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Post Earnings Announcement Drift (PEAD) in the oil industry in the United States

Author: M. Erkelens
Student number: 454142me
Thesis supervisor: Dr. J.J.G Lemmen
Second reader: Dr. A. Breaban
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PREFACE AND ACKNOWLEDGEMENTS

This thesis marks an end of my bachelor study at Erasmus University Rotterdam. In these years of studying I gained much knowledge and was taught to look critically at not only myself, but also at literature and data. Writing this thesis brought all of this knowledge together. I really enjoyed writing on a topic that is still very relevant today. I hope to extend my future knowledge on the subject in my masters and lifetime.

I would like to thank my friends, family and thesis supervisor Dr. J.J.G Lemmen for helping me write this thesis and for the very helpful feedback.

ABSTRACT

This thesis investigates whether the Post-Earnings Announcement Drift (PEAD) is visible in the stock data of oil companies in the United States during 2015-2018. It is shown that both unexpected earnings decile 2 and 9 obtain positive Cumulative Average Abnormal Returns (CAAR) in 10 days after the announcement, of respectively 0.0378 and 0.0206. Even higher abnormal returns of additionally 0.0278 and 0.012 respectively can be obtained by choosing medium sized firms. Finally, it can be concluded that there exists no PEAD in the United States oil sector for the period 2015-2018 since we see no more positive (negative) drift for firms releasing more positive (negative) news.

Keywords:
Post-Earnings Announcement Drift (PEAD), event study, abnormal returns, market efficiency, anomalies

JEL Classification: G14, G11, M40

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1. INTRODUCTION

Since the 70s, the efficient market hypothesis has been among the most supported theories in finance. The efficient market hypothesis states that all information is immediately captured by the market (Fama et al. 1969) and therefore, it is not possible to gain any arbitrage profits (Getmansky et al., 2004). Research has proven that many markets are semi-efficient and therefore somewhat confirm the efficient market hypothesis (Jensen, 1978). However, many deviations have also been discovered, which are now called anomalies. An anomaly is an economic result that is inconsistent with present economic paradigms (Kuhn, 1962, Thaler, 1987). Event studies have become the standard methodology for analyzing anomalies in stock price data. The methodology has been updated over the years and is considered the most appropriate for this type of research (MacKinlay, 1997). One of the most persistent anomalies in finance literature is the Post Earnings Announcement Drift (PEAD). The formal definition of the PEAD is the tendency for a stocks cumulative abnormal returns to drift in the same direction as the earnings surprise for a period after an earnings announcement (Livnat & Mendenhall, 2006). Using the PEAD, Foster, Olsen and Shevlin (1984) computed that by going long in the top decile of unexpected earnings and going short in the bottom decile of unexpected earnings, one could obtain an estimated abnormal return of 4.2% over a period of 60 days (25% on a yearly basis). Bernard and Thomas (1989) measure an abnormal return of 19% on a yearly basis using the exact same techniques as Foster, Olsen and Shevlin (1984) for the same period and some additional years (1974-1985). The question is whether this result can still be obtained nowadays, roughly 40 years after the first publication of this puzzling phenomenon.

This research shows that for oil companies in the years 2015-2018 abnormal returns can be obtained in the days before the announcement. However, it cannot be concluded that the Post-Earnings Announcement Drift exists, since firms that are in higher (lower) standardized unexpected earnings (SUE) deciles, do not obtain higher (lower) abnormal returns. On the other side, it can be concluded that the second to highest and second to lowest SUE deciles obtain positive cumulative abnormal returns after the announcement (0.0206 and 0.0378 respectively) over a period of 11 days. The return is even higher when only medium sized firms are chosen.

This thesis will consist of 5 sections: 1. Introduction, 2. Literature, 3. Data & Methodology, 4. Results and 5. Conclusion. In section 1, I will give a small introduction of existing literature of existing market theories and the Post Earnings Announcement Drift. In Section 2, a more in-depth literature review will be given. Data and Methodology will be discussed in Section 3, including a data selection procedure and the incorporated economic and econometric methods used. Section 4 will be the results chapter and will include the testing of the hypotheses in the methodology section. With help of the conclusions to the hypotheses, the research question will be answered. This conclusion will be written in Section 5. Recommendations for further research and limitations will also be included in Section 5.

2. LITERATURE

This section contains an overview on all relevant literature for this research. I start off with a section on market efficiency and what role this theory played in finance from the 1970s on. I will also discuss the role of behavioral finance during that period, which had a large impact on the number of anomalies that were being discovered during that time. Event studies will also be reviewed. After that, earnings anomalies in particular will be discussed. Special focus will be on earnings announcements from firms and reactions to announcements from investors. Forecasting of errors will also be discussed, as this is an important part of the methodology and results sections. In the last section, the post-earnings announcement drift (PEAD) will be extensively reviewed. Earlier results of research will be discussed.

2.1. Market efficiency

2.1.1. Efficient market hypothesis

The efficient market hypothesis is a theory that claims that all available information is immediately interpreted by the market, and therefore, captured into (stock) prices (Fama et al. 1969). It is one of the most important theories in finance. The hypothesis has been tested widely and data has shown to be in line with this theory in a variety of markets such as the New York Stock Exchange and the American Stock Exchange, but many other markets as well (Jensen, 1978), with only a few exceptions. Jensen (1978) explains that having a certain information set θ_t at time t, it is not possible to make economic profits by trading based on information set θ_t. Abnormal returns should therefore not be visible in real data, according to the efficient market hypothesis. Once new information comes available, investors try to pounce on even the smallest informational advantages. By doing so, all new information gets incorporated in the price once again (Getmansky et al., 2004). Profit opportunities will immediately be eliminated by updated prices due to a changing demand for the stock. Therefore, no profits can be obtained from information-based trading.

According to Fama (1970), there are 3 forms of the efficient market hypothesis: the weak form of the Efficient Market Hypothesis, the semi-strong form of the Efficient Market hypothesis and the strong form of the Efficient Market Hypothesis. They differ in how much information is incorporated into the stock price.

The weak form of the Efficient Market Hypothesis is a hypothesis in which only price data from the past is incorporated as information in the current price. This hypothesis is based on a random walk model, as no new information can be retrieved from historical prices (or all investors would make use of this).

The semi-strong form of the Efficient Market Hypothesis is the hypothesis in which all publicly available information at time t is captured. This hypothesis says that when new information becomes available, all investors act like it and profit possibilities immediately disappear. This is also the most testable hypothesis, since big announcements and information releases can be tested for abnormal returns in stock price data.

The strong form of the Efficient Market Hypothesis is the hypothesis in which all publicly, but also insider, information is at time t is captured. This insider information often involves information that is only available to specific investors or groups, but also company insiders (Fama, 1970). Since these insiders take advantage of their knowledge, profit opportunities will disappear again.

Market efficiency is of importance for this research, since earnings announcements are information resources that are available at one point in time. Therefore, the market adjusting to this new information is only natural. However, the question is whether abnormal returns can be retrieved from announcements like these. If that is the case, deviations from market efficiency will be proved.

2.1.2. Capital Asset Pricing Model (CAPM)

Another model that is often referred to in finance is The Capital Asset Pricing Model (CAPM). The CAPM models risk against the market premium (or the difference between the market and the risk free rate). It was created by Sharpe (1964), Lintner (1975) and Mossin (1966). The theory says that if an investor is rational (he differentiates his portfolio), any point on the CAPM line can be obtained. An investor can choose to obtain a higher return, with as a consequence higher risk. The CAPM therefore assumes that additional returns can be obtained only by incurring additional risk (Sharpe, 1964).

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{Mt} - R_{ft}) + \varepsilon_{it}$$

Where $R_{it} - R_{ft}$ is the return on stock i in excess of the risk-free rate and $R_{Mt} - R_{ft}$ the market factor, which measures the market return in access of the risk free rate. ε_{it} is the error term for stock at time t. The CAPM has gained much empirical support (Roll and Ross, 1980), but it is also criticized by many academics.

2.1.3 Arbitrage Pricing Theory (APT)

An alternative for the Capital Asset Pricing model is the Arbitrage Pricing Theory (APT). This theory was formulated by Stephen Ross in 1948. It is a model that gives a linear relationship between different factors and the return on a stock.

$$R_i = \alpha_i + \beta_{i1}\delta_1 + \beta_{i2}\delta_2 + \cdots + \beta_{ik}\delta_k + \varepsilon_i$$

R_i is the return on stock i, α_i is the constant, β_{ij} is the coefficient for the jth factor and ε_i is the error term. The main difference between the APT and CAPM is that the APT allows for more than one factor to influence the return of a stock. The APT also assumes that no riskless arbitrage profits can be obtained, while the CAPM includes this into the model (Roll and Ross, 1980). Another difference, and advantage, is that the APT is testable. However, the CAPM model has gained much more attention in financial literature (Roll and Ross, 1980).

2.2. Anomalies and deviations

2.2.1 Anomalies and behavioral finance

Research has also shown many deviations from the existing theories on asset-pricing behavior (Schwert, 2003). An anomaly is an economic result that is inconsistent with present economic paradigms (Kuhn, 1962, Thaler, 1987). They indicate either market inefficiency or inadequacies in the underlying price model. Some examples of these discovered anomalies are the January effect (Lakonishok & Schmidt, 1986, Thaler, 1987), the Weekend-effect (French, 1980), the Twist-on-Monday effect (Jaffe, Westerfield & Ma, 1989), the Holiday-effect (Lakonishok & Schmidt, 1988), the Turn-of-the-year effect (Reinagum, 1983) and the Value effect (Lakonishok, Shleifer & Vishny, 1994). However, these effects do not seem to obtain enormous profits for private investors (with normal transactions). Furthermore, after the anomalies are documented and analyzed in financial literature, they often seem to disappear, to become less visible or to reverse (Schwert, 2003). Nevertheless, it still remains relevant to research why these anomalies occur (Thaler, 1987).

A reason for the existence of anomalies can be data snooping. Data snooping is the creation of hypotheses based on the data, while this hypothesis is tested using the same data. This can cause results to be biased. This raises the question whether there was an anomaly in the first place (Schwert, 2003). Since the same data is used over and over again, no additional results are generated. It takes time for additional years of data to become available.

The sample selection bias can also be a big problem in financial literature. Anomalies have caught the eye of many new researchers, and since the publication of 'deviating' results are more popular than 'non-deviating' results, a bias towards deviating results is created (Schwert, 2003).

Another bias is the survival bias. When obtaining data, only firms that are still publicly listed will be obtained in the dataset. Firms that have gone bankrupt or have disappeared will not be visible in the dataset. This will cause the results to be biased.

2.2.2. Event study

Event studies has become the standard methodology in researching price reactions in response to an announcement or an event. Event studies are used for two reasons. The first is that the null hypothesis that the market efficiently processes newly available information can be tested. The second reason is that we can examine the wealth of a firms' shareholders as a result of the event, under the maintained hypothesis of market efficiency (Binder, 1998). The change of wealth of the shareholders is due to an unexpected change in the stock price (Kothari and Warner, 2006).

Event window

Before starting an event study, it is important to decide what event window to use. This the period that will be examined regarding stock returns. The event window is usually longer than the period of interest. The control period is a period prior to the event that is used for an estimation of normal returns. The normal return is the expected return without conditioning on the event taking place (MacKinley, 1997). It is also possible that information about an announcement prior to the announcement comes available on the market. For that reason, the best thing to do is to incorporate an intermediate period between the control period and the test period.

(Cumulative) abnormal returns

Abnormal returns (AR_{it}) in the test period are computed by subtracting the normal returns from the observed return.

$$AR_{it} = R_{it}^{*} - E(R_{it}|X_t)$$

Where R_{it}^{*} is the observed or actual return, $E(R_{it}|X_t)$ is the normal return and X_t is the conditioning information for the normal return model. In order to look at significant results during days around the announcement date (t=0) abnormal returns are aggregated for a specific event across time and securities (MacKinlay, 1997), to the cumulative abnormal return (CAR):

$$CAR_{it} = \sum_{i=1}^{n} AR_{it}$$

2.2.3. Normal return models

Fama (1970) pointed out that anomalies are being derived relative to a specific model of 'normal' return behavior. In case an anomaly is discovered, this can also mean that the underlying asset-pricing model is not adequate (Schwert, 2003). I will now discuss the most used models and how they converted into event study methodology. Most models used in the 70's are still used today but with some small improvements. MacKinlay (1997) discusses the following normal return models:

Constant mean return model

The constant mean return model is an asset return model that models the return as the mean return (μ_i) for every security i plus an error term (ε_{it}).

$$R_{it} = \mu_i + \varepsilon_{it}$$

With $var(\varepsilon_{it}) = \sigma^2_{\varepsilon_{it}}$. The constant mean return model is a very simple model, but it often yields similar results to more sophisticated models (Brown and Warner, 1980, 1985). This is because of the fact that using more complicated models often does not reduce the variance of the return (MacKinlay, 1997).

Market model

In event study methodology, the market model is one of the most used methodologies. The market model assumes that part of the return is due to market factors, and the sensitivity for market fluctuations is measured for each stock over a control period. It is important to control for market effects, since 30 to 40% of all the variability in a stock's monthly rate of return could be associated with market effects (King, 1966). The market model estimates the sensitivity to market fluctuations using the following model

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it}$$

This is done for the control period. The goal of this estimation is to estimate the normal behavior of the stock compared to the market, in order to estimate abnormal behavior during the test period. It is assumed that the parameter estimates are constant over time. Next, the abnormal return per day in the test period is determined, which is the difference between the observed return of stock i at time t (R^*_{it}) and the normal return based on market sensibility of stock i to the market at time t (R_{it}): $AR_{it} = R^*_{it} - R_{it}$. In order to look at significant results during days around the announcement date (t=0) abnormal returns are aggregated for a specific event across time and securities (MacKinlay, 1997), to the cumulative abnormal return: $CAR_{it} = \sum_{i=1}^{n} AR_{it}$.

Fama, Fisher, Jensen and Roll (1969) used the full sample (including the test period) to obtain α_i and β_i when the first used this method. Later, Ball and Brown (1968) concluded that these estimates are biased because the error terms do not have mean zero, since some of the effects of the event have been captured by α_i and β_i. The market model has shown to work well as a benchmark for returns (Binder, 1998), even though some statistical problems can occur, but they are usually not causing any problems.

The advantage of the market model over the constant mean return model is the fact that the part of the return that is related to the market return is removed, causing the variance of the abnormal returns to be reduced (MacKinlay, 1997). However, it is still important to analyze the R^2 of the different models.

Factor models

Factor models are a linear expression of multiple factors. Advantage is that these models could potentially reduce the variance of the abnormal return, because they potentially explain more of the variance in the normal return. According to MacKinlay (1997), the marginal power of additional factors is minimal, which causes the use of factor models to have limited advantages for event studies. Only in cases where all sample firms have a certain characteristic (e.g. one industry), a factor model is worth considering.

Economic models

Economic models are models such as the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT). In the 70's the CAPM was the most used model, but implications were soon discovered. The results seemed to be restricted to the CAPM restrictions. Since this problem can easily be avoided by using the market model, this became the more popular normal model in event studies. On the other hand, the APT model has been used for event studies. Similar to factor models, the additional factors of the APT have minimal additional explanation power, and therefore the market model is preferred.

Taking all possible models into consideration, the market model seems to, 1) be the most easy to use, and 2) to give the most unbiased results compared to the other models. The market model is therefore the preferred model in event studies.

2.2 Earnings anomalies

2.2.1. Earnings announcements

Earnings announcements are usually made in public financial statements and they are widely used by investors since earnings represent a summary of the performance of a company (Kariungu, 2012). Earnings announcements also provide information that allows investors to make judgements about the performance of a company (Kim & Verrecchia, 1994). Financial statements are usually published every quarter or every year for public companies.

In his research, Beaver (1968), concluded that both trading volume and volatility rise around earnings announcements, which means that earnings announcements contain information. There are also reasons for earnings announcements lacking information, according to Beaver (1968). The first reason is that measurement errors in earnings announcements can be very large, so estimating performance based on other variables might be more precise. The second reason is that there are many other instrumental variables available, such that, by the time earnings announcements become available, all information is already incorporated into the price. However, Beaver (1968) concludes that periods in which earnings announcements occur on average have larger price changes than periods in which they do not occur. This result supports the hypothesis that earnings announcements do contain information. Landsman and Maydew (1999) researched whether the information content of earnings announcements declined in the period 1972-1998. They concluded that there was no evidence of a decline of information content, measured by abnormal trading volume and volatility. Just like Buchheit and Kohlbeck (2002), they even find an increase in the information content of earnings for this period.

It is to be expected that when a firm releases positive news, that the share price will rise. Investors immediately respond to earnings announcements, very often within a few seconds (Patell & Wolfson, 1984). Kothari (2001) measured that most transactions occur within 30 minutes after the announcement. Much research has been devoted to analyzing this price reaction. There is an academic discussion on whether this initial reaction is too high or too low, respectively an overreaction or an underreaction. Section 2.2.2. will discuss this more extensively. Under- and overreactions can cause abnormal returns on the stock market, which causes the market to violate semi-strong market efficiency. (Semi-strong) market efficiency at the time of earnings announcements, among other accounting variables, is therefore a widely tested field in finance.

Many studies have already shown that there is a positive correlation between the sign of the news and the magnitude of stock returns in the post-earnings announcement period (Foster, Olsen, & Shevlin, 1984). Ball and Brown (1968) concluded that when the earnings component contains new information, the stock price will move in the same direction as the sign of the news. Since it would be expected that positive earnings news will cause the stock price of a firm to rise, I expect the return to be positive as well. In order to test for the Post Earnings Announcement Drift later, I first check whether the positive (negative) news component causes significantly positive (negative) abnormal returns on the day of the announcement.

Hypothesis 1: Firms that report positive (negative) earnings announcements have positive (negative) stock returns on the earnings announcement date

Dellevigna and Pollet (2009) have looked into detail at earnings announcements done on Fridays compared to other days of the week. They found that investors have the tendency to respond less to announcements made on Fridays compared to announcements made on other days of the week. Additionally, they find that abnormal trading volume is around 10% lower for Friday announcements compared to other days. A potential explanation could be the fact that investors tend to be more distracted from work-related activities before the weekend. Dellevigna and Pollet (2009) call this limited attention. After the weekend, the mispricing is corrected by investors. Since firms know this, they potentially tend to release more negative news on Fridays. This anomaly is taken into account in the first Hypothesis. I will go into more detail in the Methodology section.

2.2.2. Underreaction and overreaction

As discussed in the section above, investors react to earnings announcements, whether they are positive or negative. An underreaction (overreaction) is a reaction that is too low (high) for what is considered to be appropriate (De Bondt & Thaler, 1985).

In their research about testing the overreaction hypothesis, which predicts that losers become winners and winners become losers, De Bondt and Thaler (1985) conclude that NYSE common stocks data suffers from the overreaction hypothesis. Most investors tend to overreact to unexpected and dramatic news, since it is less likely to happen. De Bondt and Thaler (1985) conclude that firms that perform poorly (well) over a 3-5 year period tend to perform well (bad) over the next 3-5 year period. Due to overreaction of uninformed investors to both good and bad news, informed investors could potentially earn abnormal returns by choosing an contrarian investment strategy. This strategy suggests that investors should go short on or avoid stocks that are at that time in a period of widespread optimism and should go long on stocks that are at that time in a period of widespread pessimism. Contrarian investors bet against these so called naïve investors (Lakonishok, Schleifer & Vishny, 1994).

The underreaction hypothesis predicts that winners continue to obtain higher positive cumulative abnormal returns and losers tend to obtain higher negative cumulative abnormal returns. When investors respond slowly to publicly available information, this is called underreaction. Jagadeesh and Titman (1993) find that firms performing well over the last 3-6 months tend to obtain higher returns in the next 3-6 months than firms that were performing poorly. This was later called the momentum effect. A different anomaly that has been discovered is the Post-Earnings Announcement Drift (PEAD), which states that cumulative abnormal returns seem to rise due to underreaction of investors. The puzzling thing about the PEAD is that initially (at the earnings announcement), the information is processed, but that this reaction does not end after the news and it continues to drift in the same direction in the months after (Ball & Brown, 1968). Investors seem to not take this into account, even though the autocorrelation structure of earnings is widely known (Bernard, 1992). The PEAD therefore belongs to the underreaction category.

2.2.3 Forecasting

Forecasts of earnings are predictions of future earnings (for the next quarter or the next year). Financial analysts make earnings estimates before announcements have been made. The two most used forecasts are analyst forecasts and time series forecasts.

Foster (1977) references to his Appendix in which 71 articles with proof for the autoregressive properties of quarterly earnings are given. Bernard and Thomas (1990) claim that stocks prices show naive earnings expectations. This means that investors expect future earnings to be equal to the earnings in the same quarter of the preceding year. Therefore, the estimation of the forecast is:

$$(1)\ E(Q_t) = Q_{t-4}$$

Where $E(Q_t)$ is the expectation of quarterly earnings, Q_{t-4} the earnings 4 quarters ago.

Analysts, on the other hand, make predictions of quarterly earnings based on more information than just time series (Brown & Rozeff, 1978). Based on economic theory, we would expect that analyst forecast outperform time series forecasts. Brown et al. conclude that that this is the case and that security analysts are superior in their forecasts relative to time series forecasts. This is due to more available information for analysts. O'Brien (1988), Brown and Rozeff (1978) and Fried and Givoly (1982) conclude the same. There is some evidence that analysts' forecasts underreact to recent earnings (Abarnanell & Bernard, 1992). However, analysts still seem to outperform time series forecast based on the amount of evidence in favor of analysts' forecasts. Analyst forecasts are in general more expensive than autoregressive forecasts (Brown and Rozeff, 1978), which causes many research to be using forecasts based on autoregressive models. Because of its simplicity, the AR(1) model is used most frequently.

2.3 Post Earnings Announcement Drift (PEAD)

2.3.1 Evidence

One very puzzling anomaly is the Post Earnings Announcement Drift (PEAD). The PEAD was first discovered by Ball and Brown (1968) for the NYSE in the period 1946-1966. They assumed that capital markets are efficient and should therefore adopt new information quickly without leaving any opportunity for investors to earn abnormal returns in the days after an announcement. The semi-strong market efficiency hypothesis has the requisite that prices respond quickly to and in an unbiased manner to earnings announcements (Mendenhall, 2004). However, since the 70s of the last century, research has shown that this is not always the case. In this section I will discuss some of this research. The formal definition of the PEAD is the tendency for a stock's cumulative abnormal returns to drift in the same direction as the earnings surprise for a period after an earnings announcement (Livnat & Mendenhall, 2006).

I would like to know whether firms that report more positive news, also obtain higher cumulative abnormal returns and whether firms that report more negative news obtain lower cumulative abnormal returns over the test period. The PEAD is based on the idea that abnormal returns are associated with more extreme earnings changes, and that abnormal returns are lower for non-extreme earnings changes (Beaver et al., 1979). Based on the underreaction hypothesis discussed in Section 2.2.2., I therefore state the following hypothesis

Hypothesis 2: Firms that report more positive (more negative) news, have significantly higher (lower) cumulative abnormal returns over the test period.

Foster, Olsen and Shevlin (1984) showed that the absolute magnitude of the drift is inversely related to firm size. Bernard and Thomas (1989) find results that support this statement. According to Bushan (1989), larger firms are followed by more analysts. This results in a situation in which more private information of these firms comes available. This often causes analysts forecast to be superior to timeseries forecasts. The earnings announcements will also be less informative if all information is already available. Therefore, I expect that larger firms generate lower cumulative abnormal returns in the U.S. stock market.

Hypothesis 3: The absolute cumulative magnitude of the drift of the control period t=[-10, 10] is inversely related to firm size.

Using the Post Earnings Announcement Drift (PEAD), Foster, Olsen and Shevlin (1984) computed that by going long in the top decile of unexpected earnings and going short in the bottom decile of unexpected earnings, one could obtain an estimated abnormal return of 4.2% over a period of 60 days (25% on a yearly basis). Bernard and Thomas (1989) measure an abnormal return of 19% on a yearly basis using the exact same techniques as Foster, Olsen and Shevlin (1984) for the same period and some additional years (1974-1985). I therefore state the following hypothesis

Hypothesis 5:
A long-short long strategy of going long on the highest SUE decile and short on the lowest SUE decile for a maximum period of 10 days yields significant cumulative abnormal returns.

If there is empirical evidence for everything tested in earlier hypothesis, then the results will be taken into account in Hypothesis 5.

Researchers have proposed three possible explanations for the existence of the Post Earnings Announcement Effect (Mendenhall, 2004), measured by the standardized unexpected earnings. First of all, the effect might be due to methodological shortcomings of the studies that have documented the PEAD. Second, the drift could represent the systematic misestimation of expected returns. Third, the drift could be a result of investors that underreact to earnings information. Mendenhall (2004) concludes that extreme positive (negative) earnings surprise decile stocks in the highest arbitrage-risk quintile exhibit 3 month post-announcement abnormal returns of 5.21% (-5.46%), while those in the lowest arbitrage-risk quintile exhibit 3 month post-announcement abnormal returns of 1.32% (-1.65%). He therefore claims that investors who profit more from mispricing of high-arbitrage firms face greater uncertainty regarding their returns.

Bernard and Thomas (1989) find that, following an earnings surprise, returns around subsequent earnings announcements exhibit positive (and declining) serial correlations up to the fourth period serial correlation. This is similar to the autocorrelation results of Foster in 1977. Investors seem to not take this into account, even though the autocorrelation structure of earnings is widely known (Bernard, 1992).

Watts (1978) proved that significant abnormal returns are not enough to cover transaction costs unless a trader can trade at lower transaction costs. Moreover, methodological shortcomings have been documented widely for PEAD event studies. Some of these downfalls are using the incorrect announcement dates, look-ahead bias (which assumes that investors know beforehand which stocks will belong in the top-decile of PEAD and thus know which stock to buy, which is not the case in reality) (Holthausen, 1983) and the use of specific earnings models (Jacob et al. 1999). Recent papers have updated their methodologies, but most recent research continues to contain methodological results (Mendenhall, 2004).

The high abnormal returns documented by many other researchers suggests whether obtaining abnormal returns using the PEAD is possible today. However, most research on the PEAD has been done in the 20th century or in the first decade of the 21st century (Sojka, 2019). PEAD returns have been very consistent until the late 90's. After, the returns became riskier and much lower than the earlier years, which may be caused by wider recognition of the phenomenon by both academics and investors. However, research from the second decade (2010-2017) has shown that the drift still exists (see Figure 1). It is however important to note that these researches are difficult to compare since event study periods, methodologies and the period in which the abnormal returns are measured can differ. It therefore still remains relevant to analyze the Post Earnings Announcement Drift for different time periods. This research will analyze the period 2015 to 2018, which as is visible in Table 1, not yet analyzed.

Table 1: Overview of research Post Earnings Announcement Drift for the U.S., Source: Sojka (2019) page 61.

Author	Year of publication	Years used in research	Abnormal Return	Return period
Ball and Brown	1968	1946-1966	7.2%	6 months
Latane and Jones	1977	1971-1975	9.74%	1 month
Watts	1978	1950-1968	1.2%-2.1%	13 weeks
Foster, Olsen and Shevlin	1984	1970-1981	8.3%	90 days
Freeman and Tse	1989	1984-1988	3.23%	1 month
Bernard and Thomas	1989	1974-1986	4.2%	60 days
Affleck-Graves and Mendengall	1992	1982-1987	4.83%	61 days
Abarbanell and Bernard	1992	1976-1986	4.98%	1 month
Chan, Jegadeesh, Lakonishok	1996	1977-1993	4.3%	6 months
Collins and Hribar	2000	1988-1997	7.84%	120 days
Liang	2003	1989-2000	6%	60 days
Livnat	2003	1987-2002	3.94%	1 quarter
Chordia and Shivakumar	2005	1972-1999	0.9%	1 month
Doyle, Lundholm and Soliman	2006	1988-2000	13.95%	1 year
Jegadeesh and Livnat	2006	1987-2003	5.55%	6 months
Sadka	2006	1983-2001	1.94%	1 month
Battalio and Mendenhall	2011	1993-2002	4% to 8%	1 quarter
Francis, Lafond, Olsson and Schipper	2007	1982-2001	4.66%	1 quarter
Lerman, Livnat, Mendenhall	2008	1987-2005	2.73%	1 quarter
Livnat and Mendenhall	2006	1987-2003	5.21%	1 quarter
Ali, Chen, Yao and Yu	2007	1990-2014	3.06%	1 quarter
Ng, Rusticus and Verdi	2008	1988-2005	2.43%	1 month
Brandt, Kishore, Santa-Clara and Venkatachalam	2008	1987-2004	2.99%	3 days
Balakrishnan, Bartov and Faurel	2010	1976-2005	14.03%	120 days
Hirschleifer, Lim and Teoh	2009	1995-2004	4.52%	60 days
Chen, Chen, Hsin and Lee	2009	1997-2007	1.07%	3 months
Easter, Gao and Gao	2010	1976-2008	1.161%	1 month
Chung and Hrazdil	2011	1993-2004	5.48%	60 days
Zhou and Zhu	2012	1971-2009	3.63%	1 quarter
Dechow, Sloan and Zha	2013	1971-2011	~4%	annualized
Bird, Choi and Yeung	2014	1986-2009	0.781%	60 days
Chen, Huang and Jiang	2016	1981-2013	7.874%	1 quarter
Agapova and Mailibayeva	2017	1961-2008	6.91%	30 days
Baker, Ni, Saadi and Zhu	2017	1996-2015	2.39%	60 days

The research question is as follows:

"Does the Post-Earnings Announcement Drift obtain positive cumulative abnormal returns in the U.S. stock market in 2018 by going long in the most positive earnings release portfolios and short in the most negative earnings release portfolios?"

2.4. Oil industry

2.4.1. Oil price and stock returns

The oil industry is one of the largest industries world wide. In 2015, the worldwide oil industry was worth 168 billion dollars (numbers from Statista). The oil industry includes exploration, production, processing, transportation and marketing of natural gas and petroleum products (Petroleum in the United States, n.d.). The United States continues to produce historically high levels of crude oil and natural gas (EIA, 2020). Slow growth in domestic consumption leads to increasing exports of oil products.

Elyasiani, Mansur and Odusami (2011) find that changes in oil returns and oil return volatility influence access return volatilities of U.S. industries. Oil prices fluctuations seem to have a large impact on the industry excess returns. Sadorsky (1999) has shown that oil prices and oil price volatility play important roles in affecting real stock returns. U.S. stock market reactions to oil prices can be completely accounted for by changes in real cashflows (Jones & Kaul, 1996). Oil prices are also a good factor in predicting stock returns, according to Narayan and Gupta (2015). They also conclude that both positive and negative price changes impact the stock returns, with negative changes being relatively more important.

Much research has been devoted to analyzing the effect of oil price changes on international (Nandha & Faff, 2008), continental (Mohanty, Nandha & Bota, 2010), national (Sim & Zhou, 2015) or industry level (Elyasiani, Mansur & Odusami, 2011). However, fewer research has been devoted to the relationship between stock returns of the oil and gas industry firms and oil price changes (Scholtens & Wang, 2008). Firms that are engaged in the oil industry are exposed to two kinds of risks: oil price risk and exploration risk (Pincus & Rajgopal, 2002). These risks will also be carried by investors of oil industry stocks. The oil price being such a transparent measure, it is to be expected that investors will also respond to this price directly when considering buying and selling oil industry stocks. Scholtens and Wang (2008) find that the return of oil stocks is positively associated with an increase in the spot crude oil price. They also suggest that an increase in the oil price has impact on the expectations about the oil stocks future return. The positive oil risk premium, as they call it, may disappear as investors change their perceptions of the effect of an oil price change. There is also evidence that oil price volatility shocks have asymmetrical effects. The economy responds more heavily to positive oil price (oil price rises) shocks than to negative oil price shocks (oil price falls).

The fact that the oil price has such a big influence on the economy and in particular in the oil sector suggests whether large oil price fluctuations influence the stock price of oil sector firms. As this thesis is about the Post Earnings Announcement Drift, which analyses stock price reactions to earnings announcements, large oil price fluctuations might have a big impact on these reactions. I therefore state the following hypothesis

Hypothesis 5:

Firms that are in the highest SUE decile who have seen a highly positive oil price change in month t compared to the month before have a significantly higher CAR in month t than firms in the highest SUE decile that have not seen a highly positive oil price change.

And symmetrically

Firms that are in the lowest SUE decile who have seen a highly negative oil price change in month t compared to the month before have a significantly lower CAR in month t than firms in the highest SUE decile that have not seen a highly negative oil price change.

3. DATA & METHODOLOGY

3.1 Data selection

This research will analyze the U.S. announcement returns for the quarterly announcements during the period 2015-2018. The reason for this is that most research is based on data before 2010. It is therefore very relevant to research newly available data to test whether earlier research might have been victim of data snooping. This research is also very relevant since the results from the period 2015 to 2018 could still be relevant today.

The sample companies will retrieved from I/B/E/S through the EUR license. The sample will consist of publicly listed companies in the oil industry (SIC 1310-1389) on the NASDAQ, Amex and NYSE during the entire sample period (2015-2018). The data may therefore potentially suffer from survival bias, but this might potentially not form a problem according to Foster, Olsen and Shevlin (1984). They conducted tests which indicated that the PEAD is not sensitive to this bias.

However, the following data of the companies must be available in order to be in the sample:

i. Earnings announcement dates and times for 16 quarters (during all quarters of the period 2015-2018).
ii. Realized earnings announced at the announcement dates for the period 2015-2018
iii. The most recent earnings forecast before the announcement date made by analysts for the period 2015-2018
iv. Stock price data around each announcement date [-62, +10]

This results in a sample of 79 firms. The size of these firms is obtained from Compustat (number of common shares outstanding multiplied by the share price at the end of the year). Missing data is complemented using financial statements of the companies in question. The log is taken in order to make the data less sensitive to large observations. Monthly oil price data is obtained from Index Mundi for every month during the years 2015-2018. Monthly oil price changes are used to indicate the level of change compared to the month before. Descriptive statistics of variables of the sample will be given in section 3.3.

The event study tool from Wharton Research Data Services (WRDS) is used in order to obtain all abnormal returns (AR) and cumulative abnormal returns (CAR). An estimation window of 50 days is used (62 – 12 = 50), with a one day gap (t = -11). The event window is [-10, 10].

Earnings announcement dates and analyst forecasts have been retrieved from IBES, realized earnings have been retrieved from Compustat and stock price data has been retrieved from CRSP. This is consistent with earlier research, such as MacKinlay (1997) and Bernard and Thomas (1989). Earnings announcement time has been used in order to check whether the announcement has been after the closing of the stock market (assuming the stock market closes at 8 pm). If this is the case, the next day is called the earnings reaction date, since this is the first day on which investors get the opportunity to respond on the stock market. If the announcement is made after trading hours on a Friday, the next Monday after the weekend is used as the earnings reaction date. In case the announcement time is during trading hours, the earnings announcement date is equal to the earnings reaction date.

3.2 Methodology

This study will be executed by using event study methodology. The goal is to analyze abnormal stock returns in relation to the earnings surprise followed by an earnings announcement.

(Cumulative) abnormal returns

For this event study, a control period of [-62,-12] will be used. The reason for this short control period is that the event period of the last announcement will be otherwise be overlapped, which would create a bias. The test period will be [-10, 10]. An event window of [-10, 10] will be analyzed. The returns on daily stock prices will be computed by:

$$(1) \qquad R^*_{i,t} = \frac{P_t - P_{t-1}}{P_{t-1}}$$

where $R_{i,t}$ is the return for firm i at time t, P_{t-1} is the stock closing price at end of day (t-1) and P_t is the stock closing price at the end of day t.:

$$(2) \qquad R_{i,t} = \alpha + \beta_i R_{m,t} + \varepsilon_{i,t}$$

Where E($\varepsilon_{i,t}$) = 0 and var($\varepsilon_{i,t}$) = $\sigma^2_{\varepsilon_{i,t}}$. $R_{m,t}$ is the market return and $R_{i,t}$ is the return on company i's stock. By doing this, we filter the effect of market out of the realized return. In order to compute the abnormal return I use

$$(3) \qquad AR_{i,t} = R^*_{i,t} - R_{i,t}$$

where AR_{ti} is the abnormal return for firm i at day t, $R_{i,t}$ is the normal return for firm i at time t which is calculated via (2) and $R^*_{i,t}$ is the observed (also called actual) return of firm i at day t. Also, the average abnormal return (AAR) for the sample per day of the test period is

$$AAR_t = \frac{1}{n}\sum_{i=1}^{n} AR_{i,t}$$

The cumulative abnormal return CAR will be the sum of $AR_{i,t}$ over the event window. The announcement date occurs at date t=0. In order to compute normal returns for the period [-10, 10], the market model will be used for the period [-62,-12]. This can be mathematically shown as

$$(4) \quad CAR_{i,t} = \sum_{t=-10}^{10} AR_{i,t}$$

Furthermore, we have that the Cumulative Average Abnormal Return (CAAR) is

$$CAAR_t = \frac{1}{n}\sum_{i=1}^{n} CAR_{i,t}$$

Earnings surprises

Earnings surprises will be measured by using the Standardized Unexpected Earnings (SUE) (Ball and Brown, 1968). The Unexpected Earnings (UE) is measured as the difference between the actual en the forecasted EPS value. The SUE in quarter Q is the realized EPS in quarter Q minus the analyst forecast of EPS of quarter Q, divided by the standard deviation of earlier quarters unexpected earnings 1 to Q-1 ($SD(UE_{1,Q-1}$):

$$(5) \quad SUE_{i,Q} = \frac{EPS_{act,Q} - EPS_{fc,Q}}{SD(UE_{1,Q-1})}$$

For example, if Q = 5, then $SD\left(UE_{1,4}\right)$ is the standard deviaton of the Unexpected Earnings from quarter 1 to quarter 4.

The Breusch-Pagan test and the White test will be used to test homoskedasticity. In both cases the null is homoskedasticity. In case heteroskedasticity is present in the data, robust standard errors are used.

Significance testing

T-tests will be conducted in order to conclude anything about the statistical significance of the Abnormal Returns (AR) for each day of the test period. The following (standard) statistic will be used

$$T = \frac{AR_t - \overline{AR}}{SE_{AR_t}/\sqrt{n}}$$

Where AR_t is the abnormal return at day t, $\overline{AR}$ is the average abnormal return, SE_{AR_t} is the standard error of AR for a particular day t and n is the number of observations in the sample. A significance level of 5% will be used in order to draw conclusions.

Another very relevant test is the Patell Z test, created by Patell (1976). This test This test used the standardized abnormal returns (SAR) instead of abnormal returns.

$$SAR_{i,t} = AR_{i,t}/S_{AR_{i,t}}$$

where $AR_{i,t}$ is the abnormal return of firm i at time t and $S_{AR_{i,t}}$ is the forecast-error corrected standard deviation of the $AR_{i,t}$.The statistic for testing whether abnormal return are equal to zero, is equal to

$$Z_{Patell} = ASAR_t / S_{ASAR_t}$$

where $ASAR_t$ is the sum over the sample of the standardized abnormal returns ($\sum_{i=1}^{N} SAR_{i,t}$) and S_{ASAR_t} is the forecast-error corrected standard deviation of S_{ASAR_t}. The statistic for $CAR_{i,t}$ is equal to

$$Z_{Patell} = 1/\sqrt{N} \sum_{i=1}^{N} CSAR_i / S_{CSAR_i}$$

where $CSAR_i$ is the cumulative standardized abnormal returns ($CSAR_i = \sum_{t=T_1+1}^{T_2} SAR_{i,t}$) and S_{CSAR_i} is the forecast-error corrected standard deviation for $CSAR_i$.

Hypothesis 1:

Firms that report positive (negative) earnings announcements have positive (negative) stock returns on the earnings announcement date

In order to test this hypothesis, positive and negative announcement must be defined. Similar to MacKinlay (1997), good news is defined as an earnings announcement that exceeds the forecast by more than 2.5%. Bad news is defined as an earnings announcement that falls below a 2.5% of the analyst forecast. No news is defined as an earnings announcement that is between the range of 2.5% smaller and larger than the forecasted value of EPS by analysts. The abnormal returns for each category for every day of the test period is analyzed. In particular, the date t=0 is analyzed for this hypothesis. T-tests and the Patell Z will be used to draw conclusions about the deviation of the abnormal return from 0.

Investors have the tendency to respond less to announcements made on Fridays compared to announcements made on other days of the week. This will be tested using the following linear regression

$$AR_{ad} = \alpha + \beta * D_{Friday\ Announcement} + \varepsilon_t$$

Where AR_t is the abnormal return at announcement date (ad) and $D_{Friday\ Announcement}$ is a dummy variable that has value 1 if the announcement date ad was on a Friday and value 0 if not. ε_t is the error term. The null hypothesis is that Fridays show on average no significantly higher or lower abnormal return compared to the other days of the week.

Hypothesis 2:

Firms that report more positive (more negative) news, have higher (lower) cumulative abnormal returns over the test period.

This hypothesis will be evaluated using two measures of news. First, news is divided into the categories as used in Hypothesis 1 and the same tests will be used. After that, the standardized unexpected earnings are used to analyze the data. Together the results give a good overview of the existence of the PEAD in the data.

The standardized unexpected earnings (SUE) are obtained as decribed in the Earnings Surprise section of this Methodology section. The SUE will be divided in 10 even deciles from 1 (most negative) to 10 (most positive). SUE deciles are updated every quarter, such that for example a firm that reported the most negative news in the first quarter, can be in the second lowest in the next. One way ANOVA, T-tests and Patell Z tests will be used to compare groups. Homoskedasticity is checked first (ANOVA, Breusch-Pagan and White test). If the null of homoskedasticity can be rejected, robust standard errors will be used. By comparing decile 10 to deciles 1 to 9 using a t-test, I will be able to show whether more positive announcements gain higher cumulative abnormal returns. The same method will be used comparing decile 1 to deciles 2 to 9, etc.. In order to test whether there is a linear relationship between the earnings surprise factor and cumulative abnormal returns, ordinary least squares (OLS) is used to estimate the following linear regression:

$$CAR_{i,t} = \alpha + \beta_{SUE2} * SUE_{D2} + \beta_{SUE3} * SUE_{D3} + \beta_{SUE4} * SUE_{D4} + \beta_{SUE5} * SUE_{D5} + \beta_{SUE6} * SUE_{D6} + \beta_{SUE7} * SUE_{D7} + \beta_{SUE8} * SUE_{D8} + \beta_{SUE9} * SUE_{D9} + \beta_{SUE10} * SUE_{D10} + \varepsilon_{ti}$$

Where $CAR_{i,t}$ is the abnormal return for firm i over the period [-10,10], SUE_{Di} are all SUE deciles (i={2,3,..10}) and ε_t is the error term. In this case is the first decile the reference category. The same linear regression will be executed using every group as a reference category once. In principle, this will give the same results, but it has advantages for comparison of groups. A t-test will be used in order to conclude whether the dummy coefficient is significant. Winsorizing of 1% will be used in case of potential influence of outliers on the results.

Using this hypothesis, it is also possible to conclude whether or not abnormal returns can be gained from going long in the most positive earnings announcement firms and short in the most negative earnings announcement firms. In case both t-tests have significant results, then hypothesis 2 is true.

Hypothesis 3:

The absolute cumulative magnitude of the drift of the control period t=[-10, 10] is inversely related to firm size.

This hypothesis will be tested using a simple OLS regression

$$|CAR_i| = \alpha + \beta_1 * Ln(Firm\ Size_i) + \varepsilon_t$$

where $|CAR_{i,t}|$ is the absolute value of the CAR for firm i in quarter t. $Ln(Firm\ Size)$ is the natural logarithm of the firm size of firm i. Since the firm size is measured yearly, a firm will have the same firm size during 4 subsequent quarters in a year. ε_t is the error term. Expectation is that $\beta_1 < 0$ since literature suggests that the absolute cumulative magnitude of $CAR_{i,t}$ is inversely related to the ln of the firm size.

Hypothesis 4:

Firms that are in the highest SUE decile who have seen a highly positive oil price change in month t compared to the month before have a significantly higher CAR in month t than firms in the highest SUE decile that have not seen a highly positive oil price change.

And symmetrically

Firms that are in the lowest SUE decile who have seen a highly negative oil price change in month t compared to the month before have a significantly lower CAR in month t than firms in the highest SUE decile that have not seen a highly negative oil price change.

In order to test this hypothesis, oil prices (in $ per barrel) and oil price changes (in %) in month of the earnings announcement compared to the month before are observed. These prices and price changes are used to estimate the following linear regressions

$$EPS_t = \alpha + \beta\ P_{Oil} + \varepsilon_t$$

Which estimates the relationship between the oil price and Earnings Per Share announced. EPS_t is the Earnings Per Share announced in month t and P_{Oil} is the oil price in month t. ε_t is the error term. Furthermore,

$$CAR_{ti} = \alpha + \beta\ P_{Oil} + \varepsilon_t$$

Which estimates the relationship between the CAR in month t and the oil price in month t. ε_t is the error term.

$$CAR_{ti} = \alpha + \beta\ \Delta P_{Oil} + \varepsilon_t$$

Which estimates the relationship between the CAR in month t and the oil price change (ΔP_{Oil}) in month t. ε_t is the error term. Since the oil price and the oil price change are dependent of eachother, I add an interaction term to the regression since the oil price change is dependent of the oil price. In order to find the real effect of the oil price on the CAR, the additional linear regressions are executed

$$CAR_{ti} = \alpha + \beta_1\ P_{Oil} + \beta_2\ \Delta P_{Oil} + \varepsilon_t$$

$$CAR_{ti} = \alpha + \beta_1\ P_{Oil} + \beta_2\ \Delta P_{Oil} + \beta_3\ (P_{Oil} * \Delta P_{Oil}) + \varepsilon_t$$

Heteroskedasticity tests are executed on every linear regression in order to check whether robust standard errors need to be used. The tests used are the Breusch-Pagan and White test. In order to test the hypothesis, a dummy $D_{positive\ price\ change}$ has been created for the highest decile, which has value 1 in case the oil price change in that month is higher than 2% and value 0 if not. A dummy $D_{negative\ price\ change}$ has been created for the lowest decile, which has value 1 in case the oil price change in that month is less than -2% and value 0 if not. The next linear regressions are estimated

$$CAR_{10,t} = \alpha + \beta_{10}\ D_{positive\ price\ change} + \varepsilon_t$$

and

$$CAR_{1,t} = \alpha + \beta_1\ D_{positive\ price\ change} + \varepsilon_t$$

where $CAR_{10,t}$ indicates the CAR for the highest decile (10) and $CAR_{1,t}$ indicates the CAR for the lowest decile (1). ε_t is the error term. If β_{10} has a significantly positive coefficient and β_1 has a significantly negative coefficient, then we can say that hypothesis 4 is true.

Hypothesis 5:

A long-short long strategy of going long on the highest SUE decile and short on the lowest SUE decile for a maximum period of 10 days yields significant cumulative abnormal returns.

This hypothesis will be tested using both the Good news, No news and Bad news categories and the SUE deciles. The same t-tests as before will be used in order to draw any conclusions about the significance of the CAAR. Long (short) strategy for t days will be computed as the CAAR at [0, t] for the good news/highest SUE decile (bad news/lowest SUE decile). The period [0, t] is used in order to prevent the prediction bias, which means that investors know beforehand which companies will be in which decile. By choosing an portfolio on the day of the announcement, this bias does not occur. Only in case of significance, conclusions can be drawn about the long short cumulative abnormal returns.

3.3. Descriptive statistics

The sample used for this research contains 79 firms from the oil sector. A sample of 79 firms for 4 years with 4 quarters yields an sample of 1264 observations. The mean abnormal return (AR) and the mean cumulative abnormal return (CAR) are shown in Table 2 and Figure 1 . Table 2 shows that especially the days before the announcement have negative abnormal returns. These results will be analyzed in Section 4.

Table 2: Event time descriptive statistics (AR and CAR)

Event time	Mean abnormal return (AR)	Mean cumulative abnormal return (CAR)	T-stat AR	Patell Z
-10	-0.0016	-0.0016	-1.9659*	-1,8523**
-9	-0.0030	-0.00453	-4.1163***	-4,60969***
-8	-0.0032	-0.0078	-4.2527***	-4,54072***
-7	-0.0030	-0.0107	-3.5484***	-4,19917***
-6	-0.0018	-0.0125	-2.1998*	-2,64056***
-5	-0.0008	-0.0133	-10398,0000	-1,17005
-4	-0.0024	-0.0157	-3.1075**	-3,48890***
-3	-0.0042	-0.0199	-5.6130***	-5,16784***
-2	-0.0031	-0.0230	-3.8249***	-4,16165***
-1	-0.0029	-0.0259	-3.7300***	-3,30918***
0	0.0005	-0.0254	0.3914	0,71787
1	0.0026	-0.0228	1.7379*	1,23208
2	0.0038	-0.0190	4.0269***	3,97995
3	0.0003	-0.0187	0.3713	0,71073
4	-0.0003	-0.0190	-0.3944	-0,76725
5	0.0008	-0.0182	0.9392	-0,09250
6	0.0001	-0.0180	0.1817	-0,29882
7	0.0012	-0.0168	14254,0000	0,63033
8	0.0000	-0.0168	0.0038	-0,70608
9	-0.0019	-0.0187	-2.4669**	-2,11364**
10	-0.0005	-0.0192	-0.6106	-1,44605

Figure 1: Average CAR during event period

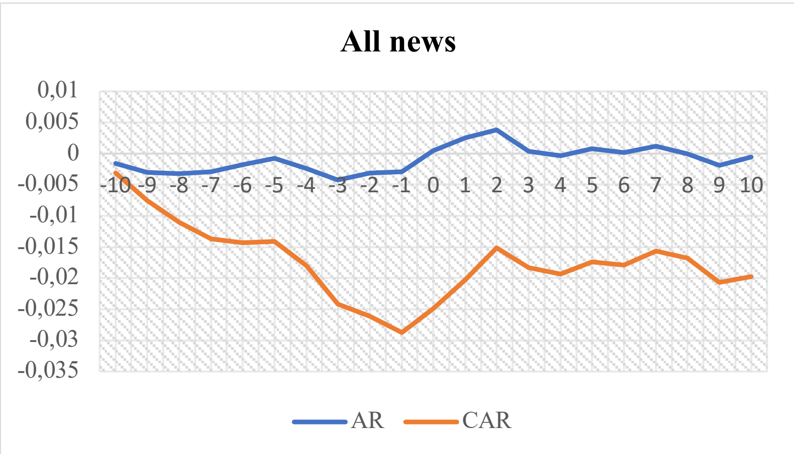


Table 3 shows the number of observations, the mean, the median, the standard deviation, the minimum and the maximum of all variables. The earnings per share announced have a negative average of -0,3866328 euro. The mean of the analyst forecast is quite different (0.0460) and has the opposite sign. This is partly due to the large minimum and maximum values of the EPS announced. However, these are real announced values, so it is relevant to keep them as they are in the data.

The firm size is also incorporated as a variable. Since size is a variable that can vary quite largely over companies, the log of firm size is incorporated. This causes the values of the size to lay between the interval of 4.2073 and 12.8331 (Table 3) instead of between 67.1736,00 and 374.398,48 million dollars.

Table 3: Descriptive statistics descriptive variables

	Number of observations	Mean	St.dev	Min	Max
Earnings per share announced	1280	-0.3867	1.9261	-15.65	13.45
Earnings per share - analyst forecast	1280	0.0460	0.7594	-8	4,9
Log firm size	316	8.2883	1.7954	4.2073	12.8331
Oil price ($ per barrel)	48	53.68	11.2973	29.78	76.73
Oil price change (%)	48	0.0021	0.0945	-0.2239	0.2034

A graph of oil price data is shown in Figure 2 and a graph of oil price changes is shown in Figure 3. As is visible in Table 3, the oil prices vary between $29.78 and $76.73. This is quite a large range considering the fact the whole oil industry is dependent of this price. It is therefore very relevant to look at the relationship between the oil price (change) and both EPS and CAR.

Figure 2: Oil price ($ per barrel) for 2015-2018

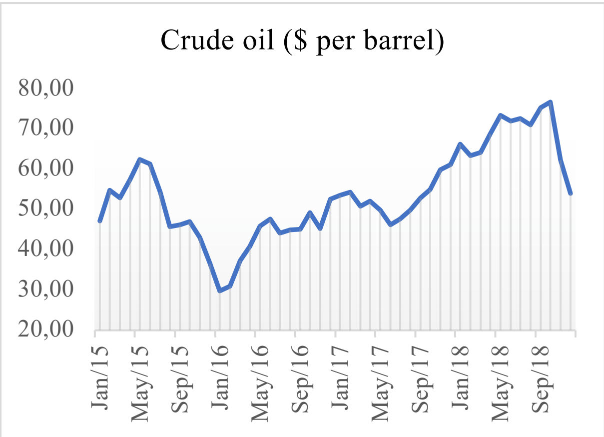
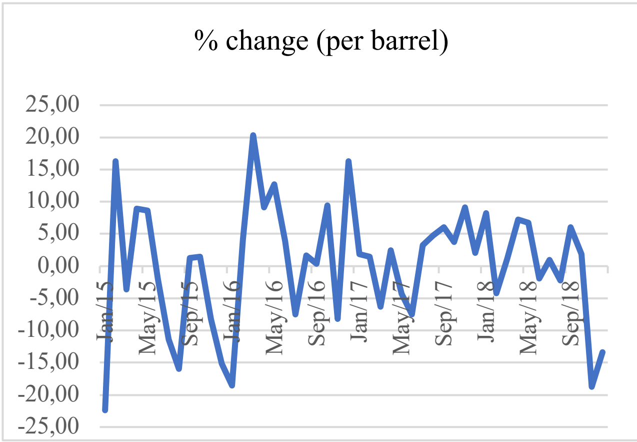


Figure 3: Oil price (per barrel) changes in % for 2015-2018



4. EMPIRICAL RESULTS

This section contains all the empirical results which will give evidence on whether the data is in favor with the hypothesis made in Section 2. The data and methodology from Section 3 will be used.

First of all, Table 4 shows the abnormal returns and the cumulative abnormal returns for all 79 observations in the sample. It is visible that all days before the announcement date (except for t=5) are significantly negative with both the normal t test and the Patell Z test. This may be caused by insider information becoming available on the market before the earnings announcement date. However, this of course requires additional research. Now that the first standard results are discussed, the hypotheses are tested.

Hypothesis 1

Firms that report positive (negative) earnings announcements have positive (negative) stock returns on the earnings announcement date

In order to test whether firms that report positive (negative) earnings announcements have positive (negative) stock returns on the announcement date, the data is divided into three groups based on the 5% margin around the analyst forecast for that particular event date. The data consisted of 484 "Good news" announcements, 41 "No news" announcements and 739 "Bad news" announcements. Because the forecasts are very different from the actual values, the errors are very large. Even when applying a 20% margin, the Bad news group remains by far the largest group. It is important to keep this in mind when reviewing the results. Looking at the Total column in Table 4 it is visible that the results are very similar to the Bad news group. This is a sample selection bias which should be taken into account. As is visible in Table 4, we can see that Good news firms have a positive AAR of 0.0033 that is significant at 10% level, but not at 5%. The No news firms do not have a significant results and the Bad news firms also does not have a significant result. The hypothesis stated that Good news firms should have positive stock returns on the earnings announcement date and also that Bad news firms should have negative stock returns on the earnings announcement date, which is not the case. The hypothesis is therefore not accepted. This result indicates that there is a possible belated reaction of investors to the newly available information.

Next, I will investigate the question whether investors tend to respond less to earnings announcements on Fridays. This will be tested using a linear regression. 110 out of 1264 announcements are made on Fridays. This is quite low considering the fact that we would expect 1/5 of all announcements to be on Friday. Table 5 shows the result from the estimation of the linear regression. We can see a close to significant positive coefficient for the Friday dummy. However, the constant is not significantly different from 0. This result indicates that Fridays do not have significantly higher abnormal returns on the announcement dates. There is therefore no reason to believe that Fridays are significantly different in adapting to earnings announcements than other days of the week. Distraction on Fridays does therefore not lead to significantly less efficient prices.

Table 4: AR and CAR for Good news, No news, Bad news and Total.

	Good news		**No news**		**Bad news**		**Total**	
Event time	**AAR**	**CAAR**	**AAR**	**CAAR**	**AAR**	**CAAR**	**AAR**	**CAAR**
-10	-0,00199	-0,00199	0,0033	0,0033	-0,0015	-0,0015	-0,0016	-0,0016
-9	-0,0025**	-0,00449**	0,0017	0,0050	-0,0035**	-0,0051***	-0,0030***	-0,0045***
-8	-0,0033**	-0,00781**	0,0007	0,0057	-0,0034**	-0,0085***	-0,0032***	-0,0078***
-7	-0,00178	-0,00959**	0,0003	0,0059	-0,0039**	-0,0124***	-0,0030***	-0,0107***
-6	-0,00105	-0,01064**	0,0021	0,0081	-0,0025	-0,0149**	-0,0018**	-0,0125***
-5	-0,00031	-0,01096**	-0,0018	0,0063	-0,0011	-0,0160	-0,0008	-0,0133***
-4	-0,0028**	-0,01375**	0,0026	0,0089	-0,0024	-0,0183**	-0,0024	-0,0157***
-3	-0,0037***	-0,01741**	-0,0068**	0,0021	-0,0045**	-0,0228***	-0,00424***	-0,0199***
-2	-0,0026**	-0,02002**	-0,0036	-0,0015	-0,0034	-0,0261***	-0,0031***	-0,0230***
-1	-0,00253**	-0,02252**	0,0033	0,0018	-0,0034**	-0,0296***	-0,0029***	-0,0259***
0	0,0033*	-0,01919**	-0,0036	-0,0018	-0,0011	-0,0307	0,0005	-0,0254***
1	0,00457	-0,01462**	0,0013	-0,0006	0,0013	-0,0294	0,0026	-0,0228***
2	0,0030**	-0,01164**	0,01027**	0,0097	0,0040***	-0,0254***	0,0038***	-0,0190***
3	-0,00070	-0,01234**	-0,0012	0,0086	0,0011	-0,0243	0,0003	-0,0187***
4	-0,00047	-0,01282**	0,0004	0,0090	-0,0003	-0,0246	-0,0003	-0,0190***
5	0,00070	-0,01212**	0,0014	0,0104	0,0009*	-0,0237	0,0008*	-0,0182***
6	0,00034	-0,01178	-0,0049	0,0055	0,0003	-0,0234	0,0001	-0,0180***
7	0,00049	-0,01128	0,0009	0,0064	0,0017	-0,0217	0,0012**	-0,0168***
8	0,00036	-0,01093	-0,0063	0,0001	0,0001	-0,0216	0,0000	-0,0168***
9	-0,00019	-0,01111	-0,0004	-0,0003	-0,0031**	-0,0247**	-0,0019	-0,0187***
10	-0,00180	-0,01291	0,0026	0,0023	0,0001	-0,0246	-0,0005	-0,0192***
Average	**-0,00061**	**-0,01353**	**0,0001**	**0,0024**	**-0,0012**	**-0,0258**	**-0,0009**	**-0,0202**
Number of observations	**484**		**41**		**739**		**1264**	

Significance: ***: < 0,01, ** < 0,05 and * < 0,1

Table 5: Linear regression estimate: Friday dummy on AR

	Coefficient	**Robust std. error**	**t**	**P > | t |**
Friday	.008619	.0045626	1.89	0.059
Constant	-.0002	.001346	-0.18	0.855
		F(1, 1264)		3.57
		Prob > F		0.0591
		R-squared		0.0028
		Number of observations		1264

Hypothesis 2

Firms that report more positive (more negative) news, have higher (lower) cumulative abnormal returns over the test period.

This hypothesis will be evaluated using two measures of news. First, we evaluate the data as shown in Table 4. News is divided into the categories as used in Hypothesis 1. After that, the standardized unexpected earnings are used to analyze the data. Together the results give a good overview of the existence of the PEAD in the data.

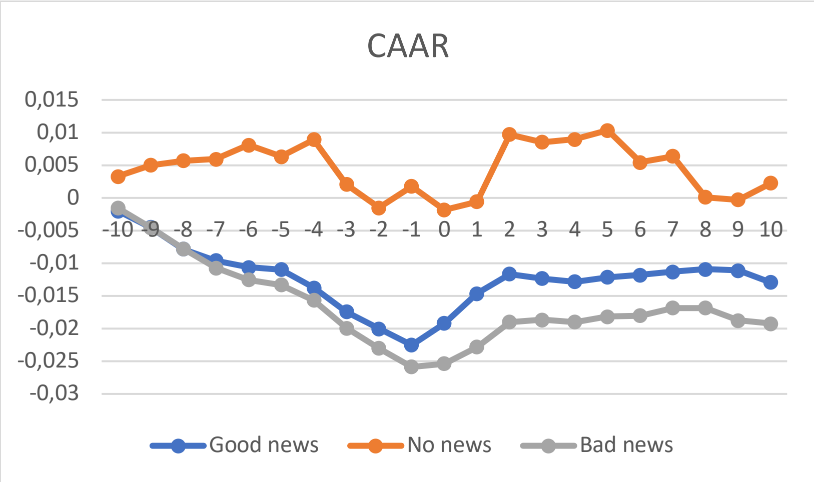
Table 4 and Figure 4 show the average AAR and CAAR during each day of the event period for all news categories (Good news, No news and Bad news). It can be seen from the table that both Good news and Bad news have a negative average AAR and CAAR over the whole event period. However, the Bad news category has almost double the negative mean compared to the Good news group. The No news category has a positive average AAR and CAAR over the event period. Table 5 also shows the following results

- Day -9, -8, -4, -3, -2, -1 and 2 are significant at a 5% significance level for the "Good news" group. All significant days have a negative sign, except for t is -3. At t = 0, there is a significant positive abnormal return visible, but only at a 10% level. The results suggest that the two days after the good news earnings announcement, significant positive abnormal returns have been realized. However, the significantly negative abnormal returns in the days before the announcement seem out of place. This could be due to insider information being already available.
- Day -3 and 2 are significant at a 5% significance level for the "No news" group. In this case day -3 has a negative sign and day 2 has a positive sign. This suggests that two days after the announcement, significant positive abnormal returns have been realized (on average).
- Day -9, -8, -7 are significant at a 1% level and day -3, -1, 1, 2 and 9 are significant at a 5% significance level for the "Bad news" group. In this case all significant days before the earnings announcement date (t=0) have a negative sign, while all days after have a positive sign. The results thus suggest that before the "Bad news" announcement, negative abnormal returns are realized. After the announcement however, positive abnormal returns are realized. A possible explanation for this is that insiders have more information about the earnings announcement before it is made, which causes them to sell/demand less of the stock of a particular firm. After the announcement is made, it is possible that the announcement is not as bad as expected, which causes the stock price to rise again.

The statistical significance of the average abnormal returns on the days before the announcement is very visible in the data. Table 2 also shows statistical significance for these days using the Patell Z test. It could potentially be the case that information has already reached investors the days before announcement date. Positive abnormal returns on day 2 after the announcement could indicate the earnings announcement being a more positive outcome than expected. Investors potentially update their expectations about future earnings. However, this requires additional research.

Negative cumulative abnormal returns are obtained for both the Good news [-9, 5] and the Bad news firms [-9, 10] (Table 4 and Figure 4). The No news firms do not show any significant cumulative abnormal returns. This might be due to the small sample size of this category (only 41 announcements). The Good news firms were expected to have a positive cumulative abnormal returns. This is in contrast with results from Ball and Brown (1968), Mendenhall (2004), Foster, Olsen and Shevlin (1984) and Bernard and Thomas (1989).

Figure 4: CAAR over the event period



Next, the standardized unexpected earnings are calculated and divided into 10 deciles of 126 or 127 observations. The lowest 126 observations will be assigned to the first decile, the 127 observations after that will be assigned to the second decile, etc. This is visible in Table 6. Since the Breusch-Pagan and the White test suggest heteroskedasticity, robust standard errors will be used in the estimation (Table 2, Appendix)

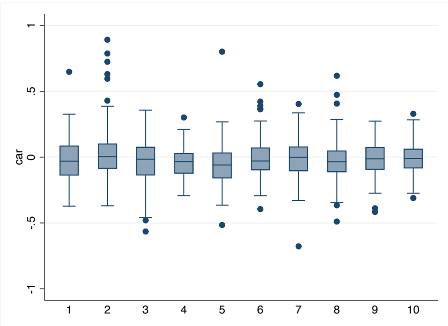
Table 6: Descriptive statistics SUE deciles

	Number of observations	Mean	Std. dev	Min	Max
D1	126	-.0266	.1618	-.3727	.6477
D2	127	.0226	.2066	-.36937	.8912
D3	126	-.0331	.1664	-.56488	.3565
D4	127	-.0419	.1171	-.29256	.3012
D5	126	-.0531	.1632	-.51547	.8006
D6	126	-.0126	.1556	-.39454	.5541
D7	127	-.0060	.1470	-.67711	.4038
D8	126	-.0253	.1590	-.48934	.6176
D9	127	-.0133	.1300	-.41617	.2732
D10	126	-.0036	.1214	-.31046	.3289
Total	1264	-.0192	.1556	-.67711	.8912

*Robust standard errors

The one-way ANOVA test (Table 2, Appendix) also suggests that there are unequal means of deciles in the data ($F(2, 46) = 2.46$, $p = 0.0088$), so the data will be looked at into more detail. Table 5 shows the descriptive statistics. It can already be seen that the means are not increasing when going up a decile. Table 7 shows the comparison of all deciles with other deciles. The table shows mixed results. We see that decile 2 obtains a significantly higher CAR ($0.035 < 0.05$) than decile 1. Also, decile 7 and 10 obtain significantly higher CAR than decile 4. The same principle is visible for decile 5 in comparison with 6, 7, 9, 10. On the other hand, we see that decile 3, 4, 5 and 8 obtain significantly lower CAR than decile 2 ($p < 0.05$). The reason for this might be the fact that the second decile has relatively more positive outliers than the other deciles, as is visible in Figure 5. For this reason, I apply winsorizing of 1% to the data. The ANOVA and Bartlett test (Table 3, Appendix) conclude that there is a significant difference between the groups and that they have unequal variances. The results however (Table 4, Appendix) do not differ that much for it to be relevant to discuss.

Figure 5: Boxplot of CAR for every decile



Taking the results from Table 4 and Table 7 together, it can be concluded that firms that report more positive (more negative) news, do not necessarily obtain higher (lower) cumulative abnormal returns over the test period. The null hypothesis must therefore be rejected. It can however be concluded that firms with more negative news have significantly negative cumulative abnormal returns.

Table 7: Coefficients and p-values for comparing deciles

SUE decile	D1	D2	D3	D4	D5	D6	D7	D8	D9
D2	.0492								
	2.11**								
D3	-.0066	-.0558							
	-0.32	-2.37**							
D4	-.0153	-.0645	-.0087						
	-0.86	-3.06***	-0.48						
D5	-.0265	-.0757	-.0199	-.0112					
	-1.29	-3.24***	-0.96	-0.63					
D6	.0140	-.0352	.0206	.0293	.0405				
	0.70	-1.53***	1.01	1.69	2.02**				
D7	.0205	-.0287	.0271	.0358	.0471	.0065			
	1.06	-1.27	1.37	2.15**	2.41**	-0.34			
D8	.0013	-.0480	.0078	.0165	.0278	-.0127	-.0193		
	0.06	-2.07**	0.38	0.94	1.37	-1.00	0.316		
D9	.0133	-.0359	.0199	.0286	.0398	-.0007	-.0072	.0120	
	0.72	-1.66*	1.06	1.84*	2.14**	-0.42	0.677	0.66	
D10	.0230	-.0262	.0296	.0383	.0495	.0090	.0024	.0217	.0097
	1.28	-1.23	1.61	2.55**	2.73***	0.14	0.885	1.22	0.61

The first value is the coefficient, the second value is the t stat where * significance at 10% level, ** significance at 5% level and *** significant at 1% level. *Robust standard errors

Hypothesis 3

The absolute cumulative magnitude of the drift of the control period t=[-10, 10] is inversely related to firm size.

The Cumulative Abnormal Returns are a good indicator of the reaction of investors to the announcements. However, literature suggests that small firms tend to have higher CARs than larger firms due to less analyst attention. Whether this is true for this dataset will be tested using the following linear regression as described in the methodology section.

$$|CAR_{it}| = \alpha + \beta_1 * Ln(Firm\ Size_{it}) + \varepsilon_t$$

where $|CAR_{it}|$ is the absolute value of the CAR for firm i in quarter t. $Ln(Firm\ Size)$ is the natural logarithm of the firm size of firm i.

First of all, a heteroskedasticity tests (again Breusch-Pagan and White) are executed. Both tests show that the data shows signs of heteroskedasticity (Table 5, Appendix). Therefore, the linear regression will be estimated using robust standard errors. The results of the linear regression with robust standard errors are given in Table 8. As expected, the natural logarithm of the firm size has a significantly negative effect on the CAR at a significance level of 1%. We can see that by increasing the ln firm size by 1, we can see an on average lower CAR of -0.000000407. The R-squared is quite low (0.0373), so size does not seem to explain a large part of the PEAD. However, the effect is still statistically significant and should therefore be taken into account.

Table 8: Linear regression of the ln(Firm Size) on CAR for firm i.

	Coefficient	**Std. error**	**t**	**P > | t |**
Ln(Firm Size)	-4.07e-07	3.62e-08	-11.23	0.000
Constant	.1260	.0032	39.54	0.000
		F(1, 1262)		126.18
		Prob > F		0.0000
		R-squared		0.0373
		Number of observations		1264

*Robust standard errors

Hypothesis 4

Firms that are in the highest SUE decile who have seen a highly positive oil price change in month t compared to the month before have a significantly higher CAR in month t than firms in the highest SUE decile that have not seen a highly positive oil price change.

And symmetrically

Firms that are in the lowest SUE decile who have seen a highly negative oil price change in month t compared to the month before have a significantly lower CAR in month t than firms in the highest SUE decile that have not seen a highly negative oil price change.

The last hypothesis tests whether an oil price change in the same direction as the SUE influences the CAR in the most extreme deciles. This is done by estimating the linear regressions described in the Methodology section. The first effect I will look at is the effect of the oil price on EPS announced. According to Breusch-Pagan test and the White test, heteroskedasticity is present in the data, so robust standard errors will be used. Table 9 shows a significant positive effect of 0.0473 of the oil price in month t on the EPS announced in month t. Earnings of oil companies are therefore significantly dependent of the oil price. This is the result I expected. This model explains 8.2% (R-squared) of the variation in the EPS. We can therefore say that the oil price explains almost one tenth of the earnings in the oil industry in the United States.

Table 9: Linear regression Oil price on EPS announced

	Coefficient	**St. dev**	**t**	**P > | t |**
Oil Price	.0473	.0049	9.66	0.000
Constant	-2.936	.2893	-10.15	0.000
		F(1, 1262)		93.35
		Prob > F		0.0000
		R-squared		0.0802
		Number of observations		1264

*Robust standard errors

Table 10 shows the results of the linear regressions of the oil price and oil price change in month t on the CAR in month t. Robust standard errors have again been used, since there is evidence of heteroskedasticity in the data (Breusch-Pagan and White test). The results (Regression 1, Table 10) indicate that there is a significant negative relationship between the oil price in month t and the CAR in month t of -0.0023. The cause could potentially be that large oil price fluctuations are seen by investors as risky investments, which is why CAR is negative. In order to see whether this is true, we look at the influence of the oil price change on the CAR (Regression 2, Table 10). The size of the oil price change has a positive significant effect on the CAR. When we add both terms to the regression, we see that both regressions have significant coefficients. Adding an interaction term, since they consist of the same data but in a different format, obtains only a significant coefficient for the oil price of -0.0026. Very high oil prices in month t therefore seem to have a negative impact on the CAR in month t. This result is the opposite of what I expected to see. A possible explanation is that the oil industry was in a period of low economic climate. In order to conclude anything, this needs to be researched in more detail.

Table 10: Linear regressions of oil price, oil price change and an interaction term on CAR.

	1	2	3	4
Oil price	-.0023***		-.0025***	-.0026***
	(-5.28)		(-5.56)	(-6.03)
Oil price change		.0018***	.0021***	-.0011
		(3.32)	(3.79)	(-0.31)
Interaction term				.0001
				(0.95)
Constant	.1067***	-.0208***	.1113***	.1164***
	(4.30)	(-4.79)	(4.51)	(4.90)
F stat	F(1, 1262) =	F(1, 1261) =	F(2, 1261) =	F(3, 1260) =
	27.85	11.03	19.14	15.35
	0.0000	0.0009		
Number of observations	1264	1264	1264	1264

*Robust standard errors

Next, I regress the dummy created for positive price changes of more than 2 percent on the CAR of the highest SUE decile (10). Symmetrically, I regress the dummy created for a negative price change of more than 2% on the CAR of the lowest SUE decile (1). Table 11 shows that the high positive oil price change dummy has no significant effect on the CAR in the highest SUE decile. However, the high negative oil price change dummy does not have a significant negative effect on the CAR in the lowest SUE decile (Table 12), since the p-value is 0.052. As discussed before, it is still important to keep in mind that over 60% of the data consists of firms in the "Bad news" decile, which can bias the results. It can be concluded that Hypothesis 4 can be rejected, since the effect not visible for both the highest and the lowest decile. This result is different than we would expect, since the oil industry should have a high correlation with the oil price, since this is their core business.

Table 11: Linear regression Positive Oil Price Change dummy on CAR (highest decile)

	Coefficient	St. dev	t	P > | t |
High positive oil price change dummy	.0129	.0218	0.59	0.556
Constant	-.0094	.0147	-0.64	0.522
		F(1, 124)		0.35
		Prob > F		0.5561
		R-squared		0.0028
		Number of observations		126

*Robust standard errors

Table 12: Linear regression Negative Oil Price Change dummy on CAR (highest decile)

	Coefficient	St. dev	t	P > | t |
High positive oil price change dummy	-.0589	.0301	-1.96	0.052
Constant	-.0065	.0176	-0.37	0.713
		F(1, 124)		3.83
		Prob > F		0.0525
		R-squared		0.0300
		Number of observations		126

*Robust standard errors

Hypothesis 5:

A long-short long strategy of going long on the highest SUE decile and short on the lowest SUE decile for a maximum period of 10 days yields significant cumulative abnormal returns.

First of all, the Good news, No news and Bad news categories are analyzed. The results are visible in Table 13. Good news only obtains significant positive average cumulative abnormal returns in [0,2] of 0.0109 at a significance level of 5%. Note again that CAAR is only the average of the CAR for the sample, which is what should be used here since we are looking at the average of the categories. After that, the CAAR is significant only at 10%. No news and Bad news do not have any significant CAAR for [0,t], $1 \leq t \leq 10$. Based on the relative categories of earnings news, we can not conclude that there are any significant cumulative abnormal returns in a long-short strategy.

Table 13: CAAR [0,10] per news category

CAR	Good news	No news	Bad news	Total
0	0.0033	-0.0036	-0.0011	0.0005
1	0.0079	-0.0023	0.0002	0.0031
2	0.0109**	0.0079	0.0042	0.0069*
3	0.0102*	0.0068	0.0053	0.0072*
4	0.0097*	0.0072	0.0050	0.0069*
5	0.0104*	0.0086	0.0059	0.0077*
6	0.0107*	0.0037	0.0062	0.0078*
7	0.0112*	0.0046	0.0079	0.0090**
8	0.0116*	-0.0017	0.0080	0.0090**
9	0.0114*	-0.0021	0.0049	0.0071*
10	0.0096	0.0005	0.0050	0.0066

* significance at 10% level, ** significance at 5% level and *** significant at 1% level.

Finally, the CAAR results for the event period of [0,10] will be analyzed. As can be seen in Table 14, most SUE deciles do not have any significantly different CAARs from zero. Exceptions are decile 2, 8 and 9, with the most significant positive results for decile 2 and 9, which are the second most negative and the second most positive SUE deciles. The fact that decile 2 generates a positive result, and the fact that it is even higher than the abnormal return of decile 9, is not in line with the expecations. A possible explanation is that the profits of going long in decile 10 and short in decile 1 are already arbitraged away. Another possibility is that the contrarian strategy is profitable in this case, since all deciles in the middle (decile 3 to 7, except for 6) have negative CARs. However, this should be investigated further in order to draw any conlusions.

This result is quite unexpected, since it was to be expected that the lowest and the highest decile would show significant CAARs. It suggests that a investing strategy of going long in the highest decile and short in the lowest decile is potentially already in use by many investors and therefore the abnormal returns are already traded away. However, this also acquires additional research.

According to Table 14, it is possible to obtain a cumulative abnormal return of 0.0378 by going long into the second most negative SUE decile over a period of 10 days after an earnings announcement [0,9]. It is also possible to obtain a cumulative abnormal return of 0.0206 by going long into the second most positive SUE decile over a period of 10 days after an earnings announcement [0,9].

Table 14: CAAR[0,10] per SUE decile (horizontally: SUE, vertically: event day)

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
0	-0.0051	0.0017	-0.0006	-0.0001	-0.0032	-0.0005	0.0040	0.0029	0.0035	0.0024
1	-0.0014	0.0051	0.0010	-0.0011	-0.0007	-0.0021	-0.0006	0.0124*	0.0109**	0.0069
2	0.0027	0.0184**	0.0038	-0.0021	-0.0011	0.0042	0.0056	0.0154**	0.0168**	0.0050
3	0.0053	0.0237**	0.0043	-0.0030	-0.0025	0.0037	0.0050	0.0156**	0.0180**	0.0016
4	0.0051	0.0249**	0.0064	-0.0042	-0.0031	0.0012	0.0063	0.0120	0.0173**	0.0027
5	0.0106	0.0286**	0.0057	-0.0040	-0.0082	0.0024	0.0064	0.0102	0.0187**	0.0064
6	0.0134	0.0341**	0.0063	-0.0089	-0.0118	0.0024	0.0050	0.0120	0.0159*	0.0099
7	0.0154	0.0376**	0.0049	-0.0084	-0.0120	0.0081	0.0023	0.0136	0.0177**	0.0112
8	0.0172	0.0378**	0.0054	-0.0094	-0.0142	0.0082	-0.0011	0.0123	0.0202**	0.0139
9	0.0096	0.0378**	0.0012	-0.0096	-0.0154	0.0022	0.0020	0.0086	0.0206**	0.0142
10	0.0110	0.0401	-0.0006	-0.0101	-0.0142	0.0003	-0.0006	0.0087	0.0165	0.0150

* significance at 10% level, ** significance at 5% level and *** significant at 1% level

Taking into account the results from Hypothesis 2, we see that the reaction before the announcement date of the stock market is very negative for both Good and Bad news announcement firms. On the other side, we see that after the announcement date, both seem to have positive CAARs on average. We even see positive significant results for decile 2 and 9. A potential explanation is a systematical overreaction to news, which causes investors to heavily speculate the days before the announcement is made. After the announcement, they update their expectations and become more positive. This is particularly the case for the negative news firms, since investors seem to respond relatively negative before the announcement and relatively positive after the announcement is made. Results are therefore suggesting both underreaction and overreaction to news at different points of the event period.

Taking into account the results from Hypothesis 3, we know that the firm size has an inverse effect on the absolute value of the magnitude of the drift. It might therefore be valuable to include firm size into the analysis. Log firm size is divided into 3 categories: small (ln size < 7.0824), medium (7.0824 ≤ ln size ≤ 9.9576) and large firms (ln size > 9.9576). As can be seen from Table 6 (Appendix), the result is the same as earlier, but now only for the medium sized firms. It is possible to obtain a cumulative abnormal return of 0.0656 by going long in the second most negative SUE decile firms that are in the medium sized firms group for a period of 11 days [0,10]. This is 0.0278 higher than by not choosing firms based on their size. Additionally, one can obtain a cumulative abnormal return of 0.0326 by going long in the second most positive SUE decile firm that are in the medium sized firms group for a period of 10 days [0,9]. This is 0.012 higher than by not choosing firms based on their size. Expectation based on Hypothesis 3 was that choosing smaller firms would increase the CARs, but this is clearly not the case. A possible explanation is that this strategy is also already arbitraged away or that medium-sized firms get less attention than small or large firms.

5. CONCLUSION, LIMITATIONS AND FURTHER RESEARCH

The Post-Earnings Announcement Drift (PEAD) is an anomaly that been documented for the first time by Ball and Brown (1968). The PEAD is a phenomenon that shows that investors tend to underreact to earnings announcements. The stock price of the firm is likely to go into the same direction as the earnings announcement in the period after the announcement occurred. This is often seen as a violation of the semi-strong efficient market hypothesis. This thesis investigates whether the Post-Earnings Announcement Drift is visible in the stock data of oil companies in the United States during 2015-2018. The research question was formulated as follows:

"Does the Post-Earnings Announcement Drift obtain positive cumulative abnormal returns in the U.S. stock market in 2018 by going long in the most positive earnings release portfolios and short in the most negative earnings release portfolios?"

In the first Hypothesis, I showed that Good news, No news and Bad news firms do not have significantly different abnormal returns from zero on the day of the announcement. This result indicates that there is a possible belated reaction of investors to the newly available information. Suspicion can arise due to the fact that abnormal returns can be obtained between 9 and 5 days before the announcement. Potentially insider information could be at work here. It can also be concluded in Hypothesis 2 that firms that report more positive (more negative) news, do not necessarily obtain higher (lower) cumulative abnormal returns over the test period. There is therefore no evidence that the overreaction hypothesis is visible in the data. It can however be concluded that firms with more negative news have significantly negative cumulative abnormal returns over the test period [-10,10].

When we zoom in on the period after the announcement in Hypothesis 4, it can be seen that both decile 2 and decile 9 obtain positive CAARs in 10 days after the announcement, respectively 0.0378 and 0.0206. The reason why decile 1 and 10, the deciles of most interest, do not obtain significant results remains unsolved. We do however see that investors tend to respond relatively negative the days before the announcement and more positive in the days after the announcement, the day of the announcement excluded. The results therefore suggest not only underreaction, but also overreaction.

It is also important to note that only the medium sized firms in the sample obtain these cumulative abnormal returns. It is possible to obtain a cumulative abnormal return of 0.0656 by going long in the second most negative SUE decile firms that are in the medium sized firms group for a period of 11 days [0,10]. This is 0.0278 higher than by not choosing firms based on their size. Additionally, one can obtain a cumulative abnormal return of 0.0326 by going long in the second most positive SUE decile firm that are in the medium sized firms group for a period of 10 days [0,9]. This is 0.012 higher than by not choosing firms based on their size.

Other factors that might influence the results are the facts that Friday announcements are less responded to, the firm size and oil prices. Friday announcements do not statistically differ from other days of the week. It can be concluded in Hypothesis 3 that the absolute cumulative magnitude of the drift of the control period [-10,10] is inversely related to firm size. However, when we control for firm size when computing a post-announcement investment strategy, it is visible that medium sized firms perform best. High oil prices have a significantly negative impact on the CAR in a certain month. This result is the opposite of what I expected to see. Oil price changes however seem to not have any influence on the CAR in the highest and lowest decile (Hypothesis 5).

Finally, it can be concluded that there exists no Post-Earnings Announcement Drift in the United States oil sector for the period 2015-2018. This is due to the fact that we do not see firms that release more positive (negative) information obtaining more positive (negative) cumulative abnormal returns, as proved in the Hypotheses 2 and 5. Cumulative abnormal returns can only be obtained in the second lowest and second highest SUE decile. Whether the non-existence of the Post-Earnings Announcement Drift is due to the drift disappearing, the drift not occurring for the oil sector or due to other circumstances requires additional research.

One of the limitations of this research is that only the period 2015-2018 is evaluated. In order to obtain a better understanding of the oil industry companies and their stock returns in association with the PEAD, it can be valuable to take a longer period into evaluation. Also, it is very relevant to compare the oil industry to other industries. This might give a better overview of the situation in both this period and the specific industry. It is also important to note that since abnormal returns are negative for both good news and bad news firms, the state of the economy could have an important role. Future research could dive deeper into this connection. It is also important to note that the sample consists of only 79 oil companies. Some of the companies that also belong to this sector have not been included due to missing data. Forecasted values made by analysts also tended to deviate widely from the observed values of EPS. This caused the SUE to be very large in some cases, which can result in an outlier effect that influences the results. Another factor that plays an important role is the fact that the number of observations is relatively low. It is important to take note of all of these limitations, since they might influence the results.

Future research could dive deeper into the sensitivity of the oil sector to the oil price and the connection with the PEAD. It is also very relevant to compare this for multiple countries and/or industries. Furthermore, it could be relevant to add more firm characteristics to the analysis such as book-to-market value. Also, characteristics of investors that typically buy oil industry stocks could be quite interesting to analyze further. It could be the case that these investors are potentially more pessimistic before announcements are made than average investors. Variables like this could potentially explain more extensively how and why the PEAD may or may not occur.

It is also valuable to look at daily oil prices instead of monthly oil prices at the day of announcement. These values could potentially explain more of the CAR variations in the oil industry in the United States than monthly oil prices. This research has taken monthly oil prices due to time restrictions. This could however be very relevant to investigate in the future.

APPENDIX

Table 1: Sample firms and ticker codes

Ticker Code	Company Name
APA	APACHE CORP
APC	ANADARKO PETROLEUM CORP
AR	ANTERO RESOURCES CORP
AXAS	ABRAXAS PETROLEUM CORP
BTE	BAYTEX ENERGY CORP
CHK	CHESAPEAKE ENERGY CORP
CKH	SEACOR HOLDINGS INC
CLB	CORE LABORATORIES NV
CLR	CONTINENTAL RESOURCES INC
CNQ	CANADIAN NATURAL RESOURCES LTD
COG	CABOT OIL & GAS CORP
COP	CONOCOPHILLIPS
CPE	CALLON PETROLEUM CO DEL
CPG	CRESCENT POINT ENERGY CORP
CQP	CHENIERE ENERGY PARTNERS L P
CRZO	CARRIZO OIL & GAS INC
CVE	CENOVUS ENERGY INC
CVX	CHEVRON CORP NEW
CXO	CONCHO RESOURCES INC
DNR	DENBURY RESOURCES INC
DVN	DEVON ENERGY CORP NEW
EC	ECOPETROL S A
EOG	EOG RESOURCES INC
EQT	E Q T CORP
ERA	E R A GROUP INC
ERF	ENERPLUS CORP
ESTE	EARTHSTONE ENERGY INC
FI	FRANKS INTERNATIONAL N V
GPOR	GULFPORT ENERGY CORP
GTE	GRAN TIERRA ENERGY INC
HAL	HALLIBURTON COMPANY
HES	HESS CORP
HLX	HELIX ENERGY SOLUTIONS GROUP INC
HP	HELMERICH & PAYNE INC
ICD	INDEPENDENCE CONTRACT DRILLING
LPI	LAREDO PETROLEUM INC
MCF	CONTANGO OIL AND GAS COMPANY
MLM	MARTIN MARIETTA MATERIALS INC
MRO	MARATHON OIL CORP

MTDR	MATADOR RESOURCES CO
MUR	MURPHY OIL CORP
NBL	NOBLE ENERGY INC
NBR	NABORS INDUSTRIES LTD
NE	NOBLE CORP PLC
NFX	NEWFIELD EXPLORATION CO
NGS	NATURAL GAS SERVICES GROUP INC
NOG	NORTHERN OIL & GAS INC
OAS	OASIS PETROLEUM INC
OII	OCEANEERING INTERNATIONAL INC
OXY	OCCIDENTAL PETROLEUM CORP
PDS	PRECISION DRILLING CORP
PE	PARSLEY ENERGY INC
PTEN	PATTERSON U T I ENERGY INC
PXD	PIONEER NATURAL RESOURCES CO
QEP	Q E P RESOURCES INC
RDC	ROWAN COMPANIES PLC
REI	RING ENERGY INC
REN	RESOLUTE ENERGY CORP
RIG	TRANSOCEAN LTD
RRC	RANGE RESOURCES CORP
SLB	SCHLUMBERGER LTD
SLCA	U S SILICA HOLDINGS INC
SM	S M ENERGY CO
SPN	SUPERIOR ENERGY SERVICES INC
SU	SUNCOR ENERGY INC NEW
SWN	SOUTHWESTERN ENERGY CO
TNP	TSAKOS ENERGY NAVIGATION LTD
TOT	TOTAL S A
TTI	TETRA TECHNOLOGIES INC
TXMD	THERAPEUTICSMD INC
UNT	UNIT CORP
VMC	VULCAN MATERIALS CO
VNOM	VIPER ENERGY PARTNERS LP
WLL	WHITING PETROLEUM CORP NEW
WPX	W P X ENERGY INC
WTI	W & T OFFSHORE INC
XEC	CIMAREX ENERGY CO
XOM	EXXON MOBIL CORP
YPF	Y P F SOCIEDAD ANONIMA

Table 2: Heteroskedasticity tests and ANOVA test

	Statistic	**Prob > Statistic**
Breusch-Pagan test	F(2, 1261) = 4.12	0.0011
Bartlett test	chi2(9) = 64.8342	0.000
White test	chi2(4) = 17.51	0.0015
One-way ANOVA	F = 2.46	0.0088

Table 3: ANOVA and Bartlett test of equal variances

ANOVA	F = 2.33	Prob > F: 0.013
Bartlett test	chi2(9) = 30.57	Prob > chi2: 0.000

Table 4: Coefficients and p-values for comparing deciles (outliers adjusted for D2)

SUE decile	D1	D2	D3	D4	D5	D6	D7	D8	D9
D2	.0383 2.12*								
D3	-0.0015 0.08	-.0383 -2.20*							
D4	-.0134 -0.74	-.0398 -2.86***	-.0120 -0.66						
D5	-.0266 -1.47	-.0649 -3.59***	-.0251 -1.38	-.0132 -0.73					
D6	.0148 0.82	-.0235 -1.3	.0163 0.90	.0282 1.56	.0414 2.28*				
D7	.0249 1.37	-.0135 -0.75***	.0263 1.45	.0383 2.12**	.0514 2.84*	.0100 0.81			
D8	.0019 -0.10	-.0365 -2.01*	0.003 0.19	.0153 0.85	.0285 1.57	-.0129 -0.56	-.0230 -1.27		
D9	.0157 0.87	-.0226 -1.25	.0172 0.95	.0292 1.61	.0423 2.34*	.0009 0.58	-.0091 -0.50	.0138 0.76	
D10	.0248 1.37	-.0135 -0.75	.0263 1.45	.0383 2.11	.0514 2.83*	.0100 0.9	-.0000 -0.00	.0229 1.26	.0091 0.50

The first value is the coefficient, the second value is the t stat where * significance at 10% level, ** significance at 5% level and *** significant at 1% level.

Table 5: Heteroskedasticity tests (firm size on absolute CAR)

	Statistic	**Prob > Statistic**
Breusch-Pagan test	F(2, 1261) = 5.83	0.0030
White test	chi2(2) = 11.57	0.0031

Table 6: SUE CAARs per firm size group (1, 2, 3)

	SUE decile 1			SUE decile 2			SUE decile 3			SUE decile 4			SUE decile 5		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0	0.0076	-0.0100	-0.006	0.0006	0.0045	-0.0070	-0.003	0.0015	-0.005	0.005	-0.0033	0.0006	-0.016	0.0016	0.0019
1	0.0264	-0.0098	-0.014	0.0033	0.0090	-0.0059	0.0120	-0.001	-0.004	0.0000	-0.0001	-0.0039	-0.008	0.0027	-0.0017
2	0.0379	-0.0087	-0.01	0.0211	0.0227**	-0.0045	0.0275	-0.004	0.0028	0.001	-0.0027	-0.0045	-0.004	0.0012	-0.0051
3	0.0491	-0.0064	-0.021	0.0338	0.0256**	-0.0047	0.0268	-0.004	0.0062	0.0002	-0.0044	-0.0035	-0.004	-0.0004	-0.0075
4	0.0463	-0.0044	-0.027	0.0241	0.0312***	0.0017	0.024	-0.001	0.0128	0.006	-0.0067	-0.0096	-0.002	-0.0028	-0.0065
5	0.0585	-0.0002	-0.027	0.0277	0.0353***	0.0039	0.0322	-0.004	0.0087	0.004	-0.0037	-0.012	-0.018	-0.0035	-0.0087
6	0.0600	0.0020	-0.02	0.0225	0.0459***	0.0115	0.04	-0.004	0.0025	0.001	-0.0097	-0.0173	-0.019	-0.0089	-0.0094
7	0.0606	0.0053	-0.021	0.0115	0.0568***	0.0170	0.0306	-0.005	0.01	-0.007	-0.0053	-0.0155	-0.022	-0.0094	-0.0047
8	0.0659	0.0048	-0.014	0.0057	0.0616***	0.0118	0.0215	-0.0004	0.0066	-0.013	-0.0058	-0.0128	-0.026	-0.011	-0.0041
9	0.0554	-0.0035	-0.013	0.0042	0.0634***	0.0080	0.0106	-0.003	0.0031	-0.011	-0.006	-0.0145	-0.029	-0.0107	-0.0092
10	0.0532	-0.0005	-0.013	0.0085	0.0656***	0.0062	0.0204	-0.009	0.003	-0.006	-0.0089	-0.0162	-0.027	-0.0101	-0.006

	SUE decile 6			SUE decile 7			SUE decile 8			SUE decile 9			SUE decile 10		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
0	0.0006	-0.0006	-0.003	0.006	0.00276	0.0029	0.0092	-0.00007	0.002171	-0.011	0.00581	0.0072	0.002391	0.000378	0.00934
1	0.0023	-0.0026	-0.011	0.004	-0.0036	-0.0002	0.0317**	0.0042	0.005407	0.0011	0.01425**	0.0092	0.01363	0.00213	0.0135
2	0.0170	0.00102	-0.018	0.017	-0.0007	0.0021	0.035**	0.0076	0.005758	0.0064	0.0225***	0.0099	0.010693	-0.00133	0.01797
3	0.014	0.00088	-0.014	0.013	0.00012	0.0029	0.0314	0.0099	0.004736	0.0084	0.0238***	0.0105	0.006807	-0.00341	0.01115
4	0.0110	-0.0035	-0.009	0.019	0.0000	0.0006	0.0176	0.0098	0.008955	-0.00003	0.0252***	0.0097	0.009297	-0.00192	0.00883
5	0.0126	-0.0034	-0.005	0.015	0.0033	-0.001	0.0104	0.0102	0.00964	-0.005	0.03069***	0.0054	0.012664	0.002115	0.01166
6	0.0130	-0.0032	-0.007	0.013	0.0023	-0.001	0.0128	0.0111	0.014357	-0.016	0.02932***	0.0044	0.018375	0.005636	0.01193
7	0.0200	0.003	-0.005	0.012	-0.0033	-0.001	0.0167	0.0118	0.014621	0.0013	0.02863**	0.0022	0.02136	0.007282	0.01012
8	0.0242	-0.0008	-0.004	0.005	-0.0036	-0.005	0.0111	0.0135	0.009331	0.0042	0.03265**	0.001	0.030534	0.009497	0.00495
9	0.0188	-0.0095	-0.003	0.008	0.0019	-0.008	0.0061	0.0089	0.013204	0.0133	0.03264**	-0.003	0.030735	0.008179	0.01067
10	0.0119	-0.0102	0.0035	0.004	0.0009	-0.012	0.0094	0.0076	0.012777	0.0043	0.02846	-0.004	0.034234	0.008936	0.00828

* significance at 10% level, ** significance at 5% level and *** significant at 1% level

REFERENCES

Ball, R., & Brown, P. (1968). An empirical evaluation of accounting income numbers. *Journal of Accounting Research*, 6(2), 159-178.

Basu, S. (1977). Investment performance of common stocks in relation to their price-earnings ratios: A test of the efficient market hypothesis. *The journal of Finance*, 32(3), 663-682.

Beaver, W. H. (1968). The information content of annual earnings announcements. *Journal of Accounting Research*, 6, 67-92.

Bernard, V. L. (1992). Stock price reactions to earnings announcements: A summary of recent anomalous evidence and possible explanations.

Binder, J. (1998). The event study methodology since 1969. *Review of quantitative Finance and Accounting*, 11(2), 111-137.

Brown, L. D., Hagerman, R. L., Griffin, P. A., & Zmijewski, M. E. (1987). Security analyst superiority relative to univariate time-series models in forecasting quarterly earnings. *Journal of Accounting and Economics*, 9(1), 61-87.

Brown, L. D., & Rozeff, M. S. (1978). The superiority of analyst forecasts as measures of expectations: Evidence from earnings. *The Journal of Finance*, 33(1), 1-16.

Brown, S. J., & Warner, J. B. (1980). Measuring security price performance. *Journal of Financial Economics*, 8(3), 205-258.

Brown, S. J., & Warner, J. B. (1985). Using daily stock returns: The case of event studies. *Journal of Financial Economics*, 14(1), 3-31.

De Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact?. *The Journal of Finance*, 40(3), 793-805.

DellaVigna, S., & Pollet, J. M. (2009). Investor inattention and Friday earnings announcements. The Journal of Finance, 64(2), 709-749. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=823186

Diebold, F. M., & Mariano, R. (1995). Comparing predictive accuracy. Journal of Business & economic statistics, 20(1).

EIA (2020). Annual energy outlook 2020. *Office of Energy Analysis*. Retrieved from: https://www.eia.gov/aeo

Elyasiani, E., Mansur, I., & Odusami, B. (2011). Oil price shocks and industry stock returns. *Energy Economics*, *33*(5), 966-974.

Fama, E. F., Fisher, L., Jensen, M. C., & Roll, R. (1969). The adjustment of stock prices to new information. *International economic review*, 10(1), 1-21.

Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. *The Journal of Finance*, 25(2), 383-417.

Fama, E. F., & French, K. R. (1992). The cross-section of expected stock returns. *The Journal of Finance*, 47(2), 427-465.

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33, 3-56.

Foster, G. (1977). Quarterly Accounting Data: Time-Series Properties and Predictive-Ability Results. *The Accounting Review*, 52(1), 1-21.

Foster, G., Olsen, C., & Shevlin, T. (1984). Earnings releases, anomalies, and the behavior of security returns. *Accounting Review*, 59(4), 574-603.

Fried, D., & Givoly, D. (1982). Financial analysts' forecasts of earnings: A better surrogate for market expectations. *Journal of Accounting and Economics*, 4(2), 85-107.

Getmansky, M., Lo, A. W., & Makarov, I. (2004). An econometric model of serial correlation and illiquidity in hedge fund returns. *Journal of Financial Economics*, 74(3), 529-609.

Griffin, P.A. (1977). The Time-Series Behavior of Quarterly Earnings: Preliminary Evidence. *Journal of Accounting Research*, 15(1), 71-83.

Holthausen, R. W., & Leftwich, R. W. (1983). The economic consequences of accounting choice implications of costly contracting and monitoring. *Journal of Accounting and Economics*, *5*(1), 77-117.

Jacob, J., Lys, T., & Sabino, J. (1999). Autocorrelation structure of forecast errors from time-series models: Alternative assessments of the causes of post-earnings announcement drift. *Journal of Accounting and Economics*, 28(3), 329-358.

Jaffe, J. F., Westerfield, R., & Ma, C. (1989). A twist on the Monday effect in stock prices: Evidence from the US and foreign stock markets. *Journal of Banking & Finance*, 13(4-5), 641-650

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of Finance*, 48(1), 65-91.

Jensen, M. C. (1978). Some anomalous evidence regarding market efficiency. *Journal of Financial Economics*, 6(2/3), 95-101.

Jones, C. M., & Kaul, G. (1996). Oil and the stock markets. *The journal of Finance*, *51*(2), 463-491.

Kariungu, W. E. (2012). Test for Post Earnings Announcement Drift at the Nairobi Stock Exchange (Doctorial dissertation, School of Business, University of Nairobi)

Kim, O., & Verrecchia, R. E. (1994). Market liquidity and volume around earnings announcements. *Journal of Accounting and Economics*, 17(1-2), 41-67.

King, B. F. (1966). Market and industry factors in stock price behavior. *the Journal of Business*, *39*(1), 139-190.

Kuhn, T. (1962). *The structure of scientific revolutions*. University of Chicago Press.

Lakonishok, J., & Smidt, S. (1986). Volume for winners and losers: Taxation and other motives for stock trading. *The Journal of Finance*, 41(4), 951-974.

Lakonishok, J. & Smidt, S.(1988) Are Seasonal Anomalies Real? A Ninety-Year Perspective, *The Review of Financial Studies*, 1(4), 403–425

Lakonishok, J., Shleifer, A., & Vishny, R. W. (1994). Contrarian investment, extrapolation, and risk. *The Journal of Finance*, 49(5), 1541-1578.

Landsman, W. R., & Maydew, E. L. (2002). Has the information content of quarterly earnings announcements declined in the past three decades?. *Journal of Accounting Research*, 40(3), 797-808.

Lee, C.M.C. (1992). Earnings News and Small Traders: An Intraday Analysis. *Journal of Accounting and Economics*, 15, (2-3), 265-302.

Lintner, J. (1975). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. In *Stochastic optimization models in finance* Academic Press, 131-155.

MacKinlay, A. C. (1997). Event studies in economics and finance. *Journal of Economic Literature*, 35(1), 13-39.

Mendenhall, R. R. (2004). Arbitrage risk and post-earnings-announcement drift. *The Journal of Business*, *77*(4), 875-894.

Mohanty, S., Nandha, M., & Bota, G. (2010). Oil shocks and stock returns: The case of the Central and Eastern European (CEE) oil and gas sectors. *Emerging Markets Review*, *11*(4), 358-372.

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the econometric society*, 34(4), 768-783.

Nandha, M., & Faff, R. (2008). Does oil move equity prices? A global view. *Energy economics*, *30*(3), 986-997.

Narayan, P. K., & Gupta, R. (2015). Has oil price predicted stock returns for over a century?. *Energy Economics*, 100(*48)*, 18-23.

O'brien, P. C. (1988). Analysts' forecasts as earnings expectations. *Journal of Accounting and Economics*, 10(1), 53-83.

Patell, J. M. (1976). Corporate forecasts of earnings per share and stock price behavior: Empirical test. Journal of accounting research, 14(2), 246-276.

Patell, J. M., & Wolfson, M. A. (1984). The intraday speed of adjustment of stock prices to earnings and dividend announcements. *Journal of Financial Economics*, 13(2), 223-252.

Petroleum in the United States. (n.d.). In Wikipedia. Retrieved June 3, 2020, from https://en.wikipedia.org/wiki/Petroleum_in_the_United_States#cite_note-definition-1

Pincus, M., & Rajgopal, S. (2002). The interaction between accrual management and hedging: Evidence from oil and gas firms. *The Accounting Review*, *77*(1), 127-160.

Reinganum, M. R. (1983). The anomalous stock market behavior of small firms in January: Empirical tests for tax-loss selling effects. *Journal of Financial Economics*, 12(1), 89-104.

Roll, R., & Ross, S. A. (1980). An empirical investigation of the arbitrage pricing theory. *The Journal of Finance*, 35(5), 1073-1103.

Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy economics*, *21*(5), 449-469.

Scholtens, B., & Wang, L. (2008). Oil risk in oil stocks. *The Energy Journal*, *29*(1), 89-112.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3), 425-442.

Schwert, G. W. (2003). Anomalies and market efficiency. Handbook of the Economics of Finance, 1, 939-974.

Sim, N., & Zhou, H. (2015). Oil prices, US stock return, and the dependence between their quantiles. *Journal of Banking & Finance*, *55(C)*, 1-8.

Sojka, M. (2019). 50 years in PEAD research. Bonum Quant Research. Retrieved from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3281679

Thaler, R. H. (1987). Anomalies: the January effect. *Journal of Economic Perspectives*, 1(1), 197-201.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185(4157), 1124-1131.