnat and Zarowin (1990) used total assets at the beginning of the year as a deflator in addition to the market value of equity. The results obtained by the two methods were very similar. In addition to minimizing heteroskedasticity, there is empirical support for assuming that deflating a measure by the market value provides a better proxy of the unexpected component than the change in the variable alone. Easton and Harris (1991), Ohlson and Shroff (1992), and Strong and Walker (1993) finds this result for earnings. Similar results were obtained by Ali and Pope (1995) for cash flows.

The alternative to deflating the unexpected components by some measure of size is to use the previous year's value of the measure as a deflator. In other words, using the percentage change. This method is used by some researchers (e.g., Ball & Brown, 1968). We chose to deflate by the market value of equity due to the empirical support for doing so discussed above.

In this study, we use the unexpected components of cash flows and accruals deflated by the market value of equity at the beginning of the year. For comparison and sensitivity analysis, we also deflate the unexpected components by total assets at the beginning of the year. The estimation of the unexpected components is based on the random-walk assumption.

5.2.4 Definitions

In the analysis, we include the following measures:

Accrual-based

NI	Net income (after extraordinary items)[11] *As reported*
WCFO	Working capital from operations *(Current assets – cash and cash equivalents – current derivative and hedging assets – other current financial assets) – (current liabilities – current derivative and hedging liabilities – short-term interest-bearing debt)*

CF-based

CFO	Cash flow from operating activities *As reported*
CFAI	Cash flow after investments (= Free cash flow to the firm) *CFO + CFI*
NCF	Net cash flow *Net change in cash and cash equivalents = CFO + CFI + CFF*

Table 2 Definition of independent variables.

The method we use to calculate WCFO is generalized for all firms. Some firm-specific adjustments may provide a more accurate WCFO figure. Our measure is, therefore, only a proxy of the actual WCFO. A more accurate calculation would not be feasible as it requires individual assessments of all balance sheets for each firm and each year.

5.3 Descriptive Statistics

As can be seen from Table 3, the means of the independent variables are non-zero. Assuming a random walk, we would expect the means to be closer to zero (Livnat & Zarowin, 1990). The reason why the means are so far from zero is probably due to the existence of extreme observations. This is supported by looking at the median, which is very close to zero.

Some of the measures, such as net income and cash flow from operations, have large standard deviations. Livnat and Zarowin (1990) suggest that this is caused by extreme observations that may occur when scaling by the market value of equity due to low market values in some firm-years. This seems to be the case in our

[11] Using NI after extraordinary items is in line with Plenborg (1999).

dataset. When scaling by total assets, which is a more stable measure than market value, we obtain lower standard deviations.

Table 3: Summary statistics

Variable	*N*[a]	*Mean*	*Median*	*Percentile* 10%	*Percentile* 90%	*Std.*	*Correl. CAR*[b]
NI[c]	1284	0.1402	0.0005	-0.2939	0.3284	2.6057	0.0468
WCFO[c]	1284	0.0031	0.0009	-0.1564	0.1862	0.5928	0.0194
CFO[c]	1284	0.0261	0.0040	-0.1216	0.2081	2.1848	0.0937
CFAI[c]	1284	0.0416	0.0021	-0.3754	0.4384	1.7246	0.0480
NCF[c]	1284	0.0473	0.0487	-0.2545	0.2895	1.3974	0.0572

a. Number of observations. The table only includes data from 2007-2018. See Section 7.1 for an explanation of the omittance of years before 2007.
b. Accumulated from April through March.
c. Unexpected components deflated by market value at the beginning of the period.

From the histograms of the variables (see Appendix B), we can see that most observations are concentrated around zero. Nevertheless, there are many singular observations scattered far out in the tails. Histograms, in combination with the examination of boxplots (see Appendix B), may suggest that we have an issue with outliers in the data. We will discuss outlier treatment in Section 6.4. One explanation of the extreme values may, as discussed above, be unstable market values of equity.

As expected, CAR accumulated over the contemporaneous year and since the last financial report (i.e., April to March) has the same pattern (see Section 6.1 for an explanation of the accumulation of abnormal returns). This leads us to believe that there will not be a significant difference between results reported with the two methods. We can, however, see that shocks in CAR accumulated over the first period appear slightly after CARs accumulated over the latter. This is expected as events taking place in January through March will appear in year *t* for the January through December CARs while it appears in year *t+1* for the April through March CARs. There are clear dips in CARs around the years 2001, 2008, and 2014. This seems to represent the dot com bubble, financial crisis, and oil price fall, respectively.

Figure 1: Cumulative abnormal returns over time

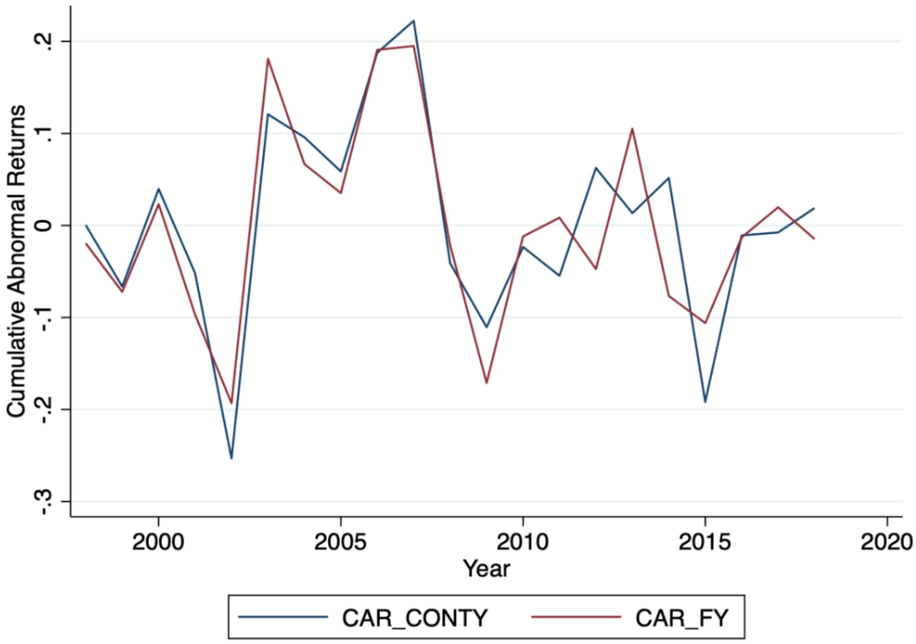

Figure 1 This figure shows the development in cumulative abnormal returns calculated as the average CAR for all firms in the sample. CAR_CONTY = CAR cumulated over the period January through December. CAR_FY = CAR cumulated over the period April through March.

6. Methodology

In this chapter, we describe the methodology used in our analysis. We will explain how we calculated cumulative abnormal returns and formulate a regression model to examine the information content of cash flow and accrual-based performance measures. We will describe how we deal with outliers and how we use different methods to calculate the same measures to check for sensitivity in our results.

6.1 Cumulative Abnormal Return

This master thesis aims to determine if accrual-based or cash flow-based performance measures contain the most information for stocks listed on OSE. We do this by examining their explanatory power of abnormal returns. The cumulative abnormal return (CAR) is the return a stock gives within the given time frame above (or below) the expected return. Following these objectives, we develop the following three-step method: 1) estimating the expected return for the stock, 2) calculating the abnormal and cumulative abnormal return, and 3) running regressions of cumulative abnormal return on accrual and cash flow-based performance measures. This methodology is consistent with Livnat and Zarowin (1990) and Board and Day (1989) but differs from Plenborg (1999), who does not estimate the abnormal return but instead uses the raw return, the market-adjusted[12] and size-adjusted return of the stock in his regression. The utilization of CAR in information content studies dates back to Ball and Brown (1968), who examined if accounting earnings convey information to the stock market.

To estimate the cumulative abnormal return, we will first estimate the expected return, referred to as *normal return*. We will use the Fama and French (1993) three-factor model as well as a Cahart Momentum factor and a liquidity factor. Hence, we get a five-factor model. All factors are calculated for the Norwegian market by Professor Ødegaard. This model builds on the capital asset pricing model (CAPM) developed by Sharpe (1964) by including four factors in addition to the market risk premium.

In 2015, Fama and French improved their model by the inclusion of two new variables related to company profitability and investments. The reason why we use the three-factor model instead of the revised five-factor model is that the last two factors are only available for the European market, calculated by Kenneth French. We do believe that using the factors calculated for the Norwegian market will give us a more accurate estimation of the expected return, and hence a more correct end-result. This assumption is supported by looking at the differences between the three available factors calculated for Europe and Norway.

Since Livnat and Zarowin's (1990) research was conducted before the Fama and French (1993) three-factor model, they calculate the abnormal return without the utilization of such a model. We do believe that our estimations will be more accurate than the once of Livnat and Zarowin (1990) due to the advances in capital asset pricing models since their research was conducted.

[12] Market-adjusted returns are calculated by deducting an index representing the market return from the stock return of company$_i$.

The five factors we will use are the three Fama and French (1993) factors MRP, SMB, and HML, in addition to the Cahart momentum factor PR1YR and a liquidity factor LIQ.

The SMB factor is a size factor. It is constructed as the difference between average returns on three small-stock portfolios (S/L, S/M, and S/H)[13] and the average of three big-stock portfolios (B/L, B/M, and B/H). HML is a book-to-market equity factor. It is constructed as the difference between the average returns on the two high book-to-market portfolios (S/H and B/H) and the average of the two low book-to-market portfolios (S/L and B/L). MRP is the market risk premium calculated as the return of a market index minus the risk-free rate. This is similar to the market risk premium factor in the CAPM. As a representation of the market return, we use the OBX index[14].

Cahart (1997) suggests that another factor is of substantial importance for security returns, namely the momentum factor PR1YR. The observation behind the rationale this factor builds on is the tendency that rising stock prices continue rising, and declining stock prices continue declining. The factor is constructed as the difference in returns of securities with the highest 30 percent 11-month returns and the securities with the lowest 30 percent 11-month returns.

In a working paper by Næs et al. (2009) on what factors that affect the Oslo Stock Exchange, the authors investigate if liquidity is a priced risk factor in the Norwegian stock market. This factor – LIQ – was estimated by sorting stocks into three portfolios based on the average relative spread of the prior month and then calculating the difference between the most liquid and least liquid portfolio. They observed that models exposed to the LIQ-factor gave a significant risk premium, independently of whether an equally- or value-weighted marked factor was applied.

Næs et al. (2009) find that a three-factor model consisting of a market-, size-, and liquidity factor provides a good fit with the cross-section of stock returns on OSE.

[13] S and B denoting “small” and “big” and L, M, and H denoting “low”, “medium”, and “high”.
[14] The OBX index consists of the 25 most traded shares in the OSEBX index on the Oslo Stock Exchange. The data is provided by Professor Ødegaard.

By combining the Fama and French (1993) factors with the liquidity factor, we obtain the three factors that have been empirically proven to be accurate factors for OSE.

The first step to calculate CAR is to calculate the abnormal return. Abnormal returns are the actual ex post-security return minus the normal return. The normal return is here defined as the expected return, not considering the information contained in the performance measures. For firm *i* at time *t* the abnormal return is:

$$AR_{i,t} = R_{i,t} - NR_{i,t} \tag{5}$$

where $AR_{i,t}$, $R_{i,t}$, and $NR_{i,t}$ are the abnormal return, actual return, and normal return, respectively. The normal return is the expected return for the period. We define the actual return as $R_{i,t} = \ln\left(\frac{Price_{i,t}}{Price_{i,t-1}}\right)$.

To estimate the normal returns, we use the Fama-French and the two other factors discussed above. We run individual regressions for each firm on the variables to estimate the coefficients. We apply the regression model:

$$\begin{aligned} R_{i,t} - R_{f,t} = \alpha_i + \ ß_i(R_{m,t} - R_{f,t}) + s_i SMB_t + h_i HML_t \\ + p_i PR1YR_t + l_i LIQ_t + \varepsilon_{i,t} \end{aligned} \tag{6}$$

where $R_{i,t}, R_{f,t}, R_{m,t}$ $UMD_t, SML_t, HML_t, PR1YR_t$, LIQ_t, and $\varepsilon_{i,t}$ is the return of security *i*, risk free-rate[15], market return, the five factors for month *t*, and the error term. $\alpha_i, ß_i, s_i, h_i, p_i$, and l_i are the model's firm-specific parameters. Hence, $R_{i,t} - R_{f,t}$ is the excess return of security *i* at time *t* and $R_{m,t} - R_{f,t}$ is the market risk premium. We can use this to estimate the normal return (NR):

$$\begin{aligned} \widehat{NR}_{i,t} = R_{f,t} + \hat{\alpha}_i + \hat{\beta}_1(R_{m,t} - R_{f,t}) + \hat{s}_i SMB_t + \ \hat{h}_i HML_t \\ + \hat{p}_i PR1YR + \hat{l}_i LIQ_t \end{aligned} \tag{7}$$

[15] The risk-free rate is estimated by Professor Ødegaard based on Norwegian government securities and NIBOR (Norwegian Interbank Offer Rate).

where $\widehat{NR}_{i,t}$, $\hat{\alpha}_i$, $\hat{\beta}_1, \hat{s}_i$, $\hat{h}_i, \hat{p}_i, \hat{l}_i$ are the estimated normal return and the OLS estimates of the coefficients in Eqn. 6.

In order to draw overall inferences from an event, i.e., the earnings and cash flow announcement, abnormal returns must be aggregated (MacKinlay, 1997). The cumulative abnormal return is the sum of the abnormal returns over a given period. The CAR for the period *s* to *t* is estimated as follows:

$$\widehat{CAR}_{s,t}^{i} = \sum_{\tau=s}^{t} \widehat{AR}_{\tau}^{i} \quad (8)$$

where $\widehat{CAR}_{s,t}^{i}$ and $\widehat{AR}_{\tau}^{i}$ is stock *i'*s estimated cumulative abnormal return for period *s* to *t* and the estimated abnormal return at period τ.

In the information content literature, there are two approaches to selecting the aggregation period of abnormal returns, i.e., s and t. Abnormal returns can be accumulated over the contemporaneous year or over a twelve-month period since the previous disclosure, i.e., from April year *t* through March[16] year *t+1* (Livnat & Zarowin, 1990). Livnat and Zarowin (1990) find that the changing return window does not have a significant impact on the results. In this study, we accumulate abnormal returns over both return windows[17]. As expected, CAR follows the same pattern over time for the two methods with the exception of a delay in the effects in CAR calculated from January to December (see Figure 1). Thus, we expect similar results obtained from the two cumulation periods.

6.2 Deflated Unexpected Components

As discussed in Section 5.2, we will use deflated unexpected components of cash flows and accruals. We define the unexpected components as the difference between the predicted and actual value of the measure. Predictions are equal to the previous year's value. This can be expressed by Eqn. 9, which corresponds to a

[16] The underlying assumption is that most companies publish annual reports by the end of March.
[17] Because most studies only cumulate abnormal returns over the period April through March we will base our main analysis on this. Abnormal returns cumulated over the contemporaneous year is used in a sensitivity analysis.

simple random walk model (Bowen et al., 1986, 1987). Consistent with previous research, Bowen et al. (1986) find that a random walk model, such as ours, predicts cash flows as good or better as more complex time-series or univariate regression models. Mathematically, we can express the predicted value of the variable as:

$$\hat{x}_{i,t+1} = x_{i,t} \tag{9}$$

where $\hat{x}_{i,t+1}$ is the predicted value of measure *x* for firm *i* in year *t+1* and $x_{i,t}$ is the value of the predictor for firm *i* in year *t*. Hence, we can define the unexpected component as $x_{i,t} - x_{i,t-1}$ for firm *i* in year *t*. This corresponds to the difference between the predicted and actual value of measure *x*.

Following Christie's (1987) recommendation, we will deflate the unexpected components by the market value of equity[18] at the beginning of the period. In the regression model, we will use measures of cash flows and accruals on the form:

$$Deflated\ Unexpected\ Component_{i,t} = \frac{x_{i,t} - x_{i,t-1}}{MVE_{t-1}} \tag{10}$$

where $x_{i,t}$, $x_{i,t-1}$, and MVE_{t-1} is measure *x* (i.e., NI, WCFO, …) for firm *i* at time *t*, the measure at time *t-1*, and the market value of equity at the beginning of the period.

6.3 Model Specification

In line with Livnat and Zarowin (1990) and Plenborg (1999), we will base our tests on annual cross-sectional and pooled data. With the annual cross-sectional data, we will run the same regression for all years from 2007 to 2018 and find the average coefficients for each independent variable. We will run regressions on CAR accumulated over January through December as well as April through March and deflate the unexpected components by both the market value of equity and total assets at the beginning of the period. Results are reported on CARs accumulated

[18] We will also deflate the unexpected components by total assets at the beginning of the period as a control. The methodology is the same as when deflating by MVE.

over the latter period, and performance measures are deflated by the market value of equity unless otherwise specified.

The alternative to a cross-sectional analysis would be a time-series analysis. Beaver et al. (1982) argue that for information content studies, cross-sectional analysis is more suitable, both from a theoretical perceptive and given the statistical properties of the data. They argue that cross-sectional variations in the measures are greater than the average variability over time. Maximum variability in the independent variables is desirable as it increases the confidence in the estimated coefficients. Further, Beaver et al. argue that time-series regressions assume cross-sectional independence. Cross-sectional dependence of returns and earnings is well documented in the literature. Nevertheless, they find that there is a non-zero serial correlation in the data. Using cross-sectional regressions that are independent over time, potentially permit significance tests that implicitly incorporates any cross-sectional dependence in the results, and thus exploits the serial independence in the data.

The underlying assumption of the cross-sectional approach is that the coefficients are constant in the given year but may vary over time. A time-series approach assumes that the coefficients may vary across firms but are constant over time. Neither of the assumptions is likely to hold (Beaver, Griffin, & Landsman, 1982). There is no conclusive evidence on which of the two approaches that best describes the relationships. Beaver, Lambert, and Morse (1980) find substantial variation across time. They also argue for interfirm homogeneity based on a temporary aggregation argument. However, the argument applies to data grouped in portfolios and cannot be directly transferred to individual security returns. Hence, we cannot claim that a cross-sectional approach violates the constant-coefficient assumption less than a time-series approach.

Our main model consists of all the five performance measures; net income, working capital from operations, cash flow from operating activities, cash flow after investments, and net cash flow. The dependent variable is the cumulative abnormal return. Based on this, we formulate the following model:

$$CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t} \qquad \text{(M1)}$$

where $CAR_{i,t}$, α_0, β_1, β_2, γ_1, γ_2, γ_3, and $\varepsilon_{i,t}$ are the cumulative abnormal return for firm *i* at year t, the intercept, the model's parameters, and the error term.

We also want to test models with accrual-based and cash flow-based performance measures alone. Doing so allows us to examine the explanatory power of accruals and cash flows individually. Further, we want to test if WCFO has information content beyond what is contained in NI. The additional equations will be helpful for hypothesis testing. We formulate the following models:

$$CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \varepsilon_{i,t} \qquad \text{(M2)}$$

$$CAR_{i,t} = \alpha_0 + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t} \qquad \text{(M3)}$$

$$CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t} \qquad \text{(M4)}$$

where $CAR_{i,t}$, α_0, β_1, β_2, γ_1, γ_2, γ_3, and $\varepsilon_{i,t}$ are the cumulative abnormal return at year t, the intercept, the model’s parameters, and the error term.

Models 2 through 4 are included to test the information content of the different components of cash flows and accruals and the relative information content of combined cash flows and accruals. The results for these models will not be discussed as a part of the regression outcomes, but instead, be a part of the hypothesis testing section. With Model 2, we can test if WCFO has information content beyond earnings. Additionally, we can see if accruals have information content on their own. We do, however, expect that earnings contain information, so the interesting interpretation of Model 2 is to see if WCFO has incremental information content. Model 3 allows us to test if cash flows have information content on their own. With Model 4, we test if cash flows have incremental information content beyond earnings.

We have accounting data and cumulative abnormal returns back to 1998 and 1999, respectively. However, we choose to only use the years from 2007 and onwards. The reason for this is that we have few observations in the year 1999 (38 observations) to 2006 (65 observations). From 2007 (79 observations) to 2018 (134 observations), there is an increasing number of observations. Including the years with few observations would give us a highly unbalanced dataset. This would be particularly problematic for the pooled regressions.

6.4 Outliers

An outlier is an observation that is "irrelevant, grossly erroneous, or abnormal" compared to the majority of the data (Hoo, Tvarlapati, Povoso, & Hajare, 2002, p. 17). Outliers may lead to incorrect conclusions if the effects of them are not accounted for (Hoo et al., 2002). By looking at boxplots and histograms of our data, it seems like there are quite a few outliers in our data (see Appendix B). We, therefore, want to see if treating the outliers has effects on the results compared to the analysis where they are included.

One way of dealing with outliers is to delete them. This is the method used by Livnat and Zarowin (1990)[19] and Plenborg (1999)[20]. Instead of deleting outliers, Tukey (1962) suggests that *winsorizing* the sample is a better approach. This method is supported by Dixon (1960), who finds that winsorized means are more stable than trimmed[21] means. Winsorizing entails replacing the value of an extreme observation by the nearest value that seems appropriate (Tukey, 1962). The method calls for a symmetrical replacement of the k smallest (largest) values with the $(k+1)^{st}$ smallest (largest). The philosophy behind this approach is that the best treatment of outliers is not to reject them but transforming them to a reasonable value. It is preferable to use this method because we keep the weight of the extreme observations in the tail.

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[19] Deleted all observations which contains components that is more than four standard deviations from the cross-sectional mean. They only report on the entire sample and the deletion of outliers is only used in a sensitivity analysis.
[20] Deleted all values with an absolute change (level) specification greater than two (three).
[21] Trimmed referrers to deleting an equal number of observations with the highest and lowest values.

We use an automated process to winsorize our data in Stata. Based on histograms and box plots of the data, we choose to winsorize the 97.5^{th} and 2.5^{th} percentiles. We specify a new variable for all the independent variables containing the original values for all observations that do not fall outside the 2.5 percent boundary of either side of the tails of the distribution. The values falling outside these tails are replaced by the value at the 2.5 percent boundary. Hence, we change 5 percent of the observations in total. A more detailed explanation of the method can be found in Appendix D.

When deleting or changing the values of outliers, there is always a chance that we reject valid data-points. This may bias the results. For that reason, we will report results both from regressions, including all data-points, as well as regressions when the winsorizing procedure is applied.

6.5 Hypotheses Tests

Tests of the incremental information content of individual performance measures conditioned on the information contained in the remaining variables can be formulated as tests of statistical hypotheses. Referring to Model 1, we could test $\beta_1 = 0$, $\beta_2 = 0$, $\gamma_1 = 0$, $\gamma_2 = 0$, and $\gamma_3 = 0$. For example, a test of the incremental information content of net income in addition to the four other measures is formulated as $\beta_1 = 0$.

If the independent variables are highly correlated, it is difficult to untangle the relative information content of the different variables. Hence, the explanatory power of the model cannot easily be assigned to any of the coefficients (Bowen et al., 1987). Patell and Kaplan (1977) and Bowen et al. (1986) find evidence of a high correlation between some combinations of independent variables in Model 1. Thus, interpretation of significance tests on individual coefficients may be difficult.

Pairwise cross-sectional correlations between the independent variables are presented in Table 4. For some years, the correlation between the variables is very high. This goes for both the accruals and cash flows. One way to counter the problem of interpreting results when variables are highly correlated is to test that 1) both coefficients on the accrual measures and 2) the three cash flow measures are equal to zero (Bowen et al., 1987).

Table 4: Pairwise correlations between the independent variables

Year	NI, WCFO	NI, CFO	NI, CFAI	NI, NCF	WCFO, CFO	WCFO, CFAI	WCFO, NCF	CFO, CFAI	CFO, NCF	CFAI, NCF
2007	-0.164	0.270	0.247	0.286	-0.616	-0.183	-0.240	0.102	0.408	0.488
2008	0.038	0.276	0.192	0.490	-0.149	-0.114	-0.183	0.324	0.192	0.514
2009	-0.128	-0.013	0.286	0.548	0.563	-0.049	-0.126	0.090	-0.140	0.647
2010	0.155	0.748	0.005	-0.413	0.152	-0.190	0.167	0.435	-0.167	0.359
2011	0.568	0.538	0.398	0.084	0.758	0.452	0.048	0.625	-0.076	0.131
2012	-0.204	0.448	-0.078	0.112	-0.375	-0.724	0.493	0.071	-0.007	-0.702
2013	0.078	-0.047	0.015	0.088	-0.471	-0.130	-0.417	-0.178	0.526	-0.116
2014	0.364	0.224	0.195	0.422	-0.352	0.076	-0.094	0.484	0.749	0.388
2015	-0.104	0.984	0.979	0.985	-0.147	-0.116	0.129	0.992	0.995	0.991
2016	-0.435	-0.787	-0.530	-0.144	0.243	-0.038	-0.491	0.697	0.379	0.383
2017	0.859	-0.812	-0.717	-0.880	-0.849	-0.791	-0.828	0.919	0.931	0.870
2018	0.781	0.124	-0.006	-0.164	0.241	0.060	-0.094	0.800	0.566	0.499
Mean	**0.151**	**0.163**	**0.082**	**0.118**	**-0.084**	**-0.146**	**-0.136**	**0.447**	**0.363**	**0.371**

The variables are the unexpected components of the measures deflated by the market value of equity at the beginning of the period.

To test the incremental information content of accruals beyond cash flow, we formulate the hypothesis:

$$H_{0:}\ \beta_1 = \beta_2 = 0 \qquad \text{(H1)}$$

To test the information content of cash flow beyond accruals, we formulate the hypothesis:

$$H_0\text{: } \gamma_1 = \gamma_2 = \gamma_3 = 0 \qquad \text{(H2)}$$

The alternative hypotheses to H1 and H2 are that the coefficients are not equal to zero, i.e., the components have information content. With Model 1, H1 is a test of whether the accruals have information content when the cash flows are included in the regression. Similarly, H2 is a test of whether cash flows have information contentment when accruals are included in the model.

7. Results

In this chapter, we report the results from our regression models and perform hypothesis tests. Also, we will perform sensitivity tests and discuss the Ordinary Least Squares (OLS) assumptions.

7.1 Regression Results

We present the results of the annual cross-sectional and pooled regressions of Model 1 in Table 5. The regressions are based on winsorized observations on market value deflated unexpected components of accruals and cash flows and abnormal returns cumulated over the period of April through March. Results from the non-winsorized sample can be seen in Appendix E, and differences in the results are discussed in Section 7.3. Results from the annual cross-sectional regressions of Model 2 to 4 are attached in Appendix E. As discussed earlier, Model 1 is the basis for discussions of the coefficients of accruals and cash flows, while Model 2 to 4 are used for testing the incremental information content. Discussions on the latter can be found in Section 7.2.

In the annual cross-sectional regressions, estimated coefficients for net income are positive and statistically significant in four out of twelve years. This indicates that net income is positively associated with abnormal security returns. Generally, this is consistent with findings in previous literature. Results from the annual cross-sectional regressions are supported by the results from the pooled regressions. Here, we find a positive coefficient significant at all conventional levels. The coefficient is, however, smaller for the pooled regressions. A positive association between unexpected earnings and security returns is consistent with the theoretical proposition of Miller and Rock (1985).

Working capital from operations is, on average, positively associated with abnormal returns. However, the sign of the estimated coefficient is negative in some years. The average coefficient is close to the one obtained in the pooled regression. We also find that the coefficient is lower and less significant than for net income. Plenborg (1999) obtain results similar to this, but in his regressions, none of the years have a negative coefficient for WCFO. With regards to WCFO, our results are more similar to Bowen et al. (1987), who also obtain positive and negative coefficients. WCFO is not statistically significant in the pooled regression and only significant in two out of twelve years in the annual cross-sectional regressions. This suggests that unexpected components of WCFO are not relevant for explaining abnormal returns.

Turning to cash flows, we find that operating cash flows have the highest estimated coefficients of all variables. Significance levels are similar to the ones of net income. This finding is similar to Rayburn (1987) but differs from Plenborg (1999), who finds that net income has the highest association with abnormal returns. An explanation for this might be that earnings have relatively higher information content in Denmark compared to Norway. In the pooled regression, the coefficient of CFO is positive and statistically significant at conventional levels.

Cash flow after investments is, on average, negatively associated with abnormal returns. The average coefficient is, however, very low and generally not significant. This indicates that CFAI is irrelevant for abnormal returns. This result is surprising given that commonly used valuation models bases the equity valuation on this figure. A plausible explanation for the irrelevance of CFAI is that investments are predicted by investors. Hence, abnormal returns cannot be associated with CFAI.

A negative average coefficient suggests that the market reacts negatively to investments. This is the opposite of the implications of the Miller and Rock (1985) model. Following their theoretical model, investments be should be positively associated with security returns. Conversely, a negative association is consistent with Amihud and Lev’s (1981) suggestion that investors react negatively to investment due to expectations of adverse manager behavior. If the coefficient is indeed negative, the evidence suggests that investors on OSE expect managers to undertake negative net present value investments (see Section 4.2 for a discussion). However, this conclusion is highly uncertain due to the low significance.

Plenborg (1999) finds that out of the five measures, CFAI has the lowest information content. In terms of the coefficients in the annual cross-sectional and pooled regression, our results are consistent with Plenborg. The results are only significant for one of the twelve years. In terms of statistical significance, the results from the pooled regression differ from the annual cross-sectional regressions. The coefficient has the same sign, but in the pooled regression, it is significant at 10 percent.

We find that the net cash flow is positively associated with abnormal returns. This is statistically significant for half of the years. NCF seems to be the most significant measure in our analysis. The coefficient on NCF is higher for WCFO and CFAI, but lower than for NI and CFO. In the pooled regression, the coefficient is less than half compared to the mean coefficient for the annual cross-sectional regressions.

Because the difference between CFAI and NCF is CFF, the evidence might suggest that financing cash flows have information content. Further, the association with security returns is positive. This conclusion contradicts the theoretical proposition of Miller and Rock (1985). However, it is consistent with the propositions of Ross (1977) and Brealey et al. (1977). They suggest that information asymmetry between managers and investors leads to a positive perception of debt issuance. Further, CFF contains dividend payments, which is considered a positive signal of future earnings by Miller and Rock (1985). There is, however, a possibility that NCF captures more value relevant information than financing cash flows, i.e., the sum of the cash flow components has incremental information content beyond the components alone. A more detailed analysis of CFF is required to conclude.

In most cases, the results from the pooled and annual cross-sectional regressions support each other. We do, however, find lower coefficients for all measures except CFO in the pooled regression. In the pooled regression, all measures except WCFO are significant on at least the 10 percent level.

For the non-winsorized sample, we obtain similar results for the annual cross-sectional regressions compared to the winsorized sample (see Table 9 in Appendix E). For the pooled regression, we find very low coefficients. We also find that the coefficient of net income is not statistically significant at any conventional level. In addition, the coefficient of NCF in the pooled regression has an opposite sign than

Table 5: Regression results for winsorized sample

Model[a]: $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

	NI	**WCFO**	**CFO**	**CFAI**	**NCF**	**N[b]**	**F[c]**	**R^2**	**H1[d]**	**H2[d]**
2007	1.308	0.143	-0.015	-0.169	0.132	79	1.93*	.117	4.17**	0.26
	(2.87)***	(0.33)	(-0.03)	(-0.87)	(0.48)					
2008	0.470	-0.093	0.599	-0.140	0.571	86	1.75	.099	0.93	0.94
	(1.36)	(-0.19)	(1.06)	(-0.74)	(1.3)					
2009	0.071	-0.335	0.503	-0.111	0.072	92	2.26*	.116	1.46	2.33*
	(0.79)	(-1.6)	(2.59)**	(-0.96)	(0.45)					
2010	0.159	0.709	0.073	0.129	0.244	92	3.30***	.161	4.16**	2.70*
	(1.13)	(2.42)**	(0.23)	(0.8)	(1.81)*					
2011	0.138	-0.345	0.867	-0.174	0.440	98	2.67**	.127	1.01	3.82**
	(0.96)	(-1.07)	(2.79)***	(-1.23)	(2.05)**					
2012	0.132	0.546	0.705	-0.091	-0.331	102	2.79**	.127	2.61*	3.24**
	(1.25)	(1.95)*	(2.96)***	(-0.75)	(-0.73)*					
2013	0.541	0.352	0.016	0.098	0.491	104	6.48***	.248	11.42***	2.92**
	(4.31)***	(1.26)	(0.05)	(0.6)	(2.23)**					
2014	0.061	0.399	-0.010	0.272	0.508	112	4.62***	.180	1.71	5.86***
	(0.40)	(1.43)	(-0.03)	(2.39)**	(2.35)**					
2015	0.215	0.075	0.388	-1.26	0.281	122	2.83**	.109	2.35*	1.84
	(2.01)**	(0.24)	(1.37)	(-1.06)	(1.26)					
2016	0.063	0.016	0.250	-0.070	-0.197	130	0.55	.022	0.22	0.83
	(0.67)	(0.06)	(1.01)	(-0.6)	(-1.25)					
2017	0.003	0.180	0.508	-0.032	0.307	133	4.75***	.158	0.34	7.50***
	(0.04)	(0.81)	(2.59)**	(-0.27)	(2.31)**					
2018	0.283	-0.075	0.301	-0.202	0.098	134	2.97**	.104	5.58***	1.28
	(3.39)***	(-0.36)	(1.43)	(-1.63)	(0.74)					
Mean	**0.287**	**0.131**	**0.349**	**-0.051**	**0.218**	**107**		**.130**		
Pooled	0.157	0.115	0.382	-0.064	0.103	1284	15.68***	.058		
	(4.94)***	(1.48)	(5.26)***	(-1.73)*	(1.99)**					

a. CAR accumulated from April through March. Unexpected components deflated by market value at the beginning of the period. The observations are winsorized at the 2.5th and 97.5th percentiles.
b. Number of observations.
c. F-ratio for the regression
d. F-ratios for H1: $\beta_1 = \beta_2 = 0$ and H2: $\gamma_1 = \gamma_2 = \gamma_3 = 0$
e. t-statistics reported in brackets.
f. p-value:
   * Significant at $0.05 < \alpha \leq 0.1$
   ** Significant at $0.01 < \alpha \leq 0.05$
   *** Significant at $\alpha \leq 0.01$

the other regressions. The sign is also opposite from what we obtain using a return window from January through December, deflating unexpected components by total assets and regressions on Model 3 and 4 (see Table 9 in Appendix E). This leads us to believe that the coefficient is indeed positive and that the coefficients for the four other measures are higher than what it seems like in the non-winsorized pooled regression. For this reason, the non-winsorized pooled regressions will not be considered in the conclusion.

Lev (1989) criticized the empirical market-based research on accounting earnings for low R^2. The explanatory power of our model seems to be fairly close to the models of similar studies. Our model explains, on average, 13 percent of the variation in cumulative abnormal returns with the annual cross-sectional regressions and 5.8 percent with the pooled regression. The average R^2 of the non-winsorized sample is somewhat lower than for the winsorized sample.

7.2 Results of Hypothesis Tests

Based on the models and hypotheses formulated in Section 6.5, we have performed hypotheses tests reported in Table 6. First, we discuss the information content of accruals and cash flows alone. We then discuss the incremental information content of WCFO beyond earnings, cash flows beyond earnings and combined accruals, and combined accruals beyond cash flows.

The information content of accruals

With the hypothesis test based on Model 2, we find evidence suggesting that accruals have information content. The F-ratio of the test that the coefficients of NI and WCFO are equal to zero is 19.00. Hence, we reject the null on all levels. Thus, we conclude that accruals have information content.

The information content of cash flows

Similarly, we test the null hypothesis that the cash flow coefficients are all equal to zero based on Model 3. We obtain an F-ratio of 16.03. We reject the null and accept the alternative hypothesis that cash flows have information content.

Table 6: Association between CAR and accruals and cash flows
Summary of pooled regressions, 2007-2018

	Coefficients (t-statistics)							*F-ratios for H_0*	
Model	**NI**	**WCFO**	**CFO**	**CFAI**	**NCF**	**R^2**	**F-ratio**	$\beta_1 = \beta_2 = 0$	$\gamma_1 = \gamma_2 = \gamma_3 = 0$
1	0.158 (4.94)***	0.115 (1.48)	0.382 (5.26)***	-0.064 (-1.73)*	0.103 (1.99)**	.06	15.68***	14.64***	13.11***
2	0.191 (6.02)***	0.051 (0.67)				.03	19.00***	19.00***	NA
3			0.404 (5.54)***	-0.065 (-1.77)*	0.128 (2.44)**	.04	16.03 ***	NA	16.03***
4	0.164 (5.20)***		0.371 (5.13)***	-0.071 (-1.96)**	0.103 (1.98)**	.06	19.04***	NA	12.52***

M1 $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

M2 $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \varepsilon_{i,t}$

M3 $CAR_{i,t} = \alpha_0 + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

M4 $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

a. CAR accumulated over the period of April through March. Unexpected components deflated by market value of equity at the beginning of the period. The observations are winsorized at the 2.5th and 97.5th percentiles We have 1284 observations for all regressions. Annual cross-sectional regressions of Model 2-4 is attached in Table 10-13 in Appendix E.

b. p-value:
 * Significant at 0.05 < α ≤ 0.1
 ** Significant at 0.01 < α ≤ 0.05
 *** Significant at α ≤ 0.01

The incremental information content of WCFO beyond earnings

We use Model 2 to test the incremental information content of WCFO beyond earnings. The coefficient of WCFO is not significant. Thus, we conclude that WCFO has no information content beyond earnings. This is supported by the findings from the annual cross-sectional regressions (see Table 10 in Appendix E). Our results are consistent with the findings of Bowen et al. (1987).

The incremental information content of cash flows beyond earnings

The last column in Table 6 presents the F-test for the null hypothesis that the coefficients of the cash flow components are equal to zero when earnings are included in the regression. As we can see from the F-test of Model 4, the F-ratio is equal to 12.52, significant at conventional levels. Further, the F-ratio of the individual components are all significant. Hence, we reject the null hypothesis and accept the alternative hypothesis that cash flows have incremental information content beyond earnings.

The incremental information content of cash flows beyond accruals

We find evidence suggesting that cash flows have information content beyond accruals. This can be derived from the F-ratio of H2 in Model 1. We obtain an F-ratio of 13.11, significant at all conventional levels. Hence, we reject the null and accept the alternative hypothesis that cash flows have information content beyond accruals. The results are generally supported by cross-sectional tests. We reject the null hypothesis in five out of the twelve years (see Table 5).

The incremental information content of accruals beyond cash flows

Turning to the incremental information content of accruals, we find that accruals have incremental information content beyond cash flows. The F-ratio of H1 in Model 1 is 14.64, significant at all levels. This is consistent with the alternative hypothesis that aggregated accruals have incremental information content. However, the small t-statistic on WCFO suggests that earnings are the component contributing to the information content. This is supported by the hypothesis test above, concluding that WCFO does not have incremental information content beyond NI. Based on the cross-sectional regressions, we reject the null hypothesis of H2 for half of the years.

7.3 Sensitivity Analysis

The results reported in Section 7.1 and 7.2 may be sensitive to the underlying assumptions and depend on a correct specification of the models. To test the robustness of the results, we control for industry, government ownership, deflating by total assets rather than the market value of equity, change of the return window, and inclusion of all observations rather than winsorizing.

Controlling for industry

Our results are not sensitive to industry[22]. Although some coefficients differ, the conclusion remains the same. This is consistent with Liu, Nissim, and Thomas (2002), who suggest that there are not different best multiples for different industries. Similarly, it seems like the information content of accruals and cash flows are the same across industries.

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[22] We control for industry using dummy variables. Determination of industries are based on the OSE industry classification.

In addition to the control for all sectors described above, we run a separate regression on oil companies. We define oil companies as companies producing oil and oil service companies (infrastructure, seismic analysis, et cetera). It seems like the information content of accruals and cash flows is very similar to those of the entire sample, with the exception of a low and insignificant coefficient on net income. Results from a pooled regression on oil companies are included in Table 7 in Appendix E.

Controlling for government ownership

We find that the information content of net income is significantly higher for companies where the government owns a portion of the shares. In the pooled regression, we find that the coefficient of NI is 1.376, significant at the 1 percent level, compared to 0.157 for the entire population. We generally find lower and not significant coefficients for the cash flow measures. Based on these results, it might seem like the information content of accruals and cash flows are different for government-owned companies than other firms. It is difficult to say why this is the case. One reason may be that the government reacts differently to news. It might also be random effects causing the differences. More research is needed to conclude.

Deflating unexpected components by total assets

Consistent with Livnat and Zarowin (1990), we find that deflating unexpected components of accruals and cash flows by market value and total assets yield the same results. The average coefficients are somewhat lower when deflated by total assets. We also find a slightly lower statistical significance.

Changing the return window

Instead of cumulating abnormal return over the period since the last annual report, i.e., April through March, we cumulate over the calendar year. Consistent with previous literature (e.g., Livnat & Zarowin, 1990; Plenborg, 1999), we find that our conclusion is not sensitive to the return window. Some coefficients change, but the conclusion remains the same. For the pooled regressions, we find higher coefficients, except for NCF, and slightly higher significance when cumulating abnormal returns over the contemporaneous year.

Winsorizing outliers

We find that our conclusion is insensitive to outliers in the annual cross-sectional regressions. However, we obtain higher average coefficients when running regressions on winsorized data. At the same time, the significance seems to be lower. WCFO appears to be the most sensitive measure to winsorizing in terms of the mean coefficient (0.131 when winsorized compared to 0.030 when not). Together with CFAI, WCFO is the measure where the significance levels are most sensitive to winsorizing. In the pooled regression, we find very low coefficients compared to the non-winsorized sample. Further, the coefficient on net income is not significant at any level. As discussed in Section 7.1, we chose to disregard the results from the pooled regressions on non-winsorized data because it differs from all other results obtained in this study.

7.4 Model Assumptions

Our models are linear multiple regression models. We use the ordinary least squares method (OLS) to predict the coefficients. OLS builds on a set of assumptions. We have tested our models for heteroskedasticity, exogeneity, and multicollinearity. Concerning the last two assumptions, our model holds in all cases. These assumptions are tested by inspections of the mean residuals and the variance inflation factor, respectively. The mean residuals are zero (or very close to zero) and the variance inflation factor is between 1.01 and 1.48, depending on the model.

In the cross-sectional regressions, we find some presence of heteroskedasticity for some of the years. The findings are based on White's test and the Breusch-Pagan test. As Breusch-Pagan is designed for detecting linear heteroskedasticity, we choose to complement it by the White's test, which lends itself better to detecting non-linear heteroskedasticity. Residual plots strengthen the suspicion of some, but not severe, heteroskedasticity.

To test our results for sensitivity of cross-sectional heteroskedasticity, we performed regressions with robust standard errors. Generally, the significance of the regressions with robust standard errors are very similar to those reported in this study. Hence, we do not believe that heteroskedasticity poses a problem.

8. Conclusion

Both accrual-based and cash flow-based performance measures have incremental information content for companies listed on the Oslo Stock Exchange. This corresponds to Panel A in the illustration of possible hypotheses outcomes in Appendix C. Cash flow from operations is the superior performance measures. Further, we find that net income has a high information content but lower than for cash flow from operations. Net cash flow also contains some information, but the information content of cash flow after investments is low. We do not find evidence for incremental information content of working capital from operations beyond earnings.

We observe the following ranking of the performance measures; 1) cash flow from operations, 2) net income, 3) net cash flow, 4) cash flow after investments, and 5) working capital from operations. The ranking of individual measures should be interpreted with care due to high correlations between them. Hence, assigning explanatory power to individual variables is difficult. Further, the information content of cash flow after investments and working capital from operations are both similarly low. The order of the ranking of these measures is, therefore, not very important.

All measures have a positive association with abnormal return, except cash flow after investments, which has a negative association. This suggests that investors react negatively to increased investments but positively to increases beyond expectations in the other variables. Further, negative reactions to investments suggest that the principal-agent problem is present in the Norwegian market. However, the low statistical significance of this finding leads us to question this conclusion. A negative (positive) coefficient on cash flow after investments (operating cash flow) differs from the findings of Plenborg (1999). A positive association between operating cash flow and abnormal returns is, however, consistent with Bowen et al. (1987) and Livnat and Zarowin (1990).

We conclude that the aggregate effect of cash flows has relative information content over the aggregate effect of accruals. Because both have incremental information content, we base the conclusion on the size of the cash flow coefficients and their significance. The aggregate effect of the cash flows is primarily driven by operating cash flows. Both in the pooled and cross-sectional regressions, we consistently obtain notably higher coefficients for operating cash flows compared to the other measures. Further, it is also the most significant measure.

The practical implication of the results is that cash flow-based performance measures are superior for the Norwegian market, but the information content is improved when supplemented by earnings. From a practitioner's perspective, this matters to the choice valuation models.

Our conclusion is consistent with Plenborg (1999) regarding the aggregated effects but differs in terms of ranking of the measures. He finds that, in a Danish context, earnings have the highest information content. This suggests that Danish earnings are relatively more informative than Norwegian. Consequently, Norwegian cash flows are relatively more informative than Danish. In line with the findings by Bowen et al. (1987) in the UK, we find that both cash flows and accruals have incremental information content in the Norwegian market.

9. Limitations of the Study and Implications for Future Research

We have chosen to use a linear model to explain the relationship between abnormal returns and accounting measures. Some researchers argue that a non-linear model is preferable (e.g., Ali and Pope, 1994, 1995). Freeman and Tse (1992) find some evidence suggesting that a linear specification may lead to a slope coefficient biased towards zero. However, Ali and Pope (1994) obtain similar results to studies with linear specifications.

For some of the performance measures, we find large variations in the coefficients and significance between years. This is typical for information content studies. However, there is a chance that the selected years in the study impact the results. Hence, results should be interpreted carefully. Attempting to explain *why* the information content of a variable change between years might be fruitful for future researchers.

Our study uses a high level of aggregation of accruals and cash flow measures. For example, investing cash flows compromises investments in tangible, intangible, and financial assets. Financing cash flows compromises debt and equity flows. Similarly, for accruals, earnings compromise all costs and revenues. As a consequence, some information may be lost as the data offset each other. As far as we can see, Livnat and Zarowin (1990) are the only researchers analyzing a decomposed cash flow statement. No decomposition has been done of accruals. It would, therefore, be interesting to investigate the information in decomposed accruals and cash flows, both for the Norwegian and foreign markets.

In our analysis, we find that the information content of accruals and cash flows for firms where the government holds shares are different from other firms. In particular, earnings seem to be relatively more informative for these firms. This may be caused by random effects. However, there might be structural explanations in the companies or how investors in government-owned firms react to news. Generally, the literature on how government ownership affects the market or specific shares is limited. We encourage future research on this topic.

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Appendices

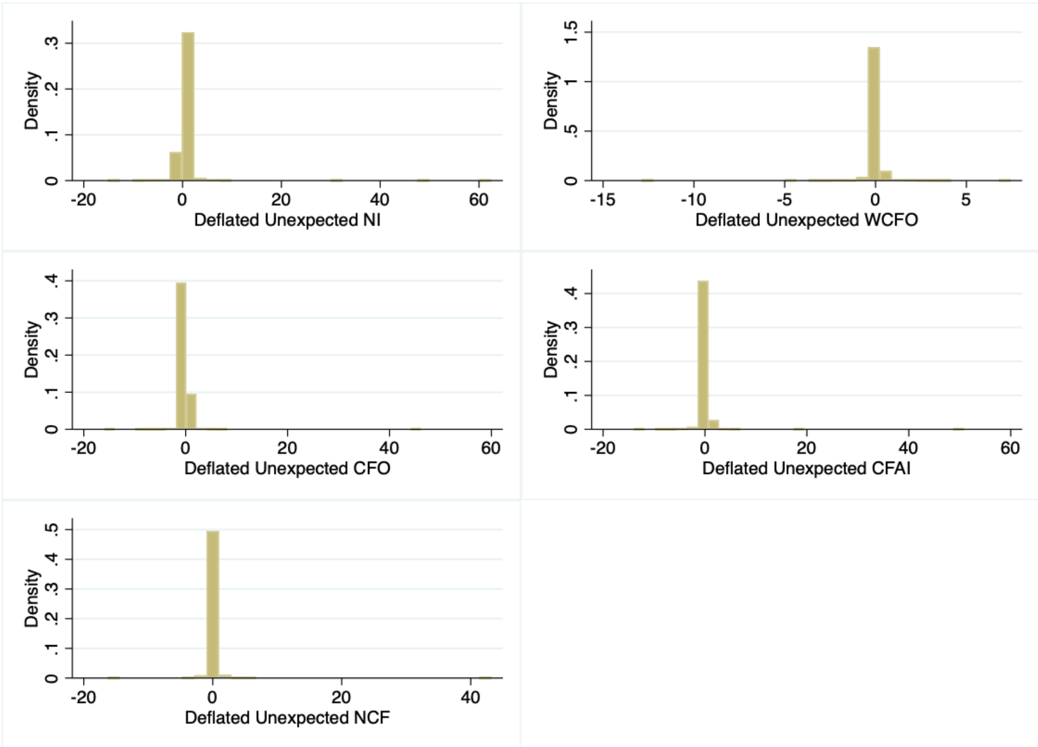
Appendix A: Downloaded Data and Data Sources

Variable	Bloomberg Command	Source	Comment
HML		BI Finance	Used to estimate CAR
LIQ		BI Finance	Used to estimate CAR
Market returns		BI Finance	Used to estimate CAR
PR1YR		BI Finance	Used to estimate CAR
Risk-free rate		BI Finance	Used to estimate CAR
SMB		BI Finance	Used to estimate CAR
Cash and Cash Equivalents	BS_CASH_NEAR_CASH_ITEM	Bloomberg	Used for WCFO calculation
Cash from Financing Activities	CF_CASH_FROM_FNC_ACT	Bloomberg	Used for NCF calculation
Cash from Investing Activities	CF_CASH_FROM_INV_ACT	Bloomberg	Used for CFAI calculation
Cash from Operations (CFO)	CF_CASH_FROM_OPER	Bloomberg	
Derivative and Hedging Assets ST	BS_DERIV_&_HEDGING_ASSETS_ST	Bloomberg	Used for WCFO calculation
Derivative and Hedging Liabilities ST	BS_DERIVATIVE_&_HEDGING_LIABS_ST	Bloomberg	Used for WCFO calculation
Historical Market Cap	HISTORICAL_MARKET_CAP	Bloomberg	Used as deflator
Historical prices	EQUITY_HP	Bloomberg	Used to estimate CAR
Net Income (NI)	NET_INCOME	Bloomberg	
Other Financial Assets – Current	ARD_OTHER_FINL_ASSETS_CURRENT	Bloomberg	Used for WCFO calculation
Short Term Debt	BS_ST_BORROW	Bloomberg	Used for WCFO calculation
Total Assets	BS_TOT_ASSET	Bloomberg	Used as deflator
Total Current Assets	BS_CUR_ASSET_REPORT	Bloomberg	Used for WCFO calculation
Total Current Liabilities	BS_CUR_LIAB	Bloomberg	Used for WCFO calculation

BI Finance = Online database by the Department of Finance at BI Norwegian Business School

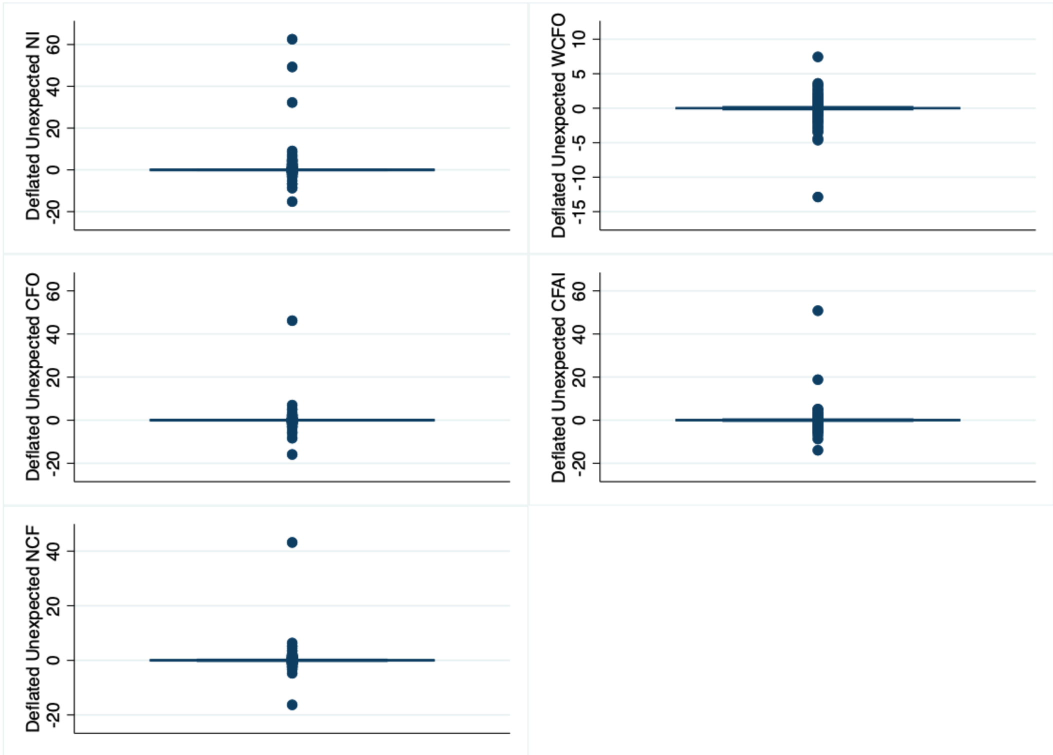
Appendix B: Histograms and Boxplots of the Independent Variables

Histograms of independent variables



Due to the existence of extreme observations, the histograms are oddly shaped. See Appendix D for histograms where extreme observations are winsorized.

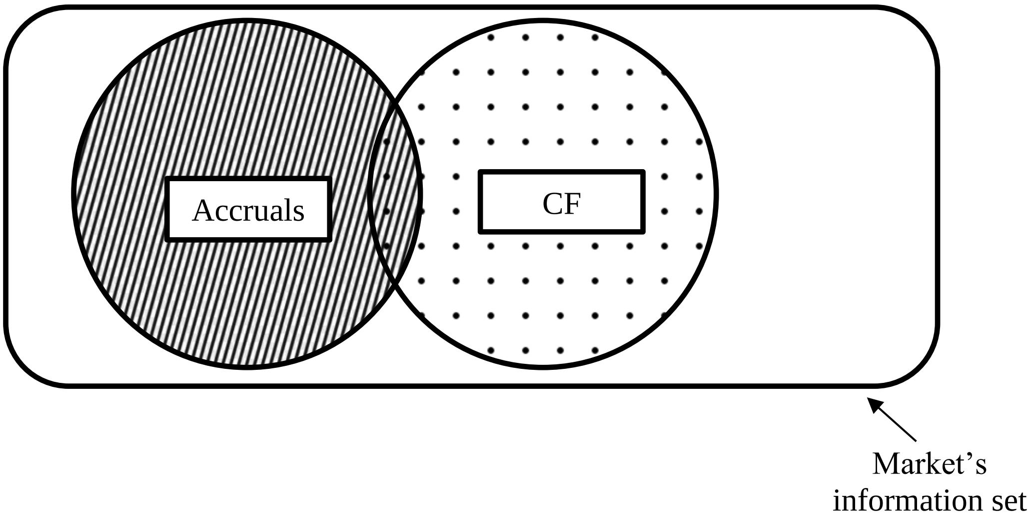
Boxplots of the independent variables



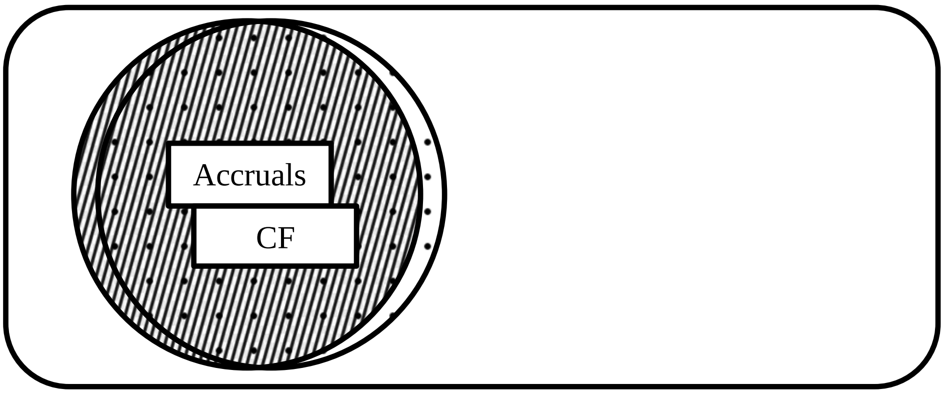
From the boxplots, it is clear that there are extreme observations in our data. See Appendix D for boxplots where the variables are winsorized.

Appendix C: Possible Outcomes of the Hypotheses Tests

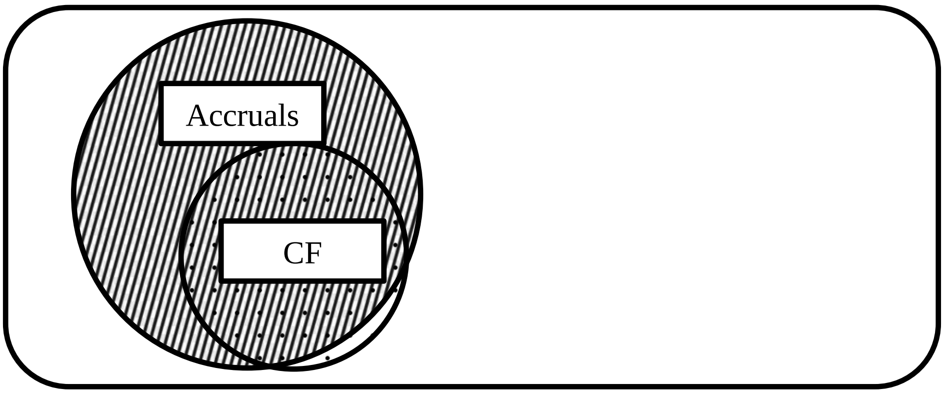
Panel A: Both individually and incrementally important



Panel B: Both individually important, but neither is incrementally important



Panel C: Each individually important, but one (e.g., accruals) is incrementally important

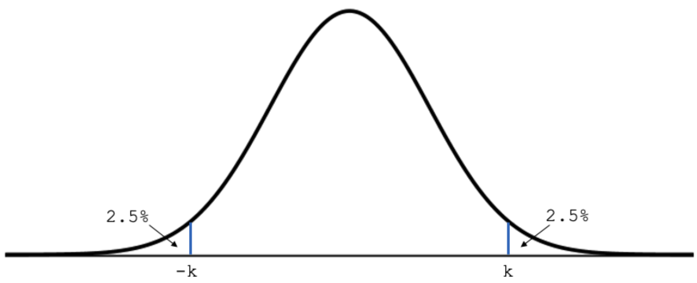


The cases “neither is individually important, but both are incrementally important” and “neither is individually nor incrementally important” are not illustrated.

The figures illustrate possible outcomes from the hypotheses tests. The large rectangle represents the whole set of relevant information available in the market, while the two circles represent the information content of accruals and cash flows, respectively. In Panel A, we illustrate the situation where both have individual and incremental importance. Here, both accruals and cash flows are significantly associated with abnormal returns. Panel B depicts the case where both are individually important, but neither has incremental information content. Essentially, accruals and cash flows are substitutes for each other. In Panel C, both are individually important, but one has incremental information content relative to the other. In the illustration, accruals have incremental information content beyond cash flows but not vice versa.

Appendix D: Winsorizing

Winsorizing is a process where we define a certain percentage of the observations that we classify as outliers and change the value with the closest value of an observation that seems appropriate. After examining the different percentages of the population to winsorize and its respective box plots and histograms, we decided to replace the 2.5 percent highest and lowest observations. We illustrate this in the distribution below[23]. All values less than -*k* are replaced with -*k* and all values greater than *k* are replaced by *k*.



We use the Stata command *winsor* to generate new values of the top and bottom 2.5 percent of the tails:

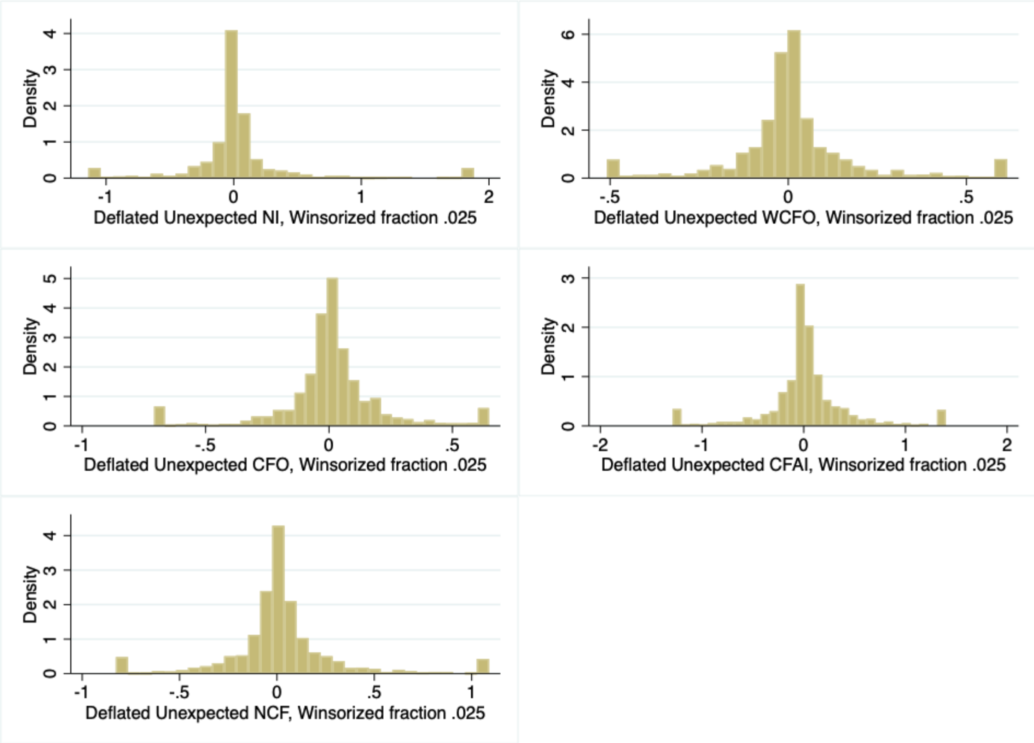
```
winsor du_ni, gen(du_ni_w) p(0.025)
```

With this command, we create a new variable *du_ni_w* of the old variable *du_ni* (deflated unexpected net income) that contains the winsorized values. We repeat this process for all independent variables.

Below, we include the histogram of all winsorized independent variables. As we can see, the bar at each side of the distribution is large because all values *v*, -*k* > *v* > *k*, are replaced with +/- *k*.

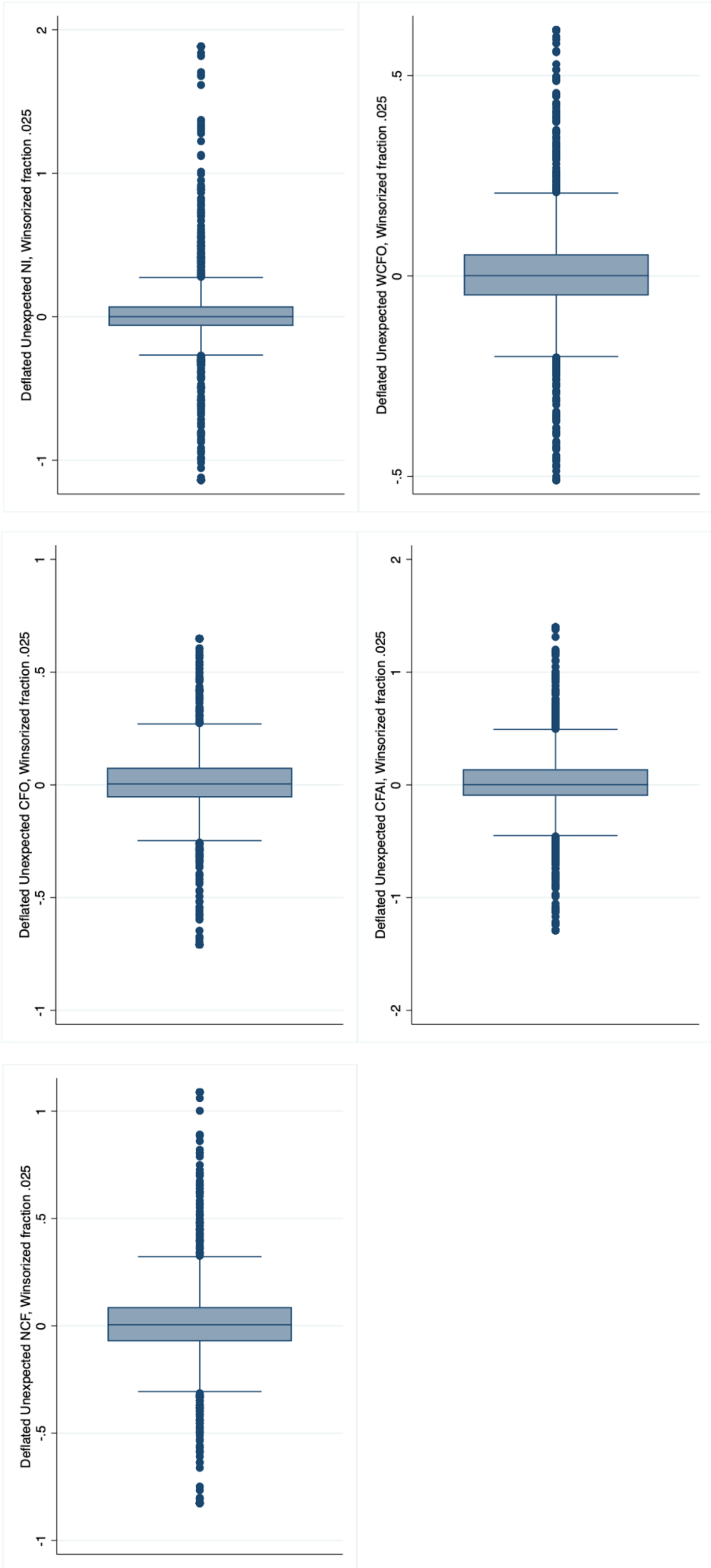
[23] The graph is for illustrative purposes and are not the distribution of our data. The actual distribution before (after) winsorizing can be seen in Appendix B (below).

Histograms of winsorized variables



For the non-winsorized histograms, see Appendix B.

Boxplots of winsorized variables



Appendix E: Additional Regressions

Table 7: Regression results controlling for government ownership and oil companies

Model[a]: $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

Pooled regressions for the period 2007-2018

	Coefficients (t-statistics) for the sample:	
	Government	**Oil**
NI	1.378	0.049
	(3.08)***	(0.65)
WCFO	0.114	-0.036
	(0.23)	(-0.10)
CFO	0.047	0.158
	(0.93)	(4.84)***
CFAI	0.243	-0.060
	(-0.67)	(-1.96)*
NCF	-0.211	-0.081
	(-0.55)	(-2.10)**
# Observations	63	357
F-ratio	2.54**	5.23***
R^2	0.18	0.07

a. CAR accumulated over the period of April through March. Unexpected components deflated by market value of equity at the beginning of the period. The observations are winsorized at the 2.5th and 97.5th percentiles.
b. p-value:
   * Significant at $0.05 < \alpha \leq 0.1$
   ** Significant at $0.01 < \alpha \leq 0.05$
   *** Significant at $\alpha \leq 0.01$

Table 8: Regression results for cumulated AR over the contemporaneous year
Model[a]: $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

	NI	**WCFO**	**CFO**	**CFAI**	**NCF**	**N**[b]	**F**[c]	**R^2**
2007	1.230	0.302	0.331	-0.161	-0.041	79	1.68	0.103
	(2.57)**	(0.67)	(0.64)	(-0.78)	(-0.14)			
2008	0.761	-0.549	0.318	-0.285	-0.122	86	1.58	0.090
	(2.13)**	(-1.09)	(0.54)	(-1.45)	(-0.27)			
2009	0.199	-0.589	0.496	-0.319	0.143	92	4.87***	0.221
	(2.25)**	(-2.83)***	(2.57)**	(-2.77)***	(0.90)			
2010	0.284	0.222	0.229	0.025	0.227	92	1.97*	0.103
	(1.65)	(0.62)	(0.59)	(0.13)	(1.38)			
2011	0.191	-0.385	0.903	-0.208	0.303	98	2.25*	0.109
	(1.23)	(-1.11)	(2.71)***	(-1.37)	(1.31)			
2012	0.109	0.631	0.586	-0.006	-0.398	102	2.20*	0.103
	(1.01)	(2.20)**	(2.39)**	(-0.05)	(-2.03)**			
2013	0.397	0.571	0.463	0.044	0.244	104	3.68***	0.158
	(2.80)***	(1.81)*	(1.27)	(0.24)	(0.98)			
2014	0.316	0.086	0.450	0.124	0.293	112	5.97***	0.220
	(2.25)**	(0.34)	(1.73)*	(1.19)	(1.48)			
2015	0.101	0.282	0.463	-0.149	0.039	122	1.03	0.042
	(0.85)	(0.81)	(1.48)	(-1.13)	(0.16)			
2016	0.103	0.346	0.247	0.011	-0.407	130	1.87	0.070
	(1.06)	(1.24)	(0.96)	(0.09)	(-2.50)**			
2017	0.082	0.179	0.403	-0.118	0.365	133	4.21***	0.142
	(1.04)	(0.81)	(2.07)**	(-1.00)	(2.77)***			
2018	0.333	-0.108	0.270	-0.167	0.164	134	3.57***	0.122
	(3.81)***	(-0.50)	(1.22)	(-1.29)	(1.18)			
Mean	**0.342**	**0.082**	**0.430**	**-0.101**	**0.068**	**107**		**0.124**
Pooled	0.172	0.115	0.438	-0.111	0.007	1284	14.65***	0.054
	(5.14)***	(1.41)	(5.74)***	(-2.89)***	(0.14)			

a. CAR accumulated from January through December. Unexpected components deflated by market value at the beginning of the period. The observations are winsorized at the 2.5th and 97.5th percentiles.
b. Number of observations.
c. F-ratio for the regression.
d. t-statistics reported in brackets.
e. p-value:
  * Significant at 0.05 < α ≤ 0.1
  ** Significant at 0.01 < α ≤ 0.05
  *** Significant at α ≤ 0.01

Table 9: Regression results for total asset deflated unexpected components
Model[a]: $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

	NI	**WCFO**	**CFO**	**CFAI**	**NCF**	**N**[b]	**F**[c]	**R^2**	**H1**[d]	**H2**[d]
2007	1.508	-0.409	-0.379	-0.137	0.093	79	3.18**	0.179	6.49***	0.41
	(3.42)***	(-1.18)	(-0.80)	(-0.85)	(0.54)					
2008	0.854	-0.374	0.155	-0.142	0.245	86	1.97*	0.110	2.96*	0.24
	(2.42)**	(-0.64)	(0.33)	(-0.46)	(0.76)					
2009	-0.190	-0.967	1.113	-0.598	0.015	92	1.48	0.079	1.83	2.26*
	(-0.61)	(-1.90)*	(2.46)**	(-1.57)	(0.08)					
2010	0.160	0.405	0.175	-0.352	0.250	92	1.39	0.075	2.01	1.84
	(0.96)	(0.98)	(0.44)	(-1.00)	(1.95)*					
2011	0.824	-0.265	-0.417	0.010	0.137	98	1.41	0.071	1.64	0.43
	(1.81)*	(-0.50)	(-1.05)	(0.02)	(0.46)					
2012	1.066	2.253	1.270	-0.707	0.443	102	5.78***	0.232	11.93***	4.13***
	(3.71)***	(2.76)***	(2.43)**	(-1.97)*	(2.79)***					
2013	-0.001	0.304	0.796	-0.054	0.261	104	1.72	0.081	0.27	2.50*
	(-0.07)	(0.73)	(1.57)	(-0.33)	(2.10)**					
2014	-0.045	0.350	-0.018	0.286	0.096	112	0.91	0.041	0.28	0.78
	(-0.18)	(0.75)	(-0.06)	(1.19)	(0.82)					
2015	0.584	-0.629	0.330	-0.645	0.115	122	2.11*	0.084	2.42*	2.60*
	(2.19)**	(-0.75)	(0.84)	(-2.50)**	(0.79)					
2016	0.231	-0.109	0.085	0.004	-0.173	130	1.43	0.055	1.59	0.33
	(1.25)	(-1.29)	(0.15)	(0.001)	(-0.92)					
2017	0.726	0.600	0.259	-0.076	0.399	133	4.69***	0.156	8.11***	6.18***
	(3.89)***	(1.35)	(1.99)**	(-1.36)	(3.50)***					
2018	0.658	-0.257	0.629	-0.223	0.037	134	6.30***	0.197	11.22***	2.40*
	(4.72)***	(-0.90)	(2.30)**	(-2.11)**	(0.67)					
Mean	**0.531**	**0.075**	**0.333**	**-0.220**	**0.160**	**107**		**0.113**		
Pooled	0.011	-0.127	0.256	-0.064	0.082	1284	6.50***	0.025	5.32***	7.41***
	(1.58)	(-2.88)***	(3.57)***	(-1.57)	(2.53)**					

a. CAR accumulated from April through March. Unexpected components deflated by total assets at the beginning of the period.
b. Number of observations.
c. F-ratio for the regression.
d. F-ratios for H1: $\beta_1 = \beta_2 = 0$ and H2: $\gamma_1 = \gamma_2 = \gamma_3 = 0$
e. t-statistics reported in brackets.
f. p-value:
   * Significant at $0.05 < \alpha \leq 0.1$
   ** Significant at $0.01 < \alpha \leq 0.05$
   *** Significant at $\alpha \leq 0.01$

Table 10: Regression results for the non-winsorized sample
Model[a]: $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

	NI	**WCFO**	**CFO**	**CFAI**	**NCF**	**N[b]**	**F[c]**	**R^2**
2007	1.305	0.116	-0.054	-0.187	0.156	79	1.98*	0.120
	(0.29)**	(0.30)	(-0.10)	(-0.99)	(0.66)			
2008	0.585	-0.224	0.679	-0.134	0.090	86	1.48	0.085
	(1.59)	(-0.46)	(1.18)	(-0.72)	(0.35)			
2009	0.018	-0.251	0.336	-0.159	0.117	92	2.53**	0.128
	(0.28)	(-2.42)**	(3.11)***	(-1.93)*	(1.16)			
2010	0.164	-0.039	-0.043	0.011	0.251	92	1.51	0.081
	(1.56)	(-0.29)	(-0.21)	(0.08)	(2.06)**			
2011	0.039	-0.495	0.533	-0.276	0.531	98	2.89**	0.136
	(0.33)	(-2.02)**	(3.10)***	(-2.16)**	(2.77)***			
2012	0.049	0.567	0.164	0.074	-0.209	102	4.20***	0.179
	(1.27)	(3.74)***	(2.64)***	(1.78)*	(-1.89)*			
2013	0.189	0.467	0.318	0.024	0.272	104	5.21***	0.210
	(3.35)***	(2.70)***	(1.59)	(0.38)	(1.91)*			
2014	0.088	0.039	0.101	0.242	0.078	112	5.29***	0.200
	(0.80)	(0.44)	(0.71)	(2.66)***	(0.70)			
2015	0.021	0.070	0.034	-0.157	0.134	122	0.84	0.035
	(0.35)	(1.33)	(0.22)	(-1.54)	(0.86)			
2016	0.002	0.000	0.158	-0.067	-0.106	130	1.00	0.039
	(0.05)	(0.00)	(1.34)	(-0.75)	(-1.27)			
2017	0.052	0.260	0.328	-0.047	0.020	133	9.73***	0.277
	(2.62)***	(2.46)**	(4.17)***	(-0.80)	(0.25)			
2018	0.094	-0.150	0.296	0.170	0.054	134	2.53**	0.090
	(2.92)***	(-3.05)***	(1.61)	(-1.71)*	(0.51)			
Mean	**0.217**	**0.030**	**0.240**	**-0.070**	**0.116**	**107**		**0.132**
Pooled	0.005	0.008	0.095	-0.031	-0.41	1284	4.02***	0.015
	(0.76)	(0.31)	(3.79)***	(-1.85)*	(-1.72)*			

a. CAR accumulated from April through March. Unexpected components deflated by market value at the beginning of the period.
b. Number of observations.
c. F-ratio for the regression.
d. t-statistic reported in brackets.
e. p-value:
   * Significant at $0.05 < \alpha \leq 0.1$
   ** Significant at $0.01 < \alpha \leq 0.05$
   *** Significant at $\alpha \leq 0.01$

Table 11: Regression results for Model 2

Model[a]: $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \beta_2 WCFO_{i,t} + \varepsilon_{i,t}$

	NI	WCFO	N[b]	F[c]	R^2
2007	1.281	0.182	79	4.57**	0.107
	(3.02)***	(0.52)			
2008	0.717	-0.316	86	2.97*	0.067
	(2.36)**	(-0.68)			
2009	0.133	-0.320	92	2.07	0.044
	(1.52)	(-1.52)			
2010	0.152	0.499	92	3.97**	0.082
	(1.24)	(1.96)*			
2011	0.145	-0.305	98	0.87	0.018
	(0.98)	(-0.91)			
2012	0.174	0.300	102	1.98	0.038
	(1.64)	(1.23)			
2013	0.562	0.256	104	11.18***	0.181
	(4.39)***	(0.95)			
2014	0.244	0.206	112	2.43*	0.043
	(1.55)	(0.73)			
2015	0.295	-0.139	122	4.21**	0.066
	(2.90)***	(-0.46)			
2016	0.035	0.108	130	0.14	0.002
	(0.39)	(0.42)			
2017	0.084	-0.071	133	0.55	0.008
	(1.03)	(-0.32)			
2018	0.271	-0.062	134	5.46***	0.077
	(3.27)***	(-0.30)			
Mean	**0.341**	**0.028**	**107**		**0.061**
Pooled	0.191	0.051	1284	19.00***	0.029
	(6.02)***	(0.67)			

a. CAR accumulated from April through March. Unexpected components deflated by market value at the beginning of the period. The observations are winsorized at the 2.5th and 97.5th percentiles.
b. Number of observations.
c. F-ratio for the regression.
d. t-statistic reported in brackets.
e. p-value:
   * Significant at $0.05 < \alpha \leq 0.1$
   ** Significant at $0.01 < \alpha \leq 0.05$
   *** Significant at $\alpha \leq 0.01$

Table 12: Regression results for Model 3
Model[a]: $CAR_{i,t} = \alpha_0 + CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

	CFO	**CFAI**	**NCF**	**N[b]**	**F[c]**	**R^2**
2007	0.137	-0.116	0.251	79	0.40	0.016
	(0.32)	(-0.59)	(0.87)			
2008	0.759	-0.142	0.791	86	2.30*	0.078
	(1.38)	(-0.75)	(1.98)*			
2009	0.524	-0.086	0.085	92	2.77**	0.086
	(2.45)***	(-0.75)	(0.53)			
2010	0.572	-0.130	0.207	92	2.54*	0.080
	(2.20)**	(-0.94)	(1.54)			
2011	0.846	-0.152	0.452	98	3.78**	0.108
	(2.73)***	(-1.09)	(2.11)**			
2012	0.621	-0.190	-0.211	102	2.82**	0.079
	(2.73)***	(-1.66)*	(-1.14)			
2013	-0.231	0.116	0.596	104	.2.36*	0.073
	(-0.68)	(0.66)	(2.49)**			
2014	-0.132	0.274	0.583	112	6.47***	0.152
	(-0.47)	(2.41)**	(2.74)***			
2015	0.404	-0.119	0.390	122	3.08	0.073
	(1.49)	(-1.01)	(1.78)*			
2016	0.257	-0.056	-0.181	130	0.78	0.018
	(1.05)	(-0.5)	(-1.19)			
2017	0.514	-0.061	0.311	133	7.78***	0.0153
	(2.66)***	(-0.54)	(2.42)**			
2018	0.307	-0.175	0.058	134	0.95	0.022
	(1.41)	(-1.37)	(0.42)			
Mean	**0.381**	**-0.070**	**0.278**	**107**		**0.078**
Pooled	0.484	-0.065	0.128	1284	16.03***	0.0362
	(5.54)***	(-1.77)*	(2.44)**			

a. CAR accumulated from April through March. Unexpected components deflated by market value at the beginning of the period. The observations are winsorized at the 2.5th and 97.5th percentiles.
b. Number of observations.
c. F-ratio for the regression.
d. t-statistic reported in brackets.
e. p-value:
   * Significant at $0.05 < \alpha \leq 0.1$
   ** Significant at $0.01 < \alpha \leq 0.05$
   *** Significant at $\alpha \leq 0.01$

Table 13: Regression results for Model 4

Model[a]: $CAR_{i,t} = \alpha_0 + \beta_1 NI_{i,t} + \gamma_1 CFO_{i,t} + \gamma_2 CFAI_{i,t} + \gamma_3 NCF_{i,t} + \varepsilon_{i,t}$

	NI	**CFO**	**CFAI**	**NCF**	**N[b]**	**F[c]**	**R^2**	**H2[d]**
2007	1.301	-0.100	-0.183	0.135	79	2.42*	0.116	0.32
	(2.89)***	(-0.24)	(-0.97)	(0.49)				
2008	0.459	0.614	-0.141	0.591	86	2.20*	0.098	1.10
	(1.36)	(1.10)	(-0.75)	(1.40)				
2009	0.054	0.493	-0.085	0.081	92	2.15*	0.090	2.24*
	(0.60)	(2.52)**	(-0.73)	(0.51)				
2010	0.217	0.316	-0.073	0.261	92	2.52**	0.104	1.99
	(1.52)	(1.03)	(-0.52)	(1.89)*				
2011	0.134	0.855	-0.176	0.436	98	3.05**	0.116	3.73**
	(0.93)	(2.75)***	(-1.24)	(2.03)**				
2012	0.125	0.569	-0.178	-0.228	102	2.46	0.092	2.43*
	(1.17)	(2.46)**	(-1.56)	(-1.22)				
2013	0.569	-0.084	0.061	0.525	104	7.65***	0.236	2.69
	(4.60)***	(-0.27)	(0.38)	(2.40)**				
2014	0.162	-0.108	0.259	0.531	112	5.21***	0.163	5.33***
	(1.18)	(-0.39)	(2.27)**	(2.45)**				
2015	0.222	0.367	-0.121	0.281	122	3.55***	0.108	1.91
	(2.16)**	(1.37)	(-1.04)	(1.27)				
2016	0.062	0.252	-0.071	-0.198	130	0.70	0.022	0.90
	(0.67)	(1.03)	(-0.62)	(-1.28)				
2017	0.012	0.510	-0.057	0.306	133	5.79***	0.153	7.34***
	(0.16)	(2.60)***	(-0.49)	(2.30)**				
2018	0.276	0.307	-0.197	0.096	134	3.70***	0.103	1.28
	(3.42)***	(1.47)	(-1.61)	(0.73)				
Mean	**0.300**	**0.333**	**-0.080**	**0.235**	**107**		**0.117**	
Pooled	0.164	0.371	-0.071	0.103	1284	19.04***	0.056	12.52***
	(5.20)***	(5.13)***	(-1.96)**	(1.98)**				

a. CAR accumulated from April through March. Unexpected components deflated by market value at the beginning of the period. The observations are winsorized at the 2.5th and 97.5th percentiles.
b. Number of observations.
c. F-ratio for the regression.
d. F-ratios for H2: $\gamma_1 = \gamma_2 = \gamma_3 = 0$
e. t-statistics reported in brackets.
f. p-value:
   * Significant at $0.05 < \alpha \leq 0.1$
   ** Significant at $0.01 < \alpha \leq 0.05$
   *** Significant at $\alpha \leq 0.01$

Appendix F: Preliminary Thesis Report

Preliminary Thesis Report

Daniel Børresen Haugen **Halfdan Meldal-Johnsen**

Study program:

MSc in Business

Major in Accounting and Business Control

Supervisor:

Associate Professor Ignacio Garcia de Olalla Lopez

Title:

The Information Content of Accrual-Based and Cash Flow-Based Performance Measures on Oslo Stock Exchange

Table of Contents

Introduction

In our master thesis, we will aim to explain the relative information content of accrual-based and cash-flow based performance measures for companies listed on the Oslo Stock Exchange.

There have previously been conducted studies on whether accrual-based or cash-flow based performance measures are the best predictors for future stock prices. Some of these studies conclude that accrual-based performance measures have the highest information content, and thus is the best predictor for future stock prices. Other studies, however, dispute this result and concludes that there is, in fact, cash-flow based performance measures that yield the best predictions. This dispute could be caused by differences in the data as the studies are conducted in different countries, which have different industry compositions. It is, therefore, interesting to take a closer look at the Oslo Stock Exchange (OSE) and see what method yields the best predictor in this market.

Another motivation for this paper is that the foreign ownership of Norwegian companies is at its highest level since the financial crisis of 2008 (Oslo Stock Exchange, 2019). This creates a higher demand for non-biased information, as there is an information asymmetry between domestic and foreign investors (Ferreira, Matos, Pereria & Pires, 2017; Dvořák, 2005).

Internationally, the literature on theoretical and empirical asset pricing is pervasive. However, there are few studies conducted on the Oslo Stock Exchange (Næs, Skjeltorp, & Ødegaard, 2009). In 2018, there were more than 35 million transactions made on OSE with a transaction value of 1.32 trillion NOK (Oslo Stock Exchange, 2019). For investors, it is of great importance to know how to predict changes in stock prices most accurately. The belief among market participants seems to be that classical financial theory holds for the Norwegian market (Næs, Skjeltorp, & Ødegaard, 2009). The assumption that international financial theory and empirical evidence holds in a Norwegian context is highly uncertain, especially given the mixed results on our topic in studies on foreign markets.

With our research, we hope to contribute with a greater understanding of equity pricing on OSE.

Literature Review

Incremental Information Content

The term *incremental information content* became popular following a series of studies on the topic. Biddle, Seow, and Siegel (1995) explain incremental information content as whether one accounting measure or a set of them, provide information content beyond what is provided by another. As a measure of information content, several authors (e.g., Kinnunen & Niskanen, 1993; Clubb, 1995; Plenborg, 1999) uses the correlation with stock prices. In other words, they find an accounting measure's predictive ability on future stock prices.

The incremental and the relative information content are, in terms of statistical dependencies, a conditional statistical relationship between accounting measures and stock returns (Kusuma, 2014). In his study, Kusuma (2014) uses the following model to represent this relationship

$$E\left(R_{jt} \middle| Op, Fin, Inv\right) = E\left(R_{jt} \middle| Fin, Inv\right)$$

Where R_{jt} is the security return,

$E\left(R_{jt} \middle| Op, Fin, Inv\right)$ is the expected value of R_{jt} given signal Op, Fin, and Inv, and

$E\left(R_{jt} \middle| Fin, Inv\right)$ is the expected value of R_{jt} given signal Fin, Inv.

With this model, Kusuma can test whether the additional variable operating cash flow changes the expected security return distribution.

Research on Information Content of Accruals and Cash Flows

During the past decades, several researchers have attempted to increase our understanding of the usefulness of earnings and other accounting measures with mixed results (Melumad & Nissim, 2009). One set of these studies attempts to explain the relative information in accrual measures versus cash flow measures. In general, these studies test the following four hypotheses (Clubb, 1995, p. 35):

H_{1A}: Accounting earnings data have no information content in relation to company share prices.

H_{1B}: Accounting earnings data have no incremental information content beyond cash flow or funds flow data in relation to company share prices.

H_{2A}: Cash flow or funds flow data have no information content in relation to company share prices.

H_{2B}: Cash flow or funds flow data have no incremental information content beyond accounting earnings data in relation to company share prices.

Plenborg (1999) analyzes the incremental information content of accrual-based performance measures over cash-flow-based performance measures in the Danish market. He finds that in Denmark, accrual-based performance measures are superior. In his study, Plenborg use Cash Flow from Operations (CFO), Cash Flow After Investments/Free Cash Flow (CFAI) and Net Change in Total Cash Flow (NCF) as cash-flow measures and Net Income (NI), Comprehensive (CI) and Working Capital from Operations (WCFO) as accrual measures. The calculation of these performance measures is specified in the methodology section. Before Plenborg's study, most researchers had examined WCFO and CFO but not CFAI, although CFAI is more frequently used in practice (p. 44). Dechow (1994) finds that NCF has a higher information content than CFO, and for that reason, Plenborg included this performance measure as well. For the same reasons, we will include both measures in our study.

Using US data, Rayburn (1986), Wilson (1986 and 1987), Bowen, Burgstahler and Daley (1987), Livnat and Zarowin (1990), and Ali (1994) finds that cash-flow-based performance measures have incremental information content over accrual-based performance measures. This is contradicting the findings of Plenborg (1999) using Danish data but consistent with the findings of Kinnunen and Niskanen (1993) on Finnish data and Clubb (1995) on UK data.

In his study, Rayburn (1986) finds that both operating cash flow (CFO) and aggregated accruals are associated with abnormal returns.

Wilson (1986 and 1987) has been criticized for using only two-quarters of data from 1981 to 1982 (Berard & Strober, 1989). Bernard and Strober (1989) even question the robustness and validity of Wilson's study.

Board and Day (1989) suggest that earnings contain information beyond the information content of funds flows from operations and cash flow from operations in the UK. However, they point out that their conclusion is not consistent with existing literature. It was found that: 1. there is a consistent information content both in the traditional HC rate of return measure and in the working-capital-based measure of cash flow, but very little information content in the net cash assets earnings figures, 2. the HC rate of return measure yields more information than either of the other 2 methods, 3. the information content of any of earnings figures is not substantially affected by inflation, and 4. there is a time effect on the information content of an earnings measure (Board & Day, 1989, p. 10).

The findings of Board and Day (1989) was supported by Charitou (1997). Charitou improved the model by incorporating the operating cycle, the magnitude of accruals, and measurement interval in the cash flow-return relationship and thereby strengthened the conclusion of Board and Day.

In a more recent study, Kusuma (2014) find that cash flows have incremental information content beyond the one of earnings alone in the Australian market.

Explanation of the Differences in Results in Previous Literature

Even in the same country, there might be contradicting results from different studies. Bernard and Strober (1989) do not find that cash-flow-based performance measures have incremental information content in the US, contradicting the findings of the authors above. The analysis of Bernard and Strober is done on data from the same period as the other studies. This implies that it is most likely dissimilarities in the chosen companies that are causing the differences. One explanation can be that different accruals have relative more information content in certain industries. If this is true, then the selection of companies would affect the results. This explanation is contradicted by the findings of Liu, Nissim, and Thomas (2002). Contrary to popular view, they find that there are not different "best" multiples for different industries. Their study is investigating multiples, but the results should be transferable to performance measures since the data are mostly the same. Instead, they find that some multiples are superior for almost all industries.

The most significant difference in the results seems to be between different countries. Ali and Pope (1995) suggest that the reason for this is that the relative information content of earnings is not the same between countries. This implies that conclusions on the incremental information content of a performance measure in one market cannot be blindly transferred to another market.

Ali and Pope (1995) argues that the information content of accrual-based performance measures depend on how the tests are conducted. According to them, “the explanatory power of earnings-returns models can be significantly improved by (i) using a specific non-linear form for the relation between returns and earnings instead of a linear relation (Freeman and Tse, 1992), (ii) using the the current level of earnings together with the change in earnings (both deflated by the beginning of the period market value of equity) as complementary proxies for the unexpected component of earnings, instead of using just the change variable (Easton and Harris, 1991); and (iii) using time-varying parameters in the earnings returns model instead of constraining the parameters to be constant across the years (Strong and Walker, 1993).

Criticism of Previous Literature

A common criticism of several studies on information content of cash and funds flow data has been the focus on operating flows rather than a broader set of cash, and funds flow that includes financing and investment flows as well as a failure to incorporate insights from valuation theory (Arnold, Clubb. Manson & Wearing, 1991; Kinnunen & Niskannen, 1991). An inclusion of fund flows from financing and investing activities have been done in some of the more recent studies (e.g., Kusuma, 2014).

Lev (1989) criticized the empirical research on the usefulness of accounting earnings for generally low R^2 in market-based tests of earrings quality. He suggested that the focus in capital market research in accounting should focus on examining earnings quality account-by-account. This suggestion is supported by

Penman (1992), who called for concentrated accounting research aimed at studying fundamentals.

A weakness with the studies on the incremental information content performance measures is that most of the studies are old. Most of the research we have found was conducted in the '80s and '90s. We cannot be sure that the results are valid for the markets today. If, for example, the relative information content of earnings has increased during the last 20 to 40 years, the results are no longer valid. Another weakness is that these studies build on financial and valuation theories from their contemporary time. Some of these theories may have been modified since the time the studies were conducted. This is an argument for conducting a new study on the area.

Related Research on Equity Pricing

Ball and Brown (1968) found that earnings explain security prices significantly better than cash flows. Their study is considered the foundation of market-based accounting research (Lev & Ohlson, 1982). Ball and Brown’s study has been criticized (e.g., Beaver & Dukes, 1972) for the measurement of accounting earnings, which had been a significant concern for users of accounting data.

Liu, Nissim and Thomas (2002) find that, contrary to popular view, there are not different "best" multiples for different industries. Instead, they find that some multiples are superior for almost all industries. In terms of relative performance, they observe the following ranking: (i) forward earnings measures, (ii) historical earnings measure, (iii) cash flow measures, and the book value of equity (tied) and (iv) sales performance. Furthermore, for forward earnings measures, performance increase when the forecast horizon lengthens (1-year to 2-year to 3-year out EPS) and if earnings forecasted over different horizons are aggregated earning. That the time-horizon of a measure is relevant, is consistent with the findings of Wilburn (1986), who finds that current accruals have information content while long-term accruals do not. Liu, Nissim, and Thomas (2002) describe the performance of cash flow measures as “poor” (p. 137). Surprisingly, they also observe that more complex measures of intrinsic value based on short-cut residual income models have worse performance. The conclusions we can draw from this are that (i) complex models and measures are not necessarily better than simpler ones, and (ii) earnings measures are better predictors for stock prices than cash flow measures.

They also find that (i) accruals improve the performance of cash flow measures, and (ii) top-line revenue has little relevance for valuation purposes before it is matched with expenses. These findings are interesting for our thesis. Firstly, we can attempt to combine accrual measures with cash flow measures to see if the predictive ability increases, and secondly, top-line measures may contain less information content relative to numbers that have been subject to expenses. From the latter, we assume that accruals, such as accounts receivables, will perform worse than accruals that have been subject to expenses.

Oil Price

A commonly accepted truth among practitioners is that oil prices are an important driver of OSE. Though such a relationship seems probable, there is little empirical evidence supporting it (Næs, Skjeltorp, & Ødegaard, 2009). In their 2009 study, Næs, Skjeltorp and Ødegaard find that changes in oil prices affect the cash flows of most industries on OSE but is not a priced risk factor in the market (p. 6).

Bjørnland (2009) finds that the oil price has an effect on OSE. Following a 10 percent oil price increase, she finds that stock returns increase by 2.5 percent. After this point, the effect gradually decreases. The effect of changes in oil prices on the stock markets, naturally, differs from country to country (Wang, Wu, & Yang, 2013). In an oil-dependent country like Norway, we expect the effect to be significant.

Government Ownership

The Norwegian Government is a major shareholder on OSE. Owning shares for NOK 684 billion on OSE as of January 2020 (Regjeringen, 2018) is giving the government approximately 25 percent of all values on OSE (Oslo Stock Exchange, 2019). This may affect several factors on OSE. However, there is, as far as we can see, not conducted extensive research on the Norwegian government ownership's effect on performance measures on OSE.

In a study on Malaysian government-linked companies, Najid and Rahman (2011) find that the government-linked listed companies perform lower in terms of financial performance measures. On the other side, they find that investors appreciate government involvement because they believe the government will back the companies in times of trouble. However, there are differences in how the Norwegian and Malaysian governments are involved in the companies, so the results may not be transferable to government ownership on OSE.

Research Methodology

The goal of this master thesis is to investigate whether accrual-based or cash-flow based performance measures yield the highest information content, i.e., how well they predict future stock prices. In order to answer this question, this thesis will utilize quantitative data based on public information from firms listed on the Oslo stock exchange.

Model

As a start, we plan to use the same model as Plenborg (1999). The models used by Plenborg are specified below.

Comparison of the information content of earnings and CF by comparing the explanatory power of the two following specifications:

(1a)

$$R_{it} = \alpha_0 + \alpha_1 \Delta NI_{it}/P_{it-1} + \alpha_2 NI_{it}/P_{it-1} + e_{it}$$

(1b)

$$R_{it} = \alpha_0 + \alpha_1 \Delta CF\ proxy_{it}/P_{it-1} + \alpha_2 CF\ proxy_{it}/P_{it-1} + e_{it}$$

The incremental information content beyond earnings is examined in a multiple regression model:

(2a)

$$R_{it} = \beta_0 + \beta_1 \Delta NCF_{it} + \beta_2 NCF_{it} + \beta_3 \Delta CFAI_{it} + \beta_4 CFAI + \beta_5 \Delta CFO_{it} + \beta_6 CFO + \beta_7 \Delta WFCO_{it} + \beta_8 WFCO_{it} + \beta_9 \Delta NI_{it} + \beta_{10} NI_{it} + e_{it}$$

To examine the incremental information content of cash flows beyond earnings, Plenborg uses the following model:

(2b)

$$AR_{iT} = \beta_0 + \beta_1 ANCF_{iT}/P_{i0} + \beta_2 ACFAI_{iT}/P_{i0} + \beta_3 ACFO_{iT}/P_{i0} + \beta_4 AWCFO_{iT}/P_{i0} + \beta_5 ANI_{iT}/P_{0i} + e_{it}$$

Where AR_{iT} equals price at time T (T = 1, 2, 3, 4) plus accumulated dividends over the return period minus price at the beginning of the return period (P_0) and then divided by P_0 for company i. $ANCF_{iT}$, $ACFAI_{iT}$, $ACFO_{iT}$, $AWCFO_{iT}$ and ANI_{iT} equals the sum of NCF, CFAI, ACFO, AWCFO and NI per share respectively over the period 1 to T for company i. Only level specification is applied.

Variables

CF-based

CFO	Cash flow from operations *WCFO - Δinventory - Δaccounts receivables + Δaccounts payables and other accrued liabilities*
CFAI	CF after investments/free cash flow *CFO + net investments in intangible assets, tangible assets and financial assets*
NCF	Net change in total CF, incl. operation, investment and financial activities *Net change in cash and cash equivalents*

Accrual-based

NI	Net income (after extraordinary items)
CI	Comprehensive income *BV_t – BV_{t-1} – net sale of common and preferred stock + dividends*
WCFO	Working capital from operations *Op. income before depreciation – tax paid + extraordinary items adjusted for the proceeds from gains and losses from sales of PPE (if possible) + financial items*

Data Collection

We plan to source income statements, balance sheets and cash flow statements for companies listed on OSE using the CCGR database. The data need to be requested via our supervisor. Due to extensive data cleaning time, we hope to request the data as soon as possible and hopefully have the data before the end of January.

We aim to have a dataset consisting of at least 100 companies listed on OSE over a period of 10 years. Since some companies has been listed more recently than ten years ago, this might not be possible for all companies. In that case, we will use data from as far back in time as possible. In order to check if the results are robust, we plan to use both annual and quarterly data.

In addition to the financial statements, we also have to download data on stock prices in the corresponding period for all the firms. Stock price data will be downloaded from Bloomberg.

To control for government ownership, we need data on this as well. This data is easily available on the Norwegian government's web page.

The data needs to be cleaned before it can be used for analytical purposes. The dataset will be checked for missing data and outliers. Missing data, in this case, will be financial data that is not consecutive for at least two years in a row.

What will be defined as outliers are not set in stone. Plenborg (1999) defines outliers as “all observations with absolute changes in earnings and CF greater than two” (Plenborg, 1999, p. 44), meaning that firms that have doubled their earnings from one year to another. This seems reasonable, as firms that are growing rapidly might not be representable for more well-established firms. Plenborg had an average of 121 observations each year after the deletion of 2-5 percent of the sample due to outliers. We expect to delete about the same number of outliers, leaving us with somewhat below 100 observations each year.

Thesis progression

The single, most time-consuming activity in our master thesis will be data collection and cleaning of the dataset. This is due to our regression requires financial ratios that cannot be extracted directly from the income statement, cash-flow statement, or the balance sheet. We are therefore expecting to complete this activity in the middle of March.

While the data is being collected and cleaned, we will also focus on writing a new literature review, as this is not dependent on the data needed to write the master thesis.

After the steps above are finished, the main body of the master thesis – analysis and observations – will be written. This part is slightly fluid timewise, as there might be some unexpected challenges and hurdles that could emerge during the writing process. There is, therefore, no detailed schedule for this part, other than that it is to be completed by early June.

The final weeks before the master thesis have to be submitted are going to be spent proof-reading the finished thesis and improve paragraphs that we are not satisfied with. We hope to have submitted well before the deadline of the 1st of July.

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