BI Norwegian Business School – Master Thesis

The Information Content in Profit Warnings and the Implications for Market Rationality

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Abstract

This paper investigates whether investors react rationally to the announcements of profit warnings in the Norwegian stock market by examining abnormal returns, information leakage and post-announcement drift. A classification of the warnings has been made to analyze whether the information content inherent in quantitative- and qualitative warnings has an effect on the market reaction. The sample includes 184 profit warnings from 2005 to 2012, where 144 of them are quantitative and 40 qualitative. The mean price reaction to the profit warnings on the announcement day was -5.25% and we report a mean CAR of -6.36% in the event window [-1, +1]. Contrary to many existing studies, this paper provides evidence of a greater market reaction to quantitative warnings than qualitative. This disparity decreases somewhat over time as qualitative warnings experience a significant one-day delayed market reaction of CAAR equal to -2.1%. Distinguishing between positive and negative disclosures reveals that bad news result in a greater market reaction than good news.

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1. Introduction

Traditional studies on earnings announcements and market efficiency have focused on the relationship between earnings information and stock prices, while studies on profit warnings have been less explored. Expectation about future cash flows is one of the main drivers of a company's share price; hence, rational investors should incorporate information revealed in profit warnings into new estimates of market values. Because profit warnings are pure information events and the market reaction upon these types of announcements is large, it is an opportunity to test whether markets are efficient and explore the information content in warnings. This paper examines profit warnings disclosed by Norwegian listed companies and test for abnormal returns ex-ante and ex-post. An event study on profit warnings disclosed in the period 01.01.2005 until 31.12.2012 is conducted to scrutinize the speed of adjustment to new information and the scope of the market reaction.

Bulkley and Herrerias (2005) categorized profit warnings into two different classes, an approach which is pursued and implemented in this thesis. They distinguished between new information which included earnings forecasts (quantitative) and new information that only included guidance for which direction earnings would deviate from previous forecasts (qualitative). This method provides insight about the content in the profit warnings and how different levels of precision in the disclosed information affect stock returns. Based on a genuine interest for this topic, the following research question has been developed:

To what extent does the Norwegian stock market react to different types of profit warnings and how fast does the market adjust to the new information?

Although some research on profit warnings in Norway exists (Svendsen 2009; Larsen and Jacobsen 2005; Hjelmeseth, Kleppan, and Nysveen 2002), it is a relatively unexplored subject given that profit warnings were not regulated until 1999. Listed companies became obliged to notify their shareholders when they were aware of significant deviations from previous earnings statements (Oslo

Stock Exchange 1999). This law was later repealed and profit warnings are now regulated by the general rule about disclosure of inside information (Oslo Stock Exchange 2005 (1); Oslo Stock Exchange 2005 (2)). An extract of the rules regarding information disclosure can be found in Appendix 1. The number of Norwegian studies that examines the degree of disclosed information and how it affects share price movements is limited. Our thesis contributes with new data, which include an assessment of market efficiency in a period of financial turmoil. In contrast to the majority of existing research based on Norwegian data, this study includes both positive and negative warnings, which makes it possible to test whether the market react differently to good and bad news.

1.1 Structure

This paper is structured into seven main sections, including this section where the hypotheses are being presented. The second section covers relevant background information concerning profit warnings and theory about market efficiency. Profit warnings are defined and the purpose of these statements is clarified. The rationale behind an efficient market and its implication on security prices is also enlightened in this section. The third section reviews published literature and research on topics relevant for this master thesis. Of special importance is the article: "Does the Precision of News Affect Market Underreaction" by Bulkley and Herrerias (2005), due to the fact that we investigate some of the same subjects and apply similar methods as the authors of that paper. Furthermore, the third section is divided into four subsections, namely: (1) event studies, (2) profit warnings and market efficiency, (3) information leakage and (4) post-earnings-announcement price drift. The fourth section describes the methodology applied in the study and reasoning behind the selection of asset pricing model, besides addressing the length of the event window and statistical- and econometric assumptions. We provide a description of the data and how it is extracted in section five. The results are presented and interpreted in the sixth section. We will in this section elaborate on the impact the results have on the Norwegian stock market. The last section concludes and summarize, before the weaknesses with this study and suggestions for future research are proposed.

1.2 Hypothesis Testing

In order to test whether the Norwegian stock market respond in accordance with the efficient market hypothesis, four different hypotheses are presented. The implications of the various hypothesis-tests are also discussed briefly.

HA_1: There are abnormal returns on the announcement date.

When information which deviates from forecasts is released, rational investors are expected to act on the new information. It is therefore presumed that evidence of abnormal returns will be found at the announcement date. A rejection of the first null-hypothesis indicates that the market is not strong-form efficient.

HA_2: There is information leakage prior to the announcement date.

The second hypothesis focuses on when the new information is released to the market. In a perfect efficient stock market, news is perceived by all investors simultaneously and the reaction to a profit warning causes an immediate change in the security price. A rejection of the second null-hypothesis indicates that some investors gain access to the information earlier than others, or that they interpret and react quicker than the rest of the market. A violation of this null-hypothesis could be a result of an inefficient market.

HA_3: There are abnormal returns in the stock market in the days following a profit warning.

If investors can achieve systematic abnormal returns through trading strategies after the announcement date, then the market is not semi-strong efficient. Significant evidence of abnormal returns following an event is called post-announcement drift and could be both positive and negative. A rejection of the third null-hypothesis is either due to an underreaction or an overreaction in the stock market.

HA_4: The degree of information disclosure impacts the magnitude of the abnormal returns.

The last hypothesis is about the information content in profit warnings, which is explored by examining the market reaction to quantitative and qualitative

warnings. If differences are detected, it is expected that quantitative warnings leads to a lower reaction in the stock market than qualitative. The basis for this assertion is that prior studies have found that investors tend to overract to qualitative profit warnings, and that share prices adjust to equilibrium faster when forecasts are provided, due to the increased knowledge among shareholders.

2. Background Information

This section provides an overview of theory related to the research question. The analysis performed in this paper is anchored in these models and publications. The first part define and describe profit warnings, the subsequent section cover different forms of market efficiency, and we end the background information with a discussion about difficulties with tests of market efficiency and statistical properties of abnormal returns.

2.1 Profit Warnings

Profit warnings are statements proclaimed by a firm due to unexpected changes in the company's financial results. These announcements are published to inform investors and stakeholders about the firm's operating performance and to alert about deviations from forecasted results or market expectations. Bulkley and Herrerias (2004) define a profit warning as an unexpected corporate announcement which declares that future earnings will decrease below current expectations. Corporations often disclose profit warnings based upon revised management projections, but the companies are also inclined to disclose a statement if they are aware of differing market expectations regarding the future performance of the company. Profit warnings include unanticipated information and a proxy for market expectations is therefore required to measure the extent of the surprise. Prevailing predictions about future profitability determine whether a profit warning include estimates above or below market expectations.

The content and scope of the profit warnings varies widely. Some warnings only state that performance will be lower or better than expected, while other warnings provide more detailed and accurate forecasts. Profit warnings are similar to earnings announcements in the way that the purpose of the announcement is to disclose information, but profit warnings are generally considered to be less anticipated and thereby cause larger fluctuations in stock prices (Church and Donker 2010). A detailed example of a profit warning disclosed through NewsWeb can be found in Appendix 2, while the entire list of the classified warnings is presented in Appendix 3.

2.2 Market Efficiency

The efficient market hypothesis (EMH) is the notion that security prices reflect all available information and the market price is considered to be an unbiased estimate of the true value of the investment (Fama 1965). The theory concerning market efficiency is consistent with Maurice Kendall's research, which discovered that stock prices seemed to follow a random walk (Kendall 1953). The concept that stock prices follow a random walk implies that price changes are independent of each other and that no systematic patterns exist (Brealey, Myers, and Allen 2008). If systematic patterns are detected, investors would exploit them and thereby eliminate them through extensive trading. Samuelson argued in the following way: "In competitive markets there is a buyer for every seller. If one could be sure that a price would rise, it would have already risen" (Samuelson 1965, 41). If the EMH is valid then future market prices should be unpredictable and only unexpected news will affect the price level. Deviations from market efficiency could lead to inefficient resource allocation; a cost borne by all citizens in a society (Mendes 2010).

Eugene Fama (1970) defined three forms of market efficiency and his work has been prevalent thereafter (Bodie, Kane, and Markus 2011):

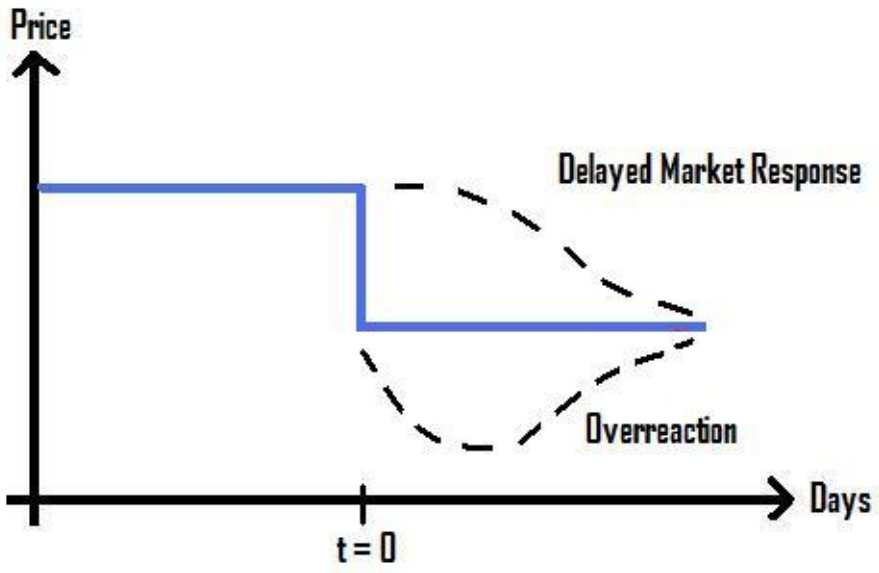
- The **Weak form** assumes that current stock prices reflect all information that can be derived from historical prices and by examining market trading data. The implication is that trading strategies based on chartism and trend analysis is not profitable.
- The **Semi-strong form** defines a market as efficient if all public available information is incorporated into the stock price. Persistent anomalies and predictions of future abnormal returns are violations of the semi-strong form of the efficient market hypothesis.
- The **Strong form** states that prices reflect all relevant information, even including inside information. This form is extreme and implies full transparency within the market, as no company insiders can pre-empt the market or take advantage of information asymmetries.

The semi-strong form of the EMH is of particular interest when examining the degree of market efficiency related to profit warnings announcements. If the

market is semi-strong efficient, then market prices will adjust immediately after the announcement in response to the new information and no post-announcement price drift will occur. The stock price will experience a jump to the new price level and investors have limited opportunity to act faster than the rest of the market. Patell and Wolfson (1984) find that the bulk of the market response to dividend or earnings announcements occurs within ten minutes after the notice. The innovations of electronic trading and online communication in the last decades have contributed to the increased speed of adjustment.

Post-announcement price drift is the tendency for a stock's cumulative abnormal returns (CARs) to drift in one direction in a longer period after the announcement (Bernard 1993). If the price continues to fall during the period following a negative warning it could be interpreted as an underreaction, while a partial reversal of the initial movement indicates that the market has overreacted to the announcement. A stock price reversal does not necessarily entail an overreaction, as it may signalize that market risk premium varies over time and be a rational response to changes in discount rates (Bodie, Kane, and Marcus 2011). Figure 1 depicts delayed market response (underreaction) and overreaction to bad news graphically, while the blue line is the efficient market reaction under the semi-strong form.

Figure 1: Semi-strong form, Over- and Underreaction



If investors gained access to information at different times and traded accordingly, it could be evidence against market efficiency. Security prices would adjust prior to the announcement due to information leakage in the market. On the other hand it could also reflect the fact that news contained in the profit warnings has been anticipated by the market before the announcement date, hence some adjustments could already have been incorporated into the share price (Jackson and Madura 2003). Investors have several sources they acquire information from, thus information leakage prior to the announcement date does not necessarily mean that the market is inefficient. Changes in security prices could also be caused by external factors, i.e. market specific risk. The effect of the announcement needs to be distinguished from the price movements caused by general market factors in order to deal with this issue.

Acquiring detailed information of individual companies is time consuming and costly. Investors are only willing to actively collect additional information if they are compensated for the added effort through higher returns (Grossman and Stiglitz 1980). Active investment strategies for common shareholders are costly due to the low percentage gain from extensive information seeking. Mutual funds can pool interests together and gain from economies of scale which gives them a greater incentive to find mispriced stocks. An efficient market will allow for abnormal returns to compensate the ones who put in additional resources, but only enough to provide superior gross returns and average net returns (Malkiel 1989). Transaction costs and illiquidity are factors which make it harder to gain from systematically mispriced stocks, i.e. barriers to arbitrage. When evaluating whether the market is inefficient or not, these factors must be taken into consideration and a market is only inefficient if arbitrage is possible net of these costs. Furthermore, it could take a long time for a mispriced security to revert back to equilibrium, thus arbitrage is challenging, risky and may tie up capital.

Abnormal returns (ARs) are defined as actual returns less expected returns implied by the asset pricing model. Presence of abnormal returns around events is not necessarily a violation of the efficient market hypothesis, but it is a violation if these abnormal returns persist over time and not follow a random walk. In an

efficient market, security prices out of equilibrium converge towards its true value and it should be equal probability for whether a stock is over- or undervalued.

2.3 Joint-Hypothesis Problem

When testing whether a market is efficient, you are implicitly testing the assumptions that the asset pricing model is based upon (Brealey, Myers, and Allen 2008). Any test of market efficiency is consequently also a joint test of whether the market model is correct. This is called the joint-hypothesis problem. If efficiency is rejected, it could be because the market truly is inefficient or because an incorrect equilibrium model has been assumed (Campbell, Lo, and MacKinlay 1997). In addition, Kothari and Warner (2004), points out that a set of assumptions concerning the statistical properties of the abnormal returns must be correctly specified. It follows that the mean abnormal returns for a cross-section of stocks must be normally distributed when performing a standard t-test. For large samples one can rely on the central limit theorem and asymptotic results, but the lack of normality in small samples can distort the statistical inferences. The implication of this theorem is that caution has to be taken when inferences are drawn upon market efficiency in small samples. Roll (1977) does moreover point out that the market portfolio is impossible to precisely estimate because the joint returns for all possible investment opportunities are unobservable.

3. Literature Review

A fairly large number of studies are dedicated to profit warnings, especially in the US. We use the following subsection to highlight some of the most acknowledged papers and report their empirical findings. This section also refers to studies about event studies and market efficiency, and entails some specifics about the different approaches applied in existing research.

3.1 Literature about Event Studies

Profit warnings are pure information events, which make them well suited for event studies. An event study is a technique in empirical financial research which measures the impact of a specific event on the value of a firm. Given rationality in the marketplace the impact should immediately be reflected in the security prices (MacKinlay 1997). One of the first event studies was performed by James Dolley (1933) and it explored the procedure of common stock split-ups. His main finding was that prices increased more often than they declined following a common stock split. The first event studies suffered from several drawbacks, as they failed to separate general stock market price movements from the effect caused by the event, but these elements were gradually improved during the next three decades (MacKinlay 1997). The standard setting methodology applied in Ball and Brown and Fama's studies in the 1960's is still practiced, although some modifications have been introduced, mainly to comprehend with violation of statistical assumptions (Brown and Warner 1980; Brown and Warner 1985).

3.2 Literature about Profit Warnings and Market Efficiency

One of the first studies to empirically test whether stock prices adjust to the release of new information was performed by Ray Ball and Philip Brown in 1968. They conducted an event study on earnings announcements for 261 firms over the period 1957 to 1965 and measured whether reported earnings were greater or lower than what the market expected, using last year's actual earnings as a proxy for the market expectations (Ball and Brown 1968; Scott 2012). The firms which reported good news experienced abnormal returns of 6% relative to the market in the period leading up to the earnings release, whereas firms that reported bad news underperformed with 9%. The interesting feature in this study was the accumulation of abnormal return prior to the event date, and Ball and Brown

concluded that the earnings report is not a medium that can be considered to be very timely.

Kasznik and Lev (1995) examined the actions of the management prior to a large earnings surprise. Their focus was on how the management disclosed this information and how the investors responded to this. They found that the likelihood of issuing a warning was positively related to firm size, existence of preceding forecasts and affiliation to the high technology industry. Another finding was a higher tendency to disclose warnings with permanent earnings disappointments than transitory, which also appear to be what the investors are concerned about. Their study furthermore questioned why not more companies disclosed disappointing earnings announcements because of the beneficiary sides, e.g. deterring litigation and reducing transaction costs. A possible explanation is the fear of an overreaction among investors, which could outweigh the benefits of disclosing earnings surprises. Another study, written by Skinner (1994), found evidence of voluntary disclosure of bad news before earnings announcements. Managers face an asymmetric loss function when deciding upon disclosure policy, due to the fear of litigation and reputational costs. Skinner also reported that bad news were likely to be qualitative statements about the current quarter's earnings, while good news tended to be point range or estimates of annual-EPS.

Investor psychology and behavioral finance are aspects which have been given increased focus in research the last decades. Relatively many researchers believe that investor irrationality can be ascribed to these concepts. The models are anchored in prospect theory, which was developed by Kahneman and Tversky (1979), as opposed to traditional decision theory which assumes rational agents and focuses on their total wealth (Scott 2012). The prospect theory describes why investors tend to react stronger to losses than to equally sized gains, i.e. loss aversion. Irrationality can be assigned to decision making under uncertainty with biased beliefs about probabilities of future events; hence the Bayesian updating process deviates from conventional risk-neutral probabilities. De Bondt and Thaler (1985) investigated violations of Bayes' Theorem and why people tend to overreact to unexpected and dramatic news events. They provide evidence of a stronger market reaction to bad news (loosers) than to good news (winners) and

that this pattern is predictable, which implies a violation of the weak form of the EMH. An explanation for the findings is that investors' posterior probabilities are greater than or less than what Bayes' Theorem suggests, which results in an underweighting of probabilities due to investor overconfidence about own skills.

A study which is of special interest to our research is written by Bulkley and Herrerias (2005). They found significant negative abnormal returns in the three months following a negative profit warning. This indicates that investors underreact to new information and that the speed of adjustment in the market is slow. A special feature in this study is the distinction between profit warnings that included a new forecast (quantitative) and profit warnings that only offered guidance about earnings below market expectation (qualitative). This classification makes it possible to test the precision of the announcement and whether the information content affects the size of the reaction (Bulkley and Herrerias 2005). According to the study, one should expect to find lower post-announcement abnormal returns for the warnings that provide quantitative information than the ones that only contribute with qualitative information. This is consistent with the efficient market hypothesis, which claims that the more informed the investors become the faster will the market correct mispricing. A greater market reaction to qualitative warnings may indicate that the investors are more uncertain about the future state of the company, i.e. they are risk-averse and reduce their holdings of these shares. This causes a downward shift in the supply curve resulting in a lower equilibrium price.

3.3 Research on Information Leakage

Studies on information leakage diverge somewhat, but several researchers submit evidence of information leakage prior to an event. Keown and Pinkerton (1981) provided significant confirmation of informational leakage as far as 12 trading days prior to merger announcements. Jackson and Madura (2003) detect information leakage prior to the announcements of profit warnings. They document an average negative cumulative abnormal return of 2.38% by applying a four-day window prior to the announcement date. Helbok and Walker (2003) report that evidence of informed trading prior to the release of profit warnings in the UK vanished after the companies became obliged to disclose information,

implying that increased disclosure of information results in a more efficient market. The fact that pre-announcement drift has been documented is a violation of the strong form of market efficiency and indicates that some market participants earn abnormal returns based on private information, though it can also be that the market anticipates forthcoming news.

3.4 Literature about Post-Announcement Drift

Among the recognized studies on post-announcement drift are Jones, Latanè and Rendleman (1982) and Ball and Brown (1968), who used the same method to rank and divide the firms into deciles based on the size of the earnings surprise. They calculated the CAR for each decile and found that the companies with the largest positive surprise experienced continuing CARs, while the companies with the most negative abnormal returns at t=0 experienced declining CARs. Jones, Latanè and Rendleman (1982) explained this observation with a gradual response to earnings announcements, but since this pattern is predictable it violates the theory about efficient markets (Bodie, Kane and Marcus 2011). This anomaly is known as post-earnings-announcement price drift which Bernard and Thomas (1990) later confirmed in their paper. Their article presented evidence of a slow market reaction to new information and that the signs and magnitude of the slow reaction were related to the autocorrelation structure of earnings. The predictability of future earnings due to autocorrelation in the residuals is evidence of market failure, i.e. market inefficiency (Bernard and Thomas 1990).

4. Methodology

The methodology applied in this thesis is based upon the pioneering methods used in Ball and Brown (1968) and Bulkley and Herrerias' (2005) studies. This section explains the underlying features of our research and how we carry it out. It also cover econometric problems that recur in event studies, how abnormal returns are calculated and the statistical tests conducted on the dataset.

4.1 Estimation Window

The length of the estimation period and the frequency of the data within the estimation window depend on the data availability and the specific event. The estimation window is applied to estimate $\hat{\alpha}$ and $\hat{\beta}$. In this paper we apply daily data and an estimation window which starts 254 days before the day of the event and ends the third day prior to the profit warning; hence, $L_1 = T_1 - T_0 = 252$ days, see Figure 2. The length of L_1 impacts the conditional variance of the abnormal returns, $\sigma^2(AR_{i\tau})$, due to the additional variance that stems from the sampling error in α_i and β_i. Using a large estimation window with many observations causes the additional variance to approach zero, due to a reduced sampling error of the parameters, i.e. the conditional variance, $\sigma^2(AR_{i\tau})$, approaches the disturbance variance, $\sigma^2_{\varepsilon i}$ (MacKinlay 1997). As the sampling error decreases with the length of the estimation window, the AR observations become independent through time.

4.2 Event Window and Post-Event window

The event window, L_2, is determined to be greater than the specific event of interest in order to capture the total market reaction to the profit warning, measured by the level of abnormal return. Hence, our main event window is [-1, +1], i.e. three days. Extending the event window beyond three days would induce additional noise in the measurement. An additional argument for a short event window is that most of the reaction is likely to occur within minutes and that the power of a three day long main event window is high. A post-event window, L_3, is also examined and the length of this window ought to be shorter than one year to secure that errors in risk-adjustment are mitigated (Kothari and Warner 2004). The length of the post-event window, L_3, is 21 trading days and begins on the second day after the announcement [+2, +22]. The decision is made on the basis that profit warnings often are followed by earnings announcement

within a month, and because extending the window might capture confounding events that could distort the inferences regarding the causality of abnormal returns. The post-event window captures any price effects that occur after the event window, like momentum and reversal effects.

A total of six event windows have been created to depict the price reaction clearer and to test the different hypotheses. The event windows which only include the days before the announcement day provide insight about information leakage and the leakage is represented by abnormal returns in the preceding days. Contrary, event windows that only include the days following the announcement day give an indication of how fast new information is absorbed by the market after announcement.

4.3 The Market Model

This subsection provides a discussion about the choice of asset pricing model and the methodology used to calculate abnormal returns. An essential aspect of event studies is the measurement of abnormal returns, for the reason that presence of abnormal returns could suggests that the market is inefficient, i.e. an arbitrage opportunity exists (MacKinlay 1997). An asset pricing model which estimates the expected returns is required to calculate the abnormal returns. This paper employs the market model, which assumes a stable linear relation between the security's return and the market return (Copeland, Weston, and Shastri 2005).

The underlying assumptions in the market model are purely statistical as it is not an economic model. The assets returns are therefore assumed to be jointly multivariate normal, in addition to independently and identically distributed through time. These are distributional assumptions in the market model (MacKinlay 1997). The rationale for selecting this model is the large impact a profit warning has on the return on the day of the event, and a more advanced model will consequently not improve the explanatory power significantly. MacKinlay (1997) argues that the market model is superior to the constant mean return model since the variance of the abnormal return is reduced. Another point in his article is that the market model is characterized as an improvement because the return related to the variation in the market return is removed. The reduced

variation in the abnormal return increases the ability to detect the effect conditional on the event. The gains from applying multifactor models in event studies are limited, because introducing additional factors with low explanatory power not necessarily reduce the variance of the abnormal return.

Equation (1) express the linear relationship between the expected return for the individual security, $E(R_{i,t})$, and the return on the market portfolio, R_m. Ordinary Least Squares (OLS) is used to minimize the sum of the squared residuals and to find the OLS-estimates that fits the straight line best.

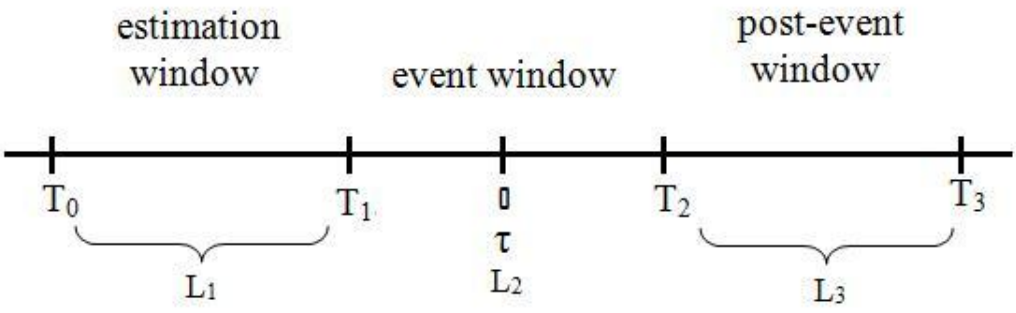
$$E(R_{it}) = \alpha + \beta_i R_{mt} + \varepsilon_{it} \qquad (1)$$

$E(\varepsilon_{i,t}) = 0$ is the zero mean disturbance term

$Var(\varepsilon_{i,t}) = \sigma_{i,t}^2$ is the variance of the disturbance term

The parameters $\hat{\alpha}$, $\hat{\beta}$ and σ are estimated using Equation (1) over the estimation window, L_1. The event window, $T_2 - T_1$, is excluded from the estimation period to avoid that the particular event of interest influences the parameters.

Figure 2: Overview of Event Study



Applying the estimated α and β makes it possible to calculate the expected return for the event window. The actual returns needs to be calculated for each day in the event window, $L_2 = T_2 - T_1$, before abnormal returns can be defined. Equation (2) is the formula for log returns. The reason for using log returns is that they conform better to the normality assumptions in the regression and because the transformation makes it easier to convert daily returns to weekly or monthly.

$$R_{i,\tau} = \ln \frac{P_{i\tau}}{P_{i\tau-1}} \quad (2)$$

$$AR_{i,\tau} = R_{i,\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m,\tau} \quad (3)$$

$$AR_{i,\tau} = R_{i,\tau} - \hat{R}_{i,\tau}$$

The abnormal return, $AR_{i,\tau,}$ is equivalent to the return conditional on the event, $R_{i,\tau}$, less the expected return unconditional on the event, $(\alpha + \beta_i R_{m,\tau})$, expressed by Equation (3). In other words, the abnormal return is the error term from the regression, i.e. the unexpected component (MacKinlay 1997).

4.4 Aggregating Abnormal Return

The next step is to aggregate the abnormal returns over time and across the securities in the sample. The cumulative abnormal returns for each security are aggregated over time using Equation (4) below.

$$CARi(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{i\tau} \quad (4)$$

Equation (4) is the formula for the CAR for one single event, and it is therefore necessary to aggregate the CARs for all event observations before final inferences can be made. The dataset has been controlled for clustering before cross-sectional aggregation. Clustering is the overlap of profit warnings in the event window, which could bias the result of an event. The reason why clustering may bias a conclusion is the non-zero covariance between the clustered abnormal returns, an issue which is addressed later in the paper. If no clustering of events exists or if they have no effect on each other, then the individual abnormal returns from Equation (3) can be aggregated for each event. The sample aggregated abnormal returns are calculated using Equation (5), where the number of events are N = 184.

$$\overline{AR}_\tau = \frac{1}{N} \sum_{i=1}^{N} AR_{i\tau} \quad (5)$$

These average abnormal returns can then be aggregated in the same manner as in Equation (4), which captures the total market reaction to the profit warning for the entire event period. The median cumulative abnormal returns and the mean CARs are both reported as they provide useful information about the sample distribution.

$$\overline{CAR}(\tau_1,\tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau \qquad (6)$$

4.5 Econometric Problems

This subsection addresses econometric problems. The daily security returns are tested for normality, heteroscedasticity and serial correlation. Financial events are often associated with variance shifts that may influence the power of the test and specification of the model. Another factor to consider is correlation between residuals, ε_{it}, and the return on the market portfolio, R_{mt}. Presence of this type of correlation will often bias the expected return of the securities, $E(R_{it})$, and cause a misspecification of the model (Henderson 1990). A final issue to reflect on is the presence of event clustering, a problem that occur when the profit warnings are overlapping. If events overlap, then the covariance between the securities could be different from zero. Clustering will distort the distributional results for the aggregated abnormal returns (MacKinlay 1997). In order to deal with this issue one alternative is to analyze the abnormal returns before the aggregation, and use a hypothesis test with the null-hypothesis that the event has no impact when applying non-aggregated data. This is a method used in the presence of a large clustering, i.e. many profit warnings on the same date. The drawback of this approach is the low sample properties of the test statistics and the test has often little power against economically reasonable alternatives (MacKinlay 1997; Bernard 1987). Another option is to remove the overlapping events from the sample.

4.5.1 OLS Estimation

The parameter (beta) estimation in the market model is based on the ordinary least square (OLS) method. Five assumptions listed in Table 1 have to be satisfied in order to draw statistically valid inferences from the OLS method:

Table 1: OLS - Assumptions

Underlying assumptions of the classical linear regression model	
Assumption 1:	$E(U_t) = 0$
Assumption 2:	$Var(U_t) = \sigma^2 < \infty$
Assumption 3:	$Cov(U_i, U_j) = 0$
Assumption 4:	$Cov(U_t, X_t) = 0$
Assumption 5:	$U_t \sim N(0, \sigma^2)$

Assumption 1 is about strict exogeneity and states that the errors in the regression should be zero on average, while assumption 4 require that the predictable variables are non-stochastic, thus not random variables and not correlated with the error term. These two assumptions are fulfilled and are not further elucidated. We will henceforth elaborate on the OLS-method applied in our study and discuss consequences and implications if any of the three remaining assumptions are violated. The results from the statistical tests for all individual time series are provided in Appendix 4.

4.5.1.1 Heteroscedasticity

The second assumption related to the classical linear regression model (CLRM) requires the variance of the errors to be constant over time. This desirable feature is known as homoscedasticity as opposed to heteroscedasticity, where the residual variance varies over time. If heteroscedasticity is discovered it could be a result of an observable systematic pattern, such as an increase in variance caused by an increase in an explanatory variable, or it could simply be changes in variance over time, i.e. autoregressive conditionally heteroscedastic (ARCH) processes. In this study we apply White's test to examine the variance over time. The form of the heteroscedasticity is rarely known and White's test does fortunately not make any assumptions about the pattern in variances. White's test runs an auxiliary regression where the squared residuals are regressed on the original variables, the cross product of the variables and the squared independent variables. A rejection of the null-hypothesis implies that the time-series is heteroscedastic.

The results from the analysis identifies 31 series with heteroscedasticity, 29 series with ambiguous results and 124 series with homoscedastic variance at a 5%

significance level, see Appendix 4. Further examination of the variances detects that 13 of the observations with heteroscedasticity are clustered in the 15 months surrounding the financial crisis (May 2008 to July 2009). These results support the claim that stock volatility changes during recessions and financial crises (Schwert 1989). A large fraction of the observations with heteroscedasticity is therefore partly caused by significant changes in the dependent variable.

Non-constant variance is common in time-series data and the consequences are inefficient coefficients derived from the OLS-estimation and possibly invalid standard errors. Harrington and Shrider (2007) proclaim that ignoring heteroscedasticity can cause biases in abnormal returns and wrong inferences about the event's significance. One possible solution is to use White's modified standard error estimates, but the changes in the significances of the parameters were marginal for the heteroscedastic-series in our sample. Fox (1997) point out that unequal error variance is worth correcting only when the problem is severe. The magnitude of the abnormal returns surrounding the event causes misspecification in the standard error estimates to be less prominent and does not alter the statistical validity of this study. Additionally, by applying the standardized residual tests on the ARs, which is robust to heteroscedastic event-window abnormal returns, we are confident that our conclusions considering the significance of the returns are valid.

4.5.1.2 Autocorrelation

The term autocorrelation is used to describe a situation where the error terms co-vary over time and it can be observed in time-series. The third assumption of the CLRM states that the disturbances should be uncorrelated, thus linearly independent of each other. Any kind of serial correlation or systematic pattern over time is a violation of the assumption and could lead to incorrect estimation of standard errors. It has been established that time series of daily returns exhibit some autocorrelation for short lags (Mandelbrot 1963). Autocorrelation could lead to wrong inferences about the variables in the regression, but the coefficient will still be unbiased (Brooks 2008). There are two types of serial correlation, namely positive and negative. Possible consequences of positive serial correlation are underestimated standard errors and inflated t-stats which could cause Type I-

errors, while overestimation and Type II-errors are risked in the presence of negative autocorrelation.

The Durbin-Watson test (DW) is performed to identify whether first-order autocorrelation is present in the data; hence, it is testing consecutive error terms. The Durbin-Watson test statistics are based on one-period lagged residuals, since the actual errors themselves are unobservable. A special feature of the DW test is that it does not follow a standard statistical distribution. Instead it has an upper and a lower critical value. The DW test statistics are bound to lie between 0 and 4, where a value close to 2 indicates that no autocorrelation is found in the data. The critical values for a sample with more than 100 observations and one explanatory factor are 1.52 and 1.56 at a 1% significance level. The characteristics for the DW test applicable to our sample and the results of the test are summarized in Table 2 below.

Table 2: Critical Values of the Durbin-Watson Statistics

Critical values 1%-level	
DL	1.52
DU	1.56
4-DU	2.44
4-DL	2.48

(>100 obs, 1 var)

Regions	Implications	No. of observations
0 - 1,52	Reject H0 → Positive autocorrelation	1
1,52 - 1,56	The test is inconclusive	0
1,56 - 2,44	Keep H0 → No autocorrelation	154
2,44 - 2,48	The test is inconclusive	6
2,48 - 4	Reject H0 → Negative autocorrelation	23
		184

Autocorrelation is discovered in 24 time-series, implying that approximately 13% of the series not satisfy the assumption of independent residuals. 23 incidents of negative autocorrelation are found, meaning that the probability of a positive error for one observation increases the probability of a subsequent negative error. One factor that partially contributes to first-order autocorrelation is thin trading which causes missing data points. Missing observations is not a favorable feature in a dataset as it reduces the reliability of the estimates (Scholes and Williams 1977).

We moreover found six of the observations to lie in the intermediate region where the test results are inconclusive. The beta coefficients are on average equal to their true values, but 24 of the beta parameters are inefficient, thus other estimators could have a smaller variance and the probability of dispersion from the true beta is no longer minimized.

The dominance of negative serial correlations causing overstated standard errors and Type II-errors to be the largest threat. In other words the issue of not rejecting the null-hypothesis when it actually is false needs to be addressed. Most of the beta estimates in the sample have high t-stats and the problem of Type II-errors does not seem to be a severe problem in our sample, see Appendix 5. However, the lack of normality in the series influences the conclusion regarding hypothesis testing on parameters, an issue which is discussed in the subsequent section. 154 out of 184 of the error terms are orthogonal and makes up the largest fraction of the sample. Based on an overall assessment, we have decided not to adjust for autocorrelation for the respective 24 observations. Dealing with autocorrelation can be done in several ways, depending on the form of autocorrelation and the specific situation, and each approach has its pros and cons, but the main decisive element for no adjustment was limited documented effect on daily stock returns (Brown and Warner 1985). Finally, the study is performed on a relatively short event window, where possible misspecifications have a small effect on the abnormal returns. This is because the daily returns conditional on the events are very high compared to the expected returns.

4.5.1.3 Normal distribution

The fifth and final CLRM-assumption states that the disturbances must follow a normal distribution and that a random variable should be normally distributed. A normal (Gaussian) distribution can be defined as a probability distribution that plots all of its values in a symmetrical manner and where the majority of the results are situated around the probability's mean (Newbold, Carlson and Thorne 2010). If the residuals deviate from normality, then it is not possible to draw any valid inferences from hypothesis tests conducted on the model parameters. In our sample we find various series which does not satisfy the normality properties. The normality test detect that the series exhibit skewness and positive kurtosis,

implying that the distribution is leptokurtic, has fatter tails and is more peaked at the mean.

The discovery of non-normality is a common feature for financial data and it is particularly often documented for individual securities when using daily data (Fama 1976). However, the central limit theorem and the law of large numbers states that the distribution of the sample means will converge toward a normal distribution and that the violation of the normality is practically inconsequential for large sample sizes (Billingsley 1995). The number of observations is about large enough to satisfy this condition. Brown and Warner (1985) show that non-normality of daily returns has little impact on event study methodologies. The conclusion is that we cannot draw any inferences considering the statistical significance of the parameters, but that non-normality has a negligible impact on the results in our study.

4.6 Significance Testing of Abnormal Returns

In this subsection we cover potential pitfalls associated with event studies and the tests of significance for abnormal returns. Assessing these issues is important before any statistical inferences can be drawn from the results. Various significance tests are employed on the abnormal returns to make sure that the model is correctly specified, and that no additional modifications of the model are needed. If the model is not able to distinguish between the null-hypothesis and economically interesting alternatives, then the model design has to be modified (MacKinlay 1997).

4.6.1 Tests of Significance

A two sided t-test of the cumulative abnormal returns from Equation (6) is performed to determine the significance level and to address whether the null-hypothesis can be rejected. The test is two-sided since abnormal returns can be both negative and positive. Imprecise predictions about the securities' unconditional expected returns and the component of the realized return on the event day, which is not attributable to the event itself, are two reasons why abnormal returns are measured with error (Kothari and Warner 2004). Both parametric and non-parametric tests are used in this study, but note that other

studies have found non-parametric tests to be unnecessary complicated and not well-performing (Henderson 1990). The differences between the two types of tests are the underlying assumptions about the distribution of abnormal returns (MacKinlay 1997), and employing both types increases the reliability of our results.

The parametric tests applied are the cross-sectional t-test and Patell's standardized residual test, and they are quoted in the result tables with t-values and z-values for the different event windows. We are testing for mean effects with changing variances and it is consequently necessary to form an estimator of the variance that does not rely upon past returns. MacKinlay (1997) argues that this assumption is satisfied in the cross-sectional t-test if no clustering of events exists. Patell-Z test is a complimentary test which is robust to heteroscedastic abnormal returns. One characteristic of the standardized residual test is that it assigns a lower weight to abnormal returns that exhibit a high variance during the event window (Event Study Metrics 2011).

Non-normality issues are likely for daily returns; hence, we run two non-parametric tests to further increase the reliability of the results. The generalized sign test checks whether the CARs have an equal probability to be positive or negative. Differences between mean and median CARs are found in the sample, and further analysis detects that the distribution is skewed. MacKinlay argues that the test not necessarily is well specified in the presence of skewness. To compensate for this weakness we also report the Corrado Rank-test as a second non-parametric test. The Rank-test assess whether the average abnormal return is zero and is applicable for individual securities as well as portfolios (Event Study Metrics 2011). The power of a study is determined by the sample size, length of the event window and the size of the abnormal returns. MacKinlay (1997) argues that the power of a test increases with sample size and abnormal returns on the event day, and decreases with the length of the event window. We expect to find substantial abnormal returns on the announcement day, due to the element of surprise in profit warnings. Hence, the power of the event study's test statistics is likely to be high.

5. Data

This section contains an overview of the data and the data collection process. The sample criteria for the profit warnings are defined and justified, and an explanation of how each individual disclosure is analyzed is provided. This section furthermore covers sources of error in the dataset and how these problems are dealt with. The last subsection includes the descriptive statistics of the data. Oslo Stock Exchange All-Share Index (OSEAX) has been selected to be the proxy for the market portfolio. The OSEAX-index consists of all the listed companies in Norway and is adjusted for dividend payments. Stock returns for each company are retrieved from Datastream, while the OSEAX-index is downloaded from Oslo Stock Exchange's web pages.

5.1 Data Collection

The first step in the data collection process is to define the date of the event, i.e. the announcement date of the profit warning. The event date sets the pre-conditions for estimation of α and β based on the estimation window, and the parameters are used to calculate the expected returns in the event window. Each individual profit warning, and hence date, is retrieved from notifications submitted to Oslo Stock Exchange via NewsWeb by listed companies. Processing each submitted notification to assess whether it is a profit warning or not is indispensable and can be a source of error in the dataset, but it is a necessity due to the lack of existing alternatives. A list of all the profit warnings in the sample can be found in Appendix 3, which includes information about the characteristics of the warnings. The criteria for inclusion in the sample are presented in Table 3, and we will henceforth discuss some of the reasons for the criteria formulation and inflicting implications.

Table 3: Sample Criteria

- Listed 254 trading days prior to the event window
- Traded in the main event window [-1, 0, +1]
- Traded at least 100 days in the estimation window
- No repeating events in 22 days following a PW
- The outliers caused by previous profit wanings are removed from the estimation window

5.2 Estimation Window

For some of the companies it is not possible to use an estimation window of 252 trading days prior to the event window when estimating the parameters because of limited data. The period from the initial public offering until the profit warning is announced, is not long enough to provide sufficient amount of data points to secure valid beta estimates. These companies have been excluded in our dataset to secure consistency. The length of one year is based on the comprehension that some of the companies are thinly traded, even though it can be argued that a shorter estimation window could have been statistically valid. An additional issue related to a shorter estimation window is that the variance of the CAR must be adjusted for estimation error in the market model parameters (MacKinlay 1997).

Another problem is illiquidity issues, including the thin trading bias and bid-ask spread bounces. Companies that are not actively traded and have many missing data points are therefore removed from the dataset. This is done because missing observations gives a downward biased estimate of the regressed betas (Koller, Goedhart, and Wessels 1990). One possible solution to this measurement problem is to use weekly or monthly observations to estimate beta or apply an industry beta. Employing weekly or monthly data with lower sampling frequency reduces the number of applicable events, which could be troublesome in this study due to the moderate sample size of 184 profit warnings, compared to studies conducted on the US stock market. Moreover, by applying daily data and a short estimation period we implicitly accommodate for the comprehension that individual security betas are changing over time. A short estimation period with a high sample frequency secures that the beta is based on recent firm characteristics and provides a better proxy for the true beta at the announcement date. This induces more noise in the data and increases the chance of the parameters being influenced by extreme values.

Bid-ask spread bounce is a potential source to distortions in beta estimation as the last recorded trade does not take into account whether it was initiated by the bidder (bid price) or the seller (ask price). Large bid-ask spread and low trading volume results in a false impression of abnormal returns associated with the specific event (Sercu, Vandebroeck, and Vinaimont 2007).

The data mining process induces reliability to our estimates and is done to secure statistical and economically reasonable betas. Prem Jain (1986) finds that adjusting for thin trading is not that important when employing the OLS estimator, as potentially biased estimates not result in misspecification of event study methodologies. The threshold of at least 100 trading days during the estimation window is therefore mainly a consistency check. We have also made sure that the day of the announcement coincides with the actual event day, since some of the companies disclosed the information after closing hours. Failing to determine correct event day would have caused wrong inferences about the timing of the abnormal returns. Abnormal returns would emerge the following day, indicating a false one-day delayed market reaction.

In terms of companies that issues several profit warnings within a year, we have adjusted the outliers in the estimation window. Several profit warnings filed by the same company are likely to cause large price changes and could change the beta estimates drastically. The outliers in the dataset, that is the abnormal returns on the announcement date of previous warnings, have been fixed to zero, thereby mitigating the problem of a biased beta estimate.

5.3 Event Window and Repeating Events

It is also determined that the stocks have to be traded in the event window, thus at least one out of three days. In order to test how the investors respond to unexpected news, shares have to change ownership, otherwise there will be no movements in stock prices and impossible to investigate the market reaction. In the presence of event clustering, repeating profit warnings are removed from the sample if they are disclosed by the same company within a period of 22 trading days following the first disclosure. Ignoring repeating warnings could cause severe misspecifications regarding conclusions based on stock price movements in the post-announcement window. Altogether, various consistency checks of our sample reduce the number of profit warnings from 270 to 184.

5.4 Classification of Profit Warnings

The sample has been divided into subsamples in order to examine whether the type of profit warning influence how investors respond to unexpected news. The

smallest subsample is the sample consisting of qualitative profit warnings and includes 40 observations, but it has sufficient statistical power. The distinction between qualitative and quantitative warnings is made by assessing each profit warning individually. Profit warnings that only declare whether operating performance would be better or worse than expected are classified as qualitative, whereas profit warnings that include any kind of numerical estimates are classified as quantitative. The quality of the forecasts and level of details disclosed are not further explored due to subjectivity and limited available data about investors' expectations prior to the news release. In this context, it could be of great interest to explore the possibility of creating a warning response coefficient, which could measure the unexpected portion in the announcements.

Another classification that has been made is the distinction between positive and negative warnings, and they have been divided into subsamples based on a subjective assessment by the authors. The underlying motive for the classification is that existing studies mainly focus on negative disclosures and few researchers include positive warnings in their dataset. Including positive warnings in the dataset allows us to measure the impact of positive news and compare it to the market reaction to negative information. This is done on the premise that investors possibly react stronger to bad news than good news, i.e. losses are penalized harder than equally sized gains. Some warnings include both good and bad news which could distort the conclusion, but we have made an assessment based on the total effect of the information. In presence of confounding effects, additional information seeking has been performed to ensure that the issuer does not try to disguise bad news behind good news.

This paper does not account for whether negative and positive profit warnings are better or worse than what the market predicts, i.e. we do not have a proxy for the market expectations. The market reaction could therefore be positive (negative), even though the content is negative (positive). As discussed more thoroughly in the result section, we observe that some announcements experience abnormal returns in the opposite direction of what we predicted. This behavioral feature of the information content is difficult to measure, due to limited available data on

existing market expectations at the announcement date, but it is discussed to some extent because of its apparent implications on abnormal returns.

5.5 Descriptive Statistics

The total sample consists of 184 observations. Among them are 50 defined as positive profit warnings, whereas 134 are defined as negative. The classification of warnings yields 144 quantitative warnings and 40 qualitative warnings. The fact that negative profit warnings predominates the sample could simply be due to the turbulent sample period, or it could be because firms are more concerned with informing about negative surprises to avoid lawsuit and discontented investors. The frequency of disclosures seems to increase during bear markets and subside in bull markets.

Table 4: Classification of Profit Warnings

This table shows the number of quantitiative and qualitative profit warnings for announcements classified as positive and negative.

	Positive (= 50)		Negative (= 134)		
	Pos-Quant	**Pos-Qual**	**Neg-Quant**	**Neg-Qual**	
2005	8	1	13	3	
2006	4	1	9	6	
2007	6	1	20	6	
2008	10	2	21	5	
2009	0	3	14	0	
2010	2	2	8	1	
2011	3	1	10	2	
2012	4	1	12	5	
Total	**37**	**12**	**107**	**28**	184

(Quant = Quantitiative, Qual = Qualitative)

Looking at Table 4, we notice that many companies issued profit warnings in the period leading up to and during the financial crisis. Interestingly, and somewhat surprisingly, is the high number of positive warnings submitted during the same period. 31.5% of the warnings in 2008 are characterized as positive and this observation could be related to management's incentive to provide good news during periods with economic turmoil. Depression and extreme drops in security prices may lead to widespread panic, whereby the management tries to reduce the downward pressure on their stock price. Financial market turmoil increases the

desire to inform the market about positive news and that the firm is outperforming the market. There are considerably more quantitative profit warnings than qualitative in the sample, and it is no obvious coherence between good or bad news and the degree of disclosure, as opposed to what Skinner (1994) reported.

Table 5: Sectors and Profit Warnings

Sector	No.
Consumer Discretionary	9
Consumer Staples	15
Energy	43
Financials	12
Health care	11
Industry	28
Information Technology	54
Materials	10
Telecommunication Services	2
Utilities	0
	184

A list of the sectors that the companies operate in is provided in Table 5. A substantial share of the warnings is disclosed by companies within the IT-sector (29.3%), the energy sector (23.4%) and the industry sector (15.2%). This observation coincides with the findings of Kasznik and Lev (1995), who demonstrated that the high technology sector was positively related to the likelihood of disclosing profit warnings. Companies within the utility sector and the telecommunication services are underrepresented in our sample. The distribution of warnings across industries is mainly due to the number of companies within each sector at Oslo Stock Exchange, but it still provide some guidance about which types of companies that experience the greatest fluctuations in operating performance.

6. Results

In this section we report and interpret the results from the analysis. The section has been divided into subsections where the distinct hypotheses are addressed. An overview of the results is presented with cumulative abnormal returns for each year. The main results have been split up into five different panels to provide greater insight about the characteristics of the sample and to investigate the market reaction in each subsample. The total sample has moreover been divided into deciles based on the level of abnormal returns in the event window. Comparing the deciles enable us to look for patterns and differences between companies that experienced different magnitudes of abnormal returns in the days surrounding the announcement.

6.1 Overview of results

Table 6 displays cumulative abnormal returns at the announcement day, measured in absolute values. Absolute values are good indicators of the overall magnitude of the market reactions, because positive and negative mean abnormal returns do not cancel each other out. The average annual standard deviation for a stock in a given year is reported in the last column of Table 6, while the standard deviation for each individual stock is provided in Appendix 6.

Table 6: Overview of Results

Mean and median are absolute values of the abnormal returns on the announcement day of the profit warning. They are calculated by squaring the mean and median values and then taking the square root of these values. Max is the highest positive abnormal return, while Min is the highest negative abnormal return in a given year.

Distribution of Companies with Profit Warnings by Calendar Year

Year	No. of observations	% of total sample	*CAR*		*AR*		
			Mean	**Median**	**Max**	**Min**	**Std.dev.**
2005	25	14 %	8.6 %	6.4 %	13.4 %	-43.0 %	50.7 %
2006	20	11 %	9.7 %	7.1 %	23.0 %	-46.3 %	52.5 %
2007	33	18 %	8.9 %	6.7 %	12.6 %	-31.6 %	42.9 %
2008	38	21 %	7.9 %	6.8 %	19.8 %	-28.4 %	53.2 %
2009	17	9 %	9.6 %	5.1 %	15.0 %	-76.8 %	85.4 %
2010	13	7 %	9.2 %	7.2 %	7.5 %	-31.1 %	54.0 %
2011	16	9 %	6.0 %	4.8 %	7.6 %	-15.9 %	57.0 %
2012	22	12 %	10.1 %	6.9 %	21.6 %	-78.1 %	67.8 %
Total sample	**184**		**9.1 %**	**6.9 %**			**56.0 %**

Looking at the number of profit warnings in the sample period we observe that 2007 and 2008 have a greater number of disclosures, but the extent of the reactions was lower than what we expected. The dispersion seems to be fairly concentrated around its mean in these two years, as there is a relative narrow bandwidth between maximum and minimum abnormal returns and relative low annual standard deviations. One explanation to this occurrence could be the bad market conditions in 2007 and 2008. Investors reduce their expectations about future profitability during periods with lower economic growth and low market consensus. Releasing profit warnings under these circumstances will therefore result in a lower market reaction than presumed because the market anticipated the bad news, i.e. the probability of negative news has increased.

The same analogy can be related to periods with increasing security prices, such as 2009 and 2012, implying that the market revises the estimates upward in bull markets. Unveiling that the company is failing to meet these expectations by disclosing a negative profit warning is consequently penalized harder by the market. Companies that disclosed profit warnings during 2009 and 2012 experienced larger reactions to negative warnings than other years, where the most extreme abnormal returns were -76.8% and -78.1% respectively, and the annual standard deviations were among the highest in the sample. These results support the norm that issuing negative warnings in periods with increasing investor confidence is a particularly bad signal regarding a firm's operating performance.

The overall market reaction on the announcement day is substantial, with a mean Cumulative abnormal return (CAR) for the full sample of 9.1%, whereas the median CAR for the full sample is 6.9%. The largest market reaction at the event day is -78.1%. Mean values are heavily influenced by outliers, which is the main reason why both mean and median values are quoted in the following subsections.

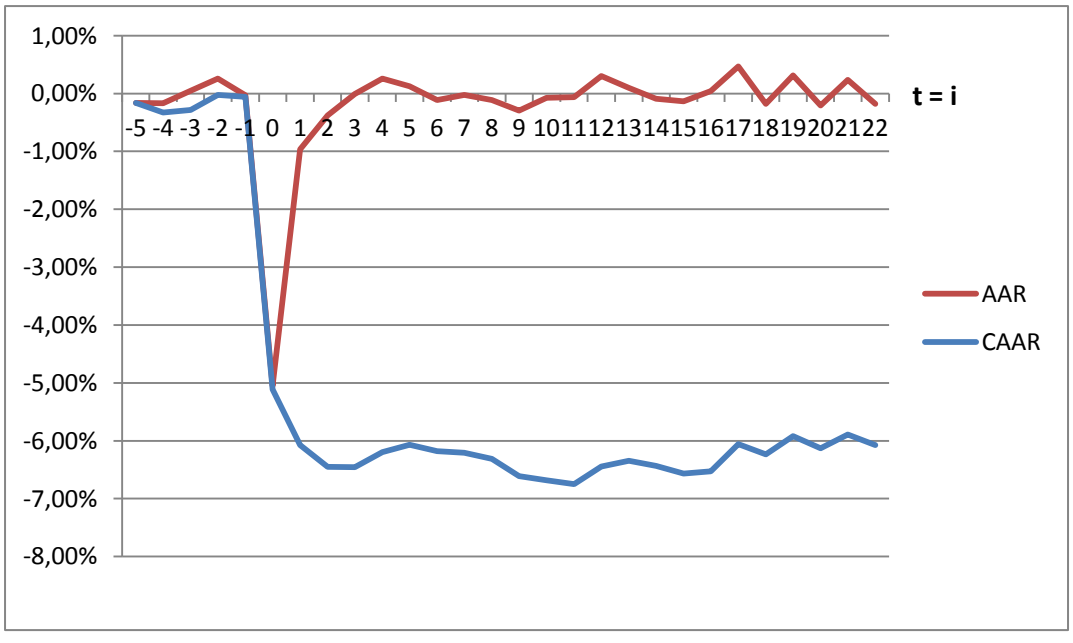
6.2 Impacts from Warning Announcements

The results for the full sample, consisting of 184 profit warnings are given in Table 7, Panel A. The mean (median) abnormal return is -6.36% (-4.08%) in the event window [-1, +1], which is significantly different from zero at a 0.1%-level,

applying both parametric and non-parametric tests. The fact that the mean is more negative than the median for all significant CARs in all event windows could indicate that large negative outliers are present. Appendix 7 presents a histogram of the negatively skewed abnormal returns on the announcement day, and the skewness in the sample is -2.2. The generalized sign test provides further assurance of a negatively skewed distribution as all values are negative and significant at a 0.1%-level.

Panel A illustrates that the market reaction is greatest at the announcement day, -5.25% (-4.44%), and there is no evidence of abnormal returns on the day prior to the announcement, which is elucidated in Figure 3. The lack of information leakage fortifies that profit warnings are unexpected events and they are not anticipated by the market. Panel A demonstrates that there seems to be a -1.08% (-0.85%) delayed market response on day one. A delayed reaction is a sign of inertia and can be evidence of poor quality in the disclosed profit warning, meaning that the information is inaccurate or incomplete. We would like to emphasize that these results and the results reported in the subsamples are based on the mean (median) reaction, not measured in absolute values. Positive and negative abnormal returns will to some degree cancel each other out.

Figure 3: Cumulative Average Abnormal Return and Average Abnormal Return



The post-event window, [+2, +22], is used to test whether this slow market reaction persist or if a reversal in security prices occur following a profit warning. Panel A gives no indication of post-announcement price drift in either direction, as the mean (median) CAR is found to be 0.01% (-0.28%) and insignificant for most of the statistical tests. It seems to be some reversal in Panel C, but these abnormal returns are insignificant as well. Results from the preceding days and the days following the main event window are in line with the semi-strong form of the efficient market hypothesis, and Figure 3 depicts this clearly. The presence of a small one-day delayed market reaction could indicate that the market is inefficient since all information is not embedded in the security price immediately.

Table 7: Profit Warning Cumulative Abnormal Returns 2005 - 2012

N is the number of companies in the sample for a given event window. The column "Pos : Neg" shows the number of observations with positive and negative abnormal returns during the event windows. T-stat cross-sectional and Patell-Z are parametric tests, while Corrado Rank test and Sign test are non-parametric tests. ***, **,* indicates the level of significance for mean CARs. Panel A displays the results for the total sample. Panel B shows the cumulative average abnormal return (CAAR) and median cumulative abnormal return (CAR) for Quantitative Profit Warnings in the stated event windows. Panel C shows CAAR and Median CAR for Qualitative Profit Warnings.

Panel A: Full sample

Event Window	N	Mean CAR	Median CAR	Pos : Neg	t-stat cross-sec.	Patell-Z	Corrado Rank	Sign test
[- 2, + 2]	184	-6,46 %	-4,07 %	53 : 131	-6,23 ***	-12,51 ***	-5,61 ***	-7,80 ***
[- 1, +1]	184	**-6,36 %**	**-4,08 %**	55 : 129	-6,07 ***	-15,77 ***	-6,54 ***	-7,50 ***
[- 1]	184	-0,04 %	0,00 %	103 : 81	-0,14	-0,15	-0,48	-0,35
[0]	184	**-5,25 %**	**-4,44 %**	59 : 125	-5,39 ***	-22,66 ***	-7,84 ***	-6,90 ***
[+ 1]	184	-1,08 %	-0,85 %	84 : 100	-3,09 **	-4,50 ***	-3,00 **	-3,18 **
[+ 2, + 22]	184	0,01 %	-0,28 %	90 : 94	0,00	-0,94	-1,05	-2,28 *

***, ** and * indicate significance at the 0,1%, 1% and 5% -level respectively

Panel B: Quantitative

Event Window	N	Mean CAR	Median CAR	Pos : Neg	t-stat cross-sec.	Patell-Z	Corrado Rank	Sign test
[- 2, + 2]	144	-6,46 %	-3,57 %	41 : 103	-5,60 ***	-11,42 ***	-4,85 ***	-6,73 ***
[- 1, +1]	144	**-6,64 %**	**-4,83 %**	44 : 100	-5,61 ***	-14,68 ***	-5,50 ***	-6,22 ***
[- 1]	144	-0,06 %	-0,19 %	76 : 68	-0,20	-0,21	-0,53	-0,85
[0]	144	**-5,77 %**	**-4,16 %**	46 : 98	-5,01 ***	-22,11 ***	-7,03 ***	-5,89 ***
[+ 1]	144	-0,81 %	-0,47 %	68 : 76	-2,34 *	-3,12 *	-1,96	-2,19 *
[+ 2, + 22]	144	-0,54 %	0,01 %	72 : 72	-0,33	-1,15	-1,41	-1,52

***, ** and * indicate significance at the 0,1%, 1% and 5% -level respectively

Panel C: Qualitative

Event Window	N	Mean CAR	Median CAR	Pos : Neg	t-stat cross-sec.	Patell-Z	Corrado Rank	Sign test
[- 2, + 2]	40	-6,63 %	-5,33 %	12:28	-2,77 *	-2,77 ***	-3,45 ***	-4,09 ***
[- 1, +1]	40	**-5,28 %**	**-3,76 %**	11:29	-2,34 *	-2,34 ***	-4,14 ***	-4,42 ***
[- 1]	40	0,07 %	0,14 %	27:13	0,16	0,16	-0,02	0,78
[0]	40	**-3,24 %**	**-4,37 %**	13:27	-1,96	-1,96 ***	-3,95 ***	-3,77 ***
[+ 1]	40	-2,10 %	-1,88 %	15:25	-2,10 *	-2,10 ***	-3,20 ***	-3,12 ***
[+ 2, + 22]	40	2,19 %	1,68 %	19:21	0,80	0,21	0,45	-1,82

***, ** and * indicate significance at the 0,1%, 1% and 5% -level respectively

6.3 Information Content in Profit Warnings

The sample has been split up into two subsamples to test whether the different types of profit warnings affects the size of the abnormal returns. The CARs of the quantitative warnings are given in Panel B, while Panel C shows the results of the qualitative warnings. Based on the fourth hypothesis we expected that quantitative warnings would have a lower market reaction than qualitative. Other studies have found evidence of an overreaction to qualitative warnings. Since there is more information inherent in quantitative warnings, less uncertainty is embedded in the more detailed forecasts and investors act more rationally. We have found negative abnormal returns on the announcement day for both types of warnings, but the market reaction is greater for quantitative warnings, which contradicts the expectations. The mean (median) CAR for the quantitative warnings at the announcement day is -5.77% (-4.16%), while the mean (median) CAR for the qualitative warnings is -3.24% (-4.37%), implying a mean difference of -2.53%. All CARs at the announcement day are significant at a 0.1%-level.

Turning to the main event window, the disparity has decreased to a mean difference of -1.36%. Further examination of the CAR for each day in the main event window detects that there is no evidence of CARs in either panel on the preceding day, day -1, implying no information leakage for either subsample. On the other hand there is a delayed reaction to qualitative warnings on day one. The delayed market reaction for qualitative warnings is -2.1% (-1.88%) and is significant at a 5%-level. The fact that the delayed market reaction is greater for qualitative warnings than quantitative may be because investors need longer time to analyze qualitative announcements; hence some of the adjustment is incorporated in the price the next day. The findings may therefore still support the claim that warnings with more detailed forecasts reduce the uncertainty embedded in profit warnings and correct the prices faster to the new equilibrium level. Some of the decline in uncertainty can be ascribed to the reduction in asymmetric information between the management of the company and the market.

There is no evidence of post-announcement drift in either of the two subsamples, as the mean and median CARs are found to be insignificant for both subsamples in the post-event window [+2, +22]. This implies that the market fully incorporate

the new information and revise their estimates within the following day. The reaction to the qualitative warnings is surprisingly slow, but as discussed it can be due to the lack of sufficient information and greater uncertainty.

6.4 Market Response to Good and Bad News

The sample has been divided into negative and positive warnings and the results are presented in Table 8. Panel D display announcements that are classified as negative, while Panel E include those classified as positive. Looking at the subsamples it is apparent that there are substantially more negative warnings than positive. The sample size of 50 positive warnings is nevertheless sufficient to draw valid inferences. Comparing the subsample consisting of positive warnings with the subsample including negative warnings reveals some interesting aspects. The market reaction to negative profit warnings is almost twice as large as the reaction to positive warnings in the main event window, -11.05% CAAR versus 5.97% CAAR, significant at a 0.1%-level.

These findings confirm the view that investors on average react stronger to bad news than good news. The implications from this finding are induced incentives for earnings management and investor irrationality. The results indicate that failure to meet investors' earnings expectations is penalized harder than the market reward news that exceeds the expectations. This imposes an incentive for the management to make sure that expectations are met, thereby managing earnings upwards (Scott 2012). It could also reflect that managers are more eager to disclose positive news than negative, resulting in asymmetric information content between positive and negative warnings. Rational investors are aware of these incentives and actions taken by the management. The presence of bad news will therefore be a confirmation of poor future profitability. With respect to investor irrationality, evidence of dissimilar reactions to good and bad news indicates a separate evaluation of gains and losses, which deviates from conventional decision theory (Scott 2012). This separate evaluation reflects that investors are loss-averse and dislike losses more than they appreciate equally sized gains, but the differences could also be due to asymmetric information content.

Table 8: Negative and Positive PWs 2005-2012

N is the number of companies in the sample for a given event window. The column "Pos / Neg" shows the number of observations with positive and negative abnormal returns during the event windows. T-stat cross-sectional and Patell-Z are parametric tests, while Corrado Rank test and Sign test are non-parametric tests. ***, **,* indicates the level of significance for mean CARs. Panel D shows the cumulative average abnormal return (CAAR) and median cumulative abnormal return (CAR) for Profit Warnings characterized as negative in the stated event windows. Panel E shows CAAR and Median CARs for positive PWs.

Panel D: Negative

Event Window	N	Mean CAR	Median CAR	Pos / Neg	t-stat cross-sec.	Patell-Z	Corrado Rank	Sign test
[- 2, + 2]	134	-10,98 %	-8,64 %	17 / 117	-9,57 ***	-17,95 ***	-6,73 ***	-10,39 ***
[- 1, +1]	134	**-11,05 %**	**-8,13 %**	18 / 116	-9,66 ***	-23,15 ***	-8,48 ***	-10,21 ***
[- 1]	134	-0,02 %	-0,08 %	75 / 59	-0,07	-0,07	-0,20	-0,26
[0]	134	**-9,50 %**	**-7,07 %**	18 / 116	-8,68 ***	-34,39 ***	-11,13 ***	-10,21 ***
[+ 1]	134	-1,53 %	-1,11 %	52 / 82	-3,50 ***	-5,64 ***	-3,36 ***	-4,28 ***
[+ 2, + 22]	134	-0,57 %	0,27 %	69 / 65	-0,28	-1,17	-1,33	-1,31

***, ** and * indicate significance at the 0,1%, 1% and 5% -level respectively

Panel E: Positive

Event Window	N	Mean CAR	Median CAR	Pos / Neg	t-stat cross-sec.	Patell-Z	Corrado Rank	Sign test
[- 2, + 2]	50	5,34 %	5,70 %	36 / 14	4,86 ***	5,22 ***	2,09 *	1,97
[- 1, +1]	50	**5,97 %**	**4,16 %**	37 / 13	5,63 ***	7,61 ***	3,76 ***	2,26 *
[- 1]	50	-0,07 %	-0,15 %	28 / 22	-0,20	-0,18	-0,54	-0,32
[0]	50	**5,89 %**	**4,23 %**	41 / 9	6,19 ***	12,90 ***	6,34 ***	3,41 **
[+ 1]	50	0,16 %	0,19 %	32 / 18	0,35	0,46	0,72	0,54
[+ 2, + 22]	50	1,42 %	-2,01 %	23 / 27	0,60	0,01	0,37	-2,17 *

***, ** and * indicate significance at the 0,1%, 1% and 5% -level respectively

We further notice that there are no significant abnormal returns prior to the event date, implying no information leakage in either subsample. Another interesting feature is that many of the warnings results in a market response in the opposite direction of what was expected. Column 5 in panel E reveals that 9 out of the 50 positive warnings yielded negative mean CARs on the announcement day. Further investigation detected that these warnings had small negative abnormal returns on the announcement day. The small impact on the stock price is probably because the warnings provided little new information, or because they included both positive and negative news which cancelled each other out and made it difficult to interpret the overall effect. Another explanation is that the market expectations prior to the announcement date could be based upon estimates which deviated substantially from the warning, and despite positive news, they could be lower than anticipated and thereby cause a negative price effect. The subjective

assessment we applied when we separated between positive and negative warnings was not based upon a market proxy. We also notice that there are less negative CARs among the profit warnings classified as positive at the announcement date than for the other event windows. This feature is desirable as we expected that most of the reaction would occur at the announcement date, and that abnormal returns on other days are less prominent and thereby more random.

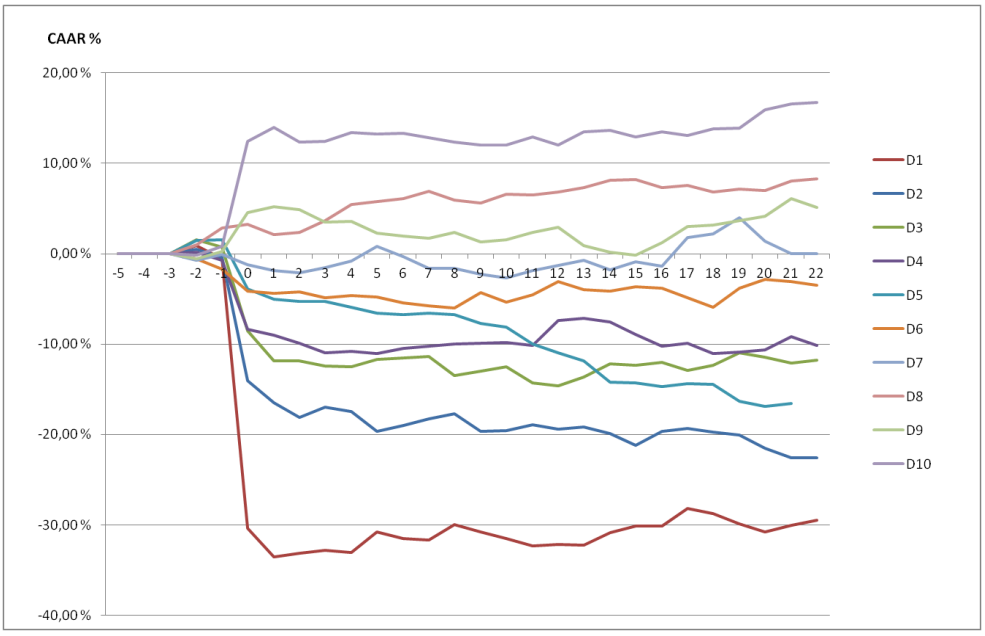
Considering the speed of adjustment after the disclosure, there seems to be a slower reaction to negative news. There is a significant negative CAAR of 1.53% the day after the announcement, shown in Panel D, while no significant post-announcement abnormal returns can be found in Panel E. A possible explanation to this could be that the management issue negative warnings concealed together with positive information to reduce the negative impact associated with bad news. Consequently, the market requires longer time to interpret and react to the new information. Efforts to conceal information would be detected and securities priced correctly in an efficient market. Overall, the slow market reaction to negative profit warnings increases the disparity between the two classifications, as no delayed market reaction is found for positive profit warnings. The analysis does not detect any significant post-announcement drift in Panel D, but there seems to be conflicting evidence of continuing positive drift and partial reversal in Panel E. The mean CAR for the post-event window is 1.42%, while the median CAR is found to be -2.01%. Considering the positive warnings, the reason for the distorted results is that the distribution is found to be positively skewed (skewness of 0.51) with some negative outliers. The CARs are in any case not statistically significant.

6.5 Profit Warnings Divided into Deciles

After calculating the abnormal returns for all events, the profit warnings have been divided into deciles based upon market impact, measured by the abnormal returns in the main event window. The profit warnings are ranked from lowest to highest, where six of the portfolios include 18 companies and four portfolios consist of 19 companies. The reasoning behind this approach is to examine the level of CAR and investigate whether there are any post-announcement differences between the deciles. Since we found some extreme reactions, it is

particularly interesting to test whether some of the reaction is reversed or if it continues to drift in the same direction. Decile 1 and 10 are thus of great interest.

Figure 4: CAAR for Different Deciles



The results are presented in Figure 4 and Table 9. The portfolios are ranked from lowest CAAR, i.e. D1, to highest CAAR, i.e. D10, and Table 9 displays the different CAARs in the event window and for the post-event window. Most of the CAARs in the event window are significant at a 0.1%-level, except from D8, which includes companies that experienced modest reaction in the event window. There are only two deciles which have significant abnormal returns in the post-event window. The graph reveals that D5 has a continuing downward drift after the negative market reaction in the event window, indicating a gradual market response. The post-announcement drift cumulates into a negative CAAR of 12.9% from day two until day 22, and is significant at a 0.1%-level. Another decile which has an underreaction is D8, which consist of companies that experienced small CAAR in the event window. The continuing drift cumulates to a CAAR of 6.1% and is found to be significant at a 5%-level. The rationale for the price drift in these two deciles cannot be explained by the characteristics of the companies or the composition of the deciles.

Table 9: PWs Divided Into Deciles

Decile	CAAR [-1, +1]	CAAR [+2, +22]
D1	-34.4 % ***	4.0 %
D2	-17.0 % ***	-6.1 %
D3	-13.4 % ***	0.1 %
D4	-9.2 % ***	-1.2 %
D5	-6.5 % ***	**-12.9 %** ***
D6	-3.9 % ***	1.0 %
D7	-1.2 % ***	1.0 %
D8	1.1 %	**6.1 %** *
D9	5.8 % ***	-0.1 %
D10	14.2 % ***	2.7 %
(***,** and * indicate significance on a 0.1%-, 1%- and 5%-level)		

The overall consensus is that there is no clear pattern for abnormal returns between the deciles in the post-event window, and Figure 4 illustrates this. Two of the deciles have significant post-announcement abnormal returns, but there exist no obvious theoretical justification for why these two deciles should exhibit continuing drift. The results could simply be due to chance, or heavily influenced by one or two extreme observation because the sample size in each decile is relative small. No significant overreaction and price-reversal is found in any of the deciles. These results support the EMH and the findings in Figure 3, i.e. the market has in most cases fully revised the information within the event window.

7. Summary and Conclusions

The main objective of this paper is to scrutinize the extent of market rationality in response to profit warning announcements. By estimating abnormal returns in the period around the event date, we examine the magnitude of the price reaction, the timing of the market reaction and the speed of adjustment to new information. Due to the unexpected nature of profit warnings they are an effective field of study to test the degree of market efficiency and to investigate whether there are any disparities in market reaction between different types of information disclosures.

We find no evidence of cross-sectional information leakage in the dataset, which clearly indicates that the market did not anticipate the news or that insiders desisted from exploiting an informational advantage. The mean CAR for the total sample is -6.36% in the main event window, while the mean CAR at the announcement date is -5.25%. In terms of absolute values, the mean CAR is 9.1% at the announcement date, which is roughly the same as what other studies have found. We provide evidence of a quick and rational response to new information and the magnitude of the abnormal returns implies high power of the study. To test for post-announcement drift we employed a post-event window, but found no evidence of momentum or reversal effects within the sample. All price adjustments accrue within the main event window, consistent with the efficient market hypothesis. The graphical representation of the CAAR for the event window resembles the semi-strong reaction almost perfectly, suggesting that the information conveyed in the announcements is adequate and that the market responds rationally.

After distinguishing between quantitative and qualitative warnings we report that the former have a greater market reaction, thus contrary to what we expected. There are no signs of overreaction to qualitative warnings. Some of the difference has diminished the day after the announcement, which suggests that qualitative warnings experience a delayed market reaction, but that this inertia is captured within the event window. The delayed market reaction for the qualitative warnings at day one is 2.1% and significant. A rational explanation to this is less

uncertainty embedded in quantitative warnings due to more accurate and detailed forecasts of future profitability. These findings suggests that the qualitative warnings are more difficult to interpret or it could indicate that the market not respond as efficiently as expected.

Abnormal returns following negative profit warnings are almost twice as high as abnormal returns following positive profit warnings, with mean CARs of -11.05% and 5.97% respectively. The fact that investors react stronger to bad news than to good news implies that the information content in negative warnings on average is more severe and of greater importance or that investors are loss-averse. The overall conclusion in our thesis is that the Norwegian stock market's response to profit warnings is in line with the semi-strong form of market efficiency.

Limitations and shortcomings in this study relates to the availability of data, parameter estimation and to the sample size. The information in each individual profit warning is unique, and stating something general based upon specific events should be done with caution. The manual assessment of each individual warning could be a weakness in this study. Sorting and separating the profit warnings from other news and the subjective classification of the warnings could lead to errors. This study does not measure the element of surprise in the announcement. An improvement of the model design would be to incorporate market expectations through analyst forecasts. Another shortcoming in this study is related to the parameter estimation. The inefficient coefficients imply that we cannot draw any inferences regarding the statistical significance of the parameters, but that the coefficients on average are equal to their true values. A final weakness is the relatively small sample size compared to studies performed in other countries. The statistical power of the study is high, but the numbers of profit warnings within the subsamples are lower and the issue more imminent.

Suggestions for future research are to employ a proxy for market expectations based on analyst forecasts and perhaps to design a warnings response coefficient. Another interesting feature would be a study focusing on personnel responsible for investor relations, such that motivation and decisive factors for disclosing information could be further investigated.

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9. Appendix

Appendix 1: Rules Regarding Information Disclosure at OSE

3.1 Inside information

3.1.1 The content of the duty to provide information

"(1) The company shall without delay and on its own initiative publicly disclose inside information that concerns the company directly, cf. Section 3-2, first to third paragraphs, of the Securities Trading Act.
(2) Inside information shall mean any information of a precise nature relating to financial instruments, the issuer thereof or other circumstances which has not been made public and is not commonly known in the market and which is likely to have a significant effect on the price of those financial instruments or of related financial instruments.
(3) Information shall be deemed to be of a precise nature if it indicates circumstances that exist or may reasonably be expected to come into existence or an event that has occurred or may reasonably be expected to occur and which is specific enough to enable a conclusion to be drawn as to the possible effect of those circumstances or that event on the price of the financial instruments or related financial instruments"…

3.1.4 Duty of prior notice when publicly disclosing particularly price-sensitive events

If the company, at any time during the exchange's opening hours, is to publicly disclose information on a take-over bid or a profit warning or other specific matters that must be assumed to have a significant effect on its share price, it must contact Oslo Børs prior to making such public disclosure. In view of the interests of investors, it is necessary for the company and Oslo Børs to collaborate on the publication of such price-sensitive information. Oslo Børs wishes to stress that the duty to give prior notice is separate and additional to the duty to notify Oslo Børs of a decision to delay publication pursuant to section 3.1.2, third paragraph. Announcements of profits warnings and takeover bids will always trigger a duty of prior notice, and the impact on prices typically associated with such announcements can
provide guidance when evaluating what kind of other information which should also trigger this duty. In other words, this duty does not apply to general announcements of a price-sensitive nature, but only to announcements of a particularly price-sensitive character, where the effect on the share price must be assumed to be so considerable that a matching halt should be considered in the best interest of the investor market"...

Appendix 2: Example of Profit Warning (TTS Group)

Title: TTS - Profit Warning
Date/time 02.11.2009 08:09

TTS warns of a weak result in the third quarter, due to further provisions in connection with the bankruptcy of Wadan shipyard and increased development cost in TTS' Energy division.

The German yard Wadan went bankrupt in the second quarter this year. TTS undertook write-downs of NOK 6m in Q2. Based on a legal opinion of the accounts receivable, and an evaluation of produced, but not delivered equipment, TTS has booked NOK 20m in provision for losses in the third quarter.

Furthermore, TTS has booked NOK 20m in development cost on drilling packages for jack-up rigs and bigger offshore cranes during the quarter.
The preliminary review of the results for Q3 forcast is a turnover of NOK 900m and a negative EBITDA of NOK 10m.

TTS will give the details of circumstances regarding the profit developments during third quarter at the announced presentation of the Group's results at Grand Hotel, Oslo 5 November 08:15.

Profit Warning TTS 02.11.2009	
Classification:	
Negative	
Quantitative	
OLS-Estimates	
Alpha	-0,01
Beta	0,79
Std error	0,06
t-stat	14,18
Event window	
CAR [-1, +1]	-13,98 %

Appendix 3: List of Profit Warnings from 01.01.2005 to 31.12.2012

List of Companies with Profit Warnings from 01.01.2005 to 31.12.2013

No.	Date	Company	Ticker	Sector	Pos. vs. Neg.	Quantitative?
1	05.01.2005	Rieber & Søn ASA	RIE	Consumer Staples	Negative	Yes
2	10.01.2005	TGS-NOPEC Geophysical Company ASA	TGS	Energy	Positive	Yes
3	19.01.2005	Acergy	ACY	Energy	Positive	Yes
4	20.01.2005	Atea ASA	ATEA	IT	Negative	Yes
5	31.01.2005	Nordic Semiconductor ASA	NOD	IT	Negative	Yes
6	02.02.2005	Stolt-Nielsen Limited	SNI	Industry	Positive	Yes
7	02.02.2005	Jinhui Shipping and Transport	JIN	Industry	Positive	No
8	02.02.2005	NextGenTel Holding ASA	NEXT	Telecom	Negative	No
9	04.02.2005	Technor	TEC	Energy	Negative	Yes
10	06.04.2005	Roxar ASA	ROX	Energy	Negative	Yes
11	18.04.2005	Atea ASA	ATEA	IT	Negative	Yes
12	29.04.2005	Hjellegjerde ASA	HJE	Consumer Staples	Negative	Yes
13	26.05.2005	Royal Caribbean Cruises Ltd.	RCL	Consumer Discretionary	Negative	Yes
14	09.06.2005	Agasti Holding ASA	AGA	Financials	Positive	Yes
15	20.06.2005	Expert ASA	EXPERT	Consumer Discretionary	Negative	Yes
16	04.07.2005	ContextVision AB	COV	Health Care	Positive	Yes
17	08.07.2005	StepStone ASA	STP	IT	Positive	Yes
18	02.09.2005	Birdstep Technology ASA	BIRD	IT	Negative	No
19	29.09.2005	Nordic Semiconductor ASA	NOD	IT	Negative	Yes
20	29.09.2005	Tandberg Data ASA	TAD	IT	Positive	Yes
21	03.10.2005	Active 24	ACTIVE	IT	Negative	Yes
22	05.10.2005	Expert ASA	EXPERT	Consumer Discretionary	Negative	Yes
23	10.10.2005	TGS-NOPEC Geophysical Company ASA	TGS	Energy	Positive	Yes
24	13.10.2005	Belships ASA	BEL	Industry	Negative	No
25	16.12.2005	Tandberg ASA	TAA	IT	Negative	Yes
26	09.01.2006	TGS-NOPEC Geophysical Company ASA	TGS	Energy	Negative	Yes
27	29.03.2006	Blom ASA	BLO	IT	Negative	Yes
28	31.03.2006	Fjord Seafood ASA	FJO	Consumer Staples	Positive	Yes
29	21.04.2006	Kitron ASA	KIT	IT	Positive	No
30	03.07.2006	Agasti Holding ASA	AGA	Financials	Positive	Yes
31	10.07.2006	Altinex ASA	ALX	Energy	Negative	No
32	10.07.2006	Vmetro ASA	VME	IT	Negative	Yes
33	10.07.2006	Software Innovation ASA	SOI	IT	Negative	No
34	15.08.2006	Jason Shipping ASA (CECO ASA)	JSHIP	Industry	Negative	No
35	06.09.2006	Tandberg Television ASA	TAT	IT	Negative	Yes
36	03.10.2006	Bionor Pharma ASA	BIONOR	Health Care	Negative	Yes
37	05.10.2006	ContextVision AB	COV	Health Care	Negative	Yes
38	09.10.2006	Simrad Optronics ASA	SIT	IT	Negative	No
39	19.10.2006	Synnøve Finden ASA	SFM	Consumer Staples	Negative	No
40	20.10.2006	Renewable Energy Corporation ASA	REC	IT	Positive	Yes
41	30.10.2006	Tandberg Data	TAD	IT	Negative	Yes
42	29.11.2006	Acergy S.A	ACY	Energy	Negative	Yes
43	12.12.2006	PSI Group ASA	PSI	IT	Positive	Yes
44	12.12.2006	Kverneland ASA	KVE	Industry	Negative	No
45	21.12.2006	Synnøve Finden ASA	SFM	Consumer Staples	Negative	Yes
46	11.01.2007	Q-Free ASA	QFR	IT	Negative	Yes
47	22.01.2007	Veidekke ASA	VEI	Industry	Positive	Yes
48	29.01.2007	Norsk Hydro ASA	NHY	Materials	Negative	Yes
49	27.03.2007	Vmetro ASA	VME	IT	Negative	Yes
50	28.03.2007	ContextVision AB	COV	Health Care	Negative	No

Appendix 3 (Continued): List of Profit Warnings

No.	Date	Company	Ticker	Sector	Pos. vs. Neg.	Quantitative?
51	12.04.2007	StepStone ASA	STP	Industry	Positive	Yes
52	13.04.2007	Bionor Pharma ASA	BIONOR	Health Care	Negative	Yes
53	19.04.2007	Tandberg Storage ASA	TST	IT	Negative	No
54	23.04.2007	OTRUM ASA	OTR	IT	Positive	Yes
55	09.05.2007	Hexagon Composites ASA	HEX	Industry	Negative	No
56	19.06.2007	Profdoc ASA	PRO	IT	Negative	No
57	25.06.2007	Kongsberg Automotive Holding ASA	KOA	Consumer Discretionary	Negative	No
58	06.07.2007	STX Europe AS	STXEUR	Energy	Negative	Yes
59	13.07.2007	TGS-NOPEC Geophysical Company ASA	TGS	Energy	Negative	Yes
60	27.07.2007	Fast Search & Transfer ASA	FAST	IT	Negative	Yes
61	27.07.2007	Norwegian Property ASA	NPRO	Consumer Discretionary	Positive	Yes
62	03.08.2007	Exense ASA	EXE	IT	Negative	Yes
63	13.09.2007	Norske Skogindustrier ASA	NSG	Materials	Negative	Yes
64	18.09.2007	ContextVision AB	COV	Health Care	Positive	No
65	05.10.2007	Agasti Holding ASA	AGA	Financials	Negative	Yes
66	09.10.2007	StepStone ASA	STP	Industry	Positive	Yes
67	09.10.2007	TGS-NOPEC Geophysical Company ASA	TGS	Energy	Negative	No
68	09.10.2007	DNB ASA	DNB	Financials	Negative	Yes
69	09.10.2007	Software Innovation ASA	SOI	IT	Negative	Yes
70	17.10.2007	Marine Harvest ASA	MHG	Consumer Staples	Negative	Yes
71	17.10.2007	Renewable Energy Corporation ASA	REC	IT	Negative	Yes
72	17.10.2007	OTRUM ASA	OTR	IT	Negative	Yes
73	09.11.2007	Ekornes ASA	EKO	Consumer Discretionary	Negative	Yes
74	29.11.2007	Acergy A.S	ACY	Energy	Negative	Yes
75	03.12.2007	Norske Skogindustrier ASA	NSG	Materials	Negative	Yes
76	18.12.2007	STX Europe AS	STXEUR	Energy	Negative	Yes
77	18.12.2007	Tandberg Data ASA	TAD	IT	Negative	Yes
78	20.12.2007	Veidekke ASA	VEI	Industry	Positive	Yes
79	07.01.2008	Bluewater Insurance ASA	UNISON	Financials	Negative	Yes
80	14.01.2008	Agasti Holding ASA	AGA	Financials	Positive	Yes
81	16.01.2008	StepStone ASA	STP	Industry	Positive	Yes
82	24.01.2008	Cermaq ASA	CEQ	Consumer Staples	Negative	Yes
83	28.01.2008	Schibsted ASA	SCH	Industry	Negative	Yes
84	28.01.2008	Kitron ASA	KIT	IT	Negative	Yes
85	31.01.2008	Petroleum Geo-Services ASA	PGS	Energy	Negative	Yes
86	31.01.2008	Faktor Eiendom ASA	FAKTOR	Consumer Discretionary	Negative	Yes
87	01.02.2008	OTRUM ASA	OTR	IT	Negative	Yes
88	01.02.2008	Hexagon Composites ASA	HEX	Industry	Negative	No
89	14.02.2008	Roxar ASA	ROX	Energy	Negative	Yes
90	19.02.2008	SeaBird Exploration PLC	SBX	Energy	Negative	Yes
91	11.03.2008	Norske Skogindustrier ASA	NSG	Materials	Negative	No
92	08.04.2008	Wintershall Norge ASA	WNOR	Energy	Positive	Yes
93	14.04.2008	Navamedic ASA	NAVA	Health Care	Negative	Yes
94	17.04.2008	Wavefield Inseis ASA	WAVE	Energy	Negative	Yes
95	18.04.2008	Cermaq ASA	CEQ	Consumer Staples	Negative	Yes
96	21.04.2008	Roxar ASA	ROX	Energy	Positive	Yes
97	30.04.2008	TECO Maritime ASA	TECO	Industry	Negative	Yes
98	17.06.2008	Kitron ASA	KIT	IT	Positive	Yes
99	30.06.2008	Axis-Shield plc	ASD	Health Care	Positive	Yes
100	02.07.2008	Songa Offshore SE	SONG	Energy	Positive	Yes

Appendix 3 (Continued): List of Profit Warnings

No.	Date	Company	Ticker	Sector	Pos. vs. Neg.	Quantitative?
101	04.07.2008	Electromagnetic Geoservices ASA	EMGS	Energy	Negative	Yes
102	08.07.2008	Norwegian Air Shuttle ASA	NAS	Industry	Negative	Yes
103	14.07.2008	Norsk Hydro ASA	NHY	Materials	Negative	Yes
104	21.07.2008	Cermaq ASA	CEQ	Consumer Staples	Negative	Yes
105	13.08.2008	Protector Forsikring ASA	PROTCT	Financials	Negative	Yes
106	15.08.2008	Codfarmers ASA	COD	Consumer Staples	Negative	Yes
107	22.09.2008	Software Innovation ASA	SOI	IT	Negative	No
108	02.10.2008	Protector Forsikring ASA	PROTCT	Financials	Negative	Yes
109	07.10.2008	ContextVision AB	COV	Health Care	Negative	No
110	16.10.2008	Ignis ASA	IGNIS	IT	Positive	Yes
111	17.10.2008	Norwegian Air Shuttle ASA	NAS	Industry	Positive	Yes
112	23.10.2008	Kitron ASA	KIT	IT	Positive	No
113	31.10.2008	Codfarmers ASA	COD	Consumer Staples	Negative	No
114	05.11.2008	Hafslund ASA	HAFS	Energy	Negative	Yes
115	18.12.2008	PSI Group ASA	PSI	IT	Positive	Yes
116	19.12.2008	Storebrand ASA	STB	Financials	Positive	No
117	05.01.2009	Grieg Seafood ASA	GSF	Consumer Staples	Negative	Yes
118	12.01.2009	Cermaq ASA	CEQ	Consumer Staples	Negative	Yes
119	19.01.2009	Aker Solutions ASA	AKSO	Energy	Negative	Yes
120	28.01.2009	Norsk Hydro ASA	NHY	Materials	Negative	Yes
121	30.01.2009	Schibsted ASA	SCH	Consumer Discretionary	Negative	Yes
122	19.02.2009	Jason Shipping ASA	JSHIP	Industry	Negative	Yes
123	25.02.2009	Reservoir Exploration Technology ASA	RXT	Energy	Negative	Yes
124	27.03.2009	TeleComputing ASA	TCO	Telecom	Positive	No
125	02.04.2009	NattoPharma ASA	NATTO	Health Care	Positive	No
126	28.04.2009	Vizrt Ltd.	VIZ	IT	Negative	Yes
127	30.04.2009	Veidekke ASA	VEI	Industry	Negative	Yes
128	05.05.2009	Simtronics ASA	SIMTRO	IT	Negative	Yes
129	08.06.2009	FARA ASA	FARA	IT	Positive	No
130	30.06.2009	Data Respons ASA	DAT	IT	Positive	Yes
131	29.07.2009	Odim ASA	ODIM	Energy	Negative	Yes
132	18.08.2009	Codfarmers ASA	COD	Consumer Staples	Negative	Yes
133	02.11.2009	TTS Group ASA	TTS	Industry	Negative	Yes
134	25.01.2010	BWG Homes ASA	BWG	Consumer Discretionary	Positive	Yes
135	05.02.2010	Seadrill Limited	SDRL	Energy	Positive	Yes
136	22.02.2010	TTS Group ASA	TTS	Industry	Negative	Yes
137	24.02.2010	Veidekke ASA	VEI	Industry	Negative	Yes
138	12.03.2010	Kitron ASA	KIT	IT	Negative	Yes
139	31.05.2010	Wilh. Wilhelmsen Holding ASA	WWI	Industry	Positive	No
140	17.09.2010	Nordic Semiconductor ASA	NOD	IT	Negative	Yes
141	30.09.2010	EVRY ASA	EVRY	IT	Negative	Yes
142	11.10.2010	Eltek ASA	ELT	IT	Negative	Yes
143	12.10.2010	Norsk Hydro ASA	NHY	Materials	Negative	Yes
144	20.10.2010	Q-Free ASA	QFR	IT	Negative	Yes
145	21.12.2010	Blom ASA	BLO	IT	Negative	No
146	28.12.2010	Protector Forsikring ASA	PROTCT	Financials	Positive	No
147	11.01.2011	SeaBird Exploration PLC	SBX	Energy	Negative	No
148	24.01.2011	EVRY ASA	EVRY	IT	Negative	Yes
149	26.01.2011	Sølvtrans Holding ASA	STRANS	Consumer Staples	Negative	Yes
150	27.01.2011	Protector Forsikring ASA	PROTCT	Financials	Positive	Yes

Appendix 3 (Continued): List of Profit Warnings

No.	Date	Company	Ticker	Sector	Pos. vs. Neg.	Quantitative?
151	04.02.2011	Yara International ASA	YAR	Materials	Negative	Yes
152	04.02.2011	Electromagnetic Geoservices ASA	EMGS	Energy	Negative	Yes
153	14.04.2011	Petroleum Geo-Services ASA	PGS	Energy	Negative	Yes
154	15.04.2011	ORIGIO a/s	ORO	Health Care	Positive	Yes
155	20.05.2011	EVRY ASA	EVRY	IT	Negative	Yes
156	17.06.2011	Aker Solutions ASA	AKSO	Energy	Negative	Yes
157	24.06.2011	Comrod Communication ASA	COMROI	IT	Negative	No
158	15.07.2011	Petroleum Geo-Services ASA	PGS	Energy	Positive	Yes
159	23.08.2011	Nordic Semiconductor ASA	NOD	IT	Negative	Yes
160	11.10.2011	Aker Solutions ASA	AKSO	Energy	Negative	Yes
161	14.10.2011	Kongsberg Automotive Holding ASA	KOA	Industry	Negative	Yes
162	18.10.2011	Spectrum ASA	SPU	Energy	Positive	No
163	06.01.2012	Spectrum ASA	SPU	Energy	Positive	No
164	09.01.2012	Birdstep Technology ASA	BIRD	IT	Negative	No
165	25.01.2012	Protector Forsikring ASA	PROTCT	Financials	Positive	Yes
166	01.02.2012	Norsk Hydro ASA	NHY	Materials	Negative	Yes
167	06.02.2012	SeaBird Exploration PLC	SBX	Energy	Negative	Yes
168	08.02.2012	DNO International ASA	DNO	Energy	Positive	Yes
169	28.02.2012	Blom ASA	BLO	IT	Negative	Yes
170	04.05.2012	Bergen Group ASA	BERGEN	Industry	Negative	No
171	08.05.2012	Jinhui Shipping and Transport. Ltd	JIN	Industry	Negative	No
172	03.07.2012	Vizrt Ltd.	VIZ	IT	Negative	Yes
173	17.07.2012	Petroleum Geo-Services ASA	PGS	Energy	Positive	Yes
174	19.07.2012	BW Offshore Limited	BWO	Energy	Negative	Yes
175	14.08.2012	Bergen Group ASA	BERGEN	Industry	Negative	Yes
176	27.09.2012	Odfjell SE	ODF	Energy	Negative	Yes
177	17.10.2012	Electromagnetic Geoservices ASA	EMGS	Energy	Negative	Yes
178	26.10.2012	Dolphin Group ASA	DOLPH	Energy	Positive	Yes
179	30.10.2012	Bergen Group ASA	BERGEN	Industry	Negative	Yes
180	20.11.2012	BW Offshore Limited	BWO	Energy	Negative	Yes
181	23.11.2012	Repant ASA	REPANT	Industry	Negative	No
182	26.11.2012	Archer Limited	ARCHER	Energy	Negative	Yes
183	13.12.2012	Nordic Semiconductor ASA	NOD	IT	Negative	Yes
184	17.12.2012	Scana Industrier ASA	SCI	Materials	Negative	No

Appendix 4: Statistical Tests

No.	Date	Company	White's-test	Heteroscedasticity	DW	Autocorrelation
1	05.01.2005	Rieber & Søn ASA	0,002	Yes	2,62	Yes
2	10.01.2005	TGS-NOPEC Geophysical Company ASA	0,018	Ambiguous	1,63	No
3	19.01.2005	Acergy	0,014	Yes	2,00	No
4	20.01.2005	Atea ASA	0,000	Ambiguous	2,09	No
5	31.01.2005	Nordic Semiconductor ASA	0,990	No	2,06	No
6	02.02.2005	Stolt-Nielsen Limited	0,000	Yes	2,22	No
7	02.02.2005	Jinhui Shipping and Transport	0,179	No	1,68	No
8	02.02.2005	NextGenTel Holding ASA	0,890	No	2,39	No
9	04.02.2005	Technor	0,001	Ambiguous	2,12	No
10	06.04.2005	Roxar ASA	0,905	No	2,46	Inconclusive
11	18.04.2005	Atea ASA	0,000	Ambiguous	2,19	No
12	29.04.2005	Hjellegjerde ASA	0,270	No	1,99	No
13	26.05.2005	Royal Caribbean Cruises Ltd.	0,054	No	1,94	No
14	09.06.2005	Agasti Holding ASA	0,089	No	1,82	No
15	20.06.2005	Expert ASA	0,460	No	2,06	No
16	04.07.2005	ContextVision AB	0,076	No	2,06	No
17	08.07.2005	StepStone ASA	0,000	Ambiguous	2,25	No
18	02.09.2005	Birdstep Technology ASA	0,061	No	1,95	No
19	29.09.2005	Nordic Semiconductor ASA	0,028	Ambiguous	2,14	No
20	29.09.2005	Tandberg Data ASA	0,068	No	2,21	No
21	03.10.2005	Active 24	0,420	No	1,80	No
22	05.10.2005	Expert ASA	0,900	No	1,73	No
23	10.10.2005	TGS-NOPEC Geophysical Company ASA	0,000	Ambiguous	1,89	No
24	13.10.2005	Belships ASA	0,780	No	2,06	No
25	16.12.2005	Tandberg ASA	0,000	Yes	2,12	No
26	09.01.2006	TGS-NOPEC Geophysical Company ASA	0,400	No	2,03	No
27	29.03.2006	Blom ASA	0,920	No	2,16	No
28	31.03.2006	Fjord Seafood ASA	0,005	Ambiguous	2,14	No
29	21.04.2006	Kitron ASA	0,100	No	2,05	No
30	03.07.2006	Agasti Holding ASA	0,007	Yes	1,94	No
31	10.07.2006	Altinex ASA	0,180	No	2,26	No
32	10.07.2006	Vmetro ASA	0,690	No	2,67	Yes
33	10.07.2006	Software Innovation ASA	0,660	No	2,12	No
34	15.08.2006	Jason Shipping ASA (CECO ASA)	0,400	No	2,23	No
35	06.09.2006	Tandberg Television ASA	0,260	No	1,81	No
36	03.10.2006	Bionor Pharma ASA	0,095	No	2,45	Inconclusive
37	05.10.2006	ContextVision AB	0,610	No	2,39	No
38	09.10.2006	Simrad Optronics ASA	0,000	Ambiguous	2,36	No
39	19.10.2006	Synnøve Finden ASA	0,390	No	2,12	No
40	20.10.2006	Renewable Energy Corporation ASA	0,000	Yes	1,99	No
41	30.10.2006	Tandberg Data	0,830	No	2,18	No
42	29.11.2006	Acergy S.A	0,012	Yes	2,25	No
43	12.12.2006	PSI Group ASA	0,051	No	2,54	Yes
44	12.12.2006	Kverneland ASA	0,430	No	1,93	No
45	21.12.2006	Synnøve Finden ASA	0,560	No	2,02	No
46	11.01.2007	Q-Free ASA	0,212	No	2,18	No
47	22.01.2007	Veidekke ASA	0,000	Yes	2,04	No
48	29.01.2007	Norsk Hydro ASA	0,000	Ambiguous	2,00	No
49	27.03.2007	Vmetro ASA	0,400	No	2,28	No
50	28.03.2007	ContextVision AB	0,009	Yes	2,32	No

Appendix 4 (Continued): Statistical Tests

No.	Date	Company	White's-test	Heteroscedasticity	DW	Autocorrelation
51	12.04.2007	StepStone ASA	0,434	No	2,18	No
52	13.04.2007	Bionor Pharma ASA	0,030	Ambiguous	2,03	No
53	19.04.2007	Tandberg Storage ASA	0,027	Ambiguous	2,29	No
54	23.04.2007	OTRUM ASA	0,390	No	2,11	No
55	09.05.2007	Hexagon Composites ASA	0,280	No	2,27	No
56	19.06.2007	Profdoc ASA	0,280	No	2,90	Yes
57	25.06.2007	Kongsberg Automotive Holding ASA	0,098	No	2,67	Yes
58	06.07.2007	STX Europe AS	0,017	Ambiguous	2,07	No
59	13.07.2007	TGS-NOPEC Geophysical Company ASA	0,230	No	2,41	No
60	27.07.2007	Fast Search & Transfer ASA	0,260	No	1,58	No
61	27.07.2007	Norwegian Property ASA	0,300	No	1,87	No
62	03.08.2007	Exense ASA	0,470	No	2,14	No
63	13.09.2007	Norske Skogindustrier ASA	0,370	No	2,36	No
64	18.09.2007	ContextVision AB	0,840	No	2,28	No
65	05.10.2007	Agasti Holding ASA	0,290	No	1,88	No
66	09.10.2007	StepStone ASA	0,260	No	2,21	No
67	09.10.2007	TGS-NOPEC Geophysical Company ASA	0,140	No	2,21	No
68	09.10.2007	DNB ASA	0,980	No	2,05	No
69	09.10.2007	Software Innovation ASA	0,480	No	2,53	Yes
70	17.10.2007	Marine Harvest ASA	0,030	Yes	1,89	No
71	17.10.2007	Renewable Energy Corporation ASA	0,390	No	1,93	No
72	17.10.2007	OTRUM ASA	0,420	No	2,40	No
73	09.11.2007	Ekornes ASA	0,136	No	2,65	Yes
74	29.11.2007	Acergy A.S	0,940	No	1,96	no
75	03.12.2007	Norske Skogindustrier ASA	0,620	No	2,04	No
76	18.12.2007	STX Europe AS	0,000	Ambiguous	1,84	No
77	18.12.2007	Tandberg Data ASA	0,000	Yes	1,45	Yes
78	20.12.2007	Veidekke ASA	0,600	No	2,31	No
79	07.01.2008	Bluewater Insurance ASA	0,290	No	2,13	No
80	14.01.2008	Agasti Holding ASA	0,107	No	1,77	No
81	16.01.2008	StepStone ASA	0,340	No	1,91	No
82	24.01.2008	Cermaq ASA	0,700	No	1,85	No
83	28.01.2008	Schibsted ASA	0,340	No	2,13	No
84	28.01.2008	Kitron ASA	0,091	No	2,34	No
85	31.01.2008	Petroleum Geo-Services ASA	0,580	No	2,30	No
86	31.01.2008	Faktor Eiendom ASA	0,450	No	2,03	No
87	01.02.2008	OTRUM ASA	0,110	No	2,58	Yes
88	01.02.2008	Hexagon Composites ASA	0,530	No	2,23	No
89	14.02.2008	Roxar ASA	0,145	No	2,27	No
90	19.02.2008	SeaBird Exploration PLC	0,396	No	1,84	No
91	11.03.2008	Norske Skogindustrier ASA	0,581	No	2,05	No
92	08.04.2008	Wintershall Norge ASA	0,005	Ambiguous	2,13	No
93	14.04.2008	Navamedic ASA	0,583	No	2,48	Inconclusive
94	17.04.2008	Wavefield Inseis ASA	0,047	Ambiguous	2,08	No
95	18.04.2008	Cermaq ASA	0,640	No	1,94	No
96	21.04.2008	Roxar ASA	0,300	No	2,09	No
97	30.04.2008	TECO Maritime ASA	0,890	No	2,35	No
98	17.06.2008	Kitron ASA	0,000	Yes	2,29	No
99	30.06.2008	Axis-Shield plc	0,157	No	2,55	Yes
100	02.07.2008	Songa Offshore SE	0,540	No	2,33	No

Appendix 4 (Continued): Statistical Tests

No.	Date	Company	White's-test	Heteroscedasticity	DW	Autocorrelation
101	04.07.2008	Electromagnetic Geoservices ASA	0,000	Yes	1,66	No
102	08.07.2008	Norwegian Air Shuttle ASA	0,530	No	1,62	No
103	14.07.2008	Norsk Hydro ASA	0,032	Ambiguous	2,01	No
104	21.07.2008	Cermaq ASA	0,350	No	1,91	No
105	13.08.2008	Protector Forsikring ASA	0,730	No	2,39	No
106	15.08.2008	Codfarmers ASA	0,750	No	2,40	No
107	22.09.2008	Software Innovation ASA	0,026	Yes	2,68	Yes
108	02.10.2008	Protector Forsikring ASA	0,410	No	2,25	No
109	07.10.2008	ContextVision AB	0,100	No	1,78	No
110	16.10.2008	Ignis ASA	0,000	Yes	2,32	No
111	17.10.2008	Norwegian Air Shuttle ASA	0,044	Ambiguous	1,72	No
112	23.10.2008	Kitron ASA	0,152	No	2,15	No
113	31.10.2008	Codfarmers ASA	0,750	No	2,40	No
114	05.11.2008	Hafslund ASA	0,015	Ambiguous	2,45	Inconclusive
115	18.12.2008	PSI Group ASA	0,000	Yes	2,03	No
116	19.12.2008	Storebrand ASA	0,000	Yes	2,07	No
117	05.01.2009	Grieg Seafood ASA	0,000	Yes	2,39	No
118	12.01.2009	Cermaq ASA	0,000	Yes	1,88	No
119	19.01.2009	Aker Solutions ASA	0,000	Yes	1,88	No
120	28.01.2009	Norsk Hydro ASA	0,001	Ambiguous	2,31	No
121	30.01.2009	Schibsted ASA	0,170	No	2,30	No
122	19.02.2009	Jason Shipping ASA	0,000	Yes	2,24	No
123	25.02.2009	Reservoir Exploration Technology ASA	0,170	No	2,03	no
124	27.03.2009	TeleComputing ASA	0,000	Yes	3,05	Yes
125	02.04.2009	NattoPharma ASA	0,005	Ambiguous	1,94	No
126	28.04.2009	Vizrt Ltd.	0,083	No	2,13	No
127	30.04.2009	Veidekke ASA	0,000	Yes	2,06	No
128	05.05.2009	Simtronics ASA	0,000	Yes	2,27	No
129	08.06.2009	FARA ASA	0,350	No	2,30	No
130	30.06.2009	Data Respons ASA	0,170	No	2,31	No
131	29.07.2009	Odim ASA	0,000	Yes	1,85	No
132	18.08.2009	Codfarmers ASA	0,380	No	1,82	No
133	02.11.2009	TTS Group ASA	0,240	No	2,30	No
134	25.01.2010	BWG Homes ASA	0,680	No	1,79	No
135	05.02.2010	Seadrill Limited	0,530	No	2,29	No
136	22.02.2010	TTS Group ASA	0,240	No	2,30	No
137	24.02.2010	Veidekke ASA	0,920	No	2,15	No
138	12.03.2010	Kitron ASA	0,440	No	2,25	No
139	31.05.2010	Wilh. Wilhelmsen Holding ASA	0,530	No	1,73	No
140	17.09.2010	Nordic Semiconductor ASA	0,062	No	2,06	No
141	30.09.2010	EVRY ASA	0,063	No	2,49	Yes
142	11.10.2010	Eltek ASA	0,000	Yes	2,23	No
143	12.10.2010	Norsk Hydro ASA	0,970	No	2,35	No
144	20.10.2010	Q-Free ASA	0,330	No	2,20	No
145	21.12.2010	Blom ASA	0,433	No	1,86	No
146	28.12.2010	Protector Forsikring ASA	0,720	No	2,51	Yes
147	11.01.2011	SeaBird Exploration PLC	0,056	No	2,26	No
148	24.01.2011	EVRY ASA	0,041	Ambiguous	2,37	No
149	26.01.2011	Sølvtrans Holding ASA	0,610	No	1,79	No
150	27.01.2011	Protector Forsikring ASA	0,730	No	2,51	Yes

Appendix 4 (Continued): Statistical Tests

No.	Date	Company	White's-test	Heteroscedasticity	DW	Autocorrelation
151	04.02.2011	Yara International ASA	0,796	No	1,95	No
152	04.02.2011	Electromagnetic Geoservices ASA	0,000	Ambiguous	2,37	No
153	14.04.2011	Petroleum Geo-Services ASA	0,910	No	1,96	No
154	15.04.2011	ORIGIO a/s	0,905	No	2,40	No
155	20.05.2011	EVRY ASA	0,017	Ambiguous	2,25	No
156	17.06.2011	Aker Solutions ASA	0,270	No	2,17	No
157	24.06.2011	Comrod Communication ASA	0,520	No	2,98	Yes
158	15.07.2011	Petroleum Geo-Services ASA	0,186	No	1,95	No
159	23.08.2011	Nordic Semiconductor ASA	0,344	No	2,26	No
160	11.10.2011	Aker Solutions ASA	0,000	Ambiguous	2,20	No
161	14.10.2011	Kongsberg Automotive Holding ASA	0,557	No	1,91	No
162	18.10.2011	Spectrum ASA	0,070	No	2,67	Yes
163	06.01.2012	Spectrum ASA	0,001	Yes	2,56	Yes
164	09.01.2012	Birdstep Technology ASA	0,144	No	3,09	Yes
165	25.01.2012	Protector Forsikring ASA	0,830	No	2,65	Yes
166	01.02.2012	Norsk Hydro ASA	0,003	Yes	2,03	No
167	06.02.2012	SeaBird Exploration PLC	0,000	Yes	2,29	No
168	08.02.2012	DNO International ASA	0,015	Ambiguous	2,27	No
169	28.02.2012	Blom ASA	0,000	Yes	2,44	Inconclusive
170	04.05.2012	Bergen Group ASA	0,830	No	2,54	Yes
171	08.05.2012	Jinhui Shipping and Transport. Ltd	0,680	No	2,43	No
172	03.07.2012	Vizrt Ltd.	0,300	No	2,09	No
173	17.07.2012	Petroleum Geo-Services ASA	0,029	Ambiguous	2,18	No
174	19.07.2012	BW Offshore Limited	0,890	No	2,08	No
175	14.08.2012	Bergen Group ASA	0,033	Ambiguous	2,57	Yes
176	27.09.2012	Odfjell SE	0,004	Ambiguous	1,67	No
177	17.10.2012	Electromagnetic Geoservices ASA	0,000	Yes	2,10	No
178	26.10.2012	Dolphin Group ASA	0,670	No	2,36	No
179	30.10.2012	Bergen Group ASA	0,218	No	2,65	Yes
180	20.11.2012	BW Offshore Limited	0,280	No	2,38	No
181	23.11.2012	Repant ASA	0,150	No	2,89	Yes
182	26.11.2012	Archer Limited	0,150	No	2,02	No
183	13.12.2012	Nordic Semiconductor ASA	0,220	No	2,00	No
184	17.12.2012	Scana Industrier ASA	0,097	No	2,45	Inconclusive

Appendix 5: OLS - Estimates

Alpha and Beta is the coefficients estimated from the OLS-regression in the estimation window. Standard error is an etimate of the standard deviation of the sample. T-stat is the estimated beta divided by the standard error. Days traded is number of trading days during the estimation window.

No.	Company	Alpha	Beta	Std. Error	t-stat	Days traded
1	Rieber & Søn ASA	0,000	0,305	0,019	16,242	169
2	TGS-NOPEC Geophysical Company ASA	0,001	1,290	0,023	55,274	233
3	Acergy	0,001	1,622	0,028	58,305	235
4	Atea ASA	-0,004	1,719	0,046	37,412	240
5	Nordic Semiconductor ASA	0,006	0,763	0,029	26,124	188
6	Stolt-Nielsen Limited	0,002	1,549	0,021	72,248	237
7	Jinhui Shipping and Transport	0,001	1,474	0,066	22,293	231
8	NextGenTel Holding ASA	0,002	0,599	0,027	22,378	202
9	Technor	-0,002	1,269	0,032	39,549	193
10	Roxar ASA	0,000	1,128	0,026	42,945	228
11	Atea ASA	-0,004	1,438	0,047	30,395	234
12	Hjellegjerde ASA	-0,000	0,217	0,025	8,848	180
13	Royal Caribbean Cruises Ltd.	-0,000	0,541	0,015	35,915	254
14	Agasti Holding ASA	0,003	0,872	0,026	33,743	231
15	Expert ASA	0,002	0,298	0,016	18,526	198
16	ContextVision AB	-0,000	1,022	0,044	23,077	133
17	StepStone ASA	0,001	1,311	0,048	27,098	237
18	Birdstep Technology ASA	-0,002	0,605	0,041	14,757	236
19	Nordic Semiconductor ASA	0,001	0,728	0,030	24,241	207
20	Tandberg Data ASA	0,000	0,573	0,034	16,859	231
21	Active 24	-0,000	0,726	0,026	27,508	200
22	Expert ASA	0,001	0,375	0,017	21,754	210
23	TGS-NOPEC Geophysical Company ASA	0,000	1,324	0,023	57,743	234
24	Belships ASA	-0,002	1,217	0,028	43,433	224
25	Tandberg ASA	-0,003	1,099	0,023	46,920	232
26	TGS-NOPEC Geophysical Company ASA	0,000	1,480	0,023	63,266	233
27	Blom ASA	0,001	1,383	0,034	41,157	234
28	Fjord Seafood ASA	0,003	1,119	0,031	36,443	240
29	Kitron ASA	0,002	0,432	0,026	16,724	232
30	Agasti Holding ASA	0,001	0,976	0,027	36,651	223
31	Altinex ASA	0,006	1,936	0,063	30,851	181
32	Vmetro ASA	0,001	0,762	0,026	29,163	186
33	Software Innovation ASA	0,000	0,554	0,025	22,534	213
34	Jason Shipping ASA (CECO ASA)	-0,000	0,805	0,021	37,552	217
35	Tandberg Television ASA	-0,001	0,973	0,023	42,453	240
36	Bionor Pharma ASA	-0,002	0,324	0,060	5,447	187
37	ContextVision AB	0,002	0,516	0,030	17,181	191
38	Simrad Optronics ASA	0,003	0,837	0,038	22,236	219
39	Synnøve Finden ASA	0,000	0,375	0,021	17,695	221
40	Renewable Energy Corporation ASA	-0,001	1,014	0,030	33,655	108
41	Tandberg Data	-0,003	0,725	0,026	28,104	231
42	Acergy S.A	0,001	1,518	0,018	85,449	254
43	PSI Group ASA	0,002	0,558	0,030	18,770	205
44	Kverneland ASA	0,000	0,321	0,028	11,498	127
45	Synnøve Finden ASA	-0,001	0,406	0,020	20,782	218
46	Q-Free ASA	-0,001	0,893	0,029	30,301	222
47	Veidekke ASA	0,001	0,464	0,021	22,138	235
48	Norsk Hydro ASA	-0,000	1,406	0,014	99,967	248
49	Vmetro ASA	-0,002	0,594	0,028	21,225	145
50	ContextVision AB	-0,001	0,322	0,024	13,569	157

Appendix 5 (Continued): OLS - Estimates

Number	Company	Alpha	Beta	Std. Error	t-stat	Days traded
51	StepStone ASA	0,001	0,913	0,030	30,394	217
52	Bionor Pharma ASA	0,000	0,467	0,042	11,065	215
53	Tandberg Storage ASA	-0,002	0,953	0,028	33,481	219
54	OTRUM ASA	-0,003	0,617	0,038	16,326	181
55	Hexagon Composites ASA	0,003	0,597	0,024	24,399	196
56	Profdoc ASA	-0,000	0,529	0,025	21,558	148
57	Kongsberg Automotive Holding ASA	-0,000	0,105	0,025	4,230	169
58	STX Europe AS	-0,000	0,782	0,022	35,476	243
59	TGS-NOPEC Geophysical Company ASA	-0,001	1,373	0,020	68,347	240
60	Fast Search & Transfer ASA	-0,002	0,938	0,023	40,484	230
61	Norwegian Property ASA	0,001	0,672	0,015	43,518	136
62	Exense ASA	0,002	0,014	0,033	0,432	161
63	Norske Skogindustrier ASA	-0,002	0,715	0,016	44,841	249
64	ContextVision AB	-0,001	-0,247	0,024	-10,343	136
65	Agasti Holding ASA	-0,001	1,010	0,020	49,829	236
66	StepStone ASA	0,002	0,741	0,024	31,187	221
67	TGS-NOPEC Geophysical Company ASA	-0,001	1,338	0,019	69,903	244
68	DNB ASA	-0,000	0,693	0,011	63,478	238
69	Software Innovation ASA	-0,001	0,387	0,029	13,193	212
70	Marine Harvest ASA	-0,000	0,840	0,021	40,513	238
71	Renewable Energy Corporation ASA	0,002	1,500	0,022	68,061	245
72	OTRUM ASA	-0,000	0,697	0,032	21,714	185
73	Ekornes ASA	-0,001	0,292	0,018	16,462	204
74	Acergy A.S	-0,000	1,147	0,016	70,105	254
75	Norske Skogindustrier ASA	-0,005	0,872	0,025	35,141	249
76	STX Europe AS	0,000	0,921	0,023	40,452	237
77	Tandberg Data ASA	-0,004	0,876	0,044	19,759	236
78	Veidekke ASA	0,000	0,886	0,028	31,759	228
79	Bluewater Insurance ASA	-0,005	0,339	0,034	10,051	171
80	Agasti Holding ASA	-0,002	1,121	0,028	40,514	234
81	StepStone ASA	0,001	0,757	0,026	29,249	227
82	Cermaq ASA	-0,001	1,040	0,025	41,491	233
83	Schibsted ASA	-0,001	0,794	0,021	38,649	237
84	Kitron ASA	-0,002	0,634	0,021	30,230	231
85	Petroleum Geo-Services ASA	0,000	1,377	0,017	79,493	244
86	Faktor Eiendom ASA	-0,005	0,758	0,046	16,438	134
87	OTRUM ASA	-0,002	0,697	0,035	19,663	174
88	Hexagon Composites ASA	-0,002	0,690	0,023	29,400	182
89	Roxar ASA	0,001	0,626	0,021	29,203	229
90	SeaBird Exploration PLC	-0,003	1,131	0,037	30,637	226
91	Norske Skogindustrier ASA	-0,006	1,130	0,034	32,923	250
92	Wintershall Norge ASA	0,000	0,620	0,025	25,139	226
93	Navamedic ASA	-0,002	0,670	0,027	24,686	208
94	Wavefield Inseis ASA	-0,001	1,243	0,026	47,562	242
95	Cermaq ASA	-0,002	0,896	0,027	33,798	230
96	Roxar ASA	-0,002	0,511	0,023	22,499	225
97	TECO Maritime ASA	-0,003	0,440	0,022	19,722	204
98	Kitron ASA	-0,001	0,593	0,024	24,258	223
99	Axis-Shield plc	0,001	0,286	0,023	12,332	198
100	Songa Offshore SE	0,002	0,931	0,017	54,641	233

Appendix 5 (Continued): OLS - Estimates

No.	Company	Alpha	Beta	Std. Error	t-stat	Days traded
101	Electromagnetic Geoservices ASA	-0,004	0,966	0,042	23,022	245
102	Norwegian Air Shuttle ASA	-0,003	0,744	0,027	27,664	233
103	Norsk Hydro ASA	0,001	1,118	0,019	57,389	251
104	Cermaq ASA	-0,001	0,809	0,027	30,310	235
105	Protector Forsikring ASA	-0,007	0,413	0,034	12,187	106
106	Codfarmers ASA	-0,002	0,612	0,041	14,774	165
107	Software Innovation ASA	-0,004	0,833	0,045	18,555	148
108	Protector Forsikring ASA	-0,004	0,666	0,035	18,950	103
109	ContextVision AB	-0,001	0,355	0,029	12,320	125
110	Ignis ASA	-0,001	0,925	0,047	19,830	244
111	Norwegian Air Shuttle ASA	-0,004	0,614	0,037	16,409	237
112	Kitron ASA	-0,001	0,504	0,031	16,222	214
113	Codfarmers ASA	-0,004	1,028	0,052	19,877	152
114	Hafslund ASA	-0,002	0,722	0,021	33,632	224
115	PSI Group ASA	-0,004	0,451	0,043	10,472	229
116	Storebrand ASA	-0,002	1,237	0,044	28,431	253
117	Grieg Seafood ASA	-0,007	0,319	0,051	6,243	187
118	Cermaq ASA	-0,001	0,622	0,035	17,863	235
119	Aker Solutions ASA	-0,000	1,567	0,039	40,677	246
120	Norsk Hydro ASA	0,000	1,247	0,028	44,020	249
121	Schibsted ASA	-0,001	0,933	0,030	31,143	245
122	Jason Shipping ASA	-0,005	0,420	0,046	9,167	222
123	Reservoir Exploration Technology ASA	-0,012	0,705	0,054	13,046	211
124	TeleComputing ASA	-0,005	0,237	0,043	5,456	150
125	NattoPharma ASA	-0,004	0,268	0,070	3,815	215
126	Vizrt Ltd.	-0,002	0,375	0,032	11,726	221
127	Veidekke ASA	0,000	0,644	0,032	20,173	233
128	Simtronics ASA	0,001	1,043	0,053	19,863	240
129	FARA ASA	-0,000	0,274	0,088	3,112	168
130	Data Respons ASA	-0,002	0,487	0,037	13,155	172
131	Odim ASA	-0,002	0,978	0,045	21,867	238
132	Codfarmers ASA	-0,009	0,691	0,074	9,359	163
133	TTS Group ASA	-0,006	0,790	0,056	14,180	219
134	BWG Homes ASA	0,006	0,965	0,038	25,547	221
135	Seadrill Limited	0,001	1,386	0,019	73,299	247
136	TTS Group ASA	-0,005	0,624	0,054	11,655	225
137	Veidekke ASA	0,002	0,497	0,022	22,419	222
138	Kitron ASA	0,000	0,477	0,032	14,943	214
139	Wilh. Wilhelmsen Holding ASA	0,001	0,558	0,019	29,183	185
140	Nordic Semiconductor ASA	0,005	1,242	0,037	33,927	235
141	EVRY ASA	-0,003	0,757	0,030	25,645	225
142	Eltek ASA	-0,001	1,087	0,031	35,237	238
143	Norsk Hydro ASA	-0,001	1,343	0,013	101,920	253
144	Q-Free ASA	-0,001	0,766	0,024	32,216	216
145	Blom ASA	-0,005	0,536	0,041	13,035	247
146	Protector Forsikring ASA	0,002	0,687	0,036	18,933	121
147	SeaBird Exploration PLC	-0,003	1,753	0,040	43,872	238
148	EVRY ASA	-0,002	0,751	0,031	23,943	217
149	Sølvtrans Holding ASA	-0,003	0,315	0,027	11,576	108
150	Protector Forsikring ASA	0,001	0,707	0,036	19,752	123

Appendix 5 (Continued): OLS - Estimates

No.	Company	Alpha	Beta	Std. Error	t-stat	Days traded
151	Yara International ASA	0,000	1,118	0,020	55,785	249
152	Electromagnetic Geoservices ASA	0,003	1,685	0,062	27,037	242
153	Petroleum Geo-Services ASA	-0,001	1,771	0,017	103,658	250
154	ORIGIO a/s	0,001	0,393	0,030	13,143	203
155	EVRY ASA	-0,001	0,745	0,031	24,356	212
156	Aker Solutions ASA	-0,000	1,577	0,017	94,082	251
157	Comrod Communication ASA	-0,001	0,483	0,027	18,099	108
158	Petroleum Geo-Services ASA	0,000	1,716	0,015	115,896	249
159	Nordic Semiconductor ASA	-0,002	1,171	0,032	36,250	237
160	Aker Solutions ASA	-0,001	1,452	0,018	79,469	250
161	Kongsberg Automotive Holding ASA	-0,003	1,510	0,024	61,783	246
162	Spectrum ASA	0,001	0,145	0,080	1,797	114
163	Spectrum ASA	0,004	0,486	0,066	7,372	129
164	Birdstep Technology ASA	-0,003	0,930	0,070	13,373	190
165	Protector Forsikring ASA	-0,000	0,598	0,029	20,308	127
166	Norsk Hydro ASA	-0,001	1,382	0,012	115,738	251
167	SeaBird Exploration PLC	-0,012	-0,018	0,089	-0,199	205
168	DNO International ASA	-0,000	1,130	0,032	34,834	247
169	Blom ASA	-0,003	0,960	0,092	10,419	176
170	Bergen Group ASA	-0,000	0,398	0,040	9,982	208
171	Jinhui Shipping and Transport. Ltd	-0,002	0,737	0,031	24,062	226
172	Vizrt Ltd.	0,001	0,269	0,027	9,878	168
173	Petroleum Geo-Services ASA	-0,000	0,229	0,036	6,440	249
174	BW Offshore Limited	-0,002	0,452	0,030	14,911	239
175	Bergen Group ASA	0,001	0,288	0,041	6,991	212
176	Odfjell SE	-0,003	0,289	0,028	10,476	104
177	Electromagnetic Geoservices ASA	-0,000	0,891	0,033	27,249	234
178	Dolphin Group ASA	0,001	0,552	0,031	17,887	227
179	Bergen Group ASA	0,004	0,554	0,037	15,101	203
180	BW Offshore Limited	-0,004	0,564	0,027	20,913	236
181	Repant ASA	-0,004	1,239	0,057	21,650	171
182	Archer Limited	-0,004	0,389	0,037	10,411	241
183	Nordic Semiconductor ASA	0,000	0,522	0,027	19,158	214
184	Scana Industrier ASA	-0,001	0,479	0,036	13,300	216

Appendix 6: Variance and Standard Deviation

No.	Company	Variance	Standard Deviation Daily	Standard Deviation Annual
1	Rieber & Søn ASA	0,000	1,89 %	30,04 %
2	TGS-NOPEC Geophysical Company ASA	0,001	2,62 %	41,55 %
3	Acergy	0,001	3,15 %	50,05 %
4	Atea ASA	0,002	4,85 %	76,92 %
5	Nordic Semiconductor ASA	0,001	3,00 %	47,54 %
6	Stolt-Nielsen Limited	0,001	2,55 %	40,50 %
7	Jinhui Shipping and Transport	0,005	6,73 %	106,89 %
8	NextGenTel Holding ASA	0,001	2,73 %	43,28 %
9	Technor	0,001	3,41 %	54,20 %
10	Roxar ASA	0,001	2,79 %	44,34 %
11	Atea ASA	0,002	4,88 %	77,40 %
12	Hjellegjerde ASA	0,001	2,46 %	38,98 %
13	Royal Caribbean Cruises Ltd.	0,000	1,57 %	24,94 %
14	Agasti Holding ASA	0,001	2,68 %	42,57 %
15	Expert ASA	0,000	1,63 %	25,82 %
16	ContextVision AB	0,002	4,49 %	71,35 %
17	StepStone ASA	0,002	4,96 %	78,78 %
18	Birdstep Technology ASA	0,002	4,13 %	65,50 %
19	Nordic Semiconductor ASA	0,001	3,07 %	48,73 %
20	Tandberg Data ASA	0,001	3,43 %	54,49 %
21	Active 24	0,001	2,71 %	42,96 %
22	Expert ASA	0,000	1,75 %	27,82 %
23	TGS-NOPEC Geophysical Company ASA	0,001	2,68 %	42,56 %
24	Belships ASA	0,001	3,02 %	48,00 %
25	Tandberg ASA	0,001	2,65 %	42,00 %
26	TGS-NOPEC Geophysical Company ASA	0,001	2,89 %	45,82 %
27	Blom ASA	0,001	3,73 %	59,24 %
28	Fjord Seafood ASA	0,001	3,33 %	52,92 %
29	Kitron ASA	0,001	2,63 %	41,68 %
30	Agasti Holding ASA	0,001	3,10 %	49,22 %
31	Altinex ASA	0,005	7,10 %	112,67 %
32	Vmetro ASA	0,001	2,86 %	45,32 %
33	Software Innovation ASA	0,001	2,60 %	41,27 %
34	Jason Shipping ASA (CECO ASA)	0,001	2,52 %	40,03 %
35	Tandberg Television ASA	0,001	2,77 %	43,94 %
36	Bionor Pharma ASA	0,004	5,96 %	94,62 %
37	ContextVision AB	0,001	3,12 %	49,50 %
38	Simrad Optronics ASA	0,002	4,01 %	63,59 %
39	Synnøve Finden ASA	0,000	2,20 %	34,94 %
40	Renewable Energy Corporation ASA	0,001	3,60 %	57,08 %
41	Tandberg Data	0,001	2,82 %	44,75 %
42	Acergy S.A	0,001	2,90 %	46,12 %
43	PSI Group ASA	0,001	3,08 %	48,96 %
44	Kverneland ASA	0,001	2,83 %	44,93 %
45	Synnøve Finden ASA	0,000	2,05 %	32,57 %
46	Q-Free ASA	0,001	3,25 %	51,63 %
47	Veidekke ASA	0,000	2,22 %	35,19 %
48	Norsk Hydro ASA	0,001	2,60 %	41,28 %
49	Vmetro ASA	0,001	2,95 %	46,75 %
50	ContextVision AB	0,001	2,42 %	38,46 %

Appendix 6 (Continued): Variance and Standard Deviation

No.	Company	Variance	Standard Deviation Daily	Standard Deviation Annual
51	StepStone ASA	0,001	3,34 %	53,05 %
52	Bionor Pharma ASA	0,002	4,27 %	67,82 %
53	Tandberg Storage ASA	0,001	3,18 %	50,55 %
54	OTRUM ASA	0,002	3,91 %	62,01 %
55	Hexagon Composites ASA	0,001	2,63 %	41,67 %
56	Profdoc ASA	0,001	2,53 %	40,09 %
57	Kongsberg Automotive Holding ASA	0,001	2,47 %	39,26 %
58	STX Europe AS	0,001	2,37 %	37,60 %
59	TGS-NOPEC Geophysical Company ASA	0,001	2,52 %	40,04 %
60	Fast Search & Transfer ASA	0,001	2,53 %	40,24 %
61	Norwegian Property ASA	0,000	1,71 %	27,12 %
62	Exense ASA	0,001	3,32 %	52,76 %
63	Norske Skogindustrier ASA	0,000	1,81 %	28,74 %
64	ContextVision AB	0,001	2,39 %	37,98 %
65	Agasti Holding ASA	0,001	2,34 %	37,21 %
66	StepStone ASA	0,001	2,53 %	40,08 %
67	TGS-NOPEC Geophysical Company ASA	0,001	2,47 %	39,17 %
68	DNB ASA	0,000	1,36 %	21,61 %
69	Software Innovation ASA	0,001	2,96 %	47,04 %
70	Marine Harvest ASA	0,001	2,30 %	36,45 %
71	Renewable Energy Corporation ASA	0,001	2,82 %	44,72 %
72	OTRUM ASA	0,001	3,31 %	52,61 %
73	Ekornes ASA	0,000	1,80 %	28,53 %
74	Acergy A.S	0,000	2,15 %	34,05 %
75	Norske Skogindustrier ASA	0,001	2,69 %	42,74 %
76	STX Europe AS	0,001	2,56 %	40,58 %
77	Tandberg Data ASA	0,002	4,56 %	72,43 %
78	Veidekke ASA	0,001	3,00 %	47,58 %
79	Bluewater Insurance ASA	0,001	3,39 %	53,83 %
80	Agasti Holding ASA	0,001	3,10 %	49,25 %
81	StepStone ASA	0,001	2,77 %	43,89 %
82	Cermaq ASA	0,001	2,89 %	45,84 %
83	Schibsted ASA	0,001	2,34 %	37,15 %
84	Kitron ASA	0,001	2,27 %	36,08 %
85	Petroleum Geo-Services ASA	0,001	2,63 %	41,70 %
86	Faktor Eiendom ASA	0,002	4,73 %	75,03 %
87	OTRUM ASA	0,001	3,68 %	58,45 %
88	Hexagon Composites ASA	0,001	2,55 %	40,43 %
89	Roxar ASA	0,001	2,33 %	36,96 %
90	SeaBird Exploration PLC	0,002	4,04 %	64,12 %
91	Norske Skogindustrier ASA	0,001	3,79 %	60,20 %
92	Wintershall Norge ASA	0,001	2,63 %	41,73 %
93	Navamedic ASA	0,001	2,88 %	45,68 %
94	Wavefield Inseis ASA	0,001	3,21 %	51,00 %
95	Cermaq ASA	0,001	2,95 %	46,90 %
96	Roxar ASA	0,001	2,39 %	37,96 %
97	TECO Maritime ASA	0,001	2,32 %	36,88 %
98	Kitron ASA	0,001	2,61 %	41,44 %
99	Axis-Shield plc	0,001	2,36 %	37,45 %
100	Songa Offshore SE	0,001	2,25 %	35,76 %

Appendix 6 (Continued): Variance and Standard Deviation

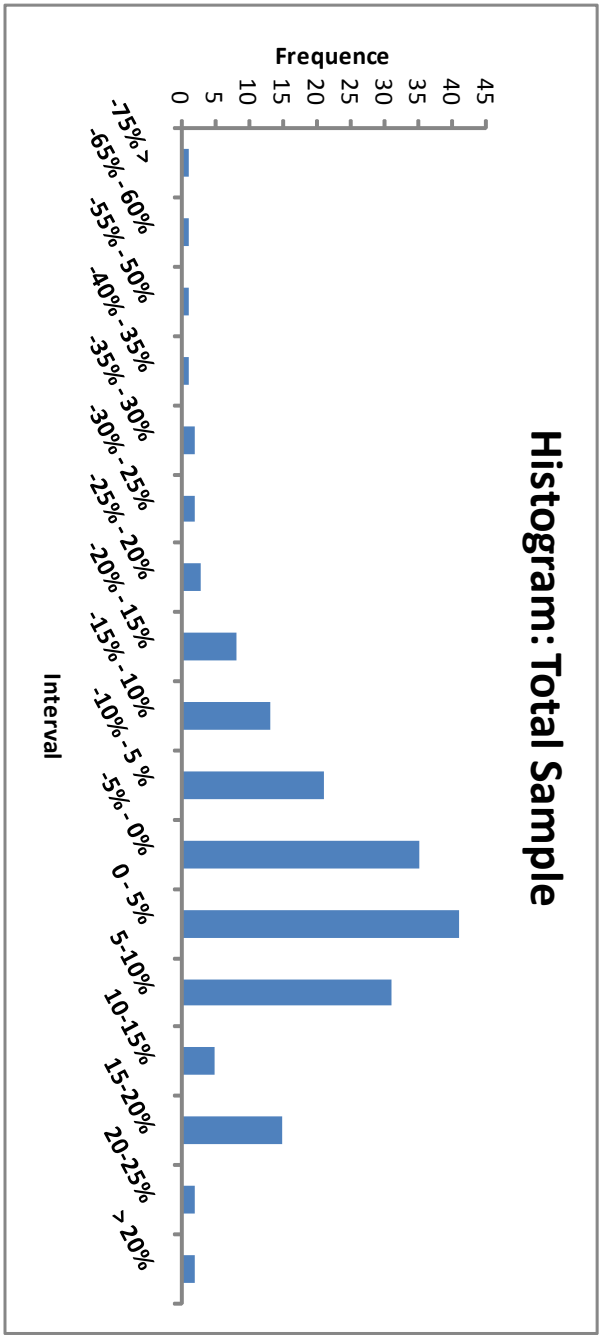
No.	Company	Variance	Standard Deviation Daily	Standard Deviation Annual
101	Electromagnetic Geoservices ASA	0,002	4,44 %	70,53 %
102	Norwegian Air Shuttle ASA	0,001	2,93 %	46,46 %
103	Norsk Hydro ASA	0,001	2,63 %	41,72 %
104	Cermaq ASA	0,001	2,96 %	46,98 %
105	Protector Forsikring ASA	0,001	3,44 %	54,58 %
106	Codfarmers ASA	0,002	4,25 %	67,50 %
107	Software Innovation ASA	0,002	4,70 %	74,54 %
108	Protector Forsikring ASA	0,001	3,67 %	58,21 %
109	ContextVision AB	0,001	2,98 %	47,23 %
110	Ignis ASA	0,003	5,09 %	80,80 %
111	Norwegian Air Shuttle ASA	0,002	3,99 %	63,27 %
112	Kitron ASA	0,001	3,33 %	52,91 %
113	Codfarmers ASA	0,003	5,77 %	91,67 %
114	Hafslund ASA	0,001	2,83 %	44,95 %
115	PSI Group ASA	0,002	4,51 %	71,63 %
116	Storebrand ASA	0,003	5,67 %	90,03 %
117	Grieg Seafood ASA	0,003	5,19 %	82,42 %
118	Cermaq ASA	0,002	3,96 %	62,92 %
119	Aker Solutions ASA	0,004	6,12 %	97,20 %
120	Norsk Hydro ASA	0,002	4,68 %	74,26 %
121	Schibsted ASA	0,002	4,08 %	64,75 %
122	Jason Shipping ASA	0,002	4,74 %	75,32 %
123	Reservoir Exploration Technology ASA	0,003	5,82 %	92,44 %
124	TeleComputing ASA	0,002	4,39 %	69,72 %
125	NattoPharma ASA	0,005	7,07 %	112,20 %
126	Vizrt Ltd.	0,001	3,40 %	53,92 %
127	Veidekke ASA	0,001	3,80 %	60,34 %
128	Simtronics ASA	0,004	6,21 %	98,58 %
129	FARA ASA	0,008	8,83 %	140,24 %
130	Data Respons ASA	0,002	4,04 %	64,17 %
131	Odim ASA	0,003	5,48 %	87,03 %
132	Codfarmers ASA	0,006	7,73 %	122,64 %
133	TTS Group ASA	0,004	5,92 %	93,98 %
134	BWG Homes ASA	0,002	4,19 %	66,55 %
135	Seadrill Limited	0,001	3,24 %	51,45 %
136	TTS Group ASA	0,003	5,47 %	86,82 %
137	Veidekke ASA	0,001	2,40 %	38,15 %
138	Kitron ASA	0,001	3,29 %	52,30 %
139	Wilh. Wilhelmsen Holding ASA	0,000	2,09 %	33,25 %
140	Nordic Semiconductor ASA	0,002	4,09 %	64,94 %
141	EVRY ASA	0,001	3,15 %	49,96 %
142	Eltek ASA	0,001	3,45 %	54,83 %
143	Norsk Hydro ASA	0,001	2,31 %	36,73 %
144	Q-Free ASA	0,001	2,62 %	41,54 %
145	Blom ASA	0,002	4,16 %	66,11 %
146	Protector Forsikring ASA	0,001	3,74 %	59,42 %
147	SeaBird Exploration PLC	0,002	4,64 %	73,59 %
148	EVRY ASA	0,001	3,30 %	52,35 %
149	Sølvtrans Holding ASA	0,001	2,74 %	43,56 %
150	Protector Forsikring ASA	0,001	3,70 %	58,68 %

Appendix 6 (Continued): Variance and Standard Deviation

No.	Company	Variance	Standard Deviation Daily	Standard Deviation Annual
151	Yara International ASA	0,001	2,50 %	39,73 %
152	Electromagnetic Geoservices ASA	0,004	6,62 %	105,10 %
153	Petroleum Geo-Services ASA	0,001	2,85 %	45,32 %
154	ORIGIO a/s	0,001	3,03 %	48,10 %
155	EVRY ASA	0,001	3,18 %	50,55 %
156	Aker Solutions ASA	0,001	2,41 %	38,20 %
157	Comrod Communication ASA	0,001	2,72 %	43,15 %
158	Petroleum Geo-Services ASA	0,001	2,28 %	36,27 %
159	Nordic Semiconductor ASA	0,001	3,52 %	55,88 %
160	Aker Solutions ASA	0,001	2,71 %	43,05 %
161	Kongsberg Automotive Holding ASA	0,001	3,25 %	51,55 %
162	Spectrum ASA	0,006	8,01 %	127,23 %
163	Spectrum ASA	0,004	6,60 %	104,81 %
164	Birdstep Technology ASA	0,005	7,08 %	112,42 %
165	Protector Forsikring ASA	0,001	3,11 %	49,33 %
166	Norsk Hydro ASA	0,001	2,45 %	38,92 %
167	SeaBird Exploration PLC	0,008	8,89 %	141,19 %
168	DNO International ASA	0,001	3,67 %	58,25 %
169	Blom ASA	0,009	9,30 %	147,62 %
170	Bergen Group ASA	0,002	4,02 %	63,82 %
171	Jinhui Shipping and Transport. Ltd	0,001	3,28 %	51,99 %
172	Vizrt Ltd.	0,001	2,75 %	43,70 %
173	Petroleum Geo-Services ASA	0,001	3,58 %	56,76 %
174	BW Offshore Limited	0,001	3,11 %	49,36 %
175	Bergen Group ASA	0,002	4,13 %	65,53 %
176	Odfjell SE	0,001	2,77 %	43,96 %
177	Electromagnetic Geoservices ASA	0,001	3,46 %	54,90 %
178	Dolphin Group ASA	0,001	3,15 %	50,02 %
179	Bergen Group ASA	0,001	3,73 %	59,17 %
180	BW Offshore Limited	0,001	2,77 %	44,00 %
181	Repant ASA	0,003	5,90 %	93,70 %
182	Archer Limited	0,001	3,76 %	59,69 %
183	Nordic Semiconductor ASA	0,001	2,78 %	44,13 %
184	Scana Industrier ASA	0,001	3,63 %	57,59 %
	Average total sample:	**0,001**	**3,53 %**	**56,04 %**
	Average 2005	0,001	3,19 %	**50,69 %**
	Average 2006	0,001	3,30 %	**52,46 %**
	Average 2007	0,001	2,71 %	**42,94 %**
	Average 2008	0,001	3,35 %	**53,18 %**
	Average 2009	0,003	5,38 %	**85,42 %**
	Average 2010	0,001	3,40 %	**54,01 %**
	Average 2011	0,002	3,59 %	**57,02 %**
	Average 2012	0,002	4,27 %	**67,77 %**

Appendix 7: Frequency Table and Histogram (Total Sample)

Interval	*Frequence*
-75% >	1
-65% - 60%	1
-55% - 50%	1
-40% - 35%	1
-35% - 30%	2
-30% - 25%	2
-25% - 20%	3
-20% - 15%	8
-15% - 10%	13
-10% - 5 %	21
-5% - 0%	35
0 - 5%	41
5-10%	31
10-15%	5
15-20%	15
20-25%	2
> 20%	2



Appendix 8: Preliminary Thesis Report

Preliminary Thesis Report

BI Norwegian Business School

Profit Warnings and Abnormal Returns: Evidence from the Norwegian Stock Market

Date of submission:
15.01.2013

Name of Supervisor:
Siv J. Staubo

Study Program:
Master of Science in Business & Economics
Major in finance

Campus:
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1 Introduction

Traditional studies on earnings announcements and market efficiency has focused on the relationship between earnings information and stock prices, while studies concerning profit warnings have been less explored. Expectations about future cash flows are one of the drivers of a company's share price; hence rational investors ought to incorporate the information in profit warnings into new estimates of the market value. Because profit warnings are pure information events and the reaction from the market is large, it is an opportunity to test market efficiency and the information content in the warnings. This paper will examine profit warnings disclosed by Norwegian listed companies and test whether there exists abnormal returns ex-ante and ex-post. An event study on profit warnings disclosed from 01.01.05 until 31.12.12 is conducted to test the speed of adjustment of the new information and the reaction by the market. Bulkley and Herrerias (2005) classified profit warnings into two differing classes and this approach will be pursued and implemented in this thesis. They distinguished between new information that included earnings forecasts (quantitative) and new information that only included guidance for which direction earnings would deviate from previous forecasts (qualitative). This gives insight into the degree of disclosed information in the profit warning and its effect on stock returns. Based on this interest, the following research question has been developed:

To what extent does the Norwegian stock market react to profit warnings and how fast does it adjust to the new information?

Although some research on profit warnings in Norway exists (Svendsen 2009; Larsen M. and Jacobsen E. 2005; Kleppan, Hjelmeseth and Nysveen 2002), it is a relatively new subject given that profit warnings had not been regulated until 1999, when listed companies became obliged to notify their shareholders if the company was aware of significant deviations from previous earnings statements (Oslo Børs 1999). This law has later been repealed and profit warnings are therefore regulated by the general rule regarding disclosure of inside information (Oslo Børs (1) 2005; Oslo Børs (2) 2005). The authors of this paper are not aware of any research within the Norwegian field that examines the degree of disclosed

information and how it affects share price movements. Our thesis contributes with updated data and takes previous research one step further by distinguishing between different profit warnings for Norwegian listed companies.

1.1 Structure

This paper is structured into seven sections including the introduction. The second section covers relevant background information concerning profit warnings and efficient market theory. Profit warnings are defined and the purpose of these statements is clarified. The rationale behind an efficient market and its implication on security prices is also enlightened in this section. The third section reviews published literature and previous research on topics that are relevant for this master thesis. Of special importance is the article "Does the Precision of News Affect Market Underreaction" by Bulkley and Herrerias (2005), due to the fact that it investigates some of the same topics and applies similar methods as will be employed in this thesis. Furthermore, this section is divided into four subsections, namely profit warnings and market efficiency, information leakage, post-earnings-announcement price drift and event studies. The fourth section describes the methodology used in the research and reasoning behind the choice of asset pricing model, besides addressing the length of the event window and statistical- and econometric assumptions. In section five a description of the data and how it is extracted is provided. The results will be presented and interpreted in the sixth section. Finally the seventh section will conclude and sum up the findings. Here it will be elaborated on the impact the results have on the Norwegian stock market, before the weaknesses with this study and suggestions for future research is proposed.

1.2 Hypothesis testing

In order to test whether the Norwegian stock market respond in accordance with the efficient market hypothesis, four different hypotheses are constructed. The implications of the hypothesis analysis are also discussed briefly.

$H0_1$: There are no abnormal returns on the announcement date

H_{A1}: There are abnormal returns on the announcement date

When new information which deviates from forecasts is released, rational investors are expected to act on the new information. It is therefore presumed that evidence of abnormal returns will be found at the announcement date. A violation of the second null-hypothesis indicates that the market is not strong-form efficient.

$H0_2$: There is no information leakage prior to the announcement date
H_{A2}: There is information leakage prior to the announcement date

The second hypothesis considers the timing of when information is released. In a perfect efficient stock market, news will be perceived by all investors simultaneously and the reaction to a profit warning will cause a jump in the security price. A rejection of $H0_2$ indicates that some investors gain access to the information earlier than others, or that they interpret and react quicker than the rest of the market. A violation of the null-hypothesis could be a result of an inefficient market.

$H0_3$: There are no abnormal returns in the stock market following a profit warning
H_{A3}: There are abnormal returns in the stock market following a profit warning

If investors can gain systematic abnormal returns through trading strategies after the announcement date, then the market is not semi-strong efficient. Significant evidence of abnormal returns in retrospect is called post-announcement drift and could be both positive and negative. This hypothesis is testing for both underreaction and overreaction in the stock market.

$H0_4$: The degree of informational disclosure does not impact the price volatility of security prices
H_{A4}: The degree of informational disclosure does impact the price volatility of security prices

The last hypothesis considers the information content in the profit warnings. It is tested for whether quantitative or qualitative warnings have a larger impact than the other. If differences are detected, it is expected that quantitative warnings leads to a lower reaction in the stock market than qualitative. The basis for this assertion is that prior research has found that investors tend to overact to qualitative profit warnings, and that share prices adjust to equilibrium faster when forecasts are provided, due to the increased knowledge among shareholders.

2 Background Information

In this section an overview of relevant theory related to the research question is provided. The research performed in this paper is anchored in these models and publications.

Profit warnings are statements proclaimed by a firm due to unexpected changes in the company's financial results. These announcements are published to inform investors and stakeholders about the firms operating performance and to alert about deviations from forecasted results. Bulkley & Herrerias (2004) define a profit warning as unexpected corporate announcement which declare that future earnings will decrease below current expectations. The content and scope of the profit warnings varies widely, where some warnings only states that performance will be lower or better than expected, while others provides more detailed and accurate forecasts. Profit warnings are similar to earning announcements in terms of disclosing information, although profit warnings generally are considered to be less anticipated and thereby cause larger fluctuations in stock prices (Church and Donker 2010).

2.1 Market efficiency

The efficient market hypothesis (EMH) is the notion that security prices reflect all available information, where the market price is considered to be an unbiased estimate of the true value of the investment (Fama 1965). The theory concerning market efficiency is consistent with Maurice Kendall's research, which discovered that stock prices seemed to follow a random walk (Kendall M. 1953). The concept that stock prices follow a random walk implies that price changes are independent of each other, and that no systematic patterns exist (Brealey, Myers and Allen

2008). If systematic patterns could be detected, investors would exploit them and thereby eliminate them through extensive trading. Samuelson argued in the following way: "In competitive markets there is a buyer for every seller. If one could be sure that a price would rise, it would have already risen" (Samuelson 1965). If the EMH holds, future market prices should be unpredictable and only unexpected news will affect the price level. Deviations from market efficiency could lead to inefficient resource allocation, a cost borne by all citizens in a society (Mendes 2010).

Eugene Fama defined three forms of market efficiency and his work has been prevalent thereafter (Bodie, Kane and Markus 2011; Fama 1970):

- **Weak form** assumes that current stock prices reflect all information that can be derived from historical prices and by examining market trading data. The implication is that trading strategies based on chartism and trend analysis is not profitable
- **Semi-strong form** defines a market as efficient if all public available information is incorporated into the stock price. Persistent anomalies and predictions of future abnormal returns would be violating the semi-strong efficiency.
- **Strong form** states that prices reflect all relevant information, even including inside information. This hypothesis is extreme and implies full transparency within the market, as no company insiders can pre-empt the market or take advantage of information asymmetries.

The semi-strong form is of particular interest when testing for market efficiency regarding profit warnings announcements. If the semi-strong efficiency hypothesis holds, market prices will adjust immediately after the announcement in response to the new information, and no post-announcement price drift will occur. The stock price jumps to the new price level and investors' opportunity to act faster than the market is limited. In fact Patell and Wolfson (1984) ascertain that most of the market response to dividend or earning announcements occurs within the first 10 minutes after the notice (Patell and Wolfson 1984). Post-announcement price drift indicates an underreaction if the price continue to fall in a longer time period beyond a negative warning (Bernard 1993). If the security price reverses some of

the initial movement, then the market may have overreacted to the announcement. A stock price reversal does not necessarily entail an overreaction, rather signalize that market risk premium varies over time and only be a rational response to changes in discount rates (Bodie, Kane and Marcus 2011).

If information was gathered at different times, it could be evidence against market efficiency, due to leakage in the market. On the other hand it could also reflect the fact that news in profit warnings may be anticipated by the market before the announcement date; hence some adjustments could already be incorporated into the share price (Jackson and Madura 2003). Investors have several sources they acquire information from, thus information leakage prior to the announcement date does not necessarily mean that the semi-strong market efficiency is violated. Changes in security prices could also be caused by external factors. In order to deal with this issue, the effect from the announcement needs to be distinguished from the price movements caused by general market factors.

Acquiring detailed information for individual companies are time consuming and costly. Investors are only willing to actively collect additional information if they are compensated for the added effort through higher returns (Grossman and Stiglitz 1980). Active investment strategies for common shareholders are costly due to the low percentage gain from extensive information seeking. Mutual funds can pool interests together and gain from economies of scale which gives them a greater incentive to find mispriced stocks. An efficient market will allow for abnormal returns to compensate the ones who put in additional resources, but only enough to provide superior gross returns and average net returns (Markiel 1989). Transaction costs and illiquidity are factors which make it harder to gain from mispriced stocks. When evaluating whether the market is inefficient or not, these factors must be taken into consideration. Furthermore, a mispriced security can use a long time to return back to equilibrium, thus arbitrage is challenging and tie up capital.

Abnormal returns are defined as actual returns less expected returns implied by the asset pricing model. Presence of abnormal returns around events is not necessarily a violation of the efficient market hypothesis, but it is a violation if

these abnormal returns persist over time and not are random. In an efficient market, security prices out of equilibrium should converge towards its true value and there should be equal probability for whether a stock is over- or undervalued.

2.2 Joint hypothesis problem

When you perform a test for whether a market is efficient, you are implicitly testing the assumptions the asset pricing model is based on (Brealey, Myers and Allen 2008). Any test of market efficiency is consequently also a test for whether the capital asset pricing model is correct. This is called the Joint hypothesis problem. If efficiency is rejected, it could be because the market is truly inefficient or because an incorrect equilibrium model has been assumed (Campbell, Lo and MacKinlay 1997). The implication of this theorem is that caution has to be taken when inferences are drawn about market efficiency. Richard Roll does moreover point out that the market portfolio is unobservable and impossible to precisely estimate, because it does not include every single asset available (Roll, 1977).

3 Literature Review

3.1 Literature about event studies

Profit warnings are pure information events, which make them well suited for event studies. An event study is a technique in empirical financial research that can measure the impact of a specific event on the value of a firm. Given rationality in the marketplace the impact can be deducted since the effects of an event should immediately be reflected in the security prices (MacKinlay, Craig. 1997). One of the first event studies was performed by James Dolley and it explored the procedure of common stock split-ups (Dolley 1933). One of the main findings was that prices increased more than they declined following a stock split. The first event studies suffered from several drawbacks, as they failed to separate general stock market price movements from the effect caused by the event, but these elements were gradually improved during the next three decades (MacKinlay 1997). The methodology applied in Ball and Brown and Fama's groundbreaking studies in the 1960's is still practiced, although some

modifications have been introduced, mainly to comprehend with violation of statistical assumptions (Brown and Warner 1980 and 1985).

3.2 Literature about profit warnings and market efficiency

One of the first studies to empirically test whether stock returns respond to release of new information to the market was Ray Ball and Philip Brown in 1968. They performed an event study of earning announcements for 261 firms over the period 1957 to 1965 and measured whether reported earnings were greater or lower than what the market expected, with last year's actual earnings as a proxy for the market expectations (Ball and Brown 1968; Scott 2012). The firms that reported good news experienced abnormal returns relative to the market of 6% in the period leading up to the earnings release, while firms that reported bad news underperformed relative to the market with 9%. The interesting feature with this study was the accumulation of abnormal return prior to the event date and Ball and Brown (1968) concluded that the earnings report is not a medium that can be considered as very timely.

Kasznik and Lev (1995) examined the actions of the management prior to a large earnings surprise. Their focus was on how the management disclosed this information and how the investors reacted to this. They found that the likelihood of issuing a warning was positively associated with firm size, existence of previous forecasts and relationship to the high technology industry. Another finding was a higher tendency to disclose warnings relating to permanent earnings disappointments than transitory, which is also what the investors appear to be concerned about. Their study also questioned why not more companies disclosed disappointing earnings announcement because of its' beneficiary sides, e.g. deterring litigation and reducing transaction costs. A possible explanation could be the fear of a negative impact caused by overreaction among investors, which outweighs the benefits of disclosing earnings surprises. Another study written by Skinner (1994) found evidence of voluntary disclosure of bad news before earnings announcement, due to the threat of large stock declines. Managers face an asymmetric loss function when deciding on disclosure policy, due to the fear of litigation and reputational costs. Skinner (1994) also reported that bad news was

likely to be qualitative statements about the current quarter's earnings, while good news tended to be point range or estimates of annual-EPS.

A study which is of special interest to our thesis is written by Bulkley and Herrerias (2005). They found significant negative abnormal returns the three months following a profit warning. This gives an indication that the market underreacts to the new information and that the market is slow to respond. A special feature in this study is the distinction between profit warnings that included a new forecast (quantitative) and profit warnings that only offered guidance about earnings below market expectation. This classification makes it possible to test the precision of a news release and whether it has an effect on the size of the underreaction (Bulkley and Herrerias 2005).

3.3 Research on information leakage

Evidence of information leakage diverge somewhat, but several researchers submit evidence of information leakage prior to an event. Keown and Pinkerton (1981) provided significant confirmation of informational leakage as far as 12 trading days prior to merger announcements. Jackson and Madura (2003) detect information leakage before profit warnings, where they document a negative abnormal return of 2.38 percent on average, by applying a four-day window prior to the announcement date. Helbok and Walker (2003) report that evidence of informed trading prior to the release of profit warnings in the UK, does not exist after the companies were obliged to disclose information in the UK. The fact that pre-announcement drift has been documented could be a violation of the semi-strong market efficient hypothesis, and indicates that some insiders can earn abnormal returns.

3.4 Literature about post-earnings-announcement price drift

When new information is released the efficient market hypothesis states that prices should reflect this immediately. Event studies are therefore a way to examine whether markets are efficient or not, since causation from a specific event may be deducted. Jones, Latanè and Rendleman (1982) used the same method as Ball and Brown (1968) to rank and divide the firms into 10 deciles based on the size of the earnings surprise, and then calculate the cumulative

abnormal return (CAR) for each decile. They found that the companies with the largest positive surprise experienced continuing CAR, while the companies with negative CAR at t=0 experienced a declining CAR. Jones, Latanè and Rendleman (1982) explained this with a gradual response to earnings announcements, but since this pattern is predictable it violates the theory about efficient markets (Bodie, Kane and Marcus 2011). This anomaly is known as post-earnings-announcement price drift which Bernard and Thomas (1990) later confirmed in their paper "Evidence That Stock Prices Do Not Fully Reflect the Implications of Current Earnings for Future Earnings" (Bodie, Kane and Marcus 2011). They found evidence of slow market reaction to new information and that the signs and magnitude of the slow reaction was related to the autocorrelation structure of earnings. The predictability of future earnings due to autocorrelation in the residuals is evidence of market failure, i.e. market inefficiency (Bernard, V and Thomas, J. 1990).

4 Methodology

The methodology used in this thesis will be based on the pioneering method used by Ball and Brown (1968) and the research of Bulkley and Herrerias (2005). They separated between qualitative and quantitative profit warnings, and this section will explain the underlying features of our research and how we intend to carry it out.

4.1 Event Window

The event window is determined to be greater than the specific event of interest, since we prefer to examine the market reaction to the profit warnings measured by the level of abnormal returns. Hence, our event window is [-10, 1, +10], i.e. 21 days. A longer event window will also be examined, but the length of this window will still be shorter than one year to secure that errors in risk-adjustment still are mitigated (Kothari and Warner 2004). The length of the large window is [-10, 1, + 90], and will capture post-profit warning effects. Investigating a longer window allows us to study whether any momentum and reversal effects exist. Our two event windows are therefore 21 days and 101 days respectively.

4.2 The Market Model

This subsection provides a discussion about the choice of asset pricing model and the methodology used to calculate abnormal returns, such that possible impacts of profit warnings can be deducted. An essential aspect of event studies is the measurement of abnormal returns, since presence of such abnormal returns suggests that the market is inefficient i.e. an arbitrage opportunity exists (MacKinlay 1997). An asset pricing model to estimate the expected returns is required in order to calculate abnormal returns. We decided to use the market model, which assumes a stable linear relation between the security's return and the market return (Copeland, Weston and Shastri 2005). The underlying assumptions in the market model are purely statistical as it is not an economic model. Therefore the assets returns are jointly multivariate normal, in addition to independently and identically distributed, i.d.d., through time. These are distributional assumptions which make the market model correctly specified (MacKinlay 1997). The reason for why this model is elected is based on the large impact a profit warning has on the return on the day of the event, and a more advanced model will consequently not improve the explanatory power that much.

MacKinlay (1997) argues that the market model is superior to the constant mean return model since the variance of the abnormal return is reduced, which in turn increases the ability to detect effects of e.g. profit warnings. The reason why the market model is an improvement is because the return that is related to variation in the market return is removed, which increases the opportunity to detect effects of an event (MacKinlay 1997). He also argues that the gains from introducing multifactor models for event studies are limited, because introducing additional factors with low explanatory power not necessarily reduce the variance of the abnormal return.

The equation below shows the linear relationship between return for security i, $E(R_{i,t})$, and the return on the market portfolio, Rm. OLS is used to minimize the sum of the squared residuals and to find the OLS-estimators that fits the straight line best.

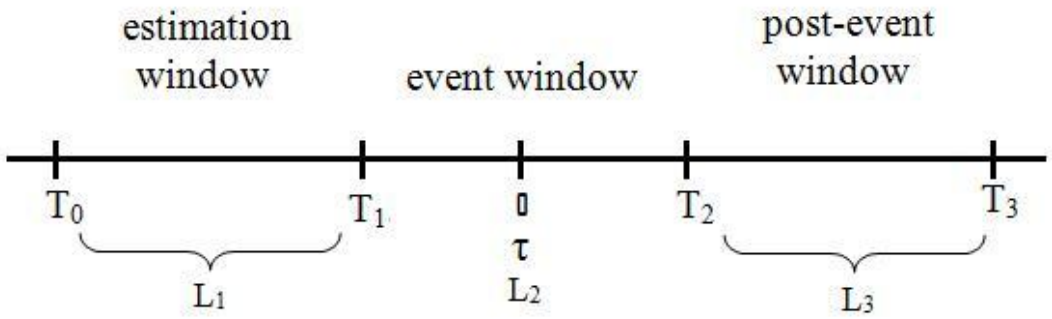
$$E(R_{it}) = \alpha + \beta_i R_{mt} + \varepsilon_{it} \qquad (1)$$

$E(\varepsilon_{i,t} = 0)$ is the zero mean disturbance term

$Var(\varepsilon_{i,t}) = \sigma_{i,t}^2$ is the variance of the disturbance term

The parameters $\hat{\alpha}$, $\hat{\beta}$ and σ are estimated with equation (1) over the estimation window, L_1, which excludes the event window. The event window is excluded to avoid that the particular event of interest influence the parameters (MacKinlay 1997). The event window, $T_2 - T_1$, is greater than the specific event of interest, in order to capture the entire effect of the profit warning.

Figure 1



By estimating α and β you are able to calculate the expected return for the event window because of the linear relation between $\beta_{i,t}$ and $R_{m,t}$. Before abnormal returns can be defined the actual returns needs to be calculated for each day in the entire event window, $L_2 = T_2 - T_1$. Equation (2) gives the log returns in L_2. The reason for using log returns is that it conforms better to the normality assumptions in the regression, and because the transformation makes it easier to convert daily returns to weekly or monthly.

$$R_{i\tau} = ln\left(\frac{P_{i\tau} - P_{i\tau-1}}{P_{i\tau-1}}\right) \quad (2)$$

$$AR_{i,\tau} = R_{i,\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m,\tau} \quad (3)$$

$$AR_{i,\tau} = R_{i,\tau} - \hat{R}_{i,\tau}$$

$AR_{i,\tau}$ are therefore equivalent to the difference between the return conditional on the event, $R_{i,\tau}$, and the expected return unconditional on the event, $-(\alpha + \beta_i R_{m,\tau})$, (MacKinlay 1997).

4.3 Aggregating abnormal return

The next step is to aggregate the abnormal returns over time and across the securities in the sample. The two event windows consist of 21 days and 101 days, which are represented in figure 1 with the T_1 to T_2. The cumulative abnormal returns for each security will be aggregated over time using equation (4) below.

$$\mathrm{CAR}_i(\tau_1,\tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{i\tau} \qquad (4)$$

Since this is the CAR for only one event, the aggregated CAR for all event observations need to be aggregated before final inferences can be made. The dataset must be controlled for clustering before cross-sectional aggregating. Clustering is the overlap of profit warnings in the event window, which may bias the result of an event. The reason why clustering may bias a conclusion is the non-zero covariance between the clustered abnormal returns. The case of clustering will be addressed later. If no clustering of events exists, then the individual abnormal returns from equation (3) can be aggregated for each event. With N events the sample aggregated abnormal returns are calculated using equation (5).

$$\overline{AR}_\tau = \frac{1}{N}\sum_{i=1}^{N} AR_{i\tau} \qquad (5)$$

These average abnormal returns can then be aggregated in the same manner as in equation (4), which captures the total effect of the profit warning for the entire event period.

$$\overline{CAR}\,(\tau_1,\tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau \qquad (6)$$

4.4 Information disclosure

In order to examine whether the degree of disclosure influence how investors' respond to a profit warning, a dummy variable is introduced. The variable take value 0 if the announcement only provides news about the direction of deviations from forecasted results, while the dummy variable equals 1 if the company provides an estimate of how large the deviations are. The precision of the news is analyzed by assessing each profit warning manually, but the quality of the forecasts and level of details disclosed are not distinguished by the authors of this paper due to the subjectivity. However, it is expected to find lower abnormal returns for the warnings that provide qualitative information than the ones that only contribute with qualitative information. This is consistent with the efficient market hypothesis, which claims that the more informed the investors are, the quicker the market will correct mispricing.

4.5 Significance tests of abnormal returns

In this subsection we will cover potential pitfalls associated with event studies and the test of significance for abnormal returns. Assessing these issues is important before any statistical inference can be drawn from the results. First we will employ various significance tests of the abnormal returns to make sure that the model is correctly specified, and that no additional modifications of the model are needed. If the model is not able to distinguish between the null hypothesis and economically interesting alternatives there is a need for modification of the model design (MacKinlay 1997).

4.5.1 Test of Significance

A two sided test of the cumulative abnormal returns from equation (6) will be tested for significance to address whether the null hypothesis can be rejected or not. The test is two-sided since abnormal returns can be negative or positive. Parametric tests will be used in this study since previous research has found non-parametric tests to be unnecessary complicated and not well-performing (Henderson 2002). Imprecise predictions about the securities' unconditional expected return and a component of the realized return on the event day, which are not attributable to the event itself, are two reasons why abnormal returns are measured with error (Kothari and Warner 2004).

4.5.2 Econometric Problems

In this subsection concerns about econometric problems will be addressed. The daily security returns will be checked for normality and cross-sectional serial correlation. Financial events are often associated with variance shifts that may influence the power of the test and specification of the model. Another factor to concider is the correlation between the security returns' residuals, ε_{it}, and the return on the market portfolio, $R_{mt.}$ Presence of such correlation will bias the expected return of the securities, R_{it}, and cause a misspecification of the model (Henderson 2002). A final issue to reflect on is the presence of event clustering, which in this case is overlapping profit warnings. If such events overlap, then the covariance between the securities will be different from zero. This will distort the distributional results for the aggregated abnormal returns (MacKinlay 1997). In order to deal with this issue an alternative is to analyze the abnormal returns before the aggregation, and consider a test with a null hypothesis of the event having no impact using non-aggregated data. This is a method used if there is presence of large clustering, i.e. many profit warnings on the same date. The drawback of this approach is the low sample properties of the test statistics and the test will often have little power against economically reasonable alternatives (MacKinlay 1997; Bernard 1987).

5 Data

In this section an overview of the data and the data collection process is presented. How profit warnings, parameters and market returns are retrieved will be explained and sources of error in the dataset will be discussed.

5.1 Profit warnings

The first step in the data collection process is to define the date of the event, i.e. the announcement date of the profit warning. This date sets the pre-conditions for estimation of α and β during the estimation window which later is employed for the expected returns in the event window. Each individual profit warning, and hence date, is retrieved from notifications that listed companies has submitted to Oslo Stock Exchange. Processing each submitted notification to assess whether it is a profit warning or not is necessary. This will be a time consuming process and

can be a source of error in our dataset, but a necessity due to the lack of existing alternatives.

5.2 Estimation window

The choice of estimation period for estimating $\hat{\alpha}$ and $\hat{\beta}$ depends on the data availability and the specific event. In this paper an estimation window prior to the event is used, which starts 261 days before the day of the event and ends eleven days prior to the profit warning; hence, $L_1 = T_1 - T_0 = 250$ days, see figure 1. The length of L_1 has an impact on the conditional variance of the abnormal returns, $\sigma^2(AR_{i\tau})$, due to the additional variance that stems from the sampling error in α_i and β_i. Using a larger estimation window with more observations causes the additional variance to approach zero, due to a reduced sampling error of the parameters (MacKinlay 1997).

5.3 Market portfolio

Oslo Stock Exchange All-Share Index, OSEAX, has been chosen as a proxy for the market portfolio. This index consists of all the listed companies on OSE and is adjusted for dividend payments.

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